CHUBACARC Cruise Report

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CHUBACARC
End of cruise report

I. Objectives of the cruise

The cruise aimed at studying the biodiversity, geodiversity, and connectivity of vent fauna between 5 areas spanning 5000 km. The areas included were Lau Basin, Futuna volcanic arc, North Fiji Basin, Woodlark Basin, and Manus Basin. For each area, we aimed at sampling at least 2 sites to document with-area diversity and connectivity. The cruise was split into 2 legs, both departing and returning to Nouméa, New Caledonia. The first leg visited the Lau Basin, Futuna volcanic arc, and North Fiji Basin. The second leg visited Woodlark Basin, and Manus Basin. In the science party, only 4 scientists stayed for both legs. The ship's and ROV crews changed in Nouméa as well.

II. First part of the cruise (March 25th-May2nd)

1. Objectives of the first part

The first part of the cruise was dedicated to the Eastern section of the targeted sites: North Fiji Basin, Futuna, and Lau Basin. During that part of the cruise, we had planned to sample at least two sites per area, and at each site, two sets of samples for each community type (mussels, *Ifremeria*, *Alviniconcha*, chimney fauna) and for high temperature fluids. We also had planned to deploy short-term and long-term deployments with chemical and temperature sensors, and video (POMME and CURIOUS systems). Finally, we had planned to deploy two *in situ* pumps for the capture of larvae.

2. Overview of operations during the first part of the cruise and problems encountered

2.1. Problems encountered

The overall success was about 80% for the first part of the cruise. The following section details the issues we encountered.

A. Permits

Issues with the permits are the main cause of time loss on the first part of the cruise overall. This could and should have been solved well before our departure.

The first part of the cruise took place in EEZ from Fiji and Tonga, as well as in French EEZ near Futuna. Three days before departure, we only had what we thought was a good permit for Futuna operations. Two days before we left, we asked John Parianos (Nautilus Minerals) if he had any contact in Tonga, where Nautilus holds an exploration permit. Through his help, we obtained the permit for Tongan waters and the name of an observer (Christina Pomee). This observer joined us in Nouméa before we sailed. Without a permit for Fiji, we changed our planned route while sorting this problem out. Because of the time difference between France (where DFO personnel is based) and the West Pacific, the chief scientist took over interactions with Fijian authorities. The permit was finally obtained after 3-4 days of work in the Lau Basin. We had to divert our route to pick up the Fijian observer from Suva, including some port formalities. In total, with the change of route, and the stop in Fiji, we lost nearly 5 days out of the 39 days of this leg.

The change of route also changed our planned presence in the Futuna area. We contacted authorities in Wallis & Futuna and in New Caledonia to ask them to shift our planned presence. The authorities in Wallis & Futuna said they were not aware of such a permit and cancelled everything on Friday evening. Our work in the North Fiji Basin was done on Saturday evening and we had to head to Futuna, not knowing if the situation would be solved. Again, the time difference was a problem. The captain and chief scientist took the interactions in their hands. After little progress and 24 hours wasted near Futuna, our Fijian observer proposed to dive in an area recently surveyed by our German colleagues in the Mangatolo triple junction area. We spent two days there and had a productive time (one new site, 2 sets of samples) but it could have been 3 days wasted near Futuna before we finally obtained the new permit. As it is, there was only an additional 1.5 days spent transiting to Mangatolo and return to Futuna that could have been prevented.

B. Elevators

Overall, the main time constrain for the dives was the deployment and recovery of elevators that needed to take place during daytime. This strongly affected our dive plans but we were able to adjust to this situation. Two problems also affected the dive work through the elevator:

- the winch used to deploy the elevator was not working one morning and was fortunately fixed by the crew to permit the second deployment planned in the dive.
- On the last dive, the weather did not permit the deployment of the elevator and only half of the planned sampling could be done.

C. ROV issues

Overall, the ROV performed very well. After the first dive, some work was necessary on the tether but this did not affect our work on the bottom. During one dive, the drawer was stuck in the open position, which rendered all work with the probes and suction sampler difficult. This did not affect the results from that dive much. On another dive, we lost control of the Maestro arm. We had to cut the dive short and deploy a second time on the same site for proper sampling. A few black-outs also happened.

D. ROV pulley

The original ROV pulley attached to the A-frame was replaced in January and tested for 1 dive. The new pulley contained sensors but it seems its attachment was too fragile. We realized that there was a serious issue, had to take shelter from the swell near Futuna to take the pulley down, and replace its axis (a new axis had to be machined on board). Despite the great work of the crew, in the end, we lost a day dealing with this issue. This could have meant the end of the cruise without the skills of the crew on board.

E. Deep-sea winch

The deep-sea winch was planned to be used for multicore sampling of regular deep-sea sediment. It was successfully used in Tongan water on our transit to Fiji. After a black-out at night, the speed regulator on this winch was damaged and could not be repaired. Only one out of the four multicore samplings could be done.

2.2. Overview of operations

A. ROV dives

During the first leg, we had a total of 12 ROV dives, and the deployment of 23 elevators to transfer equipment and samples to and from the surface (Table 1).

Lau Basin

Kilo Moana	1 dive
Tow Cam	3 dives
Tu'i Malila	1 dive
ABE	1 dive
Mangatolo	2 dives (including one aborted due to issues with the arm)

North Fiji Basin

Phoenix	1 dive

Futuna

Aster'X	1 dive
Fati Ufu	1 dive
Kulo Lasi	1 dive

B. Muticore sampling

One sample was collected during the transit from Lau to Fiji. We did not find any appropriate area for sampling between our site in the North Fiji Basin and Futuna. After that point, the damaged speed regulator on the winch did not permit the use of the multicore sampler.

2.3 Overview of the dives and operations performed during them

Dive 720

Site: Kilo Moana, Lau Basin

Deployments: The larval pumps were sent to the bottom in an elevator at the beginning of the dive but the discovery of lack of hydrothermal activity brought an end to the dive and the pumps were recovered at the end of the dive.

Summary of dive activities: A survey of the site revealed the lack of hydrothermal activity, and the presence of extinct chimneys. A few remaining mussels and barnacles were found, along with holothurians. Animal collections included mussels and barnacles. The two titanium syringes were triggered in the water near the bottom for reference water.

Dive 721

Site: Tow Cam, Lau Basin

Deployments: A total of 4 elevators were deployed during this dive. One was used for the deployment of the two SALSA and their recovery at the end of the dive. One elevator was also used to send short-term deployments of two sensor arrays, and a POMME recording system. The others were used to

transfer collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as BEG and titanium syringes.
Summary of dive activities: This site is still very active, with well-developed communities in the central diffusion area and a few black smokers. The latter are mostly found in the North, along an alignment, and a few smaller chimneys at the southern end of the site. Animal collections included 2 sets of mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna. During that dive, two autonomous sensor arrays and a POMME system were deployed. A set of two titanium syringes was triggered in the opening of a chimney to sample hydrothermal fluid. The second set could not be collected because of problems with the ROV.

Dive 722
Site: Tu'i Malila, Lau Basin
Deployments: A total of 4 elevators were deployed during this dive. One was used for the deployment of the two SALSA pumps and their recovery at the end of the dive. The others were used to transfer collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as BEG and titanium syringes.
Summary of dive activities: This site is still active, with well-developed communities in the diffusion area. Animal collections included 2 sets of mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna. Two sets of two titanium syringes were triggered in the opening of two different chimneys to sample hydrothermal fluid.
Finally, a set of 2 larval traps from our USA colleagues was deployed at this site and will be recovered in about a year.

Dive 723
Site: Tow Cam, Lau Basin
Deployments: A single elevator was deployed during this dive to send another POMME system, CURIOUS, and recover the deployed POMME, and one of the two autonomous sensor arrays.
Summary of dive activities: This dive was mostly aimed at recovering the short-term autonomous sensor systems and deploying new ones planned to stay there and record chemistry, temperature, and behavior for about 3 weeks (recovery at the end of the first leg). An artificial larval colonization module (CHARMS) was deployed near the autonomous sensors during this dive. Another set of two titanium syringes was collected in the opening of a chimney to sample hydrothermal fluid.

Dive 724
Site: Phoenix, North Fiji Basin
Deployments: A total of 3 elevators were deployed during this dive. One was used for the deployment of the two SALSA and their recovery at the end of the dive. The others were used to transfer collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as BEG and titanium syringes.
Summary of dive activities: We planned to visit Ivory Tower (=White lady), a site that has been known and sampled since 1988. We started the dive from the triple-junction area, about 3 km North of Ivory Tower. We discovered a new site (and called it Phoenix) shortly after the beginning of the dive but

our exploration further South only revealed extinct sites, including Père Lachaise, and Ivory Tower. All the collected samples came for the Phoenix area (extending 50 m x 300 m). Animal collections included 2 sets of mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna. Two sets of two titanium syringes were triggered in the opening of two different chimneys to sample hydrothermal fluid.
Several technical issues affected this dive. The winch to deploy the elevator suffered a malfunction, and its deployment was delayed by about 8 hours. Towards the end of the dive, the ROV drawer was stuck in its open position, which made a lot of actions more difficult. Finally, there were issues with the dynamic positioning, which slowed down ROV transits on the bottom.

Dive 725
Site: Mangatolo, Lau Basin
Deployments: This dive was cut short because of issues with the arm of the ROV. No elevator was deployed.
Summary of dive activities: During this dive, we explored an area that had been studied in January by our German colleagues. After the discovery of communities on the Eastern edge of the area studied by the Germans, there were issues with the arm and no community could be collected. The dive was cut short to repair the arm.

Dive 726
Site: Mangatolo, Lau Basin
Deployments: One elevator was deployed during this dive to recover animal collections.
Summary of dive activities: This dive started about 300 m South of where the previous one had ended. It found another diffusion area where a first set of samples was collected. A second set was collected in the area discovered during the previous dive. A set of two titanium syringes was triggered in the opening of a chimney to sample hydrothermal fluid. Due to limited time, the exploration further Northeast could not be pursued.

Dive 727
Site: Fatu Kapa, Aster'X, Futuna
Deployments: A total of 4 elevators were deployed during this dive. One was used for the deployment of the two SALSA and their recovery at the end of the dive. The others were used to transfer collection boxes containing *Ifremeria* and *Alviniconcha* gastropods, as well as BEG and titanium syringes.
Summary of dive activities: This dive transited from Stephanie to Aster'X. Two sets of fauna samples were collected. No mussels were found in this area.

Dive 728
Site: Fati Ufu, Futuna
Deployments: A total of 4 elevators were deployed during this dive. One was used for the deployment of the two SALSA and their recovery at the end of the dive. The others were used to transfer collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as BEG and titanium syringes.

Summary of dive activities: This dive started in the central area (Fati Ufu 1-9), explored East and then Southwest towards Fati Ufu 10-11. From there, it moved North to Fati Ufu 12, and further North in an area where water column indications hinted at the possible presence of active sites. None were found and the exploration then lead to the intermediate area (Fati Ufu 13-15). *Ifremeria* were sampled in the central and intermediate areas. *Alviniconcha* were only found in the central area. A few isolated mussels were found and sampled near Fati Ufu 10-11. Two sets of two titanium syringes were triggered in the opening of two different chimneys to sample hydrothermal fluid. Chimney wall fauna was captured on two distinct chimneys.

Dive 729

Site: Kulo Lasi, Futuna

Deployments: This dive was cut short because of issues with the arm of the ROV. No elevator was deployed.

Summary of dive activities: This dive explored all the periphery of the Kulo Lasi caldera. No high temperature emissions were found. Sporadic faunal patches were found and collections were made (few mussels, tubeworms, *Ifremeria*).

Dive 730

Site: Tow Cam, Lau Basin

Deployments: A single elevator was deployed during this dive to recover the POMME system, CURIOUS, the autonomous sensor array, and CHARMS.

Summary of dive activities: This dive was mostly aimed at recovering the long-term autonomous sensor systems after about 3 weeks of deployment. An artificial larval colonization module (CHARMS) was also recovered. Another set of two titanium syringes was collected in the opening of a chimney to sample hydrothermal fluid because the set collected during the previous dive on this site was not of sufficient quality. Additional chimney fauna was also collected for genetics.

Finally, a set of 2 larval traps from our USA colleagues was deployed at this site and will be recovered in about a year.

Dive 731

Site: ABE, Lau Basin

Deployments: The weather conditions did not allow the deployment of an elevator and prevented the recovery on the ROV that same night. The submersible was only recovered the following morning.

Summary of dive activities: This dive visited a site for the first time of the cruise. The area is essentially the same as reported in the past. Animal collections included a single set of mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna. A single set of two titanium syringes was triggered in the opening of a chimney to sample hydrothermal fluid.

Table 1: Summary of the 12 dives and associated elevators during the first part of the CHUBACARC cruise.

Dive number	Site	Max depth (m)	Time on the bottom (h)	Nbr of elevators	Total dist. on bottom (km)	Latitude min	Latitude max	Longitude min	Longitude max
720	Kilo Moana	2638	10:57	1	5.372	20°30.2696'S	19°36.1316'S	176°36.6260'W	175°39.3340'W
721	Tow Cam	2732	41:06	4	19.326	20°46.0483'S	19°51.9119'S	176°36.9141'W	175°39.5259'W
722	Tu'i Malila	1879	45:54	4	1.899	22°26.3600'S	21°32.2333'S	177°03.9833'W	176°05.6167'W
723	Tow Cam	2718	09:38	1	4.337	20°46.4833'S	19°51.9117'S	176°36.9133'W	175°39.5267'W
724	Phoenix	2028	42:59	3	30.907	17°11.7450'S	16°44.6383'S	174°09.2833'E	173°41.1167'E
725	Mangatolo	2140	10:00	0	11.193	15°51.4717'S	14°57.3083'S	175°07.9367'W	174°12.1033'W
726	Mangatolo	2077	20:11	1	9.422	15°51.4720'S	14°57.3085'S	175°07.9367'W	174°12.1033'W
727	Aster'X	1567	38:54	4	6.058	14°58.7895'S	14°31.6762'S	177°23.1711'W	176°55.3089'W
728	Fati Ufu	1537	33:57	4	6.099	14°59.1495'S	14°32.0362'S	177°25.0915'W	176°57.2285'W
729	Kulo Lasi	1472	16:34	0	10.975	15°10.0692'S	14°42.9563'S	177°28.4632'W	177°00.5768'W
730	Tow Cam	2719	07:16	1	4.345	20°46.0483'S	19°51.9119'S	176°36.9141'W	175°39.5259'W
731	ABE	2154	21:53	0	12.079	20°59.2582'S	20°32.1614'S	176°25.8645'W	175°57.0555'W

III. Second part of the cruise (May 6th-June 6th)

1. Objectives of the second part

The second part of the cruise was dedicated to the Western section of the targeted sites of the Chubacarc cruise: Manus Basin, and the Woodlark ridge. As in the first part of the cruise, the sampling plan was to visit at least two vent fields per area, and to get two replicates of the same series of communities (i.e. mussels, *Ifremeria*, *Alviniconcha*, chimney fauna) at each selected site, together with low diffuse fluid chemistry and high temperature fluid sampling. During this second leg, the second main objective was also to locate and characterize for the first time, hydrothermal active sites on the Woodlark ridge at segment 3B near TVG150 (where water anomalies have been previously detected during the German cruise SO203 in 2009). As no active vent site with classical symbiotic fauna was still discovered along the Woodlark Ridge, a series of surface operations (CTD and water sampling by casts or Tow Yow, SMF to detect the acoustic signature of the fluid emissions) and a 50 h MMR ROV dive were performed on the first part of the leg and sampling activities were focused at three distinct vent fields (PacManus, Desmos and the Susu volcanoes) in the Manus basin. Exploratory dives were planned on segment 3B of the Woodlark Ridge in the second part of leg 2 to localize and collect the vent fauna.

2. Overview of operations during the first part of the cruise and problems encountered

2.1. Problems encountered

The overall success was around 90% for the second part of the cruise with no specific issue with the Papoua-New Guinea permit. Authorization to work in Papoua-New Guinea was sent to us several weeks before the beginning of the Chubacarc leg 1 thanks to the help of John Parianos and Paul Lahari (Nautilus Minerals). The choice of the Papua observer Darren Kuama and his travelling from Port Moresby to Nouméa was solved during the first leg and the observer arrived on board one day before our departure to Papua-New Guinea EEZ.

F. Elevators

As for leg 1 of Chubacarc, the main time constraint for the dives was the deployment and recovery of elevators that needed to take place during daytime, and affected the operations of ROV for nearly 2 hours (drift of ROV during the recovery of the elevator). However, because no short-term and long-term deployments have been scheduled during leg 2, the recovery of elevator during the day did not affect much our dive plans and was not an issue.

- On the first dive on PacManus (first dive with the ROV sampling module), the deployment of the second elevator was shortened because of its unexpected acoustic release at a 300 m depth during the descent. This incident delayed the recovery of faunistic samples by nearly two hours but did not affect the work plan of the dive.
- On the last dive on La Scala (TVG150, Woodlark), the elevator was successfully deployed before the launch of the ROV but contact was lost at the depth of 100 m. The search of the elevator on the bottom by the ROV took more than 16 hours (during night-time) without success and the elevator was acoustically released without exchanging boxes with samples and titanium syringes. This seriously impacted the scientific objectives of this dive, and especially the sampling of communities of the newly-discovered vent site. The elevator was re-deployed before noon but as the weather worsened, this deployment only allowed

us to recover the first set of samples but not to finalize our sampling (i.e. the ROV was recovered before dawn without any additional samples).

G. ROV issues

Overall, the ROV performed very well during the sampling dives and nearly all scientific objectives have been achieved in due time. During the first dive of leg 2, dedicated to the microbathymetry of the hydrothermally active part of segment 3B on the Woodlark ridge (MMR module: 50 hours), the BUC navigation was very degraded with several black-outs which resulted in a lack of position data along the profiles and the need to correct the ROV position before to treat the MBE dataset to get the map of the TVG150 area. UltraShort Base navigation data were checked and improved in Toulon and sent back to us two days later. As the sampling dives on this specific zone were scheduled 10 days after initial data acquisition, this issue did not affect the map reconstruction and a microbathymetry of our target zone was obtained before its planned use when we came back to TVG150 to locate and sample the site. We also had several issues with the suction sampler, which became stuck several times, and especially during dive 16 at DESMOS where only 3 jars could be used on the fauna. We also had punctual issues with the modules PIF and Chemini due to pumping deficiencies and especially during dive 15 where chemistry could not be acquired on several deep-sea vent communities. A few black outs also happened with a brief loss of control of the Maestro arm during two distinct dives but this did not affect the scientific objectives of these dives. Before the end of the second leg and at the very end of dive 19, we had a major ROV black out due to an electric break in the ROV tether cable that required its complete change with a spare or to shorten it. Such repairs were not possible on board and would have required at least one week to find the position of the electric break, to cut the cable and to make all the splicing. Fortunately, the ROV team found a way to make the cable functional by translocating the electric power onto the cable itself, which allowed us to perform the two last dives on the Woodlark ridge. One of the two last dives was however cancelled and the last one shortened because of the weather.

H. Deep-sea winch

The speed regulator on the deep-sea winch was damaged during the first leg of Chubacarc during the second multicore sampling of regular deep-sea sediment (AMIGO project). A new speed regulator was thus ordered during the inter-leg at Nouméa and subsequently used to replace the old one at the beginning of the second leg in order to pursue with four multicore samplings planned in the Coral Sea in the EEZ of New Caledonia and the EEZ of Papua-New Guinea. Unfortunately, the replacement of the speed regulator did not fix the issue with the deep-sea winch and none of the multicore sampling scheduled were performed during the second leg.

2.2. Overview of operations

C. ROV dives

During the second leg, we had a total of 8 ROV dives, including one MMR dive of 50 hours on segment 3B of the Woodlark ridge, and the deployment of 10 elevators to transfer equipment and samples to and from the surface (Table 2).

Woodlark Ridge

La Scala, TVG150 segment 3B 3 dives

Manus Basin

PacManus (Pual Ridge)	2 dives
Desmos Caldeira	1 dive
Susu volcanoes	2 dives

D. CTD and rosette

Ten CTD casts with the rosette were performed on segment 3B of the Woodlark ridge to locate both the hydrothermal plume and the points of vent emissions. These CTD casts were first done using a Tow Yow sampling strategy along and across the TVG150 zone (3 Tow Yow) and followed by 7 Casts at some specific locations to find temperature and Eh anomalies near to the bottom. Together with the acoustic detection of vent emissions, this allowed us to locate very precisely the active site.

2.3 Overview of the dives and operations performed during them

Dive 732

Site: TVG150, Woodlark

Deployments: The ROV was deployed with the MMR module on 11th of May and recovered on 14th of May 2019 to produce a microbathymetric map at an altitude of 70 m above the bottom for a period of work of 50 hours (total time in water: 61.3 h, total time on the bottom: 56.2 h). The ROV went down to locate the active site at the end of the profiles for about two hours but was not able to find it.

Summary of dive activities: A survey of the site was performed over an overall distance of 65 kilometers. A grid of 12 profiles of 4 nautical miles separated by 250 m width was first scheduled with a ROV speed of 0.3 m/s, and finally shortened at the middle of the grid because of several black outs, a reduced ROV speed falling down to nearly 0.1 m/s and navigation issues (it was not possible to drive the ROV automatically).

Dive 733

Site: Snowcap/Big papi/Fenway (PacManus), Manus Basin

Deployments: The ROV was deployed on 16th of May on the site Tsukushi with the aim of visiting and sampling a series of sites during a period of 48 h (total time on bottom: 46.5 h). These sites: Tsukushi, Fenway, Big Papi, Satanic Mills and Solwara 8 were located on a ridge system and separated by only hundreds of meters. A total of 2 elevators were deployed during this dive at Satanic Mills and Solwara 8 to transfer collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as titanium syringes. A pushcore was also deployed at the locations Snowcap and Satanic Mills to collect hydrothermal sediments.

Summary of dive activities: This site is still very active, with well-developed communities in the Fenway area and a large mound of black smokers covered by shrimp and gastropods at Big Papi (2 Titanium syringes triggered there). Black smokers were also found and sampled with Titanium syringes at Satanic Mills. The latter are mostly found in the North, along an alignment, and a few smaller chimneys at the Southern end of the site. Animal collections were performed on three series of communities including mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna. The choice of communities localities was performed to maximize the distance between two

distinct communities associated with diffuse venting. We especially focused on Solwara 8 as this area represents one of the mining prospects of Nautilus Minerals and is located at the base of the ridge and is highly populated with animals living on chimneys and not diffuse venting areas.

Dive 734

Site: Roman's Ruins/Solwara 6,7 and 8 (PacManus), Manus Basin

Deployments: A second dive was performed on additional sites of PacManus to complement the faunistic samples in this area for 27.1 h on the bottom (Total time in water: 30.2 h, starting on 18th of May and ending on 20th of May). Again a total of 2 elevators were deployed during this dive at Roman Ruins and Solwara 6. These elevators allowed us to collect two series of communities by transferring collection boxes containing mussels, *Ifremeria* and *Alviniconcha* gastropods, as well as titanium syringes. During this dive, priority was given to the sampling and *in situ* preservation of the shrimp *Rimocaris variabilis*, which was very abundant on the hydrothermal mound at Big Papi. Shrimp were sampled twice at two locations. Collections were made first on Big Papi and then at Roman Ruins. Pushcore was also deployed between Solwara 6 and Solwara 8 to collect sediments in the periphery of active sites after a transit of 12.3 km.

Summary of dive activities: The site Roman Ruins is still active with lots of black smokers and inactive chimneys without sedimentary areas and diffuse venting. Solwara 7 was also visited during the dive and corresponds to a huge mound of black smokers with very few fauna, with the exception of *Ifremeria nautilei*. Animal collections included 2 sets of mussels (2d sampling on the big Fenway mussel beds, diffuse venting on Solwara 6), *Ifremeria (*Solwara 7 and 6*)*, *Alviniconcha (*Roman Ruins, Solwara 6*)*, barnacles, and chimney fauna at Roman ruins. Two sets of two titanium syringes were also triggered in the opening of two different chimneys to sample hydrothermal fluid.

Dive 735

Site: Onsen (Desmos Caldeira), Manus Basin

Deployments: The ROV was deployed on 20th of May to 21th of May for 30.5 h on the bottom. A single elevator was deployed during this exploratory dive to exchange titanium syringes and collection boxes at the Onsen site. The first part was to explore the area of Solwara 12 on the southeastern part of the DESMOS Caldeira and to explore the caldeira itself to reach the site Onsen located at the base of the northwestern wall of the caldeira (overall distance achieved by the ROV: 4.6 km). A total of 8 hours was dedicated to the exploration of the caldeira as no active site was found at Solwara 12. The Onsen site was still active but with a strong decrease of the venting activity with several bush of *Arcovestia* but no *Calyptogena* clams. Mussel beds were no longer present but a few surviving mussels.

Summary of dive activities: This dive was exploratory but collections of vent and peripheral fauna were made in sampling boxes and the ROV drawer, including *Arcovestia*, limpets, a few mussels, *Provanna* gastropods and polynoid worms. No gastropods *Ifremeria* and *Alviniconcha* were found at this site. One set of two titanium syringes was collected in diffuse SO_2 fluids shimmering in a cracked pillow lava together with bacterial mats for microbiology. It is worth-noting that the suction sampler was not working and nearly out before the dive and as a consequence, very little small fauna has been collected by slurping during this dive.

Dive 736

Site: North Su/Solwara 1, Manus Basin
Deployments: The ROV was deployed on the 22nd of May and recovered on the 23rd of May for a long dive of 38.0 h in order to explore the two volcanoes Suzette and North Su. The first volcano corresponds to the Nautilus Minerals Solwara 1, which will be the first target for deep-sea mining in 2020 (total distance achieved by the ROV: 15.9 km). One elevator was deployed before the dive between Solwara 1 and North Su for exchanging collection boxes and Titanium syringes.
Summary of dive activities: We first visit the Solwara 1, which was very impressive both in terms of inactive and active chimneys but also in gastropod assemblages (mainly *Ifremeria* gastropods), and perform a collection of communities and chimney fauna. We then move to collect 2 sets of mussels, *Ifremeria*, *Alviniconcha*, barnacles, and chimney fauna on North Su. Two sets of two titanium syringes were triggered in the opening of two different chimneys to sample hydrothermal fluid at Solwara 1 and North Su where addition SO_2 emissions where sampled near the Northern part of the volcano crater together with native sulfur. OTUS mapping was performed on peripheral fauna between the two volcanoes together with sediment core sampling.

Dive 737
Site: South Su, Manus Basin
Deployments: The ROV was deployed on the 24th of May and recovered on the 25th of May for a shorter dive of 22.3 h in order to explore the volcano South Su. Communities were sampled from both flanks of the volcano (total distance achieved by the ROV: 7.8 km). One elevator was deployed before the dive in the half-collapsed caldeira of the volcano for exchanging collection boxes and Titanium syringes.
Summary of dive activities: During this dive, we explored the whole caldeira and crest of the volcano and retrieve active sites previously described by the previous German expedition SONNE SO203 and/or associated with Nautilus Minerals prospects. Two sets of communities were sampled on the two sides of the volcano South Su together with vestimentiferan tubeworms and paralvinellids. Chimney fauna was also sampled using PBT and the suction pump device. Two sets of two titanium syringes was triggered in the opening of a chimney to sample hydrothermal fluid. Both collection boxes and titanium syringes were transferred and exchanged in the elevator.

Dive 738
Site: La Scala (TVG150), Woodlark ridge
Deployments: The ROV was deployed at the base of the ridge crest where acoustic echoes of emissions and CTD anomalies have been detected at TVG150 on segment 3B of the Woodlark ridge for a long dive of 40 h between 27th and 28th of May. Because the aim of this exploratory dive was to find the active vent site, only one elevator was deployed during this dive to recover animal collections but peripheral fauna was collected in the ROV drawer.
Summary of dive activities: The search of the active site was done during the first part of the dive and a very extended site with a forest of inactive chimneys covered by stalked barnacles and very active black smokers was discovered a few hours after the ROV launching. A first series of communities was sampled using collection boxes, including the gastropods *Ifremeria* and *Alviniconcha*. No mussels were found in this area. A set of two titanium syringes was triggered in the opening of a chimney to sample hydrothermal fluid. Both collection boxes and titanium syringes were transferred and exchanged in the elevator. The end of the dive was then dedicated to the exploration of the southeastern part of the crest to search for other venting sites, but no

additional site has been found. Due to a black out, the exploration further North could not be pursued.

Dive 739

Site: La Scala (TVG150), Woodlark ridge

Deployments: The ROV was deployed on the newly discovered vent site La Scala near TVG150 on segment 3B of the Woodlark ridge for a second long dive of 40 h between 29th and 31st of May to complement our sampling effort on communities and explore the southwestern part of the crest. This site stands along a steep slope of the ridge over nearly 70 m depth. Only one elevator has been deployed twice during this dive because of problems to locate it on the bottom after the first deployment. The elevator was first acoustically released without samples, and redeployed during the next day to exchange collection boxes and Titanium syringes.

Summary of dive activities: This dive was scheduled to complement our faunal and fluid sampling on communities and very active black smokers and then perform a further exploration on the southwestern part of the crest where other anomalies were previously detected. Because of the loss of the first elevator, about half of the dive was dedicated to the search of the elevator without success. This issue jeopardized our planned sampling effort and only two sets of *Alviniconcha* communities were collected along with the chimney fauna. Additionally, cores of sediment were collected in the periphery of the vent site and two Titanium syringes were triggered on the Corto black smoker.

Table 2. ROV operations during Leg 2 and % of ROV efficiency

ROV OP	Dive 733/15/14	Dive 734/16/15	Dive 735/17/16	Dive 736/18/17	Dive 737/19/20	Dive 738/20/19	Dive 739/21/20
Date of deployment	16/05/2019	18/05/2019	20/05/2019	22/05/2019	24/05/2019	27/05/2019	29/05/2019
On bottom (UT time)	07:55:15	22:31:56	13:08:42	09:10:26	08:48:38	08:10:16	23:45:25
Date of recovery	18/05/2019	20/05/2019	21/05/2019	23/05/2019	25/05/2019	28/05/2019	31/05/2019
Leaving bottom (local time)	06:39:27	01:36:14	19:59:30	19:35:42	07:14:53	17:18:00	7:12:55
Locality	PacManus BigPapi Fenway Solwara8	PacManus Roman Ruins Solwara7	Desmos Onsen	Solwara1 North Su	South Su	Woodlark La Scala	Woodlark La Scala
Time scheduled	50 h	32 h	36 h	42 h	24 h	42 h	36 h
Total time in water	50.14 h	30.20 h	35.01 h	38.01 h	25.18 h	39.05 h	37.02 h
Time on bottom	46.44 h	27.05 h	30.51 h	34.25 h	22.26 h	33.08 h	31.27 h
Distance on the bottom	4.545 km	12.276 km	4.576 km	15.941 km	7.779 km	11.579 km	14.400 km
Max depth	1752 m	1781 m	1934 m	1636 m	1458 m	3370 m	3370 m
Nb elevators	3	2	1	1	1	1	2 but one aborted
Suction pump	OK	OK	Not good	OK	OK	OK	OK but lack of time
Nb of jars with samples	8	8 + 2 FISH	2	8	8	4 (lack of fauna)	1
Chemini	OK	OK	OK (but few measures)	OK	OK	OK	OK
Nb of measures (Fe, H2S)	25	24	10	36	40	17	6
PIF	OK	OK	OK	OK	OK	PIF out after the 9th	OK
Nb of syringes	12	22	7	19	24	9	4
Nb titanium bottles scheduled	6	2	4	4	4	6	4
Nb of titanium syringes done	6	2	6 (but 2 empty)	4	4	6	2
Pushcore scheduled	Yes	Yes	Yes	Yes	Yes	No	Yes
Nb of cores done	4 (Snowcap)	1 (Solwara8)	4 (Onsen near clam shells)	4 (near Solwara1)	4 (in caldeira)	none	8 (on the top of the crest)
Nb of GBTs on communities	11 on 11 (8 on community)	5 on 6 (5 on community)	3 on 4 (no community)	6 on 6 (6 on community)	6 on 6 (6 on community)	3 on 4 (3 on community)	3 on 6 (1 on community)
Nb of PBTs on chimneys	6 on 7 (3 on chimneys)	2 on 2 (1 on chimney)	1 on 3 (mussels and peripheral fauna in drawer	3 on 4 (2 on chimney)	4 on 4 (2 on chimney)	2 on 4 (2 on chimney) (peripheral fauna in drawer)	2 on 4 (1 on chimney)
Rocks sampled	4	2	2	6		7	2
Problems encountered	Wrong launching of the 3d elevator, Chemini out after the 4th community	Pushcore locked in the elevator, no core sampled	Site becoming extinct, suction sampler out after the third jar	none	none	Black-out at the end of the dive, several boxes and jars not used	Elevator lost leading to 16 h of search and bad weather
Scientific objectives	90%	95%	90%	100%	100%	90%	50%

IV. Communication actions

Different communication actions were made during the cruise:

Article published in The Conversation
https://theconversation.com/des-oasis-de-vie-dans-les-abysses-la-faune-hydrothermale-du-pacifique-ouest-115409

Science Ouest « Inventorier la vie à 3 000 m de fond », Sciences Ouest n°371, April 2019.

The CNRS INEE website also published a piece on the cruise
https://www.inee.cnrs.fr/fr/cnrsinfo/chubacarc-un-inventaire-de-la-biodiversite-des-sources-hydrothermales-du-pacifique

Espace des sciences website
https://www.espace-sciences.org/sciences-ouest/374/actualite/chubacarc-mission-reussie-a-3000-m-de-fond

A videoconference was performed during the cruise with the Science Fair in Sète (France).

Two blogs were maintained: the main one on Facebook, and a more specific on women in science (Marie-Anne Cambon)

Between the two legs in Nouméa, a visit of the boat and presentation of the cruise was organized for students from University of New Caledonia.

Finally, a phone interview for ABC Radio Australia was done.

V. Scientific reports

Topic	Page
Geochemical study of hydrothermal fluids – Leg 1 & Leg 2	
Geological exploration and rock sampling – Leg 1	
Ecology - Leg 1	
Ecology - Leg 2	
Genetics – Legs 1 and 2	
MultiBeam Echosounder – Legs 1 and 2 TGV 150 Plume detection – Leg 2	
Biodiversity inventories through metabarcoding of environmental DNA – Legs 1 and 2	
Physiology of respiration and thermotolerance – Legs 1 and 2	
Ecogeochemistry of vent communities – Leg 1	
Symbioses & Microbiology – Leg 1	
Symbioses & Microbiology – Leg 2	
Connectivity by using elemental fingerprinting of the larval shell - Legs 1 and 2	
Larval dispersal and life cycle of vent species – Leg 1	
Immunity and antibiotics of *Paralvinella* sp. – Leg 2	

Chubacarc 2019 -Leg 1
Geochemical study of hydrothermal fluids

Authors: Cécile Cathalot, Emmanuel Rinnert (GM/LCG)
Contributors: Ewan Pelleter, Audrey Boissier (GM/LCG), Nicolas Gayet (EEP/LEP)

The geochemical study of hot fluids aims to:

- Obtain the geochemical signature of "pure" fluids (gas, mineral, organic)
- Study and understand the processes controlling the geochemistry of fluids (conditions of pressure and temperature in the reaction zone, phase separation, interactions sea water/ rock)
- Compare the signature of these fluids to that of fluids collected in other areas (Ride Atlantic Medio, East Pacific Ridge, Indian Ocean …).

The study of hydrothermal fluids during the first leg of the Chubacarc campaign was focused on the Tonga, Fiji and Wallis&Futuna EEZs. 9 sites were investigated during 12 dives. Concerning the hydrothermal fluids, the visited sites are:

- Tow Cam (Figure 1),
- Tu'I Malila (Figure 2),
- White Lady (Figure 3),
- Mangatolo (Figure 4),
- Fatu Kapa (Figure 5),
- Fati Ufu (Figure 6),
- ABE (Figure 7).

The hot fluids have been sampled with titanium syringes (Ti) and gastight bottles (BEG) described thereafter. Samples are named:

- CHU- for Chubacarc,
- PL#- for dive number #,
- Ti# for titanium syringe D1, D2, D3, G1, G2 or G3,
- Or BEG# for gastight bottles 1 to 4.

The samples are located with this denomination on maps from Figure 1 to Figure 7.
The preliminary results are presented as a table at the end of this report (Table 1).

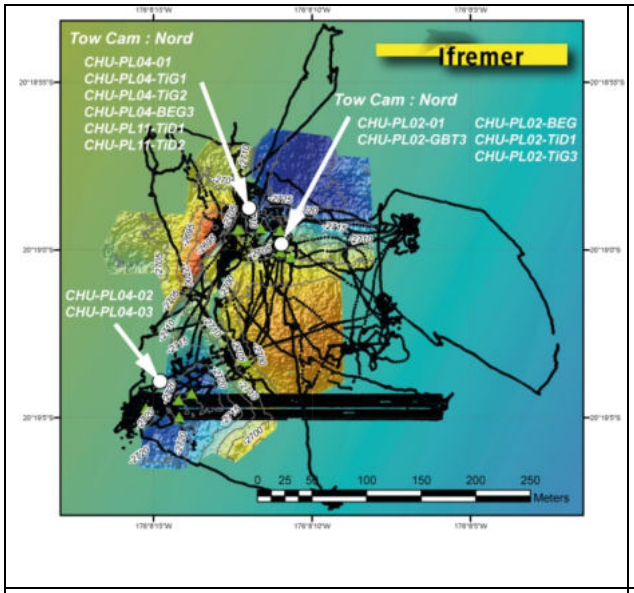


Figure 1: Tow Cam map. © Ifremer.

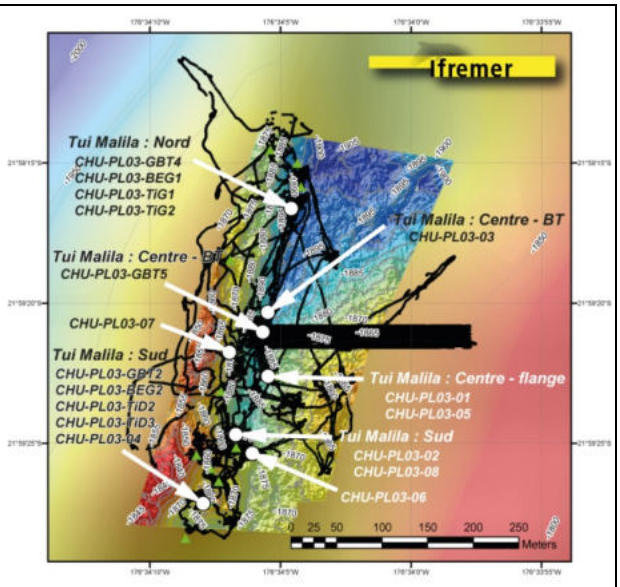


Figure 2: Tu'I Malila map. © Ifremer.

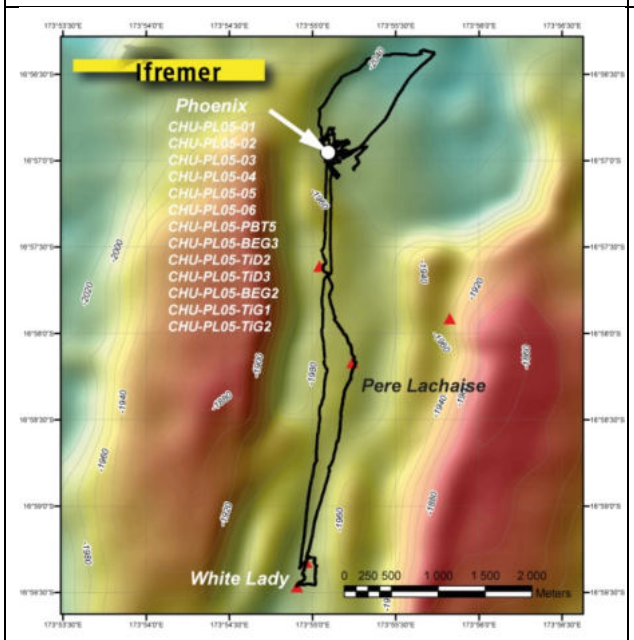


Figure 3: White Lady map. © Ifremer.

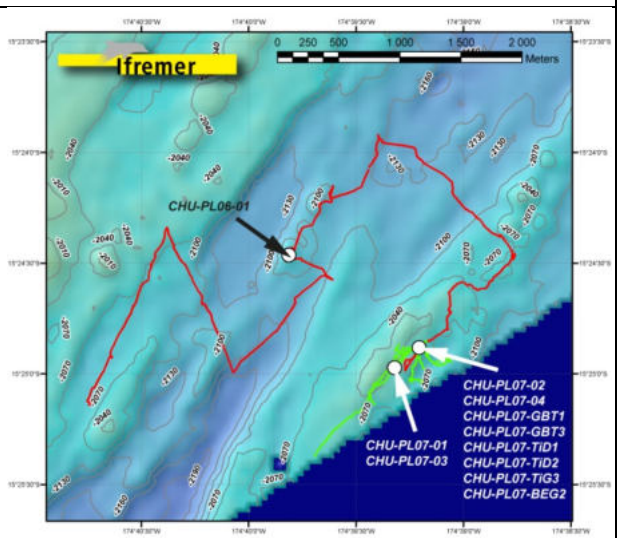


Figure 4: Mangatolo map. © Ifremer.

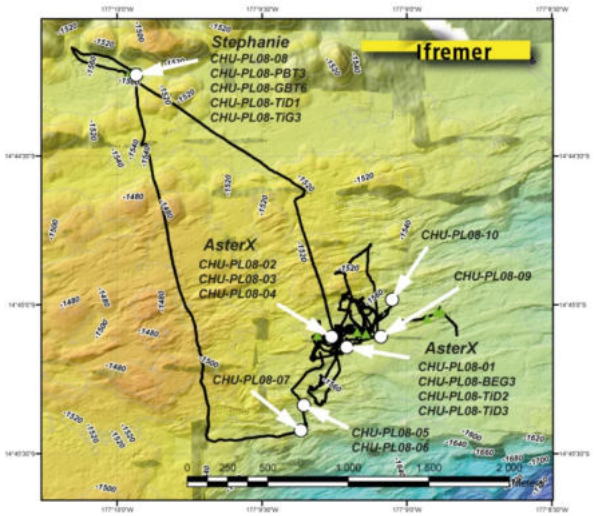


Figure 5: Fatu Kapa map. © Ifremer.

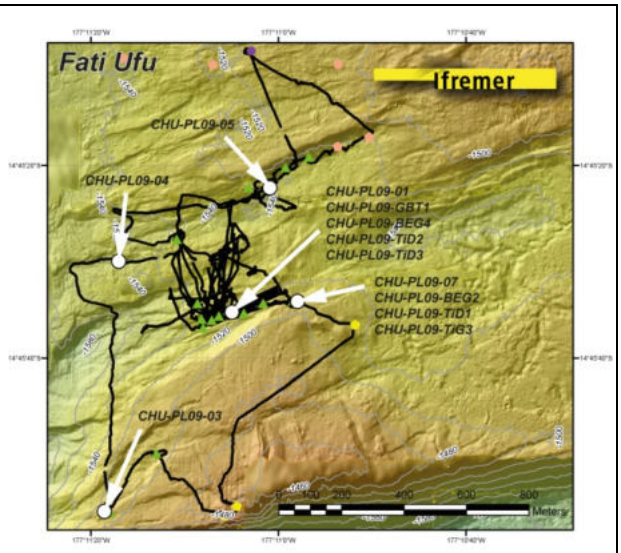


Figure 6: Fati Ufu map. © Ifremer.

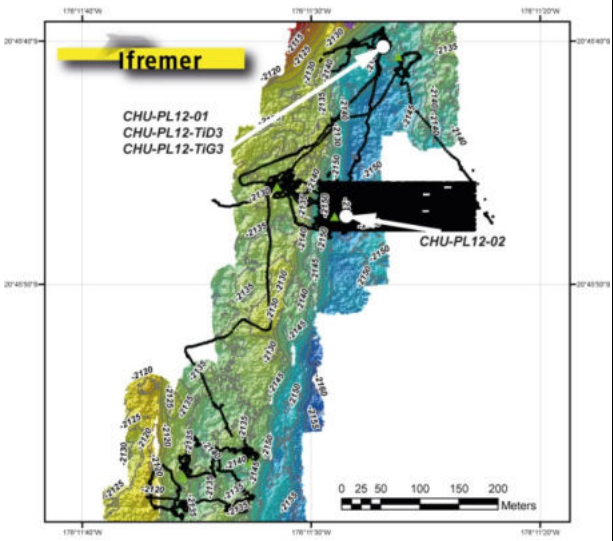


Figure 7: ABE map. © Ifremer.

1. Sampling tools

1.1. Titanium syringes

Titanium syringes are the most commonly used tool for hydrothermal fluid sampling directly at the outlet of the vent. They have the advantage of taking an important volume of hot fluid (650 mL) while ensuring good physical resistance in the aggressive matrix (acidic, corrosive and high temperature fluids) and thus guarantee optimal chemical inertness. The titanium syringes are equipped with autonomous NKE temperature sensor to measure precisely the samples temperature. The advantage of sampling the fluid directly at the outlet of the vent is to avoid as much as possible any mixture with the surrounding sea water, and thus get as close as possible to the "pure pole" (Figure 8).

Figure 8: example of hot fluid sampling with a titanium syringe. © Ifremer – Chubacarc 2019 Cruise.

1.2. BEG gastight bottles

The BEG gas-tight bottle was developed in the Geochemical Cycles and Resources Laboratory with the support of the Ifremer RDT department within the framework of a Carnot 2015 project. It is intended for the study of the gas chemistry of any liquid matrix enriched in gas (hydrothermal fluid, brine, seawater …). Although it has a smaller sample volume than titanium syringes (300 mL vs 650 mL), it has the advantage of keeping any sample taken from the bottom pressure. In the context of a hydrothermal fluid (Figure 9), thus enriched in gas, its volume is optimal to allow extraction for on-board analysis and packaging in stainless steel flasks for future analysis on shore. As the titanium syringes, BEG bottles are equipped with autonomous NKE temperature sensors.

Figure 9: example of hot fluid sampling with BEG gastight bottle. © Ifremer – Chubacarc 2019 Cruise.

2. Sampling

During the campaign, 36 samples of hydrothermal fluids were successfully collected on chimney vents during 11 dives by titanium syringes and BEG gas-tight bottles. The 6th dive does not allow sampling fluids. 5 samples correspond to seawater blank.

Technical problems occurred on some BEG gas-tight bottle triggering due to:

- One of the two valve trigger was damaged. We use the functional trigger and adapt the sampling strategy,
- One valve was damaged after rock suction that strikes out the valve seat. We replace the valve.

Only one problem occurred on titanium syringe triggering due to a bad grip by Maestro arm of ROV Victor. The triggered was jammed without allowing the sampling.

3. Work on board

- Determination of the purity of the fluid (measurement of pH and H_2S)
- Gas extraction for (1) immediate online analysis of major gases (CH_4, CO_2, N_2, H_2 and light hydrocarbons) and (2) gas storage in sealed flasks and brass tubes for complementary analysis of heavier hydrocarbons by chromatography, He and H_2 by mass spectrometry (MS) and isotopic ratio of C by GC/IR/MS and $^3He/^4He$ by MS
- Preparation of aliquots of fluids for mineral chemistry analysis (major elements, minors and traces) by ion chromatography (IC) and ICP/MS; as well as the reports isotopic (Fe, Cu, Zn) by MC/ICP/MS on land
- Dregs recovery, that is the collection of the particles remained adsorbed on the walls of the titanium syringes after fluid transfer

3.1. pH measurement

The pH measurement is made using an electrode of a Metrohm pH-meter equipped with an Ecotrode plus Metrohm pH electrode ref: 6.0262.100 (Figure 10). The calibration is made daily in two points (buffer pH=4 and pH=10) followed by a verification on buffer pH=7.

Figure 10: Metrohm pH-meter. © Ifremer – Chubacarc 2019 Cruise.

3.2. Determination of H_2S by titrimetric method

Apparatus: Titrino 848 + stirring block (Figure 11). Reference electrode LL ISE Metrohm ref: 6.0750.100. Specific electrode: Orion. Titration solution: 0.01M $AgNO_3$.

The analysis of the H_2S is carried out on 5 mL of sample directly mixed in an approximate 20 mL volume of ultra-pure water (milli-Q) and 1 mL of 2M NaOH. Under mechanical agitation, the Titrino system injects an increasing volume of silver nitrate at 0.01M. In parallel, the specific electrode and the reference electrode measure the evolution of the potential difference as a function of the volume of injected $AgNO_3$. The analysis stops when the curve ΔP = ($VAgNO_3$) draws a point of inflection, corresponding to an equivalence volume. [H2S] is calculated from this equivalence volume.

Figure 11: Metrohm Titrino used for the [H_2S] measurement. © Ifremer – Chubacarc 2019 Cruise.

3.3. Gas extraction, analysis and storage

At first, it is necessary to separate the gases from the hydrothermal liquid. This operation is made thanks to a gas extractor developed by the laboratory Geochemistry-Metallogeny of Ifremer (today Geochemical Cycles and Resources Laboratory) and coupled to a portable chromatograph (Figure 12).

During the dive, the hydrothermal fluid is removed using a titanium syringe. Upon return of the titanium syringe on board, it is connected to the extractor to transfer the whole sample (except the volume for pH and [H_2S] determination) in a decanter connected to a bellows, the whole being under vacuum thanks to a turbo-molecular pump. The liquid stays in the decanter and the gases migrate into the bellows. A secondary system allows compress the gases present in the bellows towards flasks, glass tubes, and copper tubes. Samples are stored especially for the measurement on land of isotopes of carbon, hydrogen and helium by mass spectrometry. This instrumentation makes it possible to recover all the gases (He, traces hydrocarbons, H_2, CO_2, N_2, Ar, and CH4) present in the fluid.

A final step is to pump the remaining gases through a chromatograph to identify and quantify the major gases present: generally H_2, CO_2, N_2, Ar, CH_4, H_2S and light hydrocarbons (C1 to C3) if they are in sufficient concentration. This high-performance analytical system allows gas analysis in 120s. After the extraction of the gas, the liquid in the decanter is stored in a Nalgene® bottle for an analysis of mineral compositions by ion chromatography (major and minor), by atomic absorption spectrometry (Li, Rb, Fe, Mn, Cu and Zn) and ICP/MS (trace elements).

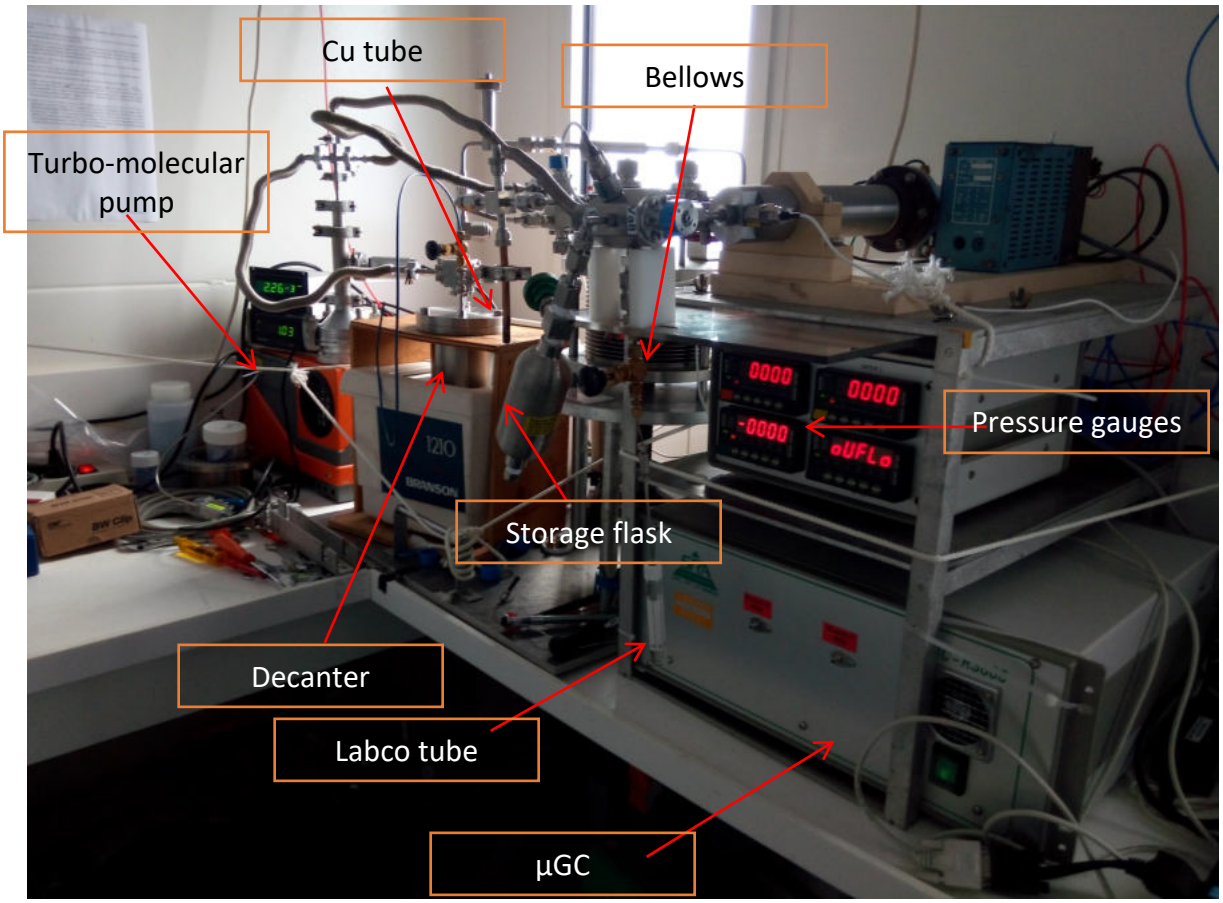


Figure 12: gas extractor coupled to a µGC. © Ifremer – Chubacarc 2019 Cruise.

3.4. Distribution of aliquots for subsequent analyses

Once the pH and H_2S are analysed, one of the two bottles of titanium syringes is under-sampled to condition water for on-shore analysis. The aliquot protocol is presented Figure 13. The acidification was carried out under controlled atmosphere in the microbiology container equipped with a laminar flow hood.

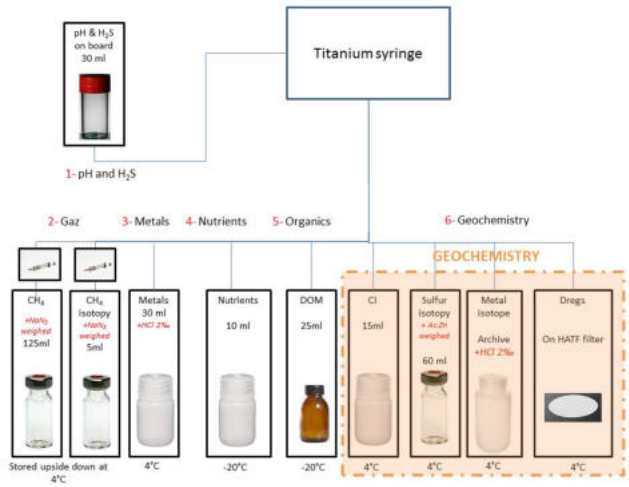


Figure 13: Distribution of aliquots of hydrothermal fluids. © Ifremer.

3.5. Recovery of "dregs"

It has been shown that for some metals in particular (e.g. Cu, Zn), a major part remained trapped in the adsorbed phases on the walls of the sampling tools, caused by a sudden cooling of the fluid in contact therewith. During the campaign, a protocol of recovery of these "dregs" was used (Erreur ! Source du renvoi introuvable.). It consists of much milli-Q water rinsing of the titanium syringe walls. The water is filtered on HATF filter under vacuum. The filtered is then put in a specific holder and frozen.

4. Preliminary results of fluid chemistry on Chubacarc Leg 1

Table 1: Summary of fluid samples taken during the Chubacarc 2019 campaign. Samples with problems during triggering are not presented. Data from salinity, pH and H_2S come from the on board measurements. Values in *italic* correspond to seawater blank.

Site name	Sample	Sampling picture	Vent type	Kind of analysis	Temperature (°C)	Depth (m)	Triggering time dd/mm/yy hh:mm (UTC)	pH	H_2S (mM)	Salinity (‰)
Kilo Moana	*CHU-PL1-TiG1*	*Figure 14*	*Blank*	*Gas*	*2.4**	*2625*	*30/03/19 17:02*	*7.64*	*4.29*	*35*
	CHU-PL1-TiG2		*Blank*	*Metal*	*2.5**	*2625*	*30/03/19 16:54*	*7.65*		*32*
Tow Cam	CHU-PL2-TiG3	Figure 15		Gas	310.0*		31/03/19 19:16	4.32	3.80	37
	CHU-PL2-TiD1			Metal	137.1*		31/03/19 19:28	4.30		38
Tu'I Malila	CHU-PL3-BEG1	Figure 16		Gas	294.8*	1891	03/04/19 09:01	4.79	0.64	40
	CHU-PL3-TiG1			Metal	292.3*	1891	03/04/19 09:13	3.98		40
	CHU-PL3-TiG2	Figure 17		Gas	14.8*	1891	03/04/19 09:20	7.05	1.41	36
	CHU-PL3-TiD2			Metal	263.5*	1991	04/04/19 10:39	4.16		40
	CHU-PL3-TiD3	Figure 18		Gas	264.6*	1991	04/04/19 10:43	4.08	1.77	40
Tow Cam	CHU-PL4-BEG3	Figure 19		Gas	272.8*		06/04/19 00:32	6.33	0.31	39
	CHU-PL4-TiG1			Metal	243.3*		06/04/19 00:50	5.49		36
	CHU-PL4-TiG2	Figure 20		Gas	98.3*		06/04/19 00:58	6.38	0.26	37
Ivory Tower	CHU-PL5-BEG2	Figure 21		Gas	276.4*	1973	10/04/19 06:59	5.98	0.39	38
	CHU-PL5-TiG2			Metal	275.6*	1973	10/04/19 06:53	4.35		39
	CHU-PL5-BEG3	Figure 22		Gas	270.7*	1973	11/04/19 02:47	7.98	2.26	37
	CHU-PL5-TiD2			Metal	257.9*	1973	11/04/19 02:37	4.49		39
	CHU-PL5-TiD3	Figure 23		Gas	184.5*	1973	11/04/19 02:37	4.70	2.35	39
Mangatolo	CHU-PL7-TiG3	Figure 24		Gas	310.4**			4.27	7.03	27
	CHU-PL7-TiD1	*Figure 25*	*Blank*	*Gas*	*2.26***			*7.69*	*<LOD*	*38*
	CHU-PL7-TiD2			Metal	308.4**			4.01	5.91	27
Fatu Kapa	CHU-PL8-BEG3	Figure 26		Gas	277.8**			8.05	1.96	38
	CHU-PL8-TiG3			Metal	287.3**			4.09	2.11	46
	CHU-PL8-TiD2			Metal	277.8**			4.39	0.87	44
	CHU-PL8-TiD3	Figure 27		Gas	278.6**			4.28	0.99	44

	CHU-PL8-TiD1	Figure 28		Gas	288.1**	4.01	2.26	46
Fati Ufu	CHU-PL9-BEG4	Figure 29		Gas	301.9**	5.67	0.73	44
	CHU-PL9-TiD1			Metal	291.8**	3.26	1.92	46
	CHU-PL9-TiD2	Figure 30		Gas	299.8**	4.11	1.83	47
	CHU-PL9-TiD3			Metal	300.2**	3.97	1.98	48
	CHU-PL9-TiG3	Figure 31		Gas	291.4**	3.30	2.41	46
Kulo Lasi	CHU-PL10-TiD2	*Figure 32*	*Blank*	*Gas*	*2.9***	*7.75*	*<LOD*	*37*
	CHU-PL10-TiD3		*Blank*	*Metal*	*3.2***	*7.75*	*<LOD*	*37*
Tow Cam	CHU-PL11-TiD1	Figure 33		Gas	316.5**	4.04	5.02	37
	CHU-PL11-TiD2			Metal	316.5#	4.25	4.11	38
ABE	CHU-PL12-TiD3	Figure 34		Gas	306.4**	4.19	4.86	36
	CHU-PL12-TiG3			Metal	307.2**	4.31	4.35	35

*Temperature: * determined by the sensor value during the sampling / ** determined by the maximum sensor value as a first approximation except for blank (minimum) / # estimation based on the CHU-PL11-TiD1 value because of sensor breakage due to overheat.*
Empty cases correspond to work in progress.

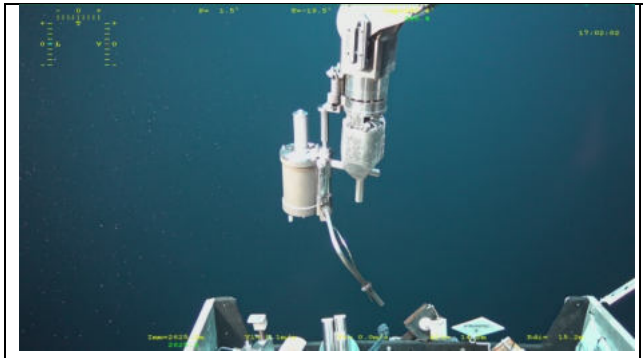


Figure 14: CHU-PL1-TiG1. © Ifremer – Chubacarc 2019

Figure 15: CHU-PL2-TiG3. © Ifremer – Chubacarc 2019

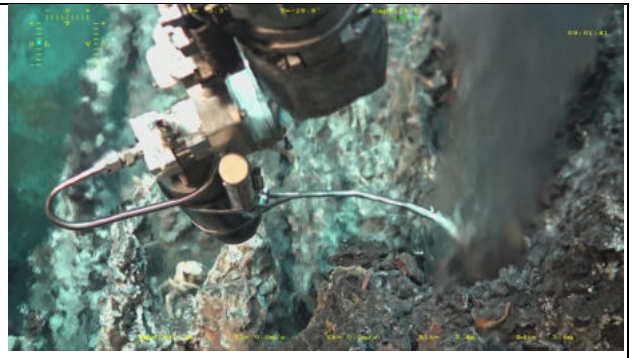


Figure 16: CHU-PL3-BEG1. © Ifremer – Chubacarc 2019

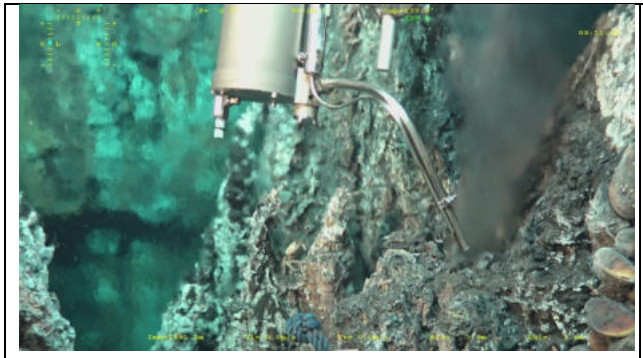


Figure 17: CHU-PL3-TiG2. © Ifremer – Chubacarc 2019

Figure 18: CHU-PL3-TiD3. © Ifremer – Chubacarc 2019

Figure 19: CHU-PL4-BEG3. © Ifremer – Chubacarc 2019

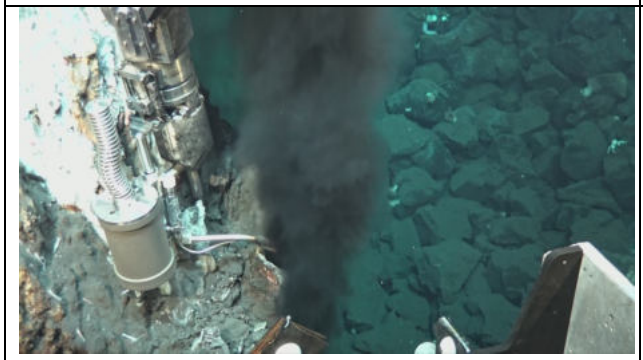


Figure 20: CHU-PL4-TiG2. © Ifremer – Chubacarc 2019

Figure 21: CHU-PL5-BEG2. © Ifremer – Chubacarc 2019

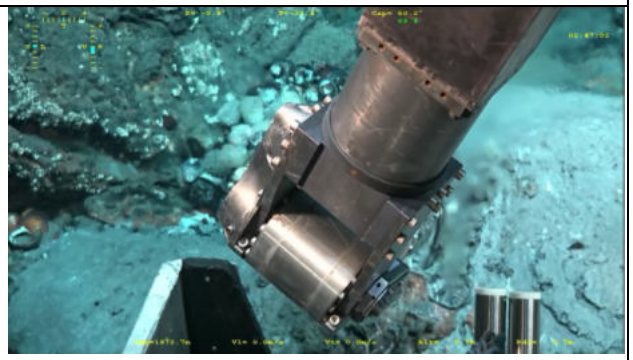


Figure 22: CHU-PL5-BEG3. © Ifremer – Chubacarc 2019

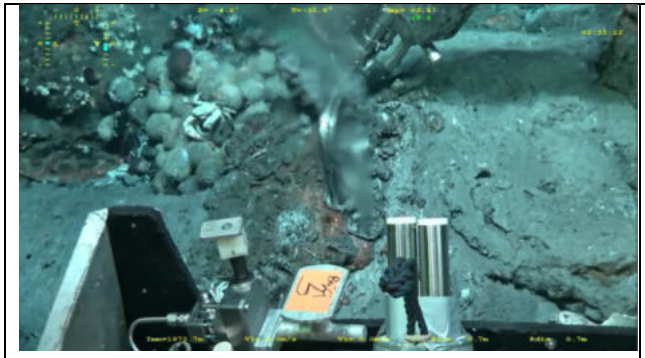


Figure 23: CHU-PL5-TiD3. © Ifremer – Chubacarc 2019	Figure 24: CHU-PL7-TiG3. © Ifremer – Chubacarc 2019	Figure 25: CHU-PL7-TiD1. © Ifremer – Chubacarc 2019
Figure 26: CHU-PL8-BEG3. © Ifremer – Chubacarc 2019	Figure 27: CHU-PL8-TiD3. © Ifremer – Chubacarc 2019	Figure 28: CHU-PL8-TiD1. © Ifremer – Chubacarc 2019
Figure 29: CHU-PL9-BEG4. © Ifremer – Chubacarc 2019	Figure 30: CHU-PL9-TiD2. © Ifremer – Chubacarc 2019	Figure 31: CHU-PL9-TiG3. © Ifremer – Chubacarc 2019
Figure 32: CHU-PL10-TiD2. © Ifremer – Chubacarc 2019	Figure 33: CHU-PL11-TiD1. © Ifremer – Chubacarc 2019	Figure 34: CHU-PL12-. © Ifremer – Chubacarc 2019

Empty cases correspond to work in progress.

5. Preliminary results of fluid chemistry on Chubacarc Leg 2. Done by O. Rouxel and C. Boulart using Titane syringes on chimneys.

Sample Name ID	DIVE	TITANIUM SYRINGES	Lat. S	Long. E	Prof (m)	Site Name	Date	Start-End Time (UTC)		Max Temp°C (ROV)	Photo Y/N	Comments	Observer ID	pH (21°C)	ΣS(-II) (mM)	FeT (mM)	Max-Min Temp°C (ICL)	Paired sulfide sample ID	Pictures	Other Comment
CHU-PL14-TIG1	PL14	TIG1	xx	xx	1704	Big Papi	05-16-2019	15:17	15:19	354	Y	Active black smoker on side of complex spire. Fluid sampling with good venting through TTH	OR	2,75	3,01	7,82	350-311	CHU-PL14-PBT1	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiG1_pictures/190516151647524_01_1080i.jpg	
CHU-PL14-TID3	PL14	TID3	xx	xx	1704	Big Papi	05-16-2019	15:54	15:56	354	Y	Same chimney than TDG1 after removing part of the chimney (sample PBT1), producing a larger orifice. Very active venting with TTH OK	OR	2,86	2,53	9,14	350-322	CHU-PL14-PBT1	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiD3_pictures/190516155339928_01_1080i.jpg	
CHU-PL14-TIG3	PL14	TIG3	xx	xx	xx	Satanic Mills	05-17-2019	00:11	00:13	285	Y	POI= smoker for chemistry'. Fluid sampling performed after unintentionnally removing about 1 meter of the chimney top	SAH-OR	2,54	1,88	1,99	283-247		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiG3_pictures/190517001054949_01_1080i.jpg	
CHU-PL14-TIG2	PL14	TIG2	xx	xx	xx	Satanic Mills	05-17-2019	00:16	00:17	285	Y	Sampling just after TIG3, same place. Loss of up to 80% of fluid upon recovery due to leak of syringe valve and overpressure	SAH-OR	2,58	1,59	1,72	274-220		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiG2_pictures/190517001701363_01_1080i.jpg	
CHU-PL14-TID1	PL14	TID1	xx	xx	xx	Solwara8	05-18-2019	04:33		271	Y	Sampling failed due to jammed Titanium syringe	OR	N/A	N/A		No datafile		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiD1_pictures/190518043923810_15_1080i.jpg	
CHU-PL14-TID2	PL14	TID2	xx	xx	xx	Solwara8	05-18-2019	04:47	04:50	271	Y	Vent fluid from black smoker with top 1.5 meters removed. Opening of 3-4 cm lined with chalcopyrite ;Paired with PBT2	OR	3,59	1,60	0,41	271-139	CHU-PL14-PBT2	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL14_TiD2_pictures/190518045007251_15_1080i.jpg	
CHU-PL15-TID3	PL15	TID3	xx	xx	xx	Roman's Ruins	05-19-2019	4:14	4:18	310	Y	Fluid sampled from open conduit of black smoker, with top 1.5m removed. Paired with sample R1 and nearby PBT7	OR	3,20	3,71	3,98	269-122	CHU-PL15-R1	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL15_TiD3_pictures/190519041250117_01_1080i.jpg	
CHU-PL15-TIG3	PL15	TIG3	xx	xx	xx	Roman's Ruins	05-19-2019	4:03	4:08	310	Y	Failed - syringe did not triggered	OR	N/A	N/A		No datafile		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL15_TiG3_pictures/190519040722523_01_1080i.jpg	
CHU-PL16-TiG2	PL16	TiG2	3°41.4609	151°51.9568	1923	Desmos	05-21-2019	03:22	03:24	5,75		Diffuse fluid through talus with abundant white microbial mats	VT	6,64	0,31	<0.01	6.05-4		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL16_TiG2_pictures/190521032242147_15_1080i.jpg	
CHU-PL16-TiD2	PL16	TiD2	3°41.4609	151°51.9568		Desmos	05-21-2019	03:02	03:04	11,4		Diffuse fluid at the interface between pillow lavas with abundant white microbial mats	TV	5,43	0,18	0,12	11.77-11.21		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL16_TiD2_pictures/190521030202954_15_1080i.jpg	
CHU-PL17-TiD1	PL17	TiD1	3°47.37	152°05.779	1503	Suzette/North Su	05-22-2019	12:28	12:30	281	Y	@crabpot	CB	4,01	0,72	0,89	280-220		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL17_TiD1_pictures/190522122814462_01_1080i.jpg	
CHU-PL17-TiG3	PL17	TiG3	3°47.37	152°05.779	1503	Suzette/North Su	05-22-2019	12:35	12:37	281	Y	Same as D1. @ crabpot. Very small and fragile high-T diffusers. The top is about 20 cm high (anhydrite)	CB	3,79	0,84	0,99	281-240		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL17_TiG3_pictures/190522123536588_01_1080i.jpg	
CHU-PL17-TiG1	PL17	TiG1	3°43.066	152°06.09	1225	Suzette/North Su	05-23-2019	11:25	11:26	228	Y	On sulfure chimney	CB	3,32	0,93	0,03	9.5 !		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL17_TiG1_pictures/190523112542710_15_1080i.jpg	
CHU-PL17-TiD3	PL17	TiD3	3°47.99	152°06.049	1155	North Su	05-23-2019	12:20	12:21	320	Y	On black smoker after chimney sampling for microbio.	CB	4,18	1,13	3,79	226-215	CHU-PL17-PBT5	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL17_TiD3_pictures/190523122022430_15_1080i.jpg	CHU-PL17-ROCK3 CHU-PL17-ROCK4
CHU-PL18-TiD1	PL18	TiD1	3°48.5649	152°06.3141	1330	South Su	05-24-2019	13:39	13:41	291	Y	Base of diffuser sampled for microbio (PBT6)	OR	2,84	2,03	2,69	278-215	CHU-PL18-PBT6	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL18_TiD1_pictures/190524134029500_15_1080i.jpg	
CHU-PL18-TiG2	PL18	TiG2				South Su	05-25-2019	05:22	05:23	N/A	Y	Return to chimney rockd2, sampling venting from base of chimney	OR	2,86	1,73	2,77	141-135		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL18_TiG2_pictures/190525051942413_15_1080i.jpg	
CHU-PL18-TiD2	PL18	TiD2				South Su	05-24-2019	13:58		287	Y	Base of tall (10m) and thin chimney with...	OR	2,87	1,34	3,07	288-200		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL18_TiD2_pictures/190524135735946_15_1080i.jpg	CHU-PL18-ROCK1 CHU-PL18-ROCK2
CHU-PL18-TiG3	PL18	TiG3				Northern South Su	05-25-2019	04:54		60	Y	Vigorous diffuse venting through vertical crack, covered with white microbial mat	OR	3,20	1,08	0,01	91-70		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL18_TiG3_pictures/190525045336352_15_1080i.jpg	
CHU-PL19-TiG1	PL19	TiG1	9°47.95	155°03.11		Scala (Woodlark)	05-27-2019	15:58		366	Y	Top of 7m tall black smoker (POI smoker #5)	OR	3,58	3,64	ND	366-330		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL19_TiG1_pictures/190527155827963_15_1080i.jpg	
CHU-PL19-TiG2	PL19	TiG2	9°47.94	155°03.124			05-28-2019	03:09	03:10	364	Y	Black smoker 6	TV	5,71	0,34	ND	360-310		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL19_TiG2_pictures/190528030840022_15_1080i.jpg	
CHU-PL19-TiD2	PL19	TiD2	9°47.94	155°03.124			05-28-2019	03:22	03:23	364		Black smoker 6	TV	4,31	1,17	ND	318-290		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL19_TiD2_pcitures/190528032151050_15_1080i.jpg	
CHU-PL19-TiD3	PL19	TiD3	9°47.95	155°03.11			05-27-2019	15:40		367		Base of black smoker 10cm diam.	OR	3,41	4,04	ND	364-356	CHU-PL19-PBT2	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL19_TiD3_pictures/190527154026771_15_1080i.jpg	CHU-PL19-ROCK1
CHU-PL20-TiD2	PL20	TiD2	9°47.9315	155°03.1295		Scala (Woodlark)	05-30-2019	03:00	03:01	365	Y	Base of diffuser . Very large conduit ok black smoker (carioca smoker)	OR	3,64	3,75	ND	366-330		/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL20_TiD2_pictures/190530025929755_15_1080i.jpg	
CHU-PL20-TiG2	PL20	TiG2	9°47.9315	155°03.1295		Scala (Woodlark)	05-30-2019	03:05	03:06	365	Y	Base of diffuser . Very large conduit ok black smoker (carioca smoker)	OR	3,31	4,08	ND	360-310	CHU-PL20-PBT2	/Volumes/science/CHUBACARC/LEG2/05_Leg2_Geochemistry/01_TITANE/CHU_PL20_TiG2_pictures/190530030529597_15_1080i.jpg	CHU-PL20-ROCK1 CHU-PL20-ROCK2

Geological exploration and rock sampling

Ewan Pelleter and Audrey Boissier
Ifremer, Marine geoscience department.

During Leg1 of the CHUBACARC cruise, sixty-nine rock samples were collected. Fifty-six corresponds to mineralized rocks and thirteen to igneous rocks. Most of the mineralized samples are sulfides ± sulfates chimney (39/56). Other mineralization includes semi-massive to massive sulfides (9/56), Fe±Si±Mn low temperature precipitates (5/56), barite chimney (1/56) and disseminated sulfides (2/56). Detailed description of rock samples is available in annex 1 (in French) including pictures of the sampling area as well as the rock sample.
On board, rock samples are selected and representative pieces are cut by a rock saw in three parts, one for a polished section, an other as a control sample and the last one to be crushed. All these samples are dried at 60°C overnight. The third part is crushed by a planetary crusher from the Frisch company for 4 to 10 min to get a grain size finer than 50µm. A part of the powder (6g) is used to make pellet for X-ray fluorescence analysis. It's combined with 0.6g of wax and press at 10T. The other part is kept to future preparation and/or analyses.
A Minipal 4, a dispersion energy x-ray fluorescence spectrometer from Panalytical had been taken on board for preliminary analysis. Unfortunately, a problem appeared in the X-ray alimentation and we were not able to use it during the cruise. All measurement will be done in the laboratory.

Three main zones were investigated during the first leg of the CHUBACARC cruise: (i) the Lau basin, (ii) the north Fiji basin and (iii) the Wallis and Futuna EEZ. In the Lau basin, four known site were visited (Kilo Moana, Tow Cam, ABE and Tui Malila) and exploration was made in the Mangatolo triple junction. In the North Fijji basin, only one hydrothermal field has been investigated leading to the discovery of a new hydrothermal site (called Phoenix). Work on the Wallis and Futuna EEZ was focused on the Fatu Kapa hydrothermal field (including AsterX, Stephanie, Fati Ufu) and the Kulo Lasi Caldera.

Lau Basin

Kilo Moana – Northern ELSC

Kilo Moana is located at depth of 2620m and is composed of three distinct vent sites. The area is characterized by two volcanic domes composed of pillow lavas and crosscut by N-S to N20 faults and cracks (Figure 36A). The vent sites are systematically bordered by major fissures and sometimes at the intersection of faults (Figure 36B). The three sites (north, central and south) are now inactive. During dive 1 (720; Figure 35), we sampled six mineralized rocks, five (CHU-PL01-01 and CHU-PL01-GBT1 to 4) in the central site and one (CHU-PL01-02) in the north site. Most of the samples corresponds to Zn- and Fe-rich chimney composed of wurtzite (including orange, low-Fe wurtzite), pyrite, marcasite, chalcopyrite and amorphous silica (Figure 37). One sample corresponds to an altered and mineralized basalt collected on the fault that crosscut the north site (Figure 36B and Figure 37B).

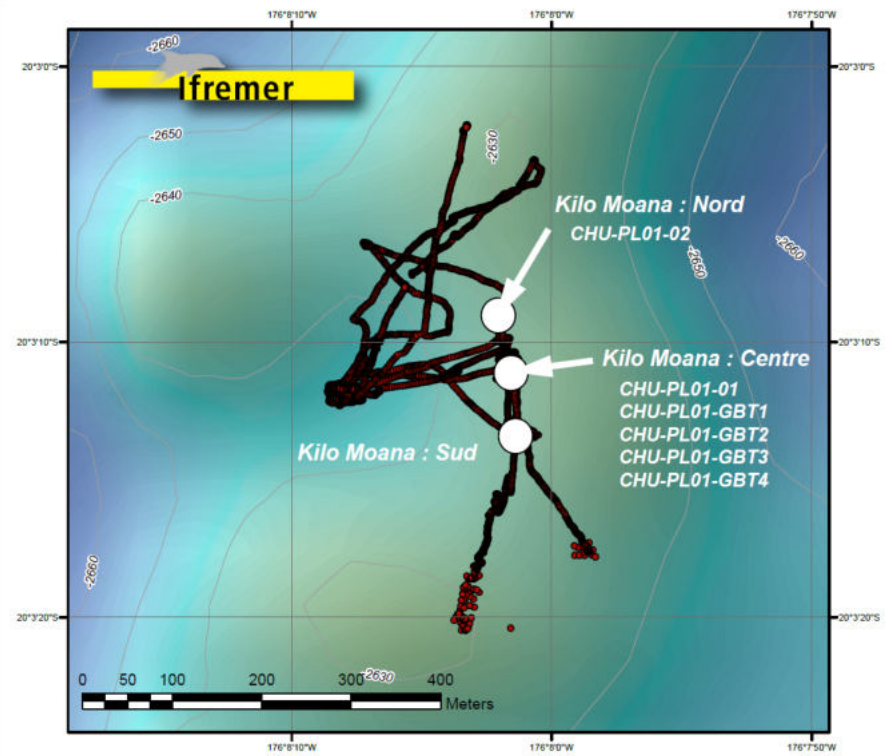


Figure 35 : Localization of the Kilo Moana sulfides deposits and position of the rock samples.

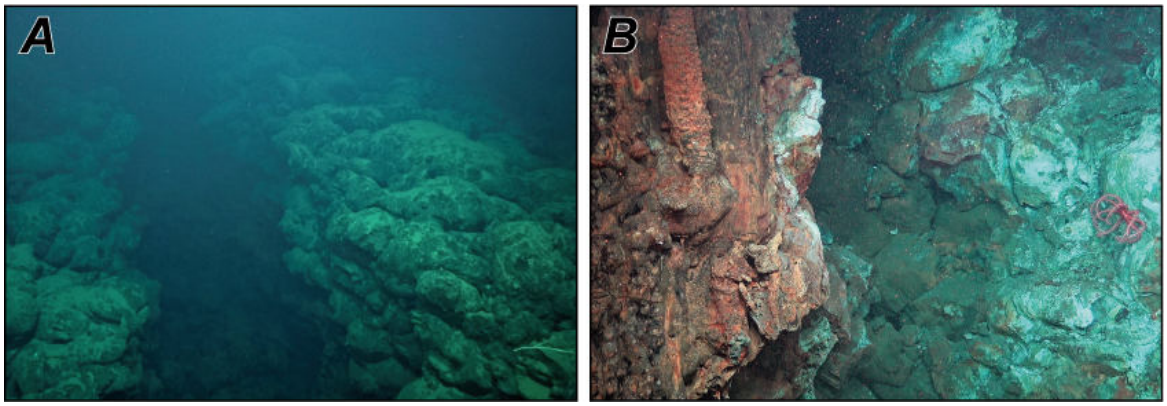


Figure 36 : A. Major fault that crosscut the pillow lavas. B. Kilo Moana (north zone) with inactive hydrothermal chimneys (in the front) and strongly altered pillow lavas (in the back)

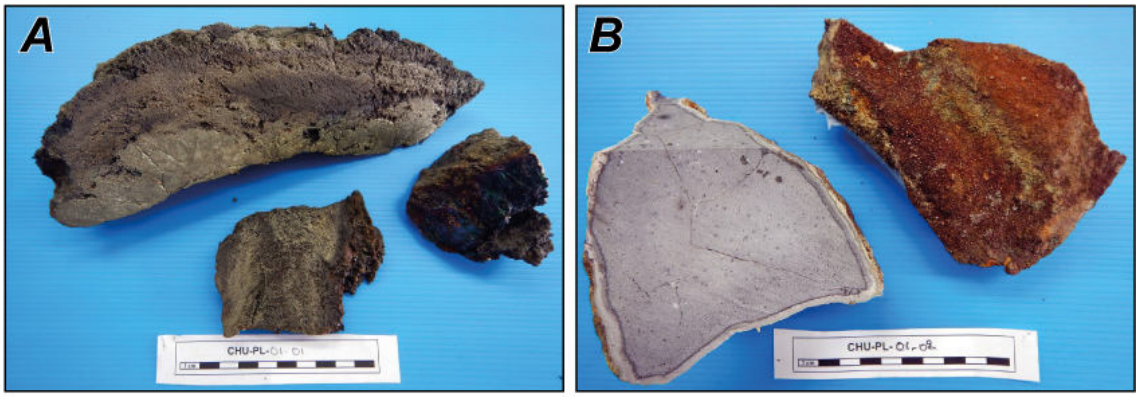


Figure 37 : A. Sample of an inactive sulfide chimney; note the massive zone (2cm-thick) composed of chalcopyrite. B. Altered basalt mantle with secondary minerals and sulfides.

Tow Cam – North ELSC

Tow Cam is located at 2700m water depth (Figure 38) and can be divided into three zones: two hydrothermal vents (north and south zones) and one diffusion zone (central zone). The hydrothermal zones are still active. They are controlled by N20 faults and are in close vicinity of large (150m in diameter) volcanic domes. We mainly focus on the north zone where vigorous black smoker has been observed (Figure 39A). Fluid sampling has been performed during dive 2, 4 and 11 (721, 723 and 730) and we systematically collected the base of the chimney (Figure 39B) to study the high temperature sulfides (e.g. chalcopyrite) in equilibria with the fluids. Two basalts have been sampled for peripheral fauna and for cirripeds (CHU-PL04-02 and CHU-PL04-03).

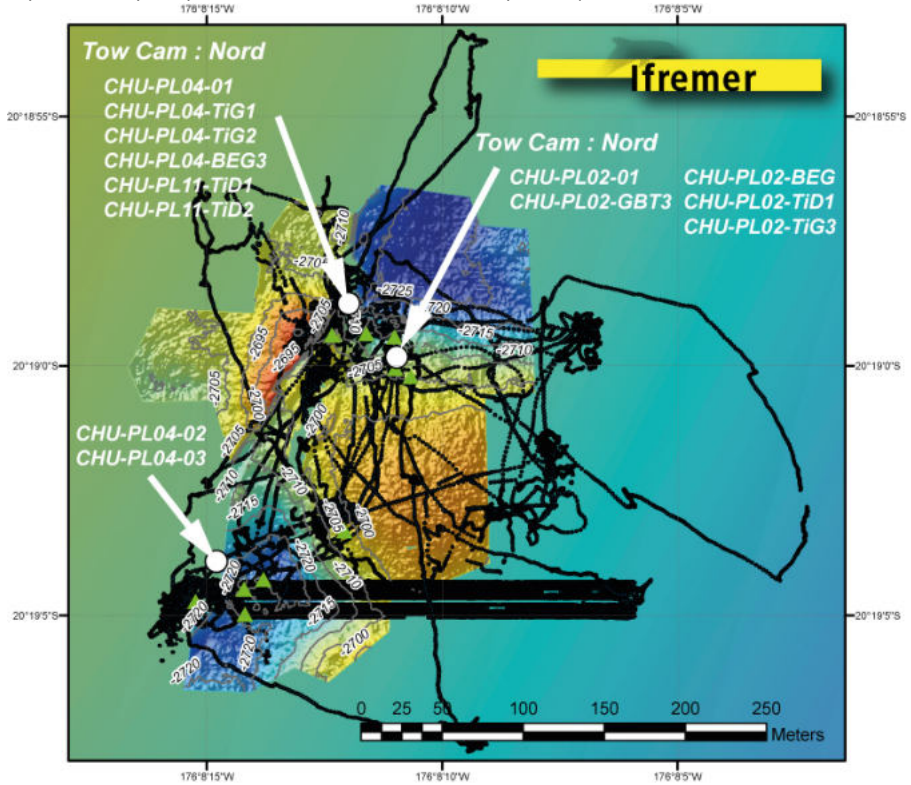


Figure 38 : Localization of Tow Cam hydrothermal zones and position of the rock and fluid samples. High-resolution map from Ferrini et al. 2008.

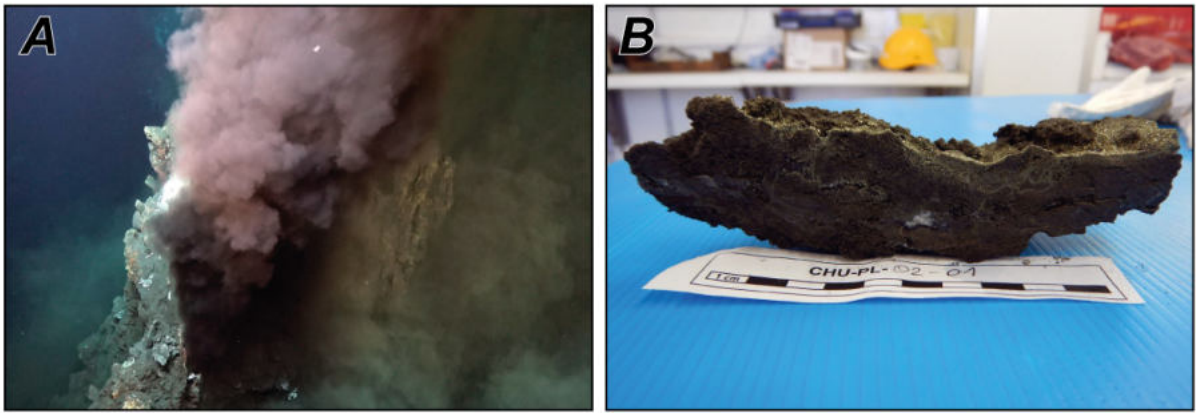


Figure 39 : A. Black smoker located in the north zone. B. Base of the black smoker chimney (in A) composed of chalcopyrite, wurtzite, pyrite and patches of anhydrite

ABE – Central ELSC

ABE is located at depth of 2140m and is mainly controlled by a major NE-SW trending fault. Three active zones can be distinguished: the north zone, the central zone and the south zone. The south hydrothermal vents are located 450m south of the north hydrothermal vents (Figure 40). During the last dive of the campaign (PL12; 731) we collected the base of a chimney composed chalcopyrite, pyrite and Zn sulfides (CHU-PL12-01) and the associated hydrothermal fluids. Additionally, the top of an inactive chimney has been sampled for cirripeds and for characterization of the sulfides mineralogy (CHU-PL12-02).

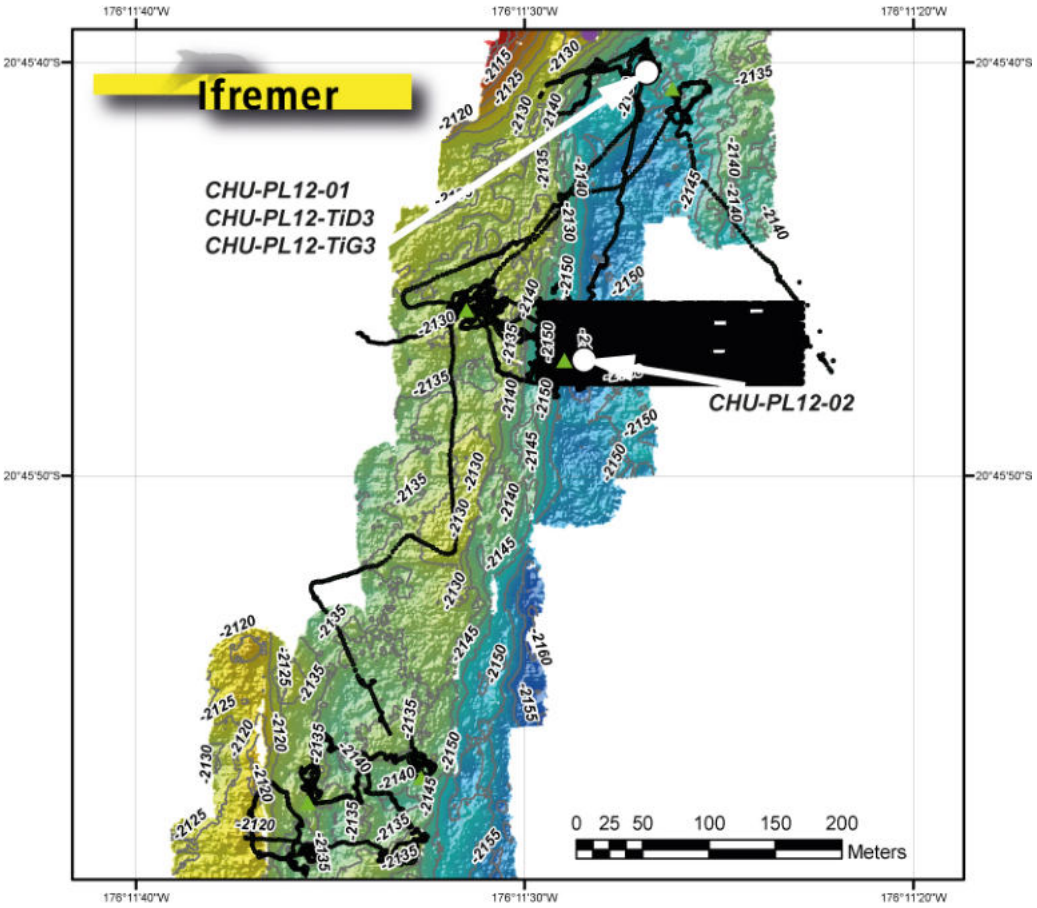


Figure 40 : Localization of ABE hydrothermal zones and position of the rock and fluid samples. High-resolution map from Ferrini et al. 2008.

Tui Malila –Valu Fa Ridge

Tui Malila is located at 1870m water depth and is characterized by several hydrothermal vents extended over an area of approximatively 300m (Figure 41). Three zones can be distinguished: the north zone, the central zone and the south zone. We focused on the north and south zone for fluid sampling and collection of related sulfides chimneys (CHU-PL03-04 and CHU-PL03-GBT4). During this dive, we also had the opportunity to sample semi-massive to massive sulfides (CHU-PL03-02 and CHU-PL03-06) and small pieces of "flanges" (CHU-PL03-01 and CHU-PL03-05; Figure 42). Low temperature precipitates were also recovered during Dive 3 (722). It

consists of a 5 to 6-mm thick manganese oxyhydroxydes layer that cover a basaltic rock (CHU-PL03-03). Additionally, basaltic rocks with cirrpeds or peripheral fauna have been collected.

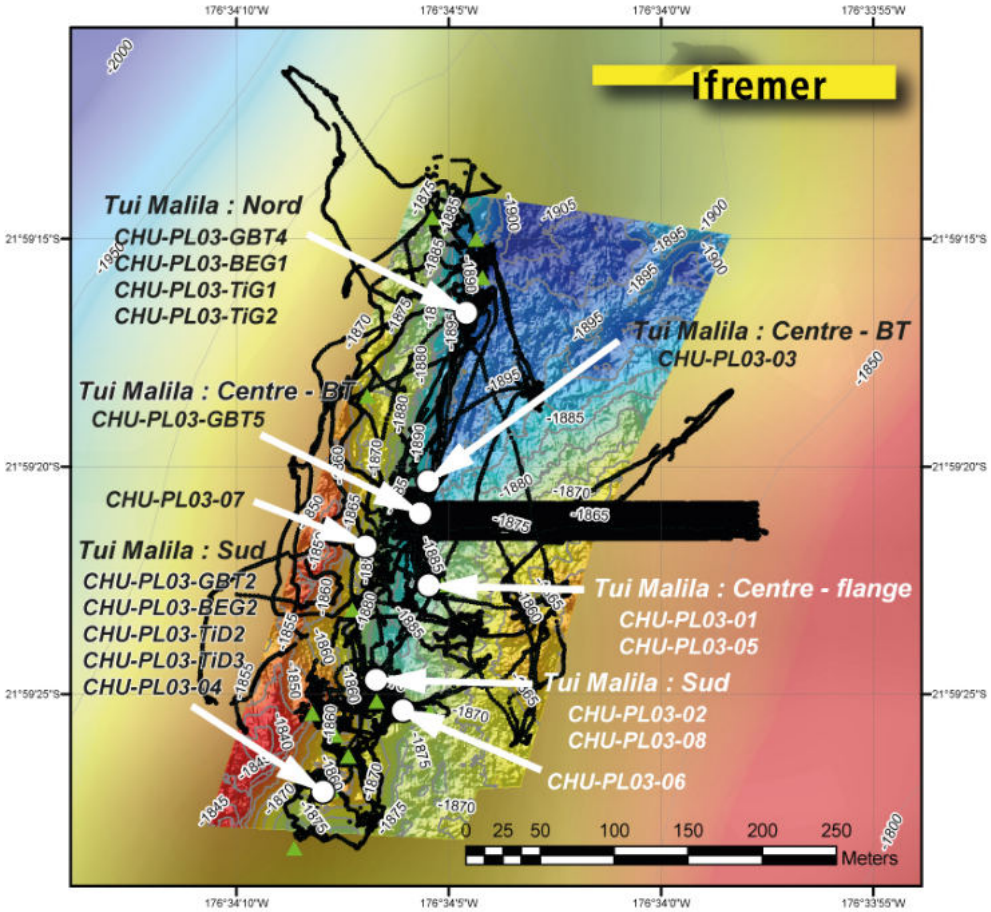


Figure 41 : Localization of Tui Malila hydrothermal zones and position of the rock and fluid samples. High-resolution map from Ferrini et al. 2008.

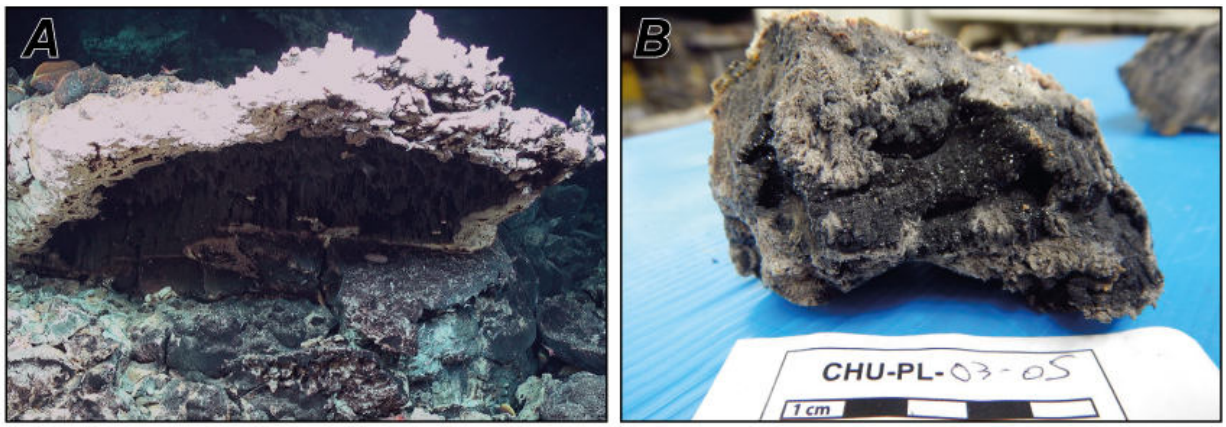


Figure 42 : A. Active flange observed in the south hydrothermal zone. B. Piece of a flange-type mineralization mainly composed of barite, silica and Zn sulfides.

Mangatolo triple junction – North Lau basin

We focused on the actively spreading north arm of the Mangatolo triple junction investigated during Archimedes-I cruise (SO267) in January 2019. During this cruise, German teams identified potential plume anomalies in a relatively wide area (around 5km in diameter). The first dive (dive 6; 725) follows NE-SW to NNE-SSW trending faults and crosscut a 1 to 2km-wide grabben (Figure 43). During the first seven hours of exploration, we only observed isolated inactive chimney or small (10-20m in diameter) Fe-Si±Mn deposits (Figure 44A). A sample of a low-temperature Fe-Si precipitate was collected on the summit of a volcanic dome (CHU-PL06-01; Figure 45A). On the east flank of the grabben, low temperature diffusions and inactive sulfides chimneys were observed. Exploration through the south in order to follow NE-SW trending faults that crosscut volcanic domes permits the discovery of high temperature activity and diffusion. Four hydrothermal sites have been discovered but only one is characterized by high temperature fluid with chimneys composed of anhydrite and few sulfides (Figure 44B and Figure 45B). Other rock samples collected during dive 7 (726) include semi-massive sulfide (CHU-PL07-01) and pieces of a flange structure (CHU-PL07-03).

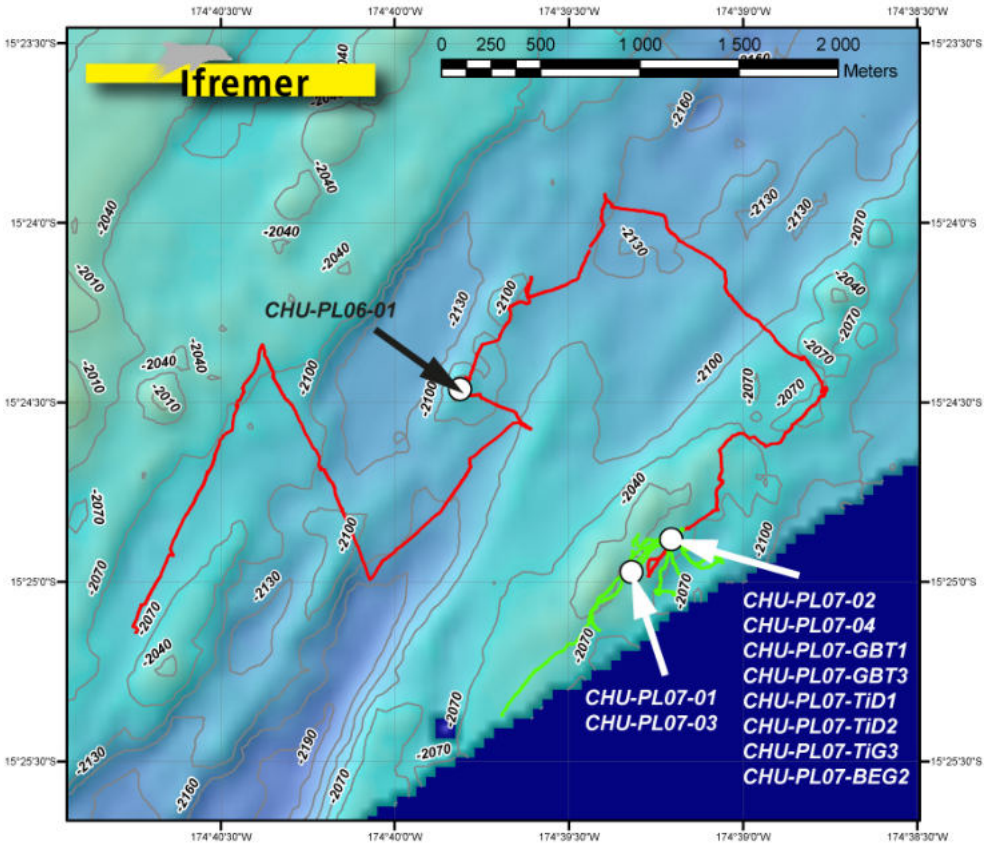


Figure 43 : In red: exploration track of dive 6 (725) that leads to the discovery of the hydrothermal sites. In green: track of the dive 7 (726) focused on the discovered hydrothermal sites. Localization of rock and fluid samples is also shown.

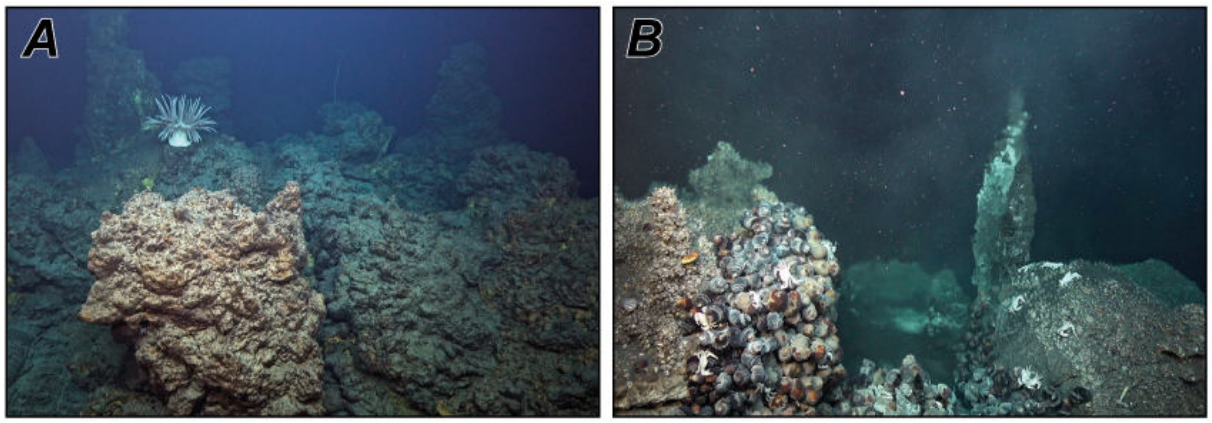


Figure 44 : A. Inactive chimneys composed of amorphous silica and iron oxyhydroxides. B. High-temperature chimney mainly composed of anhydrite with few sulfides at the base.

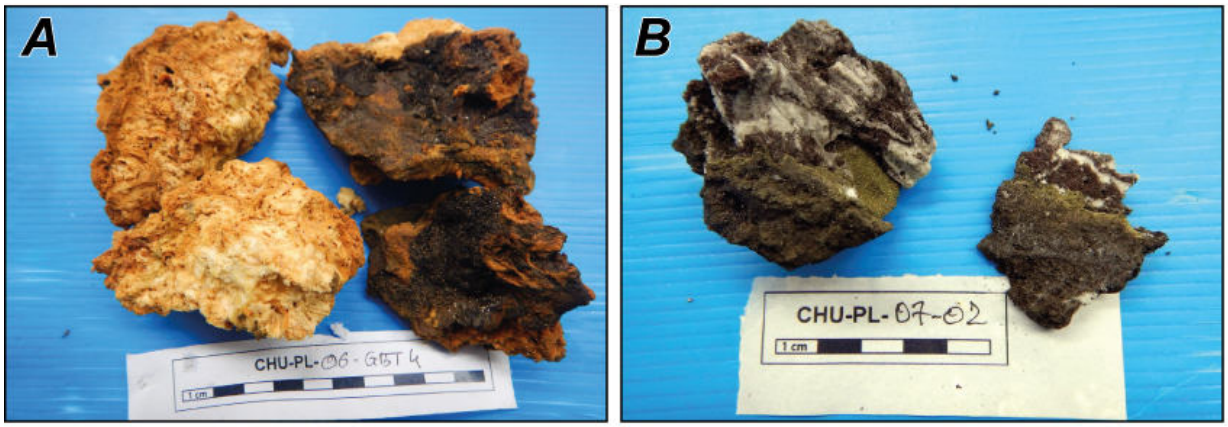


Figure 45 : A. Fe-Si precipitates sampled during dive 6. B. Anhydrite ± sulfides chimney sampled

North Fiji basin

White Lady and Phoenix

The objectives of the dive 5 (724) was to (i) explore the Sonne Field and Pere Lachaise and (ii) work in the active zone called White Lady (Figure 46). The Sonne field and Pere Lachaise were known to be inactive last time scientists visited these deposits in the early 90's. Dive 5 began 1.5km north of Sonne field in order to explore the west flank of a large depression (2.5km in diameter) characterized by massive flows and lava lake pillars (Figure 47). Rapidly, we found a new hydrothermal field composed of several massive deposits (>30m in diameter) with no high-temperature activity (only diffusions or medium-temperature - 150-200°C - activity) and small clusters of high-temperature chimneys (Figure 47). This latter were mainly found in the west part of the field, west of a large N-S trending fissure. They are at the top of small deposits (<10m in diameter) which lies on lava ropes. Sampling of massive sulfides deposits and active chimneys was done during this dive (Figure 48). This new active field is called Phoenix.

The White Lady was not seen during this dive. We only observed inactive chimney with no hydrothermal fauna. At the estimated point, we saw collapsed inactive chimney (Figure 47Figure

44) and dead mussels. With only 1 hour and half to explore the area (due to the sampling schedule), we cannot be sure whether we missed the White Lady chimney or we found it inactive.

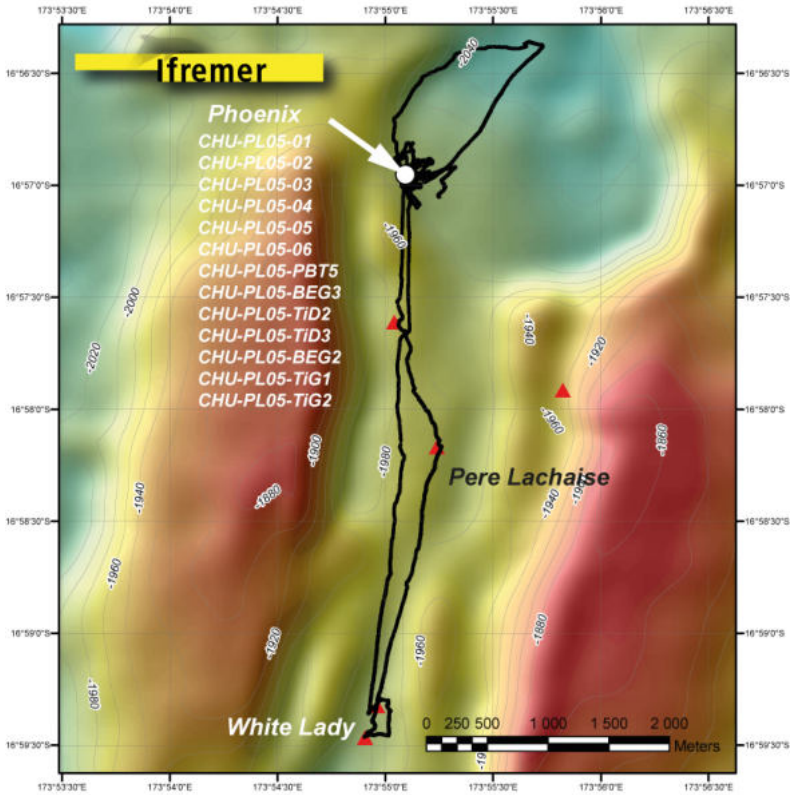


Figure 46 : Localization of the different hydrothermal sites visited in the North Fiji Basin and position of the rock and fluid sampling operations

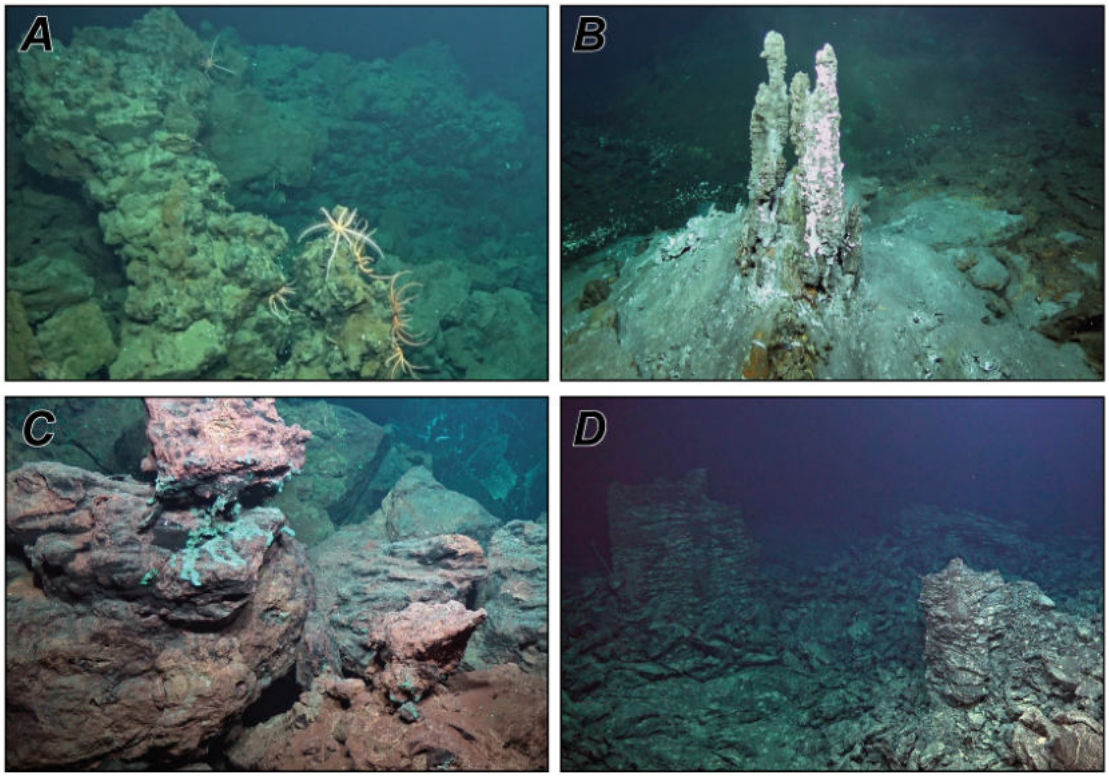


Figure 47: A. Collapsed inactive chimney at the estimated position of the White Lady chimney. B. Active anhydrite chimney at Phoenix (new hydrothermal site). C. Massive sulfides with atacamite (in green) at Phoenix. D. Lava lake pillars and draped lava flows.

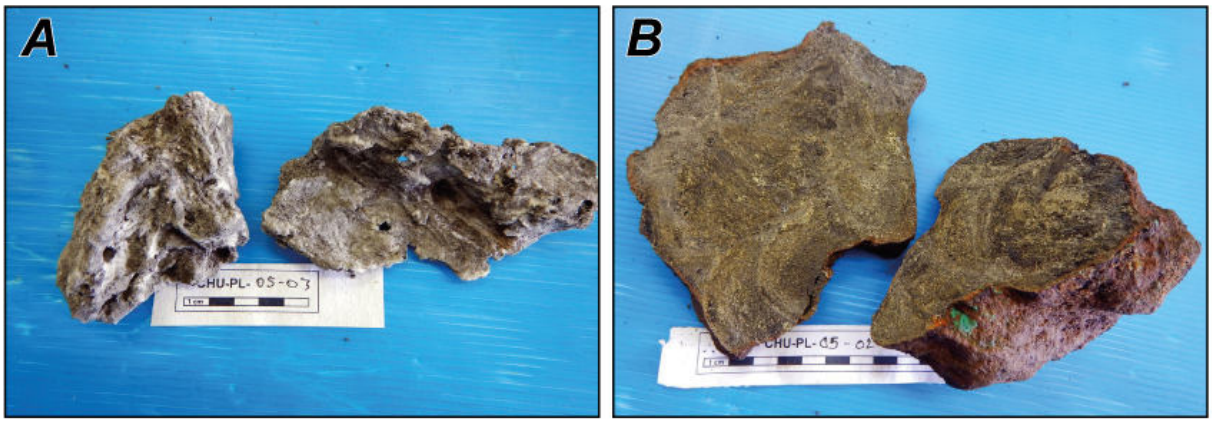


Figure 48 : A. Anhydrite chimney with few sulfides (mainly Zn sulfides). B. Massive sulfides with significant amount of chalcopyrite and Zn sulfides.

The Fatu Kapa field - Wallis and Futuna EEZ

This hydrothermal field covering an area of 10x10 km at water depth comprised between 1300 and 2000 mbsf. It has been discovered during the FUTUNA3 (2012) cruise. It is a complex area on the volcanic and tectonic point of views, with several generation of lava flows and many directions of faults. Several hundred sites were then located by the study of acoustic signals in the water column, and by using the high-resolution acoustic images of the AUV. The most extensive sites are the AsterX, Stephanie and Fati Ufu sites but all potential targets could not be explored during the FUTUNA3 cruise.

AsterX and Stephanie – dive 8

AsterX and Stephanie were investigated during dive 8 (727) (Figure 49). During this dive, exploration was performed south of AsterX to check potential target identified after analysis of data acquired during the FUTUNA3 cruise. We found three new inactive site, including low temperature (i.e.Fe-Si-Mn deposits) and high-temperature (massive sulfides) deposits. Mineralization were taken in two of these newly discovered sites (CHU-PL08-05, 06 and 07).

AsterX is the largest deposit of the area but it is not the most extensive field in Fatu Kapa. The main structure is about 100m in diameter and characterized by three coalescent mounds with anhydrite chimneys at the summit. In 2012, the same active zones were observed even if they may have evolved during the last 7 years (Figure 50). North-west and north-east of the main structure there are other active zones characterized by diffusion and sometimes high-temperature chimneys. Fluid and active chimney sampling was performed in the southeast part of the main structure. Three other mineralized samples were collected in the northwest area (CHU-PL08-02, 03 and 04).

Stephanie is located 2.5km north-west of AsterX. It is composed of four hydrothermal sites in a relatively small area (100m x 100m) that corresponds to a collapsed lava lake. Fluid and active chimney sampling was performed in the northern site.

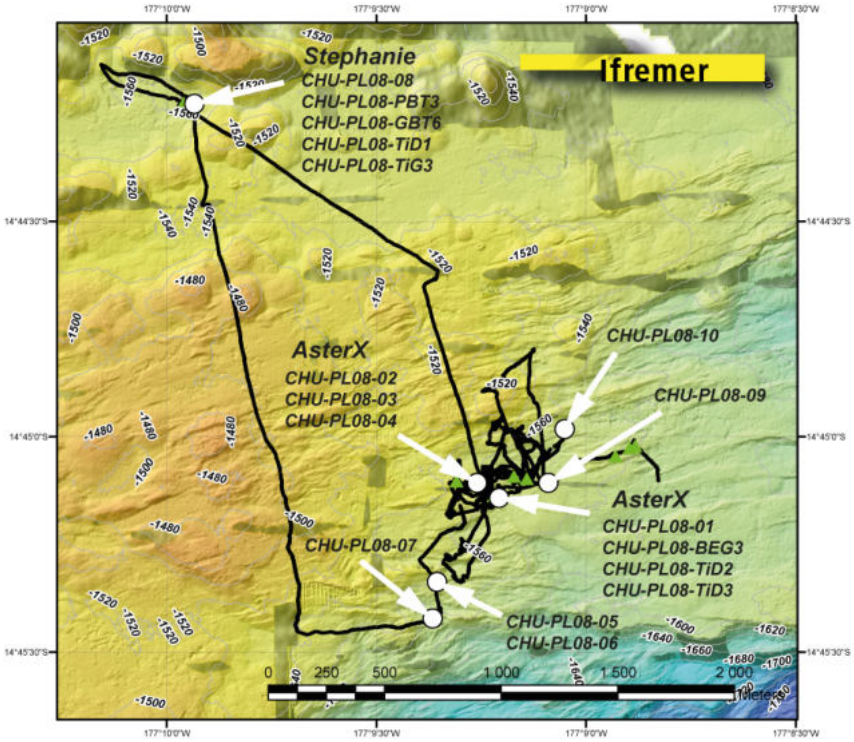


Figure 49 : Localization of AsterX and Stephanie hydrothermal sites visited during dive 8 and position of the rock and fluid sampling operations

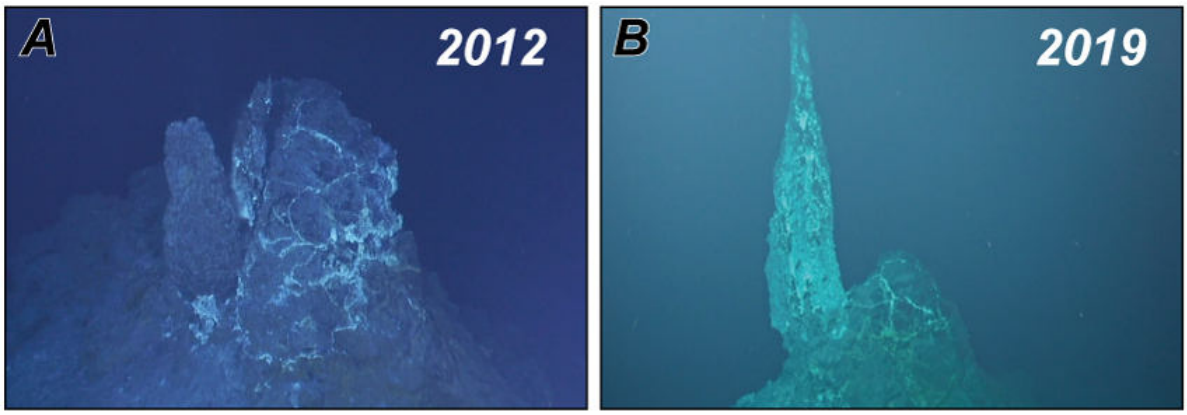


Figure 50: A and B. The same active chimney in 2012 and 2019. AsterX

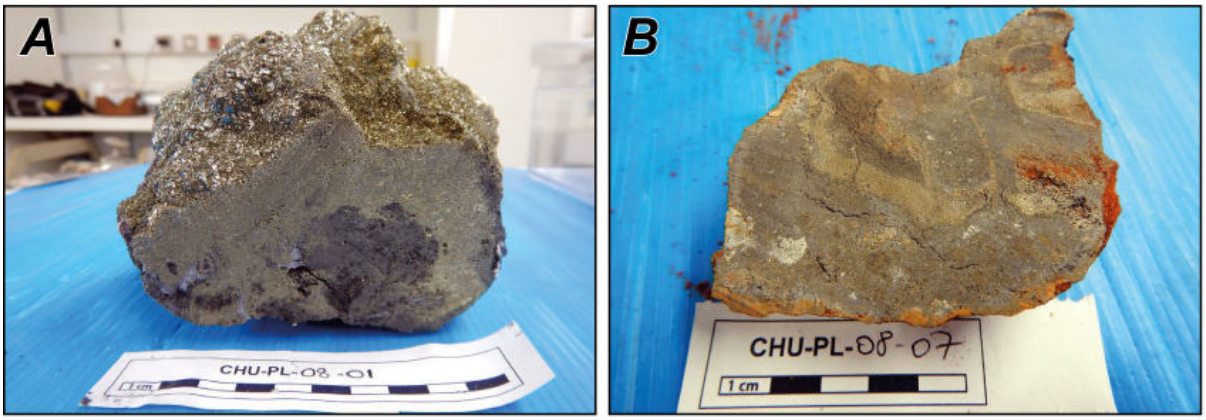


Figure 51 : A. Base of an active chimney related to the fluid sampled at AsterX. B. Massive sulfides collected 700m south of AsterX on an old inactive site.

Fati Ufu

Fati Ufu is probably the most extensive active field found in the Fatu Kapa area. More than twenty clusters of actives chimneys are found in an area of 1.5km x 1.5km. Numerous inactive chimneys and/or deposits are also present in the area. The main active zone is located in a small grabben linked to the development of ENE-WSW to E-W trending faults. South and North of this area, activity seems to decline and we may found large deposits (>50m in diameter) with only one small high-temperature chimney or few diffusive zones. The area is also characterized by the presence of small white chimney mainly composed of barite and amorphous silica. Two chimney samples associated with fluids were collected in the main active area and three rock samples were picked up in the peripheral zones.

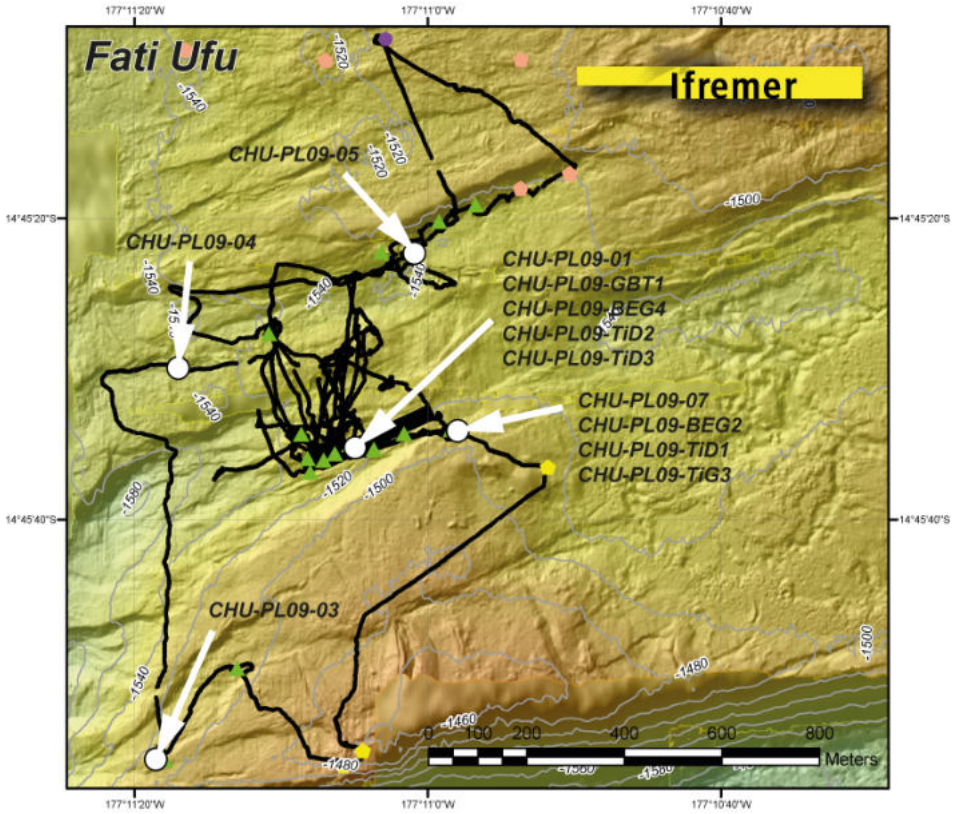
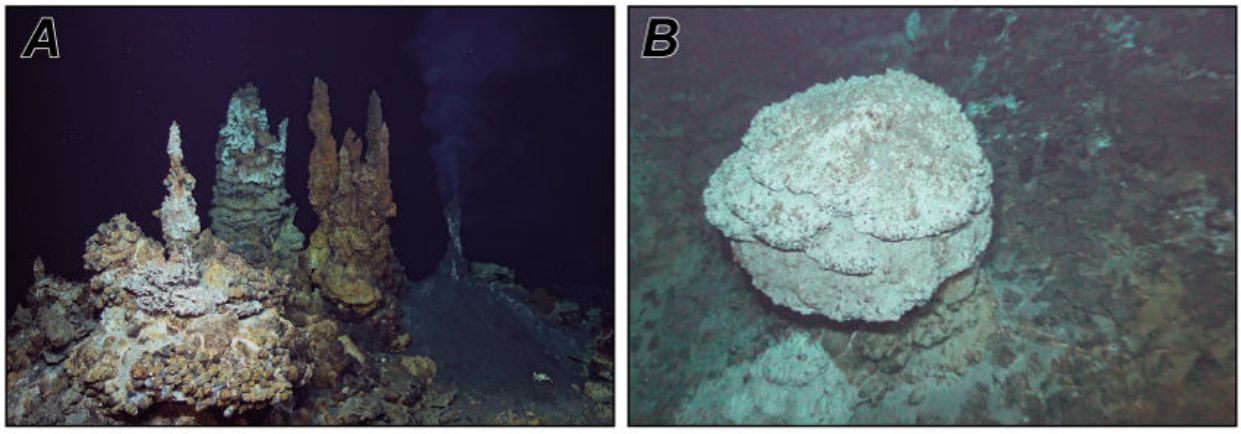


Figure 52 : Fati Ufu hydrothermal field visited during dive 9 and position of the rock and fluid sampling operations



The Kulo Lasi caldera - Wallis and Futuna EEZ

This active volcano, discovered during the FUTNA (2010) cruise, consists of a relatively flat edifice of 20km in diameter. This recent volcano is not tectonized and built on an older and highly faulted area. At its summit is large circular caldera 5 km in diameter and 300 m deep. In 2010, there was a very diverse hydrothermal activity: (i) low temperature vents (<5° C) emitting clear fluids and locally rich in hydrothermal fauna. (ii) low temperature discharge (<50° C) associated with siliceous chimneys up to ten meters high and forming mounds of a few tens of meters in extension . (iii) Sulfide chimneys emitting low temperature clear fluids. (iv) Several tens of young

sulfide chimneys emitting black or translucent fluids (up to 345° C) and located on the most recent lava flows.

During dive 10, we found the low temperature vents with the Siboglinidia and the diffusive silica chimneys (50-60°C; CHU-PL10-GBT4). However no high temperature fluid with related black smoker were found on the recent lava flows. Even the sulfide chimneys emitting low-temperature clear fluid are now inactive (CHU-PL10-07). We also found the stockwork zone characterized by strongly altered and mineralized basalt (CHU-PL10-03) located in the south wall of the caldera.

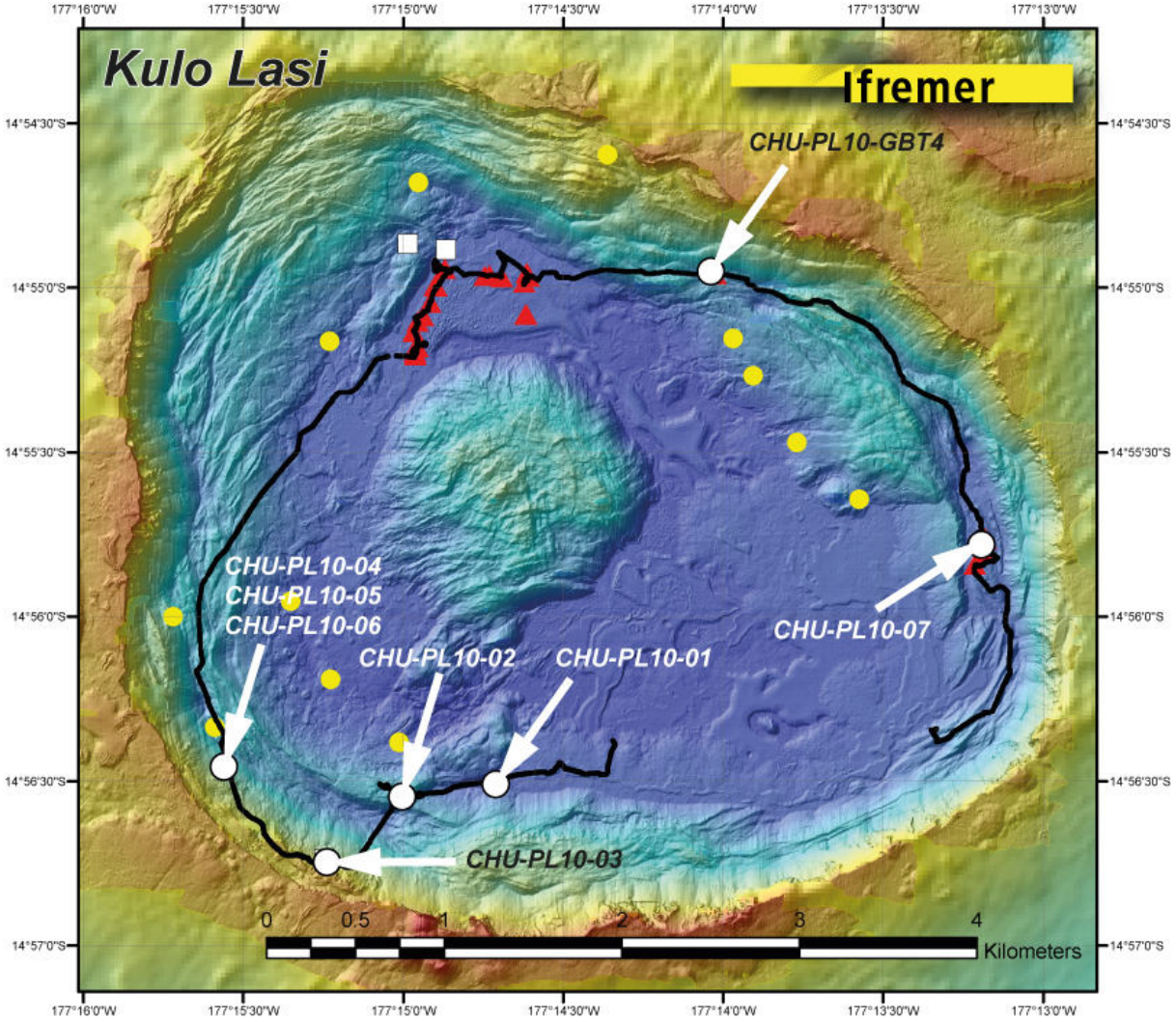
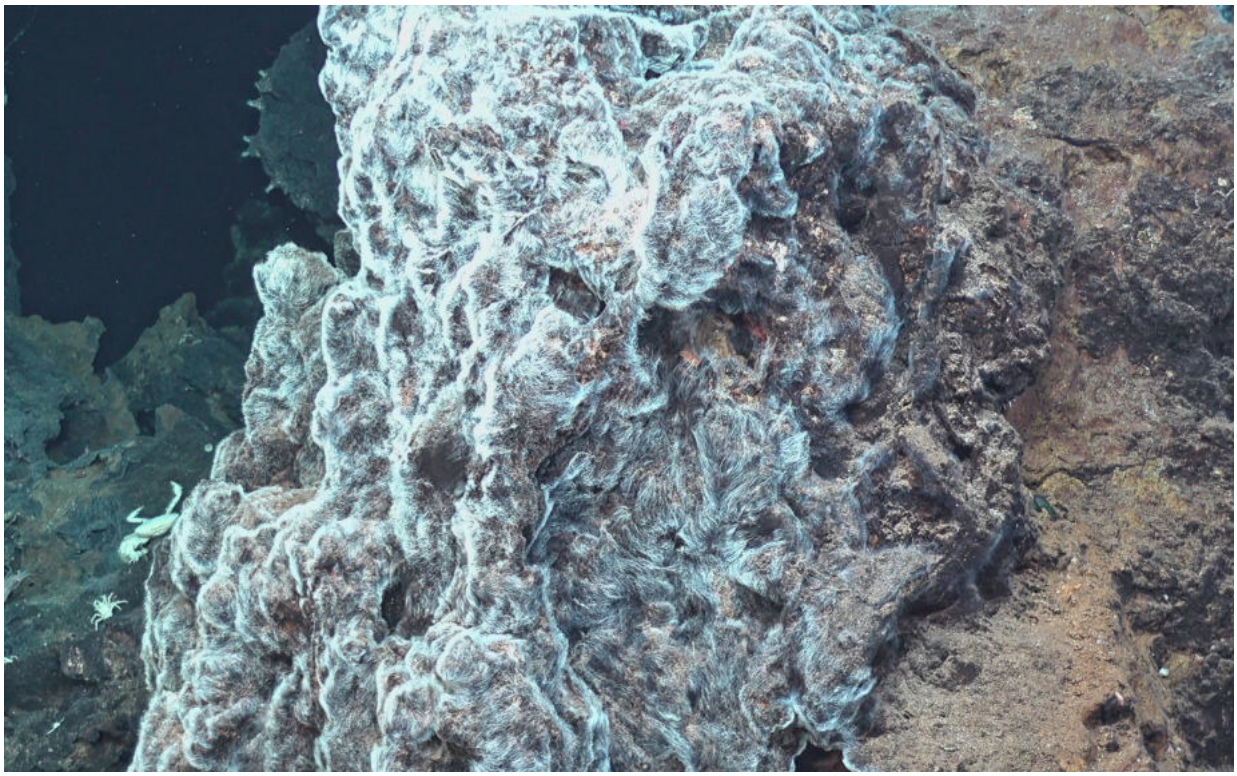


Figure 53: Kulo Lasi caldera and position of the hydrothermal sites discovered in 2010 (FUTUNA cruise)

Campagne Chubacarc 2019
Atalante/Victor 6000



Rapport d'écologie par Marjolaine Matabos et Camille Poitrimol en collaboration avec C. Cathalot et N. Gayet (équipe chimie).

26 mars-3 mai 2019
Bassins arrière-arcs du Pacifique ouest

Objective 1. Ecological sampling of vent communities

Ecological sampling focused on each three main communities dominated by the mussel *Bathymodiolus* and the gastropods *Ifremeria nautilei* and *Alviniconcha hessleri*.
The sampling procedure was as follow:

- Deployment of the marker Casimir in the field of view to assess the surface area sampled
- Pictures and videos
- Chemistry: 3 points of Chemini in distinct areas of the community and 1 PIF fluid collection
- Collection of animals using the ROV claw
- Suction the sampled surface with the suction sampler when possible
- Chemistry: 2 points on the bare substrate
- Recover Casimir

On board, big dominant species were washed to recover the totality of associated macrofauna. Individuals were then sorted, identified when possible, and preserved for future analyses. Most macrofauna (sieved on 250 µm) was preserved in ethanol 96°C to allow for future genetic studies, or freezed at -80°C for isotopic analyses. Meiofauna (20 to 250 µm) was either preserved in formalin or freezed at -80°C for metabarcoding analyses.

1.1. Lau basin

1.1.1. PL01-720 Kilo Moana (2600 m)

The site was inactive at 2600 m depth with the absence of diffusing areas colonized by vent species. A few mussels were collected individually at site 3 in KM north on March 30. The rest of the fauna sampling consisted in peripheral fauna including the holothurian *Chiridota*, brisingids stars, squat lobsters *Munidposis* and buccinid gastropods (Table 1). Some tissues were preserved at -80°C for isotopic analyses (Table A1)

Table 1. Chemical and ecological sampling at Kilo Moana during dive Pl01-720 on March 30

Dive	Date	Community	Sampling		PIF		Chemini
			Sampler	Time	Syringe	Time	# points
720	30/03	Mussels	GBT 3 Aspi 1	11H18 11H34	1 2	11:02 11:04	1: 11H03 2: 11H07
720	30/03	Mussels	GBT 2	11H46			
720	30/03	Brisingids	GBT 4	12H25			
720	30/03	Chiridota	Aspi 2	12H49			
720	30/03	Galathea	Aspi 4	14H47			
720	30/03	Holothuria - Gastropod	Aspi 6	14H58			
720	30/03	Gastropod	Aspi 7	15H04			
720	30/03	Galatheid + gastropod	Aspi 8	15H08			

1.1.2. PL02-721 Tow Cam (2600 m)

The dive started at the southern end of the site at an immersion of 2698 m. All three communities were sampled during this dive (Table 1), as well as chimney fauna (Table 3). A large diffusing area colonised by mussels, *Ifremeria* and *Alviniconcha* was selected for sampling (lat -20°19.0849'; Long

-176°8.2630'; depth 2711 m). Samples of mussels 1, *Ifremeria* 2 and *Alviniconcha* 2 were collected in the same diffusion patch (Figure 1). The first samples of Alviniconcha (1) were collected at TC north (lat -20°19.0746'; Long -176°8.2596'; depth 2716 m), 200 m away. Mussels 2 and Ifremeria 1 were sampled in the same area but in different patches. No peripheral fauna was collected during this dive. Animals collected from active area were preserved for isotopic analyses.

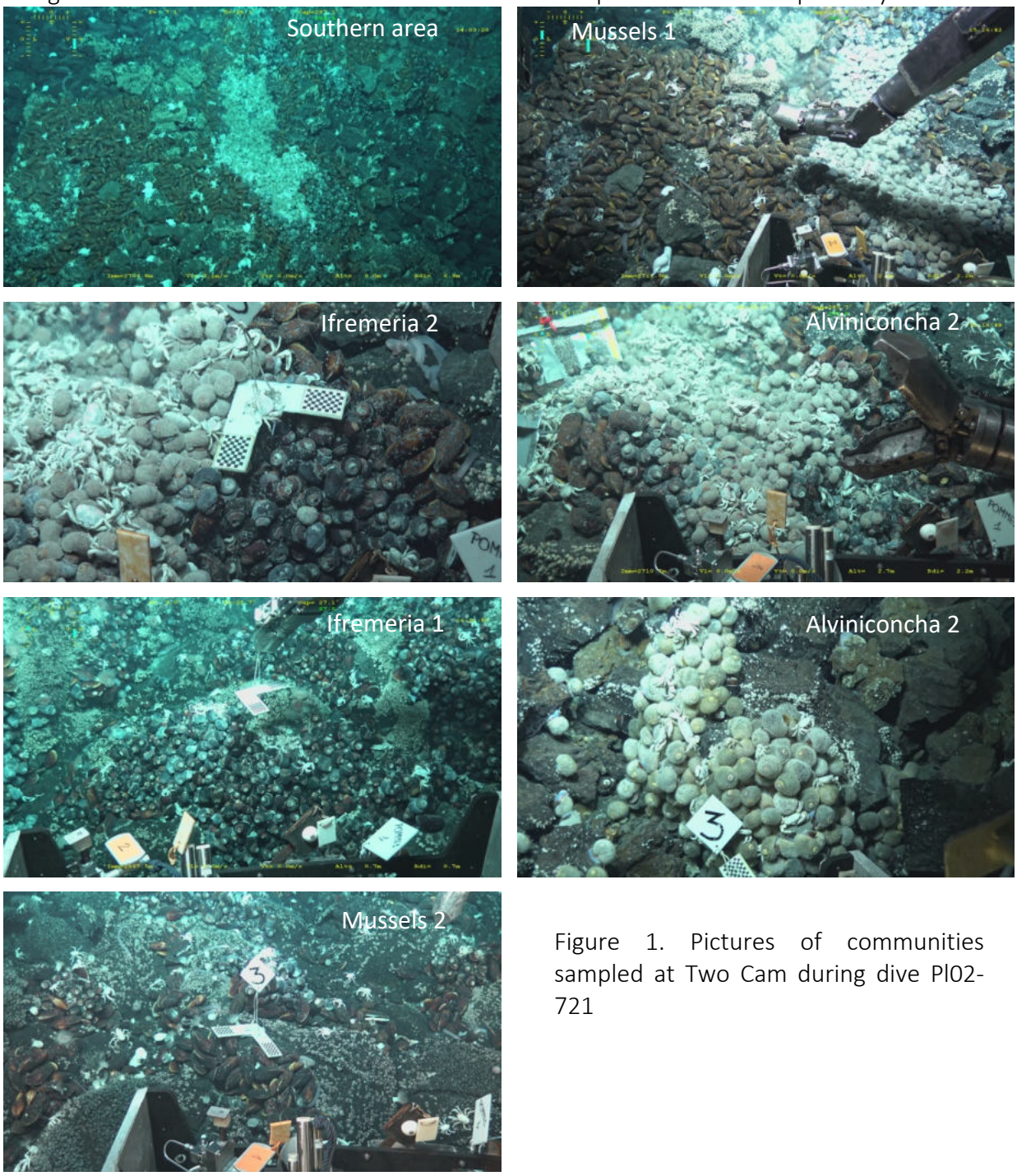


Figure 1. Pictures of communities sampled at Two Cam during dive PI02-721

Table 2. Chemical and ecological sampling at Tow Cam during dive Pl02-721

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before Time-Temp	After
721-2	31/03	Mussels 1	GBT4 Aspi 1	15H14 15H49	25	14H51	1: 14H49 - 9-11°C 2: 14H57 - 10.7 °C 3: 15H03 - 4.22°C	1: 16H01
721-2		Ifremeria 1	GBT2 Aspi 2	17H16 17H40	26	16H51	1: 16H51 - 2.65°C 2: 16H56 - 2.9°C 3: 17H01	
721-2		Alviniconcha 1	GBT1 Aspi 3	23H21 23H49	27	23H03	1: 23H01 - 6.86°C 2: 23H06 3: 23H14 - 22°C	
721-2	01/04	Ifremeria 2	GBT5	10H52	28	10H06	1: 10H00 - 4.9°C 2: 10H08 - 6.2°C 3: 10H14 - 4.9°C	
721-2		Alviniconcha 2	GBT6 Aspi 4 Aspi 5	11H13 11H42 11H47	29 (pt#2)	10H28	1: 10H21 2: 10H27 3: 10H33	
721-2		Mussels 2	PBT3 Aspi 6	20H46	30	20H17	1: 20H16 - 3.3°C 2: 20H21 3: 20H26	

Table 3. Additional opportunistic sampling at Tow Cam during dive Pl02-721

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
721-2	Alviniconcha chimney	GBT7	01/04	12H23	
721-2	Mixed community on chimney	Aspi 7	01/04	23H45	Shrimp
721-2	Bare substrate	Aspi 8	02/04	00H08 02H06	Polynoid Shrimp

1.1.3. PL03-722 Tui Malila (1900 m)

Tui Malila is located in the southern part of the Lau basin at 1900 m. During dive Pl03-722 all three communities also colonized the field and could be sampled (Table 4). The first samples of mussels, *Ifremeria* and *Alviniconcha* (1) were sampled nearby in different patches in TM Center B1 (lat -21°59.35', long -176°34.09'; depth 1874 m, Figure 2). In addition the dive allowed for the collection of *Alviniconcha* from chimney, peripheral fauna, bare substrate and small fauna from chimney and flange (Table 5)

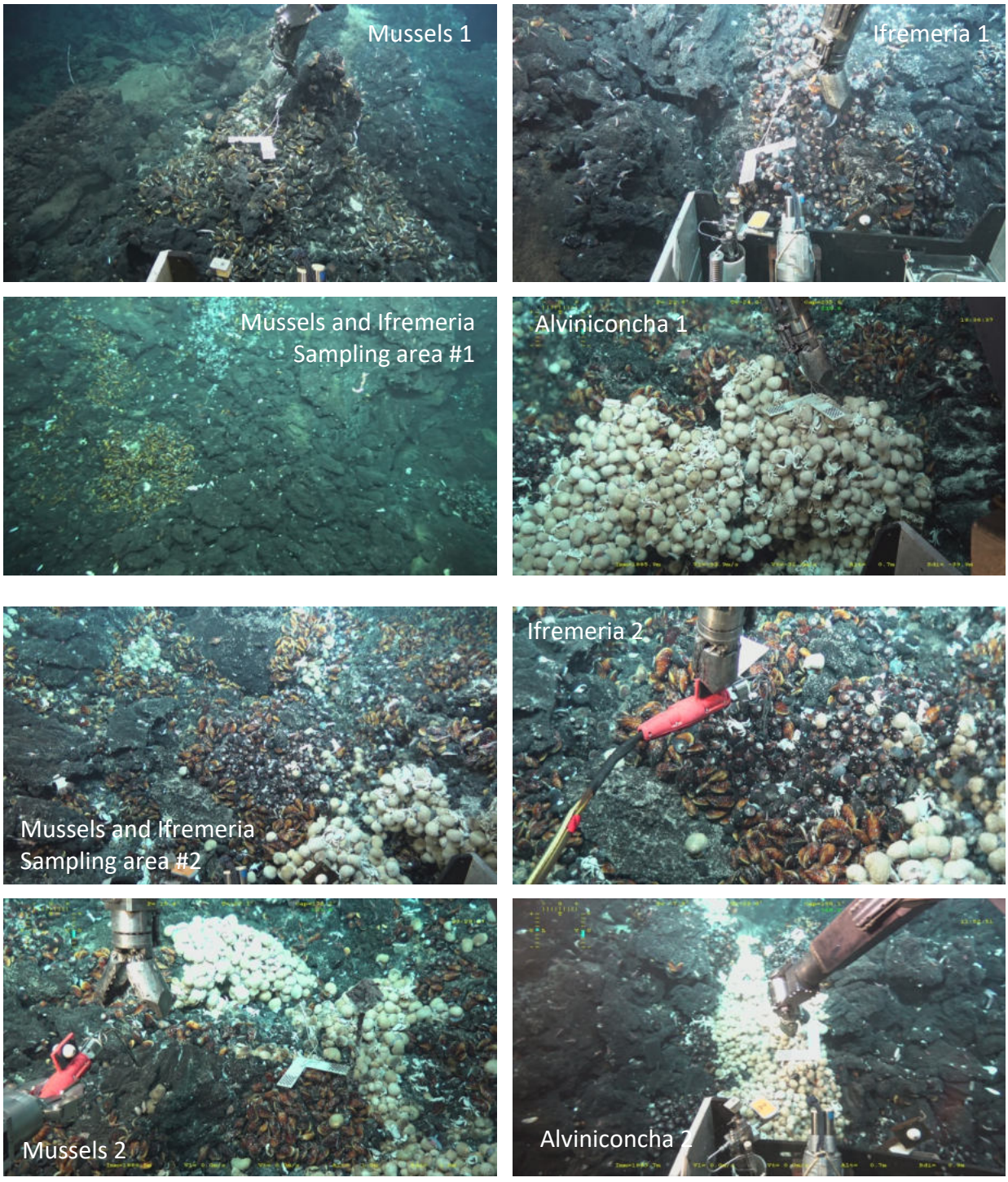


Figure 2. Pictures of communities sampled at Tui Malila Pl03-722

Table 4. Chemical and ecological sampling at Tui Malila during dive Pl03-722

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
722-3	03/04	Mussels 1	GBT2 Aspi 1 (failed)	14H12 14H25	25	13H49	1: 13H49 - 3.8°C 2: 13H52 - 3.5°C 3:13H59 - 9°C	
722-3		Ifremeria 1	GBT3	15H55	26	14H42	1: 14H42- 20°C 2: 14H48 3: 14H56	
722-3		Alviniconcha 1	GBT1 Aspi 2	20H08 20H30	27 28 (#2) 29 (#3)	19H45 19H46 19H59	1: 19H40 2: 19H46 3: 19H52	
722-3	04/04	Ifremeria 2	GBT6	08H55	30	8H34	1: 08H33 2: 08H39 -12°C 3: 08H45 - 4°C	1: 09H13 - 8/10°C 2: 09H20
722-3		Alviniconcha 2	GBT5	12H24	23	11H57	1: 11H55 - 27.6°C 2: 12H03 - 22.7°C 3: 12H09 - 12°C	
722-3		Mussels 2	GBT8 Aspi 8	20H56 21H15	24	20H31	1: 20H31 2: 20H38 3: 20H43	1: 21H27 2: 21H32 3: 21H36

Table 5. Additional opportunistic sampling at Tui Malila during dive Pl03-722

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
722-3	Bare substrate in musselbed	Aspi 3	03/04	21H11	Small mussels
722-3	Ifremeria on chimney	GBT7	03/04	23H36	Only a few (mistake)
722-3	Alviniconcha on chminey	GBT7	04/04	00H36	Real chimney?
722-3	Flange Bare substrate on chimney	Aspi 4 Aspi 5 Aspi 6	04/04	12H54 13H01 13H05	Paralvinella Polynoids
722-3	Shrimp	Aspi 7	04/04	13H20	Shrimp

1.1.4. PL04-723 Tow Cam (2600 m)

Pl04-723 allowed for additional sampling of chimney and peripheral fauna at Tow Cam (Table 6).

Table 6. Additional opportunistic sampling at Tow Cam during dive Pl04-723

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
723	Chimney	Aspi 1 & 2	06/04	02H25	Polynoids
723	Chimney	Aspi 3 & 4	06/04	02H48	Paralvinella
723	Mussels	PBT	06/04	03H30	
723		Aspi 5 & 6	06/04	03H58	Paralvinella fijiensis
723	Periphery	?	06/04	04H45	Phymorhyncus
723	Periphery	Basket	06/04	04H50	Rock with anemones
723	Periphery	Aspi 8	06/04	04H52	Holothurian and galathean
723	Periphery	drawer	06/04	05H09	Rock with anemone and cirripieds
723	Periphery	drawer	06/04	05H18	Brisingids

1.1.5. PL11-730 Tow Cam (2600 m)

This dive was dedicated to the recovery of instruments, but also included the sampling of an extra mussel community to complete the need for analyses (Table 7), and collection of polynoids using the suction sampler in the northern area, and anemones/polynoids at TC-center-BT (Table 8).

Table 7. Chemical and ecological sampling at Tow Cam during dive Pl11-730

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
730-11	26/04	Mussels 1	GBT3 GBT2	00H45 00H59	25	00H27	1: 00H26 2: 00H32 3: 00H38	

Table 8. Additional opportunistic sampling at Tow Cam during dive Pl11-730

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
730-11	Chimney	Aspi 1	26/04	03H59	Polynoids
730-11	Chimney	Aspi 2 & 3	26/04	04H04	Polynoids
730-11	Chimney – 'Alvi'	Aspi 4	26/04	05H11	*Paralvinella* worms
730-11	Bare substrate	Aspi 6	26/04	05H26	Anemones and polynoids

1.1.6. PL12-731 ABE (2200 m)

This bonus dive allowed for the sampling of all three communities at the site ABE at 2150 m depth at Vent central on the same patch along a chimney wall (ABE 1 & 2) (Table 9, Figure 3). Additional sampling included polynoids, *Paralvinella* worms and shrimp from chimneys in Vent central and cirripeds in the north (Table 10).

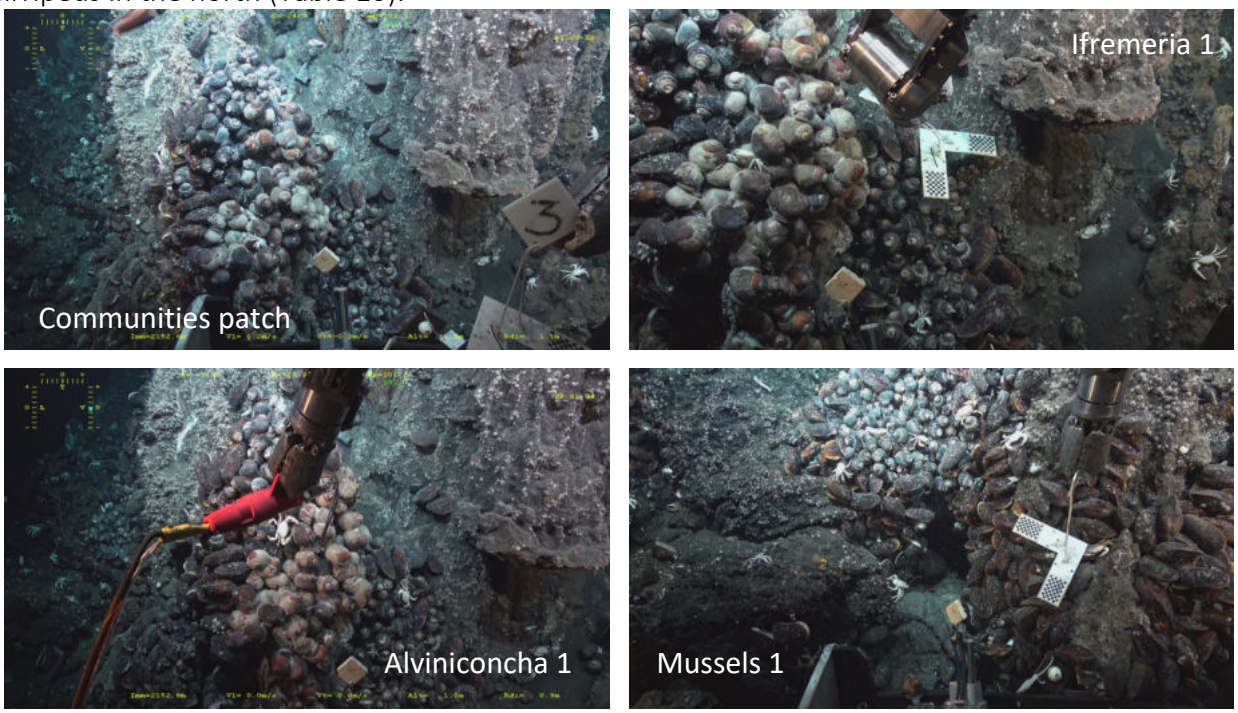


Figure 3. Pictures of communities sampled at ABE Pl12-731

Table 9. Chemical and ecological sampling at ABE during dive Pl12-731

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
731-12	26/04 27/04	Ifremeria 1	GBT2 Aspi 1	23H28 23H54	25	22H35	1: 22H35 – 5.6°C 2: 22H41 – 4°C 3: 22H46 – 5°C	1: 01H41 2: 01H46
731-12		Alviniconcha 1	GBT3 Aspi 3	01H11 01H22	26	23H02	1: 22H53 – 15°C 2: 23H01 – 8°C 3: 23H06	1: 01H29 – 10/14°C 2: 1H33 – 16°C
731-12	27/04	Mussels 1	GBT1 Aspi 2	00H23 00H33	27	00H04	1: 00H04 – 2.6°C 2: 00H09 3: 00H14	1: 00H39 – 3°C 2: 00H44

Table 10. Additional opportunistic sampling at ABE during dive Pl12-731

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
731-12	Subtrate	Aspi 4	27/04	01H55	Shrimp
731-12	Chimney	Aspi 5	27/04	02H01	Polynoids & *Paralvinella*
731-12	Big chimney	Aspi 6	27/04	02H22	Polynoids
731-12	Chimney	Drawer	27/04	05H22	Cirripeds CHU-PL11-02
731-12	Chimney	Aspi 7	27/04	05H58	Polynoids, mussels and Ifremeria
731-12	Chimney	Aspi 8	27/04	06H03	*Paralvinella* worms

1.2. North Fiji basin

1.2.1. Pl05-724 Père Lachaise – Phoenix (2000 m)

The dive PL05-724 started on an old site 'Père Lachaise'. The exploration led to the discovery of a new site that appeared to be an old site reactivated site, called Phoenix. The target site 'Ivory tower' was found inactive with numbers of fossil chimneys, so sampling was performed on Phoenix. All communities were found in the area and were sampled in replicates (Figure 4, Table 11). Replicates were sampled at a small distance from each other. The second mussels sample (GRAPPES) consisted in a mix of localities to insure a sufficient number of individual for genetic analyse. In addition, the suction sampler was used to collect polynoids from chimney (Table 12).

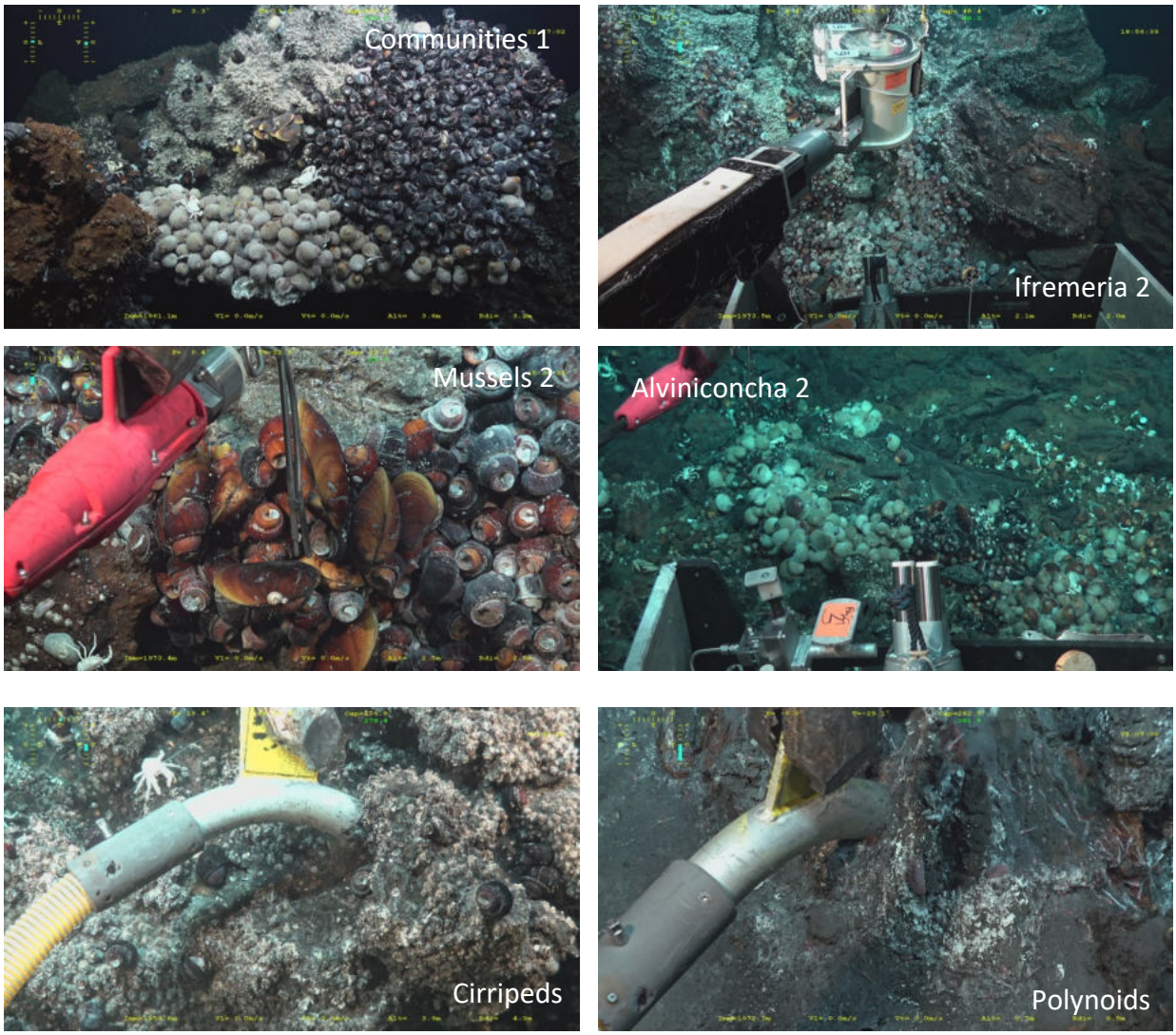


Figure 4. Pictures of communities sampled at Phoenix Pl05-724

Table 11. Chemical and ecological sampling at Phoenix during dive Pl05-724

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
724-5	09/04	Ifremeria 1	GBT1 Aspi 4	23H26 00H38	25	22H30	1: 22H29 - 4.7°C 2: 22H34 - 10°C 3: 22H40 - 4.9°C	1: 01H11
724-5		Mussels 1	GBT3 Aspi 3	23H58 00H34	26	22H47	1: 22H47 - 7°C 2: 22H52 3: 22H58 - 5.5°C	1: 3.5°C 01H10
724-5		Alviniconcha 1	GBT4 Aspi 1	23H41 00H29	27	23H05	1: 23H04 - 13°C 2: 23H10 - 26°C 3: 23H15 - 7°C	1 : 17°C 01H17
724-5		Cirripeds	/				1: 00H53 - 3°C	
724-5	10/04	Flange	/		1, 2	01H27	1 : 01H25 -146.8°C	
724-5		Mussels 2 (two localities)	GBT2	16H46 20H07	28	15H37	1: 15H37 2: 15H42	
724-5		Ifremeria 2	PBT6 Aspi 6	19H00 19H52	29	17H50	1: 17H49 - 3-4°C 2: 17H55 - 7°C 3: 18H01 - 3.8°C	
724-5	11/04	Alviniconcha 2	PBT4 Aspi 7	00H37 01H50	30	00H16	1: 00H16 2: 00H21 3: 00H26	

Table 12. Additional opportunistic sampling at Phoenix during dive Pl05-724

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
724-5	Alviniconcha 1	Aspi 2	10/04	00H32	Polynoids
724-5	Substrate (Blanche neige)	Aspi 8	11/04	01H35	Polynoids

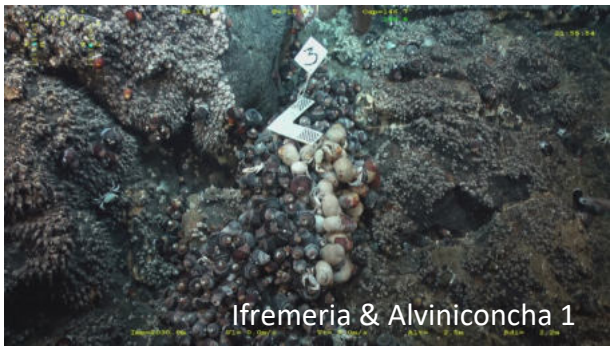
1.3. Mangatolo

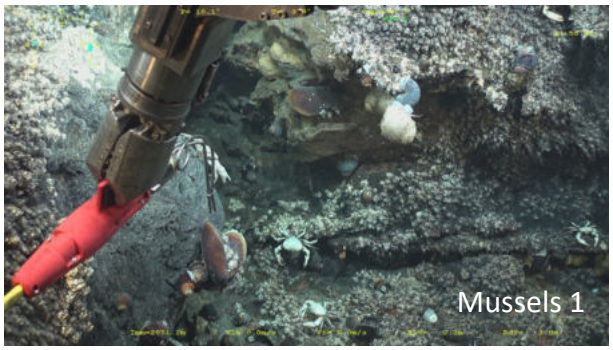
1.3.1. Pl06-725 site 1 (2000 m)

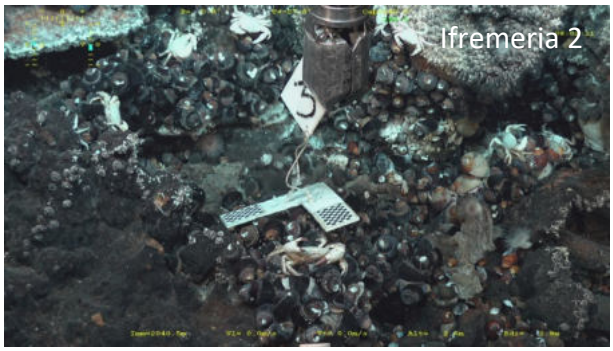
During this dive patches were observed and referenced for future sampling. Sampling didn't occur because of a problem with the ROV arm that that required the recovery of the submersible.

1.3.2. Pl07-726 site 1 (2000 m)

This second dive on Mangatolo allowed the sampling of all three communities, although mussels were never found in patches of significant size (Figure 5, Table 13). The first mussels 'sample' consists in a mix of individuals collected in different localities across chimneys. Note that for the first sampling of *Alviniconcha* community, the probe moved while collecting fluid for Chemini Fe & S in situ measurements. Additional sampling of fauna included cirripeds, bare substrate and chimney fauna using the suction sampler, and one anemone collected with the ROV arm (Table 14).







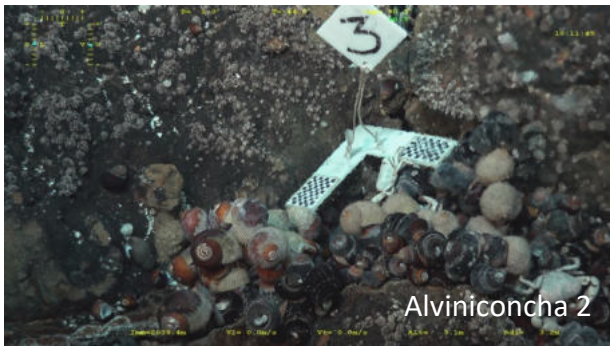


Figure 5. Pictures of communities sampled at Mangatolo triple junction during dive Pl07-726

Table 13. Chemical and ecological sampling at Mangatolo triple junction during dive Pl07-726

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
726-7	16/04	Alviniconcha 1	GBT4 Aspi 2	22H28 23H35	25	22H00	1: 21H59 - 17°C 2: 22H04 - 20°C 3: 22H09 - 12°C	1: 22H39 2: 22H45 - 22°C
726-7		Ifremeria 1	GBT2 Aspi 1	23H19 23H28	26	22H54	1: 19°C 2: 4°C 3: 4-5°C	1: 23H42 2: 23H48
726-7	17/04	Mussels 1 (mix of areas)	GBT3	00H10			1: 5°C	
726-7		Ifremeria 2	PBT4	08H38	27	08H15	1: 10-11°C 2: 14.48°C 3: 6.4°C	1: 10-13°C
726-7		Mussels 2	PBT5	09H33			1: 09H27	
726-7		Alviniconcha 2	PBT6 Aspi 6	10H30 11H14	28	10H14	1: 10H14 2: 10H19 3: 10H23	1: 4°C 10H57

Table 14. Additional opportunistic sampling at Mangatolo triple junction during dive Pl06-725

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
726-7	Cirripeds	Aspi 3	17/04	01H31	
726-7	Chimney	Aspi 4	17/04	01H40	
726-7	Bare substrate	Aspi 7	17/04	11H47	
726-7	Anemones	Drawer	17/04	15H03	

1.4. Futuna

1.4.1. Pl08-727 Fatu Kapa (1500 m)

The two first communities of *Ifremeria* and *Alviniconcha* during dive 727-08 were collected at Asterix 4 in the same patch (Figure 6). Polynoids were suctionned on chimney borders at Asterix 2. The second part of the dive occurred at Stéphanie for the second communities and polynoids sampling (Table 15, 16). *Ifremeria* and *Alviniconcha* 2 were sampled at Stéphanie 1d. The suction sampler was broken during 'Aspi 7' polynoids sampling and could not be used to clean sampled areas for *Ifremeria* and *Alviniconcha* 2. After sampling chemistry measurements were performed on bare rocks. No mussels were found on this site.

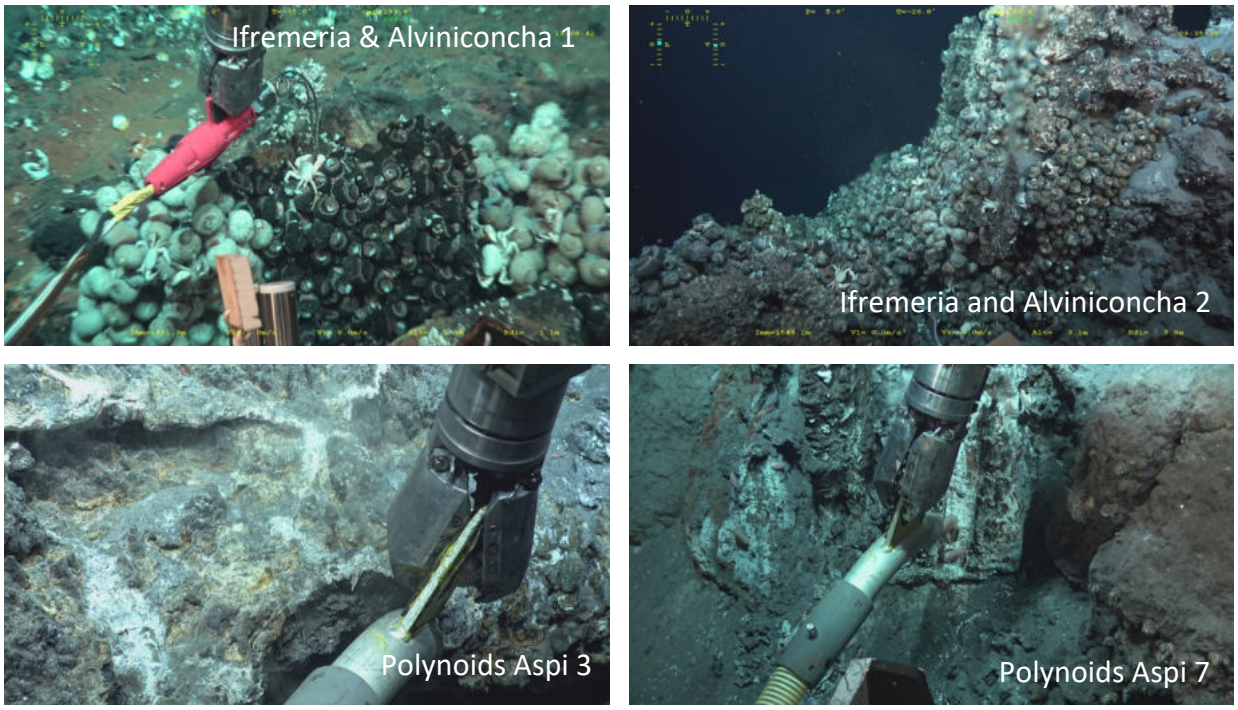


Figure 6. Pictures of communities sampled at Futuna/Fatu Kapa during dive Pl08-727

Table 15. Chemical and ecological sampling at Futuna/Fatu Kapa during dive PI08-727

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
727-8	18/04	Ifremeria 1	GBT3 Aspi 2	19H19 20H39	25	19H05	1: 19H05 - 5.7°C 2: 19H09 - 8.8°C 3: 19H19	1: 19H40 - 24°C
727-8		Alviniconcha 1	GBT2 Aspi 1	20H16 20H35	26 (on #3)	20H06	1: 19H51 - 24°C 2: 19H56 3: 20H02	1: 20H27
727-8	19/04	Ifremeria 2	GBT5	19/04 10H05	27	09H39	1: 7.5°C 2: 5.2°C 3: 6.38°C	1: 7.4°C 2: 10°C
727-8		Alviniconcha 2	GBT4	10H52	28 (on #2)	10H32	1: 10.5°C 2: 8°C 3: 8.5°C	1: 8°C 2: 11H17

Table 16. Additional opportunistic sampling at Futuna/Fatu Kapa during dive PI08-727

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
727-8	Chimney Asterix 2	Aspi 3	19/04	02H27	
727-8	Chimney Asterix 2	Aspi 4	19/04	02H42	
727-8	Chimney at Stéphanie	Aspi 7	19/04	08H27	Polynoids/Paralvinella
727-8	Rock with cirripeds	Drawer	19/04	11H24	

1.4.2. PI09-728 Fati Ufu (1500 m)

This dive allowed the sampling of communities of *Alviniconcha* and *Ifremeria* but mussels were extremely rare, sparse and hidden in cracks (Table 17). First replicates of communities were collected at Fati Ufu 1 in the same patch (Figure 7). The second sample of *Ifremeria* was collected at Fati Ufu 14, an area with no *Alviniconcha*. Because *Alviniconcha* patches could not be found elsewhere, the second one was sampled in the same center area around Fati Ufu 2. Mussels were sampled individually around Fati Ufu 11 (Table 18).
Additional fauna included polynoids and Alviniconcha from chimney, cirripeds on rocks and small mussels on substrate (Table 17).

Table 17. Chemical and ecological sampling at Futuna/Fati Ufu during dive PI09-728

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
728-9	20/04	Alviniconcha 1	GBT2 Aspi 2	00H08 00H18	25	23H06	1: 23H06 2: 23H11 3: 23H16	1: 00H33 2: 00H39
728-9		Ifremeria 1	GBT4 Aspi 1	23H46 00H01	26	23H22	1: 23H22 2: 23H27 – 14°C 3: 23H33 – 17°C	1: 00H23 – 11°C 2: 00H29 – 8°C
728-9	21/04	Ifremeria 1	GBT3 Aspi 5	13H37 13H49	27	13H20	1: 13H19 – 12°C 2: 13H24 – 3.4°C 3: 13H29 – 6°C	1: 13H55 – 3.3°C 2: 13H59 – 3.4°C
728-9		Alviniconcha 2	PBT4 Aspi 6	15H32 15H54	28	15H12	1: 15H12 – 3.6°C 2: 15H16 – 19°C 3: 15H21	1: 16H00 – 16°C 2: 16H05 – 5.4°C

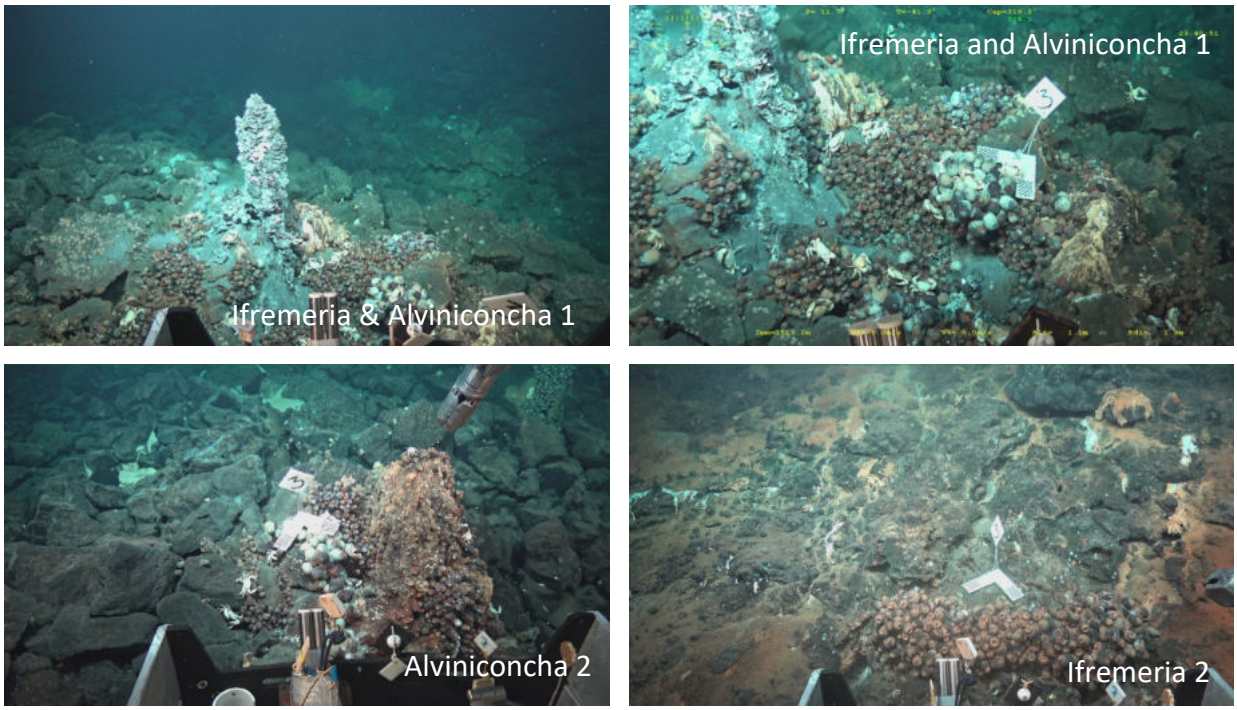


Figure 7. Pictures of communities sampled at Futuna/Fati Ufu during dive Pl09-728

Table 18. Additional opportunistic sampling at Futuna/Fati Ufu during dive Pl09-728

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
728-9	Chimney	Aspi 3	21/04	04H22	polynoids
728-9	*Polynoid worms tower*	Aspi 4	21/04	04H45	Polynoids on chimney
728-9	Rock with cirripeds	Drawer	21/04	05H21	
728-9	Subtrate	PBT7 Aspi 8	21/04	08H07 08H54	Mussels
728-9	Rock with cirripeds 2	Drawer	21/04	16H46	
728-9	*Barite polynoidae*	Aspi 7	21/04	17H26	Polynoids
728-9	Chimney Fati Ufu 1	GBT6	22/04	04H41	Alviniconcha

1.4.3. Pl10-729 Kulo Lasi (1400 m)

Siboglinids were sampled in the south of the Kulo Lasi caldera (lat -14°55.3780'; Long -177°15.0078'; depth 1413.96 m) (Table 19, Figure 8). *Ifremeria* were found further west (lat -14°56.4688'; Long -177°15.5551'; depth 1371 m) (Table 19, Figure 8). No *Alviniconcha* were found and small mussels were sporadically present and collected with the suction sampler close to the *Ifremeria* community and further north with cirripeds (lat -14°56.537'; Long - 177°15.0042'; depth 1411 m) (Table 20). Additional sampling also included *Paralvinella* worms on chimney (Table 20).

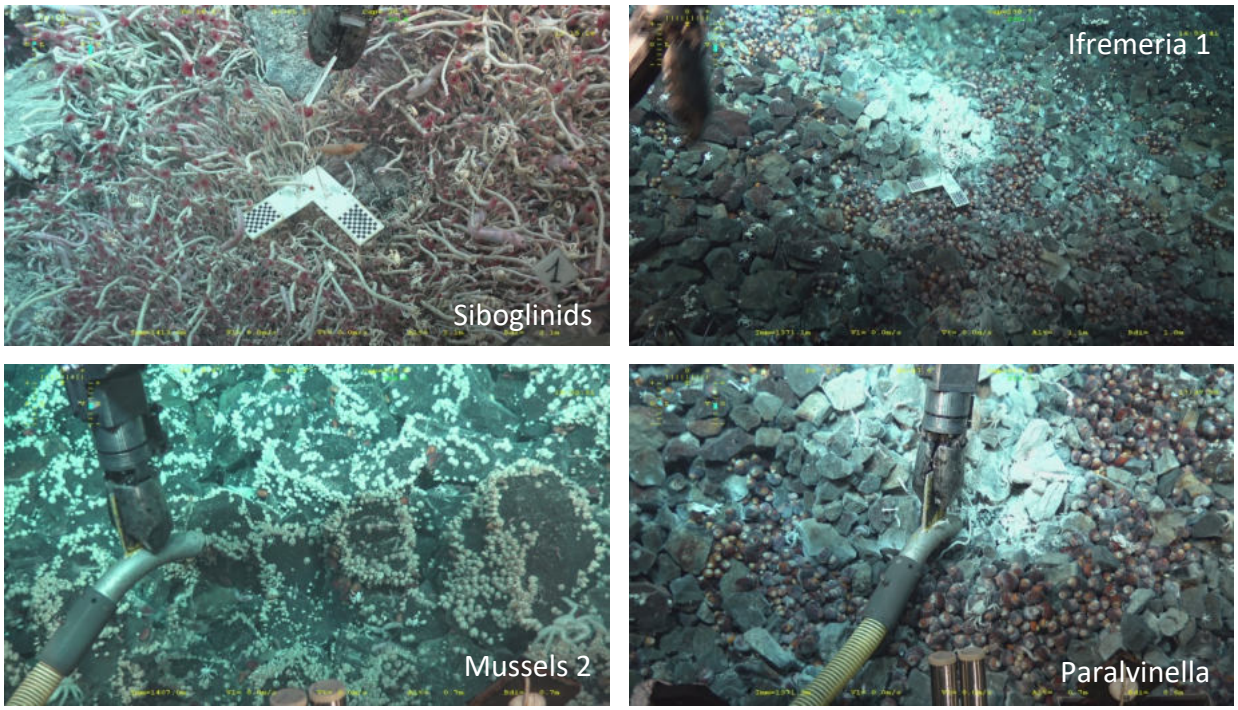


Figure 8. Pictures of communities sampled at Futuna/Kulo Lasi during dive Pl10-729

Table 19. Chemical and ecological sampling at Futuna/ Kulo Lasi during dive Pl10-729

Dive	Date	Community	Sampling		PIF (point #1)		Chemini (# points)	
			Sampler	Time	Syringe	Time	Before	After
729-10	23/04	Siboglinids	Aspi 1 GBT1 Aspi 2	13H32 13H42 13H52	25 26	13H19 14H05	1: 13H18 2: 13H23 3: 13H28	1: 14H05
729-10		Ifremeria	GBT2 Aspi 4	17H12 17H31	27	16H58	1: 16H55 – 4.2°C 2: 17H00 – 8°C 3: 17H04 – 3.9°C	1: 17H21 – 4.2°C 2: 17H25 - 4.2°C

Table 20. Additional opportunistic sampling at Futuna/Kulo Lasi during dive Pl10-729

Dive	Habitat	Sampling			Comments
		Sampler	Date	Time	
729-10	Bare substrate	Aspi 3	23/04	14H13	Mussels/ cirripeds
729-10	Substrate	Aspi 5	23/04	17H36	Paralvinella
729-10	Substrate	Aspi 6	23/04	18H02	Small mussels

Objective 2. Communities high resolution temporal dynamics

2.1. Short-term deployments

2.1.1. Lau/Tow Cam

During dive Pl02-721 POMME 1 was deployed on a musselbed located south of Tow Cam in the diffusion are sampled for all three communities on April 1st at 19H46 (Lat -20°19.0832'; Long -176°8.2643'; depth 2709 m; Figure 9). The camera sampled 1.5 minutes every 2 hours with a delayed start set at April 02, 19H00 UTC. Nine iButtons were configured to measure temperature

data every minute (Table 21, Figure 10 & 11). The system was recovered on dive Pl04-723 on April 05 at 21:33 and recorded 37 videos until April 05, 20H00 UTC.

Figure 9. Deployment of POMME 1 during dive Pl02-721 at Tow Cam south in the diffusion area sampled.

Table 21. Temperature measurement recorded by the nine iButtons deployed on POMME 1 on Lau/Tow Cam from April 01, 19H46 UTC, to April 05, 21H23 UTC.

iButton #	Serial #	Colour	Sampling frequency	Av T°C	Sd T°C
24	480000001A885D41	Striped	1/minute	7.5	1.9
66	E30000004B619041	Red	1/minute	7.7	2.2
19	880000001A5CEA41	Blue	1/minute	6.1	1.4
65	190000001A659641	Red	1/minute	8.0	1.6
37	610000001A7E5341	Blue	1/minute	7.6	2.2
57	630000001A9C4341	Striped	1/minute	7.3	1.7
31	180000001AB4B941	Blue	1/minute	7.9	2.3
52	D40000001A9DFF41	Striped	1/minute	8.0	1.9
59	0A0000001AEB2A41	Red	1/minute	9.3	1.7

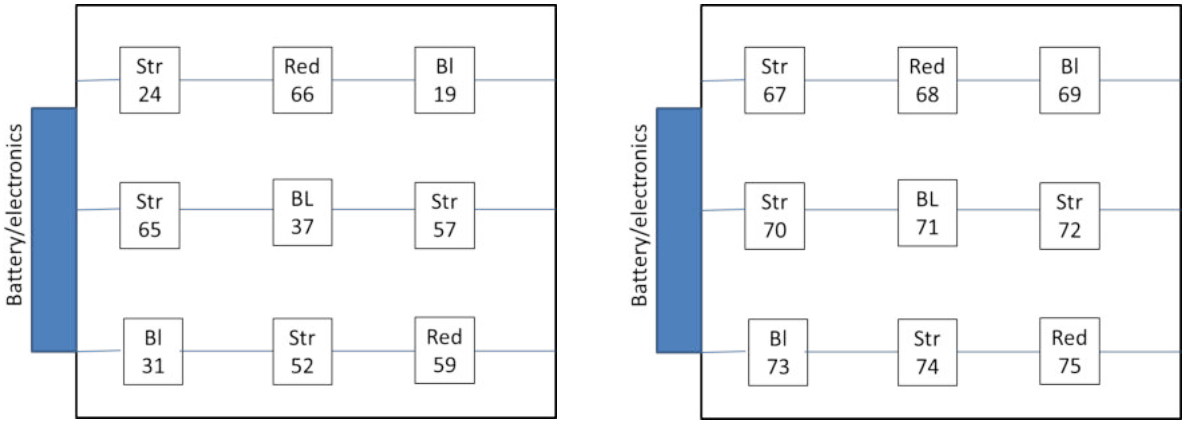


Figure 10. iButtons layout for POMME 1 (left) an POMME 2 (right)

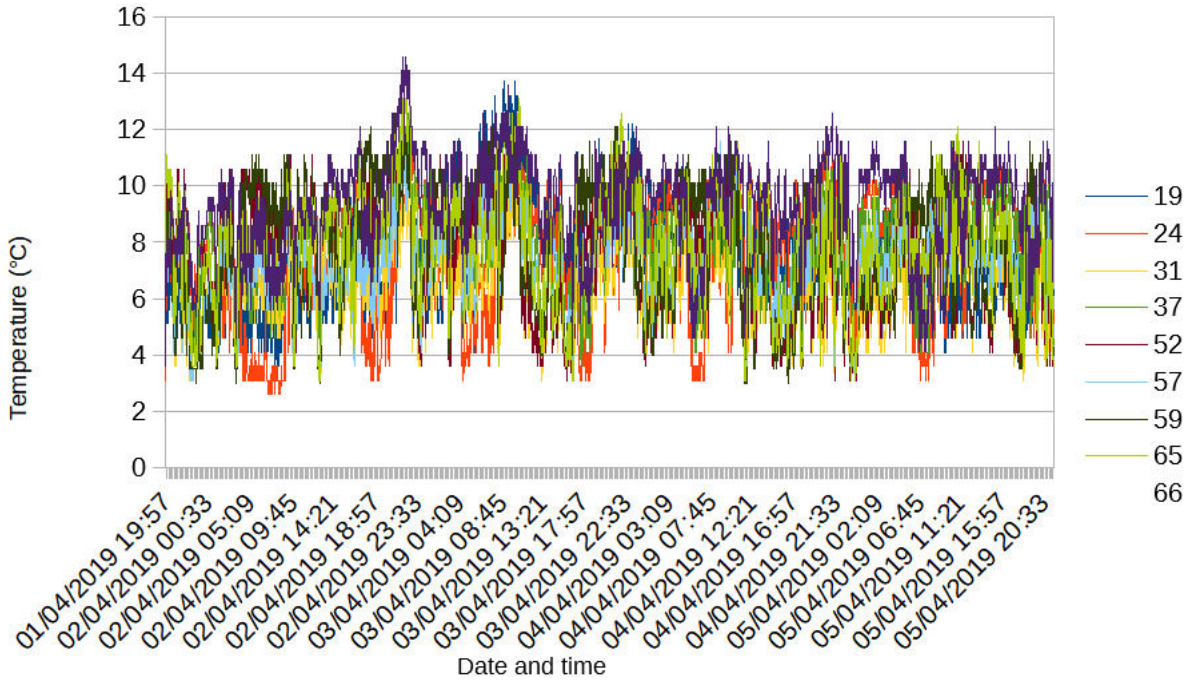


Figure 11. Temperature measurement recorded by the nine iButtons deployed on POMME 1 on Lau/Tow Cam from April 1st 19H46 to April 5th 21H23.

2.1.2. Futuna/Fatu Kapa

During dive Pl08-727 POMME 1 was deployed on an Alviniconcha community located at Asterix 2 in the diffusion area on April 18 at 23H32 (lat -14°45.1241'; Long -177°9.2335'; depth 1547 m, Figure 12). The camera sampled 5 minutes every half hour with a delayed start set at April 19, 02H00 UTC. Nine iButtons were configured to measure temperature data every minute (Table 22, Figure 10 & 13). The system was recovered on the same dive on April 19 at 18H45. The system encountered issues of lightening and recording. It fell on the Spot probe (N. Lebris, LECOB) while in position and was replaced on April 19 at 15H15. The videos recorded correctly from April 19, 02H06 UTC, until April 19, 10H35 UTC. Beyond that point, the projector started blinking with no defined program, the recording stopped on April 19 at 12H45 UTC.

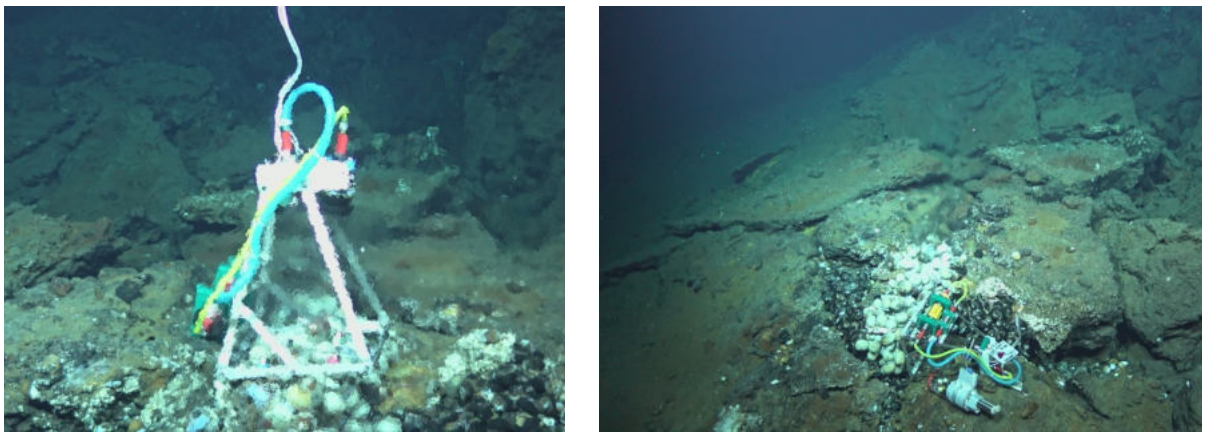


Figure 12. Deployment of POMME 1 during dive Pl08-727 at Futuna/Fatu Kapa/Asterix 2 in a diffusion area. Left: just after deployment. Right: before recovery

Table 22. Temperature measurement recorded by the nine iButtons deployed on POMME 1 on Futuna/Fatu Kapa/Asterix 2 from April 19, 02H00 UTC, to April 19, 17H55 UTC.

iButton #	Serial #	Colour	Sampling frequency	Av T°C	Sd T°C
24	480000001A885D41	Striped	1/5 minutes	10.8	6.5
66	E30000004B619041	Red	1/5 minutes	8.2	6.9
19	880000001A5CEA41	Blue	1/5 minutes	5.7	3.4
65	190000001A659641	Red	1/5 minutes	8.9	8.5
37	610000001A7E5341	Blue	1/5 minutes	7.2	5.9
57	630000001A9C4341	Striped	1/5 minutes	5.9	4.2
31	180000001AB4B941	Blue	1/5 minutes	7.3	7.4
52	D40000001A9DFF41	Striped	1/5 minutes	8.5	9.1
59	0A0000001AEB2A41	Red	1/5 minutes	16.5	21.7

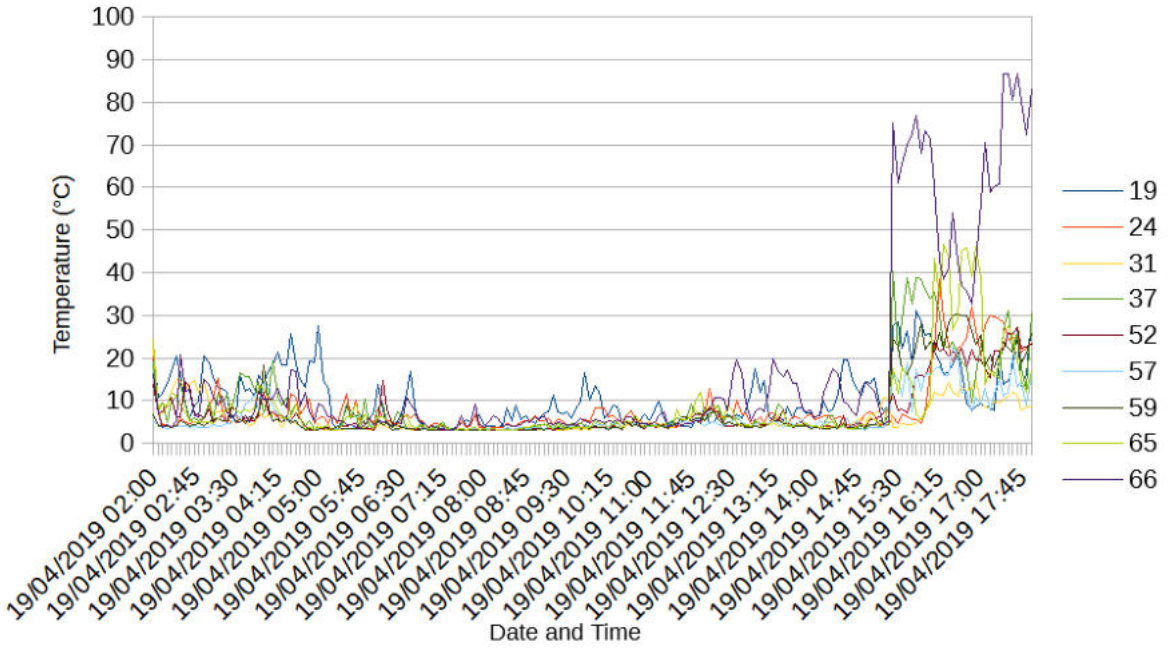


Figure 13. Temperature measurement recorded by the nine iButtons deployed on POMME 1 at Futuna/Fatu Kapa/Asterix 2 from April 19, 02H00 UTC, to April 19, 17H55 UTC.

2.2. Long term deployment

During dive Pl04-723 POMME 1 was deployed on an Ifremeria community located south of Tow Cam in the diffusion are sampled for all three communities on April 05 at 22H37 (lat -20.3179699; Long -176.1376653; depth 2712.26). The camera sampled 1 minute every 2 hours with a delayed start set at April 05, 20H00 UTC. Nine iButtons were configured to measure temperature data every minute (Table 23, Figure 10 & 15). The system was recovered on dive Pl11-730 on April 25 at 23H12 UTC and recorded 106 videos until April 14, 06H00 UTC. The system had recording, and then projector issues, starting on April 13 at 12H23. That day the recording didn't stop after a minute and the following videos developed projector issues. The system fell on April 13 between 16H00 and 18H00 UTC.

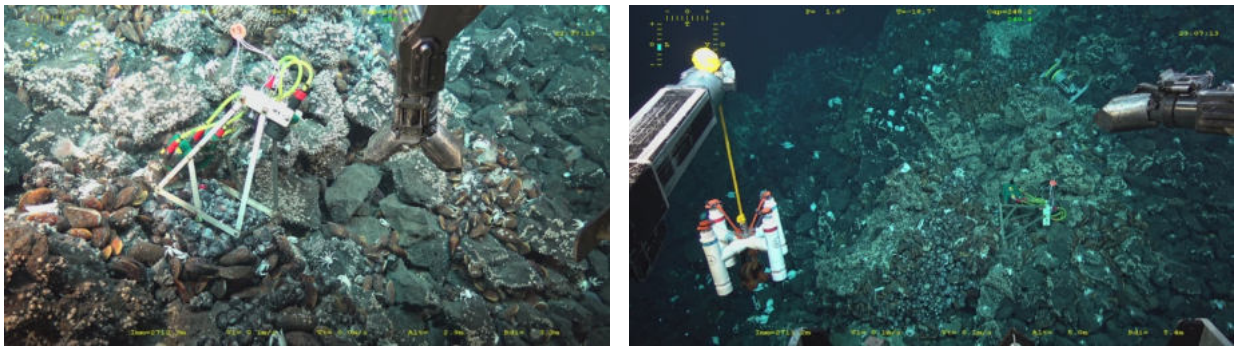


Figure 14. Deployment of POMME 2 on an *Ifremeria* community. Left: deployment during dive Pl04-723. Right: recovery during diver Pl11-730.

Table 23. Temperature measurement recorded by the nine iButtons deployed on POMME 2 on Lau/Tow Cam from to April 5, 33H00 UTC to April 15, 23H00 UTC.

iButton #	Serial #	Colour	Sampling frequency	Av T°C	Sd T°C
67	280000004B65D841	Striped	1/30 minutes	3.8	0.8
68	D70000004B5E0241	Red	1/30 minutes	3.8	0.6
69	460000004B629541	Blue	1/30 minutes	4.0	0.8
70	240000004B60CF41	Red	1/30 minutes	4.4	2.2
71	2E0000004B62A241	Blue	1/30 minutes	4.4	1.9
72	910000004B5E6541	Striped	1/30 minutes	4.4	1.6
73	3F0000004B5BEC41	Blue	1/30 minutes	7.6	6.1
74	E60000004B5D1D41	Striped	1/30 minutes	5.9	4.1
75	A60000004B5C5641	Red	1/30 minutes	5.6	3.1

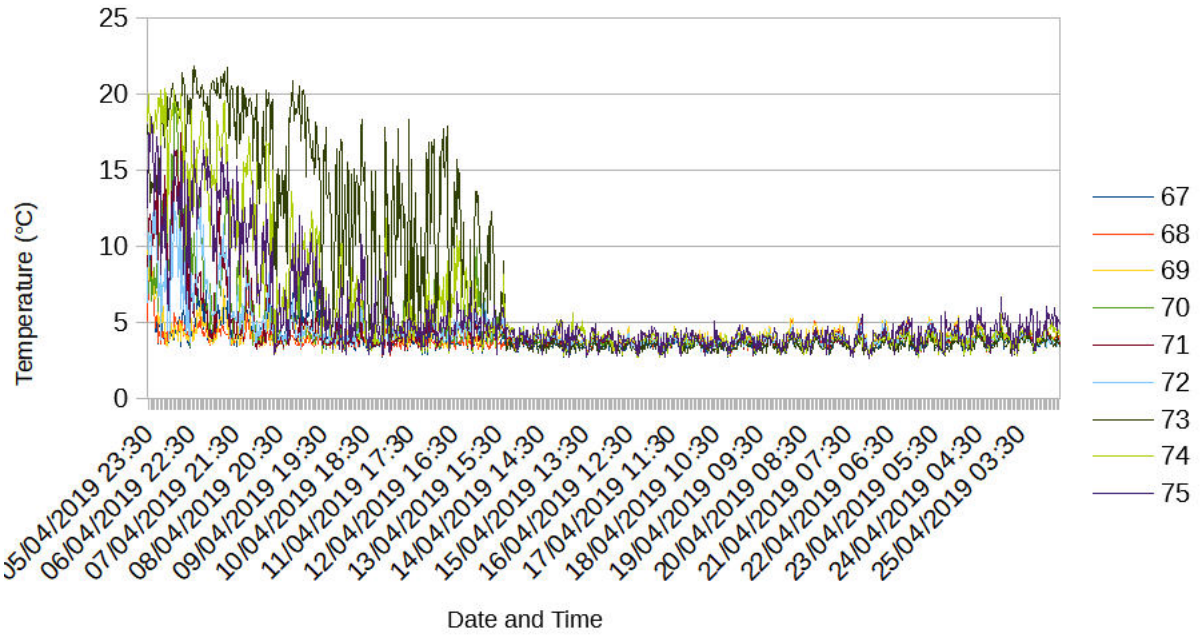


Figure 15. Temperature measurement recorded by the nine iButtons deployed on POMME 2 at Lau/Tow Cam from April 5, 23H00 UTC, to April 25, 23H00 UTC.

Objective 3. Habitat and community mapping

At each site a mosaic was performed at 4 m altitude at a speed of 0.2 m/s with a period of acquisition of 3s. Boxes were defined to cover 250 m on 25 m starting on an active site but were modified depending on timing and geomorphology (Table 24).

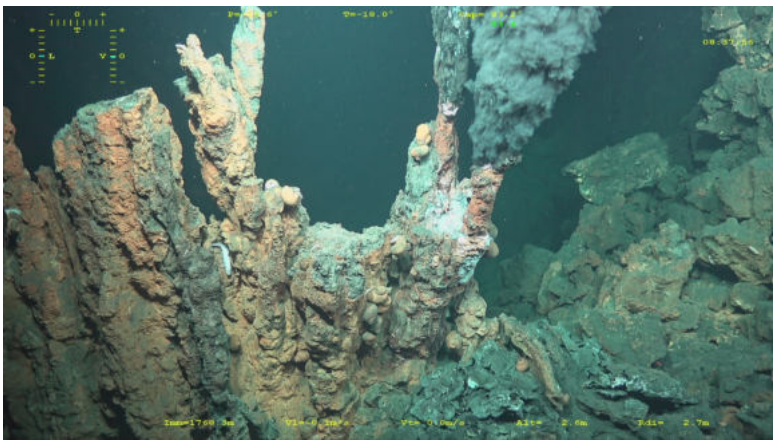
- Dive 721-2: on Tow Cam the profile was split in two because of issues with the OTUS2 acquisition. The camera failed if the live stream was running. The profiles resumed correctly once the stream was stopped.
- Dive 722-3: the profile was performed in the Northern part of the site Tui Malila.
- Dive 724-5
- Dive 727-8: the mosaic had to be stop for operations on the elevator.
- Dive 728-9: problem of navigation, the mosaic had to be stopped at line 11-12.
- Dive 731-12: the ROV could not be recovered because surface weather conditions, which allowed for a larger mosaic on that site. The profile was stopped after three lines to perform SPOT measurements to allow for a more complete larger mosaic.

Table 24. List of OTUS mosaics performed during the cruise.

Dive	Site	Date	Start time	End time	Length	Width	# of lines
721-2	Lau/Tow Cam – Part 1	01/04	05H21	08H21	250	12	6
721-2	Lau/Tow Cam – Part 2	01/04	13H20	15H11	250	13	7
722-3	Lau/Tui Malila	04/04	03H09	08H01	250	25	13
724-5	Fidji/Phoenix	10/04	12H11	15H13			20
727-8	Futuna/Fatu Kapa – 1	19/04	21H31	00H16			14
729-9	Futuna/Fati Ufu	22/04	22H03	00H59	250	25	
731-12	Lau/ABE – 1	27/04	06H24	07H33	250		3
731-12	Lau/ABE – 2	27/04	08H39	13H38	250		19

Rapport d'écologie – Leg 2

Eric Thiébaut, Camille Poitrimol et Loïc Michel, en collaboration avec Olivier Rouxel et Cédric Boulart (équipe chimie)



Ecological sampling of vent communities

Ecological sampling focused on each of the three main communities inhabiting back-arc basins in the western Pacific: the community dominated by the mussel *Bathymodiolus* sp., the community dominated by the gastropod *Ifremeria nautilei* and the community dominated by the bivalve *Alviniconcha hessleri*. The aims of this study was to describe the α- and β-diversity of benthic macrofauna in these 3 main communities reported in back-arc basins and to assess the role of local (e.g. physico-chemical environments) and regional (e.g. geological settings, connectivity) processes in structuring benthic communities.
The sampling procedure was as follow:

- Deployment of the marker Casimir in the field of view to assess the surface area sampled
- Pictures and videos
- Chemistry: 3 points of Chemini S in distinct areas of the community and 3 PIF fluid collection
- Collection of animals using the ROV claw
- Suction the sampled surface with the suction sampler when possible
- Chemistry: 3 points of Chemini on the bare substrate, and eventually one PIF fluid collection
- Recover Casimir

On board, big dominant species were washed to recover the totality of associated macrofauna. Individuals were then sorted, identified when possible, and preserved for future analyses in ethanol. Some individuals of two dominant species (*Lepetodrilus schrolli* and *Shinkailepas tollmani*) were preserved in formalin for histological studies and analysis of the reproduction status. Some individuals were also used for genetic studies. Most macrofauna (sieved on 250 µm) was preserved in ethanol 96°C to allow for future genetic studies (e.g. barcoding analysis), or dried for isotopic analyses. Meiofauna (20 to 250 µm) was either preserved in formalin or frozen at -80°C for metabarcoding analyses.

1.5. Manus basin

1.1. PL733-14: Pac Manus vent field (1600 m)

The vent field “Pac Manus” extends on a large area and includes sites with different levels of activity. During this first dive on this vent, we mainly explored the sites along an East-West gradient. The first site which was visited (Tsukushi) seems inactive. The second site, Snowcap is moribund but small patches of mussels were observed and one patch was sampled on May 16. The third site Big Papi is very active with black smokers. One sample of the *Alviniconcha* community was performed at this site. The fourth site Fenway corresponds to an area covered by very large mussel beds which show an important spatial heterogeneity. It also harbours patches of *Alviniconcha*, *Paralvinella*, tubeworms and *Ifremeria*. Different samples were collected at this site:

- Two Ifremeria communities (one within a big patch)
- One tubeworm (Arcovestia) community
- One Paralvinella community
- One Alviniconcha community mixed with Paralvinella
- One Bathymodiolus community in a high diffuse area close to a Paralvinella colony; this raises the question of the representativeness of this sample.

The last site is Solwara 8 where *Ifremeria* and *Alviniconcha* samples were collected.
Detailed information on biological samples collected during this dive are given in Tables 1 & 2, and Figure 1.

Table 1. Chemical and community sampling at Pac Manus during dive Pl733-14 on May 16-18. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points (Tp max)
733	16/05	Snowcap	Bathymodiolus 1	GBT 1 Aspi 1	11:05	1 2 3	10:40 10:45 10:50	1: 10:40 (4.08°C) 2: 10:45 (4.0°C) 3: 10:50 (3.55°C) After sampling 1 : 11:34 (7.50°C) 2: 11:40 (3.50°C) 3: 11:46 (6.30°C)
733	16/05	Big Papi	Alviniconcha 1	GBT 2 Aspi 2	13:20	1 2 3	12:50 12:56 13:03	1: 12:50 (16.0°C) 2: 12:56 (7.51°C) 3: 13:03 (15.3°C) After sampling 1: 14:13 (13.6°C) 2: 14:20 (5.6°C) 3:14:31 (7.8°C)
733	16/05	Fenway	Ifremeria 1	GBT 3	17:44	1 2 3	17:23 17:29 17:35	1: 17:19 (3.67°C) 2: 17:27 (6.32°C) 3: 17:35 (12°C) After sampling 1: 18:05 (4.7°C) 2: 18:11 (9.62°C) 3: 18:17 (3.42°C)
733	17/05	Fenway	Alviniconcha 2	GBT 8	10:32	1 2 3	10:13 10:19 10:28	1: 10:13 (6.12°C) 2: 10:19 (13.06°C) 3: 10:26 (5.05°C) After sampling 1 : 11:06 (4.57°C)
733	17/05	Fenway	Bathymodiolus 2	GBT 5	11:49	No		No – only temperature
733	17/05	Fenway	Ifremeria 2	GBT 7	14:15	No		No
733	18/05	Solwara 8	Alviniconcha 3 (mix with Ifremeria?)	GBT 9	3:22	No		No
733	18/05	Solwara 8	Ifremeria 3	GBT 11 Aspi 6	2:08	No		No

Table 2. Additional opportunistic sampling at Pac Manus during dive 733-14 on May 16-18. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
733	Big Papi	Active black smoker – piece of chimney	PBT 1	16/05	14:38	
733	Big Papi	Scale worms	Aspi 3			
733	Big Papi	Scale worms + Paralvinella	Aspi 4			
733	Fenway	Arcovestia	PBT3 Chimie			
733	Fenway	Barnacles	Aspi 5			
733	Satanic Mills	Active chimney	PBT 4			
733	Satanic mills	Rock samples with cirripeds	GBT 4	17/05	1:25	
733	Fenway	Paralvinella colony	GBT 6	18/05	1:59	
733	Near Big Papi	One Echinoderm	PBT 5	18/05		
733	Solwara 8	Inactive chimney with cirripeds	GBT 10	18/05	4:03	
733	Solwara 8	Alviniconcha and Ifremeria on a top of a chimney	PBT 7	18/05	1:16	
733	Solwara 8	Alviniconcha and Ifremeria on a top of a chimney	Aspi 7			
733	Solwara 8	Shrimps	Aspi 8			

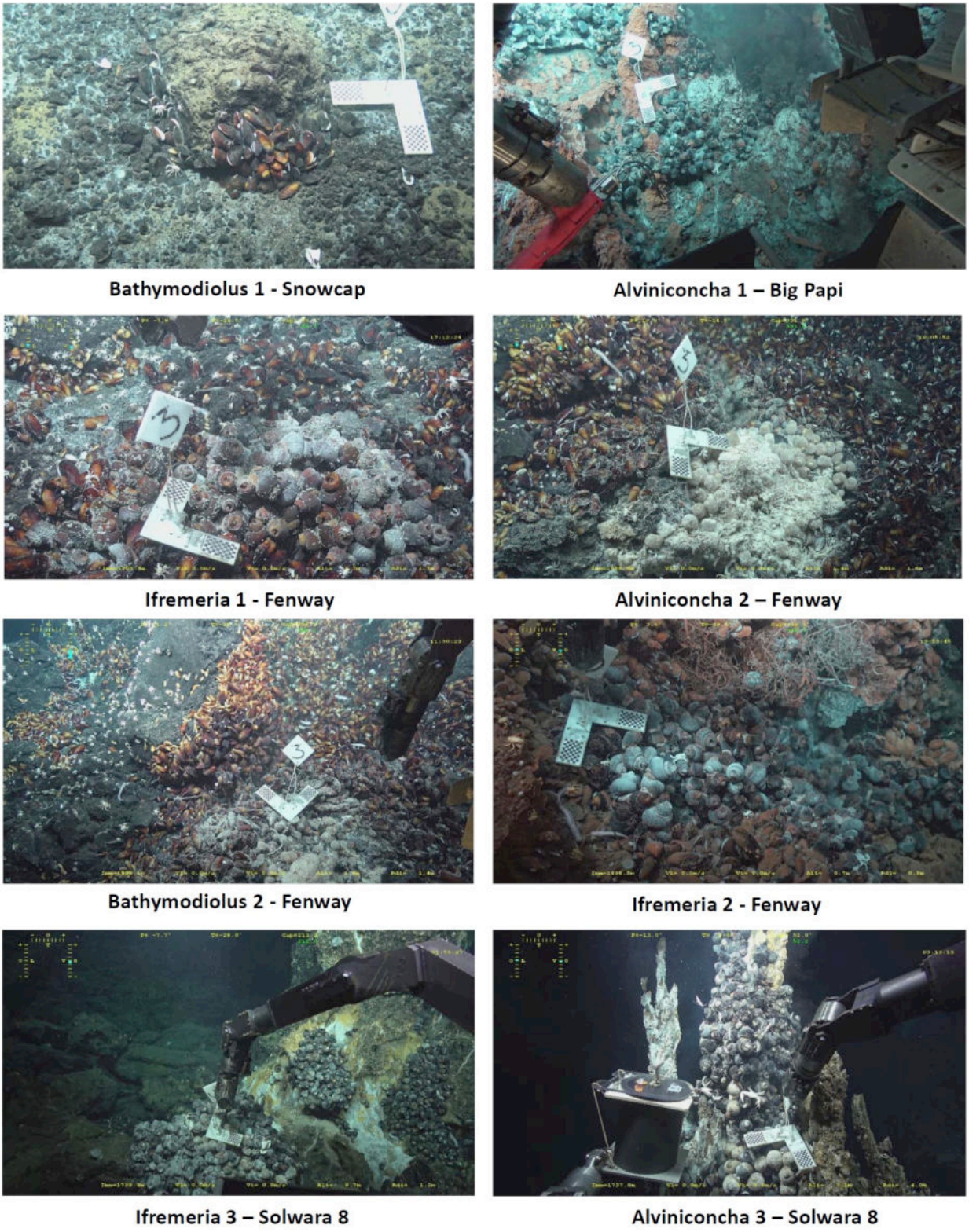


Figure 1. *Pictures of* PL734-15: Pac Manus vent field (1600 m)

This second dive at Pac Manus was dedicated to a second visit of the vent field on both sides of the ridge along a SE-NE gradient, from Solwara 6 to Solwara 7. The sites Roman's Ruins is characterized by black smokers. Ifremeria community was observed only on the north-west of the visited area at Solwara 7 while Ifremeria and Bathymodiolus communities were sampled on the south-west of the visited area at Solwara 6. An additional sample of Bathymodiolus was collected again at Fenway to better characterize the small scale heterogeneity of the mussel beds at this site.

Detailed information on biological samples collected during this dive are given in Tables 3 & 4, and Figure 2.

Table 3. Chemical and community sampling at Pac Manus during dive Pl734-15 on May 19-20. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points
734	19/05	Solwara 7	Ifremeria 1	GBT 5 Aspi 3	10:15	1 2 3 After 1 2	9h52 9h59 10:08 10:53 11:10	1: 9:52 (5.45°C) 2: 9:59 (5.68°C) 3: 10:08 (4.04°C) After sampling 1: 10:53 (4.74°C) 2: 11:00 (10.0°C) 3: 11:06 (3.70°C)
734	19/05	Fenway	Bathymodiolus 1	GBT 1 Aspi 5	13:47	1 2 3 4	13:20 13:29 13:37 14:17	1: 13.21 (3.34°C) 2: 13.29 (3.11°C) 3: 13:37 (3.05°C) 4: 14:23 (4.07°C) 5: 14:36 (3.03°C)
734	19/05	Solwara 6	Bathymodiolus 2 (+ tubeworms)	GBT 2 Aspi 6	23:12	1 2 3 After 1	22:51 22:58 23:05 23:34	1: 22:51 (4.2°C) 2: 22:58 (5.1°C) 3: 23:05 (4.8°C) After sampling 1: 23:34 (5.5°C) 2: 23:41 (5.27°C)
734	20/05	Solwara 6	Ifremeria 2	GBT 4 Aspi 7 and 8 ?	00:36	1 2 3 After 1 2	00:17 00:23 00:30 00:52 00:58	1: 00:17 (11.1°C) 2: 00:23 (9.5°C) 3: 00:30 (4.0°C) After sampling 1: 00:52 (11.5°C) 2: 00:58 (4.6°C) 3: 1:03 (6.7°C)

Table 4. Additional opportunistic sampling at Pac Manus during dive 734-15 on May 19-20. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
734	Roman's ruins	Alviniconcha on a chimney wall	GBT 9	19/05	2:42	
734	Roman's ruins	Active diffuser	PBT 7	19/05	3:28	
734	Roman's ruins	Rimicaris and scale worms on a chimney wall	Aspi 1	19/05	7:20	
734	Solwara 7	Fish	Aspi 2	19/05	9:10	
734	Solwara 7	Shrimp and chimney fauna	Aspi 4	19/05	11:30	
734	Solwara 6	Cirripeds with Ifremeria	PBT 3	19/05	19:37	
734	Solwara 6	Phymorhynchus in mussel community	Aspi 7	20/05	01:10	
734	Solwara 6	Rock pieces and shrimps in Ifremeria community	Aspi 8	20/05	01:17	

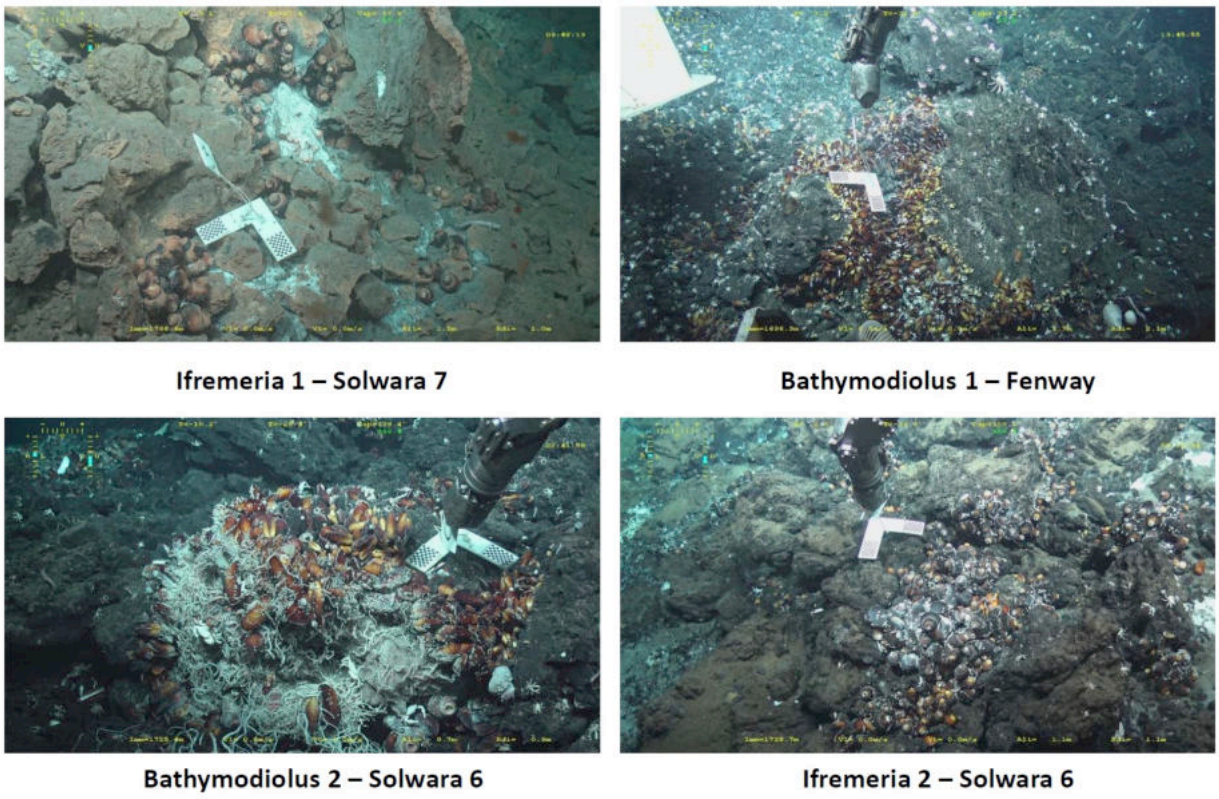


Figure 2. Pictures of community sampling at Pac Manus during the dive PL734-1

To conclude, the number of replicates collected at Pac Manus for the different communities during the two dives is as follows:

- 3 replicates for Alviniconcha community
- 5 replicates for Ifremeria community
- 4 replicates for Bathymodiolus community in different facies.

1.2. PL735-16: Desmos vent field

During the dive, we prospected mainly the eastern part of the Caldera from Solwara 12 to the north of the Caldera near the Onsen site. Solwara 12 was inactive and just fossilized chimneys were reported. In the north of the caldera, some diffusive areas covered by bacterial mats, scale worms and provanids, or bush of *Arcovestia* were observed. The site is also characterized by cliffs inhabited by individual mussels, *Alaysia*, provanids, pectinids… Old dead shells of Calyptogena were observed in the sedimented area at depth ranging between 1920 and 1950 m.
None of the targeted communities was observed. Only an opportunistic sampling was performed to improve the inventory of biodiversity in this area. Detailed information on biological samples collected during this dive are given in Table 5.
NB: Troubles with the vacuum altered the quality of the samples.

Table 5. Additional opportunistic sampling at Desmos Caldera during dive 735-16 on May 21-22. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
735	Desmos Caldera	Snails and worms on a S0 massif	GBT 7 Aspi 1	20/05	21:40	
735	Desmos Caldera	Bacterial mats	PBT 2 Aspi 2	21/05	3:29 3:32	
735	Desmos Caldera	Tubeworms bush	GBT 4 Aspi 3	21/05	5:06 5:19	PIF and Chemini data available
735	Desmos Caldera	Gastropods close to tubeworms	Aspi 4	21/05	8:15	
735	Desmos Caldera	Scale worms	Aspi 5	21/05	9:26	
735	Desmos Caldera	Tubeworms, Phymorhynchus, Bathypecten, maldanid on a wall	GBT 8	21/05	9:57	
735	Desmos Caldera	Phymorhynchus	Aspi 6	21/05	10:40	Not observed on board?
735	Desmos Caldera	Bathymodiolus, Bathypecten on rocks, gastropods, tubeworms, goose barnacles….	ROV Basket and compartment	21/05	From 19:06 to 19:52	

1.3. PL736-17: North Su vent field

This dive was dedicated to the survey of two submarine volcanoes: Suzette and North Su. The first volcano is characterized by some active black smokers harbouring rare Paralvinella, shrimps and scale worms, and by very large and dense aggregations of Ifremeria on old chimneys. Alviniconcha is present in the most active diffuse areas. Both communities were sampled on this volcano. No mussel was observed.
The North Su volcano offers very different seascapes. A large mussel bed was present on the northern flank of North Su in mixture with clumps of Alviniconcha and Ifremeria and bushes of Oasisia. Cirripeds (Eochionelasmus) were also present at the periphery of the active areas. The

three target communities were sampled. Very active black smokers were present at the top of the volcano. On the southern flank of the volcano, very active white smokers releasing a very acidic and SO2-rich fluid were observed. Only shrimps and fish seem to be able to colonize these habitats. Detailed information on biological samples collected during this dive are given in Tables 6 & 7, and Figure 3.

Table 6. Chemical and community sampling at North Su during dive PI736-17 on May 23-24. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points
736	22/5	Suzette	Ifremeria 1	GBT 4 Aspi 2	13:59 14:15	1 2 3	13:37 13:44 13:50	1: 13:37 (5.00°C) 2: 13:44 (5.15°C) 3: 13:50 (9.10°C) After sampling 1: 14:33 (5.33°C) 2: 14:39 (6.50°C) 3: 14:44 (9.17°C)
736	22/5	Suzette	Alviniconcha 1	GBT 3	14:56	1 2 3	13:19 13:25 13:31	1: 13:22 (9.00°C) 2: 13:29 (9.00°C) 3: 13:31 (5.86°C) After sampling 1: 15:11 (9.07°C) 2: 15:18 (6.8°C)
736	22/5	North Su	Bathymodiolus 1	GBT 7 Aspi 3	19:45 20:17	1 2 3	19:20 19:33 19:38	1: 19:17 (7.80°C) 2: 19:23 3: 19:30 (8.0°C) 4: 19:38 After sampling 1: 20:26 (11.2°C) 2: 20:32 (5.0°C) 3: 20:37 (5.3°C)
736	23/5	North Su	Bathymodiolus 2	GBT 9 Aspi 6	13:32 13:46	1 2 3	13:12 13:19 13:25	1: 13:12 (10.5°C) 2: 13:19 (8.28°C) 3: 13:25 ((9.2°C) After sampling 1: 13:53 (8.0°C) 2: 13:58 (8.4°C) 3: 14:03 (8.4°C)
736	23/5	North Su	Alviniconcha 2	GBT 10	15:10	1 2 3	14:46 14:51 14:57	1: 14:46 (6.3°C) 2: 14:51 (18.3°C) 3: 14:57 (7.9°C) After sampling 1: 15:21 (30.46°C) 2: 15:25 (33.7°C) 3: 15:29 (26.93°C)
736	23/5	North Su	Ifremeria 2	GBT 8 Aspi 7	15:59 16:08	1 2 3	15:42 15:47 15:53	1: 15:42 (6.81°C) 2: 15:47 (7.73°C) 3: 15:53 (6.21°C) After sampling 1: 16:18 (8.23°C) 2: 16:22 (10.84°C) 3: 16:28 (12.95°C)

Table 7. Additional opportunistic sampling at North Su during dive 736-17 on May 23-24. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
736	Suzette	Scale worms and sponges	Aspi 1	22/5	10:45	
736	Suzette	Chimney with cirripeds	Rock 1 in the basket	22/5	16:04	
736	?	Scale worms + shrimp	Aspi 4	23/05	00:35	
736	?	Scale worms + Paralvinella	Aspi 5	23/05	1:35	
736	North Su	Tubeworms - Oasisia	PBT 6	23/05	14:28	
736	North Su	Rocks with cirripedes	Rocks 5 & 6 in the basket	23/05	16:40 16:46	
736	Suzette	Paralvinella	Aspi 8	23/05	18:44	

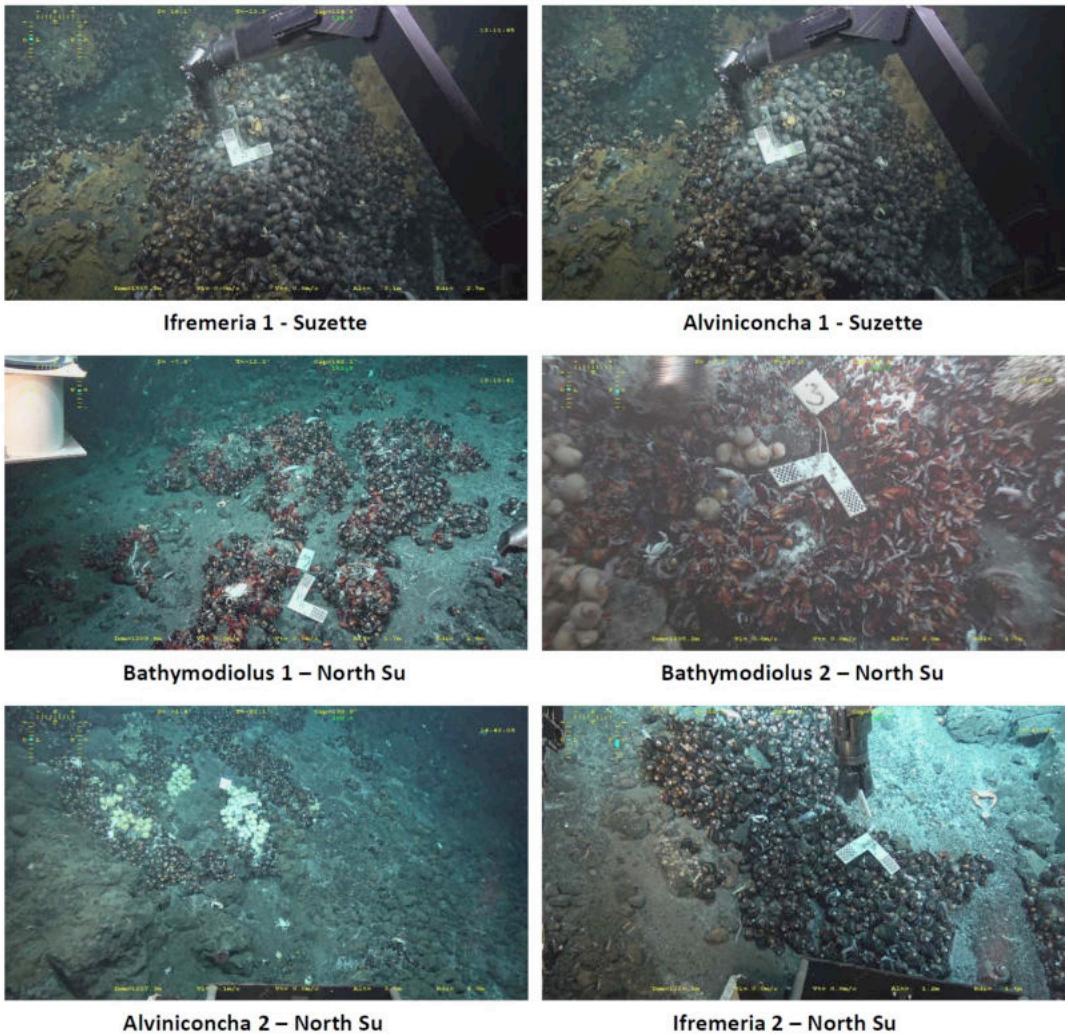


Figure 3. *Pictures of community sampling at North Su during the dive PL736-17.*

1.4. PL737-18: South Su vent field

The three target communities were observed on the northern and southern flanks of this volcano and two replicates for each community was sampled. Tubeworms, paralvinellid polychaetes and scale worms sere also sampled. Detailed information on biological samples collected during this dive are given in Tables 8 & 9, and Figure 4.

Table 8. Chemical and community sampling at South Su during dive Pl737-18 on May 24-25. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points
737	24/05	South Su	Bathymodiolus 1	GBT 9 Aspi 1	15:29 15:46	1 2 3	15:10 15:18 15:24	1: 15.10 (5.40°C) 2: 15:18 (6.20°C) 3: 15:24 (7.29°C) 24/05After sampling 1: 15:53 (4.21°C) 2: 15:59 (5.82°C) 3: 16:05 (5.28°C)
737	24/05	South Su	Alviniconcha 1	GBT 10	16:40	1 2 3	16:21 16:27 16:33	1: 16:21 (5.36°C) 2: 16:27 (27.10°C) 3: 16:33 (5.04°C) After sampling 1: 16:52 (11.82°C) 2: 16:59 (30.00°C) 3: 17:07 (35.4°C)
737	24/05	South Su	Ifremeria 1	GBT 8 Aspi 2	17:57 18:22	1 2 3	17:33 17:41 17:47	1: 17:33 (5.03°C) 2: 17:41 (5.90°C) 3: 17:47 (9.34°C) After sampling 1: 18:28 (5.07°C) 2: 18:33 (5.87°C) 3: 18:39 (7.01°C)
737	25/05	South Su	Bathymodiolus 2	GBT 3 Aspi 8	1:41 01:49	1 2 3	01:24 01:29 01:35 After 01:55	1: 01:23 (3.69°C) 2: 01:29 (3.65°C) 3: 01:35 (3.83°C) After sampling 1: 01:55 (4.88°C) 2: 01:59 (3.58°C) 3: 02:04 (3.59°C)
737	25/05	South Su	Alviniconcha 2	GBT 7	2:57	1 2 3	02:31 02:40 02:49 After 03:07 03:10 03:17	1: 02:31 (7.96°C) 2: 02:40 (16.0°C) 3: 02:45 (7.5°C) After sampling 1: 03:07 (5.7°C) 2: 03:10 (10.32°C) 3: 03:17 (28.39°C)
737	25/05	South Su	Ifremeria 2	GBT 4 Aspi 4	4:08 4:39	1 2 3	03:44 03:53 04:02 After 04:24	1: 03:44 (5.36°C) 2: 03:53 (5.6°C) 3: 04:02 (4.15°C) After sampling 1: 04:25 (5.65°C)

								2: 04:28 (3.53°C) 3: 04:32 (4.17°C)

Table 9. Additional opportunistic sampling at South Su during dive 737-18 on May 24-25. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
737	South Su	Alviniconcha on chimney	PBT 5	24/05	14:31	
737	South Su	Paralvinella	PBT 1	25/05	00:00	
737	South Su	Vestimentiferans	PBT 2	25/05	00:51	
737	South Su	Zoarcid fish	Aspi 3	25/05	03:30	
737	South Su	Scale worms on bacterial mats	Aspi 5	25/05	06:18	
737	South Su	Scale worms	Aspi 6	25/05	19:27	
737	South Su	Paralvinella	Aspi 7	25/05	20:04	

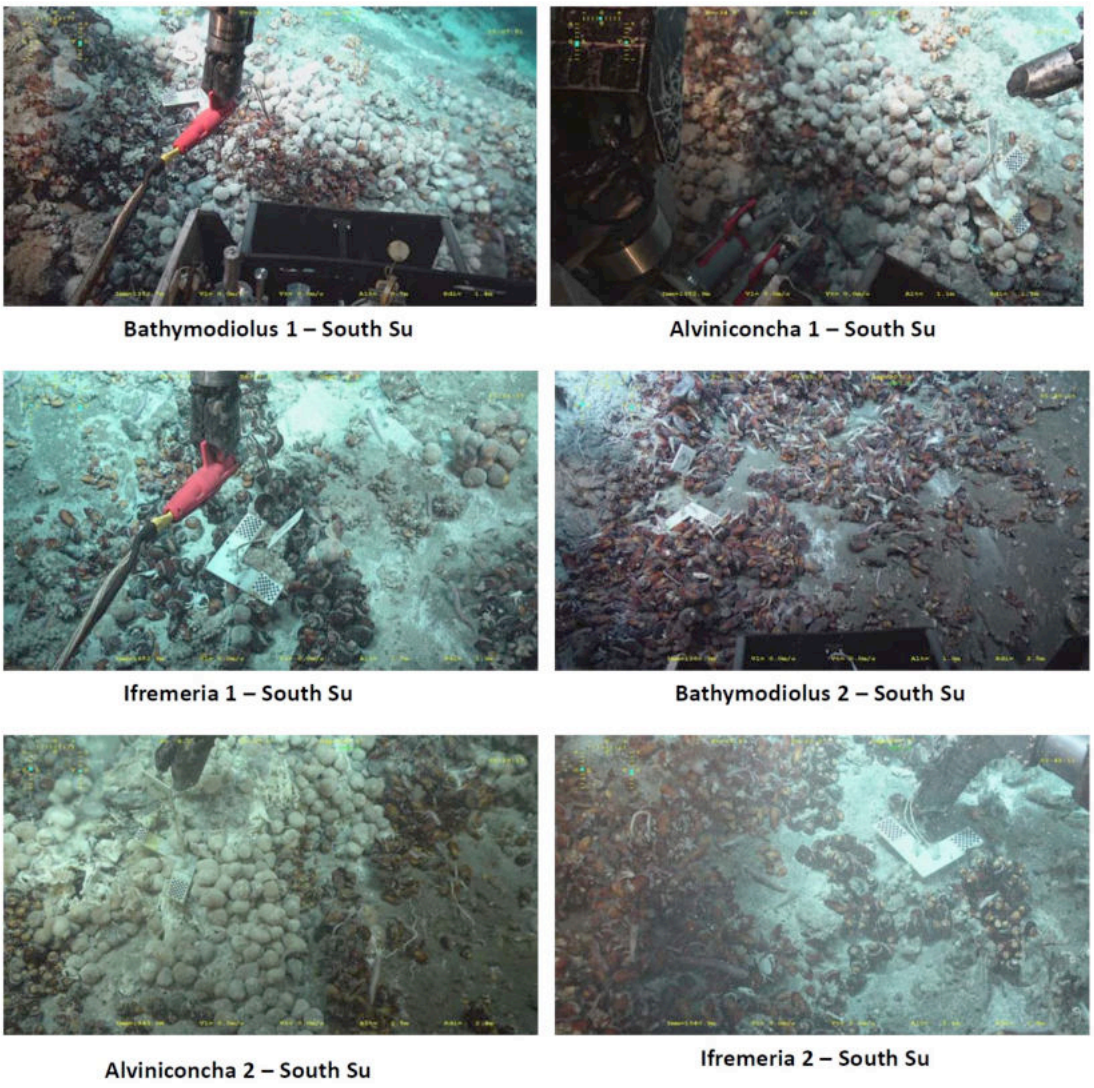


Figure 4. *Pictures of community sampling at South Su during the dive PL737-18.*

1.6. Woodlark basin

2.1. PL738-19: Scala vent field

The Scala was discovered during this dive. It extends on the slopes of a submarine relief on a distance of a few tens of meters. It is characterized by very large beds of goose barnacles colonizing poorly active diffusion areas on old chimneys. In more active diffuse areas, patches of *Alviniconcha* and *Ifremeria* were present. No mussel was observed. At the top of the site and at its periphery, very active black smokers were reported. The surveying of the east of the site did not allow to identify other active hydrothermal sites.

Only one replicate of two target communities (i.e. *Alviniconcha* and *Ifremeria*) was collected in parallel with a sample of goose barnacles. Additionally, crabs and scale worms as well as peripheral fauna including sea anemones, holothurians, barnacles and gorgons were sampled.

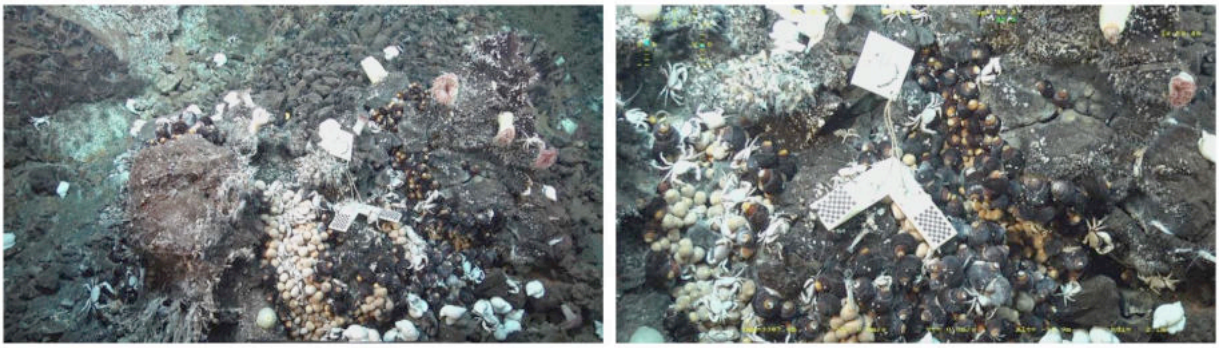
Detailed information on biological samples collected during this dive are given in Tables 10 & 11, and Figure 5.

Table 10. Chemical and community sampling at Scala during dive Pl738-19 on May 27-28. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points
738	27/05	Scala	Alviniconcha 1	GBT10	18:27	1 2 3	18:01 18:11 18:19	1: 17:56 (6.4°C) 2: 18:07 (18.6°C) 3: 18:15 (7.3°C) After sampling 1: 18:40 (10.1°C) 2: 18:45 (20.3°C) 3: 18:51 (9.1°C)
738	27/05	Scala	Ifremeria 1	GBT 9 Aspi 1	19:31 19:58	1 2 3	19:07 19:15 19:22	1: 19:03 (5.6°C) 2: 19:11 (6.1°C) 3: 19:18 (3.9°C) After sampling 1: 20:07 (7.1°C) 2: 20:11 (5.7°C) 3: 20:16 (3.6°C)

Table 11. Additional opportunistic sampling at Scala during dive 738-19 on May 27-28. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
738	Scala	Cirripeds and sea anemone	Rock 3	27/05	20:21	
738	Scala	Scale worms	Aspi 3	27/05	20:30	
738	Scala	Scale worms and crabs	Aspi 2	27/05	21:03	
738	Scala	Sea anemone 2 and Phymorhynchus	Tiroir	27/05	22:16	
738	Scala	Goose barnacles	GBT 3 Aspi 4	28/05	03:35 03:42	
738	Scala	Barnacles on sponge spicules	Tiroir	28/05		
738	Scala	Gorgones	Tiroir	28/05		



Alviniconcha 1 Ifremeria 1

Figure 5. Pictures of community sampling at Scala during the dive PL738-1

2.2. PL739-20: Scala vent field

Initially, this second dive at Scala vent field was dedicated to complete the sampling of vent fauna and communities. Technical troubles and bad weather conditions deeply modify and this initial programme. Only one Alviniconcha community was sampled.
Detailed information on biological samples collected during this dive are given in Tables 12 & 13, and Figure 6.

Table 12. Chemical and community sampling at Scala during dive Pl739-20 on May 30-31. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points
739	31/05	Scala	Alviniconcha 1	GBT10	01:50	1 2 3	01:31 01:36 01:42	1: 01:31 (4.06°C) 2: 01:36 (3.76°C) 3: 01:42 (4.24°C) After sampling 1: 01:58 (4.75°C) 2: 02:04 (5.89°C) 3: 02:09 (14.68°C)

Table 13. Additional opportunistic sampling at Scala during dive 739-20 on May 30-31. Date and time are given in UT.

Dive	Site	Habitat	Sampling			Comments
			Sampler	Date	Time	
739	Scala	Alviniconcha on chimney	PBT5	30/05	01:14	
739	Scala	Shrimps	Aspi 1	30/05	02:18	
739	Scala	Sea anemone	GBT4	31/05	04:11	At the base of a chimney
739	Scala	Scaleworms	GBT3	31/05	04:29	Base of an active chimney

Figure 6. *Picture of community sampling at Scala during the dive PL739-20.*

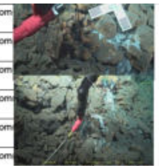
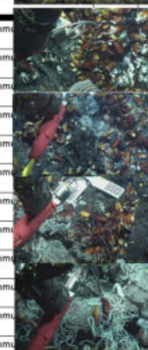
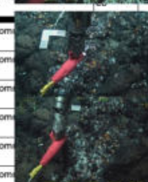
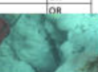
Water Chemistry on vent assemblages

Chemical data recorded by the analysis of diluted fluids (Chemini and PIF) during the Leg2 are summarized in the following table by Olivier Rouxel in an Excel format.

Table 14. Chemical data recorded on the three vent assemblages using PIF and Chemini during the Chubacarc 2019 Leg 2.

DIVE #	Date	#Cycle CHEMINI	# Reference CHEMINI	Lat. S	Long. E	Site Name	Start Time (UTC)	End Time (UTC)	Temp. Max°C	Temp. Min°C	H_2S (ΣS^{II}) (µM)	PIF #	Comments (LED signals, other...)	Observation (habitats, hydrothermal site)	Observer ID	PHOTO	Sample Name PIF #	Start Time (UTC)	Total Vol recovered (mL)	Filter (Y/N)	pH (21°C)	Fe_{TD} (µM)	H_2S (µM)	CH_4	$\delta^{13}C$	$\delta^{34}S$	ICP	Site Name	Observation (habitats, hydrothermal site)
PL14	05-16-2019	2	16|05|2019,07h53m49'!A1			At Bottom	7:57	08:00	N/A		0,0	N	FLAT@840.000	Calibration	OR														
PL14	05-16-2019	3	16|05|2019,07h58m05'!A1			At Bottom	8:00	08:04	N/A		10,0	N	MIN@740.000	Calibration	OR														
PL14	05-16-2019	1	16|05|2019,08h02m12'!A1			At Bottom	8:04	08:08	N/A		0,0	PIF-1	Noisy	Bottom seawater	OR		CHU-PL14-PIF-1	8:00	60	Y	7,32	<1.5		x			x	At Bottom	Bottom seawater
PL14	05-16-2019	4	16|05|2019,08h06m15'!A1			At Bottom	8:08	08:12	N/A		30,0	N	MIN@525.000	Calibration	OR														
PL14	05-16-2019	5	16|05|2019,08h10m20'!A1			At Bottom	8:12	08:16	N/A		80,0	N	MIN@105.000	Calibration	OR														
PL14	05-16-2019	1	16|05|2019,10h26m59'!A1			Snowcap	10:29	10:33	4,1	3,7	1,4	PIF-2	Data OK but not reported; PEP has been turned off during sampling and after tubing purging	Mussel community #1, before sampling / CANCELLED	CB		CHU-PL14-PIF-2	10:28	60	Y	ND	1,8					x	Snowcap	Mussel community #1, before sampling / CANCELLED
PL14	05-16-2019	1	16|05|2019,10h33m10'!A1			Snowcap	10:35	10:37	4,0		<0.5	PIF-3	Data OK but not reported; PEP has been turned off during sampling and after tubing purging	Mussel community #1, before sampling / CANCELLED	CB		CHU-PL14-PIF-3	10:34	60	Y	ND	2,3					x	Snowcap	Mussel community #1, before sampling / CANCELLED
PL14	05-16-2019	1	16|05|2019,10h38m06'!A1			Snowcap	10:40	10:44	4,1		<0.5	PIF-4	Data OK but not reported	Mussel community #1, before sampling	CB		CHU-PL14-PIF-4	10:40	60	Y	ND	2,9		x			x	Snowcap	Mussel community #1, before sampling
PL14	05-16-2019	1	16|05|2019,10h43m10'!A1			Snowcap	10:45	10:50	4,0		4,1	PIF-5	Data OK but not reported	Mussel community #1, before sampling	CB		CHU-PL14-PIF-5	10:45	60	Y	ND	1,6			x		x	Snowcap	Mussel community #1, before sampling
PL14	05-16-2019	1	16|05|2019,10h49m00'!A1			Snowcap	10:50	10:56	3,6		0,8	PIF-6	Data OK but not reported	Mussel community #1, before sampling	CB		CHU-PL14-PIF-6	10:50	60	Y	7,22	2,6					x	Snowcap	Mussel community #1, before sampling
PL14	05-16-2019	5	16|05|2019,10h54m09'!A1			Snowcap	10:56	11:01	N/A		85,0	N/A	Data OK but not reported	N/A	CB														
PL14	05-16-2019	1	16|05|2019,11h32m37'!A1			Snowcap	11:34	11:39	7,5		1,4	N	Data OK but not reported	Mussel community #1, after sampling	CB														
PL14	05-16-2019	1	16|05|2019,11h38m09'!A1			Snowcap	11:40	11:45	3,5		5,6	N	Data OK but not reported	Mussel community #1, after sampling	CB														
PL14	05-16-2019	1	16|05|2019,11h43m10'!A1			Snowcap	11:46	11:50	6,3		2,9	N	Data OK but not reported	Mussel community #1, after sampling	CB														
PL14	05-16-2019	1	16|05|2019,12h48m02'!A1			Big Papi	12:50	12:54	16,0		3,3	PIF-7	Data OK but not reported	Alviniconcha community#1, before sampling	CB		CHU-PL14-PIF-7	12:50	60	Y	ND	109,9		x			x	Big Papi	Alviniconcha community#1, before sampling
PL14	05-16-2019	1	16|05|2019,12h54m54'!A1			Big Papi	12:56	13:00	7,5	5,3	36,4	PIF-8	Data OK but not reported	Alviniconcha community#1, before sampling	CB		CHU-PL14-PIF-8	12:56	60	Y	6,81	191,5			x		x	Big Papi	Alviniconcha community#1, before sampling
PL14	05-16-2019	1	16|05|2019,13h01m26'!A1			Big Papi	13:03	13:07	15,3	14,6	34,1	PIF-9	Data OK but not reported	Alviniconcha community#1, before sampling	CB		CHU-PL14-PIF-9	13:03	60	Y	ND	519,7					x	Big Papi	Alviniconcha community#1, before sampling
PL14	05-16-2019	1	16|05|2019,14h10m51'!A1			Big Papi	14:13	14:17	13,6	11,5	45,5	N	MIN@250.000	Alviniconcha community#1, after sampling	OR													
PL14	05-16-2019	1	16|05|2019,14h17m52'!A1			Big Papi	14:20	14:23	5,6	5,0	73,9	N	MIN@120.000	Alviniconcha community#1, after sampling	OR														
PL14	05-16-2019	1	16|05|2019,14h24m56'!A1			Big Papi	14:27	14:30	6,0	5,0	54,6	N	MIN@210.000, problem with PEP pumping	Alviniconcha community#1, after sampling / CANCELLED	OR														
PL14	05-16-2019	1	16|05|2019,14h29m06'!A1			Big Papi	14:31	14:35	7,8	6,5	35,5	N	MIN@315.000	Alviniconcha community#1, after sampling	OR														
PL14	05-16-2019	1	16|05|2019,17h16m47'!A1			FenWay	17:19	17:26	5,0	3,7	22,0	PIF-10	MIN@430.000	Ifremeria community#1, before sampling	OR		CHU-PL14-PIF-10	17:23	60	Y	ND	4,2		x			x	FenWay	Ifremeria community#1, before sampling
PL14	05-16-2019	1	16|05|2019,17h25m44'!A1			FenWay	17:27	17:32	6,3	3,8	9,9	PIF-11	MIN@630.000	Ifremeria community#1, before sampling	OR		CHU-PL14-PIF-11	17:29	60	Y	ND	3,4			x		x	FenWay	Ifremeria community#1, before sampling
PL14	05-16-2019	1	16|05|2019,18h04m49'!A1			FenWay	18:05	18:10	4,7	3,7	42,8	PIF-12?	MIN@315.000	Ifremeria community#1, after sampling	SL		CHU-PL14-PIF-12?					4,4							
PL14	05-16-2019	1	16|05|2019,18h10m12'!A1			FenWay	18:10	18:15	9,6	5,0	16,8	N	MIN@525.000	Ifremeria community#1, after sampling	SL														
PL14	05-16-2019	1	16|05|2019,18h15m41'!A1			FenWay	18:17	18:21	3,4	3,2	32,9	N	MIN@320.000	Ifremeria community#1, after sampling	SL														
PL14	05-17-2019	1	17|05|2019,10h11m34'!A1	3°43.6845	151°40.3730	FenWay	10:13	10:17	6,1	6,1	<0.5	PIF-13	MIN@785.000	Alviniconcha community#2, before sampling	CB		CHU-PL14-PIF-13	10:13	60	Y	ND	3,6		x			x	FenWay	Alviniconcha community#2, before sampling
PL14	05-17-2019	1	17|05|2019,10h17m28'!A1	3°43.6845	151°40.3730	FenWay	10:19	10:23	13,1	8,1	29,7	PIF-14	MIN@400.000	Alviniconcha community#2, before sampling	CB		CHU-PL14-PIF-14	10:19	60	Y	6,24	4,2			x		x	FenWay	Alviniconcha community#2, before sampling
PL14	05-17-2019	1	17|05|2019,10h24m45'!A1	3°43.6845	151°40.3730	FenWay	10:26	10:31	5,1	4,7	34,3	PIF-15	MIN@315.000	Alviniconcha community#2, before sampling	CB		CHU-PL14-PIF-15	10:26	60	Y	ND	3,9					x	FenWay	Alviniconcha community#2, before sampling
PL14	05-17-2019	1	17|05|2019,11h04m07'!A1	3°43.6845	151°40.3730	FenWay	11:06	11:10	4,6		24,6	N	MIN@420.000	Alviniconcha community#2, after sampling	CB														

DIVE #	Date	#Cycle CHEMINI		Lat. S	Long. E	Site Name	Start Time (UTC)	End Time (UTC)	Temp. Max°C	Temp. Min°C		PIF #	Comments (LED signals, other...)	Observation (habitats, hydrothermal site)	Observer	PHOTO	Sample Name PIF #	Start Time (UTC)	Total Vol recovered (mL)	Filter (Y/N)	pH (21°C)	FeTD (uM)		CH4	d13C	d34S	ICP (FIS)	Site Name	Observation (habitats, hydrothermal site)
PL15	05-18-2019	1	18|05|2019,22h32m38'!A1			Around Big Papi	22:36	22:40	N/A	N/A	0,6	PIF-01	MIN@840.000	PEP not turned ON	OR		CHU-PL15-PIF-01	22:34	60	Y	ND	ND					x	Around Big Papi	Sampling without PEP turned ON (mainly mmQ water of ROV intake plumbing)
PL15	05-18-2019	1	18|05|2019,22h37m02'!A1			Around Big Papi	22:40	22:44	N/A	N/A	<0.5	PIF-02	MIN@840.000	PEP turned ON	OR		CHU-PL15-PIF-02	22:39	60	Y	ND	<1.5					x	Around Big Papi	Bottom water near Big Papi
PL15	05-18-2019	2	18|05|2019,22h41m09'!A1			Around Big Papi	22:44	22:48	N/A	N/A	<0.5	N	MIN@840.000	N/A	OR														
PL15	05-18-2019	3	18|05|2019,22h45m10'!A1			Around Big Papi	22:48	22:52	N/A	N/A	25,0	N	MIN@525.000	N/A	OR														
PL15	05-18-2019	4	18|05|2019,22h49m12'!A1			Around Big Papi	22:52	22:57	N/A	N/A	50,0	N	MIN@310.000	N/A	OR														
PL15	05-18-2019	5	18|05|2019,22h53m14'!A1			Around Big Papi	22:57	23:01	N/A	N/A	100,0	N	MIN@105.000	N/A	OR														

PL15	05-19-2019	1	19|05|2019,09h50m02'IA1	3°43.04	151°40.37	Solwara 7	09:52	09:56	5,5	4,3	0,5	**PIF-03**	MIN@790.000	Ifremeria com sampling			CHU-PL15-PIF-03	09:52	60	Y	7,28	17,3					x	Solwara 7	Ifremeria community#1, before sampling
PL15	05-19-2019	1	19|05|2019,09h56m58'IA1	3°43.04	151°40.37	Solwara 7	09:59	10:05	5,7		7,7	**PIF-04**	MIN@680.000	Ifremeria com sampling			CHU-PL15-PIF-04	09:59	60	Y	ND	37,4					x	Solwara 7	Ifremeria community#1, before sampling
PL15	05-19-2019	1	19|05|2019,10h05m38'IA1	3°43.04	151°40.37	Solwara 7	10:08	10:13	4,0	3,7	21,4	**PIF-05**	MIN@500.000	Ifremeria com sampling			CHU-PL15-PIF-05	10:08	60	Y	ND	6,8					x	Solwara 7	Ifremeria community#1, before sampling
PL15	05-19-2019	1	19|05|2019,10h51m26'IA1	3°43.04	151°40.37	Solwara 7	10:53	10:57	4,7		3,8	**PIF-06**	MIN@735.000	Ifremeria com sampling			CHU-PL15-PIF-06	10:53	60	Y	7,41	11,7					x	Solwara 7	Ifremeria community#1, after sampling
PL15	05-19-2019	1	19|05|2019,10h57m49'IA1	3°43.04	151°40.37	Solwara 7	11:00	11:04	10,0	6,1	6,2	**N**	MIN@680.000	Ifremeria com sampling															
PL15	05-19-2019	1	19|05|2019,11h04m10'IA1	3°43.04	151°40.37	Solwara 7	11:06	11:10	3,7		45,5	**PIF-07**	MIN@300.000	Ifremeria com sampling			CHU-PL15-PIF-07	11:10	60	Y	ND	4,4					x	Solwara 7	Ifremeria community#1, after sampling
PL15	05-19-2019	1	19|05|2019,13h19m29'IA1	3°43.675	151°40.3600	Near Fenway	13:21	13:25	3,3	3,2	3,6	**PIF-08**	MIN@735.000; flow meter not turning	Mussel comm sampling			CHU-PL15-PIF-08	13:20	60	Y	ND	2,1					x	Near Fenway	Mussel community#1, before sampling
PL15	05-19-2019	1	19|05|2019,13h27m36'IA1	3°43.675	151°40.3600	Near Fenway	13:29	13:33	3,1	3,0	4,3	**PIF-09**	MIN<735.000; flow meter tturning	Mussel comm sampling			CHU-PL15-PIF-09	13:29	60	Y	7,28	2,9					x	Near Fenway	Mussel community#1, before sampling
PL15	05-19-2019	1	19|05|2019,13h34m49'IA1	3°43.675	151°40.3600	Near Fenway	13:37	13:41	3,1	3,0	1,3	**PIF-10**	MIN>735.000; flow meter turning	Mussel comm sampling			CHU-PL15-PIF-10	13:37	60	Y	ND	1,7					x	Near Fenway	Mussel community#1, before sampling
PL15	05-19-2019	1	19|05|2019,14h15m00'IA1	3°43.675	151°40.3600	Near Fenway	14:17	14:21	4,0	3,5	0,6	**PIF-11**	MIN@840.000	Mussel comm sampling			CHU-PL15-PIF-11	14:17	60	Y	6,95	2,9					x	Near Fenway	Mussel community#1, after sampling
PL15	05-19-2019	1	19|05|2019,14h20m50'IA1	3°43.675	151°40.3600	Near Fenway	14:23	14:27	4,1	3,5	11,7	**N**	MIN@630.000; flow meter not turning	Mussel comm sampling															
PL15	05-19-2019	1	19|05|2019,14h34m21'IA1	3°43.675	151°40.3600	Near Fenway	14:36	14:40	3,0	3,0	17,5	**N**	MIN@525.000	Mussel comm sampling															
PL15	05-19-2019	1	19|05|2019,22h44m19'IA1	3°43.66	151°40.86	Solwara 6	22:46	22:48	4,2	3,5	<0.5	**PIF-12**	MIN@630.000, PEP was off	Mussel comm sampling			CHU-PL15-PIF-12	22:46	60	Y	ND	4,0					x	Solwara 6	Mussel community#2, before sampling
PL15	05-19-2019	1	19|05|2019,22h49m47'IA1	3°43.66	151°40.86	Solwara 6	22:51	22:55	4,2	3,5	1,0	**PIF-13**	MIN@740.000	Mussel comm sampling			CHU-PL15-PIF-13	22:51	60	Y	ND	<1.5					x	Solwara 6	Mussel community#2, before sampling
PL15	05-19-2019	1	19|05|2019,22h55m43'IA1	3°43.66	151°40.86	Solwara 6	22:58	23:01	5,1	3,8	1,7	**PIF-14**	MIN@735.000	Mussel comm sampling			CHU-PL15-PIF-14	22:58	60	Y	7,40	<1.5					x	Solwara 6	Mussel community#2, before sampling
PL15	05-19-2019	1	19|05|2019,23h02m41'IA1	3°43.66	151°40.86	Solwara 6	23:05	23:09	4,8	3,8	4,8	**PIF-15**	MIN@720.000	Mussel comm sampling			CHU-PL15-PIF-15	23:05	60	Y	ND	<1.5					x	Solwara 6	Mussel community#2, before sampling
PL15	05-19-2019	1	19|05|2019,23h32m30'IA1	3°43.66	151°40.86	Solwara 6	23:34	23:38	5,5	4,0	35,7	**PIF-16**	MIN@360.000	Mussel comm sampling			CHU-PL15-PIF-16	23:34	60	Y	ND	1,7					x	Solwara 6	Mussel community#2, after sampling
PL15	05-19-2019	1	19|05|2019,23h38m02'IA1	3°43.66	151°40.86	Solwara 6	23:41	23:44	5,3	4,5	7,6	**N**	MIN@660.000	Mussel comm sampling															
PL15	05-20-2019	1	20|05|2019,00h15m34'IA1	3°46.64	151°40.85	Solwara 6	00:17	00:21	11,1	10,0	51,9	**PIF-17**	MIN@250.000	Ifremeria com sampling			CHU-PL15-PIF-17	00:17	60	Y		<1.5					x	Solwara 6	Ifremeria community#2, before sampling
PL15	05-20-2019	1	20|05|2019,00h20m50'IA1	3°46.64	151°40.85	Solwara 6	00:23	00:27	9,5	6,0	15,0	**PIF-18**	MIN@560.000	Ifremeria com sampling			CHU-PL15-PIF-18	00:23	60	Y	7,38	<1.5					x	Solwara 6	Ifremeria community#2, before sampling
PL15	05-20-2019	1	20|05|2019,00h27m47'IA1	3°46.64	151°40.85	Solwara 6	00:30	00:34	4,0	3,5	11,0	**PIF-19**	MIN@630.000	Ifremeria com sampling			CHU-PL15-PIF-19	00:30	60	Y	ND	<1.5					x	Solwara 6	Ifremeria community#2, before sampling
PL15	05-20-2019	1	20|05|2019,00h50m35'IA1	3°46.64	151°40.85	Solwara 6	00:52	00:56	11,5	8,0	4,0	**PIF-20**	MIN@730.000	Ifremeria com sampling			CHU-PL15-PIF-20	00:52	60	Y	ND	2,3					x	Solwara 6	Ifremeria community#2, after sampling
PL15	05-20-2019	1	20|05|2019,00h56m16'IA1	3°46.64	151°40.85	Solwara 6	00:58	01:02	4,6	4,7	22,3	**PIF-21**	MIN@550.000	Ifremeria com sampling			CHU-PL15-PIF-21	00:58	60	Y	7,63	<1.5					x	Solwara 6	Ifremeria community#2, after sampling
PL15	05-20-2019	1	20|05|2019,01h01m51'IA1	3°46.64	151°40.85	Solwara 6	01:03	01:07	6,7	5,4	3,9	**PIF-22**	MIN@735.000	Ifremeria com sampling			CHU-PL15-PIF-22	1:03	60	Y	ND	<1.5					x	Solwara 6	Ifremeria community#2, after sampling
PL15	05-20-2019	5	20|05|2019,01h07m17'IA1			Near Solwara 6	1:10		ND		90,2		MIN@105.000	Calibration	OR														
PL15	05-20-2019	2	20|05|2019,01h11m54'IA1			Near Solwara 6	1:20		ND		0,6		MIN@830.000	Calibration	OR														
PL15	05-20-2019	1	20|05|2019,01h34m10'IA1			Near Solwara 6	1:37		ND		6,5	**PIF-23**	MIN@830.000	Bottom Seawater	OR		CHU-PL15-PIF-23	1:38	60	Y	7,71	<1.5					x	Near Solwara 6	Bottom Seawater
PL15	05-20-2019	1				Near Solwara 6						**PIF-24**					CHU-PL15-PIF-24					<1.5							
DIVE #	Date	#Cycle CHEMINI		Lat. S	Long. E	Site Name	Start Time (UTC)	End Time (UTC)	Temp. Max°C	Temp. Min°C		PIF #	Comments (LED signals, other...)	Observation (habitats, hydrothermal site)	Observer	PHOTO	**Sample Name PIF #**	Start Time (UTC)	Total Vol recovered (mL)	Filter (Y/N)	pH (21°C)	FeTD (uM)		CH4	d13C	d34S	ICP (FIS)	**Site Name**	**Observation (habitats, hydrothermal site)**
PL16	05-20-2019	1	20|05|2019,12h36m14'IA1			Near Solwara12	12:40	12:42	N/A	N/A	<0.5	**PIF-01**	MIN@820.000	PEP not turned ON	OR		CHU-PL16-PIF-01	12:39	60	Y	ND	<1.0					x	Near Solwara12	
PL16	05-20-2019	2	20|05|2019,12h40m26'IA1			Near Solwara12	12:42	12:47	N/A	N/A	<0.5	**N**	MIN@820.000; noisy	PEP not turned ON	OR														
PL16	05-20-2019	3	20|05|2019,12h44m26'IA1			Near Solwara12	12:47	12:51	N/A	N/A	25,0	**N**	MIN@440.000; noisy	PEP not turned ON	OR														
PL16	05-20-2019	4	20|05|2019,12h48m26'IA1			Near Solwara12	12:51	12:55	N/A	N/A	50,0	**N**	MIN@230.000	PEP not turned ON	OR														
PL16	05-20-2019	5	20|05|2019,12h52m28'IA1			Near Solwara12	12:55	12:58	N/A	N/A	100,0	**N**	MIN@100.000	PEP not turned ON	OR														
PL16	05-21-2019	1	21|05|2019,01h29m41'IA1	3°41.46	151°51.96	Desmos	01:32	01:36	5,8	5,4	<0.5	**PIF-02**	MIN@800.000	White microbia			CHU-PL16-PIF-02	01:32	60	Y	6,53	6,8					x	Desmos	White microbial mat
PL16	05-21-2019	1	21|05|2019,01h33m46'IA1			Desmos	01:36	01:40	5,8	5,4	355,8	**PIF-03**	MIN@0000 Saturation	White microbia			CHU-PL16-PIF-03	01:34	60	Y	ND	4,9					x	Desmos	White microbial mat
PL16	05-21-2019	2	21|05|2019,01h37m53'IA1			Desmos	01:40	01:44	N/A		55,4		MIN@210.000 / purge Chemini		V/T														
PL16	05-21-2019	2	21|05|2019,01h45m47'IA1			Desmos	01:48	01:52	N/A		5,8		MIN@680.000 / purge Chemini		V/T														
PL16	05-21-2019	2	21|05|2019,04h32m40'IA1			Desmos	04:35	04:39	N/A		0,7		MIN@800.000 / purge Chemini		V/T														
PL16	05-21-2019	1	21|05|2019,04h36m44'IA1	3°41.54	151°51.98	Desmos	04:39	04:43	3,5	3,0	291,7	**PIF-04**	MIN@0000/ memory effect	Arcovestia vestin			CHU-PL16-PIF-04	04:35	60	Y	7,65	1,3					x	Desmos	Arcovestia vestimentiferan base
PL16	05-21-2019	1	21|05|2019,04h42m46'IA1			Desmos	04:45	04:49	4,0	3,8	45,4	**PIF-05**	MIN@250.000	Arcovestia vestin			CHU-PL16-PIF-05	04:45	60	Y	7,27	1,8					x	Desmos	Arcovestia vestimentiferan gills
PL16	05-21-2019	1	21|05|2019,04h49m17'IA1			Desmos	04:51	04:55	3,1	3,0	41,5	**PIF-06**	MIN@275.000	Arcovestia vestin			CHU-PL16-PIF-06	04:51	60	Y	ND	2,6					x	Desmos	Arcovestia vestimentiferan base
PL16	05-21-2019	1	21|05|2019,05h37m47'IA1	3°41.542	151°51.98	Desmos	05:41	05:45	3,5		42,2	**PIF-07**		Vestimentiferan sampling			CHU-PL16-PIF-07	05:43	60	Y	7,39	2,9					x	Desmos	Vestimentiferan base after sampling
PL16	05-21-2019	1	21|05|2019,05h41m59'IA1			Desmos	05:46	05:50	3,5	3,5	23,3		MIN@420.000																
PL16	05-21-2019	1	21|05|2019,06h16m34'IA1			Desmos	06:19	06:23	3,5	3,0	27,5		MIN@400.000	Vestimentiferan															
PL16	05-21-2019	1	21|05|2019,06h23m38'IA1			Desmos	06:25	06:29	3,5	3,0	14,5		MIN@525.000																
PL16	05-21-2019	1	21|05|2019,06h28m50'IA1			Desmos	06:31	06:35	3,5	3,5	42,7		MIN@300.000		SL														

DIVE #	Date	#Cycle CHEMINI		Lat. S	Long. E	Site Name	Start Time (UTC)	End Time (UTC)	Temp. Max°C	Temp. Min°C		PIF #	Comments (LED signals, other...)	Observation (habitats, hydrothermal site)	Observer	PHOTO	Sample Name PIF #	Start Time (UTC)	Total Vol recovered (mL)	Filter (Y/N)	pH (21°C)	FeTD (uM)		CH4	d13C	d345	ICP (FIS)	Site Name	Observation (habitats, hydrothermal site)
PL17	05-22-2019	1	22|05|2019,08h59m47"|A1	3°47.338	152°05.35	Suzette/North Su	09:02	09:06	N/A	N/A	<0.5	PIF-01		Bottom Seawater	CB		CHU-PL17-PIF-01	09:03:00	60	Y	7,42	ND					x	Suzette/North Su	Bottom Seawater
PL17	05-22-2019	2	22|05|2019,09h06m51"|A1				09:10	09:14	N/A	N/A	<0.5	N	Blank	Calibration	CB														
PL17	05-22-2019	3					09:15					N	PEP was turned off during the cycle		CB														
PL17	05-22-2019	1	22|05|2019,09h16m09"|A1				09:19	09:23	N/A	N/A	<0.5	N	MIN@785000	Bottom Seawater	CB														
PL17	05-22-2019	2	22|05|2019,09h20m19"|A1				09:23	09:27	N/A	N/A	<0.5	N	No absorbance	Blank	CB														
PL17	05-22-2019	3	22|05|2019,09h24m38"|A1				09:27	09:31	N/A	N/A	25,0	N	MIN@420000	Std1	CB														
PL17	05-22-2019	4	22|05|2019,09h28m48"|A1				09:31	09:35	N/A	N/A	50,0	N	MIN@295000	Std2	CB														
PL17	05-22-2019	5	22|05|2019,09h33m03"|A1				09:36	09:40	N/A	N/A	100,0	N	MIN@100000	Std3															
PL17	05-22-2019	1	22|05|2019,13h16m37"|A1	3°47.338	152°05.338	Suzette	13:19	13:23	9,0	5,5	0,8	PIF-2	MIN@735000	Alviniconcha #1			CHU-PL17-PIF-2	13:19:00	60	Y	7,20	ND					x	Suzette	Alviniconcha #1 point 1
PL17	05-22-2019	1	22|05|2019,13h23m13"|A1	3°47.683	150°05.784	Suzette	13:25	13:29	9,0	3,8	1,1	PIF-3	MIN@735000	Alviniconcha #1			CHU-PL17-PIF-3	13:25:00	60	Y	7,31	ND					x	Suzette	Alviniconcha #1 point 2
PL17	05-22-2019	1	22|05|2019,13h29m22"|A1			Suzette	13:31	13:35	5,9	4,9	2,4	PIF-4		Alviniconcha #1			CHU-PL17-PIF-4	13:31:00	60	Y	7,46	ND					x	Suzette	Alviniconcha #1 point 3
PL17	05-22-2019	1	22|05|2019,13h35m28"|A1			Suzette	13:37	13:42	5,0	4,3	1,9	PIF-5	MIN@730000	Ifremeria #1 po			CHU-PL17-PIF-5	13:37:00	60	Y	7,54	ND					x	Suzette	Ifremeria #1 point 1
PL17	05-22-2019	1	22|05|2019,13h41m27"|A1			Suzette	13:44	13:47	5,2	4,4	1,7	PIF-6	MIN@730000	Ifremeria #1 po			CHU-PL17-PIF-6	13:44:00	60	Y	7,60	ND					x	Suzette	Ifremeria #1 point 2
PL17	05-22-2019	1	22|05|2019,13h48m01"|A1			Suzette	13:50	13:54	10,7	9,1	2,8	PIF-7	MIN@700000	Ifremeria #1 point 3	CP		CHU-PL17-PIF-7	13:50:00	60	Y	7,33	ND					x	Suzette	Ifremeria #1 point 3
PL17	05-22-2019	1	22|05|2019,14h31m01"|A1			Suzette	14:33	14:37	5,3	5,0	6,9	N	MIN@630000	Ifremeria #1 point 1 after sampling	CP														
PL17	05-22-2019	1	22|05|2019,14h37m01"|A1			Suzette	14:39	14:43	6,5	4,9	3,5	N	MIN@690000	Ifremeria #1 po sampling															
PL17	05-22-2019	1	22|05|2019,14h43m09"|A1			Suzette	14:44	14:49	9,2	7,8	3,8	N	MIN@660000	Ifremeria #1 po sampling															
PL17	05-22-2019	1	22|05|2019,15h09m25"|A1			Suzette	15:11	15:15	9,1	8,6	5,8	N	MIN@640000	Alviniconcha # sampling															
PL17	05-22-2019	1	22|05|2019,15h15m32"|A1			Suzette	15:18	15:22	6,8	5,5	6,7	N	MIN@630.000	Alviniconcha #1 point 2 after sampling	VC														
PL17	05-22-2019	1	22|05|2019,19h15m13"|A1	3°47.947	152°06.061	North Su	19:17	19:21	7,8	5,0	<0.5	PIF-8	735000	Mussel commu sampling			CHU-PL17 -PIF-8	19:20:00	60	Y	7,35	ND					x	North Su	Mussel community #1, before sampling
PL17	05-22-2019	1	22|05|2019,19h21m06"|A1				19:23	19:27		4,2	9,6	PIF-9	620000	Mussel commu sampling			CHU-PL17 -PIF-9	19:29:00	60	Y	7,53	ND					x	0	Mussel community #1, before sampling
PL17	05-22-2019	1	22|05|2019,19h27m53"|A1				19:30	19:34	8,0		3,8	PIF-10	700000	Mussel commu sampling			CHU-PL17 -PIF-10	19:38:00	60	Y	7,53	ND					x	0	Mussel community #1, before sampling
PL17	05-22-2019	1	22|05|2019,19h35m38"|A1				19:38	19:42		4,6	1,0	N	735000	Mussel commu sampling															
PL17	05-22-2019	1	22|05|2019,20h24m14"|A1				20:26	20:30	11,2	4,6	0,5	N	735000	Mussel commu sampling															
PL17	05-22-2019	1	22|05|2019,20h29m38"|A1				20:32	20:36	5,0	5,0	0,8	N	735000	Mussel commu sampling															
PL17	05-22-2019	1	22|05|2019,20h34m51"|A1				20:37	20:41	5,3	4,9	0,6	N	735000	Mussel community sampling	SLH														
PL17	05-23-2019	1	23|05|2019,13h09m51"|A1	3°47.950	152°06.09	North Su	13:12	13:16	10,5	9,1	<0.5	PIF-11	760000	Mussel commu sampling pt1			CHU-PL17-PIF-11	13:12:00	60	Y	7,53	ND					x	North Su	Mussel community #2 before sampling pt1
PL17	05-23-2019	1	23|05|2019,13h17m17"|A1				13:19	13:23	8,3	7,1	<0.5	PIF-12	760000	Mussel commu sampling pt2			CHU-PL17-PIF-12	13:19:00	60	Y	7,48	ND					x	0	Mussel community #2 before sampling pt2
PL17	05-23-2019	1	23|05|2019,13h22m42"|A1				13:25	13:29	9,2	6,5	6,6	PIF-13	650000	Mussel commu sampling pt3			CHU-PL17-PIF-13	13:25:00	60	Y	7,31	ND					x	0	Mussel community #2 before sampling pt3
PL17	05-23-2019	5	23|05|2019,13h27m08"|A1				13:30	13:33			100,5	N	100000	Std 4	VCG														
PL17	05-23-2019	1	23|05|2019,13h49m51"|A1				13:53	13:57	8,0	5,2	5,7	N	640000	Mussel commu sampling pt1															
PL17	05-23-2019	1	23|05|2019,13h54m41"|A1				13:58	14:02	8,4	5,5	7,2	N	630000	Mussel commu sampling pt2															
PL17	05-23-2019	1	23|05|2019,13h59m47"|A1				14:03	14:06	8,4	7,3	7,3	N	630000	Mussel commu sampling pt3															
PL17	05-23-2019	1	23|05|2019,14h43m18"|A1	3°47.934	152°06.045	North Su	14:46	14:50	6,3	5,0	5,2	PIF-14	660000	Alviniconcha # point 1			CHU-PL17-PIF-14	14:46:00	60	Y	7,34	ND					x	North Su	Alviniconcha #2 before sampling point 1
PL17	05-23-2019	1	23|05|2019,14h49m11"|A1				14:51	14:57	18,3	6,6	6,2	PIF-15	650000	Alviniconcha #2 point 2			CHU-PL17-PIF-15	14:51:00	60	Y	7,44	ND					x	0	Alviniconcha #2 before sampling point 2
PL17	05-23-2019	1	23|05|2019,14h55m11"|A1				14:57	15:01	7,9	4,8	15,9	PIF-16	525000	Alviniconcha #2 point 3			CHU-PL17-PIF-16	14:57:00	60	Y	7,17	ND					x	0	Alviniconcha #2 before sampling point 3
PL17	05-23-2019	1	23|05|2019,15h18m01"|A1				15:21	15:24	30,5	18,6	52,5	N	210000	Alviniconcha #2 point 1															
PL17	05-23-2019	1	23|05|2019,15h22m35"|A1				15:25	15:29	33,7	6,3	17,7	N	500000	Alviniconcha #2 point 2															
PL17	05-23-2019	1	23|05|2019,15h27m26"|A1				15:29	15:33	26,9	10,9	59,1	N	210000	Alviniconcha # point 3															
PL17	05-23-2019	1	23|05|2019,15h40m27"|A1	3°47.934	152°06.045	North Su	15:42	15:46	6,8	5,3	52,3	PIF-17	230000	Ifremeria #2 b point 1			CHU-PL17-PIF-17	15:42:00	60	Y	6,93	ND					x	North Su	Ifremeria #2 before sampling point 1
PL17	05-23-2019	1	23|05|2019,15h45m25"|A1				15:47	15:52	7,7	5,4	41,2	PIF-18	300000	Ifremeria #2 b point 2			CHU-PL17-PIF-18	15:47:00	60	Y	6,90	ND					x	0	Ifremeria #2 before sampling point 2
PL17	05-23-2019	1	23|05|2019,15h50m40"|A1				15:53	15:57	6,2	5,2	27,0	PIF-19	410000	Ifremeria #2 before sampling point 3	VCG		CHU-PL17-PIF-19	15:53:00	60	Y	6,97	ND					x	0	Ifremeria #2 before sampling point 3
PL17	05-23-2019	1	23|05|2019,16h15m00"|A1				16:18	16:21	8,2	5,6	10,4	N	600000	Ifremeria #2 a point 1															
PL17	05-23-2019	1	23|05|2019,16h20m21"|A1				16:22	16:26	10,8	5,5	3,4	N	700000	Ifremeria #2 a point 2															
PL17	05-23-2019	1	23|05|2019,16h25m51"|A1				16:28	16:32	12,9	6,6	10,1	N	610000	Ifremeria #2 a point 3															

PL19	05-27-2019	1	27|05|2019,17h53m46'!A1			Scala	17:56	18:00	8,6	6,4	1,0	**PIF-1**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,18h04m33'!A1				19:07	18:11	18,6	11,7	23,7	**PIF-2**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,18h12m41'!A1				18:15	18:19	7,3	6,5	69,5	**PIF-3**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,18h36m51'!A1				18:40	18:44	10,1	9,7	23,5	**N**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,18h42m28'!A1				18:45	18:49	20,3	13,6	20,1	**N**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,18h48m04'!A1				18:59	19:03	9,1	7,0	19,1	**N**		Alviniconcha #1	
PL19	05-27-2019	1	27|05|2019,19h00m18'!A1	9°47.946	155°03.161		19:03	19:07	5,6	4,4	15,5	**PIF-4**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,19h07m57'!A1				19:11	19:15	6,1	5,3	8,1	**PIF-5**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,19h15m53'!A1				19:18	19:22	3,9	3,3	3,6	**PIF-6**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,20h03m48'!A1				20:07	20:11	7,1	4,1	1,6	**N/A**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,20h08m42'!A1				20:11	20:15	5,7	2,6	1,4	**N/A**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,20h14m01'!A1				20:16	20:20	3,6	2,4	1,4	**N/A**		Ifremeria #1 po	
PL19	05-27-2019	1	27|05|2019,22h54m18'!A1	9°47.933	155°03.182		22:56	23:00	12,8	2,8	0,5	**PIF-7**	Min@630000	Anemone Phym	
PL19	05-27-2019	1	27|05|2019,23h02m42'!A1				23:05	23:09		2,0	0,7	**PIF-8**	Min@630000	Anemone Phym	
PL19	05-27-2019	1	27|05|2019,23h54m05'!A1	9°47.94	155°03.182		23:58	00:02	21,4	9,2	<0.5	**PIF-9**		Test chemini-ca	
PL19	05-28-2019	1	27|05|2019,23h58m57'!A1				00:02	00:06	19,4	2,3	0,8	**N/A**		Test chemini	
PL19	05-28-2019	5	28|05|2019,00h03m00'!A1				00:07	00:11		2,1	94,8	**N/A**	Min@105000	Test chemini	
DIVE #	Date	#Cycle CHEMINI		Lat. S	Long. E	Site Name	Start Time (UTC)	End Time (UTC)	Temp. Max°C	Temp. Min°C		**PIF #**	Comments (LED signals, other...)	Observation (habitats, hydrothermal site)	Observer
PL20	05-29-2019	1	29|05|2019,23h46m47'!A1	9°47.81	155°03.07	Scala	23:49	23:53	N/A	N/A		**PIF-1**	Min@600000	Bottom Seawater	CB
PL20	05-29-2019	2	29|05|2019,23h50m59'!A1				23:53	23:57	N/A	N/A	0,0	**N**	Min@735000	Data OK	CB
PL20	05-29-2019	3	29|05|2019,23h55m07'!A1				23:57	00:01	N/A	N/A	25,0	**N**	Min@480000	Data OK	CB
PL20	05-30-2019	4	29|05|2019,23h59m38'!A1				00:02	00:06	N/A	N/A	50,0	**N**	Min@300000	Data OK	CB
PL20	05-30-2019	5	30|05|2019,00h03m40'!A1				00:06	00:10	N/A	N/A	100,0	**N**	Min@105000	Data OK	CB
PL20	05-31-2019	1	31|05|2019,01h28m14'!A1	9°47.939	155°03.1171	Scala	01:31	01:34	4,1	2,5	<0.5	**PIF-2**	Min@550000	Alviniconcha #2 sampling	
PL20	05-31-2019	1	31|05|2019,01h33m14'!A1				01:36	01:39	3,7	2,8	7,4	**PIF-3**	Min@500000	Alviniconcha #2 sampling	
PL20	05-31-2019	1	31|05|2019,01h39m10'!A1				01:42	01:46	4,2	3,0	14,0	**PIF-4**	Min@430.000	Alviniconcha #2 sampling	
PL20	05-31-2019	1	31|05|2019,01h56m00'!A1				01:58	02:02	4,8	2,9	16,9	**N**	Min@410000	Alviniconcha #2 sampling	VCG
PL20	05-31-2019	1	31|05|2019,02h01m21'!A1				02:04	02:08	5,9	3,6	27,4	**N**	Min@330000	Alviniconcha #2 point 2 after sampling	VCG
PL20	05-31-2019	1	31|05|2019,02h06m44'!A1				02:09	02:14	14,7	4,9	49,5	**N**	Min@230000	Alviniconcha #2 point 3 after sampling	VCG

PL19		CHU-PL19-PIF-1	18:01:00	60	Y	7,36	ND					x	Scala	Alviniconcha #1 point 1 beforeS
PL19		CHU-PL19-PIF-2	18:11:00	60	Y	7,03	ND					x	0	Alviniconcha #1 point 2 beforeS
PL19		CHU-PL19-PIF-3	18:19:00	60	Y	7,35	ND					x	0	Alviniconcha #1 point 3 beforeS
PL19														
PL19														
PL19														
PL19		CHU-PL19-PIF-4	19:07:00	60	Y	7,55	ND					x	0	Ifremeria #1 point 1 beforeS
PL19		CHU-PL19-PIF-5	19:15:00	60	Y	7,68	ND					x	0	Ifremeria #1 point 2 beforeS
PL19		CHU-PL19-PIF-6	19:22:00	60	Y	7,76	ND					x	0	Ifremeria #1 point 3 beforeS
PL19														
PL19														
PL19														
PL19		CHU-PL19-PIF-7	22:56:00	0??	Y	ND	ND							Anemone Phymorhynchus
PL19		CHU-PL19-PIF-8	23:00:00	60	Y	7,81	ND					x	0	Anemone Phymorhynchus
PL19		CHU-PL19-PIF-9	23:57:00	60	Y	7,81	ND					x	0	Test chemini-canule bouchée
PL19														
PL19														
DIVE #	PHOTO	**Sample Name PIF #**	Start Time (UTC)	Total Vol recovered (mL)	Filter (Y/N)	pH (21°C)	FeTD (uM)		CH4	d13C	d345	ICP (FIS)	**Site Name**	**Observation (habitats, hydrothermal site)**
PL20		CHU-PL20-PIF-1	23:49:00	60	Y	7,70	ND					x	Scala	Bottom Seawater
PL20														
PL20														
PL20														
PL20														
PL20		CHU-PL20-PIF-2	01:31:00	60	Y	7,74	ND					x	Scala	Alviniconcha #2 point 1 before sampling
PL20		CHU-PL20-PIF-3	01:36:00	60	Y	7,74	ND					x	0	Alviniconcha #2 point 2 before sampling
PL20		CHU-PL20-PIF-4	01:42:00	60	Y	7,72	ND					x	0	Alviniconcha #2 point 3 before sampling
PL20														
PL20														
PL20														

3. Habitat and community mapping

During several dives, OTUS mosaics were performed to study spatial variation in benthic communities from the active sites to their periphery. The ROV performed parallel transects at a speed of 0.2 m/s and an altitude of 3 meters above the bottom, while automatically acquiring an image every 3 seconds. Table 14 lists the OTUS mosaics performed during leg 2.

Table 14. List of OTUS mosaics performed during Leg 2 of the Chubacarc cruise (dates and times in UTC).

Dive	Site	Date	Start time	End time	Number of transects	Remarks
733/14	Fenway (Pacmanus, Manus Basin)	2019/05/17	04:20	08:10	9	Restart at 04:37, pause between 05:13 and 05:23
734/15	Roman ruins (Pacmanus, Manus Basin)	2019/05/19	15:08	16:40	9	Pause between 15:23 and 15:28
735/16	Desmos caldeira (Manus Basin)	2019/05/21	13:02	16:48	13	Pause between 16:23 and 16:30
736/17	North Su & Suzette (Manus Basin)	2019/05/23	02:22	07:27	11	Acquisition interrupted around 05:22

4. Trophic ecology

During both legs of the Chubacarc cruise, subsamples of collected organisms were taken for stable isotope analyses of C, N and S. Those analyses will allow to depict trophic links in the visited sites, and understand how ecological interactions between dominant species can vary at multiple spatial scales (i.e. between different basins vs. among different sites of the same basin). Particular attention has been devoted to fauna living in the periphery of active sites. Those samples will be used to quantify how much species that are not typical from hydrothermal vents, but live close to them (from a few dozens to a few hundreds of meters) depend on chemosynthetic production for their nutrition. In total, 1320 specimens have been sampled for stable isotope analysis (494 during leg 1 and 826 during leg 2). A full list is available in table 15. After collection, all samples were oven-dried at 56°C for 72h, and stored in airtight containers for transportation to France.

Table 15. List of samples taken for stable isotope analysis.

Leg	Basin	Site	Dive	Date	Taxon	Qty
1	Lau	Kilo Moana	720/01	2019-03-31	Brisingidae	2
1	Lau	Kilo Moana	720/01	2019-03-31	*Chiridota* sp.	3
1	Lau	Tow Cam	721/02	2019-04-02	*Alviniconcha boucheti*	2
1	Lau	Tow Cam	721/02	2019-04-01	*Alviniconcha* sp.	16
1	Lau	Tow Cam	721/02	2019-04-01	*Austinograea hourdezi*	1
1	Lau	Tow Cam	721/02	2019-04-01	*Bathymodiolus brevior*	7
1	Lau	Tow Cam	721/02	2019-04-01	*Ifremeria nautilei*	9
1	Lau	Tow Cam	721/02	2019-04-01	*Lepetodrilus schrolli*	20
1	Lau	Tow Cam	721/02	2019-04-01	*Shinkailepas tollmanni*	20

1	Lau	Tow Cam	721/02	2019-04-01	*Thermosipho desbruyeresi*	1
1	Lau	Tu'i Malila	722/03	2019-04-04	*Alviniconcha* sp.	35
1	Lau	Tow Cam	723/04	2019-04-06	Brisingidae	2
1	Lau	Tow Cam	723/04	2019-04-06	*Chiridota* sp.	4
1	Lau	Tow Cam	723/04	2019-04-06	*Munidopsis* sp.	4
1	Lau	Tow Cam	723/04	2019-04-06	*Phymorhynchus starmeni*	3
1	North Fiji	Phoenix	724/05	2019-04-10	*Alviniconcha boucheti*	10
1	North Fiji	Phoenix	724/05	2019-04-10	*Alviniconcha kojimai*	30
1	North Fiji	Phoenix	724/05	2019-04-10	*Alviniconcha strummeri*	8
1	North Fiji	Phoenix	724/05	2019-04-10	*Bathymodiolus* sp.	10
1	North Fiji	Phoenix	724/05	2019-04-10	*Ifremeria nautilei*	10
1	North Fiji	Phoenix	724/05	2019-04-10	*Lepetodrilus schrolli*	20
1	North Fiji	Phoenix	724/05	2019-04-10	*Shinkailepas tollmanni*	20
1	Lau	Mangatolo	726/07	2019-04-17	*Alviniconcha boucheti*	10
1	Lau	Mangatolo	726/07	2019-04-18	*Alviniconcha kojimai*	13
1	Lau	Mangatolo	726/07	2019-04-17	Ampharetidae	10
1	Lau	Mangatolo	726/07	2019-04-17	*Bathymodiolus* sp.	10
1	Lau	Mangatolo	726/07	2019-04-17	Decapoda	2
1	Lau	Mangatolo	726/07	2019-04-17	*Ifremeria nautilei*	10
1	Lau	Mangatolo	726/07	2019-04-17	*Lepetodrilus schrolli*	10
1	Lau	Mangatolo	726/07	2019-04-17	*Shinkailepas tollmanni*	10
1	Futuna	Fatu Kapa (AsterX)	727/08	2019-04-19	*Alviniconcha kojimai*	20
1	Futuna	Fatu Kapa (AsterX)	727/08	2019-04-19	*Ifremeria nautilei*	20
1	Futuna	Fatu Kapa (Stéphanie)	727/08	2019-04-19	*Alviniconcha kojimai*	10
1	Futuna	Fatu Kapa (Stéphanie)	727/08	2019-04-19	*Ifremeria nautilei*	10
1	Futuna	Fati Ufu	728/09	2019-04-22	*Alviniconcha boucheti*	4
1	Futuna	Fati Ufu	728/09	2019-04-21	*Alviniconcha kojimai*	16
1	Futuna	Fati Ufu	728/09	2019-04-21	*Alviniconcha strummeri*	10
1	Futuna	Fati Ufu	728/09	2019-04-22	*Alviniconcha strummeri*	3
1	Futuna	Fati Ufu	728/09	2019-04-22	*Bathymodiolus* sp.	5
1	Futuna	Fati Ufu	728/09	2019-04-21	*Ifremeria nautilei*	10
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Bathymodiolus* sp.	8
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Galapagomystides*sp.	1
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Ifremeria nautilei*	10
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Lamellomphalus* sp.	2
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Lepetodrilus* sp.	1
1	Futuna	Kulo Lasi	729/10	2019-04-24	Siboglinidae	6
1	Futuna	Kulo Lasi	729/10	2019-04-24	*Thermarces* sp.	1
1	Lau	Tow Cam	730/11	2019-04-25	*Cladorhiza* sp.	2
1	Lau	Tow Cam	730/11	2019-04-25	*Provanna* sp.	5
1	Lau	Tow Cam	730/11	2019-04-25	Zoantharia	5
1	Lau	ABE	731/12	2019-04-28	*Alviniconcha boucheti*	10
1	Lau	ABE	731/12	2019-04-28	*Alviniconcha kojimai*	2
1	Lau	ABE	731/12	2019-04-28	*Alviniconcha strummeri*	1
1	Lau	ABE	731/12	2019-04-28	*Bathymodiolus* sp.	10
1	Lau	ABE	731/12	2019-04-28	*Ifremeria nautilei*	10
2	Manus	Pacmanus (Big Papi)	733/14	2019-05-16	*Alviniconcha boucheti*	10
2	Manus	Pacmanus (Big Papi)	733/14	2019-05-17	Brisingidae	1
2	Manus	Pacmanus (Big Papi)	733/14	2019-05-17	Galathoidea	1

2	Manus	Pacmanus (Fenway)	733/14	2019-05-17	*Alviniconcha boucheti*	10
2	Manus	Pacmanus (Fenway)	733/14	2019-05-16	*Arcovestia ivanovi*	10
2	Manus	Pacmanus (Fenway)	733/14	2019-05-17	*Bathymodiolus manusensis*	10
2	Manus	Pacmanus (Fenway)	733/14	2019-05-16	*Ifremeria nautilei*	20
2	Manus	Pacmanus (Fenway)	733/14	2019-05-17	*Lepetodrilus schrolli*	90
2	Manus	Pacmanus (Fenway)	733/14	2019-05-16	*Shinkailepas tollmani*	10
2	Manus	Pacmanus (Snowcap)	733/14	2019-05-16	*Bathymodiolus manusensis*	10
2	Manus	Pacmanus (Solwara 8)	733/14	2019-05-18	*Alviniconcha boucheti*	10
2	Manus	Pacmanus (Solwara 8)	733/14	2019-05-18	*Austinograea* sp.	1
2	Manus	Pacmanus (Solwara 8)	733/14	2019-05-18	*Ifremeria nautilei*	10
2	Manus	Pacmanus (Solwara 8)	733/14	2019-05-18	*Rimicaris variabilis*	10
2	Manus	Pacmanus (Fenway)	734/15	2019-05-19	*Bathymodiolus manusensis*	10
2	Manus	Pacmanus (Roman Ruins)	734/15	2019-05-19	*Rimicaris variabilis*	7
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-19	*Arcovestia ivanovi*	10
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-19	*Bathymodiolus manusensis*	10
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-20	*Ifremeria nautilei*	10
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-20	*Lepetodrilus schrolli*	20
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-19	*Rimicaris variabilis*	3
2	Manus	Pacmanus (Solwara 6)	734/15	2019-05-20	*Shinkailepas tollmani*	15
2	Manus	Pacmanus (Solwara 7)	734/15	2019-05-19	*Ifremeria nautilei*	10
2	Manus	Pacmanus (Solwara 7)	734/15	2019-05-19	*Thermarces* sp.	1
2	Manus	Desmos	735/16	2019-05-21	Actiniaria	1
2	Manus	Desmos	735/16	2019-05-21	*Alaysia spiralis*	4
2	Manus	Desmos	735/16	2019-05-21	*Arcovestia ivanovi*	10
2	Manus	Desmos	735/16	2019-05-21	*Bathymodiolus manusensis*	5
2	Manus	Desmos	735/16	2019-05-20	*Provanna* sp.	10
2	Manus	Susu (North Su)	736/17	2019-05-23	*Alviniconcha kojimai*	10
2	Manus	Susu (North Su)	736/17	2019-05-22	*Bathymodiolus manusensis*	20
2	Manus	Susu (North Su)	736/17	2019-05-23	*Ifremeria nautilei*	10
2	Manus	Susu (North Su)	736/17	2019-05-22	*Lepetodrilus schrolli*	70
2	Manus	Susu (North Su)	736/17	2019-05-23	*Oasisia* sp.	10
2	Manus	Susu (North Su)	736/17	2019-05-23	*Rimicaris variabilis*	6
2	Manus	Susu (Suzette)	736/17	2019-05-22	*Alviniconcha kojimai*	10
2	Manus	Susu (Suzette)	736/17	2019-05-22	*Austinograea* sp.	1
2	Manus	Susu (Suzette)	736/17	2019-05-22	Carnivorous Porifera	4
2	Manus	Susu (Suzette)	736/17	2019-05-22	*Ifremeria nautilei*	10
2	Manus	Susu (Suzette)	736/17	2019-05-22	*Rimicaris variabilis*	4
2	Manus	Susu (Suzette)	736/17	2019-05-22	*Shinkailepas tollmani*	15
2	Manus	Susu (South Su)	737/18	2019-05-25	Actiniaria	1
2	Manus	Susu (South Su)	737/18	2019-05-25	Algal remains	1
2	Manus	Susu (South Su)	737/18	2019-05-24	*Alviniconcha boucheti*	28
2	Manus	Susu (South Su)	737/18	2019-05-24	*Alviniconcha kojimai*	12
2	Manus	Susu (South Su)	737/18	2019-05-25	*Arcovestia ivanovi*	3
2	Manus	Susu (South Su)	737/18	2019-05-24	*Bathymodiolus manusensis*	20
2	Manus	Susu (South Su)	737/18	2019-05-24	*Ifremeria nautilei*	20
2	Manus	Susu (South Su)	737/18	2019-05-24	*Lepetodrilus schrolli*	90
2	Manus	Susu (South Su)	737/18	2019-05-24	*Shinkailepas tollmani*	30
2	Manus	Susu (South Su)	737/18	2019-05-25	*Thermarces sp.*	1
2	Woodlark	Scala	738/19	2019-05-27	*Alviniconcha kojimai*	13

2	Woodlark	Scala	738/19	2019-05-28	Ampharetidae	10
2	Woodlark	Scala	738/19	2019-05-27	Anemone	2
2	Woodlark	Scala	738/19	2019-05-27	*Austinogrea* sp.	6
2	Woodlark	Scala	738/19	2019-05-27	*Branchinotogluma segonzaci*	4
2	Woodlark	Scala	738/19	2019-05-28	Brisingidae sea star	1
2	Woodlark	Scala	738/19	2019-05-27	*Chiridota* sp.	2
2	Woodlark	Scala	738/19	2019-05-27	*Ifremeria nautilei*	10
2	Woodlark	Scala	738/19	2019-05-28	Isididae coral	1
2	Woodlark	Scala	738/19	2019-05-27	*Phymorhynchus* sp.	2
2	Woodlark	Scala	738/19	2019-05-28	*Provanna* sp.	10
2	Woodlark	Scala	738/19	2019-05-27	*Rimicaris variabilis*	3
2	Woodlark	Scala	738/19	2019-05-28	Stalked sponge	1
2	Woodlark	Scala	738/19	2019-05-28	*Vulcanolepas* sp.	10
2	Woodlark	Scala	739/20	2019-05-30	*Alviniconcha boucheti*	10
2	Woodlark	Scala	739/20	2019-05-31	*Alviniconcha kojimai*	10
2	Woodlark	Scala	739/20	2019-05-31	*Rimicaris variabilis*	6
2	Woodlark	Scala	739/20	2019-05-30	*Vulcanolepas* sp.	10

Water column acoustic data acquisition

Carla SCALABRIN and Ewan PELLETER, Ifremer, Marine Geosciences research unit

The use of acoustic data of the water column has developed a lot in recent years for the detection and study of fluid systems. Ifremer teams were able to highlight the effectiveness of acoustic "water column" data acquired near the bottom with a multibeam echosounder (MBES) mounted on an AUV (autonomous underwater vehicle) to detect new hydrothermal systems. However, during the FUTUNA 3 cruise (2012), it was also possible to discover the ObelX hydrothermal site located at 1600 meters below sea surface (mbss) using the MBES EM122 of the *R/V L'Atalante*. This site corresponds to a sulfide deposit dominated by a 20 m high active chimney mainly composed of anhydrite. The hydrothermal activity is characterized by a large flow of high temperature (270°C) translucent fluid relatively poor in particles. The detection of a site located as deep as ObelX has made it possible to actually consider the use of acoustic water column data acquired with ship-borne MBES to detect and localize hydrothermal vents sites. As a result, in 2016, tests were performed on another type of hydrothermal system. The LEVE-SMF cruise (2016), carried out with the same MBES mounted on the *R/V L'Atalante*'s hull, tested the capacity of this kind of acoustic system to detect active sites located at significant depths (> 3500m). The test zones, TAG and Snake Pit in the Mid-Atlantic Ridge, were characterized by extremely strong flows of a very high temperature fluid (> 300 ° C) which, when mixed with seawater, created a black smoke loaded with particles. Different intensity anomalies (water column echoes) at the TAG and Snake Pit hydrothermal vent sites were observed along different water column acoustic acquisition profiles carried out during the LEVE-SMF cruise. These promising results observed on much contrasted sites (translucent smoker versus black smokers) and located at different depths (1600 versus 3600mbss) seem to indicate the possibility of using the backscattered acoustic signals received by the ship on the surface to detect hydrothermal active sites. However, additional data

are required on other active sites to constrain the limits of this sea-surface and long-range detection method.

The CHUBACARC cruise offers the opportunity to test again this methodology on many known sites in the Southwest Pacific, but also to use it as an exploratory approach to find the sources of Eh anomalies observed in the segment 3 of the Woodlark ridge by the SO-203 cruise in 2009 (IFM-GEOMAR). The Leg 1 of the CHUBACARC cruise explored various hydrothermal sites located at depths between 1500 and 2700mbss: Tow Cam, Tui Malila, White Lady and Fati Ufu (Lau and North Fiji basins and Futuna area). The Leg 2 covered the sites located on the north-eastern of Manus basin at water depths ranging from 1700 to 1100 mbss (PAC-MANUS on the Pual ridge, Desmos caldera and Su-Su-Knolls volcanos) and explored the segment 3 of the Woodlark ridge (~3400mbss depth). For each site, profiles dedicated to acoustic acquisition of the water column data were carried out.

1. Ship-borne multibeam echosounder : EM122

The *R/V L'Atalante* is equipped with two hull-mounted multibeam echosounders:

- Kongsberg EM122 operating at a frequency of 12 kHz for measurements at depths of 1000 to 10000 m (Figure 54, Table 2);
- Kongsberg EM710 operating at a frequency of 70 to 100 kHz for lower depths (a few meters to 1000 m).

Given the water depths of the areas covered during the CHUBACARC cruise, only the lower frequency long range EM122 was implemented.

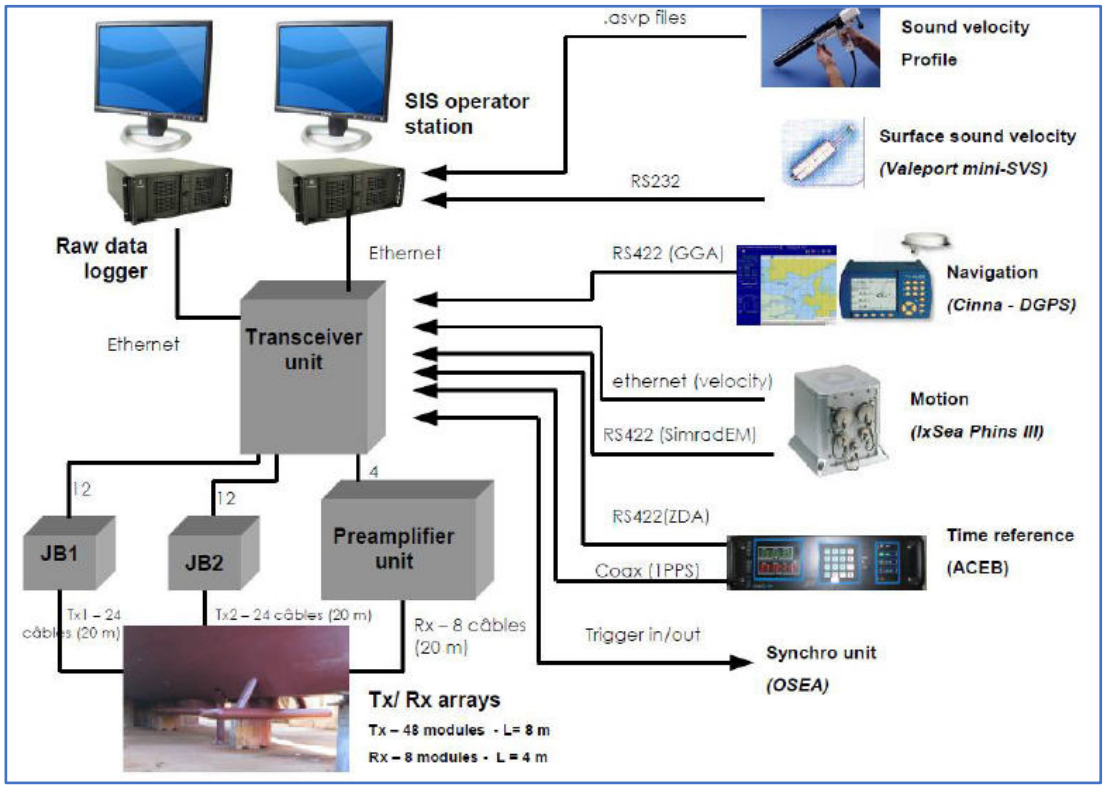


Figure 54 : general architecture of the MBES EM122 as implemented on the R/V L'Atalante (source: Genavir, 2009).

Table 2 : main technical characteristics of the R/V L'Atalante MBES (source: Genavir, 2009)

	EM122	EM710
mesures	Bathymétrie / imagerie	
fréquence	12 kHz (11 à 13 kHz)	73 à 97 kHz
Signaux	CW / FM	
Niveau d'émission max	241 dB re 1 µPa @1 m	229 dB re 1 µPa @1 m
Durée d'impulsion	2 / 3 / 5 / 8 / 15 ms (CW) 25 / 40 / 60 / 100 ms (FM)	0.2 / 0.5 / 2 ms (CW) 20 / 40 / 60 / 120 ms (FM)
Faisceau d'émission	1° x 144° Emission par secteurs transversaux (8 max) Emission de deux swaths dépointés sur l'avant et l'arrière (mode dual swath) Compensation roulis/tangage/lacet	0.5 x 140° Emission par secteurs transversaux (3) Emission de deux swaths dépointés sur l'avant et l'arrière (mode dual swath) Compensation roulis/tangage/lacet
Cadence d'émission max	5 Hz	40 Hz
réception	Cadence de numérisation : 9090 Hz Dynamique : 140 dB	Cadence de numérisation : 55.6 kHz Dynamique : 140 dB
Faisceaux de réception	2° x 32° formation des voies : domaine temporel – focalisation dynamique compensation en roulis	1° x 32° formation des voies : domaine temporel – focalisation dynamique compensation en roulis
Nombre de faisceaux	288 faisceaux x 2 swaths	256 faisceaux x 2 swaths
Répartition	Equidistante ou équiangle	Equidistante ou équiangle
Bathymétrie	Mode equidistant ou equiangle : 288 sondes (1 par faisceau) x 2 swaths Mode high density : 432 sondes équidistantes x 2 swaths	Mode equidistant ou equiangle : 256 sondes (1 par faisceau) x 2 swaths Mode high density : 400 sondes équidistantes x 2 swaths
Réflectivité	1 valeur de BS pour chaque échantillon du signal, à l'intérieur de chaque faisceau L'échantillonnage dépend du range max, du mode de fonctionnement (single ou dual swath) et du type d'impulsion (CW/FM)	

2. Expandable bathythermograph (XBT)

A total of 4 and 13 XBT (Sippican) shots were made during, respectively, Leg 1 and Leg 2. The vertical sound speed profile measurements were integrated into the MBES EM122 system in order to provide accurate range data.

3. Acquisition and post-processing

3.1 Water column acoustic acquisition

The acoustic coverage strategy and acquisition parameters used during Leg 1 and Leg 2 were defined based on the results obtained during previous cruises (e.g. FUTUNA3, LEVE-SMF, BIG).

Optimized acquisition profiles for water column data logging were mainly performed with the following parameters (EM122):

- Global angle aperture: ±60° or ±40°
- Mode DEEP without FM
- TVGFunctionApplied: 30 dB
- TVGOffset: 30 dB

3.2 Post-processing of water column acoustic data

Post-processing of MBES EM122 raw data files was carried out with SonarScope software (©Ifremer) and visualized in a 3D environment with GLOBE software (©Ifremer).

Digital terrain models (DTM) were generated with GLOBE software from acoustic data acquired during water column acoustic coverages by Pierre Le Meur (GENAVIR operator of MBES).

4. Leg 1 preliminary results (Ewan Pelleter)

The results are presented by site in the following sections. The summary of the parameters used in the acquisition of the acoustic water column data and the preliminary results observed during leg1 of the CHUBACARC cruise is presented in Table 3.

4.1 Tow Cam site

The Tow Cam site is located on the northern segment of the East Lau Accretion Ridge (N-ELSC) at 2700m depth. It is an area composed of two high temperature sites separated by about 150 m. The proximal vents of the north site are characterized by translucent fluid to black smoke and one of the chimneys (sampled for HT fluids) has a high flux associated with black smoke and a high particulate load. Four "water column" profiles have been completed. Each profile goes at a distance from the sites between 150m and 400m to optimize the vision of an anomaly near to the center of the echogram. No anomalies in the site area could be observed during the preliminary data analysis (

Figure 55).

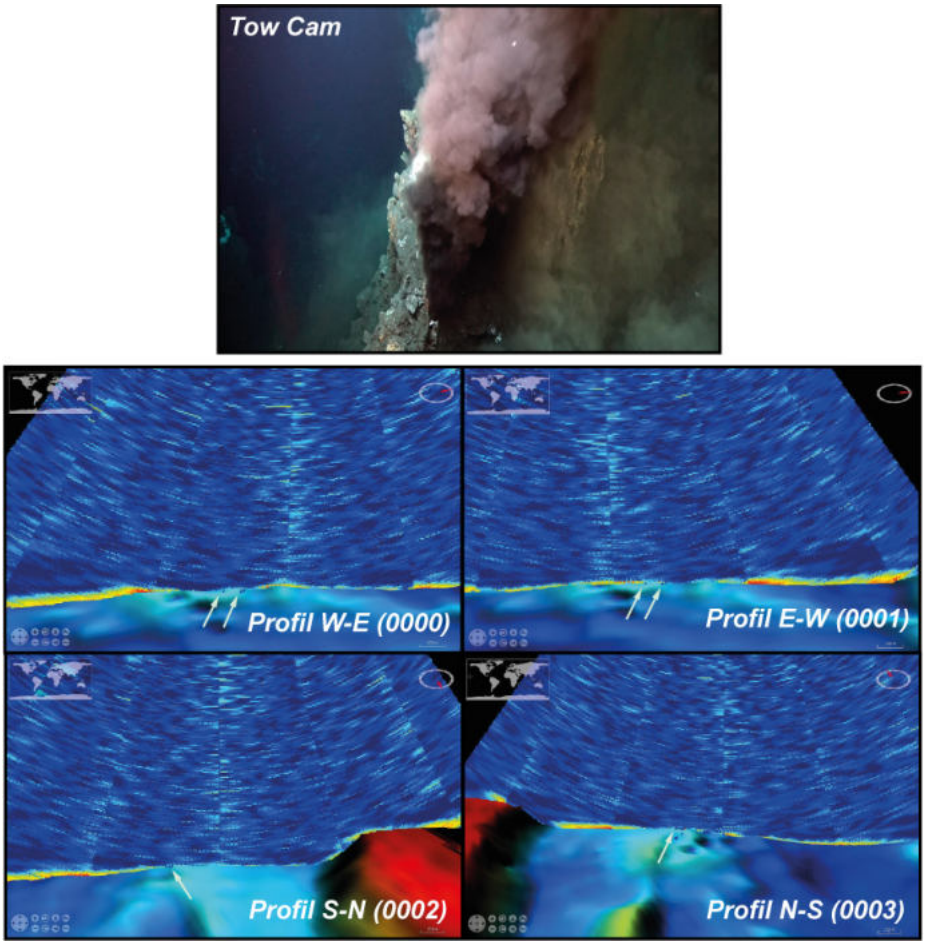


Figure 55 : site Tow Cam. Polar echograms in line with the north black smoker. No acoustic anomaly is visible (the arrows indicate the position of the vents)

4.2 Tui Malila site

The Tui Malila site is located on the Valu Fa Ridge about 200km south of the Tow Cam site. The maximum depth of the active zones is 1930m. Two high temperature zones can be distinguished: a northern zone and a southern zone separated by 350m. The chimneys are about 4-6m high and the activity is characterized by a translucent fluid (about 280 °C) with a moderate to strong flow. Six "water column" profiles have been completed. The first two were recorded before arriving at the active sites to explore 6 km of the northern part of the Valu Fa ridge. The other four profiles made it possible to survey the hydrothermal activity zone. No anomalies in the site area could be observed during the preliminary data analysis (

Figure 56).

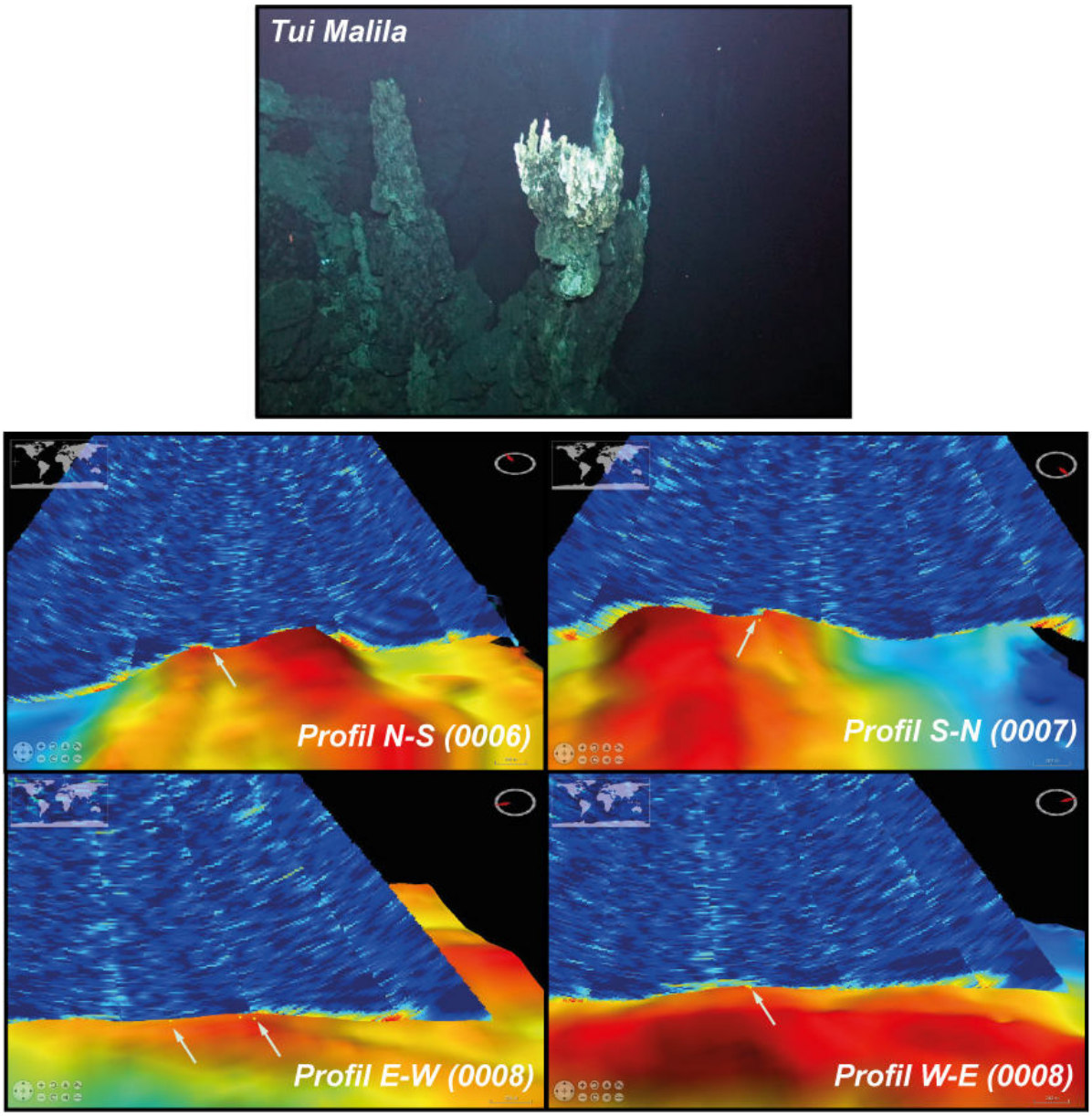


Figure 56 : site Tui Malila. Polar echograms in line with the hydrothermal vents. No acoustic anomaly is visible (the arrows indicate the position of the vents)

4.3 White Lady site

The four profiles were centered on the site White Lady whose coordinates were not accurate (300m between the various points of the literature). The profiles were set approximately 200m from the most likely point for the location of the chimney. During the last cruises in the area, the White Lady site consisted of an active anhydrite chimney. The fluid was translucent with a temperature of 285 °C. On the echograms no anomaly is visible, either on the raw echograms or compensated polar echograms. However, it should be noted that the ROV VICTOR dive 5 carried out on the area was not able to find the active chimney after 1h30 of exploration around the point. Remains of shells observed around an inactive and highly disturbed zone (linked to the Grab operation of the German teams in 1990?) could indicate that the site of White Lady is now inactive.

Unfortunately, the N-S profiles carried out in the area were not long enough to cover the new site (Phoenix) discovered at the very beginning of the dive 5.

4.4 Fatu Kapa sites

Seven hydrothermal sites of Fatu Kapa were studied during the Leg 1 of the CHUBACARC cruise: Carla, AsterX, IdefX, Obelx, Stephanie, Fati Ufu and Tutafi. During the first acquisition session, the profiles allowed to pass twice on Carla, AsterX, IdefX and Stephanie and three times on ObelX. It should be noted that the first profiles were acquired with a TVGOffset of 20 (instead of 30) and that this value was reset to 30 after the 0049 profile (see Table 3). The second acquisition session focused on the Fati Ufu and Tutafi zones with five profiles to observe four times Fati Ufu site and three times Tutafi site. On this session, after profile 0064 (see Table 3), the TVGOffset was set to 20 and the angular aperture was reduced to 60° (± 30°). The third session focused on ObleX site with four closer profiles allowing ObleX to be about 160m from the nadir. Table 3 summarizes the parameters used for the different Fatu Kapa sites.

The preliminary processing does not make it possible to identify acoustic anomalies at the sites Carla (masked by the seafloor morphology), Stephanie, and AsterX. For the ObelX site, only a profile of the first session made it possible to see an anomaly to be confirmed on the compensated polar echogram (Figure 6, profile 0057 fig 4). This anomaly could very well correspond to an artifact related to the seafloor morphology.

On the Obelx site, anomalies were observed on the four complementary profiles made during the third session. Compared to the first session, the profiles were brought closer to the emission zone to be between 145m and 170m from the nadir. Similarly, the angular aperture was reduced to 60° and the TVGOffset was set to 20. On the last profile (0076), we chose to test the penetration filter (Penetration filter) by positioning it on "WEAK". Anomalies were observed on three of the four profiles (0070, 0072, 0074,

Figure 57) but are only visible on compensated polar echograms. The raw echograms do not allow, *a priori*, observing a specific anomaly for the ObelX site.

The results of the second session on the Fati Ufu and Tutafi sites do not clearly distinguish echoes in the polar echograms. No anomaly was observed from the study of echograms through Tutafi. On Fati Ufu, very slight anomalies were identified on three profiles (0062, 0064 and 0067,

Figure 58). However, these echoes are, *a priori*, not visible on the raw echograms. They could therefore be artifacts rather than an echo on the backscattered image.

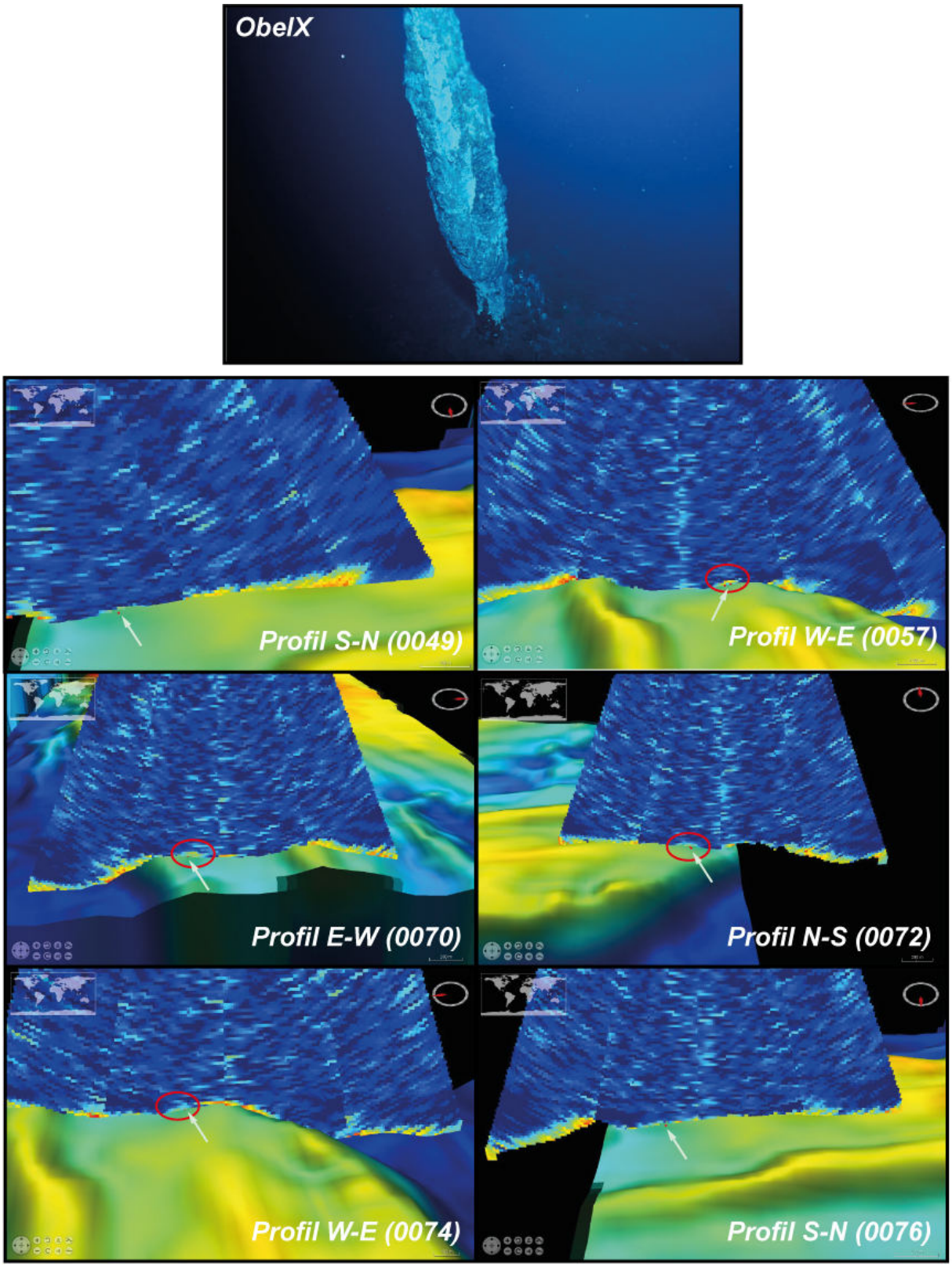


Figure 57 : site ObelX. Polar echograms in line with the hydrothermal vent. The arrows indicate the position of the ObelX site and red circles the acoustic anomalies to be confirmed

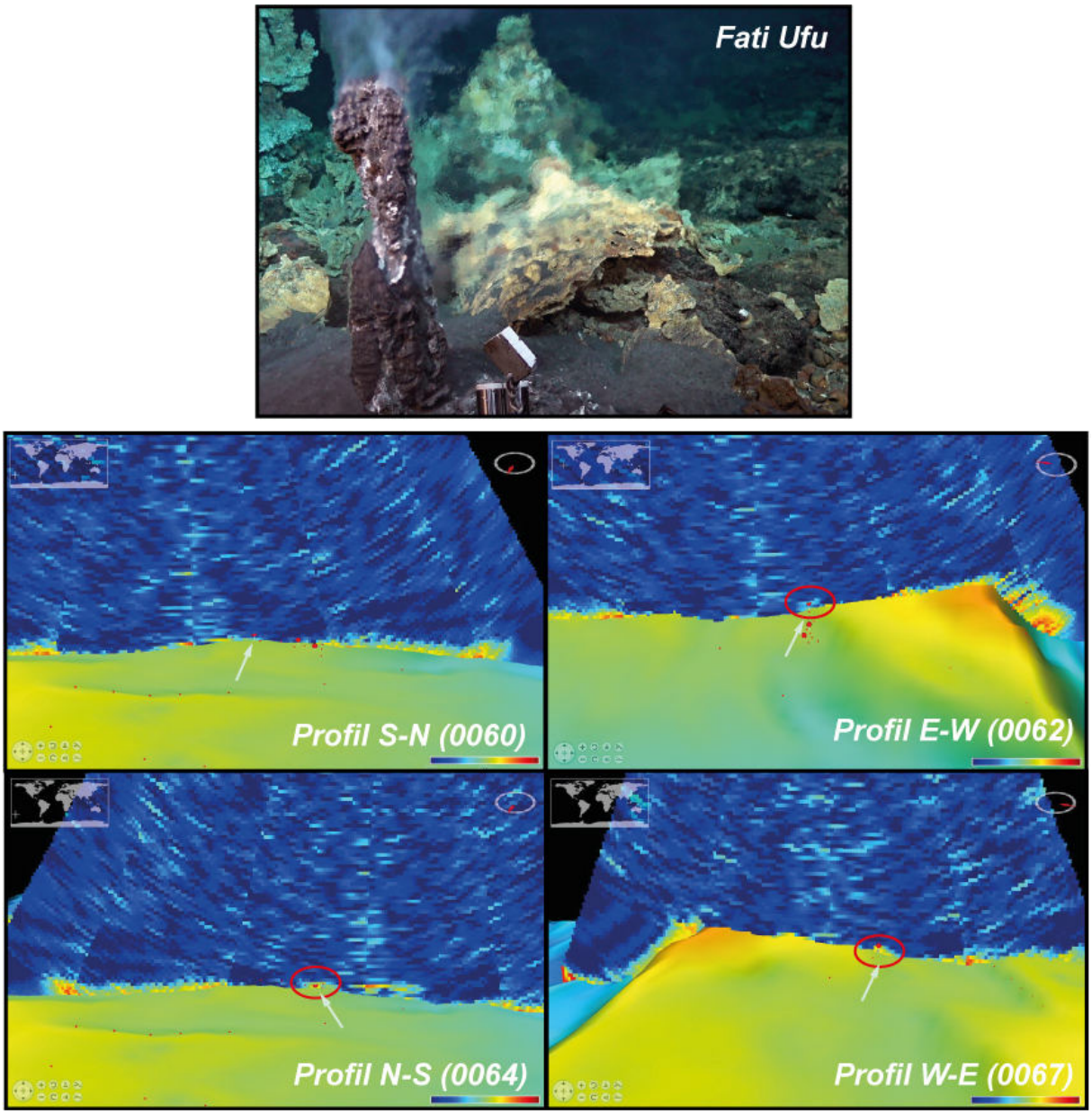


Figure 58 : site Fati Ufu. Polar echograms in line with the main hydrothermal vents (gray smokers). The arrows indicate the position of the vents and red circles the acoustic anomalies to be confirmed.

4.5 Conclusions

The plume detection methodology work done during Leg 1 is not, for the moment, very conclusive. No indisputable plume anomaly could be clearly identified from the raw and compensated polar echograms. The few signals observed on the compensated polar echograms are only very rarely visible on several ping, and could therefore only correspond to artifacts. In Leg 2, additional tests will be carried out by Carla Scalabrin to verify that the parameters used in Leg 1 were really adapted to the type of acquisition desired.

Complementary processing of Leg 1 data will be carried out on land by Carla Scalabrin to clarify the nature of the anomalies observed.

Table 3 : summary of the acquisition parameters and preliminary results from water column acoustic coverage of CHUBACARC cruise (Leg 1)

Site	Tow Cam 0000 à 0003	Tui Malila 0004 et 0005	 0006 à 0009	 0010	White Lady 0041 à 0044	Mangatolo 0088
Profondeur	2700 m	-	1930 m	1930 m	1960 m	1960 m
Type fumeur	Translucides et noirs	-	Translucides	Translucides	inactif?	Translucides
Distances des profils par rapport aux sites	env. 300m (150-400m)	-	env. 220m (120-545m)	209m (site nord) et 510m (site sud)	env. 200m du point moyen estimé	
Paramètres	Paramètres initiaux	Paramètres initiaux	Paramètres initiaux	= profil E-W (0008). TVGOffset à 20	TVGOffset à 20	TVGOffset à 20
Commentaires	Pas d'anomalies	Profils d'exploration	Pas d'anomalies	Pas de passage sur le site - seuleument 128 pings (Pb d'acquisition?)	Le site n'a pas été trouvé lors de la plongée 5 - pas d'anomalies	Exploration sur site non déouvert - pas d'anomalies

Site	Carla 0045 et 0051	AsterX 0045 et 0047	ObelX 0049, 0055 et 0057	 0070, 0072, 0074, 0076	Stephanie 0051 et 0053	Fati Ufu 0060, 0062, 0064 et 0068	Tutafi 0060, 0064 et 0066
Profondeur	1670 m	1550 m	1670 m	1670 m	1560 m	1523 m	1610 m
Type fumeur	Translucide	Translucide	Transclucide	Translucide	Transclucide	Translucide à gris	Translucide à gris
Distances des profils par rapport aux sites	170 m et 200 m	145 m et 160 m	200 m, 245 m, 270 m	entre 145 m et 170 m	190 m et 200 m	Entre 120 m et 280 m	230 m, 250 m et 300 m
Paramètres	TVGOffset à 20	TVGOffset à 20	TVGOffset à 20 - 0049 TVGOffset à 30 - autres	TVGOffset à 20 Ouverture angulaire 60°	TVGOffset à 20 - 0051 TVGOffset à 30 - 0053	A partir de 0066 : TVGOffset à 20 et Ouverture angulaire 60°	A partir de 0066 : TVGOffset à 20 et Ouverture angulaire 60°
Commentaires	Pas d'anomalies	Pas d'anomalies	Anomalie sur profil 0057 - artefact?	Anomalies sur 3 profils (0070, 0072, 0074) - artefacts?	Pas d'anomalies	Anomalies sur 3profils (0062, 0064, 0067) - artefacts?	Pas d'anomalies

5 Leg 2 preliminary results (Carla Scalabrin)

The Leg 2 covered the sites located on the north-eastern of Manus basin at water depths ranging from 1700 to 1100 mbss (PAC-MANUS on the Pual ridge, Desmos caldera and Su-Su-Knolls volcanos,

Figure 59) and explored the segment 3 of the Woodlark ridge (~3400mbss depth).

For each site, profiles dedicated to acoustic acquisition of the water column data were carried out according to the set up indicated in section 3. For each hydrothermal site, the index number of MBES files, duration, geographical extension, minimum and maximal depths and the total length covered by the water column acoustic coverages carried out are provided in

Table 4. During the Leg 2 of CHUBACARC cruise, a total of ~75 hours were dedicated to the acoustic coverage of main hydrothermal sites totalizing 384 nm in profiles for water column acoustic acquisition.

Results are presented for each hydrothermal site except for the Desmos site where the crater morphology does not allow to clearly observe water column echoes. In this case, the acoustic water column is masked by the seafloor ghost echoes generated by the internal flanks of the crater. However, data from the water acoustic coverage was used to generate a digital terrain model with a 10-m grid.

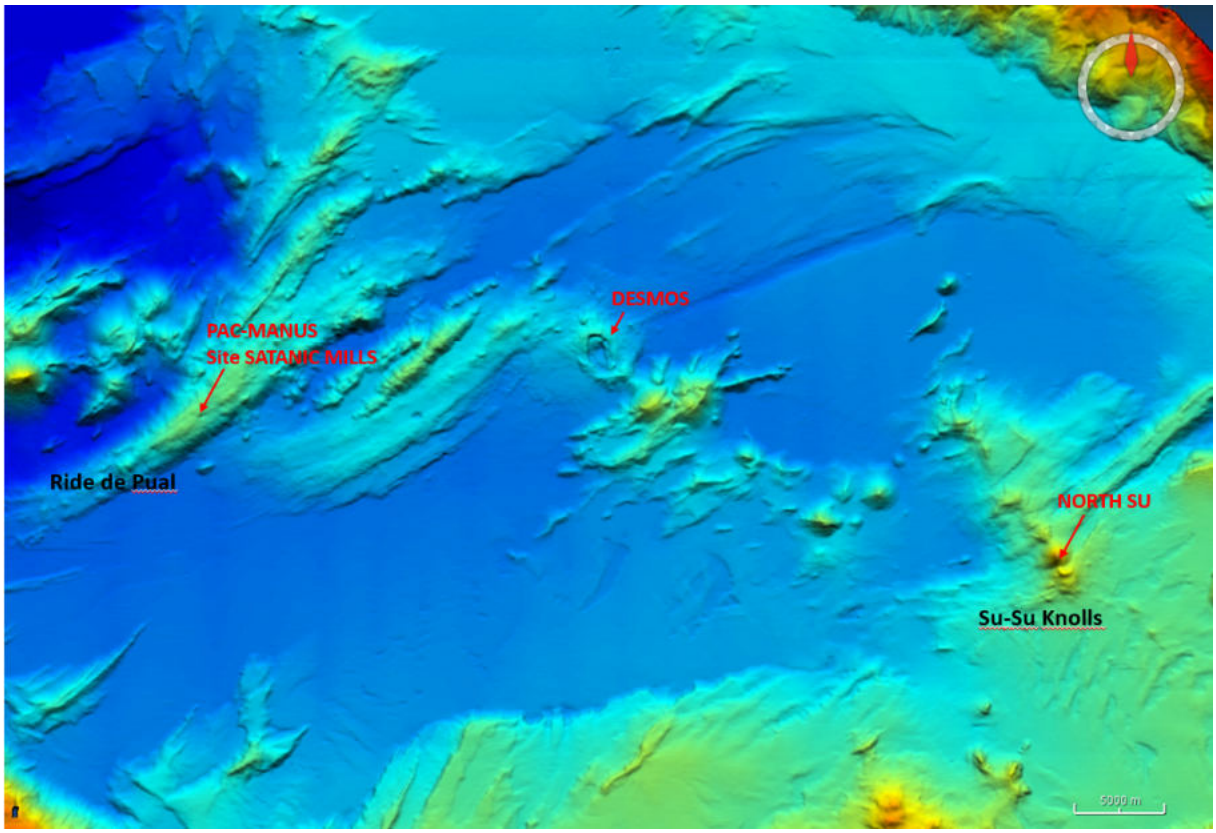


Figure 59 : location of Manus basin hydrothermal sites visited during the CHUBACARC cruise (DTM source: Sonne2011_EastManus_EM120_35mSUTM56)

Table 4 : summary of water column acoustic coverage of Leg 2 hydrothermal sites. Profil N corresponds to one acoustic coverage including several profiles. Index number of MBES files, duration, geographical extension, minimum and maximal depths and the total length covered with water column acoustic profiles are provided for each coverage

N° profil	Couverture acoustique/n° fichier EM122	Objectif	Durée (heure décimale)	Date/Durée	Heure	Latitude	Longitude	Lat Min	Lat Max	Lon Min	Lon Max	Prof Min (m)	Prof Max (m)	Dist (milles nautiques)
PROFIL1	**WOODLARK 1**	**colonne d'eau**	**4**	**0j4h0mn19s**				**S 9° 51.00652'**	**S 9° 46.6635'**	**E 154° 58.1946'**	**E 155° 5.4648'**	**3328**	**3714**	**20.7**
PROFIL1-Début	all 0163			10/05/2019	02:44:00	S 9° 51.00652'	E 154° 58.7528'							
PROFIL1-Fin	all 0174			10/05/2019	06:44:19	S 9° 46.97081'	E 155° 5.20932'							
PROFIL2	**WOODLARK 2**	**colonne d'eau**	**4.5**	**0j4h24mn25s**				**S 9° 48.4113'**	**S 9° 45.54402'**	**E 155° 1.014'**	**E 155° 5.2806'**	**3146**	**3663**	**22.9**
PROFIL2-Début	all 0184			10/05/2019	12:59:15	S 9° 48.14011'	E 155° 2.27132'							
PROFIL2-Fin	all 0198			10/05/2019	17:23:40	S 9° 48.41129'	E 155° 3.29992'							
PROFIL3	**WOODLARK 3**	**colonne d'eau**	**4**	**0j4h6mn42s**				**S 9° 50.05158'**	**S 9° 47.48112'**	**E 155° 0.70798'**	**E 155° 6.525'**	**3317**	**3684**	**22.8**
PROFIL3-Début	all 0207			11/05/2019	00:56:34	S 9° 49.69807'	E 155° 0.70798'							
PROFIL3-Fin	all 0215			11/05/2019	05:03:16	S 9° 49.70831'	E 155° 2.20012'							
PROFIL4	**WOODLARK 4**	**colonne d'eau**	**4**	**0j3h54mn18s**				**S 9° 49.35768'**	**S 9° 47.18328'**	**E 155° 1.1964'**	**E 155° 6.1818'**	**3358**	**3716**	**19.7**
PROFIL4-Début	all 0225			11/05/2019	12:31:42	S 9° 47.22467'	E 155° 2.98612'							
PROFIL4-Fin	all 0233			11/05/2019	16:26:00	S 9° 48.90593'	E 155° 1.19672'							
PROFIL11	**WOODLARK 5**	**colonne d'eau**	**2**	**0j2h3mn9s**				**S 9° 48.5385'**	**S 9° 47.50134'**	**E 155° 2.3922'**	**E 155° 3.6438'**	**3319**	**3551**	**8.3**
PROFIL11-Début	all 0690			27/05/2019	00:07:58	S 9° 48.31901'	E 155° 2.87327'							
PROFIL11-Fin	all 0702			27/05/2019	02:11:07	S 9° 47.97481'	E 155° 3.10841'							
PROFIL12	**WOODLARK 6**	**colonne d'eau**	**5.3**	**0j5h17mn11s**				**S 9° 48.52902'**	**S 9° 47.48934'**	**E 155° 2.1288'**	**E 155° 4.0272'**	**3316**	**3627**	**25.5**
PROFIL12-Début	all 0752			29/05/2019	00:56:01	S 9° 48.16084'	E 155° 3.41818'							
PROFIL12-Fin	all 0801			29/05/2019	06:13:12	S 9° 48.37877'	E 155° 2.69587'							
PROFIL13	**WOODLARK 7**	**bathymétrie et CE**	**2.6**	**0j2h38mn51s**				**S 9° 48.04884'**	**S 9° 46.39002'**	**E 154° 57.981'**	**E 155° 3.00248'**	**3091**	**3620**	**11.5**
PROFIL13-Début	all 0803			29/05/2019	07:12:04	S 9° 47.98435'	E 155° 3.00248'							
PROFIL13-Fin	all 0805			29/05/2019	09:50:55	S 9° 47.93962'	E 155° 2.43278'							
PROFIL14	**WOODLARK 8**	**bathymétrie et CE**	**6.75**	**0j6h45mn34s**				**S 9° 47.41315'**	**S 9° 38.0775'**	**E 154° 57.477'**	**E 155° 12.963'**	**2510**	**4510**	**35.1**
PROFIL14-Début	all 0810			29/05/2019	12:36:04	S 9° 47.41315'	E 154° 57.4796'							
PROFIL14-Fin	all 0819			29/05/2019	19:21:38	S 9° 46.37331'	E 154° 59.72722'							
PROFIL15	**WOODLARK 9**	**bathymétrie et CE**	**10**	**0j10h6mn56s**				**S 9° 52.46706'**	**S 9° 41.31042'**	**E 155° 1.2654'**	**E 155° 16.4574'**	**2563**	**4292**	**56.0**
PROFIL15-Début	all 0864			31/05/2019	11:13:06	S 9° 45.99511'	E 155° 5.55734'							
PROFIL15-Fin	all 0884			31/05/2019	21:20:02	S 9° 49.22629'	E 155° 2.60509'							
PROFIL16	**WOODLARK 10**	**bathymétrie et CE**	**1.5**	**0j1h23mn36s**				**S 9° 46.04748'**	**S 9° 42.29532'**	**E 154° 54.7422'**	**E 154° 57.8256'**	**2922**	**3411**	**8.2**
PROFIL16-Début	all 0891			01/06/2019	00:49:01	S 9° 44.01918'	E 154° 57.51143'							
PROFIL16-Fin	all 0896			01/06/2019	02:12:37	S 9° 46.04746'	E 154° 57.82517'							
PROFIL17	**WOODLARK 11**	**bathymétrie et CE**	**3**	**0j2h49mn35s**				**S 10° 1.60188'**	**S 9° 48.89896'**	**E 154° 55.305'**	**E 155° 3.3684'**	**3057**	**4091**	**16.7**
PROFIL17-Début	all 0904			01/06/2019	06:01:44	S 9° 48.89896'	E 154° 57.97756'							
PROFIL17-Fin	all 0909			01/06/2019	08:51:19	S 10° 1.60189'	E 155° 3.36782'							

Table 3: Continued

N° profil	Couverture acoustique/n° fichier EM122	Objectif	Durée (heure décimale)	Date/Durée	Heure	Latitude	Longitude	Lat Min	Lat Max	Lon Min	Lon Max	Prof Min (m)	Prof Max (m)	Dist (milles nautiques)
PROFIL5	**PAC MANUS 1**	**CE et bathymétrie**	**0.3**	**0j0h20mn19s**				**S 3° 44.03462'**	**S 3° 42.97866'**	**E 151° 39.774'**	**E 151° 41.21497'**	**1631**	**1717**	**1.8**
PROFIL5-Début	all 0307			16/05/2019	05:05:03	S 3° 42.97866'	E 151° 41.21497'							
PROFIL5-Fin	all 0307			16/05/2019	05:25:22	S 3° 44.03462'	E 151° 39.77413'							
PROFIL6	**PAC MANUS 2**	**CE et bathymétrie**	**7.5**	**0j7h27mn58s**				**S 3° 46.58705'**	**S 3° 40.5962'**	**E 151° 36.2082'**	**E 151° 46.0356'**	**1635**	**2151**	**37.9**
PROFIL6-Début	all 0374			18/05/2019	12:16:08	S 3° 44.04914'	E 151° 39.74123'							
PROFIL6-Fin	all 0395			18/05/2019	19:44:06	S 3° 43.90136'	E 151° 40.07797'							
PROFIL8	**DESMOS 1**	**CE et bathymétrie**	**6.3**	**0j6h16mn43s**				**S 3° 43.31872'**	**S 3° 40.38078'**	**E 151° 51.24749'**	**E 151° 53.2782'**	**1776**	**2097**	**33.7**
PROFIL8-Début	all 0431			20/05/2019	04:24:04	S 3° 41.60901'	E 151° 51.24749'							
PROFIL8-Fin	all 0461			20/05/2019	10:40:47	S 3° 42.61417'	E 151° 52.01201'							
PROFIL9	**SU-SU 1**	**CE et bathymétrie**	**7.5**	**0j7h35mn5s**				**S 3° 49.91498'**	**S 3° 43.73851'**	**E 152° 1.68427'**	**E 152° 7.122'**	**1164**	**2091**	**38.8**
PROFIL9-Début	all 0500			21/05/2019	23:15:31	S 3° 43.73851'	E 152° 1.68427'							
PROFIL9-Fin	all 0528			22/05/2019	06:50:36	S 3° 47.51707'	E 152° 5.72582'							
PROFIL10	**SU-SU 2**	**CE et bathymétrie**	**5.25**	**0j5h15mn53s**				**S 3° 48.46182'**	**S 3° 47.49337'**	**E 152° 5.5602'**	**E 152° 6.6276'**	**-1**	**1673**	**24.1**
PROFIL10-Début	all 0569			23/05/2019	21:55:00	S 3° 47.99406'	E 152° 5.5764'							
PROFIL10-Fin	all 0615			24/05/2019	03:10:53	S 3° 48.29225'	E 152° 5.92773'							
TOTAL			**74.5**											**383.7**

5.1 Pual ridge hydrothermal sites (PAC-MANUS)

At least 10 different hydrothermal sites are dispersed within a circle of 800-m radius on the summit of the Pual ridge but also on the flanks. Part of them are low temperature diffusion sites, but others like Big Pap and Satanic Mills sites match to high temperature black smokers.
The Pual ridge was twice covered for MBES water column data acquisition. The first one was carried out on May 16th along the top of the ridge, the second one, on May 18th, was centered on the hydrothermal sites (
Figure 60). The weather was nice with calm sea state for both coverages and average wind speed less than 15 knots.
Water column acoustic anomalies corresponding to hydrothermal vents echoes were observed in several profiles for both coverages (
Figure 61). Preliminary results show that observed echoes are located on the top of the ridge and might well correspond to Satanic Mills site. This site presents several black smokers with fluids flowing strongly from fairly high chimneys (
Figure 62). Satanic Mills site is located near the top of the ridge at water depths of 1683 mbss.

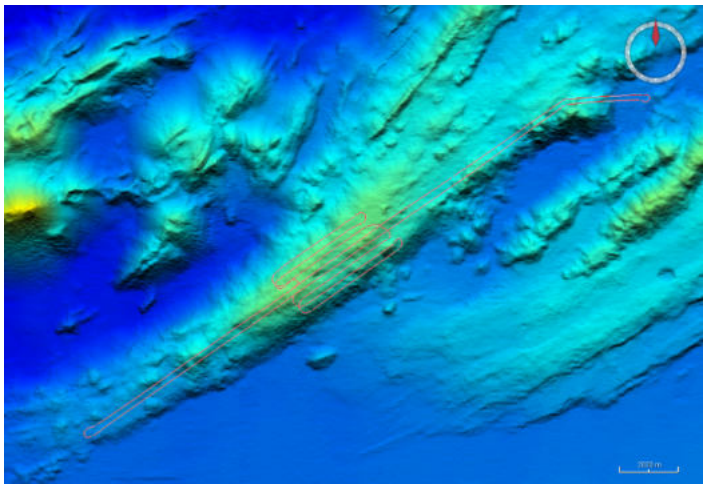


Figure 60 : water column acoustic coverages of the Pual ridge hydrothermal sites (PAC-MANUS)

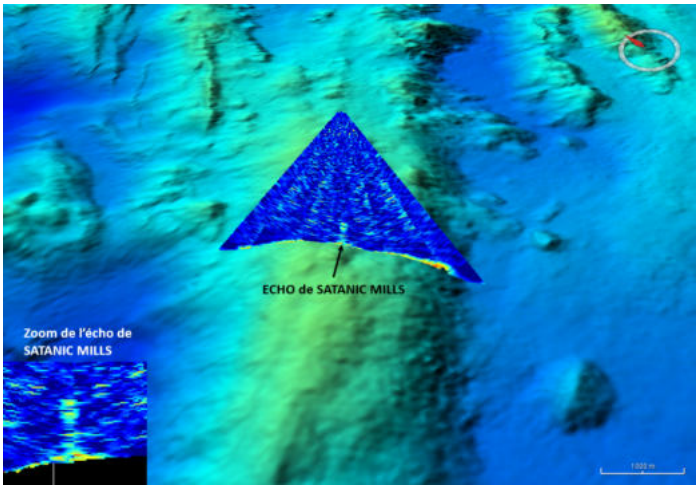


Figure 61 : polar echogram in line with Satanic Mills hydrothermal site showing an echo generated by hydrothermal vents (lower left: expanded view of the echo)

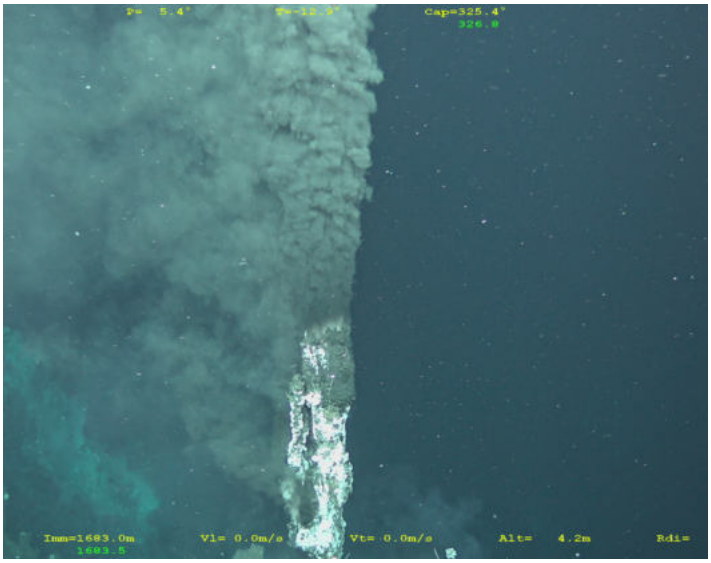


Figure 62 : black smoker of Satanic Mills site (CHUBACARC ROV VICTOR dive 15)

5.2 Su-Su Knolls volcanos

The SuSu Knolls hydrothermal area is composed of three individual volcanic structures (from NW towards SE: Suzette, North Su and South Su) located on individual volcanic structures at water depths between 1150 and 1510 mbss. Several hydrothermal sites can be observed on each of the three structures, but the most impressive are located near to the summit of the North Su volcano. Two very different fluid emission sites were observed and sampled in North Su volcano during the ROV VICTOR dive 17 of CHUBACARC cruise.

The Su-Su Knolls area was covered twice for MBES water column data acquisition. The first one was carried out on May 21-22th along the three volcano structures, the second one, on May 23-24th, was centered on the hydrothermal sites of the North Su volcano (

Figure 63). The weather was nice with a calm sea state for both coverages and average wind speed less than 20 knots.

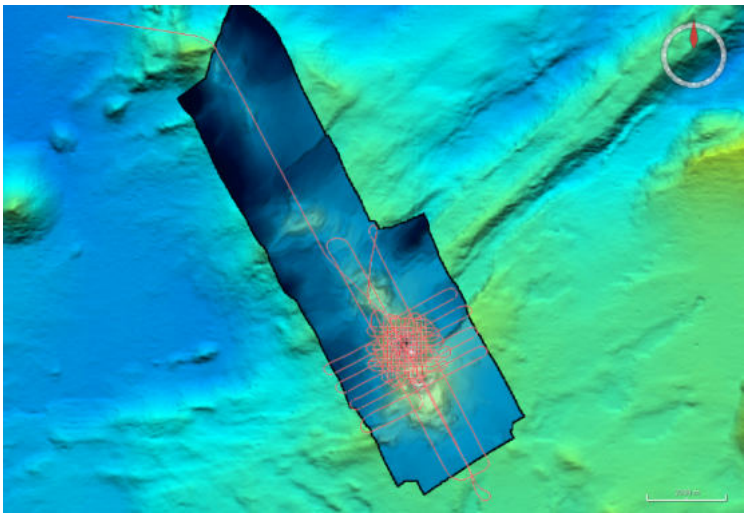


Figure 63 : water column acoustic coverages of the Su-Su Knolls hydrothermal sites

Water column acoustic anomalies corresponding to hydrothermal vents echoes were observed in several profiles for both coverages of the North Su volcano. Preliminary results show that observed echoes are located on two different positions near the top of the volcano (
Figure 64).

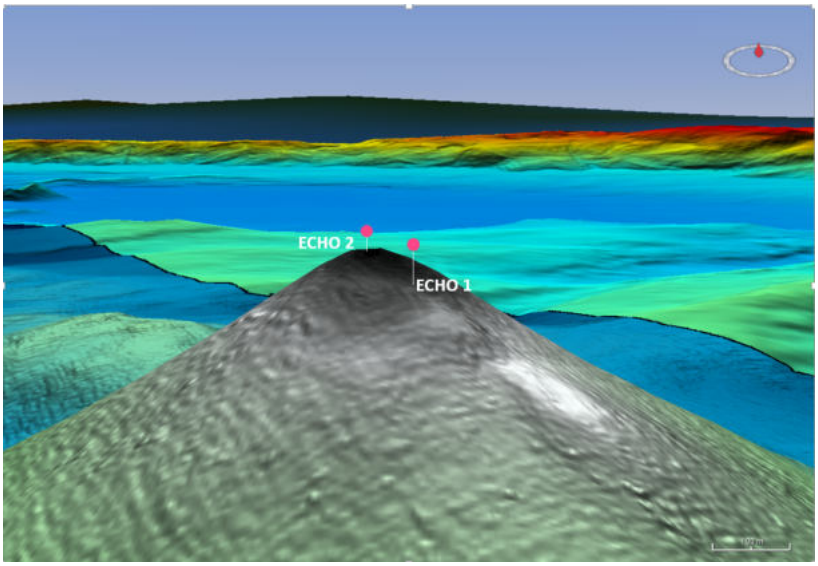


Figure 64 : location of hydrothermal fluid echoes observed during water acoustic coverages of North Su volcano

The first fluid echo (
Figure 65) was observed below the summit of the volcano, on its southern flank at 1200 mbss, and might well correspond to the smokes of Sulphur Candle field described in the literature showing flows of liquid Sulphur and widespread milky-white venting of acid-sulphate type compositions with bubbling liquid CO2 (Reeves *et al.*, 2015; Thal *et al.*, 2016). Large static clouds well above the altitude of 17 m were observed during the ROV VICTOR dive 17 of the CHUBACARC cruise at this echo location as well as native Sulphur flows on the seafloor (Figure 66).

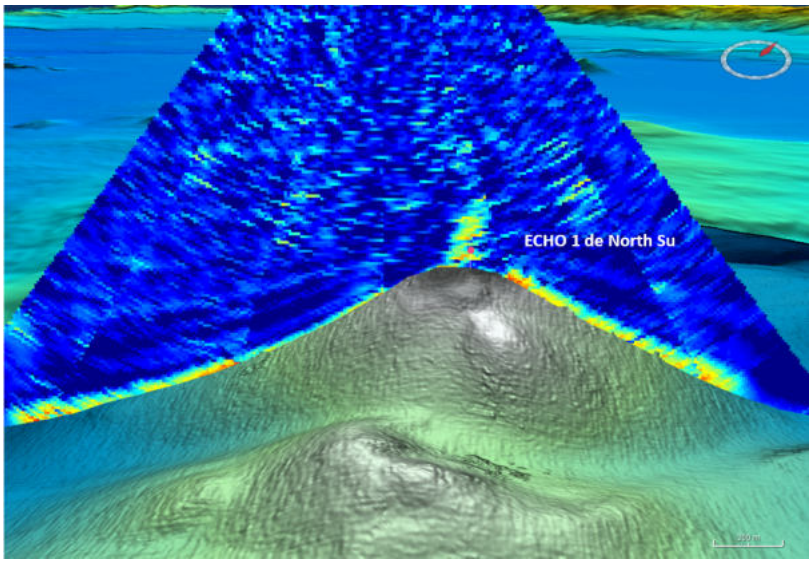


Figure 65 : polar echogram in line with North Su hydrothermal site showing the ECHO 1 probably generated by vents of or near to Sulphur Candle hydrothermal field (DTM: Pierre Le Meur, Chubacarc cruise data)

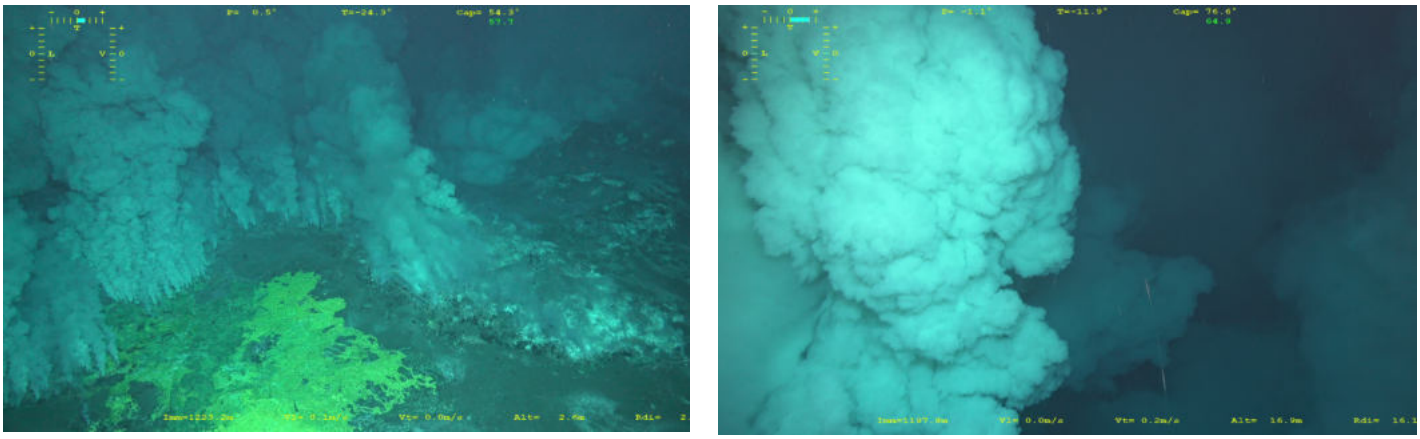


Figure 66 : fluid emissions of the Sulphur Candle hydrothermal field as observed during the CHUBACARC ROV VICTOR dive 17

The second fluid echo (
Figure 67) was observed near the summit of the volcano at 1160 mbss and ~40 m above the firs echo site. ECHO 2 corresponds rather to the black smokers' hydrothermal site (
Figure 68) as described in the literature. This site is dominated by venting of high-temperature black smoker fluids from multi-spired sulfide chimney complexes up to 11 m tall (Seewald *et al.*, 2006; Craddock, 2009; Reeves, 2010).
All the available data acquired on the Su-Su Knolls have not yet been analyzed, but it is probable that neither Suzette nor South Su vents could not have been detected due to the orientations of the profiles which were not optimized for the morphology of both volcanos.

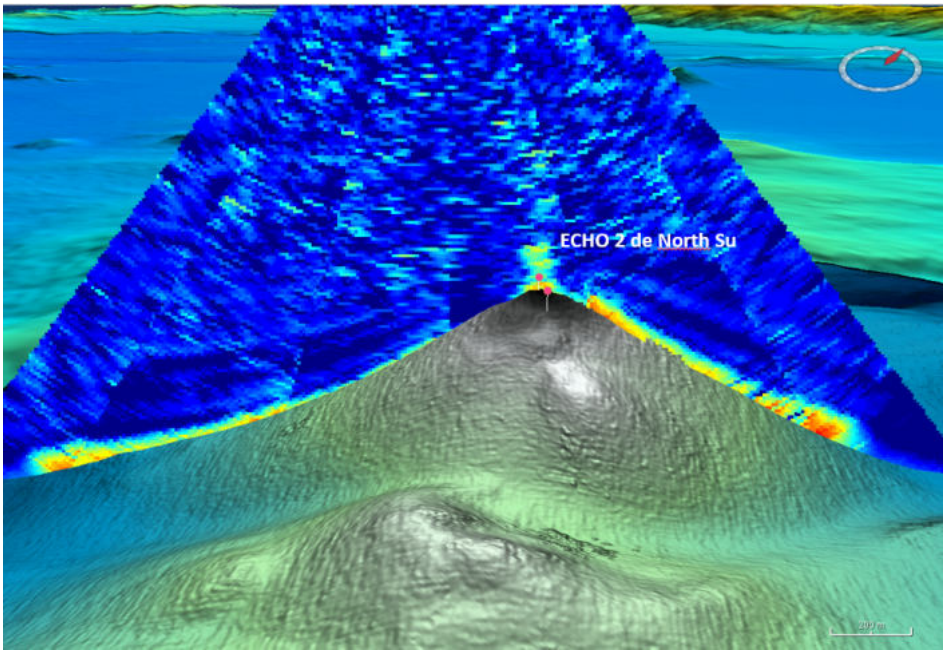


Figure 67 : polar echogram in line with North Su hydrothermal site showing the ECHO 2 probably generated by the black smokers located near the summit of the volcano (DTM: Pierre Le Meur, Chubacarc cruise data)

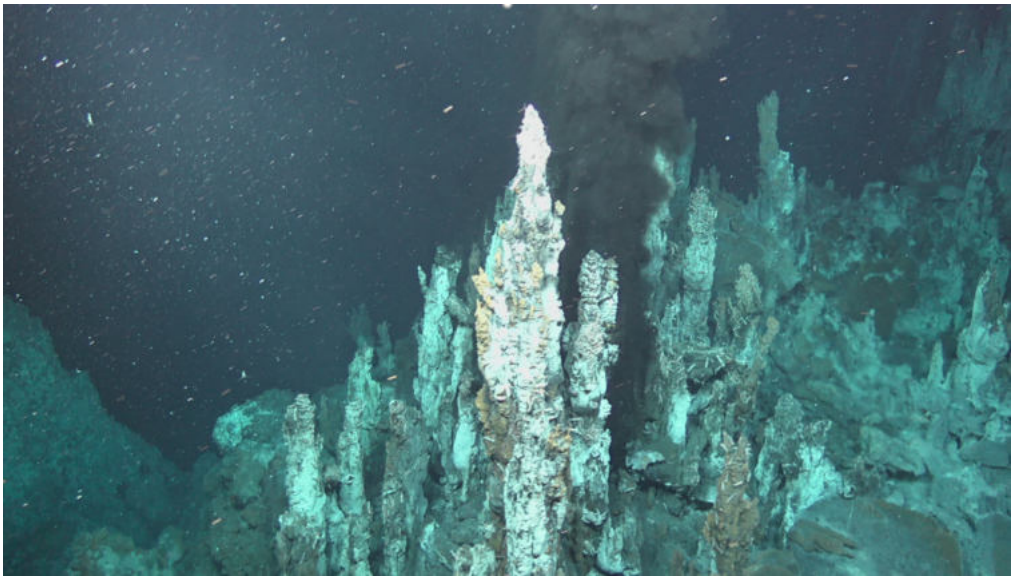


Figure 68 : black smoker of North Su hydrothermal site (CHUBACARC ROV VICTOR dive 17)

5.3 Segment 3 of Woodlark Ridge

The Woodlark basin, located in Salomon Sea, is one of the few places on the Earth where active seafloor propagation into continental crust can be studied as reported by Laurila *et al*., 2012: the wedge-shaped basin contains an approximately E-W oriented active spreading axis divided into five spreading segments, numbered 1 to 5 from West to East. Three locations of present-day hydrothermal activity are reported in the literature: Franklin Seamount on segment 1 (Lisitzin *et al*., 1991; Binns *et al*., 1993), an unnamed plume on segment 5 (M. Leybourne et al., Evidence for

hydrothermal activity in the Woodlark Basin, an arc-influenced oceanic spreading center, manuscript in preparation, 2012) and evidence for an active hydrothermal site on segment 3 of Woodlark ridge (Laurila *et al*., 2012).

Hydrothermal activity evidence on segment 3 of Woodlark Ridge was found during the IFM-GEOMAR cruise SO203 carried out on board *R/V Sonne* from October 27th to December 6th in 2009. Redox anomalies with Eh probes were measured in the northeastern area of segment 3. A trial to find the source point on the seafloor with a TV-grab failed, but this sampled area is called TVG-150 point.

A major objective of CHUBACARC cruise is to study the population connectivity, hydrothermal biodiversity and the degree of exchange of vent species between hydrothermal fields at a regional scale (S. Hourdez and D. Jollivet, cruise proposal). The discovery and sampling of hydrothermal biological communities in the Woodlark Ridge can help establish an intermediate milestone between the Lau Basin in the East and Manus Basin in the West.

The main goal of the water column acoustic coverage of the segment 3 of the Woodlark Ridge was to find the location of the active hydrothermal site. The accurate location of the site could then be useful to define the ROV VICTOR dives strategy for biological sampling of hydrothermal communities. However, this goal was very ambitious because of the water depths reached in the zone (~3400 mbss) and the lack of knowledge on the nature and the origin of the hydrothermal plume.

Several coverages of Woodlark Ridge segment 3 were carried out in the beginning and in the last part of Leg 2 (

Figure 69). The first coverage when arriving in the zone, was carried out with three NE-SW oriented water column acoustic profiles. An interesting hydrothermal fluid type echo was clearly observed on the real-time MBES screen during the second profile (

Figure 70 A). The echo was better observed in post-processed data and visible at the same location by the other two profiles (

Figure 70 B). This echo is located in the neighborhood of the TVG-150 point. Hydro-casts carried out along and across the NE part of segment 3 showed the presence of a regional plume corresponding to results already provided by the SO-203 cruise in 2009.

Several others acoustic coverages where carried out when returning to zone at the end of Leg 2 with two objectives: confirm the presence of the ECHO and collect data to expand the bathymetry of this part of the segment 3. Data have not yet been totally analyzed, but again, the same echo was visible on the same location. Two hydro-casts were carried out on the ECHO location and the vertical profiles confirmed the presence of a hydrothermal anomaly. CHUBACARC ROV VICTOR dive 19 surveyed the area validating the hydrothermal origin of the ECHO composed of several high-temperature black smokers (

Figure 71). The new hydrothermal site discovered in the segment 3 of the Woodlark Basin was named LA SCALA.

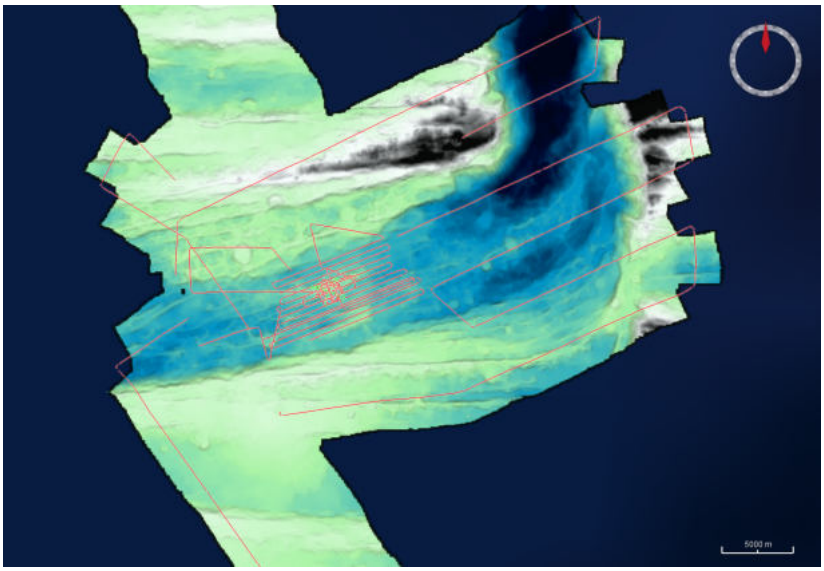


Figure 69 : water column acoustic coverages of the Woodlark Ridge Segment 3 carried out during CHUBACARC cruise (DTM: Pierre Le Meur, Chubacarc cruise data)

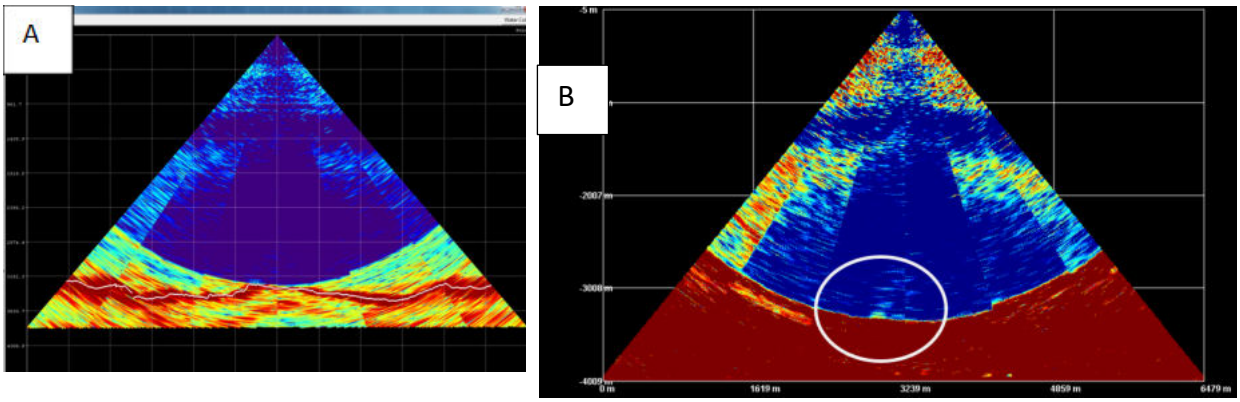


Figure 70 : (A) real time print screen of the MBES EM122 and (B) post processed polar echogram showing the ECHO potentially attributed to a hydrothermal vent in the Woodlark Ridge

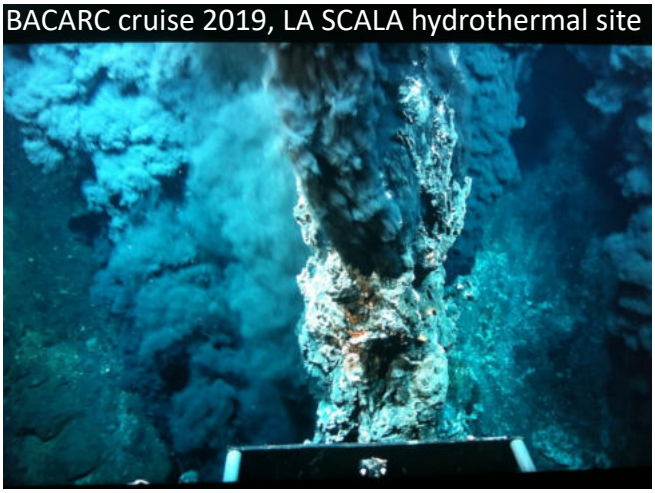


Figure 71 : black smokers of La Scala hydrothermal site discovered in the segment 3 of Woodlark Ridge (CHUBACARC ROV VICTOR dive 19)

6 Preliminary conclusions

The CHUBACARC cruise provided an uncommon opportunity to test again the potential use of ship-borne MBES signals to detect and locate deep sea hydrothermal vents. First, by surveying well known hydrothermal sites, hence, Pac-Manus and Su-Su Knolls hydrothermal sites generated strong and tall echoes at water depths in the range 1700-1200 mbss. Second, for discovering the hydrothermal site La Scala in the segment 3 of Woodlark Ridge at 3400 mbss.

Many thanks to Didier Jollivet and Stéphane Hourdez, co-leaders of Chubacarc cruise, for giving this opportunity to a recent experimental field of underwater acoustics.

CHUBACARC – Leg 2 (May 6 – June 7, 2019)

Water column chemistry - CTD-rosette operations

Preliminary report

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1. Objectives

The objectives of the CTD-rosette survey of the water column were primarily to detect and confirm anomalies in the water column due to hydrothermal activity on the seafloor above the segment 3 of the Woodlark Ridge, in coordination with acoustic survey of the seafloor and the water column. Once the source located, the objectives were to characterise the non-buoyant and buoyant plumes and to map its dispersal above the ridge.

On the Manus Basin, the objectives were to follow the chemical evolution of hydrothermal discharges from the endmember fluids to the buoyant plumes in different geological settings. A secondary objective was to evaluate the dispersal of dissolved gases from the source to the water column and their potential to sustain bacterial activity in different contexts.

Additionally, water filtration was performed on three stations, once the plume identified in the Woodlark basin, in order to attempt characterizing the microbial communities in the plume through environmental DNA analysis. The objective is to follow the changes in the biotic compartment associated to the plume, in order to compare it to the pattern of chemical evolution

of the signature, as well as to test for its possible role as a dispersing pathway for some lineages at increasing distance from the sites.

2. Equipment and sampling strategy

All operations were conducted using a 24-Niskin bottle rosette frame (Figure 1) onto which were mounted 2 Turbidimeters (Seapoint Turbidity Meters), 1 pH sensor (AMT GmBH) and 1 Eh sensor (AMT GmBH), as well as an altimeter for seafloor detection. Note that pH and Eh sensors were acquired through the LEFE action 'MEMESTRA' and belong to UMR 7144 (Station Biologique de Roscoff). The full CTD-rosette package was provided by the DT-INSU (Parc océanographique hauturier), which also provided the assistance for interfacing Eh and pH sensors on the CTDrosette. All sensors were interfaced to a SBE9+ (Seabird Electronics). The rosette frame was hung on the coaxial seacable using a shackle, while connection between the ship's cable and the CTDrosette was realized par the ship's engineers.

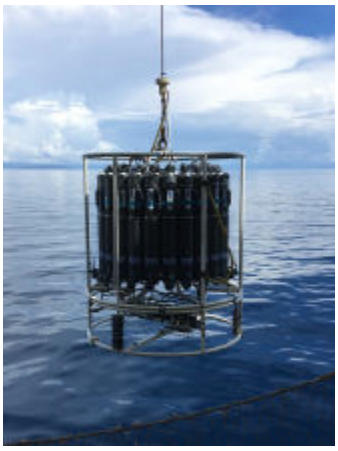

Figure 1. Deployment of the CTD-rosette fitted with 24 Niskin bottles, 2 Seapoint Turbidimeters, a pH and Eh sensor.

The other end of the seacable was connected to the SBE11+ deck unit interfaced to a PC. Seasave Software provided by Seabird Electronics was used for real-time data acquisition and display of the down- and upcasts data. Niskin bottles were fired during upcasts at different levels in the water column, whenever an anomaly (T, S, turbidity and Eh) appeared on the screen.

The CTD-rosette was deployed in tow ways, either as vertical casts or as towed casts ('tow-yos'). During vertical casts, the CTD-rosette was lowered in the water column at a speed of 1 m/sec or less to the deepest point. There, the depths for water sampling were chosen based on turbidity and Eh anomalies displayed on the screen. Bottles were fired on the way up step by step. From deployment to recovery, operations lasted about 3h for a 3400m water column.

Tow-yos consisted in lowering and raising the CTD-rosette between a constant set depth and 100 m above the seafloor while the ship moved along a transect at a maximum speed of 1 knot. Note that we chose this altitude because of the roughness of the seafloor in the Woodlark Basin. We

also reduced the speed of the ship to 0.5 knot to keep the cable as vertical as possible. Bottles were fired in the anomalies along the transect on the way up in order to map the plumes.

Physico-chemical characteristics of the water column as well as the sample bottle files were extracted using SBE-processing software, producing .cnv files, which are available on the cruise's hard drive.

Casts are named:

- CHU- for CHUBACARC
- CTD-xx for CTD cast number,
- D for downcast,
- U for upcast,
- T for tow-yos.

Samples are named

- CHU- for CHUBACARC
- CTD-xx for cast number,
- N-xx for Niskin number (1-24).

Water samples will be analysed for dissolved gas analysis (CH4 , CO2), ð 13 C-CH4 /DIC (C. Boulart), Trace Metals (Fe, Mn..), isotopes (O. Rouxel) and DNA (S. Arnaud).

Some of the Niskin bottles were targeted to filter water for environmental DNA characterization of the communities associated to the plume at increasing distances from the encountered active site. For each depth targeted depending on the intensity of the chemical signature, a volume of 5 liters water was filtered using Sterivex filters 0.2µm for environmental DNA analysis.

3. CTD locations

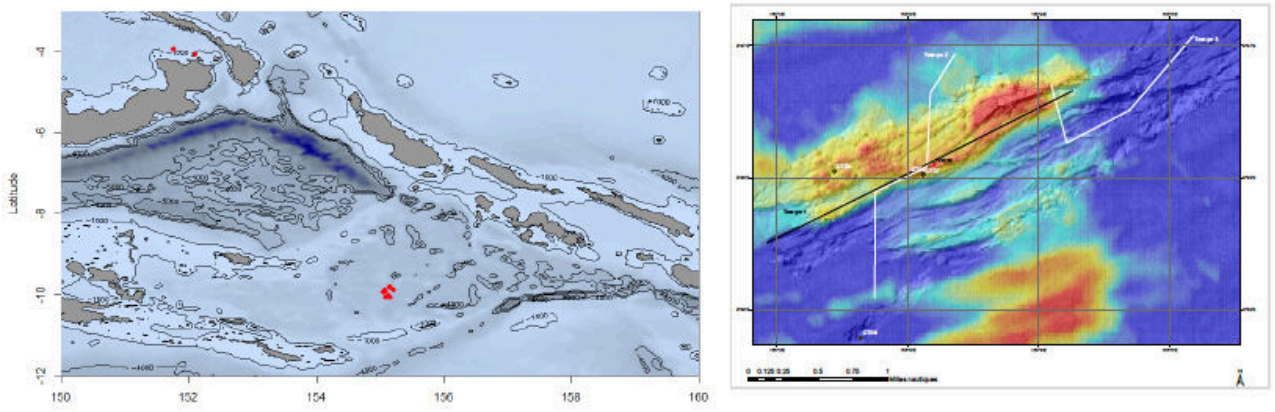

Figure 2. Locations of CTD-rosette hydrocasts (left) and towpaths over the Woodlark Segment 3B (right)

- Woodlark Basin

Locations for CTD-rosette deployments (Figure 2) were chosen from Laurila et al. (2012), who spotted several significant turbidity and Eh anomalies over the segment 3B of the Woodlark ridge. The strategy was to re-occupy the positions of these anomalies and follow the maximum anomaly. CTD 7, 8, 9 and 10 aimed at following the extension of the main plume over the Woodlark Ridge.

• Manus Basin

The CTD-rosette was deployed twice in the Manus Basin, over Big Papi vent site and North Su volcano (see Table 1). The strategy was to occupy the position of the main venting system in order to catch the buoyant plume.

4. Summary of operations

Date	Start time (UTC)	End time (UTC)	Cast#	Lat S	Long E	Depth (m)	Stations	Location	Site name	Type of operation
10/05/19	07:05:00		CHU-CTD01	9°47.353	155°04	3432	Ext2	Woodlark	TVG150 area	Tow-yo
				9°47.90	155°03.20	3350	TVG150	Woodlark	TVG150 area	Tow-yo
		12:45:00		9°48.087	155°02.754	3427	End	Woodlark	TVG150 area	Tow-yo
10/05/19	17:50:00		CHU-CTD02	9°47.054	155°03.370	3494	CTD2_4	Woodlark	TVG150 area	Tow-yo
							CTD2_3	Woodlark	TVG150 area	Tow-yo
							CTD2_2	Woodlark	TVG150 area	Tow-yo
		00:28:00		9°48.925	155°02.732	3475	CTD2_1	Woodlark	TVG150 area	Tow-yo
11/05/19	05:44:00		CHU-CTD03	9°46.919	155°05.182	3640	CTD3_1	Woodlark	TVG150 area	Tow-yo
				9°47.488	155°04.693		CTD3_2	Woodlark	TVG150 area	Tow-yo
				9°47.735	155°04.213		CTD3_3	Woodlark	TVG150 area	Tow-yo
		11:45:00		9°47.298	155.04095		CTD3_4	Woodlark	TVG150 area	Tow-yo
18/05/19	10:14:00	12:00:00	CHU-CTD04	3°43.728	151°40.330	1725	CTD4	Manus	Big Papi	Vert. Cast
24/05/19	03:33:00	05:30:00	CHU-CTD05	3°47.992	152°06.04	3297	CTD5	Manus	North Su	Vert. Cast
27/05/19	02:15:00	05:15:00	CHU-CTD06	9°47.978	155°03.117	3484	CTD6	Woodlark	La Scala	Vert. Cast
28/05/19	22:07:00	00:36:00	CHU-CTD07	9°47.979	155°03.119	3473	CTD7	Woodlark	La Scala	Vert. Cast
29/05/19	09:53:00	23:30:00	CHU-CTD08	9°47.952	155°02.439	3374	CTD8	Woodlark	La Scala	Vert. Cast
31/05/19	21:28:00	23:52:00	CHU-CTD09	9°49.211	155°02.639	3605	CTD9	Woodlark	Off-site	Vert. Cast
01/06/19	03:10:00	05:33:00	CHU-CTD10	9°49.394	155°00.188	3695	CTD10	Woodlark	Off-site	Vert. Cast

Table 1. Summary of CTD operations. Note that position and depths for tow-yos are for the first downcast.

• CHU-CTD01

On the first downcast, we found turbidity anomalies (0.08 NTU) centred around 3200m depth. These anomalies were found consistently along the way to TVG150 position (Figure 3). Because we did not find anomalies at the depth described by Laurila et al, we decided to tow-yo at a depth between 3100 and the bottom. At the end of the transect, on the last upcast (2 nautical miles in the WSW of TVG150), we spotted a significant turbidity anomaly together with a slight Eh anomaly at a depth of 2900m, i.e. 400m above the seafloor. It was noted that the density of the bottom waters was very high (1042), which would explain the altitude of the plume, if this plume was of hydrothermal origin. However, it is likely that the 2900m plume could have spotted before, around

TVG150. Anyhow, this plume is consistent with Laurila et al's findings. It was also noted that the current on the bottom was towards the SW.

During the upcasts, we closed several Niskin bottles (see appendix) in the maximum turbidity anomaly. At 12.45, the CTD-rosette was back on the deck.

CTD01 (Tow-yo) - Turbidity anomalies

• CHU-CTD02

CHU-CTD02, launched on 10/05/19 at 5.30pm, was a mix of tow-yos and fixed vertical cast along a path that crossed the CHU-CTD01 tow-yo near the TVG150 location. It was decided to slightly move the crossing point as consistent acoustic anomalies were found at a location SW of TVG150.

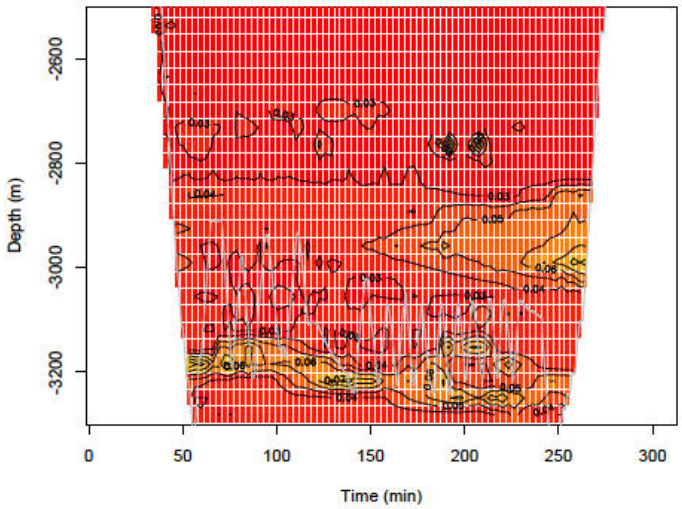

Figure 3: Turbidity anomalies along CTD01 profile. The grey line is the towpath of the CTD-rosette.

In order to check the distribution and the extension of the 2900m plume, we decided to start the profile north of the massif at CTD02-4, going SW towards CTD02-3, where a full vertical cast was carried out, then towards CTD02-2 (Figure 4), where a full vertical cast (Figure 5) was also done and finally SW to CTD02-1. At that time, we still had not left the 2900m plume, so we decided to go southward to check the southern extension of the anomaly but it was persistent. The first conclusions were the confirmation of a 'regional' plume above the entire area around the acoustic anomalies position as well as the presence of smaller plumes at 3200m. Because of the Eh anomaly and potentially a Temperature anomaly (0.03°C) around the TVG150, we could confirm the hydrothermal origin of the signals in the water column.

CTD02 - Towyo - Turbidity anomalies

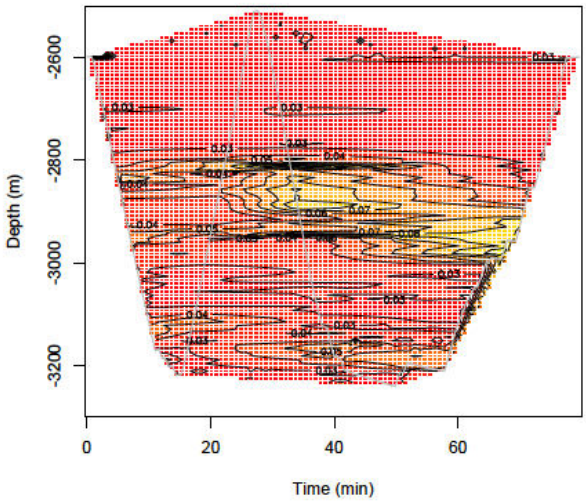

Figure 4: Turbidity anomalies along CTD02 profile between CTD02-3 and CTD02-2. The grey line is the towpath of the CTD-rosette.

• CHU-CTD03

While we confirmed the presence of a source somewhere in the SW part of the massif around TVG150, we also found some anomalies on the eastern part of the massif, which were also spotted on the echograms from the acoustic survey. In order to check the anomalies, we carried out a third tow-yo starting at CTD03-1 in the East of the massif. There, no anomaly was found throughout the entire water column. At CTD03-2, we caught the 'regional anomaly' at 2900m as well as small ones around 3200m depth (Figure 5). They got stronger all the way to CTD03-3.

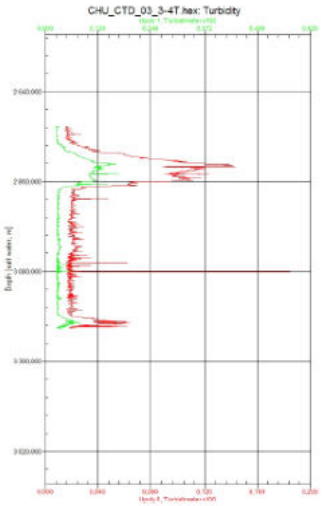

Figure 5: Turbidity anomaly at CTD03-2 showing the regional plume at 2800-2900 m depth

It was decided to come back at the end of the cruise to carry out another vertical cast close to TVG150 and the acoustic echoes.

• CHU-CTD04

This cast was carried out above the Big Papi vent site in the Manus Basin with the aim to catch the non-buoyant plume in the water column. We managed to find the buoyant plume at 1200m depth (Turbidity anomaly of 0.3 NTU) as well as the non-buoyant plume close to the seafloor at 1620m depth, with a strong Turbidity anomaly (0.4 NTU), Temperature anomaly (0.6°C) and Eh anomaly (50 mV) (Figure 6).

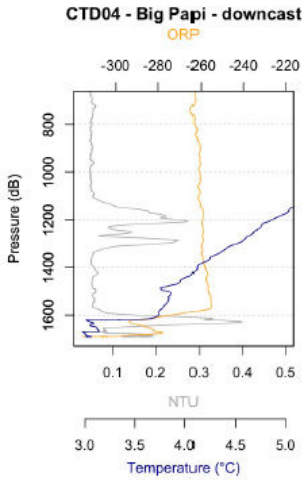

Figure 6: CTD and Eh profile over Big Papi vent site

• CHU-CTD05

The same operation as CTD04 was carried out above North Su vent site (Figure 7).

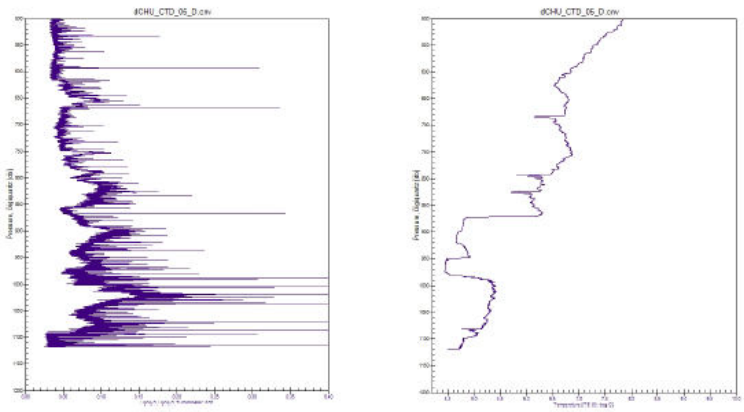

Figure 7: Turbidity (left) and temperature (right) anomalies above North Su vent site

• CHU-CTD06

Back to the Woodlark Basin, after a thorough study of the bathymetric chart as well as the echograms, we decided to carry out a vertical cast on a location slightly west of the TVG150 near a small ridge, in the area of the strongest acoustic anomalies. This was decided before the ROV exploration dive to find the active vent site. This was a successful cast as not only we retrieved the

regional plume at 2900m depth but also very strong turbidity anomalies (up to 0.5 NTU) at 3350m depth together with a significant Eh anomaly and a strong Temperature anomaly (0.3°C).

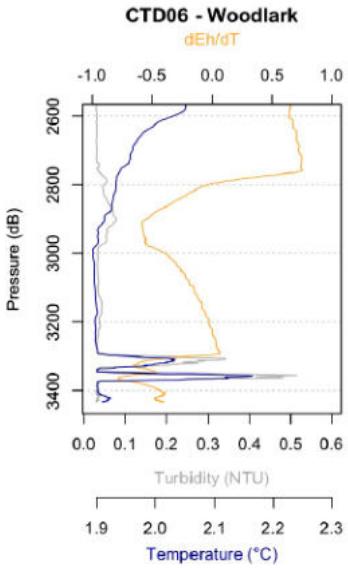

Figure 8: Turbidity, Eh and Temperature anomalies over the CTD06 station, near TVG150 in the vicinity of an active vent.

CHU-CTD06 confirmed the presence of an active vent site in the vicinity of the cast (20-30m). The following ROV dive found the active site, now named La Scala.

• CHU-CTD07

This cast was dedicated to study the structure of the plume above the new 'La Scala' vent site and evaluate the transfer of hydrothermal material in the water column as well as its dispersal above the ridge. The same position as CHU-CTD06 was re-occupied.

Interestingly, the structure of the plumes is different from CTD06, with a 'Christmas tree' shape (Figure 10). Turbidity anomalies went up to 0.6 NTU and temperature anomalies up to 0.2°C.

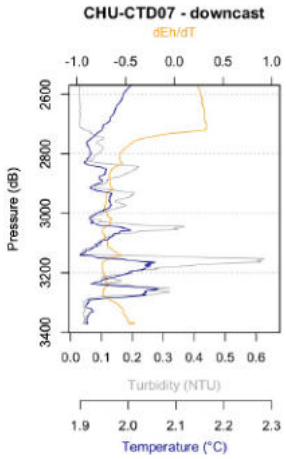

Figure 9: Non-buoyant and buoyant plumes above the newly discovered 'Scala' vent site.

Niskin bottles retained for water filtration in this rather heterogeneous "Christmas tree" were, kin order of increasing intensity of the chemical signature: CTD1&2, 21&23, 3&4, 12&13.

• CHU-CTD08, CHU-CTD09 and CHU-CTD10

These casts were dedicated to evaluate the extension of 'La Scala' plumes above the Woodlark ridge. As a result, we could see a small anomaly at 3100m depth to the south of the source (2.3 km) but nothing was detected SW to Scala (6.3 km).

In the more homogeneous plume profile of CHU-CTD-08, niskin bottles 1&2 were retained for filtration. For Niskin CHU-CTD09, low signal CTD 1&2 / 7 were sampled and filtered.

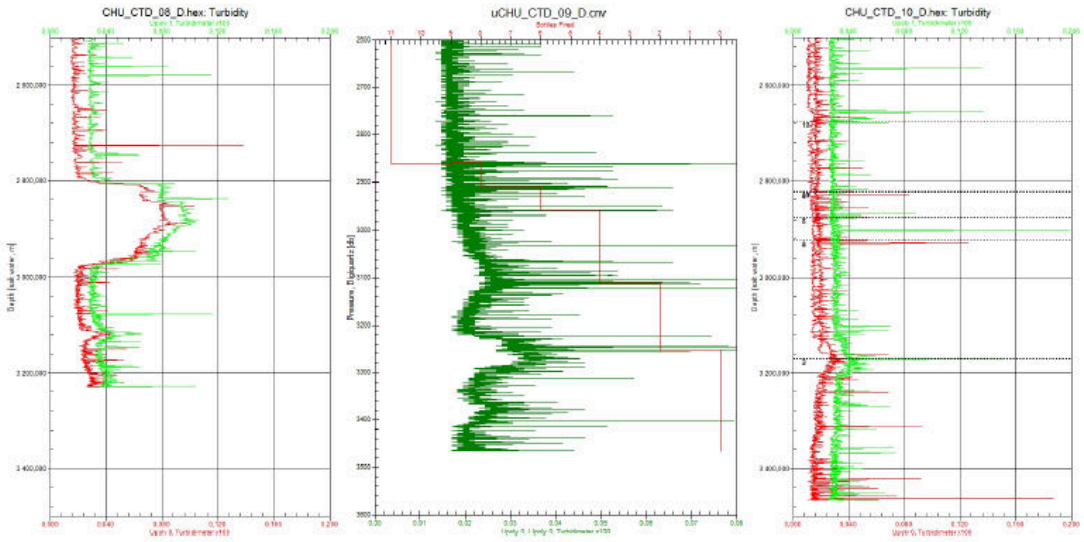

Figure 10: Turbidity profiles for CTD08, 09 and 10 (left to right)

References

Laurila, T. E., Petersen, S., Devey, C. W., Baker, E. T., Augustin, N., & Hannington, M. D. (2012). Tectonic and magmatic controls on hydrothermal activity in the Woodlark Basin: HYDROTHERMALISM IN THE WOODLARK BASIN. Geochemistry, Geophysics, Geosystems, 13(9). https://doi.org/10.1029/2012GC004247

Scientific Report CHUBACARC 2019 (Genetics Team)

LEG 1

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1- Overall scientific objectives

The *Chubacarc* cruise is associated to a broader scientific program called *Cerberus*, which is funded by the French National Agency for Research (ANR). The main objectives of this project are: (1) to evaluate the contemporary connectivity of deep-sea vent populations within and between western Pacific back-arc basins (BaBs), and (2) to determine whether the histories of ridge colonization by vent species reflect the past tectonic history of the whole western Pacific region. The studied basins, which include the North Fiji basin, the Lau basin, Futuna back-arc volcanoes, the Woodlark ridge and the Manus basin, represent altogether a discontinuous ridge system. The complex geological history of that system has shaped the evolutionary history of the vent species in multiple ways, including episodes of geographic isolation, secondary contacts and demographic changes (e.g. variation in population sizes). These processes are known to result in recognizable footprints within species' genomes, which make it possible to reconstruct the recent and past evolutionary history of vent species using the power of population genomics approaches. Here, we describe how these approaches will be implemented, using the samples that were collected during the course of the *Chubacarc* research cruise.

To estimate the levels of past and present genetic connectivity between vent populations, a variety of species have been targeted for genetic analyses. These species comprise emblematic symbiotic engineer species, a cortege of abundant and small-sized associated species, and a couple of more vulnerable filter-feeding peripheral species. Preliminary selection of species was performed according to differences in their life-history traits, and especially larval development. In this way, we expect that the analysis of multiple species with contrasted life-history traits will reveal the impact of species' biological features on genetic connectivity patterns. The symbiotic engineer species are the mytilid bivalves *Bathymodiolus brevior* and *B. manusensis*, and the large provannid snails *Alviniconcha* spp. and *Ifremeria nautilei* with planktotrophic development. Accompanying species with large population sizes include the limpets *Olgasolaris tollmanni* (planktotrophic), and *Lepetodrilus schrolli* (lecithotrophic), the polychaete species living on chimneys, *Paralvinella fijiensis*, and *P. hessleri*, and the scaleworms *Branchipolynoe pettibonae, Branchinotogluma segonzaci*, and *B. trifurcus*, all with lecithotrophic development and much smaller population sizes. Finally, peripheral fauna was mostly dominated by the cirriped *Eochionelasmus ohtai* and lolipop carnivorous sponges. This work will be part of two PhD studies (Jade Castel and Adrien Tran Lu Y) funded by the ANR *Cerberus*. These two PhD projects, together with parts of the PhD conducted by Camille Poitrimol (dealing with the geographic and environmental partition of the vent biodiversity; see Marjolaine Matabos' report), will federate the work of several researchers in the field of evolutionary sciences. These researchers belong to several French teams located in Montpellier, Roscoff and Banyuls. The people associated with this sampling effort during the leg1 of the *Chubacarc* cruise, which is the object of the present report, are: Nicolas Bierne, Pierre Alexandre Gagnaire, François Lallier, Jade Castel, Thierry Comtet, Stéphane Hourdez and Didier Jollivet.

2- Specific objectives targeted by the genetic analyses:

A. Barcoding each individual using classical sequencing of the mitochondrial *Cytochrome c oxidase 1* (*mtCOI*) gene in order to investigate the potential cryptic biodiversity contained in the samples and its regional distribution (i.e. over the whole western Pacific). To reach this goal, all specimens will be first barcoded to validate species assignation before searching for lower levels of species subdivision.

B. Inferring the phylogeographic history of each species in order to reconstruct how past episodes of inter-basin isolations and migrations have shaped the genetic diversity within species. One objective here is to test whether communities of BaBs have been more frequently and intensely isolated from each other than those from mid-oceanic ridges. We also want to relate geographic and genomic patterns of species subdivisions to the respective roles of different mechanisms of evolutionary diversification, such as sympatric and allopatric speciation. This should provide a better understanding of the evolution of the vent fauna in the light of the recent tectonic history of plates (2-20 Mya) that led to the opening of the basins. To reach these specific objectives, we will carry out a comparative study of genomic diversity from our series of selected species. The implemented approach called ddRAD genome sequencing (RADseq) will enable to genotype thousands of loci in hundreds of individuals per species (20 individuals per population, 2 sites per basin, 5 basins). This genome-wide diversity picture will allow us to cover a large range of divergence times, and correlate phylogeographic/migration patterns with the tectonic history of the BaBs. We will also investigate the presence of hybrids potentially generated by interbreeding between divergent lineages, and the level of introgression between such lineages. An analysis on the joint allele frequency spectrum of population pairs will then be conducted to evaluate historical demographic parameters, such as the population size, the direction and intensity of the gene flow, and divergence times. In some species whereby hybrid zones are suspected to exist between lineages, RADseq will be supplemented by RNAseq, which is a more suitable approach to capture polymorphism and divergence information in protein coding regions of the genome. These data will be finally used for assessing the impact of selection across the genomes, such as the analysis of adaptive substitution rates.

C. The last objective will be the inference of present-days spatial connectivity patterns within and between basins (BaBs). The study of connectivity requires the use of different complementary approaches: (1) the direct observation of larvae and postlarvae within populations combined with the elemental fingerprinting of larval shell to assign their origin, and (2) the indirect measurement of genetic connectivity based on observed differences in allele frequencies among populations at thousands loci across the genome, which can also be used to assign individuals to a specific origin of birth. Larval dispersal will be estimated by combining these two approaches. The encapsulated embryos (protoconch) of the gastropod species *Olgasolaris tollmanni* will be used to cross-validate the larval shell signature and multilocus-based genotype (ddRAD) assignments (see T. Comtet report).

1- Specific objectives for Bathymodiolus mussels, scaleworms and vestimentiferan tubeworms (N. Bierne, F. Lallier, T. Comtet & S. Hourdez).

Transmissible cancer in hydrothermal vent mussels.

Cancer cells are egoist entities that derived from and escaped the immune system controls of a multicellular organism. Cancerous cell lines usually become extinct with the death of their host; however, some cell lines

-called transmissible cancers- acquired the potential to infect a new host from the same or even another species. Transmissible leukemias has been identified in four marine bivalve species to date: soft-shell clams *Mya arenaria,* cockles *Cerastoderma edule,* golden carpet shell clams *Politapes aureus,* and bay mussels *Mytilus trossulus*. To our knowledge it has never been investigated in *Bathymodiolus* mussels. As their coastal counterpart these mussels also form dense populations and they have a strong filtering activity and no adaptive immune response with a weak self-recognition system. They are also long lived and face a carcinogenic prone environment. They are therefore good candidate to investigate the presence of transmissible cancer. Our objective is first to screen a high number of individuals for the presence of neoplasia in the hemolymph (leukemia) in order to test if disseminated neoplasia exists in hydrothermal vent mussels. Secondly, we expect to compare the genotype of blood cells and a hard tissue (mantle) in order to test for genetic chimerism which is the hallmark of transmissible cancer. In order to do this we will sample from the same mussel (I) a sample of hemolymph for cytological investigation, (ii) a sample of hemolymph for genetic analysis and (iii) a sample of mantle for a second genetic test.

Sex determination and Doubly Uni-parental Inheritance of mitochondrial DNA in Bathymodiolus mussels

The reproductive system of *Bathymodiolus* mussels is not well known. They are thought to be protandrous (sequential) hermaphrodites (male when young and female when older), but this has never been verified in species of the Pacific back-arc basin. Under the hypothesis that hermaphroditism is a derived state in *Bathymodiolus* mussels, if some species have retained an ancestral gonochoric system (separated sexes) we might expect to observe an unusual mode of mitochondrial genome inheritance observed in coastal *Mytilidae* species and called Doubly Uni-parental Inheritance (DUI): a female lineage transmitted from mother to daughters and a male lineage transmitted from father to sons. Some mussels of the sample will be sexed. This required microscopic inspection of the gonad. In addition, gonad DNA will be sequenced with mitochondrial markers in order to screen for heteroplasmy (the presence of two mitochondrial haplotypes in the same individual).

Search for a possible hybrid zone between B. brevior *and* B. manusensis *at Futuna/Mangatolo*

Previous studies reported the presence of *B. manusensis* at Futuna while *B. brevior* is the only species found at sites of both the Lau and North Fiji basins. Most genetic studies have been conducted with the mitochondrial marker mtCOI and no information about putative gene introgression between the two species have been already gained at the genome scale. The co-occurrence of two mussel morphotypes (one elongated and the other of short size) was also reported by R. von Cosel as two distinct morphological species, which were then synonymized by RC Vrijenhoek following the analysis of their mtCOI sequences. First examination of mussel samples suggests morphological differences between shells of mussels collected at Futuna/Mangatolo when compared with those of the Lau and North Fiji basins. Further genetic analyses at the genome scale will allow us to test whether these forms represent 'true' distinct species and whether they are still able to exchange genes at some locations.

Animal dissection and tissue preservation

In this context, DNA has been extracted from 220 mussels collected at nearly all localities (see Table 1a) during leg 1 for a total of 300 sampled and preserved, and 192 during leg 2 (Table 1b) for a total of 344 sampled. Its commensal scaleworm *Branchipolynoe pettibonae* was also collected when present and preserved in ethanol 80%. Additionally, several *Arcovestia* tubeworms were also collected in Kulo lasi in order to be compared with populations present in the Manus basin (Chubacarc leg2) and preserved in both ethanol and liquid nitrogen. Another free-living scaleworm *Branchinotogluma segonzaci* was collected for the multispecies comparison of the genetic structure of deep-sea vent organisms as this worm is living

together with *Paralvinella* worms on the wall of active vent chimneys and is widespread over the five back-arc basins of the western Pacific. A total of 165 worms were collected and preserved in ethanol 80% for subsequent DNA extraction and genetic analyses for leg 2, and about the same number for leg 1.

At the arrival on the boat, either from the elevator or from the ROV, mussels were taken from collection boxes, epifauna (limpets, barnacles, worms etc) removed with a plastic tip and seawater washing, and unbroken mussels were placed in a seawater tank in the cold room (temperature: 8°C). When the sample size was large enough, broken mussels were directly transferred into recipients with 80% ethanol. When the sample size was small, broken mussels were dissected in order to preserve a piece of gill and muscle tissue in 2ml eppendorf tubes with 80% ethanol, and mantle tissue transferred in a 2ml eppendorf tube with PK buffer for subsequent DNA extraction. Unbroken mussels stalled in cold seawater tanks were treated the following way:
- a plastic tip was inserted in-between the two valves of filtering mussels in the tank to maintain the two valves opened.
- from 1ml to 2ml of hemolymph was extracted from the muscle sinus with a syringe. Half of the hemolymph sample was transferred in 80% ethanol for subsequent genetic analysis and the other half was transferred in Davidson buffer (8% formalin) for subsequent cytological analysis.
- a sample of muscle and a sample of gill were preserved in 80% ethanol
- for mature individuals a sample of gonad was preserved in 80% ethanol
- a sample of mantle tissue was transferred into a 2 ml eppendorf tube with PK buffer for subsequent DNA extraction on board.
- for a sub-sample of 50 mussels from the Tow Cam site, a sample of gonad was also preserved in Davidson (8% formalin) for subsequent histological inspection and sexing.
- for the five first mussels of each study site, a sample of gill was fast frozen in liquid nitrogen and another preserved in RNA later buffer for subsequent analysis of gene expression and symbiosis.

Table 1a. *Bathymodiolus brevior*, *Branchipolynoe aff pettiboneae, Branchinotogluma segonzaci* and *Arcovestia* species samples collected during leg 1

Site	Sample	*B. brevior*	*B. pettiboneae*	*B. segonzaci*	*Arcovestia*
Kilo Moana - DIVE720 - Lau Basin	GBT2	10	1		
Tow Cam - DIVE721 - Lau Basin	GBT4	16			-
	PBT3	21	2		
	Aspi 8			1	
Tu'i Malila - DIVE722 - Lau Basin	GBT2	34			
	GBT4	2		1	
	GBT8	21	19		

	GBT9	15	17		
	Aspi4_7			17	
Phoenix - DIVE724 - Fidji Basin	GBT2	24	32		
	GBT3	18	4		
	Aspi2&8			11	
Mangatolo - DIVE726 - Lau Basin North	GBT3	17	1		
	PBT5	7	1		
	Aspi 4			11	
Aster'X - DIVE727 - Fatu Kapa - Futuna basin	GBT3	-	6		-
	Aspi 4			5	
Stephanie –DIVE727 Fatu kapa -Futuna	Aspi 7			20	
Fati Ufu - DIVE728 - Futuna basin	PBT7	5			
	Aspi3-8	2		48	
Kulo Lasi - DIVE729 - Futuna basin	aspi3&5	12	6	3	
	GB1				20
	GBT2	13	10		
	ROCK	4	4		
Tow Cam DIVE730 – Lau basin	GBT1-2	50	9		
	Aspi1-5			26	
ABE - DIVE731 - Lau basin	GBT1	29	16		
	Aspi6-8			22	
TOTAL		300	122	165	20

2- Specific objectives associated with the symbiotic gastropods *Alviniconcha* and *Ifremeria* (CASTEL Jade et JOLLIVET Didier)

Sampling of Alviniconcha *spp.*

Previous works indicated that the *Alviniconcha* complex of species is sub-divided into three mitochondrial species: *A. kojimai*, *A. boucheti* and *A. strummeri*, gradually structured along the Lau basin, with *A. boucheti* particularly abundant in the northern part of the basin and *A. strummeri* restricted to the southern site Tui'Malila (Beinart et al. 2012). The two former species were also described in the north Fiji basin, Futuna and the Manus basin. To examine more specifically the spatial distribution of these species and their possible hybridization at some locations, we performed a hierarchical sampling of the species over the three basins (North Fiji, Lau and Futuna) with environmental replicates on two distinct habitats (diffuse venting vs chimney). We also took advantage of the discovery of a new active site at Mangatolo triple junction to get additional *Alviniconcha* and *Ifremeria* samples at an intermediate position between the Lau basin and Futuna, Because no active site was found at the northern site Kino Moana, this new sample provides intermediate data that may be particularly interesting for speciation and inter-basin connectivity. Our first observation is that the three species co-occur on all the surveyed sites, with some subtle differences in their microhabitat. Depending on the site, animals were taken on both basalts with diffuse venting and chimneys to search for adaptive differences between individuals of a given species (RNAseq) and species habitat specificities. A total number of 526 *Alviniconcha* spp. was collected during this first leg

over 7 distinct fields (Tow Cam, Tui'Malila, ABE, North-Fiji triple junction, Mangatolo triple junction, Fatu kapa and Fati Ufu), with the noticeable exception of the Kulo lasi caldeira (see table 2). 142 individuals were attributed to *A. boucheti*, 201 to *A. kojimai* and only 64 to *A. strummeri*. Unfortunately, at the beginning of the cruise, we were unable to discriminate species easily and, 113 individuals were not assigned to a given species.

For each gastropod, a piece of gill and a piece of foot were placed in ethanol 80% for preservation. A second fragment of gill was preserved in RNAlater for a future RNA extraction. For the majority of individuals (474 ind), DNA was extracted directly on board from fresh asymbiotic tissues using either a Macherey-Nagel tissue kit or the CTAB/PVP protocol with chloroform. However, due to lack of time, 52 samples have been stored at -80 ° C and will be extracted later in the laboratory. The shell of each animal was measured and photographed to search for morphological characters able to discriminate species. A fragment of the shell has also been stored to examine more carefully the arrangement of 'bristles', which seems to represent a discriminating trait between species. Gonads were also dissected for gender identification and reproductive patterns (see F. Pradillon report).

From DNA extracts, both ddRAD and mtCOI sequencing will be performed in order to assess the genetic structuring of each species and quantify the level of gene introgression between species (i.e. mitochondrial lineages) if any. 16S amplification of symbionts from the gill tissues by qPCR will also allowed us to also get a clearer information about the symbiotic association within each individual according to both environmental conditions, phylogenetic constraints and possible hybridization. Subsequent genetic analyses will then allowed us to test different evolutionary hypotheses about speciation.

Sampling of Ifremeria nautilei

The sampling of *Ifremeria nautilei* was similar to that of *Alviniconcha* spp. but *Ifremeria* was also found in Kulo lasi (Futuna). 432 individuals of *Ifremeria nautilei* were collected during this first leg over the 8 vent fields (see table 2). For each gastropod, and a piece of foot was preserved in ethanol 80%, and a piece of gill was stored in liquid nitrogen in order to study its bacterial symbiosis. For the majority of individuals (352 ind.), DNA was extracted directly on board from fresh asymbiotic tissues using either a Macherey-Nagel tissue kit or the phenol/chloroform method. Genetic analyses will be then performed using a ddRAD approach to evaluate the degree of population connectivity between basins.

In vivo *experimentations on board*

Heat shock experiments were made in tanks at atmospheric pressure during this first leg for the three *Alviniconcha* species and *Ifremeria nautilei*. They were conducted with the aim of observing if *Alviniconcha spp.* and *I.nautilei* species display differences in their thermal preferences. For this, after 24 hours in the cold room (recovery after depressurization), 16 individuals of each species were placed under 4 thermal regimes (4°C, 10°C, 15°C and 20°C). Animals were sampled at two different times (3h30 and 12h30) after the thermal shock in order to visualize the stress response (3h30) and the long-term response (acclimatization, 12h30) of the individuals. Thus, for each time and each temperature, only 2 replicates were taken. This sampling effort was minimal because of the number of animals caught for each species with the ROV. For each individual, a fragment of gill was flash-frozen in liquid nitrogen (rapid fixation for gene expression analysis) and in ethanol 80% for species identification and genotype. A shell fragment was also collected for future identification. The bioinformatic analysis of transcriptomes will allow us to design primers specific of heat-shock proteins (hsp40, 70, 90) and genes involved in the oxidative stress response. Portions of these genes will be then amplified by qPCR on the experimented individuals to examine their levels of expression in the face of temperature.

Sampling of Paralvinella *tubeworms*

In addition, *Paralvinella* polychaetes have been sampled on the walls of active vent chimneys for population genetics analyses. First examination of individuals indicated that they are mostly belonging to the species *Paralvinella fijiensis*. However, species determination was not easy on small specimens and there is a non-negligible possibility that some *Paralvinella hessleri* but also a still undescribed species co-occur with *P. fijiensis* at some locations. All specimens have been stored in ethanol 80% for further morphological investigations and will be subsequently barcoded at the Cytochrome c oxidase mitochondrial gene. Specimens belonging to *P. fijiensis* will be then used to assess population connectivity at the scale of the three basins surrounding the Fiji islands.

Table 2. Gastropod species (*Alviniconcha* & *Ifremeria*) and *Paralvinella* samples

Site	Sample	Alviniconcha spp.	A. kojimai	A. boucheti	A. strummeri	I. nautilei	P. hessleri
Tow Cam - DIVE721 - Bassin de Lau	Vac 8	-	-	-	-	-	1
	GBT1	24	2	6	2	-	-
	GBT2	-	-	-	-	44	-
	GBT4	-	-	-	-	8	-
	GBT5	-	-	-	-	28	-
	GBT6	46	-	-	-	-	-
	GBT7	20	-	-	-	-	-
Tu'i Malila - DIVE722 - Bassin de Lau	Vac 4-7	-	-	-	-	-	31
	GBT1	-	18	17	20	-	-
	GBT2	-	-	-	-	12	-
	GBT3	-	-	-	-	28	-
	GBT5	23	2	4	19	-	-
	GBT6	-	-	-	-	41	-
	GBT7	-	15	15	6	-	-
	GBT9	-	-	-	-	24	-
Tow Cam - DIVE723 - Bassin de Lau	Vac 4-5	-	-	-	-	19	-
	Vac 6-7	-	-	-	-	19	-
Phoenix - DIVE724 - Bassin Fidjien	Vac 6	-	-	-	-	-	10
	GBT1	-	-	-	-	24	-
	GBT4	-	16	23	-	-	-
	PBT4	-	16	18	8	-	-
	PBT6	-	-	-	-	24	-
Mangatolo - DIVE726 - Lau Nord	Vac 2	-	-	-	-	-	2
	Vac 5	-	-	-	-	-	2
	Vac 7	-	-	-	-	-	7
	GBT2	-	-	-	-	24	-
	GBT3	-	4	-	-	-	-
	GBT4	-	26	-	-	-	-
	PBT4	-	-	-	-	24	-
	PBT6	-	18	3	-	-	-

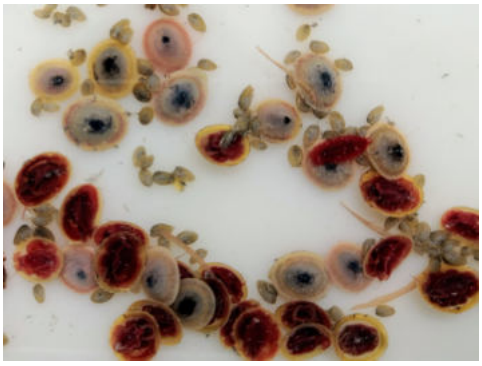
Aster'X - DIVE727 - Fatu Kapa - Futuna	Vac 3	-	-	-	-	-	26
	Vac 4	-	-	-	-	-	17
	GBT2	-	26	-	-	-	15
	GBT3	-	-	-	-	24	-
Stephanie - DIVE727 - Fatu Kapa - Futuna	Vac 7	-	-	-	-	-	24
	GBT4	-	17	-	-	-	9
	GBT5	-	-	-	-	23	8
Fati Ufu - DIVE728 - Futuna	Vac 2	-	-	-	-	-	6
	Vac 3	-	-	-	-	-	11
	Vac 4	-	-	-	-	-	20
	Vac 6	-	-	-	-	-	2
	Vac 7	-	-	-	-	-	2
	GBT2	-	27	-	6	-	3
	GBT3	-	-	-	-	32	16
	GBT4	-	-	-	-	24	-
	PBT4	-	39	-	3	-	11
	PBT7	-	3	4	-	-	-
Kulo Lasi - DIVE729 - Futuna	Vac 5	-	-	-	-	-	3
	GBT2	-	-	-	-	24	-
Tow Cam - DIVE730 - Lau	Vac 1	-	-	-	-	-	1
	Vac 4	-	-	-	-	-	20
	Vac 5	-	-	-	-	-	15
ABE - DIVE731 - Lau	Vac 3	-	-	-	-	-	16
	Vac 4	-	-	-	-	-	2
	Vac 5	-	-	-	-	-	10
	Vac 7	-	-	-	-	-	8
	Vac 8	-	-	-	-	-	13
	GBT2	-	-	-	-	24	-
	GBT3	-	1	27	2	-	-

3- Specific objectives associated with the accompanying and peripheral species (GAGNAIRE Pierre-Alexandre)

Small-size accompanying species

Two species of limpets with different larval developments have been collected: *Olgasolaris tollmanni* and *Lepetodrilus schrolli*. These are abundant and small-sized accompanying species, which forage on the shells of *Bathymodiolus* mussels and provannid snails. *Lepetodrilus* is likely to incubate its fertilized eggs before spawning them in the water column as lecithotrophic larvae whereas *Olgasolaris* lays egg capsules onto the shell of *Ifremeria* from which planktotrophic larvae are released. Therefore, these two species rely on the presence of the large-sized engineering species to install and maintain. Each of these two species can be found both on *Bathymodiolus* mussels and *Ifremeria* snails. Therefore, a host-specific association of cryptic genetic lineages may exist within each of these species, which will be tested using population genomic approaches. Shell differences have been already found between *Lepetodrilus* samples at Futuna (Kulo lasi vs Fatu kappa) according to the host species. Because the two limpets have a lecithotrophic development, their dispersal potential and therefore their degree of spatial and evolutionary connectivity

may be more restricted compared to planctotrophic species. This hypothesis will be tested by comparing the inferred demographic histories of lecithotrophic and planctotrophic species. Using ddRAD genome scans, we will also test whether these more abundant species display a higher level of genetic diversity, as expected due to a reduced effect of genetic drift.



Picture of the two limpets Olgasolaris tollmanni *(the large one) and* Lepetodrilus schrolli *(the small one) sampled for evolutionary genomics studies.*

Peripheral species of hydrothermal vent ecosystems

The cirriped *Eochionelasmus ohtai*, which was the most abundant species of cirriped found during the *Chubacarc* leg1, was sampled for evolutionary genomic studies. This species has the particularity to perform egg fertilization within its shell and to incubate its eggs (and maybe small larvae) before releasing them in the water. Therefore, a lower dispersal potential is expected to have imprinted both long and short-term evolutionary patterns in this species, increasing the chance for genetic subdivision. This hypothesis will be tested using ddRAD genome scans to evaluate past and contemporary genetic connectivity patterns in this species.

Picture of the cirriped Eochionelasmus ohtai *sampled for evolutionary genomics studies.*

Sampling for population genetics

Each of the three species described above (*Olgasolaris tollmanni*, *Lepetodrilus schrolli*, and *Eochionelasmus ohtai*) were submitted to the same sampling protocol, consisting of up to 50 individuals per site (when possible). *Olgasolaris tollmanni* and *Lepetodrilus schrolli* were evenly sampled from *Bathymodiolus* mussels and *Ifremeria* snail shells, while *Eochionelasmus ohtai* was most of the time sampled from a piece of rock, if not present on *Bathymodiolus* mussel shells. A detailed description of the sampling in each species is provided in the table 3 below.

Animal dissection and tissue preservation

Each sample was preserved individually in a 2ml tube filled with 80% ethanol, and shells larger that 5mm were separately conserved in 20ml vials filled with ethanol. Half of the samples (i.e. the 24 first individuals of each collected site) were cut into two pieces, one preserved in ethanol and the other submitted to on-board DNA extraction. DNA isolation and purification was initiated by a tissue lysis with proteinase K digestion in CTAB buffer at 56°C overnight, and ended by chloroform extraction followed by 100% ethanol precipitation. Finally, individual DNA was conserved at -20°C in 70% ethanol for subsequent molecular genetics analyses. All collected samples metadata were entered in an Access database for secure data information collection and management during the course of the project.

Table 3. Associated small species and peripheral species samples

SITE	SAMPLE	*O. tollmanni*	*L. schrolli*	*E. ohtai*
Kilo Moana - DIVE720 - Lau Basin	GBT1	-	-	5
	GBT2	-	-	3
	GBT3	-	-	9
	ROCK	-	-	31
Tow Cam - DIVE721 - Lau Basin	GBT2	-	26	-
	GBT4	50	24	-
	GBT5	50	24	-
	PBT3	-	26	24
	ROCK	-	-	29
Tu'i Malila - DIVE722 - Lau Basin	GBT2	-	26	-
	GBT3	50	16	-
	GBT9	49	32	50
Phoenix - DIVE724 - Fidji Basin	GBT1	50	24	-
	GBT3	-	26	50
	PBT6	50	24	-
	ROCK	-	-	5
Mangatolo - DIVE726 - Lau Basin North	GBT2	50	24	-
	GBT3	-	50	50
	PBT4	-	26	-
	PBT5	50	24	50
Aster'X - DIVE727 - Fatu Kapa - Futuna basin	GBT3	-	6	-
	PBT3	50	-	-

	ROCK	-	-	50
Stephanie - DIVE727 - Fatu Kapa - Futuna basin	GBT4	2	2	-
	GBT5	48	24	7
	ROCK	-	-	50
Fati Ufu - DIVE728 - Futuna basin	GBT3	49	2	-
	GBT4	50	26	13
	ROCK	-	-	50
Kulo Lasi - DIVE729 - Futuna basin	VAC3	-	36	-
	GBT2	46	50	-
	ROCK	-	-	50
ABE - DIVE731 - Lau basin	GBT1	-	26	-
	GBT2	50	24	-
	ROCK	-	-	50
TOTAL		694	568	576

Further analyses in the Lab for all targeted species

The next steps, which will be realized in France will involve ddRAD individual library construction and sequencing. This will generate the raw material for subsequent bioinformatic treatments that will aim at generating a genome-wide polymorphisms dataset for each species. Then, dedicated evolutionary genomics analyses will be conducted to first, describe the spatial genetic structure of each species, and then related these patterns to contemporary and historical genetic connectivity. Finally, the results obtained for each species will be combined across all species to provide a more complete overview of how genetic diversity of species with different life-history traits has been shaped by the complex geological history of the studied region.

4- Additional preservation of tissues for qualitative histological studies (LALLIER François)

Mussels (*Bathymodiolus*), provannid gastropods (*Alviniconcha*, *Ifremeria*) and siboglinid tubeworms (*Arcovestia*) are well known for their endosymbiosis with chemoautotrophic bacteria. Although this is not a major objective of the Cerberus program, we have preserved gill tissue (or trophosome for tubeworms) of some individuals either to compare with extensive previous studies on atlantic *Bathymodiolus* or to verify, at least qualitatively, the presence and extent of symbiotic bacteria.

Gill tissue or trophosome tissue were fixed in Paraformaldehyde for later fluorescent *in situ* hybridation studies (FISH) or in glutaraldehyde for examination under transmission electronic microscopy (TEM). Some samples were frozen in liquid nitrogen for later DNA, RNA or protein studies

In our analysis, a particular attention will be given to apoptosis extent in these symbiotic tissues since our recent work has revealed an elevated level of apoptosis in the gill of other *Bathymodiolusodiolus* species in relation to symbiotic bacterial content.

Table of treated individuals for histological studies of symbiosis

Species / Dive	721	722	723	724	726	728	729	730	731
Bathymodiolus	7	5	8	3	3		2	5	2
Alviniconcha	2			5	2	1			
Ifremeria		3				10			
Arcovestia								5	

Scientific Report CHUBACARC 2019

LEG2
Genetics

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The scientific objectives were the exact continuation of those of Leg 1, except that the team was largely renewed with the exception of two people who remained on board.
Leg 2 was centered on the Papuan basins of Manus and Woodlark, with 7 fruitful ROV dives. It was a success in continuation of Leg 1, even if slightly less individuals have been collected.

We give below the complete count of individuals that have been processed individually for further genetic analysis (1358 samples extracted on board, 2205 collected altogether).

Sampling realized during Chubarcarc leg 2: the hierarchical sampling described above was repeated in the Manus basin and in the newly discovered site "La Scala" in the Woodlark basin. Two of the three *Alviniconcha* species were found (*A. boucheti* and *A. kojimai*). During this leg, 290 *Alviniconcha* individuals (178 *A. boucheti*, 111 *A. kojimai*, 1 unidentified) were sampled over 4 distincts areas (Pacmanus, Desmos, Susu, La Scala), see Table 1.

During this leg, a piece of gill and a piece of foot were stored in 80% ethanol for preservation, and another fragment of gill was also preserved in RNAlater. Another piece of foot was immediately used for C-tab extraction onboard. In addition, 122 of these individuals were also sampled for later isotopic analyses (see report by Loic Michel), 40 were dissected for fine-scale analyses of symbiosis patterns (see report by Valérie Cueff), and ca. 40 were chosen for hemolymphe sampling (see report by Aurélie Tasiemski). We used the same methodology as in leg 1 for pictures, shell measures and shell fragments.

Overall, the Chubacarc mission allowed us to sample 816 *Alviniconcha* individuals over five basins.

Table 1. *Alviniconcha* species sampled during Chubacarc leg 2

Site	Sample	*Alviniconcha* spp.	*A. kojimai*	*A. boucheti*	*A. strummeri*
Pacmanus - DIVE 733 - Bassin de Manus	GBT2	-	-	24	-
	GBT8	-	-	24	-
	GBT9	-	-	13	-
	GBT11	-	-	5	-
	PBT7	-	-	5	-
Pacmanus - DIVE 734 - Bassin de Manus	GBT9	-	-	23	-
Desmos - DIVE 735 - Bassin de Manus	-	-	-	-	-
Susu - DIVE 736 - Bassin de Manus	GBT3	-	24	-	-
	GBT10	-	22	-	-
Susu - DIVE 737 - Bassin de Manus	GBT7	-	-	24	-
	GBT10	-	-	24	-
	PBT5	1	17	12	-
La Scala - DIVE 738 - Bassin de Woodlark	GBT10	-	27	-	-
La Scala - DIVE739 - Bassin de Woodlark	GBT10	-	21	-	-
	PBT5	-	-	24	-

Samples collected and processed on board for DNA extractions are summarized in Table 2, including the gastropods *Alviniconcha* spp. This table was extracted from our genetic database specifically designed by F. Bonhomme and A. Tran Lu Y for further investigations in the preparation of ddRAD librairies and subsequent genetic analyses.

In this context, DNA has been extracted from 192 mussels during leg 2 for a total of 344 sampled for the fluid sampling (Table 3b). Its commensal scaleworm *Branchipolynoe pettibonae* was also collected when present and preserved in ethanol 80%. Additionally, several *Arcovestia* tubeworms were also collected in Desmos and frozen at -80°C in order to be compared with populations present at Kulo lasi (Chubacarc leg1). Another free-living scaleworm *Branchinotogluma segonzaci* was collected for the multispecies comparison of the genetic structure of deep-sea vent organisms as this worm is living together with *Paralvinella* worms on the wall of active vent chimneys of the PacManus and Susu chimneys and is widespread over the five back-arc basins of the western Pacific. A total of 165 *Branchinotogluma segonzaci* worms were collected and preserved in ethanol 80% for subsequent DNA extraction and genetic analyses for leg 2.

Table 2. Biological samples (all species confounded) collected during leg 2 for population genetics.

Bassin	Site	Longitude	Latitude	Date	Profondeur	Plongee	Genre	N
Manus	Big_Papi	E 151 40.335	S 03 43.731	16/05/2019	1708	733	BRANCHINOTOGLUMA	9
Manus	Big_Papi	E 151 40.336	S 03 43.731	16/05/2019	1708	733	ALVINICONCHA	24
Manus	Fenway	E 151 40.344	S 03 43.704	16/05/2019	1701	733	LEPETODRILUS	50
Manus	Fenway	E 151 40.342	S 03 43.707	16/05/2019	1703	733	IFREMERIA	24
Manus	Fenway	E 151 40.342	S 03 43.707	16/05/2019	1703	733	LEPETODRILUS	50
Manus	Fenway	E 151 40.342	S 03 43.707	16/05/2019	1703	733	OLGASOLARIS	50
Manus	Fenway	E 151 40.344	S 03 43.704	16/05/2019	1701	733	BATHYMODIOLUS	5
Manus	Fenway	E 151 40.344	S 03 43.704	16/05/2019	1701	733	EOCHIONELASMUS	24
Manus	Fenway	E 151 40.344	S 03 43.704	16/05/2019	1701	733	BRANCHIPOLYNOE	2
Manus	Snowcap	E 151 40.213	S 03 43.691	16/05/2019	1640	733	BATHYMODIOLUS	33
Manus	Snowcap	E 151 40.213	S 03 43.691	16/05/2019	1640	733	BRANCHIPOLYNOE	34
Manus	Big_Papi	E 151 40.334	S 03 43.729	17/05/2019	1709	733	BRANCHINOTOGLUMA	18
Manus	Big_Papi	E 151 40.334	S 03 43.729	17/05/2019	1709	733	PARALVINELLA	8
Manus	Fenway	E 151 40.367	S 03 43.665	17/05/2019	1699	733	IFREMERIA	24
Manus	Fenway	E 151 40.367	S 03 43.665	17/05/2019	1699	733	LEPETODRILUS	24
Manus	Fenway	E 151 40.370	S 03 43.681	17/05/2019	1698	733	BATHYMODIOLUS	50
Manus	Fenway	E 151 40.370	S 03 43.681	17/05/2019	1698	733	BRANCHIPOLYNOE	35
Manus	Fenway	E 151 40.370	S 03 43.681	17/05/2019	1698	733	LEPETODRILUS	24
Manus	Fenway	E 151 40.372	S 03 43.684	17/05/2019	1698	733	ALVINICONCHA	24
Manus	Fenway	E 151 40.372	S 03 43.684	17/05/2019	1698	733	PARALVINELLA	10
Manus	Fenway	E 151 40.374	S 03 43.684	17/05/2019	1698	733	PARALVINELLA	31
Manus	Solwara_8	E 151 40.441	S 03 43.825	18/05/2019	1739	733	ALVINICONCHA	5
Manus	Solwara_8	E 151 40.441	S 03 43.825	18/05/2019	1739	733	IFREMERIA	24
Manus	Solwara_8	E 151 40.441	S 03 43.825	18/05/2019	1739	733	LEPETODRILUS	24
Manus	Solwara_8	E 151 40.443	S 03 43.834	18/05/2019	1734	733	ALVINICONCHA	5
Manus	Solwara_8	E 151 40.443	S 03 43.834	18/05/2019	1734	733	IFREMERIA	2
Manus	Solwara_8	E 151 40.451	S 03 43.825	18/05/2019	1736	733	EOCHIONELASMUS	24
Manus	Solwara_8	E 151 40.452	S 03 43.820	18/05/2019	1737	733	BRANCHINOTOGLUMA	1
Manus	Solwara_8	E 151 40.460	S 03 43.820	18/05/2019	1737	733	OLGASOLARIS	24
Manus	Solwara_8	E 151 40.458	S 03 43.821	18/05/2019	1737	733	ALVINICONCHA	13
Manus	Fenway	E 151 40.360	S 03 43.675	19/05/2019	1696	734	BATHYMODIOLUS	53
Manus	Fenway	E 151 40.360	S 03 43.675	19/05/2019	1696	734	BRANCHIPOLYNOE	26
Manus	Romans_Ruins	E 151 40.469	S 03 43.287	19/05/2019	1659	734	IFREMERIA	10
Manus	Romans_Ruins	E 151 40.469	S 03 43.287	19/05/2019	1659	734	ALVINICONCHA	23
Manus	Romans_Ruins	E 151 40.469	S 03 43.287	19/05/2019	1659	734	LEPETODRILUS	24
Manus	Romans_Ruins	E 151 40.469	S 03 43.287	19/05/2019	1659	734	OLGASOLARIS	24
Manus	Romans_Ruins	E 151 40.463	S 03 43.287	19/05/2019	1666	734	BRANCHINOTOGLUMA	3
Manus	Solwara_6	E 151 40.867	S 03 43.649	19/05/2019	1725	734	LEPETODRILUS	24
Manus	Solwara_6	E 151 40.842	S 03 43.680	19/05/2019	1740	734	EOCHIONELASMUS	24
Manus	Solwara_6	E 151 40.867	S 03 43.649	19/05/2019	1725	734	BATHYMODIOLUS	50
Manus	Solwara_6	E 151 40.867	S 03 43.649	19/05/2019	1725	734	BRANCHIPOLYNOE	20
Manus	Solwara_7	E 151 40.374	S 03 43.042	19/05/2019	1769	734	IFREMERIA	24
Manus	Solwara_7	E 151 40.374	S 03 43.042	19/05/2019	1769	734	LEPETODRILUS	24
Manus	Solwara_7	E 151 40.374	S 03 43.042	19/05/2019	1769	734	OLGASOLARIS	24
Manus	Solwara_7	E 151 40.377	S 03 43.033	19/05/2019	1765	734	BRANCHINOTOGLUMA	3
Manus	Solwara_6	E 151 40.854	S 03 43.654	20/05/2019	1729	734	IFREMERIA	24
Manus	Solwara_6	E 151 40.854	S 03 43.654	20/05/2019	1729	734	LEPETODRILUS	24

Manus	Solwara_6	E 151 40.854	S 03 43.654	20/05/2019	1729	734	OLGASOLARIS	24
Manus	Desmos	E 151 51.933	S 03 41.528	21/05/2019	1896	735	BATHYMODIOLUS	5
Manus	Desmos	E 151 51.933	S 03 41.528	21/05/2019	1896	735	BRANCHIPOLYNOE	3
Manus	Desmos	E 151 51.985	S 03 41.542	21/05/2019	1912	735	LEPETODRILUS	24
Manus	North_Su	E 152 06.060	S 03 47.942	22/05/2019	1210	736	BATHYMODIOLUS	50
Manus	North_Su	E 152 06.060	S 03 47.942	22/05/2019	1210	736	BRANCHIPOLYNOE	31
Manus	North_Su	E 152 06.060	S 03 47.942	22/05/2019	1210	736	LEPETODRILUS	24
Manus	Suzette	E 152 05.819	S 03 47.374	22/05/2019	1520	736	EOCHIONELASMUS	24
Manus	Suzette	E 152 05.783	S 03 47.368	22/05/2019	1505	736	ALVINICONCHA	24
Manus	Suzette	E 152 05.783	S 03 47.368	22/05/2019	1506	736	IFREMERIA	24
Manus	Suzette	E 152 05.783	S 03 47.368	22/05/2019	1506	736	LEPETODRILUS	24
Manus	Suzette	E 152 05.783	S 03 47.368	22/05/2019	1506	736	OLGASOLARIS	24
Manus	North_Su	E 152 06.046	S 03 47.935	23/05/2019	1216	736	LEPETODRILUS	24
Manus	North_Su	E 152 06.046	S 03 47.935	23/05/2019	1216	736	OLGASOLARIS	24
Manus	North_Su	E 152 06.084	S 03 46.957	23/05/2019	1194	736	LEPETODRILUS	12
Manus	North_Su	E 152 06.089	S 03 47.957	23/05/2019	1195	736	BATHYMODIOLUS	51
Manus	North_Su	E 152 06.089	S 03 47.957	23/05/2019	1195	736	BRANCHIPOLYNOE	19
Manus	North_Su	E 152 06.089	S 03 47.957	23/05/2019	1195	736	LEPETODRILUS	24
Manus	North_Su	E 152 06.046	S 03 47.933	23/05/2019	1218	736	ALVINICONCHA	22
Manus	North_Su	E 152 06.045	S 03 47.936	23/05/2019	1215	736	EOCHIONELASMUS	24
Manus	North_Su	E 152 06.046	S 03 47.935	23/05/2019	1216	736	IFREMERIA	24
Manus	Suzette	E 152 05.412	S 03 47.412	23/05/2019	1579	736	BRANCHINOTOGLUMA	1
Manus	Suzette	E 152 05.733	S 03 47.348	23/05/2019	1497	736	BRANCHINOTOGLUMA	17
Manus	Suzette	E 152 05.794	S 03 47.345	23/05/2019	1503	736	BRANCHINOTOGLUMA	6
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	BATHYMODIOLUS	24
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	BRANCHIPOLYNOE	24
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	LEPETODRILUS	24
Manus	South_Su	E 152 06.314	S 03 48.556	24/05/2019	1331	737	BRANCHINOTOGLUMA	1
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	IFREMERIA	24
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	ALVINICONCHA	24
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	LEPETODRILUS	24
Manus	South_Su	E 152 06.310	S 03 48.582	24/05/2019	1353	737	OLGASOLARIS	24
Manus	South_Su	E 152 06.299	S 03 48.530	24/05/2019	1300	737	ALVINICONCHA	30
Manus	South_Su	E 152 06.300	S 03 48.482	25/05/2019	1360	737	BRANCHIPOLYNOE	29
Manus	South_Su	E 152 06.300	S 03 48.482	25/05/2019	1360	737	BATHYMODIOLUS	24
Manus	South_Su	E 152 06.291	S 03 48.499	25/05/2019	1340	737	BRANCHINOTOGLUMA	19
Manus	South_Su	E 152 06.291	S 03 48.499	25/05/2019	1341	737	IFREMERIA	24
Manus	South_Su	E 152 06.291	S 03 48.499	25/05/2019	1341	737	LEPETODRILUS	24
Manus	South_Su	E 152 06.291	S 03 48.499	25/05/2019	1341	737	OLGASOLARIS	24
Manus	South_Su	E 152 06.292	S 03 48.497	25/05/2019	1343	737	ALVINICONCHA	24
Manus	South_Su	E 152 06.295	S 03 48.498	25/05/2019	1343	737	PARALVINELLA	14
Manus	South_Su	E 152 06.300	S 03 48.480	25/05/2019	1359	737	LEPETODRILUS	24
Woodlark	Scala	E 155 03.160	S 09 47.935	27/05/2019	3374	738	BRANCHINOTOGLUMA	25

Woodlark	Scala	E 155 03.160	S 09 47.935	27/05/2019	3374	738	PARALVINELLA	7
Woodlark	Scala	E 155 03.160	S 09 47.945	27/05/2019	3388	738	ALVINICONCHA	27
Woodlark	Scala	E 155 03.160	S 09 47.945	27/05/2019	3388	738	PARALVINELLA	1
Woodlark	Scala	E 155 03.161	S 09 47.945	27/05/2019	3388	738	IFREMERIA	24
Woodlark	Scala	E 155 03.161	S 09 47.945	27/05/2019	3388	738	LEPETODRILUS	22
Woodlark	Scala	E 155 03.161	S 09 47.945	27/05/2019	3388	738	OLGASOLARIS	10
Woodlark	Scala	E 155 03.161	S 09 47.947	27/05/2019	3388	738	PARALVINELLA	27
Woodlark	Scala	E 155 03.135	S 09 47.934	30/05/2019	3353	739	ALVINICONCHA	24
Woodlark	Scala	E 155 03.117	S 09 47.939	31/05/2019	3344	739	ALVINICONCHA	21
Woodlark	Scala	E 155 03.117	S 09 47.939	31/05/2019	3344	739	BRANCHINOTOGLUMA	4

During the sampling of specimens for popgen, more specific objectives were achieved for *Bathymodiolus manusensis* (Table 3a) and more specifically for fluid sampling to analyze transmissible cancers (Table 3b).

Objectives	Methods	Selected tissues	Preservation pr	Recipient/person in charge	Maxim
Cancer				Nicolas.Bierne@umontpellier.fr	50
	Genetics	hemoplymph	Davidson for 2 to 24h, then ethanol		
	Cell counting	hemoplymph	ethanol 80%		
taxonomy &connectivity	Genetics			Nicolas.Bierne@umontpellier.fr	50
		mantel	extracted PCI-precipitated, stored in	Francois.bonhomme@umontpellier.fr	
		mantel	EtOH80%		
		muscle	EtOH80%		
		entire animals (when >50 or broken)	EtOH80%		
Symbiosis		gill	EtOH80%	lallier@sb-roscoff.fr	50
Symbiosis & gene expression	RNASeq		RNAlater		5
Foodwebs				Loïc.Michel@ifremer.fr	10
	isotopes stabl	muscle	dried in the lab hoven		
Structures & apoptose	histology			andersen@sb-roscoff.fr	5
		gills (posterior;middl	Fixation PFA 4% (16% diluted/4 in seawater filtered 0.22µm) 2 to 12h, then 2xEtOH70%		
		Foot	id		
		mantel	id		
		digestive gland	id		
Calcification & growth		shells	dried shells	franck.lartaud@obs-banyuls.fr	

Table 3a: Recapitulative of mussels sampled on first and second legs, organs & methods of preservation, objectives of the analysis and corresponding partner

Table 3b. *Bathymodiolus* samples collected during leg 2 for fluid sampling

Site/dive	Sample	Lat	Lon	Depth	*B. manusensis*
SNOW CAPE DOME-DIVE733	GBT1	03°43.691	151°40.213	1640	49
FENWAY-DIVE733-	GBT5	03°43.680	151°40.369	1698	33
	PBTChimie	03°43.704	151°40.343	1701	5
ROMANS RUINS-DIVE734	GBT1	03°43.675	151°40.360	1696	53
	GBT2	03°43.649	151°40.861	1725	50
DESMOS-DIVE736	Panier	03°41.524	151°51.933	1896	5
NORTH SU- DIVE 736	GBT9	03°47.958	152°06.097	1201	51
	GBT7	03°47.943	152°06.059	1210	50
SOUTH SU1- DIVE 737	GBT9	03°48.531	152°06.599	1300	24
	GBT3	03°48.783	152°06.499	1360	24
TOTAL LEG 2					344

Biodiversity inventories through metabarcoding of environmental DNA

Sophie Arnaud-Haond (Ifremer, MARBEC)
Camille Poitrimol (Ifremer, EEP-LEP)

During the past ten years, the increasing yield of high throughput molecular sequencing and the increased sensitivity of molecular methods has allowed the extension of massive barcoding of targeted genes, initially mostly applied to prokaryotes, to the eukaryotic compartment. Methods have been developed to inventory the biodiversity present in a given ecosystem, based on the characterization of genomes or part of genomes present in samples from the environment (air, water, sediment…). During Chubarcarc, we aim at testing the possibility to core on the periphery of vents active systems, to investigate the nature and amount of information that can be expected from the DNA content of sediments in terms of biodiversity inventory.
Additionally, samples collected for communities inventories were sieved to extract bulk DNA and test for the accuracy of inventory that can be extracted from metabarcode on those fractions.

1. Sediment cores

Sediments were sampled during the first and second leg of Chubacarc using blade corer and push core samplers operated using the ROV (Figure 1), and a Multicore sample was operated from the deck in the abyssal plain apart from hydrothermal sites.

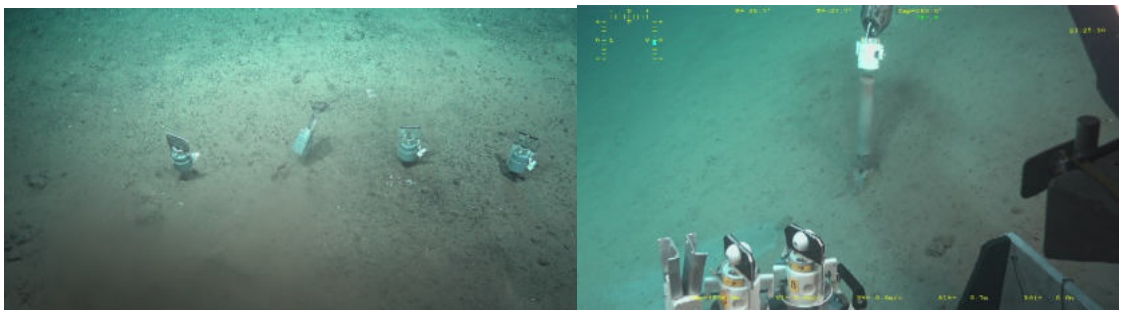


Figure 1: Core sampling close to Satanic Mills (left) and North Su (right)

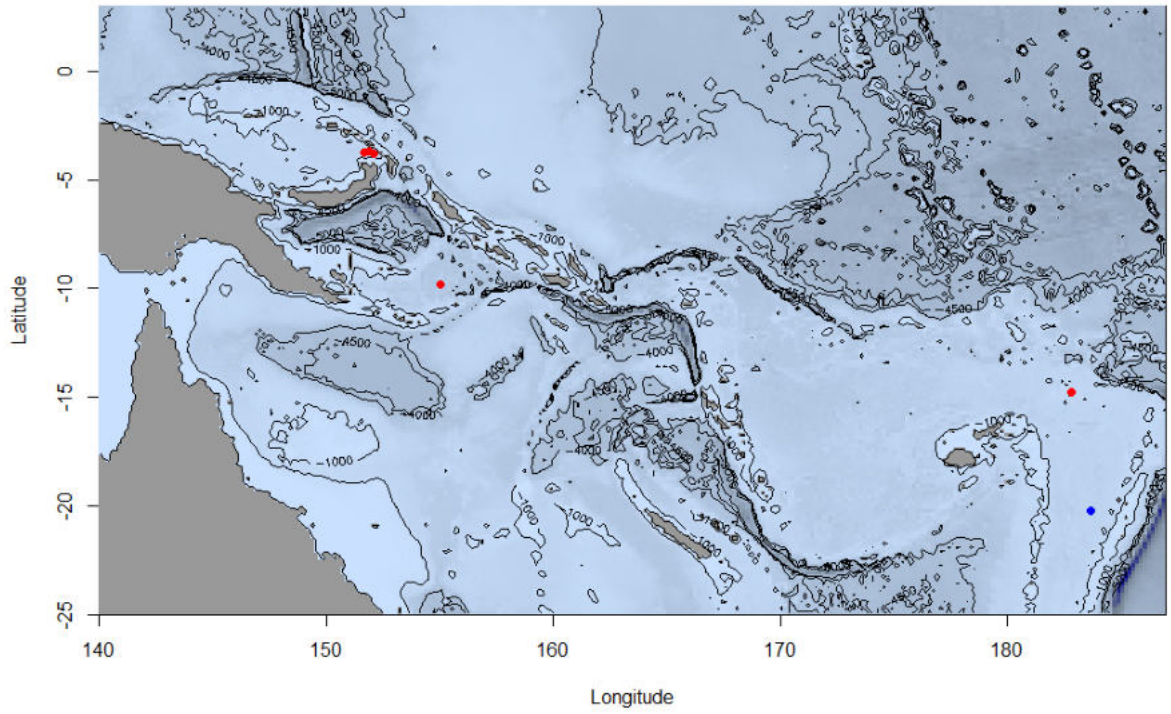


Figure 2: map of the sampling locations for sediment acquired with cores (green), multicore (blue).

Table 1: List and locations of sites sampled for sediment

Site	Dive	Lon	Lat	Depth
Abyssal plain				
	MUC	-176.3315	-20.2558	2658
Futuna				
Fatu kapa	PL08	-177.1546	-14.7517	1545
Manus				
Satanic Mills	PL14	151.66987	-3.7285	1635
Desmos Caldeira	PL16	151.86727	-3.69228	1903
Suzette	PL17	152.09657	-3.7897	1523
South Su	PL18	152.1044	-3.80838	1357

Woodlarc				
La Scala	PL20	155.05347	-9.79753	3369
La Scala	PL20	155.05345	-9.79857	3347

All cores were sliced using the same scheme (Figure 3) and fraction /horizon sliced were stored in ziplock bags at -80°C. For each horizon, two sub-samples of approximately 10g were prepared to be ready for DNA extraction once returned to the lab.
Additionally, on the last coring, 2 cores were selected to be transmitted to teams working on fungi for the first one, and on mercury content for the second.

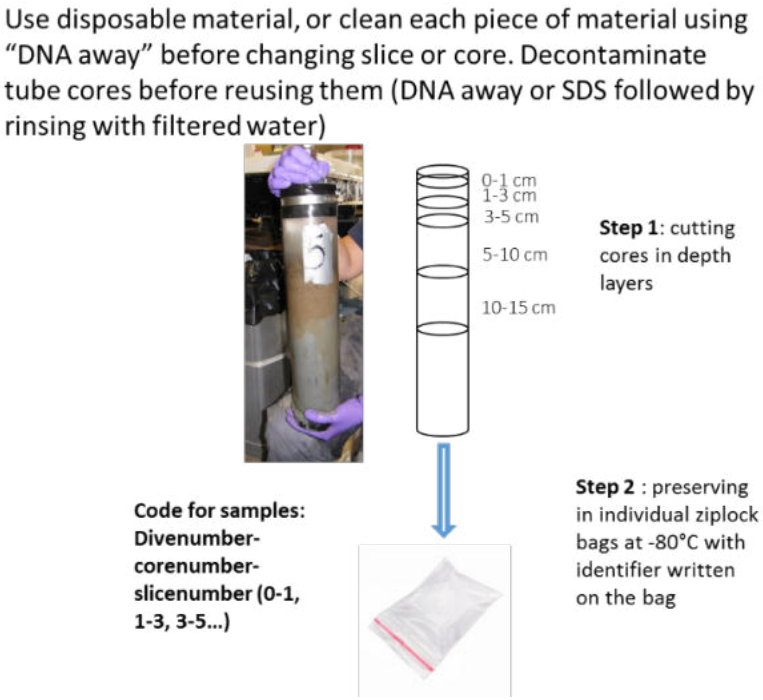


Figure 3: scheme of the core slicing and conditioning protocol

2. Bulk samples from communities

Processing

This part was realized opportunistically after sieving the sampling box and succion sampler jar/bowls collected on hard substrate, it was decided during leg 1 to keep the remaining 20µM fraction at -80°C for future metabarcoding analysis.
Sieving was performed on 20µm, then the sieve was washed and re-concentrated using seawater filtered at 0.2µm, and sediment was placed in a ziplock, either using water or using a *clean* spoon. After sediment was deposited at the bottom of the bag, excess of water was pipetted out of the bag, and the sediment was put in -80°C. In specific cases (once on the first leg, two or three times on the second) when large sieve was used because there was a large amount of sediment, a clean spoon (washed with DNA away and EtOH96°C) was used to subsample sediment and place it in ziplock bags, instead of just using the pipette.

As this part of the sampling was not initially planned, the sieving was performed with other morphological/taxonomic analysis, thus without glove, and sieving was performed with seawater filtered at 0.2µm, extracellular DNA may still be present as well as bacteria. Any molecular application will thus focus on metazoans, for it would be challenging to discriminate bacteria from the samples from those from the samplers, and extracellular DNA particularly from µeukaryotes is likely still present in filtered water.

Table 2: List and locations of sites sampled for bulk DNA

Basin	Site	plongée	Nb samples
North Fiji	Phoenix	724	5
Mangatolo		726	6
Futuna	Fatu Kapa	727	4
Futuna	Fati Ufu	728	5
Futuna	Kulo Lasi	729	2
Lau	ABE	731	4
Manus	Pacmanus	733	16
Manus	Pacmanus	734	13
Manus	Desmos	735	2
Manus	North Su	736	6
Manus	South Su	737	10
Woodlark	La Scala	738	3
Woodlark	La scala	739	3

Physiology of respiration and thermotolerance

Personnel on board: Victor Le Layec, Stéphane Hourdez

I. Objectives

The physiology section of the Chubacarc cruise aimed at measuring oxygen consumption and thermotolerance in hydrothermal vent invertebrates maintained in pressurized aquaria. These measurements aimed at determining the physiological limits of these organisms.
Two important parameters for hydrothermal vents were studied:

- oxygen concentration, that may be found in limited amounts at hydrothermal vents and
- temperature, a factor that controls species distribution in many environments.

We were aiming for a comparative approach, choosing a group of annelids that is species-rich and occupies a range of environmental conditions. These closely related species are each specialized in a very specific range of conditions. This strategy allows us to use a phylogenetically independent contrast analysis. We chose the annelid family Polynoidae, for which we also have data from other environments (temperate area, Antarctic).

Adaptations to hypoxia can be found at different levels of the organisms: quantity and properties of respiratory pigments, morphology. We aimed at collecting coelomic fluid from a large number of specimens of species that were large enough to allow this sampling. We also sought to collect whole specimens preserved for morphological studies. Finally, we also aimed at collecting frozen tissues from a large range of species for a comparative study of thermal stability of proteins after return to the laboratory.

II. Methods

The PAXDA aquarium system are flow-through modular systems in which we can adjust the internal volume of the aquarium and observe the animals through a window (PAXDA system; figure 1). The flow rate through the aquarium is controlled by a system of HPLC pump and the pressure controlled by a pressure-relief valve.

Temperature inside the aquaria was controlled by immersion into an insulated box in which temperature is maintained by a thermocryostat. Oxygen concentration in the water feeding the aquaria was modified by bubbling either pure nitrogen or air into the water reservoir that fed the aquaria. An oxygen optode was used to measure oxygen concentrations of the water coming out of the aquarium after the pressure relief valve.

Several types of experiments were carried out under pressure:

- oxygen consumption rates at a fixed temperature for a range of species. Weight-specific rates will be calculated after the wet weight of the specimen has been measured after return to the laboratory
- determination of Arrhenius break point by increasing temperature at a rate of about 1˚C / 10 min and measuring oxygen consumption rates

- determination of temperature sensitivity by following survival during a temperature increase of 1˚C / 10 min in an aquarium containing several specimens. Ventriflexion was used as the sign of death.

Figure 1: A specimen of the species *Levensteiniella raisae* in a small PAXDA pressurized aquarium under 150 bars of pressure.

III. Sampling

While onboard, we sampled Polynoidae either associated to communities collected for ecology studies or found in suction sampler jars. From these samples, specimens were selected for pressurized aquaria experiments, and sampling and dissection for further work on the laboratory once back on land (Table 1).

Table 1: Polynoidae sampled during the cruise, this list does not include small unidentified Polynoidae (≈500) that will be identified in the lab. *Branchinotogluma segonzaci* and *Branchippolynoe sp.* are also used in genetic studies in the context of Adrien Tran Lu Y's PhD.

Species	Leg 1	Leg 2
Branchinotogluma sp.	2	≈30
Branchinotogluma jasoni	13	0
Branchinotogluma segonzaci	130	83
Branchinotogluma trifurcus	174	32
Branchipolynoe sp.	111	≈250
Eulagiscinae	5	7
Levensteiniella sp.	2	0
Levensteiniela raisae	12	13
Lepidonotopodium sp.	1	0
Thermiphione fijiensis	4	0
Thermopolynoe branchiata	22	17

IV. Experimental work and tissue collections

During the cruise, two complete systems of pressurized aquaria were used most of the time. Repairs had to be carried a few times on one of the two pumps. A single system was equipped for oxygen consumption measurements while the other was either used for thermal ramps or simple maintenance of animals under pressure before being experimented for oxygen consumption.

IV.1. Experimental work onboard

Mainly three types of experiments were carried out during the cruise (Table 2): oxygen consumption at a fixed temperature, survival during thermal ramps, and Arrhenius break point of aerobic metabolism. The first and last types of experiments were performed on isolated specimens. The two latter types of experiments to cover the whole range of temperatures.
Finally, we aimed to determine the oxyregulation capacity for a range of species. This type of experiments represents about 12 h of work and could only be performed during longer transits. For all experiments that required oxygen consumption measurements, only large specimens could be used to yield reliable measurements.

Table 2: List of all the experiments conducted in pressurized aquaria. Thermal ramps were performed on several specimens at once whereas Oxygen consumption, Arrhenius break point, and Oxyregulation were performed on one specimen at once.

Species	Thermal ramps	Oxygen consumption	Arrhenius break point	Oxyregulation
Branchinotogluma jasoni	0	1	1	0
Branchinotogluma segonzaci	0	3	3	0
Branchinotogluma trifurcus	5	3	1	1
Branchipolynoe sp.	4	6	4	0
Eulagiscinae sp.	0	1	0	0
Levensteiniella raisae	0	4	0	1
Thermiphione fijiensis	0	2	0	0
Thermopolynoe branchiata	2	9	3	2

A - Oxygen consumption rates

The measurement of oxygen consumption rates was performed on 29 different specimens onboard. The raw data gathered with those experiments still need to be corrected. In particular, several control runs (empty aquarium) were performed on board and additional ones will be done back in lab. Then the oxygen consumption will be related to the wet weight of each specimen, the measurement of this weight was not able on the ship with its movement. The experimented specimens will need to be weighed in the laboratory to calculate weight-specific consumption rates.
However, a first look at the data seems to show that every scale worms consumption seems to be directly correlated with their mass. No significant differences between species can be seen yet.

These data will be combined with similar data on other species from the East Pacific Rise for a comparative study over a wide range of species.

B – Oxyregulation capacity

The determination of the oxyregulation capacity is very time-consuming, and only few runs were done. It was however essential as it demonstrates that oxygen consumption does not depend on environmental oxygen concentration (Figure 2) and that consumption rates can be compared without correcting for this factor. We are can already tell that *Branchinotogluma segonzaci, Levensteiniella raisae* and *Thermopolynoe branchiata* are capable of oxyregulation, and this down to low oxygen concentrations. This likely involves their hemoglobin whose properties have already been studied in the laboratory. One of these species does not possess gills, demonstrating that the presence of gills is not necessary for this capacity.

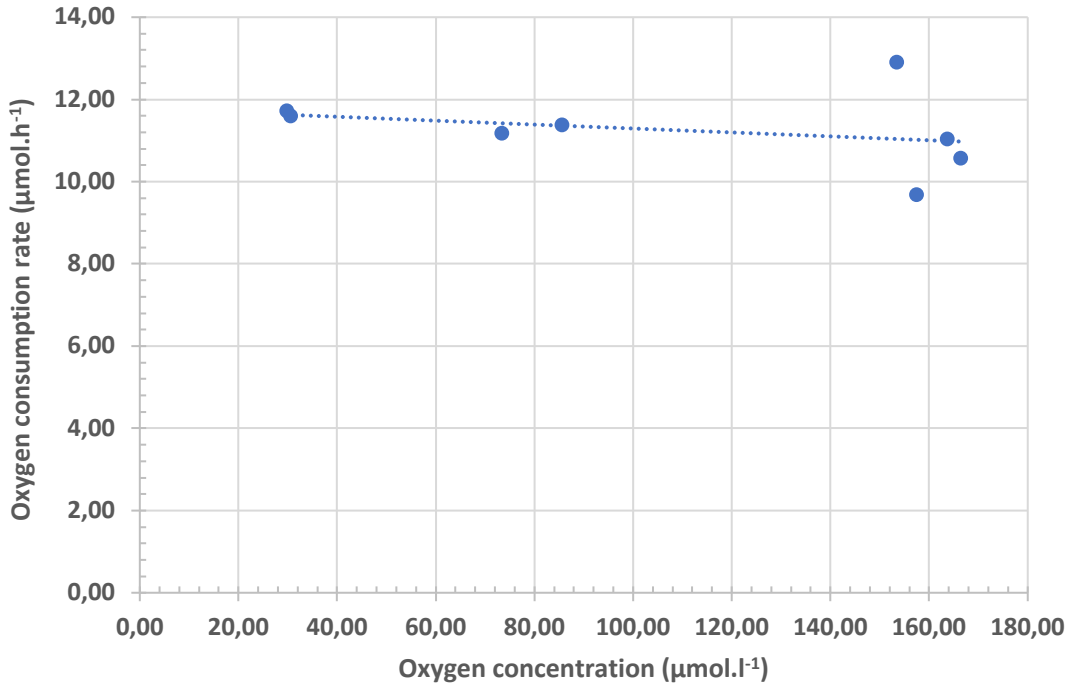


Figure 2: Oxygen consumption rate as a function of oxygen concentration for a specimen of *Branchinotogluma segonzaci* at 7.6˚C and under *in situ* pressure. The data indicate that oxygen consumption does not depend on environmental oxygen concentration.

C – Thermotolerance

Arrhenius breakpoint

Ectothermic species usually see their aerobic metabolism increase when the temperature increases. This augmentation stops at a critical temperature above which the oxygen availability in the animal is insufficient for the aerobic metabolism to follow. At this point the animal is in metabolic failure and its death can follow. This specific point is called Arrhenius breakpoint and it represents the maximal temperature that the animal can withstand, it depends on the concentration of oxygen in the environment and the oxygen gathering ability of the animal.

Eleven Arrhenius breakpoint experiments were performed onboard (e.g. Figure 3) on several specimens of *B. jasoni, B. segonzaci, B. trifurcus* and *T. branchiata*. Those experiments still need more analysis to highlight the important results but overall, some differences seem to be visible between species.

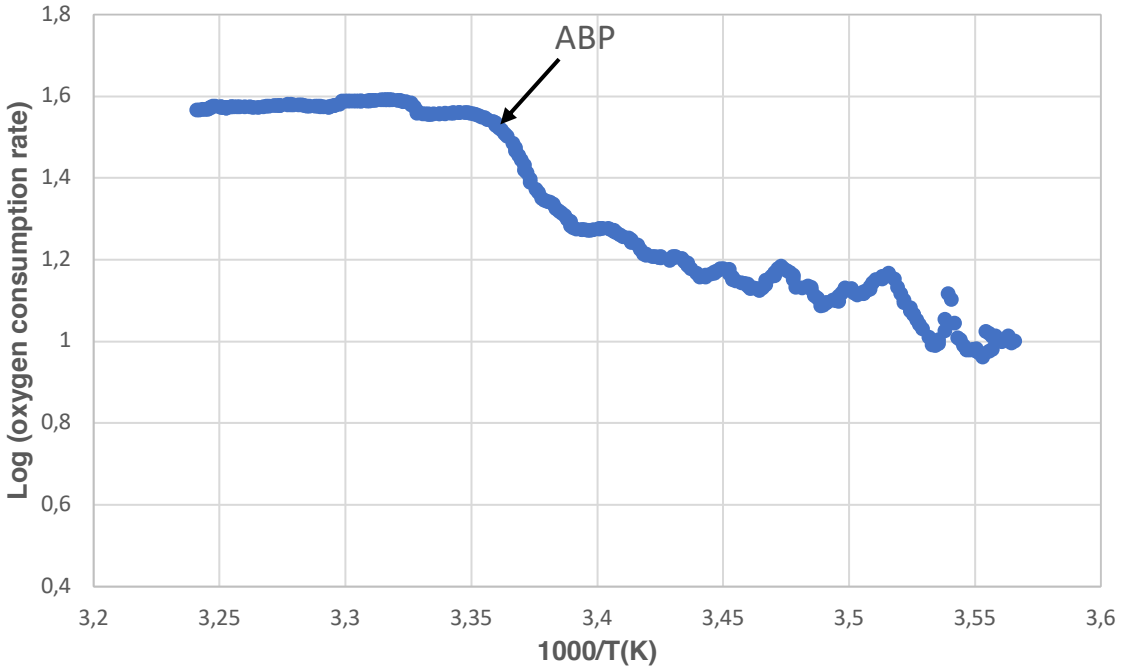


Figure 3: An example Arrhenius Break Point determination experiment on *Branchinotogluma segonzaci* at 160 bars. X-axis is the inverse of temperature in degrees Kelvin (times 1000 for ease of reading), Y-axis is the log of oxygen consumption rate. High temperatures are on the left and low temperatures on the right. The potential break point is indicated (ABP).

Thermal ramps

The thermal ramps allow us to determine the temperature for which 50% of the scaleworms of each of the different species die (T_{50}). The increase rate has a direct effect on the ability of the animals to survive. A constant rate of 1˚C/10 min has been used during the cruise to compare the sensitivity to that of scaleworms from other environments (temperate zone, Antarctica). These experiments were performed on species that are found in large enough numbers to allow some confidence on the T_{50} determination (e.g. Figure 4).

Initial results already show us that the different species have different T_{50}, which is correlated with the temperature of the living environment of those species: species that live in hotter environment have higher T_{50}. It also seems that for a single species, the T_{50} can change by a few degrees from one collection to another. This could indicate a capacity for acclimation and we will include the data of temperature near the communities at the time of sampling.

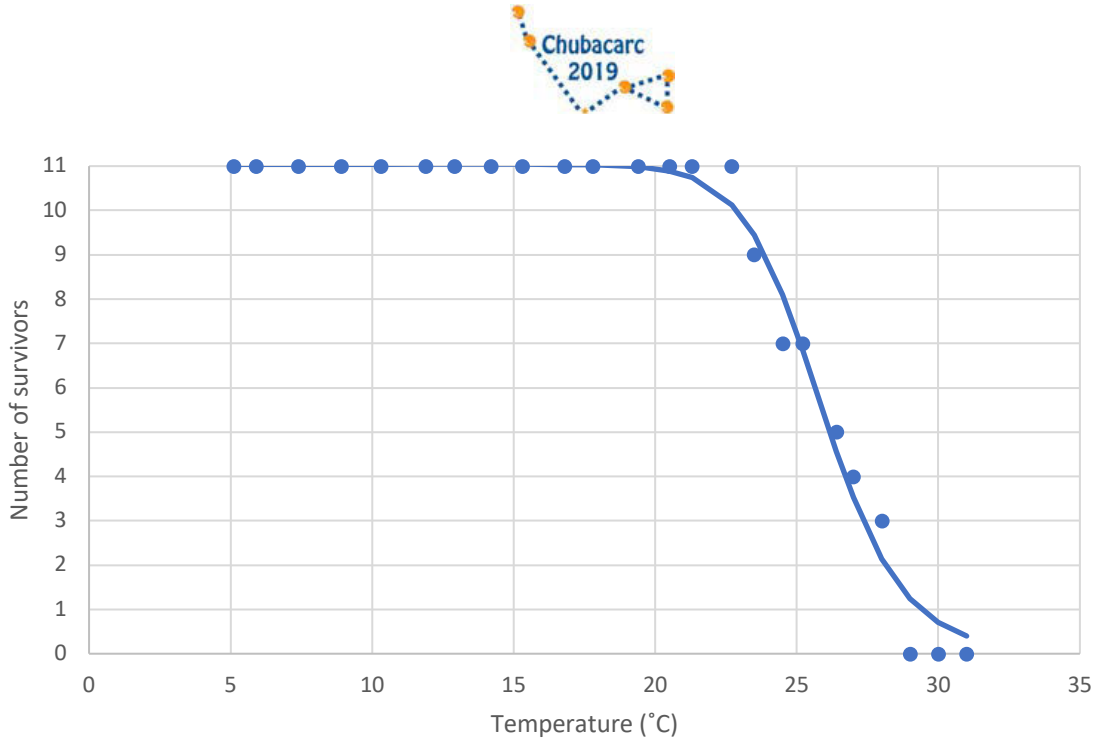


Figure 4: An example of thermal ramp. Here we observe the mortality of 11 *Branchipolynoe sp.* while the temperature increases by 1°C every 10 minutes. The first *Branchipolynoe* died at a temperature of 23.5°C and the last one at 29°C. The temperature of 50% mortality T_{50} is 25.9±0.1°C.

IV.2 – Sampling of coelomic fluid and tissues for in vitro studies

Out of the 697 specimens that have been individually sampled, we collected coelomic fluid for 191 of them and preserved it at -80°C to measure the concentration of hemoglobin once back in the laboratory. These samples include not only species endemic of hydrothermal vents but also non-vent species that were collected near vent communities.
For each of the 697 scale worms we also preserved a sufficient part of the body to study the thermal stability of the MDH back in the lab.

V. Future work in the lab

Personnel: V. Le Layec, S. Hourdez

After the samples arrive in the laboratory, several measurements/studies need to be performed to complement and publish the results acquired during the cruise:

- Wet weight of the animals used in respirometry
- Control experiments in PAXDA for oxygen consumption measurement
- Hemoglobin concentration in the sampled coelomic fluids
- Thermal stability of the enzyme Malate Deshydrogenase (MDH)

These experiments will be carried out within a year after the end of the cruise.

CHUBACARC Leg 1
Ecogeochemistry of vent communities

Nadine Le Bris (SU-CNRS LECOB, Banyuls-sur-Mer)
Francine Beaujot (IMBRSEA Master intern, LECOB, Banyuls-sur-Mer)

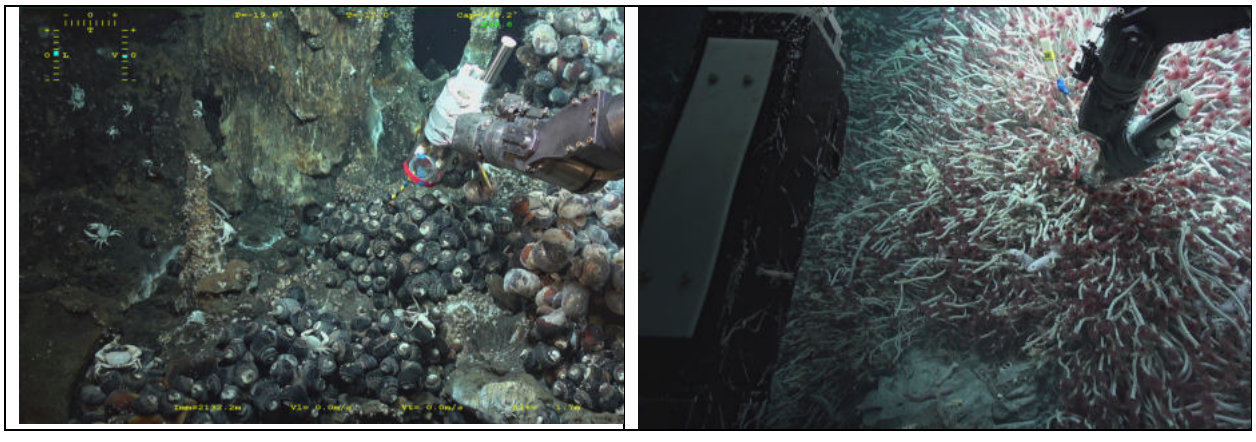
1. General objectives

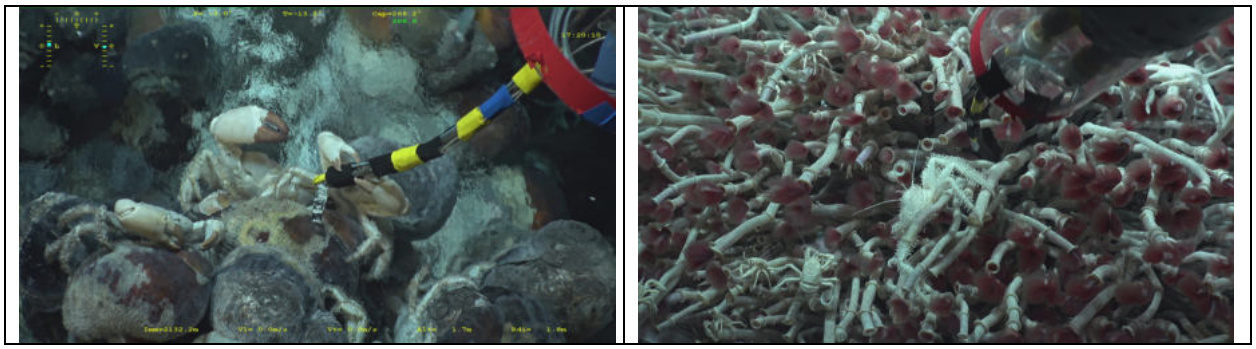
Foundation species of hydrothermal ecosystems govern energy transfer from fluids to vent and surrounding communities via their chemosynthetic symbionts. By modifying environmental conditions within their aggregations they also act as habitat builders and influence later colonists.
The abiotic constraints exerted in vent habitat are multiples and can include temperature, oxygen availability, low pH, hydrogen sulfide exposure. Yet little is known about the combination fluctuating factors under the influence of local hydrodynamic variability that can exert strong constraints on the settlement and growth of vent organisms.
During this cruise we documented the variability of key abiotic factors such as temperature, pH, free sulfide and Eh in the habitats of dominant western Pacific taxa (*Bathymodiolus* mussels, *Alviniconcha* spp., *Ifremeria nautilei*), using autonomous sensors. Electrochemical sensors were used to monitor fluctuations with a frequency of 1 mes/15s during 3 min measurement sequences on selected locations, the sensor tip precisely positioned by the pilots within assemblages. Longer time series were obtained by deploying the sensor with the tip positioned among fauna assemblages. For one of these deployments, the underwater autonomous camera CURIOUS was associated with the sensors allowing to document the position of the tip with respect to vent organisms.

2. Instruments for in situ measurement of vent habitat conditions

2.1. SPOT

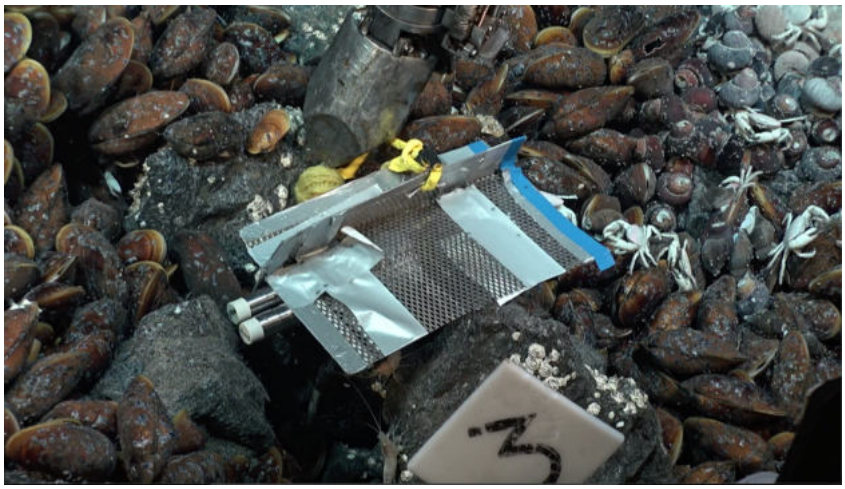
SPOT is integrating 5 independent electrochemical sensors composed of potentiometric (Eh, pH, pS) and voltammetric (Ag and Hg-amalgam) loggers and electrodes attached to a temperature probe. The 5 autonomous devices integrated in a holder that can be manipulated by the submersible arm. It is positioned in its holder on the basket when not used for measurements.





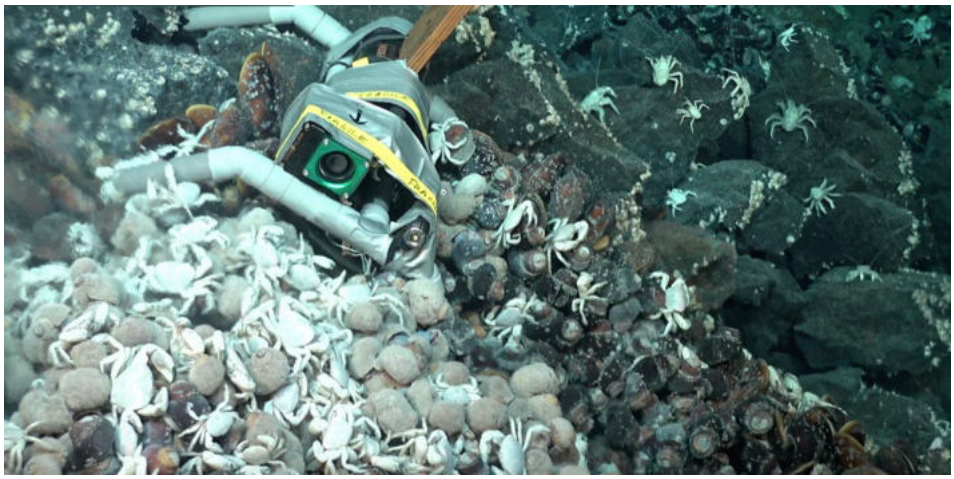
2.2. AUTO

AUTO are smaller devices associating only one pH sensor and one pS sensor with a low-temperature probe. Titanium grids serve as holders to ensure stable positioning on top of animal aggregations. 2 AUTO probes were used labeled AUTO-B (blue label) and AUTO-Y (yellow label).



2.3. CURIOUS

The system integrates the SPOT sensors with an autonomous camera system equipped with a LED and Time-lapse controller and powered by Li-Po batteries. 2 pictures and a 10s video was captured every 70 min.



All sensors have been repeatedly calibrated on board 1) for pS, SPOT, SPOT-L and Eh by standard additions of Na_2S stock solutions (titrated by the iodine method) in seawater at fixed pH and 2) for pH standard addition of HCl 0.5 M in seawater using a Titrino Metrohm system.

3. Summary of measurement sequences during dives

3-mn sequences were recorded while the tip of the SPOT probe was positioned on the desired locations within aggregations. Measurement frequencies were set to 1meas. /15s for pH, Eh, pS and temperature (T1). A second temperature sensor (T2) was used with a 5s meas. frequency from dive 725 to 731.

Table 1 : List of short-term measurement sequences with SPOT tip positionned by the VICTOR manipulator arm (Ifre : Iframeria nautilei, Alvi : Alviniconcha spp., Para : paralvinella spp., mus : Bathymodiolus mussel, cir : cirripeds, cat. : bacterial mat, sibo :siboglinids, flu: diffuse fluids, poly :polynoids, anem :anemony).

Dive	Date	Vent field/Site	Sequences	Fauna	Locations	Remark
720	30/03/19	Kilo Moana	17 :08- 17 :09		background sw	No measurement on fauna
721	31/03/19- 2/04/19	Tow Cam	16 :28-16 :43 20 :39-21:21 22 :09-22:21 22 :42-22:47 08:57-09:47 16 :26-17:21 (SPOT21-SPOT31)	Ifre ? Ifre+cir Alvi Gastropods (species?) Alvi+Ifre+mus+cir Alvi+Ifre+mus	Base of chimney	Eh not correct
722	3/03/19 3/03/19 4/03/19	Tui Malila	06 :45-07 :53 (SPOT1-SPOT15) 15 :15-15:49 (SPOT16-SPOT23 16 :19 -16 :36 (SPOT24-SPOT26) 19 :05-19 :26 (SPOT27-SPOT31) 20 :03-20 :18 (SPOT32-SPOT34)	Mus+Ifr+paralv.+bact Ifre+mus+cir In crack, fluid outflow, crabs Alvi+mus mus, mus +Ifre, mus		Additional peak at 10 :51 (plume?)
723			No meas.			CURIOUS and AUTO recovery/replacement
724	9/04/19 10/04/19 10/04/19 10/04/19 11/04/19	PHOENIX new site ? (NEAR IVORY TOWER not found and PERE LACHAISE)	21 :49-22 :18 (SPOT1-SPOT5) 18 :07-18 :46 (SPOT6-SPOT12) 22 :17-22 :19 (SPOT13) 23 :14 - 00:06 (SPOT14-SPOT24)	Ifr, mus, cir Alvin, ifre, anem, mus, cir		
725		Mangatolo triple junction	No measurements (Short dive – pb with arm of VICTOR)			Small background signals
726	17/06/19 17/04/19	Mangatolo triple junction	6 :11-6 :55 (SPOT1-SPOT9) 7 :27-7 :52 (SPOT10-SPOT16)	Gastropods ? flu Ifre, flu + ??		Large background signals 15/04/19 00 :23 & 16/04/19 2 :48 (Ti sampling)
727	18/06/19	Fatu Kapa	17 :12-17 :48 (SPOT1-SPOT8) 17 :56-18 :11 (SPOT9-SPOT12)	 Alvi+ ??		

	19/06/19		15 :35-16 :57 (SPOT13-SPOT30) 17 :51 (SPOT31)	Ifre , Alvi, phymo, flu, cir		
728	20/04/19 20/04/19 21/04/19	Fati Ufu	21 :48-22 :19 (SPOT1-SPOT7) 22 :23-22 :35 (SPOT8-SPOT11) 18 :53-19 :23 (SPOT12-SPOT18)	Alvi, ifre, poly, flu, bact poly, ifr, shrimp, flu		
729	23/04	Kulo Lasi	12 :21-13 :05 (SPOT1-10) 14 :37-14 :43 (SPOT11-12)	sibo mus		
730		Tow Cam	No sensor deployed on VICTOR			Recovery opf CURIOUS and AUTO-B
731	26/04 27/04 27/04	ABE	21 :16-22 :23 (SPOT1-SPOT13) 7 :40-8 :30 (SPOT1-SPOT13) 17 :05-17 :36 (SPOT14-SPOT21)	Alvi, mus Alvi, para, poly, bact, flu, ifre, mus Mus, alvin + crabs, ..		2nd series with same SPOT numbers as first from this dive

4. Summary of unattended deployments

Five unattended deployments were performed: 3 with the AUTO systems, including two successive series without recovery for AUTO-B that was repositioned on mussels on 5/04/19 to get the tip of the probe about mussels and facing the *Alviniconcha* patch were CURIOUS was deployed.

Table 2 : SPOT, AUTO and CURIOUS unattended deployment on fauna aggregations.

Vent field	Device	Dives	Fauna	Deployment	Replacement	Recovery
Tow Cam	AUTO-B	721-723-731	mus	1/04/19 5:20 - tip below mussels	5/04/19 21:18 - tip above mussels	25/04/19 23:43
	AUTO-Y	721-723	Alvi > mus	1/04/19 5:15 on alvin (after short mn on mussels)	Moved by fauna during deployment	5/04/19 21:24
Tow Cam	CURIOUS	723-731	Alvi (+individual mussels) > out of patch	5/04/19 22:12	Up side down at recovery - succession of sequences (see videos).	25/04/19 23:26
	SPOT	727	Alvi+Ifre	18/04/19 23:44	To be checked	19/04/19 15:23
	SPOT	728	Alvi	21/04/19 00:51	To be checked	21/04/19 5:23

5. Expected outcomes

From this data set we will explore how the chemical composition of fluids, mixing conditions, chemical reactivity and biological consumption drives the availability of energy for symbionts and the associated abiotic constraints. Longer time-series will be analysed to identify the influence of hydrodynamic tidal forcings on habitats chemistry (Nedoncelle et al. 2015). The data set that encompasses different vent fields with different geochemical and hydrological backgrounds offer the opportunity to examine the habitat range of fondation species across this arc/back-arc region, and further investigate the specificity of western Pacific vents as compared to other well studied vent ecosystems (e.g. East Pacific Rise, Mid Atlantic Ridge, Juan de Fuca Ridge).

Cruise report CHUBACARC Leg1

Symbioses

MA Cambon and F Pradillon

Activities scheduled on board:
Symbioses of *Alviniconcha* and shrimp *Alvinocaridae*.
Sampling at the hottest biotope with chimney samples for S L'Haridon-UBO (looking for methanogenes diversity) and E Roussel for DPANN diversity and finally at the North Fidji basin for A Godfroy, chimney sample to try to isolate *Pyrococcus abyssi*.
Laurence Meslet-Cladière sampling of water and sediments to enrich fungi.
Anne Lorrain for an ANR dealing with mercury, asking for gastropods, mussels and sediments.
Number of samples: CHU for Chubacarc; PLXX number of dive, ASPI ou GBT or PBT is the tool and CR for shrimp, AX for Alviniconcha, CH for chimney samples

1. Sampling of active chimneys

Work has been done in the white lab of the Atalante using the laminar flow hood still on all during the leg. Washed using soap then alcohol. Nota : the hood was damaged under the working area on arrival.
All chimneys have been crushed using sterile mortar and pillar. All the material is first washed and sterilised using the autoclave on board. Then during process, using of DNAaway and RNAaway to keep the area as clean as possible.
For each chimney sample, fluid sample have been collected (Titanium syringe, BEG, PIF, chemini) and temperature measured.

1.1 Chimney sampling for S L'Haridon

31 /03 Sampling at Tow Cam: CH1 (figure 1).
10 cryotubes of 4,5ml (instead of 1.8ml) et 3 Belco. Cryotubes immediately frozen at -80°C et Belco tubes flushed with filtered N2 (0.22µm filter) 0.5 bar at the laboratory of GM.
Warning: No difficulty with blue stopper but the plier does not close correctly the tubes. Stored at à 4°C.

Figure 1: Chimney sampling CH1

3 /04, sampling at Tu I Malila: CH2, figure 2
Same conditioning using cryotubes 1.8ml. Still troubles with the plied even after looking at it. Chimney more compact and difficult to crush. In the box, also recovered 2 mussels, 2 crabs, 1 lepetodrilus and a shrimp.

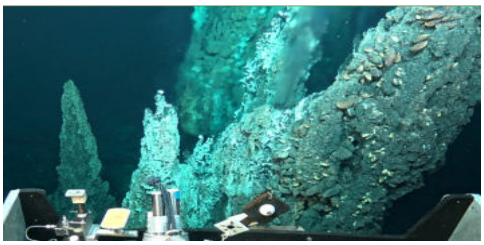


Figure 2: Chimney sampling CH2

4 /04 Still Tu I Malila: CH3, figure 3, Chimney of anhydrite, poor recovery in the box as the main part fell before sampling. Same procedure.

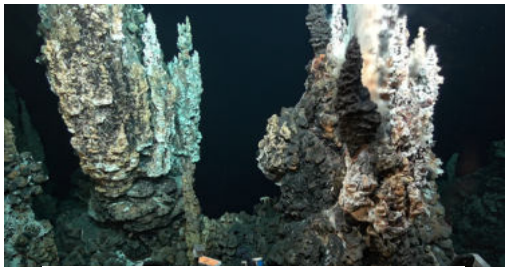


Figure 3: Chimney sampling CH3

10/04 new site at the North Fidji basin called Phenix, CH4 (figure 4). (Ivory Tower and Starmer seemed dead). Same procedure

Figure 4: Chimney sampling CH4

27/04 ABE site (figure 5), chimney CH8 same procedure.

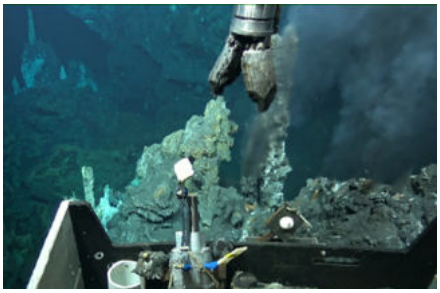


Figure 5: Chimney sampling CH8

1.2 Chimney sampling for A Godfroy

Chimney CH5 sampled the 10 /04 new Phoenix site, on the boarder of the lava lake, north of the North Fidgi basin area (north Ivory Tower and Starmer, looked dead). One 250ml Schott has been done and flushed under N2 filtered for *P. abyssi* culture.

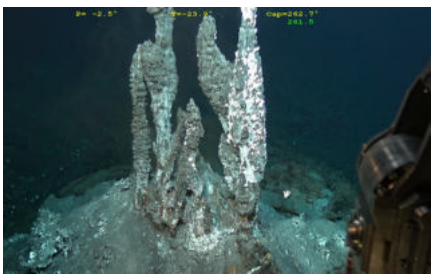


Figure 6: Chimney sampling CH5

1.3 Sampling for E Roussel

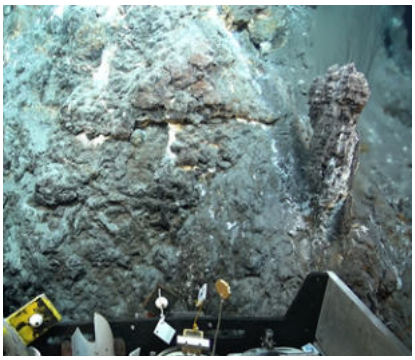


Figure 7: Chimney sampling CH6

20 /04/ 2019, chimney Stéphanie area of Futuna, PL08 (figure 7 & 8). From 00h28 to 00h48 sampling of an anhydrite chimney on the main active site. Then sampling of fluids (Titanium and BEG) and gradient (PIF).
PBT7 several fragments of chimney of the upper part, the BioBox opened close to the fluid event. Some part of the chimney lift with the fluid flow. Then GBT6 lower part of the chimney, large piece of pyrite.
In the lab, the PBT7 was placed under the laminar flow hood; water was passed in the sterile container (5 minutes). Then the chimney samples were crushed and conditioned in 2 X 100ml shoot bottles, flushed with sterile N2 1.5bar. Then 2 X 50ml Falcon were frozen (-80°C) and a Chromacol tube was filled with PBT7 water and stored at -20°C. The water was then passed back in the PBT7 and homogenised with chimney powder, and then pumped in 2 X 5 litres sterile bags stored at 4°C. This last part took about 1 hour. Then carefully removed bubbles and closed the bags.
GBT6 same treatment with 2 Falcons and 50 ml et 3 Schott for culture and 3 water bags and 1 Chromacol -20°C.
(dive video MP4 de 13h54)

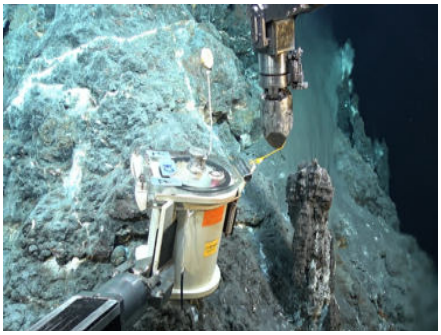


Figure 8: Sampling CH6, opening the BioBox close to the vent

Figure 9: Chimney sampling CH7

Chimney sampling CH7 (figure 9) at the Fati Ufu site (ZEE FUTUNA). Sampling in the GBT1 BioBox and conditionned in Shoot vial 100ml under filtered N2 at 4°C for cultures and 2 Falcon 50 ml for DNA (-80°C).

2. Symbioses of *Alviniconcha* and *Alvinocaridae* spp

2.1 *Alviniconcha* spp symbioses

Previous work conducted at Ifremer/EEP (post-doc of Sven Laming 2017-2018) on symbiosis in the three *Alviniconcha* species (*A. kojimai*, *A. boucheti*, and *A. strummeri*) found at vent sites in the Futuna area showed that symbiotic diversity within the host is higher than previously described. Several types of intracellular symbionts were observed in the gills, with different distribution depending on host species, localisation within the gill, and possibly vent site. In addition, we found bacterial communities living in the gut of the snails that could also contribute to their nutrition. We also investigated juveniles early after their recruitment as well as post-larval

stages in order to characterize symbiont acquisition, and evaluate the possible influence of the bacterial proliferation in post-recruitment stages on subsequent species distribution.

In order to expand that work, systematic sampling of adult specimens of the three species was conducted during CHUBACARC in all assemblages collected for biodiversity studies that were also assessed for habitat chemical conditions (see reports by M. Matabos and C. Cathalot). Upon collection boxes recovery on board, all specimens were sorted under the laminar flow hood in the cold room using gloves. Species were identified based on external characteristics such as the arrangement of periostracal hairs on the shell, as well as body coloration.

Whenever possible, sets of three specimens per species were selected for dissection of the tissues and conditioning for symbiosis studies. For each specimen (except the few first specimens for which gills were conditioned as a whole), gills were separated in three parts: anterior, middle and posterior, and a subset of gill filaments were preserved for FISH imagery, electron microscopy studies (Glutaraldehyde fixation) and DNA diversity for each part. The digestive whorl was conditioned either for FISH imagery, electron microscopy studies or DNA diversity. A piece of the gonad was also preserved similarly to the digestive whorl, in order to check for possible bacterial transmission to the next generation. Pieces of foot muscle were frozen for later barcoding in order to validate morphological specimen identification and for isotopic analyses. Specimens treated for symbiotic analyses were also sampled for genetic approaches conducted by Didier Jollivet, Jade Castel et al. All rests of dissections were frozen at -80°C, as well as a piece of shell for later confirmation of morphological species diagnostic.

Before dissection, each specimen was photographed and 6 biometric measurements were recorded: shell length (SL), shell width (SW), aperture height (distance between the tip of the columella and the suture point of the outer lip of the aperture) (ei), maximal aperture width (fh), the body whorl thickness at the level of the suture point of the outer lip (ce), and the body whorl thickness at the level of the maximal aperture width (bf) (fig x)

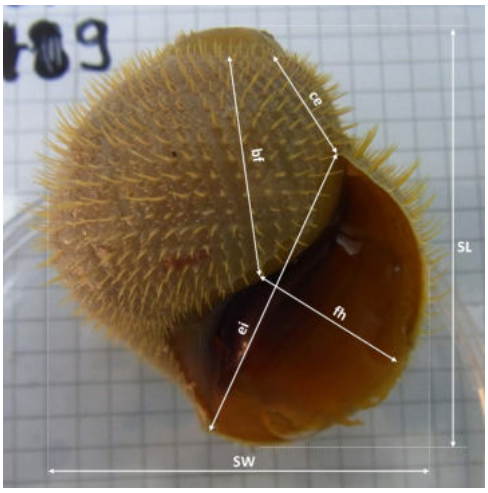


Figure 10: biometric measurements recorded for each *Alviniconcha* specimen.

A total of 132 adult specimens were dissected (95) or frozen without dissection as back-up (37). Most individuals belong to the species *A. kojimai* (92 individuals), whereas *A. strummeri* (24 individuals) and *A. boucheti* (16 individuals) were collected in much lower numbers. Details of specimen dissections are presented in the table on the following pages (Table 2).

Post-larval stages and juveniles (from size < 1mm up to 1 cm) sorted from collection boxes or suction sampler bowls were also preserved for studies of symbiotic proliferation in early post-recruitment stages. A total of 92 specimens were conditioned for DNA studies (host identification and bacteria diversity), FISH imagery or electronic microscopy (Table 1).

Date	Dive	Collection tool	Site	Stage / size (mm)	nb	treatment
01/04/2019	721 (02)	GBT1	Tow Cam	juveniles > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
02/04/2019	721 (02)	ASPI3	Tow Cam	juveniles > 5mm	3	piece of tissue frozen for DNA barcoding, whole body for FISH
04/04/2019	722 (03)	GBT1	Tu'i Malila	post-larvae	8	frozen whole for DNA barcoding/symbiont diversity
				post-larvae	8	fixed for FISH imagery
				juveniles < 5 mm	5	fixed for FISH imagery
				juveniles < 5 mm	3	frozen whole for DNA barcoding/symbiont diversity
05/04/2019	722 (03)	GBT6	Tu'i Malila	post-larvae	2	frozen whole for DNA barcoding/symbiont diversity
05/04/2019	722 (03)	GBT8	Tu'i Malila	post-larvae	3	frozen whole for DNA barcoding/symbiont diversity
				juvenile < 5mm	1	fixed for FISH imagery
				juvenile < 5mm	1	frozen whole for DNA barcoding/symbiont diversity
				juvenile > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
05/04/2019	722 (03)	ASPI3	Tu'i Malila	juvenile < 5mm	2	fixed for FISH imagery
11/04/2019	724 (05)	ASPI8	Phoenix	juvenile > 5mm	4	piece of tissue frozen for DNA barcoding, whole body for FISH
				juvenile > 5mm	1	frozen whole for DNA barcoding/symbiont diversity
				juvenile < 5mm	1	fixed for FISH imagery
11/04/2019	724 (05)	ASPI5	Phoenix	post-larvae	1	fixed for FISH imagery
11/04/2019	724 (05)	PBT4	Phoenix	juvenile < 5mm	1	fixed for FISH imagery
18/04/2019	726 (07)	PBT4	Mangatolo	post-larvae	2	frozen whole for DNA barcoding/symbiont diversity
				post-larvae	1	fixed for FISH imagery
				juvenile < 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
				juvenile < 5mm	1	piece of tissue frozen for DNA barcoding, whole body for electronic microscopy (glutaraldehyde)
				juvenile < 5mm	2	fixed for FISH imagery
				juvenile > 5mm	3	piece of tissue frozen for DNA barcoding, whole body for FISH
18/04/2019	726 (07)	ASPI7	Mangatolo	juvenile > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
18/04/2019	726 (07)	PBT6	Mangatolo	post-larvae	1	frozen whole for DNA barcoding/symbiont diversity
				post-larvae	1	fixed for FISH imagery
				juvenile < 5mm	1	fixed for FISH imagery
19/04/2019	727 (08)	GBT3	AsterX	post-larvae	7	frozen whole for DNA barcoding/symbiont diversity
				post-larvae	3	fixed for FISH imagery
				post-larvae	2	fixed for electronic microscopy (glutaraldehyde)
				juvenile < 5mm	6	frozen whole for DNA barcoding/symbiont diversity
				juvenile < 5mm	7	fixed for FISH imagery
				juvenile < 5mm	3	fixed for electronic microscopy (glutaraldehyde)
20/04/2019	727 (08)	GBT4	Stéphanie	juvenile > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
21/04/2019	728 (09)	GBT4	Fati Ufu	juvenile > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH
21/04/2019	728 (09)	PBT4	Fati Ufu	juvenile < 5mm	1	fixed for FISH imagery
28/04/2019	731 (12)	ASPI7	ABE	juvenile > 5mm	1	piece of tissue frozen for DNA barcoding, whole body for FISH

Table 1: List of juveniles and post-larval stages of Alviniconcha spp preserved for studies on bacterial symbiont acquisition and proliferation.

Date	Dive	Sampling tool	Community	site	Species	nb of individuals	Treatment
01/04/2019	721 (02)	GBT1	Alviniconcha 1	Tow Cam	A. strummeri	1	Digestive whorl, whole gill, piece of gonad : FISH fixed
					A. strummeri	1	Digestive whorl, whole gill, piece of gonad : -80°C frozen
					A. kojimai	3	Digestive whorl, whole gill, piece of gonad : FISH fixed
					A. kojimai	2	Digestive whorl, whole gill, piece of gonad : Glutaraldehyde fixed
					A. kojimai	3	Digestive whorl, whole gill, piece of gonad : -80°C frozen
					A. kojimai	6	Whole individuals frozen as back-up
02/04/2019	721 (02)	GBT6	Alviniconcha 2	Tow Cam	A. kojimai or boucheti	2	Digestive whorl, pieces of gills (ant/mid/post), piece of gonad : FISH fixed
					A. kojimai	1	Digestive whorl, pieces of gills (ant/mid/post), piece of gonad : Glutaraldehyde fixed
					A. kojimai	2	Digestive whorl, pieces of gills (ant/mid/post), piece of gonad : -80°C frozen
					A. kojimai	2	Whole individuals frozen as back-up
					A. boucheti	1	Whole individuals frozen as back-up
02/04/2019	721 (02)	GBT7	Chimney	Tow Cam	A. boucheti	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
04/04/2019	722 (03)	GBT1	Alviniconcha 1	Tu'i Malila	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	3	Whole individuals frozen as back-up
					A. kojimai	3	Whole individuals frozen as back-up
04/04/2019	722 (03)	GBT7	Chimney	Tu'i Malila	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	2	Whole individuals frozen as back-up
05/04/2019	722 (03)	GBT5	Alviniconcha 2	Tu'i Malila	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	4	Whole individuals frozen as back-up
10/04/2019	724 (05)	GBT4	Alviniconcha 1	Phoenix	A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
11/04/2019	724 (05)	PBT4	Alviniconcha 2	Phoenix	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C

Table 2 : List of Alviniconcha spp adult specimens conditioned for symbiosis studies

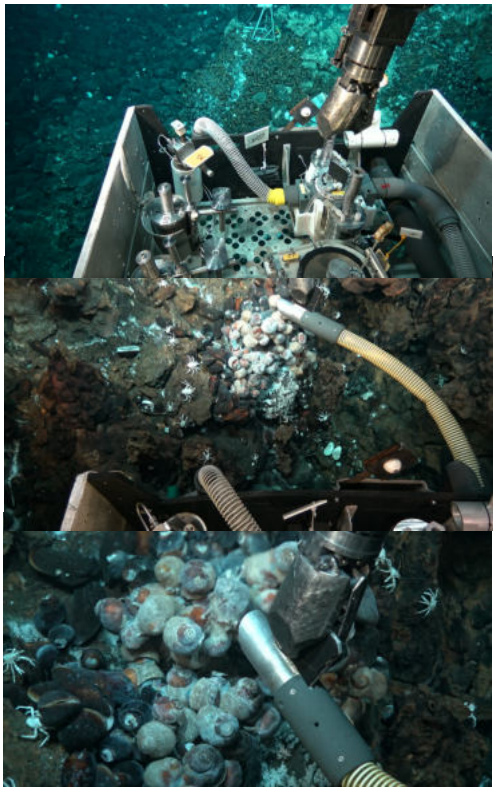
Date	Dive	Sampling tool	Community	site	Species	nb of individuals	Treatment
17/04/2019	726 (07)	GBT4	Alviniconcha 1	Mangatolo	A. boucheti	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Whole individuals frozen as back-up
					A. kojimai	2	Whole individuals frozen as back-up
18/04/2019	726 (07)	PBT6	Alviniconcha 2	Mangatolo	A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
19/04/2019	727 (08)	GBT2	Alviniconcha 1	AsterX	A. kojimai	2	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	2	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	3	Whole individuals frozen as back-up
20/04/2019	727 (08)	GBT4	Alviniconcha 2	Stéphanie	A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Whole individuals frozen as back-up
21/04/2019	728 (09)	GBT2	Alviniconcha 1	Fati Ufu	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	6	Whole individuals frozen as back-up
22/04/2019	728 (09)	PBT4	Alviniconcha 2	Fati Ufu	A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	3	Whole individuals frozen as back-up
22/04/2019	728 (09)	GBT6	chimney	Fati Ufu	A. boucheti	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
28/04/2019	731 (12)	GBT3	Alviniconcha 1	ABE	A. boucheti	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. boucheti	1	Digestive whorl, piece of gonad: -80°C frozen + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
28/04/2019	731 (12)	ROV basket		ABE	A. kojimai	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. kojimai	1	Digestive whorl, piece of gonad: Glutaraldehyde fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C
					A. strummeri	1	Digestive whorl, piece of gonad: FISH fixed + pieces of gills (ant/mid/post) preserved for FISH/Glutaraldehyde/-80°C

Table 2 (continued): List of Alviniconcha spp adult specimens conditioned for symbiosis studies.

2.2 *Alvinocaridae* sp Symbioses

Sampling of shrimps in suction device jars: In order to work properly on symbioses of the shrimps, they must be collected as late as possible just before ROV ascent. Unfortunately, in most site, only poor sampling of shrimps have been possible, long dives, troubles with suction device or no shrimps almost on site. The sampled shrimps have been dissected for FISH, MET/MEB or DNA analyses (FISH, Glut, -80°C) when possible (more than 2,5 cm long). Otherwise, they have been frozen in one piece of if very small conditioned in FISH or Glut (see sampling excel).

Sampling using FISH BOX: (beginning of dive 4): All the hose have been changed, boxed washed and prepared as asked using alcohol and then filtered distilled water. Just before the dive FISH1 was filled with Formalin 5% and FISH2 with homemade RNAlater.



The complete FISH system take a large part of the ROV basket and can be used then in shrot dive. Only one time finally during Leg1. Some corrosion troubles have been noticed bit the system worked properly. The hose of the slurp gun in on the right and seems quite difficult to manage using Maestro, and seems to be a bite too short for the ROV and is often folded.

In situ, the FISH boxes were correctly managed. The pin was removed correctly but the ROV had to use the clam to close properly the box. The vacuum system worked properly without loose of charge. It only took 30 min for each FISH boxe.

The sampling area was poor in shrimps which were hidden among gastropods. The sampling has been done with FISH1 containing formalin on shrimps then we tried to collect 2 mussels broken the the ROV clam (for F Lallier). Then following the same procedure, FISH2 was deployed. FISH 1 was recovered in the elevator and FISH2 with the ROV.

After recovery in the lab, FISH1 contained only 1 crab and 1 small shrimp; it was probably sealed by a gastropod. The samples have been immediately rinsed and stored at -200C in PBS Alcohol.

FISH2 containing RNAlater had some more shrimps, very small, a gastropod and some mussels. Shrimps were place in commercial RNAlater overnight, then place in trizol with an incision on the back to properly fix the digestive system. As their size was very small, they were not fully dissected. The shrimps were so small that some of them have been recovered in the fixative bottle of each FISH box, going through the hose after fixative injection in the central part of the box. As they were poorly fixed (strong seawater dilution), they have been frozen entire at -80°C.

Samples obtained:

CHU-PL02-ASPI7-CR1 to CR 5 and CHU-PL02-ASPI8-CR6: dissected for FISH, MET/MEB and DNA. Numbers 1 and 6 were gravid.

CHU-PL02-ASPI7-CR7 to CR11 entire shrimps for DNA

CHU-PL03-GBT4-CR12 and CR13 entire shrimps for DNA

CHU-PL04-FISH1-CR14 entire shrimp fixed *in situ* in formalin for FISH

CHU-PL04-FISH1-CR 15 entire shrimp for DNA unfixed

CHU-PL04-FISH2-CR16 to 24 entire shrimps fixed in RNAlater and stored in Trizol

CHU-PL04-FISH2-CR25 to 27 entire shrimps for DNA unfixed
CHU-PL05-ASPI8-CR28 to 33 dissected shrimps for FISH, MET/MET and DNA
CHU-PL05-ASPI8-CR34 to 45 entire shrimps for FISH, DNA or MET/MEB
CHU-PL07-ASPI7-CR46 to 48 entire shrimps for DNA
CHU-PL12-ASPI4 CR 49, 50 entire juveniles FISH
CHU-PL12-ASPI4 CR 51, 52 entire juvenile MET/MEB
CHUPL12-ASPI4 CR53 gravide female stored -80°C and eggs in FISH, MET/MEB and DNA condition
CHU-PL12-ASPI4 CR54 to 74 one bag of 20 entire shrimps -80°C
PL12 shrimps sampling site


3. Other sampling

3.1 Sampling for Anne Lorrain

Animals (after geneticist sampling) and sediments have been collected (on MTB only on this Leg due to technical and environmental constrains). Samples have been kept in plastic bags and frozen at -80°C.
For this study, samples of *Ifremeria*, *Alvoniconcha* and mussels have been collected on eauch area : Lau Bassin, Fidji Bassin and Futuna area.
Samples:
02/04/2019, *Ifremeria*, *Alviniconcha* and mussel (1 each) TowCam
10/04/2019 *Ifremeria* and *Alviniconcha* without shell and mussel; Phoenix North Fiji
Sediment MTB upper part, transit Lau Bassin to Fiji
19/04/2019, *Ifremeria* and *Alviniconcha,* AsterX on Futuna

3.2 Sampling for L Meslet Cladière

During Leg1 several samples of seawater from Bioboxes containing gastropods *Alviniconcha* on different sites have been conditioned in Penni vial as asked, sealed and kept at 4°C. No sediment have been collected in Leg1 for this study (Core tube ROV system not deployed).
CHU-PL03-GBT5
CHU-PL07-GBT6
CHU-PL08-GBT2
CHU-PL09-GBT2

Cruise report CHUBACARC Leg2

Symbioses

V. CUEFF-GAUCHARD

Activities scheduled on board:
Symbioses of *Alviniconcha* and shrimp *Alvinocaridae*.
Laurence Meslet-Cladière sampling of water and sediments to enrich fungi.
Anne Lorrain for an ANR dealing with mercury, asking for gastropods, mussels and sediments.
Number of samples: CHU for Chubacarc; PLXX number of dive, ASPI ou GBT or PBT is the tool and CR for shrimp, AX for Alviniconcha, CH for chimney samples

4. Symbioses of *Alviniconcha* and *Alvinocaridae* spp

1.1 *Alviniconcha* spp symbioses

Previous work conducted at Ifremer/EEP (post-doc of Sven Laming 2017-2018) on symbiosis in the three *Alviniconcha* species (*A. kojimai*, *A. boucheti*, and *A. strummeri*) found at vent sites in the Futuna area showed that symbiotic diversity within the host is higher than previously described. Several types of intracellular symbionts were observed in the gills, with different distribution depending on host species, localisation within the gill, and possibly vent site. In addition, we found bacterial communities living in the gut of the snails that could also contribute to their nutrition. We also investigated juveniles early after their recruitment as well as post-larval stages in order to characterize symbiont acquisition, and evaluate the possible influence of the bacterial proliferation in post-recruitment stages on subsequent species distribution.

In order to expand that work, systematic sampling of adult specimens of the three species was conducted during CHUBACARC in all assemblages collected for biodiversity studies that were also assessed for habitat chemical conditions (see reports by O. Rouxel). Upon collection boxes recovery on board, all specimens were sorted in the cold room using gloves. Species were identified based on external characteristics such as the arrangement of periostracal hairs on the shell, as well as body coloration.

Sets of three specimens per species were selected for dissection of the tissues and conditioning for symbiosis studies. For each, gills were separated in three parts: anterior, middle and posterior, and a subset of gill filaments were FISH imagery (formaldehyde fixation), electron microscopy studies (glutaraldehyde fixation) and DNA diversity for each part. The digestive whorl was conditioned either for FISH imagery, electron microscopy studies or DNA diversity. A piece of the gonad was also preserved similarly to the digestive whorl, in order to check for possible bacterial transmission to the next generation. Pieces of foot muscle were frozen for later barcoding in order to validate morphological specimen identification and for isotopic analyses. Specimens treated for symbiotic analyses were also sampled for genetic approaches conducted by Didier Jollivet, Jade Castel et al. All rests of dissections were frozen at -80°C, as well as a piece of shell for later confirmation of morphological species diagnostic.

Moreover, samples of gonads of the two *Alviniconcha* species were collected on animals also symbiosis and genetic studies. Gonads were fixed whole in a borax buffered 4% formalin solution. They will be used for histological studies aiming at assessing gametogenesis, fertilization processes, reproductive synchrony, and potential developmental mode of larvae.

Before dissection, each specimen was photographed and 6 biometric measurements were recorded: shell length (SL), shell width (SW), aperture height (distance between the tip of the columella and the suture point of the outer lip of the aperture) (ei), maximal aperture width (fh), the body whorl thickness at the level of the suture point of the outer lip (ce), and the body whorl thickness at the level of the maximal aperture width (bf) (as shown previously on the symbiosis Leg 1 report).

A total of 113 adult specimens were treated: 27 were dissected, 14 were frozen without dissection as back-up and 72 were only used for gonads preservation in formalin. We found only two species, *A. strummeri* wasn't present neither in Manus Basin nor in Woodlark site. We have collected 65 *A. boucheti* including 12 individuals for symbiosis studies and 48 *A. kojimai* including 29 individuals for symbiosis studies. In total, gonads of 113 specimens were collected. Details of specimen dissections are presented in the table on the following pages (Table 1).

2.2 *Alvinocaridae* sp symbiosis

Sampling of shrimps in suction device jars: most of the time, the shrimps were sampled long before the ROV recovery. So they were not very fit so dead. We only sampled 1 *Alvinocaris komai*, all the other sampled shrimps were *Rimicaris variabilis*. The sampled shrimps have been dissected for FISH preservation with fixation with 3% formaldehyde, for scanning electronic microscopy with fixation with glutaraldehyde or for DNA analyses with dry freezing at -80°C. As they were little, a part of them were dissected under magnifying glass when possible (more than 2,5 cm long).

Otherwise, the specimens have been packed in their entirety. In total, 112 shrimps (111 *Rimicaris variabilis* and 1 *Alvinocaris komai*) were treated, 38 were dissected and we have prepared 74 whole specimens. In Manus Basin, lots of female were gravid. Details of specimen dissections are presented in the table 2.

Chubacarc 2019

Table 1 : List of Alviniconcha spp adult specimens conditioned for symbiosis and life cycle studies

Date	Dive	Sampling tool	Community	site	Species	nb of individuals	Ifremer number	Roscoff number	Treatment
17/05/2019	733 (14)	GBT2	Alviniconcha 1	PacManus - Big Papi	*Alviniconcha boucheti*	1	Ax472	Alv527	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax473	Alv528	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax474	Alv529	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	19	Ax481 to Ax499	Alv531 to Alv550	gonads for histology
18/05/2019	733(14)	GBT8	Alviniconcha 2	PacManus - Fenway	*Alviniconcha boucheti*	12	Ax500 to Ax511	Alv551 to Alv562	gonads for histology
23/05/2019	736 (17)	GBT3	Alviniconcha 1	Manus - Suzette	*Alviniconcha kojimai*	1	Ax475	Alv621	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax476	Alv622	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax477	Alv623	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	7	Ax512 to Ax518	[redacted]	Whole individuals frozen as back-up
24/05/2019	736 (17)	GBT10	Alviniconcha 2	Manus - North Su	*Alviniconcha kojimai*	1	Ax478	Alv645	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax479	Alv646	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax480	Alv647	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	19	Ax519 to Ax537	Alv648 to Alv666	gonads for histology
25/05/2019	737 (18)	GBT10	Alviniconcha 1	Manus - South Su	*Alviniconcha boucheti*	1	Ax538	Alv667	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax539	Alv668	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax540	Alv669	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
25/05/2019	737 (18)	PBT5	chimney	Manus - South Su	*Alviniconcha kojimai*	1	Ax541	Alv691	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax542	Alv692	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax543	Alv693	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax544	Alv694	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax545	Alv695	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax546	Alv698	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
25/05/2019	737 (18)	GBT7	Alviniconcha 2	Manus - South Su	*Alviniconcha boucheti*	2	Ax547 to Ax548	Alv721 to Alv722	gonads for histology
28/05/2019	738 (19)	GBT10	Alviniconcha 1	Woodlark - La Scala	*Alviniconcha kojimai*	1	Ax549	Alv745	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax550	Alv746	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax551	Alv747	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	7	Ax555 to Ax561	[redacted]	Whole individuals frozen as back-up
31/05/2019	739 (20)	PBT5	chimney	Woodlark - La Scala	*Alviniconcha boucheti*	1	Ax552	Alv769	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax553	Alv770	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	1	Ax554	Alv771	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha boucheti	20	Ax565 to Ax584	Alv775 to Alv795	gonads for histology
31/05/2019	739 (20)	GBT10	Alviniconcha 2	Woodlark - La Scala	*Alviniconcha kojimai*	1	Ax562	Alv772	Digestive tract, piece of gonad: DNA + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax563	Alv773	Digestive tract, piece of gonad: FISH + pieces of gills (ant/mid/post) for DNA/FISH/SEM
					Alviniconcha kojimai	1	Ax564	Alv774	Digestive tract, piece of gonad: SEM + pieces of gills (ant/mid/post) for DNA/FISH/SEM

Sampling using FISH BOX: (starting of dive 734 / 15): To be sure to have good sampling for metatranscriptomic studies, I prepared the 2 box with homemade RNA later in case there is a problem during the dive.

As the complete FISH system takes a large part of the ROV basket (Figure 2), we used it only one time during Leg 2. The hose of the slurp gun in on the right and seems quite difficult to manage using Maestro. There is a way to further improve the pipe part for suction.

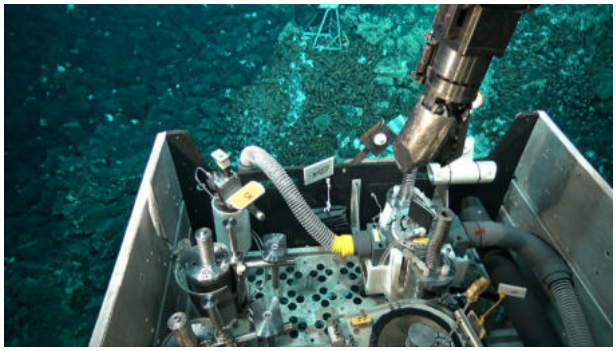


Figure 72 : FISH system inside the ROV basket

In situ, the 2 FISH boxes were correctly managed. So we sampled on 2 different sites: the FISH 1 on Big Papi site (PacManus) and the FISH2 on Roman ruins site (PacManus) (Figure 3). The pin was removed correctly but the ROV had to use the clam to close properly the box at 1700 m depth. The vacuum system worked properly without loose of charge. It only took between 15 and 30 min for each FISH box.

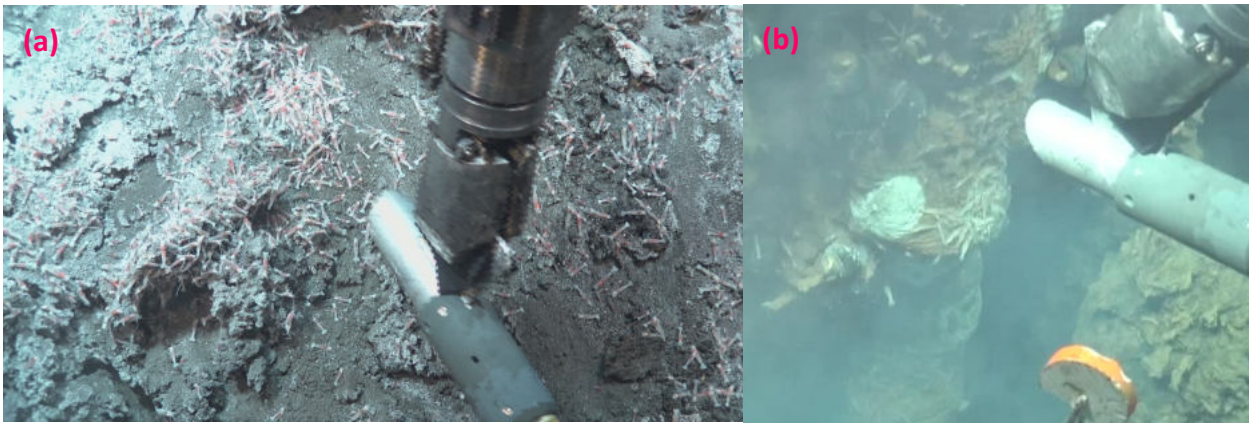


Figure 73 : suction of shrimps for FISH1 (a) and FISH2 (b)

After recovery in the lab, FISH1 contained very small shrimps. A large part were sucked inside the fixative bottles with the seawater because pipes were bigger than shrimps. The shrimps left in the bowl (14 on 45) were preserved as whole specimens either in commercial RNA later or in Trizol®. Shrimps inside FISH2 were bigger so I dissected 12 of them and preserved 20 whole specimens either in commercial RNA later or in Trizol®. After 1 night inside RNA later at 4°C, I transferred a part of whole specimens and dissected tissues in Trizol®.

Details of sampled specimens are presented in the table 2.

5. Other sampling

2.1 Sampling for Anne Lorrain

Samples of *Ifremeria*, *Alviniconcha* and *Bathymodiolus* (rest of the body after genetician sampling) and sediments have been collected. Samples have been kept in plastic bags and frozen at -80°C.
When possible, I sampled on both sites Manus Basin and Woodlark (no mussel at Woodlark).
Samples:
Manus basin
CHU-PL15-GBT1-BB341 : *Bathymodiolus manusiensis*
CHU-PL15-GBT5-In523 : *Ifremeria nautilei*
CHU-PL16-CT2 : sediment
CHU-PL17-GBT3-Alv634 : *Alviniconcha kojimai*
Woodlark – La Scala
CHU-PL19-GBT10-Alv748 : *Alviniconcha kojimai*
CHU-PL20-CT8 section 0-5 cm (site 2) : sediment

2.2 Sampling for Laurence Meslet Cladière

During Leg2, several samples of chimney and one sample of sediment have been conditioned in penicillin vial as asked, sealed, flushed with nitrogen and kept at 4°C.
Manus Basin
CHU-PL18-PBT6-CH15 : fraction of homogenized chimney (South Su site)
Woodlark – La Scala
CHU-PL19-PBT2-CH17: fraction of homogenized chimney
CHU-PL20-CT8 section 0-5 cm: sediment
CHU-PL20-PBT2-CH19: fraction of homogenized chimney

Tableau 2: List of shrimp sampled for symbiosis

Date	Dive	Sampling tool	site	Species	nb of individuals	Ifremer number	Treatment
18/05/2019	733 (14)	ASPI6	PacManus - Solwara8	*Rimicaris variabilis*	9 whole shrimps	CR101 to CR109	4 DNA, 1 FISH, 2 SEM, 2 isotop
		ASPI7	PacManus - Solwara8	*Rimicaris variabilis*	4 dissected shrimps	CR79 to CR82	1 DNA (head part 1, digestive tract) + FISH (head part 2), 1 FISH (head part 1, digestive t DNA (head), 1 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
				Rimicaris variabilis	11 whole shrimps	CR83 to CR93	6 DNA, 3 FISH, 2 SEM
		ASPI8	PacManus - Solwara8	*Rimicaris variabilis*	4 dissected shrimps	CR75 to CR78	1 DNA (head part 1, digestive tract) + FISH (head part 2), 1 FISH (head part 1, digestive t DNA (head), 1 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
				Rimicaris variabilis	7 whole shrimps	CR94 to CR100	3 DNA, 2 FISH, 2 SEM
19/05/2019	734 (15)	FISH2	PacManus - Roman ruins	*Rimicaris variabilis*	12 dissected shrimps	CR110 to CR121	12 RNA (RNA later or Trizol)
				Rimicaris variabilis	20 whole shrimps	CR122 to CR141	20 RNA : 10 Trizol and 10 RNA later
19/05/2019		FISH1	PacManus - Big Papi	*Rimicaris variabilis*	14 whole shrimps	CR142 to CR155	14 RNA : 7 Trizol and 7 RNA later
		ASPI1	PacManus - Roman ruins	*Rimicaris variabilis*	7 dissected shrimps	CR156 to CR162	2 DNA (head part 1, digestive tract) + FISH (head part 2), 2 FISH (head part 1, digestive t DNA (head), 2 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
		ASPI6	PacManus - Solwara6	*Rimicaris variabilis*	12 whole shrimps	CR168 to CR179	6 DNA, 3 FISH, 3 SEM
		ASPI7	PacManus - Solwara6	*Rimicaris variabilis*	3 dissected shrimps	CR163 to CR165	1 DNA (head part 1, digestive tract) + FISH (head part 2), 1 FISH (head part 1, digestive t DNA (head), 1 SEM (head part 1, digestive tract) + DNA (head)
		ASPI8	PacManus - Solwara6	*Rimicaris variabilis*	2 whole shrimps	CR166 to CR167	1 DNA, 1 SEM
24/05/2019	736 (17)	ASPI2	Manus - Suzette	*Rimicaris variabilis*	4 dissected shrimps	CR182 to CR183 and CR188 to CR189	1 DNA (head part 1, digestive tract) + FISH (head part 2), 1 FISH (head part 1, digestive t DNA (head), 1 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
				Rimicaris variabilis	5 whole shrimps	CR192-CR193-CR195-CR196-CR197	2 DNA, 3 FISH
		ASPI3	Manus - North Su	*Rimicaris variabilis*	2 whole shrimps	CR190 and CR194	1 DNA, 1 FISH
		ASPI4	Manus - Suzette	*Rimicaris variabilis*	6 dissected shrimps	CR180 to CR181 and CR184 to CR187	2 DNA (head part 1, digestive tract) + FISH (head part 2), 2 FISH (head part 1, digestive t DNA (head), 1 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
				Rimicaris variabilis	1 whole shrimp	CR191	1 DNA
25/05/2019	737 (18)	ASPI8	Manus - South Su	*Alvinocaris komai*	1 dissected shrimp	CR198	1 DNA (head part 1, digestive tract) + FISH (head part 2)
29/05/2019	738 (19)	ASPI2	Woodlark - La Scala	*Rimicaris variabilis*	9 whole shrimps	CR204 to CR212	9 DNA
		ASPI3	Woodlark - La Scala	*Rimicaris variabilis*	3 dissected shrimps	CR199 to CR201	1 DNA (head part 1, digestive tract) + FISH (head part 2), 1 FISH (head part 1, digestive t DNA (head), 1 SEM (head part 1, digestive tract) + DNA (head)
				Rimicaris variabilis	2 whole shrimps	CR202 to CR203	2 DNA
31/05/2019	739 (20)	ASPI1	Woodlark - La Scala	*Rimicaris variabilis*	6 dissected shrimps	CR213 to CR218	2 DNA (head part 1, digestive tract) + FISH (head part 2), 2 FISH (head part 1, digestive t DNA (head), 1 DNA (head part 1, digestive tract) + SEM (head part 2), 1 SEM (head part digestive tract) + DNA (head)
				Rimicaris variabilis	14 whole shrimps	CR219 to CR232	6 DNA, 4 FISH, 4 SEM

ChuBacArc: leg 2 (6 mai- 7 juin)
Scientific report: Microbiology

L'Haridon Stéphane

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Scientific objectives. Hyperthermophilic chemolithoautotrophic methanogens belonging to the genus *Methanocaldococcus* are widespread in deep-sea hydrothermal vents. Species of the genus *Methanocaldococcus* have been isolated from the Mid- Atlantic Ridge, from the East Pacific Rise and from the Indian Ocean. A strong endemicity of the species of this genus has been observed with a genetic structuration along the east Pacific Rise. During the ChuBacArc cruise, numerous basins will be visited which include the North Fiji basin, the Lau basin, Futuna back-arc volcanoes, the Woodlark ridge and the Manus basin. Even if molecular survey, sequencing of the 16S rRNA genes, has indicated the presence of species related to the genus *Methanocaldococcus* in the Lau Basin (Flores et al., 2012), none species/strains related to the genus *Methanocaldococcus* have been isolated from all this basins.

The main objectives will be to enrich and to isolate hyperthermophilic methanogens belonging to the genus *Methanocaldococcus* from all the basins. After purification of the isolates, the genome of the different strains will be sequenced in order to study the genetic connectivity of all the isolates from the different basins.

Hydrothermal field sampled: During the second leg, 2 different ridges have been sampled: the Manus basin and Woodlark. At Manus basin, Chimneys samples have been collected from Big Papi, Satanic Mills, Romans Ruins, Solwara 8, Solwara 1, North Su and South Su volcano sites. On the Woodlark field, a new hydrothermal site have been found and called "La Scala", chimney samples were also collected on this new site. The list of the chimney samples during the second leg are presented in the table 1.

Methods: The piece of active chimneys are sampled with the arms of the ROV and placed in BioBox such as GBT and PBT. After chimney sampling, the temperature of the fluid is measured and the fluid is collected using titanium bottle for further analysis. On board, chimneys are crushed with a mortar and pillar, previously sterilized. For DNA extraction, future work of metabarcoding and metagenomic studies, 10 or 20 cryotubes of 2 ml are filled with crushed chimneys and stored at -80°C. For the cultivable approach, sterile Bellco tubes, penicillin flasks of 100 ml or 250 ml Schott flasks previously flushed with Nitrogen are filled with crushed chimneys and closed with dedicated stoppers. The different flasks are stored under Nitrogen (1 Bar) at 4°C.

Methanogenic medium preparation and enrichment: the methanogenic medium contained per liter: NaCl 20 g ; $MgCl_2$, $6H_2O$ 4 g ; $MgSO_4$, 7 H_2O 3.45 g ; NH_4Cl 0.25 g ; KCl 0.33 g ; $CaCl_2$, 2 H_2O

0.14 g ; trace element 10 mL ; $Fe(NH_4)2(SO_4)2$, 7 H_2O 2 mg ; $NaHCO_3$ 0.5 g ; KH_2PO_4 0.14 g ; yeast extract (Oxoid) 0.2 g; few drops of resazurin. pH is adjusted to 6.5. The medium is boiled under N_2/CO_2 (80/20) and cooled down. 0.3 g of cysteine HCl, 1 mL of selenate/tungstate, 1ml of a vitamin solution are added. 25 ml of medium are then distributed in 100 ml penicillin flask under a N_2/CO_2 atmosphere (80/20). The flasks are sealed with blue stopper and aluminium caps. The flasks are autoclaved. 2 to 3ml of crushed chimneys are used for inoculum. The flasks are pressurized with $H_2/C0_2$ (80/20, 200 kPa) and incubated at 80°C in an oven

List of the chimney sampled. The pictures represent the chimneys sampled at the bottom and on board in the laboratory before crushing and sampling.

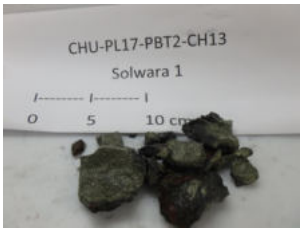
Manus basin, Big Papi: CHU-PL14-PBT1-CH9


Manus basin, Satanic Mills: CHU-PL14-PBT4-CH10

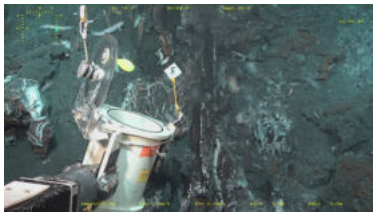

Manus basin, Solwara 8: CHU-PL14-PBT2-CH11


Manus basin, Roman Ruins: CHU-PL15-PBT7-CH12

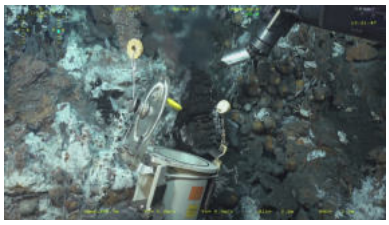

Manus basin, Solwara 1: CHU-PL17-PBT2-CH13

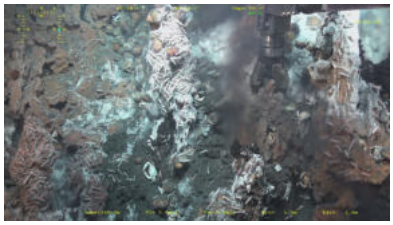
Manus basin, North Su: CHU-PL17-PBT5-CH14



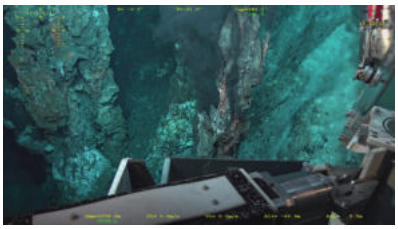

Manus basin, South Su: CHU-PL18-PBT6-CH15




Manus basin, South Su: CHU-PL18-Rock-CH16

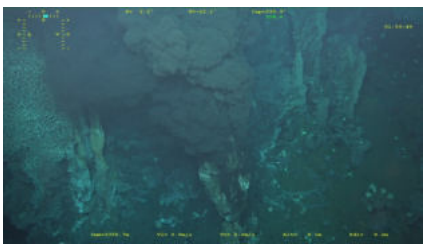



Woodlark, La Scala: CHU-PL19-PBT2-CH17




Woodlark, La Scala: CHU-PL19-PBT6-CH18


Woodlark, La Scala: CHU-PL20-PBT2-CH19




Enrichment results on the cultivation of chemolithoautotrophic hyperthermophilic methanogens.

The chimneys which have been sampled during the first and second leg were processed for the enrichment of hyperthermophilic autotrophic methanogens directly on board. Positive enrichments were obtained from the Lau Basin siteTu I Malila and Abe, from the North Fidji basin site Phoenix, from the Manus Basin site Romans Ruins and Big Papi and from Woodlark site “La Scala”. On board, no positive enrichments of methanogens were obtained from the Futuna Basin. New attempts to enrich the methanogenic microorganisms will be done back to the lab for all the samples.
At the laboratory, hyperthermophilic methanogens will be isolated from all the positive enrichments.

Table 1 : List of chimneys sampled during the first and second leg of ChuBacArc cruise.

Leg	Date	Field	Site (Marker)	longitude	Latitude	depth	Site (station) #	Fluid temperature	titane syringe	Sample name (B)
1	31/03/2019	South Lau	Tow Cam	S 20.1895	W 176 08.182	2704	Tow Cam	315	TiG3-1; TiD1-1; BEG2	CHU-PL02-GBT CH1
1	03/04/2019	South Lau	Tu I Malila	S 21.1895	W 176.34.075	1891	Tu I Malila	295	BEG-1, TiG1, TiG2	CHU-PL03-GBT CH2
1	04/04/2019	South Lau	Tu I Malila				Tu I Malila	267	BEG-2, D2, D3	CHU-PL03-PBT CH3
1	10/04/2019	North fidji	Phoenix	S 16.56.967	E 173.55.081	1973	Phoenix	270	Ti-G1, Ti-G2, BEG-3	CHU-PL05-GBT CH4
1	18/04/2019	North Lau	Mangatolo	S 15.24.873	W174.39.207	2028	Mangatolo	310	Ti-G3, Ti-D1, Ti-D2	CHU-PL07-GBT CH5
1	19/04/2019	Futuna	Stéphanie	S 14.45.186	W 177.09.324	2028	Stéphanie	287	Ti-D2, Ti-D3, BEG-3	CHU-PL08-PBT CH6 -bas
1	19/04/2019	Futuna	Stéphanie	S 14.45.186	W 177.09.324	2028	Stéphanie	287	Ti-D2, Ti-D3, BEG-3	CHU-PL08-PBT CH6 -haut
1	21/04/2019	Futuna	Fati Ufu	S 14.45.589	W 177.11.069	1514	Fati Ufu	300	Ti-D2, Ti-D3, BEG-4	CHU-PL09-GBT CH7
1	27/04/2019	South Lau	ABE	S 20.45.671	W 176.11.448	2137	ABE	307	Ti-D3, Ti-G3	CHU-PL12-GBT CH8
2	16/05/2019	Manus	Big Papi	S 03 43.729	E 151 40.331	1704	Big Papi	352	Ti-G1	CHU-PL14-PBT CH9
2	17/05/2019	Manus	Satanic Mills	S 03 43.630	E151 40.331	1686	Satanic Mills	285	Ti-G2, Ti-G3	CHU-PL14-PBT CH10
2	18/05/2019	Manus	Solwara 8	S 03.43.820	E 151 40.460	1737	Solwara 8	270	Ti-D1, Ti-D2	CHU-PL14-PBT CH11
2	19/05/2019	Manus	Romans Ruins	S 03 43.263	E 151 40.486	1667	Romans Ruins	310-170	Ti-D3, Ti-G3	CHU-PL15-PBT CH12
2	22/05/2019	Manus	Solwara 1	S 03 47.370	E 152 05.782	1505	Solwara 1	281	TI-D1, Ti-G3	CHU-PL17-PBT CH13
2	23/05/2019	Manus	North Su	S 03 47.999	E 152 06.048	1155	North Su	320	Ti-D3	CHU-PL17-PBT CH14

2	23/05/2019	Manus	North Su	S 03 47.999	E 152 06.048	1155	North Su			CHU-PL17-Rock
2	25/05/2019	Manus	South Su	S 03 48.566	E 152 06.315	1327	South Su	290	Ti-D1	CHU-PL18-PBT6 CH15
2	25/05/2019	Manus	South Su	S 03 48.566	E 152 06.315	1327	South Su	290	Ti-D1	CHU-PL18-PBT6 CH15
2	25/05/2019	Manus	South Su	S 03 48.565	E 152 06.314	1330	South Su			CHU-PL18-Rock CH16
2	28/05/2019	Woodlark	La Scala	S 09 47.950	E 155 03.115	3378	La Scala	366	Ti-D3, Ti-G1	CHU-PL19-PBT7 CH17
2	28/05/2019	Woodlark	La Scala	S 09 47.939	E 155 03.152	3378	La Scala	364	Ti-G2, Ti-D2	CHU-PL19-PBT6 CH18
2	28/05/2019	Woodlark	La Scala	S 09 47.950	E 155 03.117	3380	La Scala	367	Ti-D3	CHU-PL19-rock
2	31/05/2019	Woodlark	La Scala	S 09 47.936	E 155 03.130	3357	La Scala	361	Ti-G2, Ti-D2	CHU-PL20-PBT7 CH19

Inference of connectivity by using elemental fingerprinting of the larval shell

Principal investigator : Thierry Comtet

Investigator for Chubacarc Leg 1 (April 25 - June 2, 2019): Thierry Comtet

Involved in sampling/sorting: Camille Poitrimol, Marjolaine Matabos

Investigator for Chubacarc Leg 2 (May 6 - June 7, 2019): Thomas Broquet

Involved in sampling/sorting: Camille Poitrimol, Eric Thiébaut

This report is an update of the report written by T. Comtet at the end of the first Chubacarc leg.

Scientific objectives

Studying present-day spatial connectivity patterns within and between basins (BaBs) requires the use of different complementary approaches. Besides genetic-based inferences, either indirect through the assessment of differences in allele frequencies, or direct through genetic assignments (see report of the genetics team), elemental fingerprinting is a supplementary tool that could be used in species with calcified structures (otolith, statolith, shell), in particular in molluscs, which are very abundant in the targeted vent communities (see report of the ecology team). When built, the larval calcified structures 'imprint' the local environmental conditions (e.g. seawater chemistry, temperature) in their elemental composition. Provided that these conditions differ spatially, measuring the elemental composition (elemental fingerprint) of these larval structures in recruits will allow identifying their natal origin. Our main objective here is thus to assess the potential of such an approach in our understanding of back-arc basins connectivity.

To achieve this aim, we focused on two gastropod "species" (*Olgasolaris tollmanni* and *Alviniconcha* spp.) and mytilid bivalves (*Bathymodiolus brevior* and/or *B. manusensis*). *Olgasolaris tollmanni* lays benthic egg capsules from which hatch planktotrophic larvae that are likely to disperse long distance, and which protoconch (larval shell) is visible on juvenile shells. This species is thus well suited to test the reliability of the elemental fingerprinting approach. The specific objectives were (1) to study the elemental composition of the shells (protoconchs) of encapsulated embryos collected from different sites, to test for the occurrence of site-specific signatures, and (2) to measure the elemental composition of the protoconch at the apex of benthic recruits collected on the same sites to infer their natal origin. To complement the measurements of the elemental composition of the shell of encapsulated larvae, the elemental composition of the growing margin of the benthic recruits (i.e. shell produced on the site) will be measured to check for site-specific signature. The mytilids *Bathymodiolus brevior* and/or *B. manusensis* are broadcast spawners and encapsulated larvae of known origin are not available. The assessment of site-specific signature will be done by measuring the elemental composition of the most recent part of young shells (i.e. margin). The elemental fingerprint of the larval part of juvenile shells will thus be used to infer their natal origin.

A secondary objective aims to better understand the individual dispersal trajectory of larvae, in particular to determine if some larvae migrate to subsurface layers of the ocean, as has been suggested for several deep-sea species, including vent and seep ones. We here aim to measure the value of $\delta^{18}O$, a proxy of the temperature experienced during shell deposition, along larval and postlarval shells. This will be done on *O. tollmanni* and *Bathymodiolus* spp., but also on *Alviniconcha* spp. *Alviniconcha* spp. lose their early larval shell during dispersal, so that applying elemental fingerprinting to infer the natal origin of recruits in not possible. However, measuring

$\delta^{18}O$ along their larval and postlarval shells may still bring information on the conditions in which they are deposited, then the conditions during dispersal.

Sampling description

Sampling for this task mostly consisted in recovering postlarvae and juveniles of the targeted species.

Following the overall sampling strategy for the ecological study of the targeted communities (i.e. communities dominated by the mytilid bivalves *Bathymodiolus* spp. and the gastropods *Ifremeria nautilei* and *Alviniconcha* spp.) (see report of the Ecology team) early life stages of the targeted species and specimens of opportunity were sampled as follows.

After on-board recovery, all samples (either collected in boxes or with the suction sampler) were sorted to recover large specimens (see report by Ecology team). The remaining macrofauna was then sieved on a 250-µm mesh sieve. All sieved material was then sorted under a dissecting microscope in a clean Dollfus cuvette or Petri dishes to collect postlarvae, juveniles and young specimens. These specimens were collected either with plastic forceps or with a Pasteur pipette. All collecting material was acid washed whenever possible and rinsed with ultrapure water. Specimens were then preserved in acid-washed 2-mL tubes at - 20°C. For encapsulated larvae of *Olgasolaris tollmanni*, egg capsules laid on adults of *Ifremeria nautilei* (5-12 individuals) were opened with a needle and their developmental stage checked (Figure 1A). When capsules contained veliger larvae, they were pipetted and the presence of a larval shell was checked with cross-polarized light (Figure 1B). Veliger were then preserved in acid-washed 2-mL tubes at - 20°C.

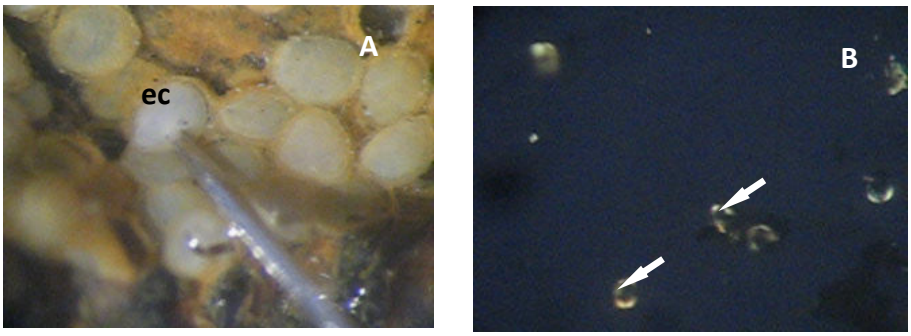


Figure 1. Sampling encapsulated veligers of *Olgasolaris tollmanni*. A: opening of an egg capsule (ec) with a needle. Each capsule contains 10-20 veligers. B: observation of swimming veligers with cross-polarized light, showing the birefringence of the calcareous shells (arrows).

Chubacarc leg 1 sampling specificities

Because the first dives in the Lau Basin did not allow to sample many early recruits of the targeted species, we took the opportunity of a 3-week mooring program to deploy on the site Tow Cam an artificial settlement structure built on board, with the aim to collect settling larvae. Inspired from the standard ARMS (Autonomous Reef Monitoring Structure) devices (http://www.oceanarms.org/), CHARMS (for Chubacarc Hydrothermal ARMS) was deployed at Tow Cam on the edge of a mussel/*Ifremeria* bed (Figure 2). Unfortunately, no recruit of the targeted species was recovered.

Figure 2. CHARMS (arrow) deployed at Tow Cam.

Chubacarc leg 1 preliminary results

Overall, we collected all targeted species, with varying success depending on the species and the sites (Table 1, Figure 3). The most complete dataset has been obtained for *Olgasolaris tollmanni* for which veliger larvae were obtained at all sites (except Fati Ufu South in the Futuna area), and postlarvae and juveniles at several sites. The variations in abundances of recruits among sites suggested an asynchrony in the recruitment events at the different sites. The high abundance of postlarvae at the site Tu'i Malila (Lau Basin) makes it an interesting case to test for a multiple origin of settling larvae provided that site-specific signatures exist. Only a few *Bathymodiolus* sp. were observed but in all cases the larval shell is visible on the juveniles. Again, the highest abundance was observed at Tu'i Malila. *Alviniconcha* sp. postlarvae were observed in all basins, although at a low frequency. Apart from these targeted species we also collected additional species (Table 1, Figure 3) that will allow to compare the elemental composition of the larval and juvenile shells between species. In particular, *Lepetodrilus schrolli* was very abundant and sampling of opportunity was carried out on this species that shows a lecithotrophic development.

Chubacarc leg 2 preliminary results

As for the first leg, sampling was most successful for *Olgasolaris tollmanni*, with veliger larvae samples from five sites in the Manus basin and one sample from the newly discovered site in Woodlark (Table 2). In addition, several individuals at the post-larval stage were sampled from a few sites. Again, we observed that the proportion of mature egg capsules was much different from site to site, suggesting asynchronous recruitment (as observed in leg 1).
Only five *Bathymodiolus* juvenile (with protoconch) were found during this leg.
Similarly, *Alviniconcha* sampling was not successful (n=5), but a larger number of individuals were classified as "unidentified gastropod" (n=35) for later identification by T. Comtet and may include *Alviniconcha* samples.

We completed the sampling effort undertaken in leg 1 for species that were not targeted initially. In particular, 85 individuals of *Lepetodrilus schrolli* at different developmental stages were collected. We also found in one site a collection of egg capsules most likely produced by another limpet: *Shinkailepas tufari*. Fifty veliger larvae were collected using the same method as for *Lepetodrilus schrolli.*

Finally, we took the opportunity to sample another interesting species that was not originally targeted: a bivalve from the Solemyidae family (n=48 juveniles or adults, essentially from one site in the Manus basin).

A sampling summary per main basin for the two legs combined is presented in Table 3.

Table 1. List of samples collected during leg 1. For each species and developmental stage, the number of specimen collected is indicated. Totals per species and basin are also given.

	Futuna								Lau				Mangatolo				North Fiji	
Species	**Fati Ufu**	**Fati Ufu Centre**	**Fati Ufu North**	**Fati Ufu South**	**Fatu Kapa AsterX**	**Fatu Kapa Stéphanie**	**Kulo Lasi**	**Total Futuna**	**ABE**	**Tow cam**	**Tu'i Malila**	**Total Lau**	**North**	**South**	**Mangatolo**	**Total Mangatolo**	**Phoenix**	**Total North Fiji**
***Alviniconcha* sp.**		**1**			**23**	**1**	**1**	**26**			**24**	**24**			**8**	**8**	**5**	**5**
Postlarva		1			23	1	1	26			24	24			8	8	5	5
Bathymodiolus brevior				**1**			**8**	**9**		**1**	**53**	**54**						
Juvenile							1	1			22	22						
Postlarva							2	2		1	31	32						
Young				1			5	6										
Lamellomphalus manusensis							**55**	**55**										
Juvenile							55	55										
Lepetodrilus schrolli				**2**	**1**	**11**	**70**	**84**	**34**	**49**	**47**	**130**	**55**	**33**	**1**	**89**	**147**	**147**
Juvenile				2	1	11	48	62	34	9	4	47	55	33	1	89	135	135
Postlarva							18	18		6	1	7					12	12
Small adult										34	42	76						
Young							4	4										
Lepetodrilus-like											**3**	**3**						
Postlarva											3	3						
Neomphalid	**1**		**9**			**17**	**1**	**28**										
Juvenile	1		9			17	1	28										
Young																		
Olgasolaris tollmanni	**2**	**100**	**105**		**100**	**102**	**110**	**519**	**207**	**129**	**265**	**601**	**101**	**60**	**10**	**171**	**135**	**135**
Egg capsule																		
Juvenile							9	9	3		21	24	1			1		
Postlarva	2		5			2	1	10	4	4	114	122		10	10	20	5	5
Veliger		100	100		100	100	100	500	200	125	130	455	100	50		150	130	130
Provanna-like											**2**	**2**						
Postlarva											2	2						
Pseudorimula sp.													**1**	**1**	**2**	**4**		
Juvenile													1	1	1	3		
Postlarva															1	1		
Shinkailepas tufari															**2**	**2**		
Juvenile															2	2		
Symmetromphalus sp.										**2**		**2**					**3**	**3**
Postlarva																	3	3
Small adult										2		2						
Unidentified gastropod	**5**		**6**		**13**	**4**	**3**	**31**	**1**	**2**	**15**	**18**	**1**			**1**		
Postlarva	5		6		13	4	3	31	1	2	1	4	1			1		
Various											14	14						
Total	**8**	**101**	**120**	**3**	**137**	**135**	**248**	**752**	**242**	**183**	**409**	**834**	**158**	**94**	**23**	**275**	**290**	**290**

Table 2. List of samples collected during leg 2. For each species and developmental stage, the number of specimen collected is indicated. Totals per species and basin are also given.

	Manus								Total Manus	Woodlark	Total
Species	**Fenway**	**Big_Papi**	**Snowcap**	**Solwara_8_Th2**	**Roman_Ruins**	**Solwara1**	**North_Su**	**South_Su**		**Scala**	
Alviniconcha sp.						**1**	**4**		**5**		**5**
Postlarva						1	4		5		5
Lepetodrilus schrolli	**32**	**1**	**1**	**17**	**9**	**12**	**13**		**85**		**85**
Juvenile	32	1	1	17	9	11	7		78		78
Postlarva						1	6		7		7
Lepetodrilus-like			**3**						**3**		**3**
Juvenile			3						3		3
Olgasolaris tollmanni	**40**			**140**	**56**	**2**	**203**	**203**	**644**	**70**	**714**
Juvenile								1	1		1
Postlarva					1	2	3	2	8		8
Veliger	40			140	55		200	200	635	70	705
Shinkailepas tufari							**4**	**50**	**54**		**54**
Juvenile							4		4		4
Veliger								50	50		50
Unidentified gastropod	**7**	**1**	**2**	**2**	**7**	**1**	**11**	**3**	**34**	**1**	**35**
Juvenile							4		4		4
Postlarva	1			1	7	1	7	3	20		20
NA	6	1	2	1					10		10
Solemyidae	**1**		**39**				**3**	**5**	**48**		**48**
Juvenile							3	5	8		8
NA	1		39						40		40
Bathymodiolus manusensis	**1**		**1**		**3**				**5**		**5**
Juvenile	1		1		3				5		5
Total	**81**	**2**	**46**	**159**	**75**	**16**	**238**	**261**	**878**	**71**	**949**

Table 3: sampling summary per main basin for the two legs combined

	Manus	Woodlark	Lau	North Fiji	Mangatolo	Futuna	Total
Species							
Alviniconcha sp.	5		24	5	8	26	**68**
Postlarva	5		24	5	8	26	**68**
Lepetodrilus schrolli	85		130	147	89	84	**535**
Juvenile	78		47	135	89	62	**411**
Postlarva	7		7	12		18	**44**
Small adult			76				**76**
Young						4	**4**
Lepetodrilus-like	3		3				**6**
Juvenile	3						**3**
Postlarva			3				**3**
Olgasolaris tollmanni	644	70	601	135	171	519	**2140**
Juvenile	1		24		1	9	**35**
Postlarva	8		122	5	20	10	**165**
Veliger	635	70	455	130	150	500	**1940**
Egg capsule							
Shinkailepas tufari	54				2		**56**
Juvenile	4				2		**6**
Veliger	50						**50**
Unidentified gastropod	34	1	18		1	31	**85**
Juvenile	4						**4**
Postlarva	20	1	4		1	31	**57**
NA	10						**10**
Various			14				**14**
Solemyidae	48						**48**
Juvenile	8						**8**
NA	40						**40**
Bathymodiolus manusensis	5						**5**
Juvenile	5						**5**
Symmetromphalus sp.			2	3			**5**
Postlarva				3			**3**
Small adult			2				**2**
Provanna-like			2				**2**
Postlarva			2				**2**
Bathymodiolus brevior			54			9	**63**
Juvenile			22			1	**23**
Postlarva			32			2	**34**
Young						6	**6**
Pseudorimula sp.					4		**4**
Juvenile					3		**3**
Postlarva					1		**1**
Neomphalid						28	**28**
Juvenile						28	**28**
Young							
Lamellomphalus manusensis						55	**55**
Juvenile						55	**55**
Total	**878**	**71**	**834**	**290**	**275**	**752**	**3100**

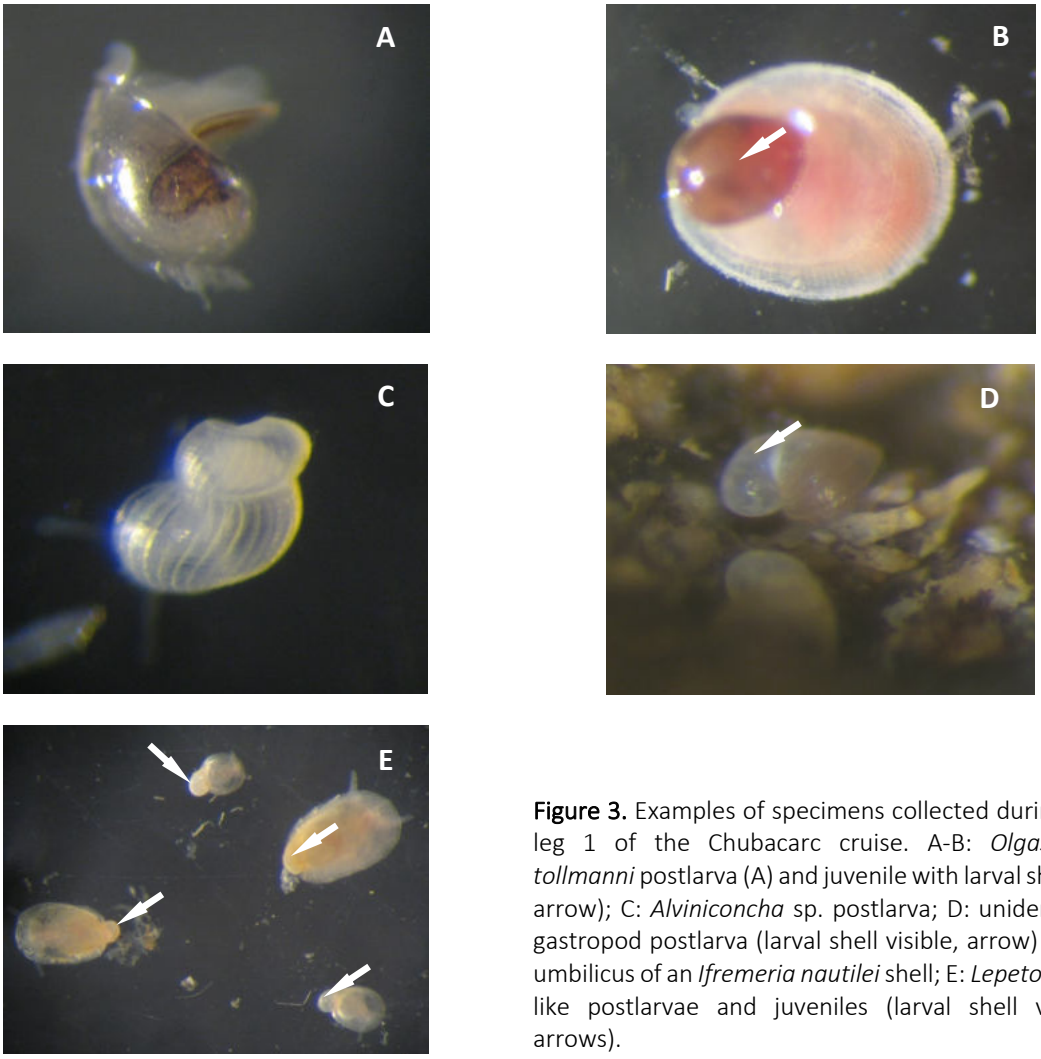


Figure 3. Examples of specimens collected during the leg 1 of the Chubacarc cruise. A-B: *Olgasolaris tollmanni* postlarva (A) and juvenile with larval shell (B, arrow); C: *Alviniconcha* sp. postlarva; D: unidentified gastropod postlarva (larval shell visible, arrow) in the umbilicus of an *Ifremeria nautilei* shell; E: *Lepetodrilus*-like postlarvae and juveniles (larval shell visible, arrows).

Further analyses in the laboratory

Sampling during leg 1 will be completed by additional sampling in the Manus basin and the Woodlark ridge during the leg 2 of the cruise.

Back in the laboratory, analyses of these samples will consist in two main actions:

1- Confirmation of the identification of several specimens, either based on morphology or on DNA barcoding (based on reference sequences obtained by the genetics team). Some of the sampled individuals will be dedicated to this task, but whenever possible, we will try to get some DNA from all individuals to be analyzed for larval shell microchemistry

2- The main analyses aim to determine the elemental composition of both larval and juvenile shells for elemental fingerprinting. The elemental composition will be measured by mass spectrometry (HR-ICP-MS) coupled with femtosecond laser ablation (fsLA-HR-ICPMS). At least 15 elements will be measured in order to maximize the chance to find site-specific signatures. To determine the accuracy of the assignment based on the elemental fingerprints, encapsulated embryos (or shell margin of juveniles) of known origin will be reclassified to their site of collection using discriminant function analyses. This will allow determining the spatial scale at which assignment is correct. Site-

specific elemental fingerprints will then be used to infer the origin of recruits based on the elemental composition of their larval shell. Mass spectrometry analyses will be conducted on the PAMAL platform at the University of Pau, a leading laboratory for elemental analyses of calcified structures. Costs will be supported by the ANR project *Cerberus*. $\delta^{18}O$ measurements will be made with a NanoSIMS probe at the PAMAL platform. Fluid chemistry measurements conducted by the geochemistry team (see report of geochemistry team) will help interpreting the results obtained on the elemental fingerprinting.
Connectivity assessments obtained with elemental fingerprinting will be compared with those obtained with genetic approaches, in particular on *O. tollmanni*.

CHUBACARC Leg 1, cruise report

Larval dispersal and life cycle of vent species

Florence Pradillon, Marie-Anne Cambon

I-Larval dispersal

I-1. Sampling planktonic larval pool with the SALSA pumps

The main objective is to characterize larval diversity in waters surrounding vent sites a few meters and several tens of meters away from vent animal communities, search for larval forms of vent species and evaluate their potential for dispersal.

Larvae were collected using the SALSA pumps. SALSAs are autonomous systems powered with lithium batteries that collect particles from water by filtration (fig. 1). Both SALSA 1 and SALSA 2 systems are similar, and only have minor technical differences in their motor and command systems. Another difference is the number of sampling bowls: 5 in SALSA 1 with a purge in the 6^{th} position; 6 in SALSA 2 with purges between each bowl (12 positions in total).

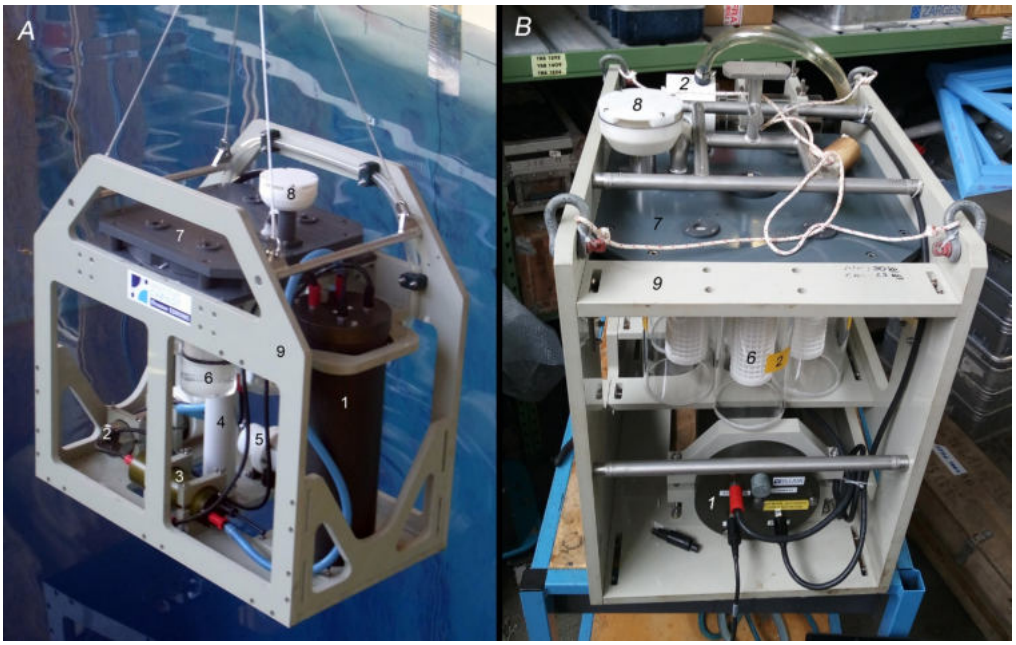


Figure 1: SALSA pumps. A: SALSA 1, B: SALSA 2. Legend : 1: battery and electronic control housing, 2: pump, 3: electronic signal conversion housing (only on SALSA 1), 4: stepper motor, 5 : oil pressure compensation system (only on SALSA 1), 6 : sampling bowl, 7 : rotation plate supporting sampling bowls, 8: water inlet, 9: frame.

During the cruise, SALSA deployments were scheduled to collect 4 samples, each sample resulting from the water filtered during one tidal phase (approx. 6h 12min) in order to assess the influence of tide on the larval pool. At each deployment total filtration duration was approx. 25 h. Both SALSA were deployed at the same time and were programmed to sample simultaneously at two different place, one just near vent communities, and the second a few tens of meters away. The two first sampling bowls were equipped with a 50 µm mesh in order to collect large particles including larval stages. These bowls are dedicated to larval studies using morphological and individual barcoding approaches. The two last sampling bowls are equipped with a 5 µm mesh and are meant to evaluate biodiversity in the larval pool through metabarcoding approaches.

Both SALSA modules were equipped with an autonomous nephelometry sensor (NKE STBD6000, also measuring temperature and pressure) mounted near the water inlet of each system to evaluate variations in water particle load at any time during sampling. These data are used to assess water masses changes, either due to current variations (possibly in relation with tide) or to nearby disturbance (due to venting activity for example).

Both SALSA were deployed by the elevator and positioned on the bottom by the ROV VICTOR 6000. Similarly at the end of each deployment, they were collected by the ROV and placed in the elevator to reach the surface.

Once on board, sampling bowls were treated in the cold room: the content of the 50 µm meshed bowls were concentrated and preserved in ethanol at -20°C for subsequent morphological observation and individual barcoding. 5µm meshed bowls were concentrated onto filters and frozen at -80°C. Samples treated for morphology/individual barcodes will be used to create a catalogue of the larvae present in the water column around sites, and will allow a first

characterization of the larval pool (diversity, developmental stages), while samples treated for metabarcoding will allow to assess genetic diversity of the larval pool including smaller organisms (eg microeukaryotes).
Six deployments were conducted during the cruise.

I-1.1. Deployment at Kilo Moana

The SALSA pumps were sent to the bottom with the elevator, but were not deployed because the Kilo Moana vent field was found to be inactive. However, pumps functioned for 4 hours before interruption after their recovery at the surface. A 6337L sample was collected with SALSA 2 (bowl rotation failed in SALSA 1 and no sample was collected), through the entire water column.

I-1.2. Deployment at Tow Cam

SALSA pumps were deployed during dive 02 (721) on March 31^{rst} 2019. SALSA 1 was deployed at 12h53 UTC, approximatively 100 m to the east of diffusion area at the center of the vent field, on pillow lava colonized by sparse corals and sponges, at 2701 m depth. SALSA 2 was deployed at 13h19 UTC, in the northern part of the Tow Cam vent field, near chimneys with small patches of *Alviniconcha* spp. and *Ifremeria nautilei*, approx. 170 m north-west of SALSA 1 and at 2720 m depth. SALSA 1 was recovered on April 1^{rst} 2019 at 23h14 UTC, and SALSA 2 was recovered on April 2nd 2019 at 00h32 UTC.

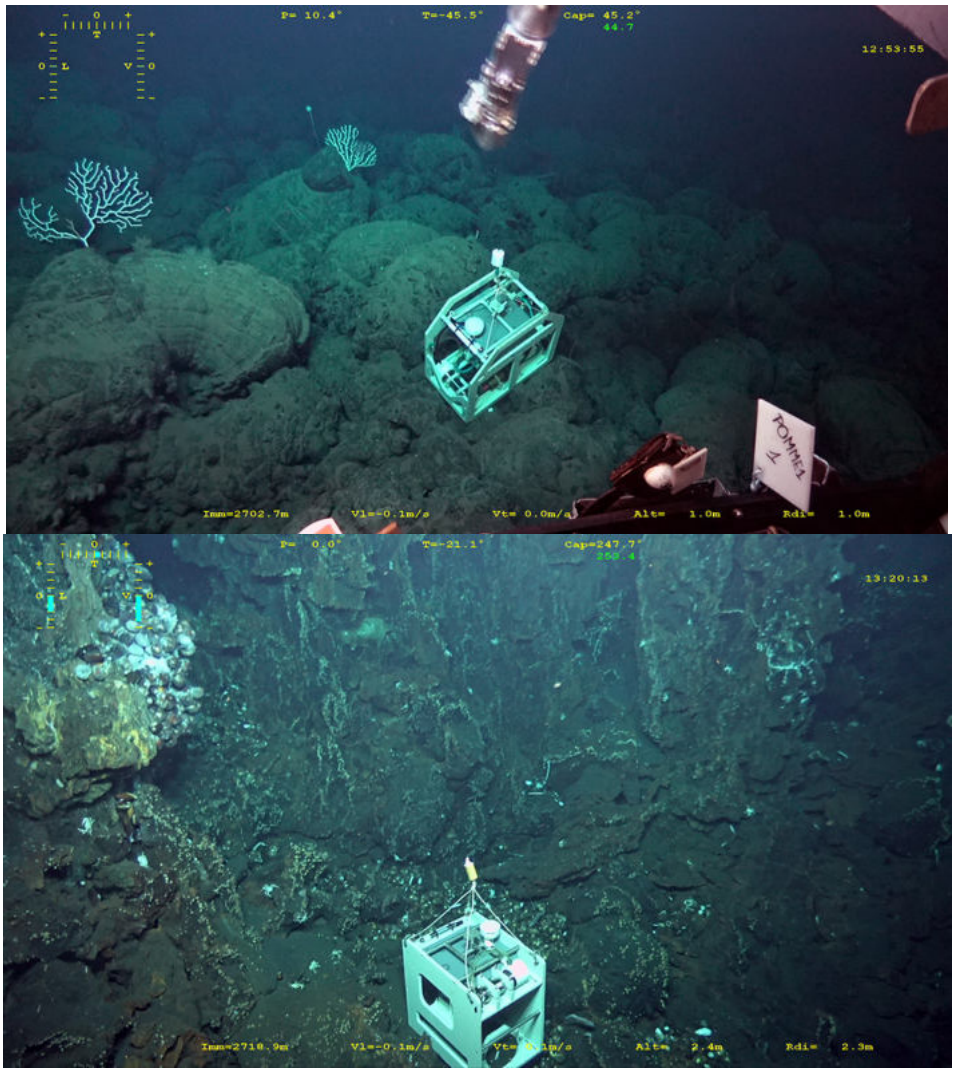


Figure 2: SALSAs deployed at Tow Cam during dive 712. Top: SALSA 1 100 m to the east of the active areas. Bottom: SALSA 2 in the northern part of the vent field near chimneys with gastropods.

Summary of SALSA deployment #2

Sample	1 (Bowl 2)	2 (Bowl 3)	3 (Bowl 4)	4 (Bowl 5)
Start (date – hour UTC)	31/03/19 – 15:31	31/03/19 – 21:43	01/04/19 – 03:55	01/04/19 – 10:07
End (date – hour UTC)	31/03/19 – 21:40	01/04/19 – 03:52	01/04/19 – 10:04	01/04/19 – 16:16
Mesh size (µm)	50	50	5	5
Analyses	Morphology / barcoding	Morphology / barcoding	Metabarcode	Metabarcode
Volume SALSA 1 (L)	9300	9300	7824	7694(1)
Volume SALSA 2 (L)	9300	9300	7824	7824

(1) Battery exhausted before the end, resulting in a lower sample volume.

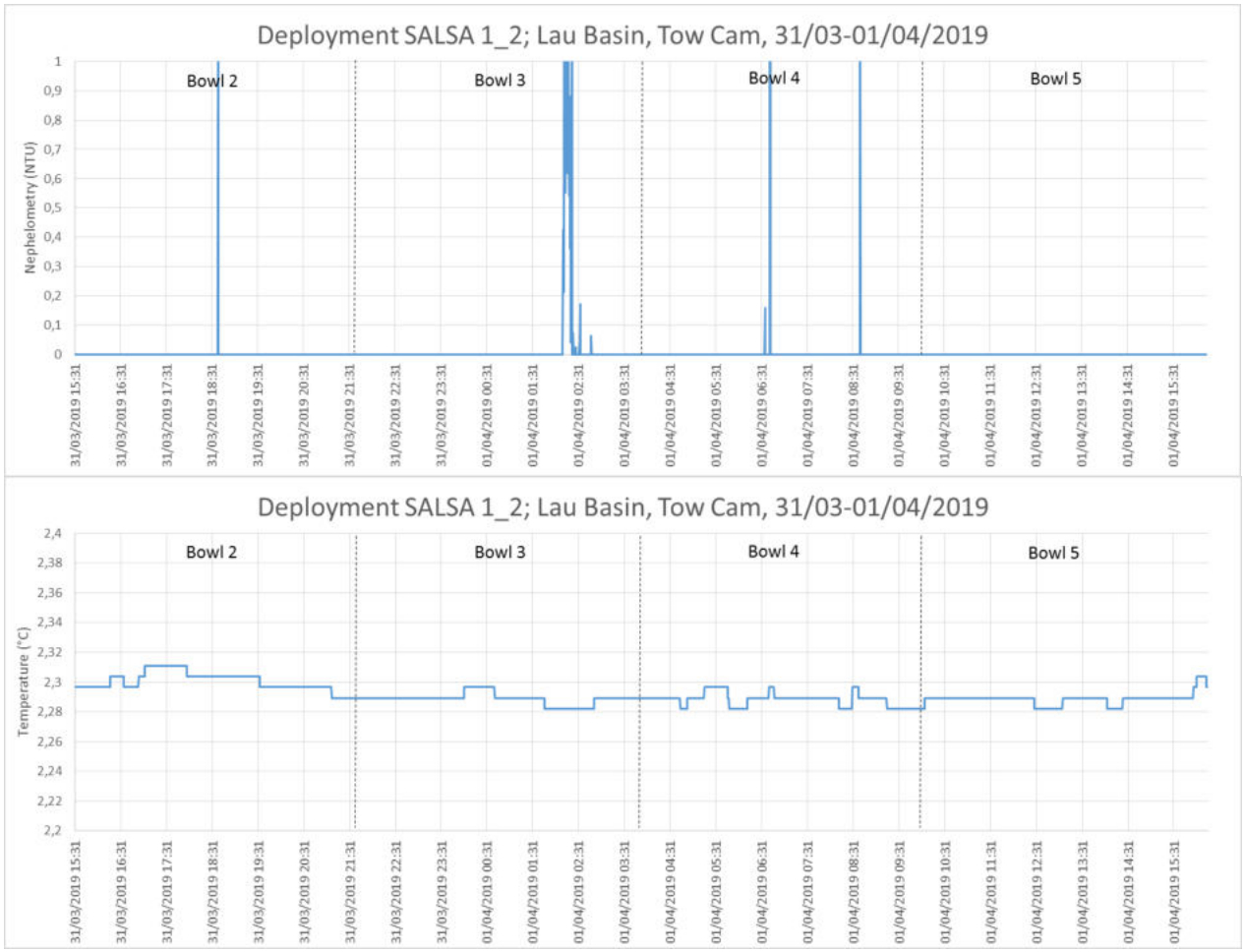


Figure 3: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA 1 sampling in an inactive area near Tow Cam (Dive 721).

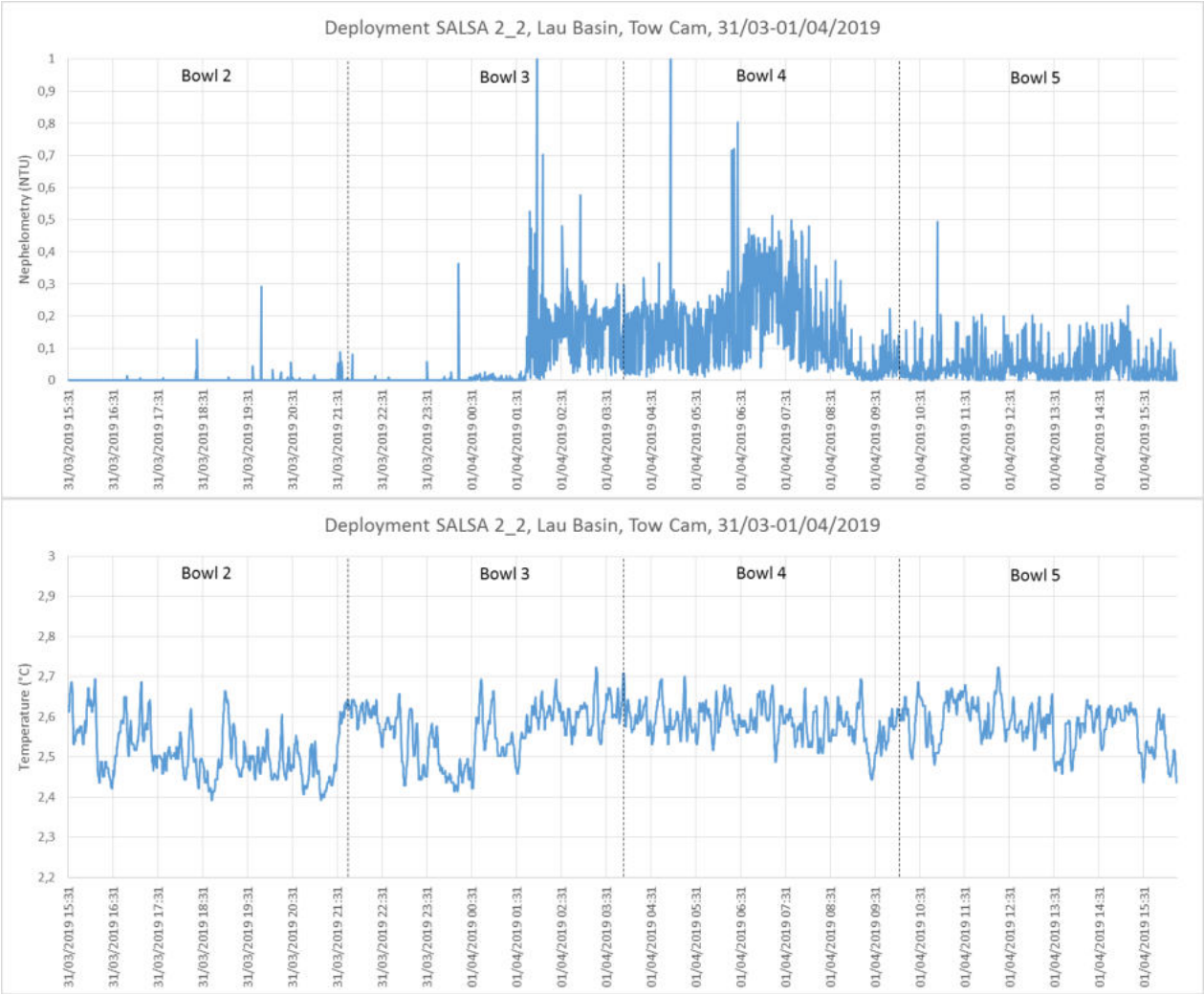


Figure 4: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA2 sampling at Tow Cam near communities in active area (Dive 721).

A quick preliminary observation of the sampling bowls showed a higher particle load in samples 3 and 4 of SALSA 2, which reflects nehelometry data (fig. 4). In samples from SALSA 2 dedicated to morphological studies (samples 1 and 2), shrimp larval stages were observed as well as a zoe crab larva.

I-1.3 Deployment at Tu'i Malila

SALSA modules were deployed during dive 03 (722) on April 3rd 2019. SALSA 1 was deployed, at 5h47 UTC, approximatively 100 m east of the chimney area of the Fati Ufu vent field, in a slightly sedimented area with a few sponges and corals, at 1862 m depth. SALSA 2 was deployed at 6h24 UTC, in the central part of the Tu'i Malila vent field, near Cladorhyza sponges and a diffusion zone with Ifremeria nautilei, at 1880 m depth, and about 150 m north-west of SALSA 1. Both SALSAs were recovered on April 4th 2019, at 22h52 UTC (SALSA1) and 23h12 UTC (SALSA2).

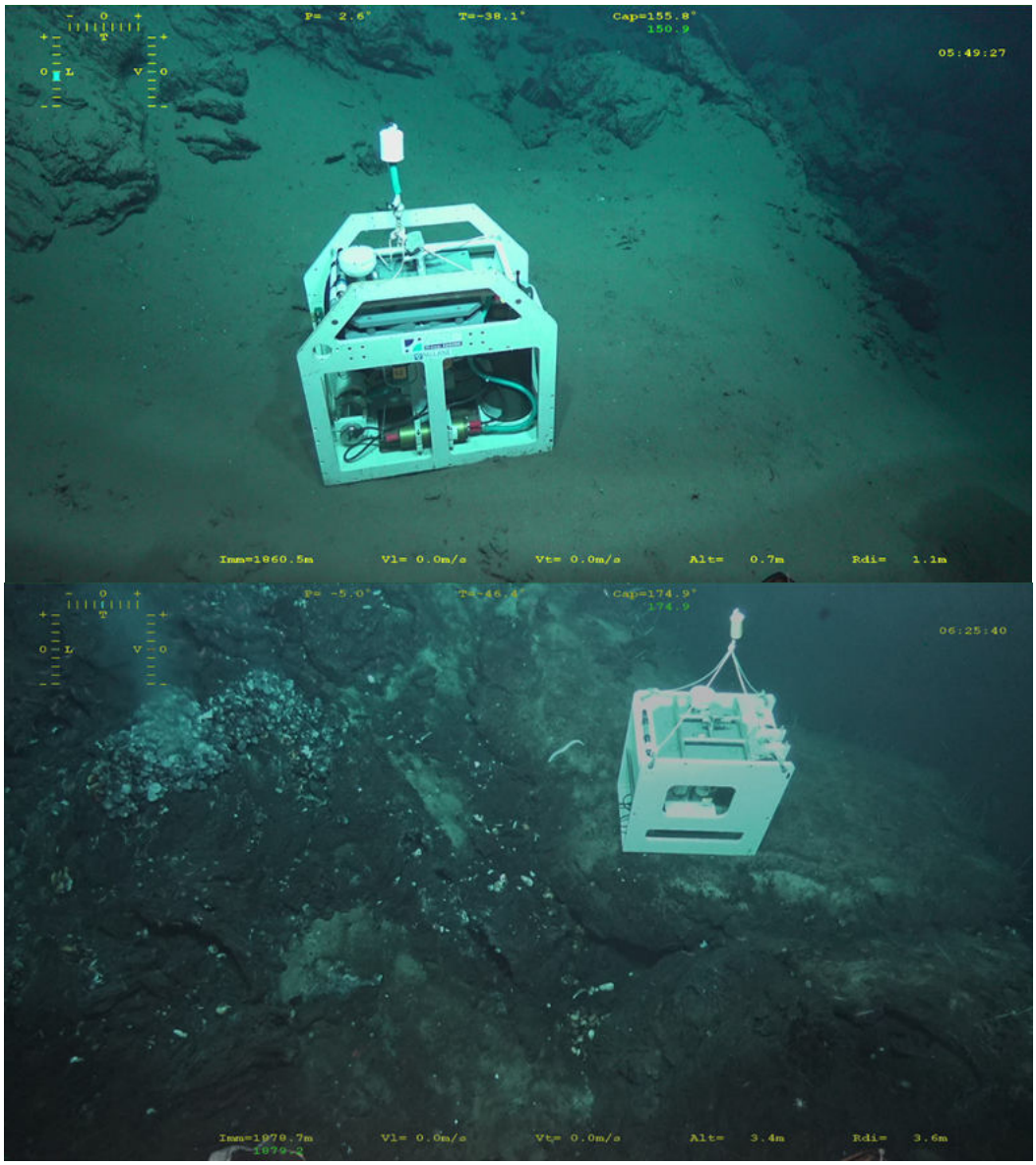


Figure 5: SALSAs deployed at Tu'i Malila during dive 722. Top: SALSA 1 100 m to the east of the active areas. Bottom: SALSA 2 in the central part of the vent field near an assemblage of Ifremeria nautilei.

Summary of SALSA deployment #3

Sample	1 (Bowl 2)	2 (Bowl 3)	3 (Bowl 4)	4 (Bowl 5)
Start (date – hour UTC)	03/04/19 - 11:06	03/04/19 - 17:14	03/04/19 - 23:22	04/04/19 – 05:30
End (date – hour UTC)	03/04/19 - 17:11	03/04/19 - 23:19	04/04/19 – 05:27	04/04/19 – 11 :35
Mesh size (µm)	50	50	5	5
Analyses	Morphology / barcoding	Morphology / barcoding	Metabarcode	Metabarcode
Volume SALSA 1 (L)	9199	9199	7739	7739

Volume SALSA 2 (L)	9199	9199	7739	7141[(1)]

(1) Battery exhausted before the end, resulting in a lower sample volume.

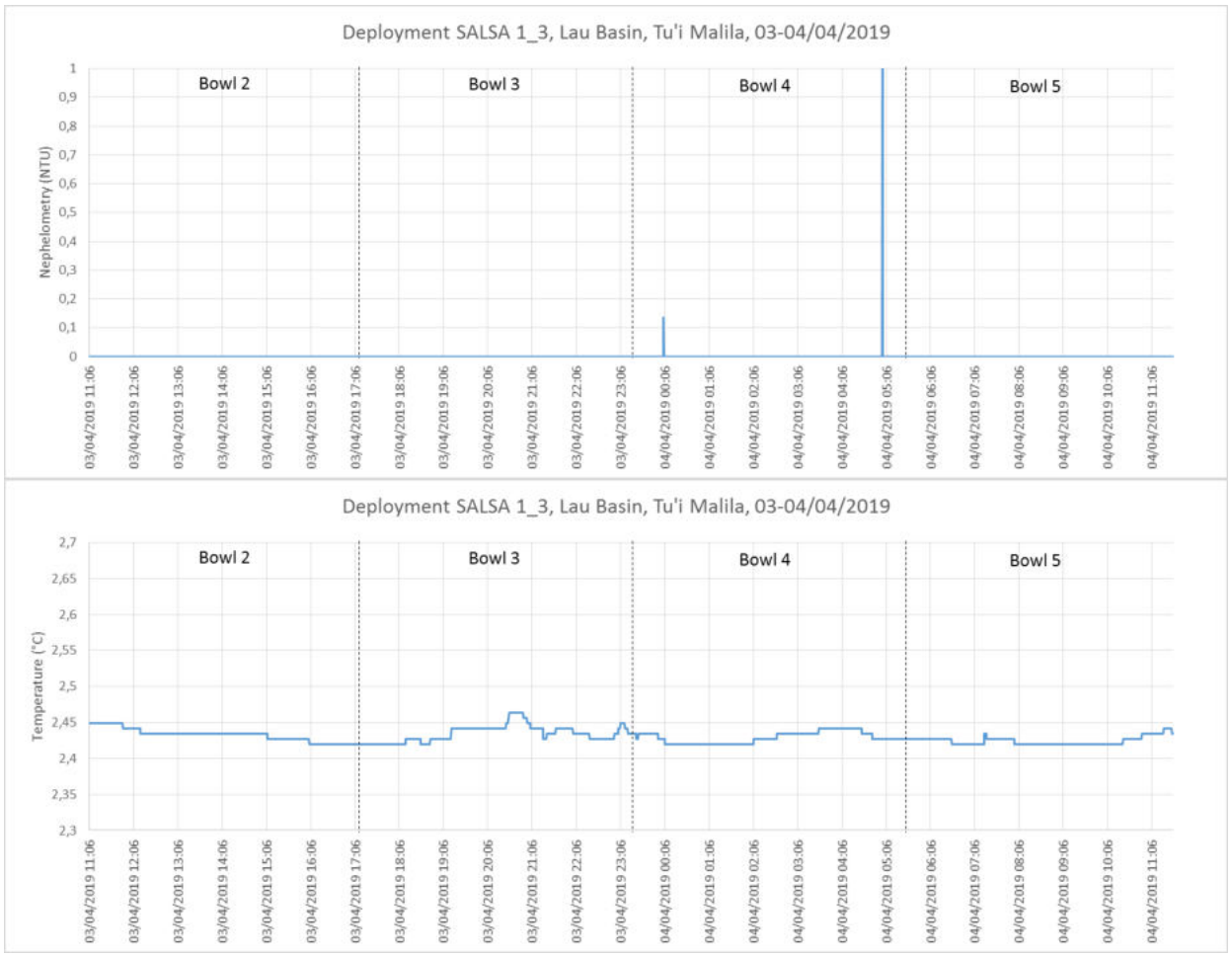


Figure 6: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA 1 sampling in an inactive area near Tu'i Malila (Dive 722).

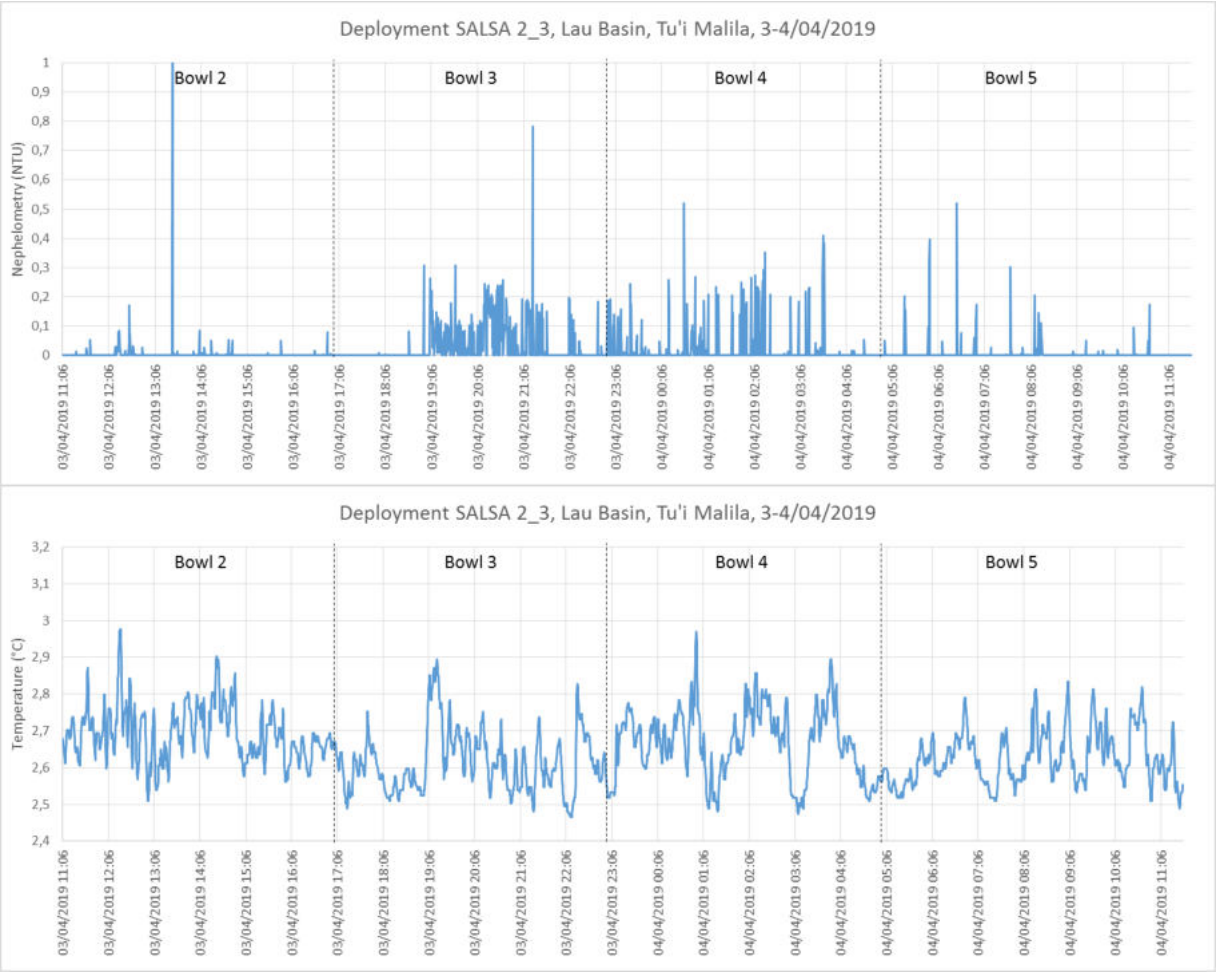


Figure 7: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA2 sampling at Tu'i Malila near communities in active area (Dive 722).

Preliminary observation of the sampling bowls dedicated to morphological analysis in SALSA 2 showed numerous larvae including Ifremeria Warén larvae, gastropod larval stages as well as shrimp zoea and many polychaete larvae. Corresponding bowls in SALSA 1 had much less larval stages.

I-1.4. Deployment at Phoenix

At Phoenix, SALSA pumps were deployed during dive #5 (724) on April 10th 2019. SALSA 1 was positioned at 3h54 UTC in a slightly sedimented area at 1987 m depth, approximately 175 m south-east to diffusion zones. SALSA 2 was positioned at 4h46 UTC in the central part of Phoenix near diffusions with *Alviniconcha* and *Ifremeria* snails, at 1967 m depth and approximately 240 m north-west of SALSA 1. Both pumps were recovered on April 11th 2019 at 3h15 UTC (SALSA 1) and 3h30 UTC (SALSA 2). This deployment had to be shortened to be fitted in the dive plan and due to issues with the elevator. For each pump, 3 sampling periods only were scheduled.

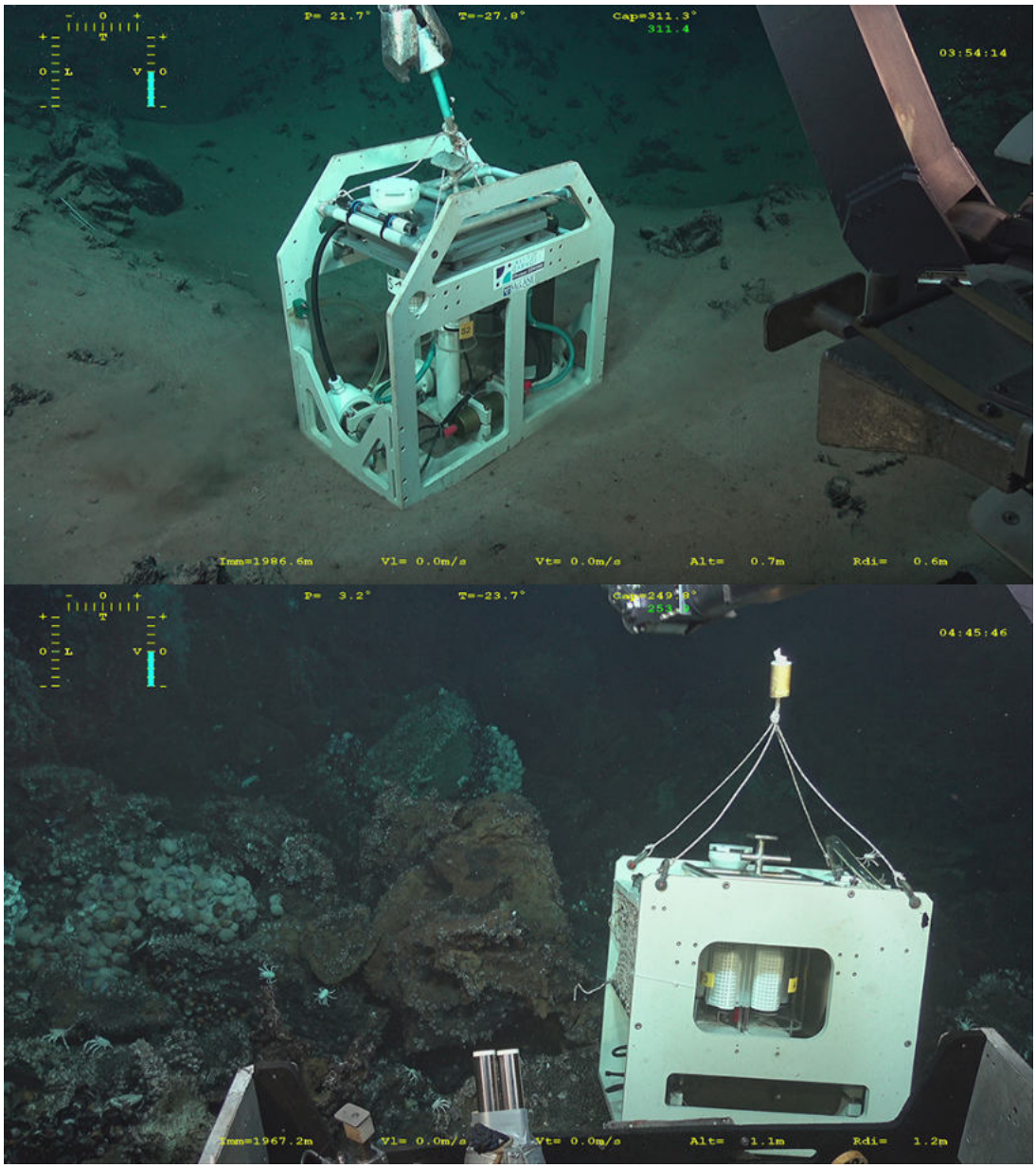


Figure 8: SALSAs deployed at Phoenix during dive 724. Top: SALSA 1 150 m to the east of the active areas. Bottom: SALSA 2 in the central part of the vent field near an assemblage of gastropods.

Summary of SALSA deployment #4

Sample	1 (Bowl 2)	2 (Bowl 3)	3 (Bowl 4)
Start (date – hour UTC)	10/04/19 - 09:54	10/04/19 - 16:06	10/04/19 - 22:18
End (date – hour UTC)	10/04/19 - 16:03	10/04/19 - 22:15	11/04/19 – 02:57
Mesh size (µm)	50	50	5
Analyses	Morphology / barcoding	Morphology / barcoding	Metabarcode
Volume SALSA 1 (L)	10038	Flux blocked	Flux blocked
Volume SALSA 2 (L)	10038	10038	6194

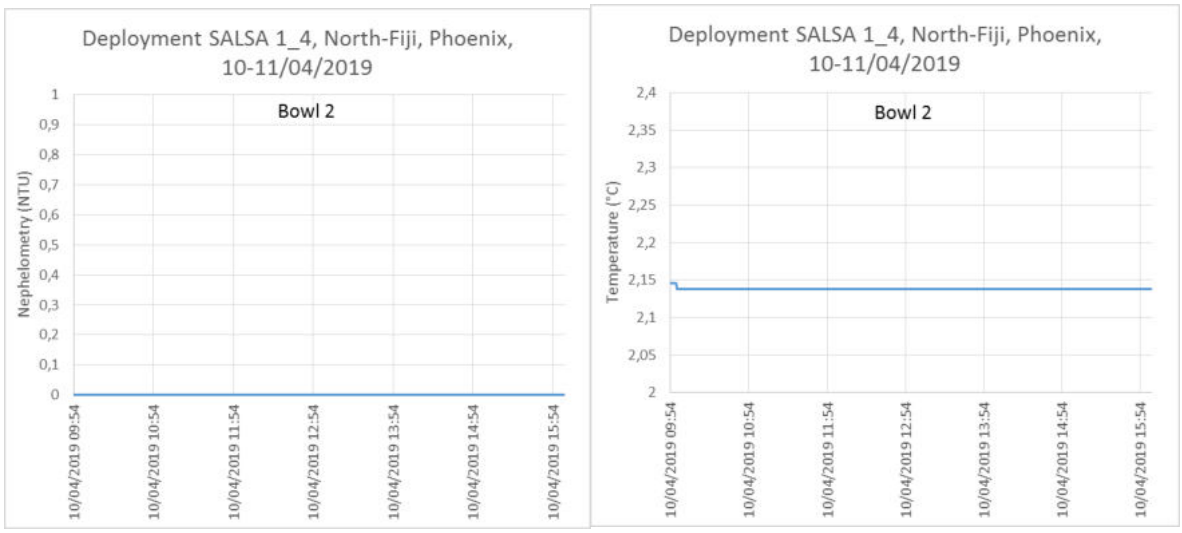


Figure 9: Nephelometry (left) and temperature (right) profiles during SALSA1 sampling in an inactive sedimented area near the Phoenix site.

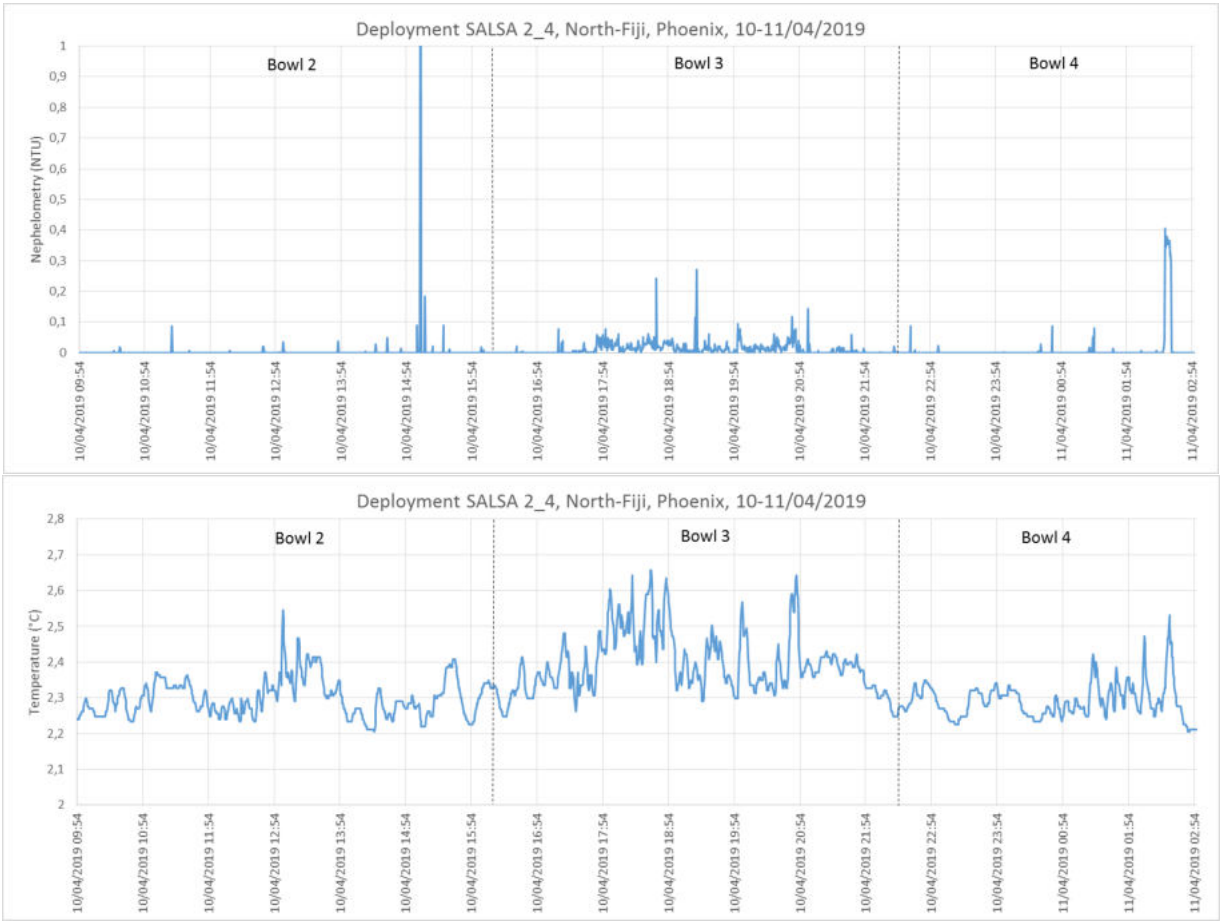


Figure 10: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA2 sampling at Phoenix near communities in active area (Dive 724).

At recovery of the pumps, we found that SALSA 1 had issues with the rotation of the bowls after the first sampling period. A wrong alignment of the sampling bowl due to incomplete rotation blocked water influx, and stopped any further sampling. Only one sample (in bowl 2 with 50µm mesh) was obtained. In SALSA 2, the second sample (bowl 3) had a higher particle content, which also corresponds with increased turbidity at the corresponding period (fig. 10). A quick look at the sample revealed many polychaete larvae among others.

I-1.5. Deployment at AsterX

SALSA modules were deployed during dive 08 (727) on April 18th 2019. SALSA 1 was deployed at 21h29 UTC, approximatively 150 m north to the AsterX vent field, on a slope with large pillow lava emerging from sediments, at 1555 m depth. SALSA 2 was deployed at 22h20 UTC, in the north-eastern part of the AsterX vent field, near diffusions with *Alviniconcha* spp. and *Ifremeria nautilei* assemblages (sampled community Ifremeria 1 and Alviniconcha 1), approx. 180 m south-east of SALSA1 and at 1565 m depth. Both SALSAs were recovered on April 20th 2019, at 01h18 (SALSA2) and 01h31 (SALSA1).

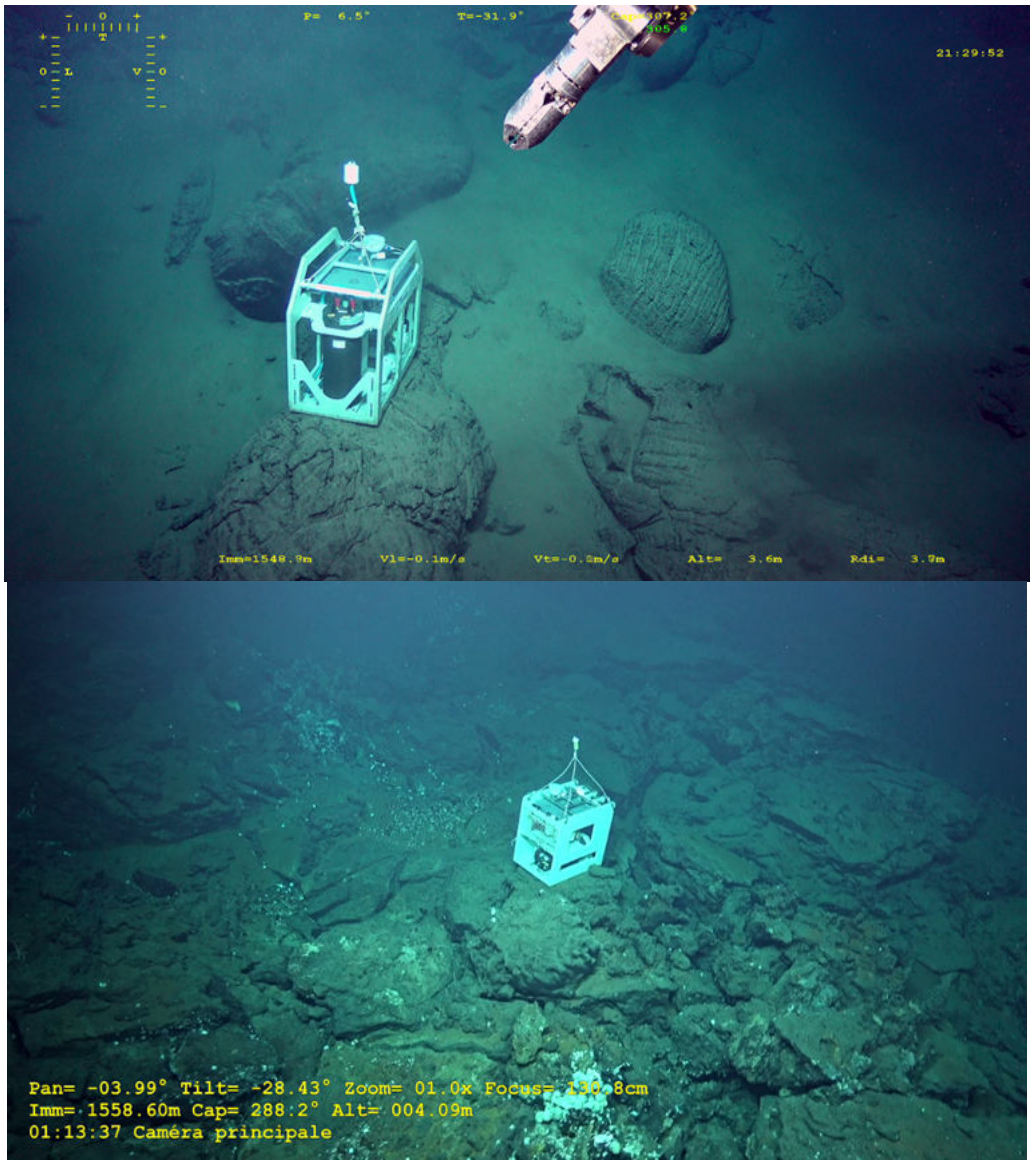


Figure 11: SALSA deployed at the AsterX vent field during dive 08 (727). Top: SALSA 1, approx. 150 m north to active areas of the vent field. Bottom: SALSA 2 in the north-eastern part of the vent field near gastropod communities gathered around diffusions.

Summary of SALSA deployment #5

Sample	1 (Bowl 2)	2 (Bowl 3)	3 (Bowl 4)	4 (Bowl 5)
Start (date – hour UTC)	18/04/19 - 23:42	19/04/19 - 05:54	19/04/19 - 12:06	19/04/19 - 18:18
End (date – hour UTC)	19/04/19 - 05:51	19/04/19 - 12:03	19/04/19 - 18:15	20/04/19 – 00:27
Mesh size (µm)	50	50	5	5
Analyses	Morphology/ barcoding	Morphology/ barcoding	Metabarcode	Metabarcode
Volume SALSA 1 (L)	8931,5	8931,5	7085,4[(1)]	7085,4[(1)]

Volume SALSA 2 (L)	8931,4	8931,4	7085,3	6667,7[(2)]

(1) Rotation failure after sampling in bowl 4: samples 3 and 4 are both in bowl 4 that remained open during ascent to the surface. Bowl 5 is empty: only one metabarcode sample.

(2) Battery exhausted before the end: pumped for 5h47 instead of 6h09, resulting in a lower volume sampled, and bowl 5 remained open during ascent to the surface.

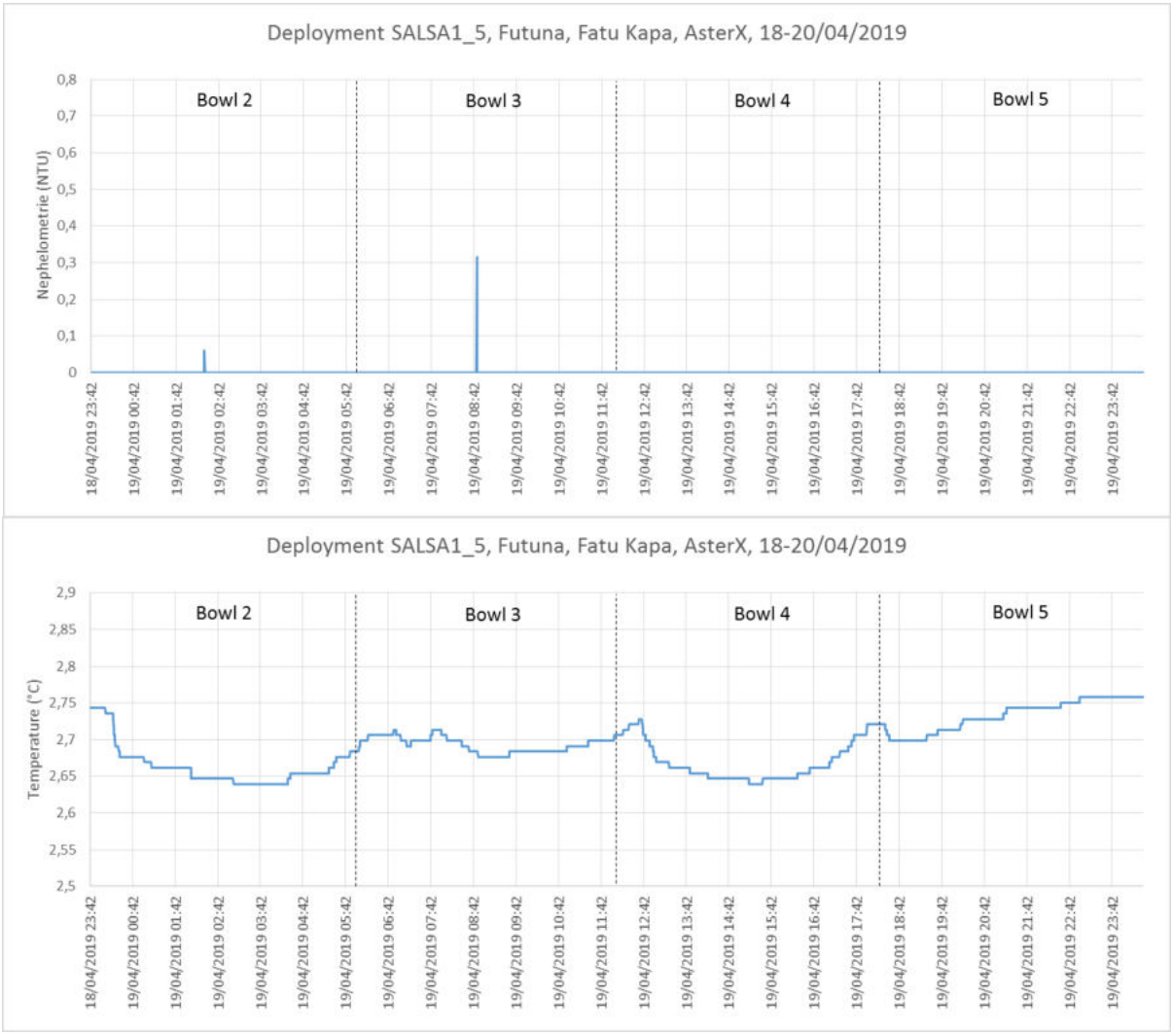


Figure 12: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA 1 sampling in an inactive area near AsterX (Dive 726).

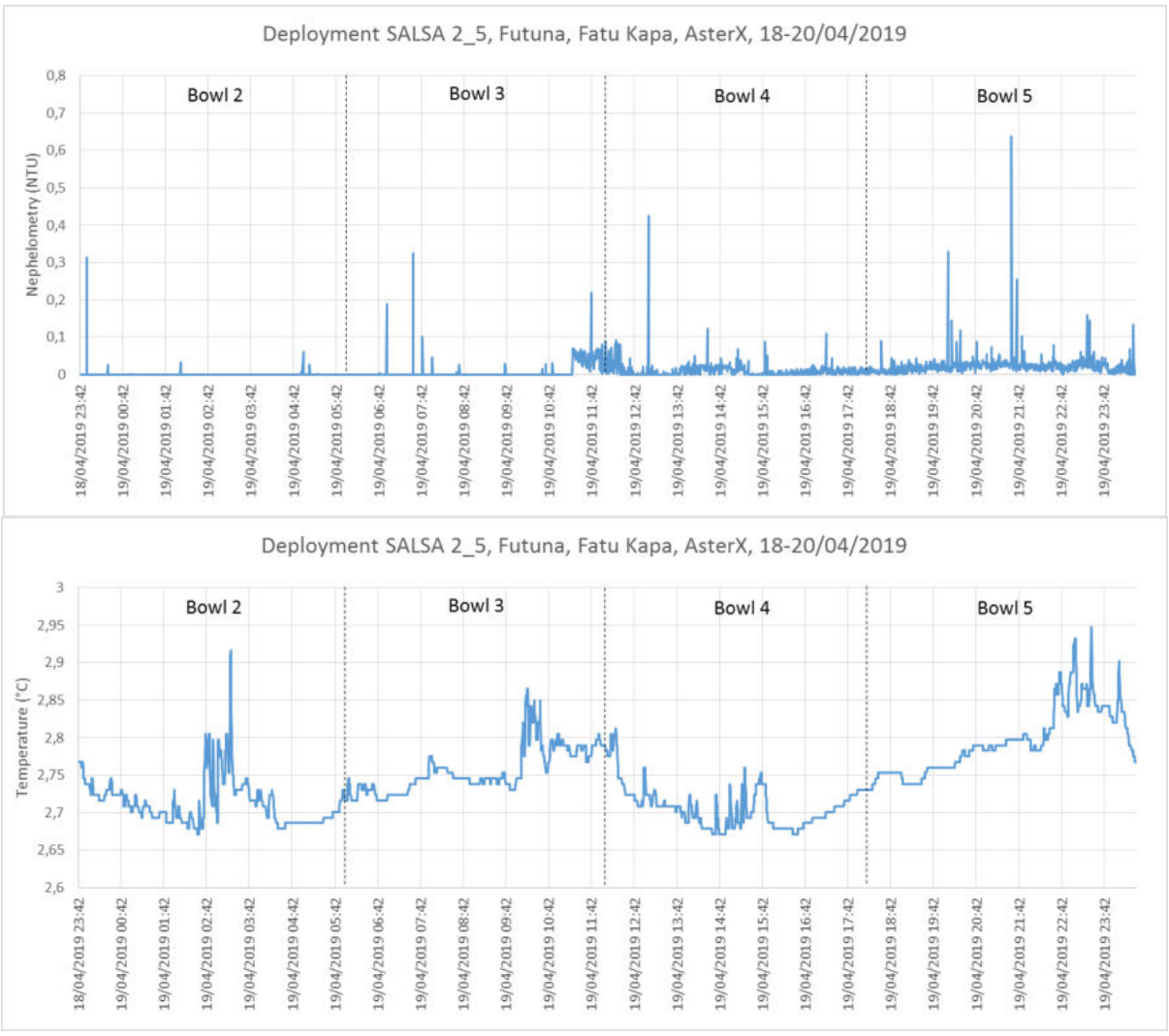


Figure 13: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA2 sampling at AsterX near communities in active area (Dive 726).

The contents of the sampling bowls were rapidly observed and conditioned according to their main planned analyses (summary table). Bowls 2 and 3 had a low particle content in each SALSA, in good agreement with the low nephelometry during the corresponding sampling period for both pumps. In SALSA 1, bowl 4 had a relatively higher particle load, due to the accumulation of both samples 3 and 4. Bowls 4 and 5 for SALSA 2 also had a relatively higher particle load reflecting the higher turbidity during the corresponding period. Large amphipods were collected in SALSA 1 samples 1 and 2. A quick observation under the binocular microscope of SALSA 2 bowl 2 showed cypris larvae, *Ifremeria* ciliated larvae (Waren type), *Alviniconcha* late larval stages, many polychaete larvae with a diversity of stages (trochophores, metatrochophores, early segmented stages) and taxa (many spionids), a bivalve D-larvae, and many eggs with different sizes and stages. Detailed observation, high resolution pictures, individual barcoding as well as metabarcoding approaches will be conducted in the laboratory.

I-1.6. Deployment at Fati Ufu

SALSA modules were deployed during dive 09 (728) on April 20th 2019. SALSA 1 was deployed at 21h11 UTC, approximatively 150 m north to the central part of the Fati Ufu vent field, in an area with basalt rocks emerging from sediments, at 1520 m depth. SALSA 2 was deployed at 21h32 UTC, in the central part of the Fati Ufu vent field, near diffusions with *Alviniconcha* spp. and *Ifremeria nautilei* assemblages, approx. 200 m south-south-west of SALSA1 and at 1525 m depth. Both SALSAs were recovered on April 22nd 2019, at 02h20 (SALSA1) and 02h42 (SALSA2).

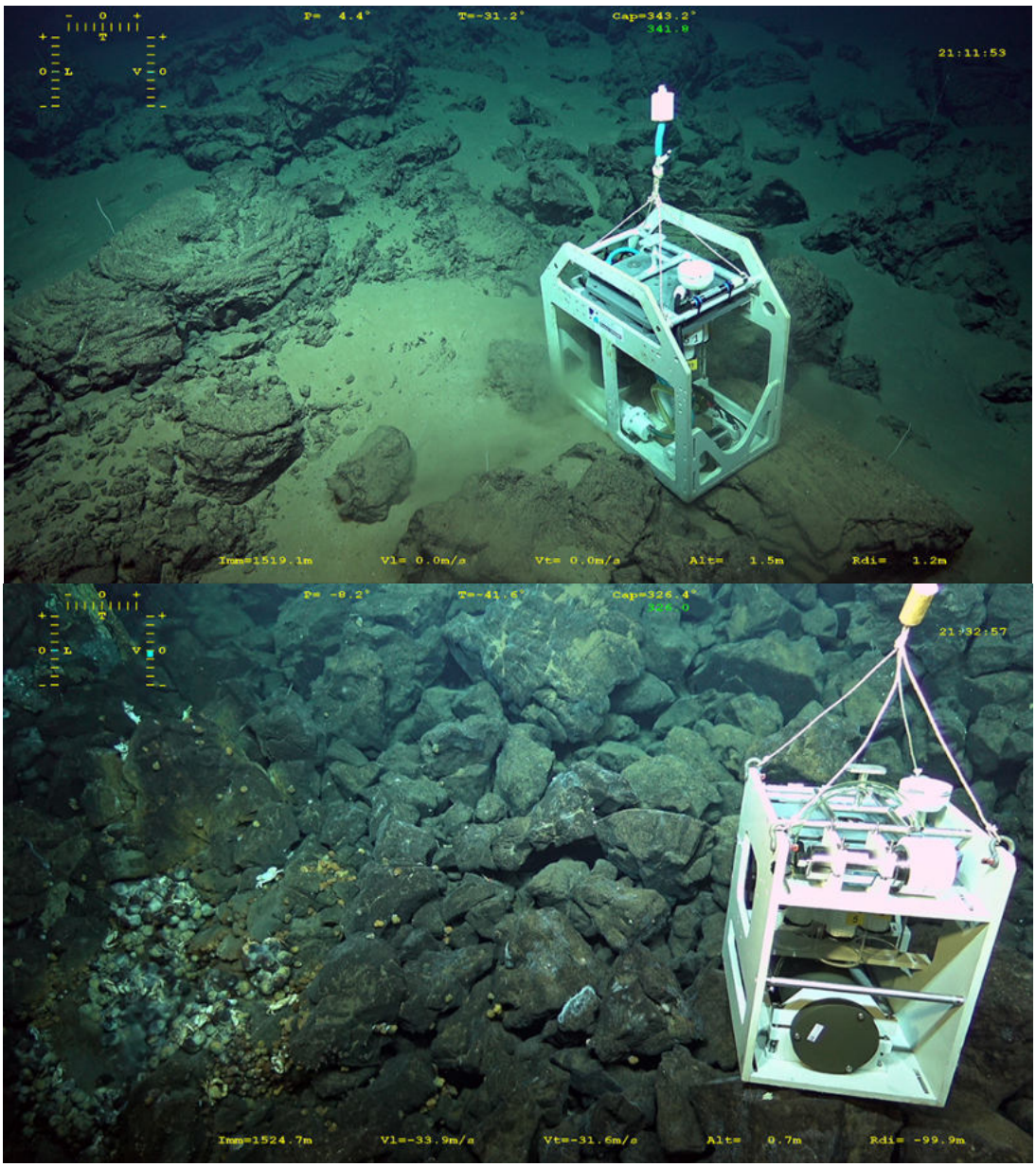


Figure 14: SALSA deployed at the Fati Ufu vent field during dive 09 (728). Top: SALSA 1, approx. 150 m north to active areas of the vent field. Bottom: SALSA 2 in the central part of the vent field near gastropod communities gathered around diffusions.

Summary of SALSA deployment #6

Sample	1 (Bowl 2)	2 (Bowl 3)	3 (Bowl 4)	4 (Bowl 5)
Start (date – hour UTC)	21/04/19 - 01:16	21/04/19 - 07:24	21/04/19 - 13:32	21/04/19 - 19:40
End (date – hour UTC)	21/04/19 - 07:21	21/04/19 - 13:29	21/04/19 - 19:37	22/04/19 - 01:45
Mesh size (µm)	50	50	5	5
Analyses	Morphology/ barcoding	Morphology/ barcoding	Metabarcode	Metabarcode
Volume SALSA 1 (L)	8467,5	8467,5(1)	7008,6(1)	7008,6(1)
Volume SALSA 2 (L)	8467,4	8467,4	7008,5	5339,9(2)

(1) Rotation failure after sampling in bowl 3: samples 2, 3 and 4 are both in bowl 3 that remained open during ascent to the surface. Bowl 4 and 5 are empty: no metabarcode sample.

(2) Battery exhausted before the end: pumped for 4h38 instead of 6h05, resulting in a lower volume sampled, and bowl 5 remained open during ascent to the surface.

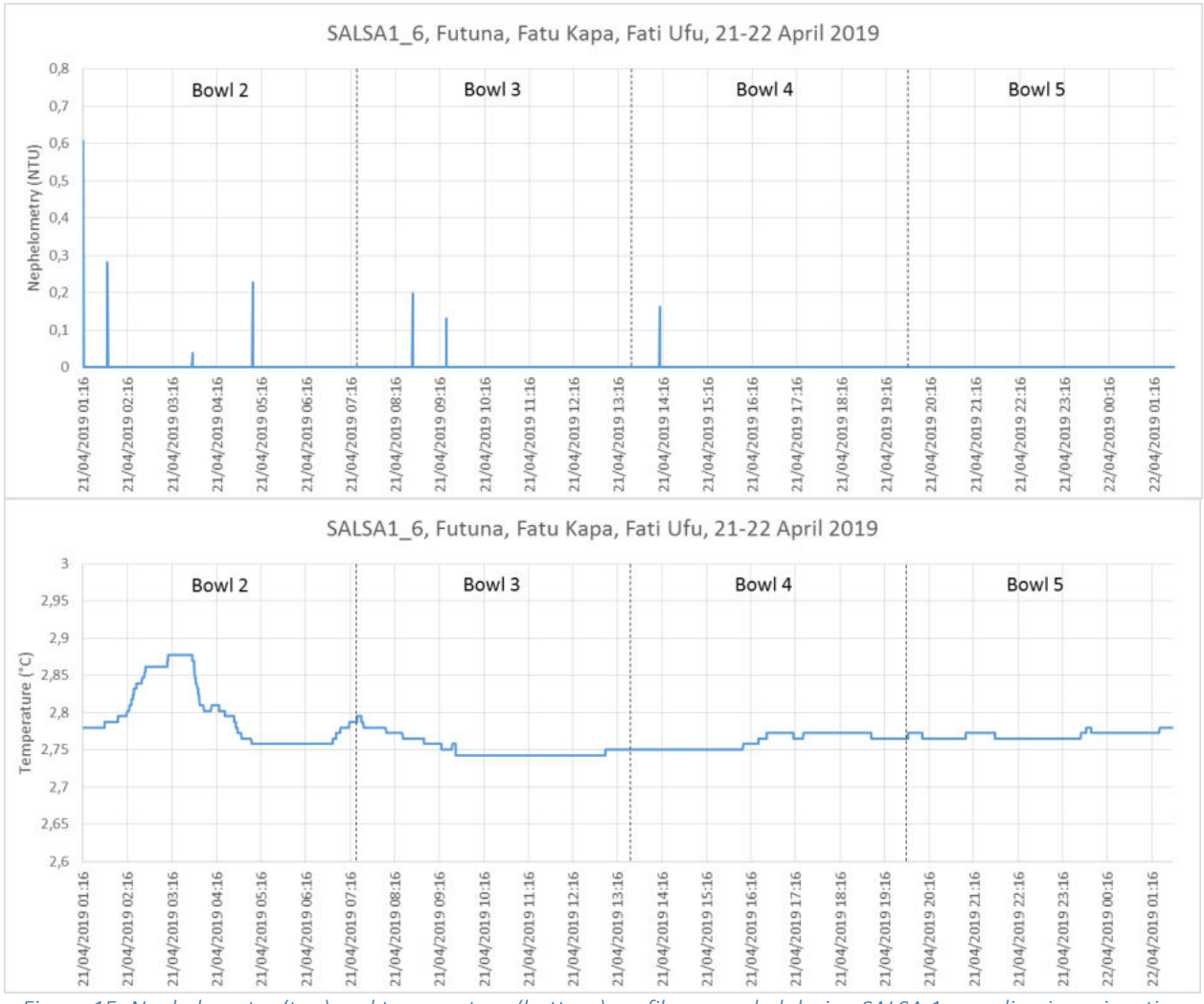


Figure 15: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA 1 sampling in an inactive area near Fati Ufu (Dive 727).

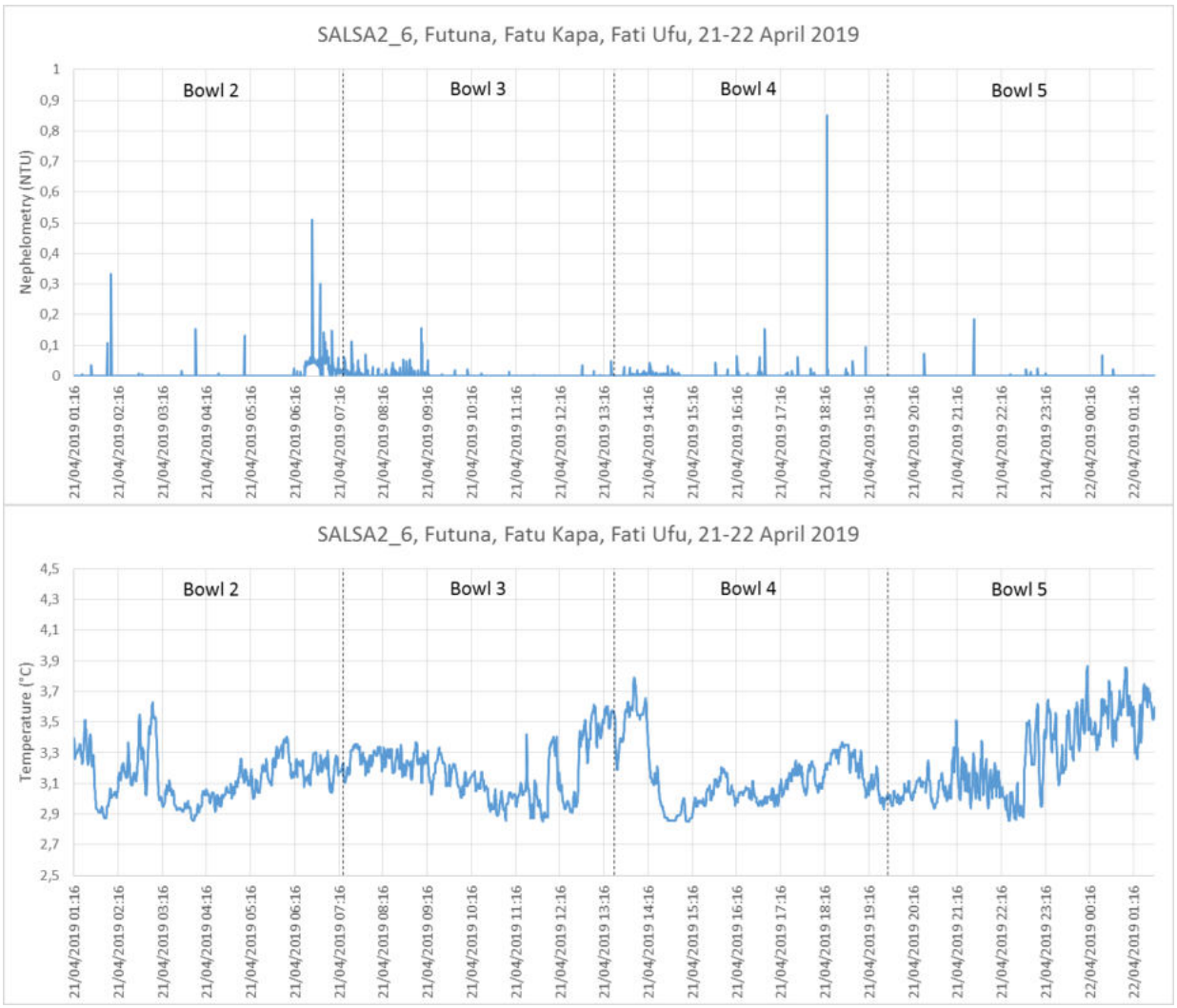


Figure 16: Nephelometry (top) and temperature (bottom) profiles recorded during SALSA2 sampling at Fati Ufu near communities in active area (Dive 727).

The contents of the sampling bowls were rapidly observed and conditioned according to their main planned analyses (summary table). Bowl 3 in SALSA1 had a higher particle load due to the accumulation of samples 2-4 in that bowl and resulting in no samples for metabarcode. Technical problems encountered with SALSA functioning are treated elsewhere. Bowl 3 of SALSA 2 had a slightly higher particle load than bowl 2, although this is not reflected in nephelometry profiles. A quick observation under the binocular microscope of SALSA 2 bowl 3 showed copepods, nauplius stages, cypris cirriped larvae, *Ifremeria* ciliated larvae (Waren type), many polychaete larvae with a diversity of stages (trochophores, metatrochophores, early segmented stages) and taxa (many spionids), young post-larvae of undetermined gastropods, several shrimp larvae, and many eggs with different sizes and stages.

I-1.7. Summary of SALSA samples

After deployment on the bottom, the content of bowls dedicated to the morphological / barcoding studies were briefly inspected and a few larvae were picked up, photographed (fig. 17)

and individually frozen, while the rest of the sample was stored in Ethanol at -20°C for later sorting, and analyses.

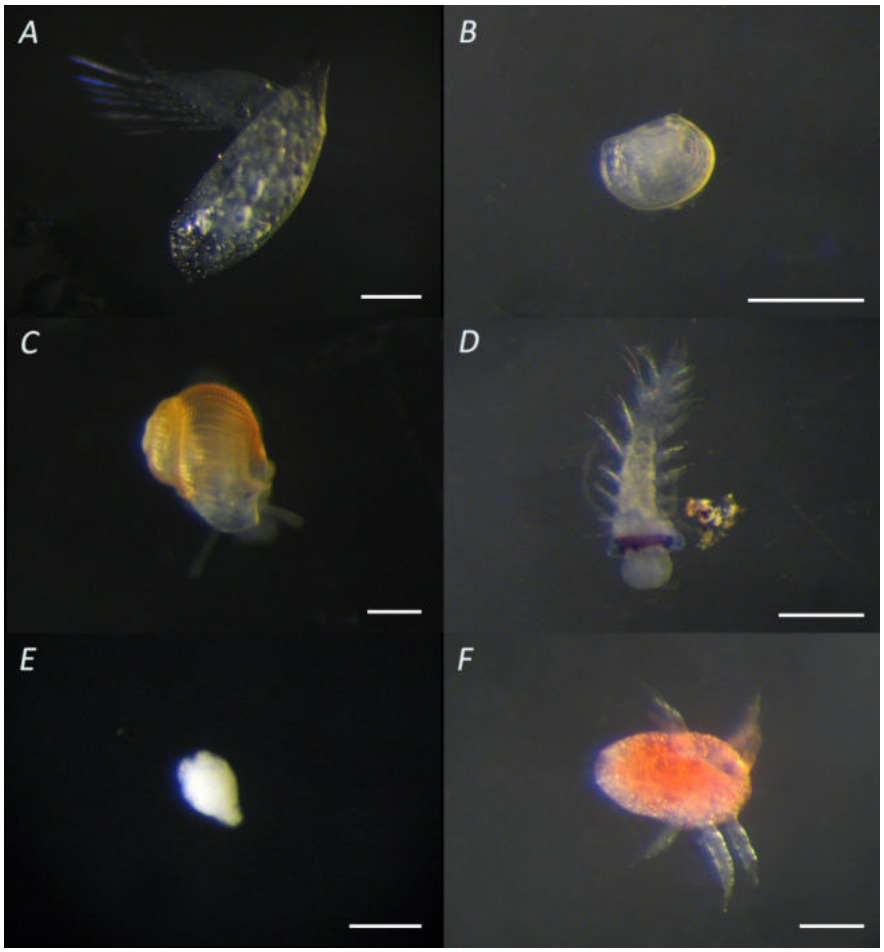


Figure 17: Examples of larvae collected with SALSAs deployed at vent sites. A: Cypris larva, B: D-shell bivalve larva, C: gastropod juvenile, D: polychaete larva, E: Ifremeria Waren larva, F: Nauplius larval stage. Scale bars are 100 µm.

A summary of all collected samples is given in the following table

Table: Summary of SALSA samples

Date	Dive	Site	Sample	volume (L)	On/Off active venting	Fixative	Analyses	remark
31/03/2019	PL01-720	Kilo Moana	CHU-PL01-SALSA2-1_bol2	6337,9	off: in elevator and through water column	EtOH	morpho/barcode	bowl open and pumping ON during ascent
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA1-2-bol2	9299,7	off	EtOH	morpho/barcode	amphipods
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA1-2-bol3	9299,7	off	EtOH	morpho/barcode	
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA1-2-bol4	7824,2	off	dry/-80°C	metabarcode	
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA1-2-bol5	7694,5	off	dry/-80°C	metabarcode	
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA1-2-bol5		off	EtOH	morpho/barcode	2 amphipods
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA2-2-bol2	9299,5	on	EtOH	morpho/barcode	a shrimp zoe, a crab zoe
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA2-2-bol3	9299,5	on	EtOH	morpho/barcode	a shrip zoe, an alvinocaridid zoe
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA2-2-bol4	7824,1	on	dry/-80°C	metabarcode	
02/04/2019	PL02-721	Tow Cam	CHU-PL02-SALSA2-2-bol5	7824,1	on	dry/-80°C	metabarcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol2	9198,8	off	EtOH	morpho/barcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol2-L009		off	dry/-80°C	barcode	post-larvae Olgasolaris ?
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol3	9198,8	off	EtOH	morpho/barcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol4	7739,5	off	dry/-80°C	metabarcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol4		off	EtOH	morpho/barcode	1 amphipod, 1 copepod
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA1-3-bol5	7739,5	off	dry/-80°C	metabarcode	low particle load
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol2	9198,7	on	EtOH	morpho/barcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol2-L003		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3	9198,7	on	EtOH	morpho/barcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3-L004		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3-L005		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3-L006		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3-L007		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol3-L008		on	dry/-80°C	barcode	Ifremeria waren larva
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol4	7739,3	on	dry/-80°C	metabarcode	
05/04/2019	PL03-722	Tu'i Malila	CHU-PL03-SALSA2-3-bol5	7140,8	on	dry/-80°C	metabarcode	low battery : sampling terminated earlier
11/04/2019	PL05-724	Phoenix	CHU-PL05-SALSA1-4-bol2	10038,2	off	EtOH	morpho/barcode	low particle load
11/04/2019	PL05-724	Phoenix	CHU-PL05-SALSA2-4-bol2	10038,1	on	EtOH	morpho/barcode	average particle load
11/04/2019	PL05-724	Phoenix	CHU-PL05-SALSA2-4-bol3	10038,1	on	EtOH	morpho/barcode	high particle load
11/04/2019	PL05-724	Phoenix	CHU-PL05-SALSA2-4-bol4	6194,1	on	dry/-80°C	metabarcode	
11/04/2019	PL05-724	Phoenix	CHU-PL05-SALSA2-4-bol4-L012		on	EtOH	morpho/barcode	small gastropod
11/04/2019			CHU-PL05-SALSAs-4-blank			dry/-80°C	metabarcode blank	
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol2	8931,5	off	EtOH	morpho/barcode	low particle load
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol2		off	EtOH	morpho/barcode	2 large amphipods
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol3	8931,5	off	EtOH	morpho/barcode	low particle load
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol3		off	EtOH	morpho/barcode	1 large amphipod
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol4	14170,8	off	dry/-80°C	metabarcode	cumulation of bowl 4+5
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA1-5-bol4		off	EtOH	morpho/barcode	amphipod
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2	8931,4	on	EtOH	morpho/barcode	low particle load
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L014		on	dry/-80°C	barcode	Cypris
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L015		on	dry/-80°C	barcode	Ifremeria waren larva
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L016		on	dry/-80°C	barcode	Ifremeria waren larva
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L017		on	dry/-80°C	barcode	unusual spionid larva
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L018		on	dry/-80°C	barcode	standard spionid larva
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L019		on	dry/-80°C	barcode	D-shell larva
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L020		on	dry/-80°C	barcode	egg (white, average size)
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L021		on	dry/-80°C	barcode	egg (white, average size)
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol2-L022		on	dry/-80°C	barcode	large egg (white)
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol3	8931,4	on	EtOH	morpho/barcode	low particle load
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol4	7085,3	on	dry/-80°C	metabarcode	average particle load
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol4		on	EtOH	morpho/barcode	6 amphipods
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol5	6667,7	on	dry/-80°C	metabarcode	low battery : sampling terminated earlier; average to high particle content
20/04/2019	PL08-727	AsterX	CHU-PL08-SALSA2-5-bol5		on	EtOH	morpho/barcode	1 amphipod
20/04/2019			CHU-PL05-SALSAs-5-blank			dry/-80°C	metabarcode blank	
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA1-6-bol2	8467,5	off	EtOH	morpho/barcode	
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA1-6-bol3	22484,7	off	EtOH	morpho/barcode	cumulation of bowl 3+4+5
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol2	8467,4	on	EtOH	morpho/barcode	average particle load
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3	8467,4	on	EtOH	morpho/barcode	average to high particle load
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L023		on	dry/-80°C	barcode	orange gastropod
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L024		on	dry/-80°C	barcode	nectochaete
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L025		on	dry/-80°C	barcode	small white nauplius
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L026		on	dry/-80°C	barcode	standard spionid larva
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L027		on	dry/-80°C	barcode	large red nauplius
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L028		on	dry/-80°C	barcode	small white trochophore (or waren larva ?)
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L029		on	dry/-80°C	barcode	Cypris
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L030		on	dry/-80°C	barcode	Ifremeria Waren larva
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L031		on	dry/-80°C	barcode	yellow chaetosphaerid long setae
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L032		on	dry/-80°C	barcode	metatrochophore
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L033		on	dry/-80°C	barcode	large egg
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L034		on	dry/-80°C	barcode	Cypris
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L035		on	dry/-80°C	barcode	shrimp zoe (swim backwards, blue eyes)
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol3-L036		on	dry/-80°C	barcode	egg (white, average size)
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol4	7008,5	on	dry/-80°C	metabarcode	average particle load
22/04/2019	PL09-728	Fati Ufu	CHU-PL09-SALSA2-6-bol5	5339,9	on	dry/-80°C	metabarcode	low battery : sampling terminated earlier; average particle content
22/04/2019			CHU-PL05-SALSAs-6-blank			dry/-80°C	metabarcode blank	

I-2. Deployment of long-term collection tube traps (Collab. US C. Young, S. Arellano)

US colleagues Roxanne Beinart (Rhodes Island University), Craig Young (Oregon Institute of Marine Biology) and Shawn Arellano (Western Washington University) are developing a project looking at the influence of environmental conditions, the development of symbiotic relationships between the snails and different types of bacterial symbionts, and connectivity on the distribution of *Alviniconcha* spp. and *Ifremeria nautilei* snails in the Lau basin. Part of the project is devoted to the collection of larval stages in the water column during a cruise planed in the Lau Basin in 2020, using different approaches including the Syprid system mounted on the AUV Sentry, autonomous pumps and passive tube traps.

As part of a collaborative effort on aspects related to larval dispersal, we deployed four tube-trap units provided by our colleagues. These traps will passively collect larval stages close to the seafloor for one year before their recovery during the 2020 US cruise.

The tube-trap units consist of 4 collection tubes mounted on a plastic frame made of plumbing pipes assembled in a 4-leg module (fig. 18). The module is deployed with a 2 kg weight attached underneath and a floating propylene line with a monkey fist for manipulation by the ROV. Each unit has 2 tubes filled with a borax buffered 10% formalin solution (denoted by red tape) and 2 tubes filled with a NaCl saturated 20% DMSO solution (denoted by blue tape). DMSO solution was not buffered for tube trap units N°1 and 2 : pH = 6,6, and was buffered at pH = 7,6 with NaHCO3 for tube trap units N° 3 and 4 (pH on the seafloor is close to 7,5 at the study sites). Before deployment, each tube was closed with a stretchable rubber cover maintained with shock cord and a fusible magnesium link. Collection of particles within the tube-trap begging once the magnesium fusible has dissolved in seawater and released the rubber cover.

Figure 18: Tube-trap unit ready for deployment

A first set of two units (N°1 and N°2) was deployed at Tu'i Malila during the ROV VICTOR 6000 dive #722 on April 4th 2019 (1h30 UTC). Both units were placed in the elevator to get to the seafloor. While Unit N°1 was retrieved from the elevator by the ROV, the cover of one of the tubes (1.1 with formalin) was accidentally removed, leaving the tube open as it was not yet deployed at its final place.

Both units were deployed by the ROV VICTOR6000 near assemblages of gastropods and mussels in the central part of the Tu'i Malila vent field. Unit N°1 was placed on a rock surrounded with a few *Cladorhiza* sponges, a few meters away from Unit N°2 which was placed on an assemblage with *Alviniconcha* gastropods and *Bathymodiolus* mussels, as well as some *Ifremeria nautilei*. The deployment site is at a depth of 1885 m with coordinates: 21.9890°S, 176.5683°W (cap 257).

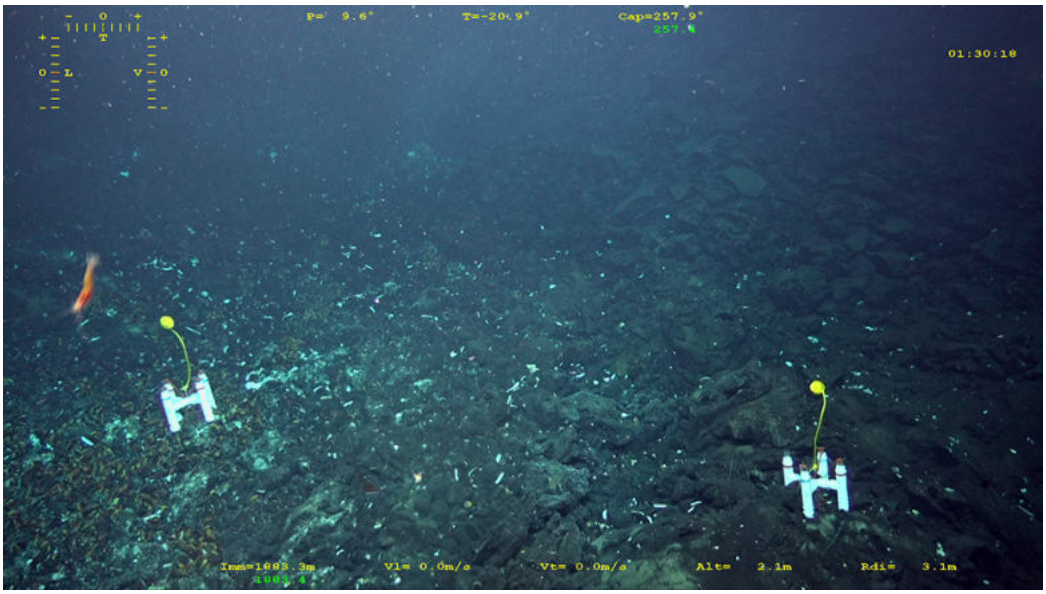


Figure 19: General view of the tube traps deployed at Tu'i Malila on April 4th, 2019.

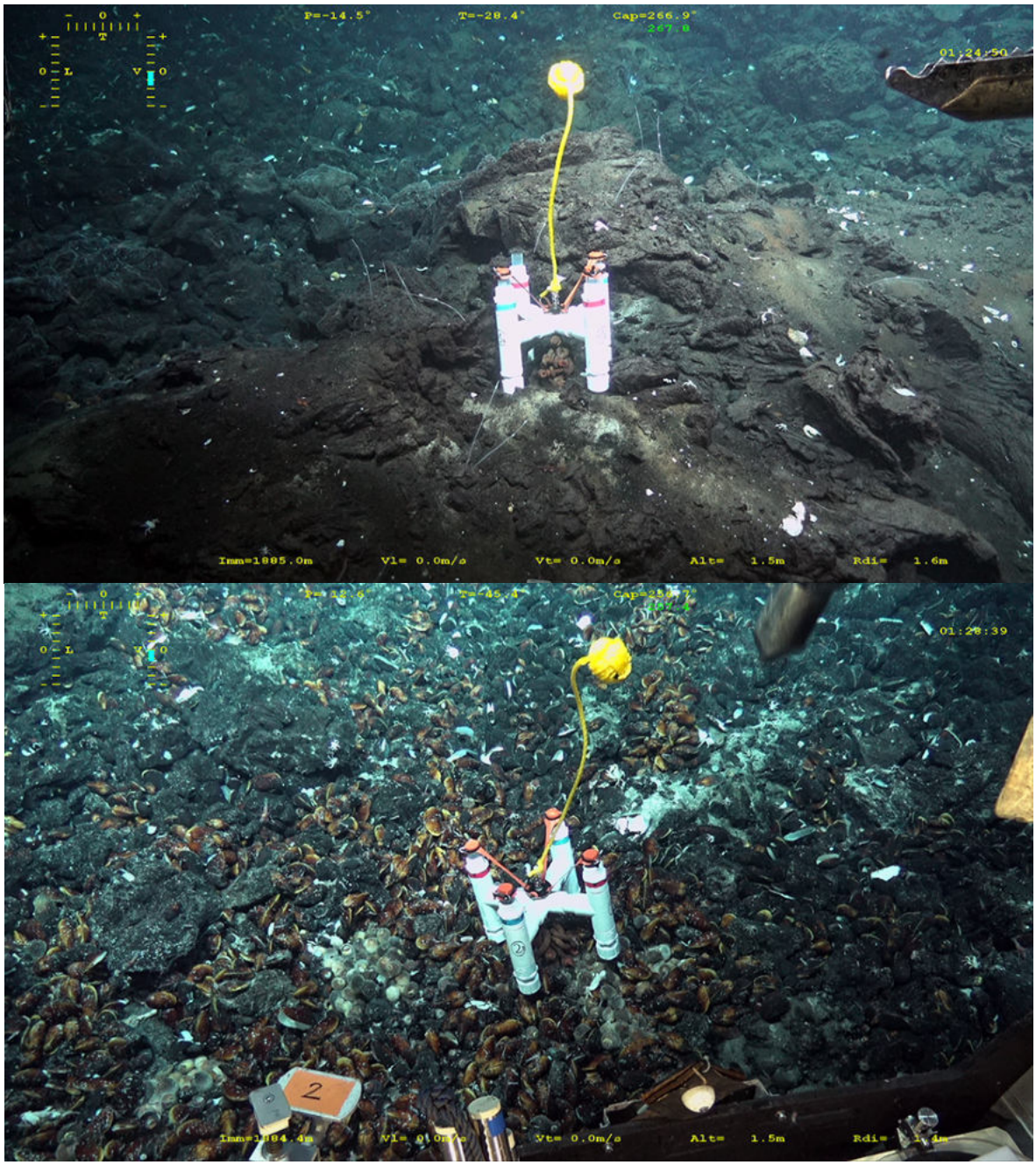


Figure 20: Close up views of the tube trap units deployed at Tu'i Malila. Top : Unit #1 on rocky substratum with a thin layer of sediments and nearby Cladorhiza sponges ; Bottom : Unit #2 deployed on Alviniconcha snails and Bathymodiolus mussels with a few Ifremeria snails.

A second set of two units (N°3 and N°4) was deployed at Tow Cam during the dive #730 on April 25th 2019 (23h15 UTC). Again, both units were placed in the elevator to get to the seafloor, and were deployed by the ROV VICTOR6000 near assemblages of gastropods and mussels in the southern part of the Tow Cam vent field. Unit N°3 was placed just next to an assemblage of *Ifremeria nautilei* and *Bathymodiolus* sp. *Alviniconcha* snails were also present a few meters away, in an area with a steep slope preventing any stable deployment. Unit N°4 was placed a few meters

away from N°3, on basalt blocks colonized by some *Eochionelasmus* barnacles. The deployment site is at a depth of 2713 m with coordinates: 20.3179°S, 176.1379°W (cap 255).

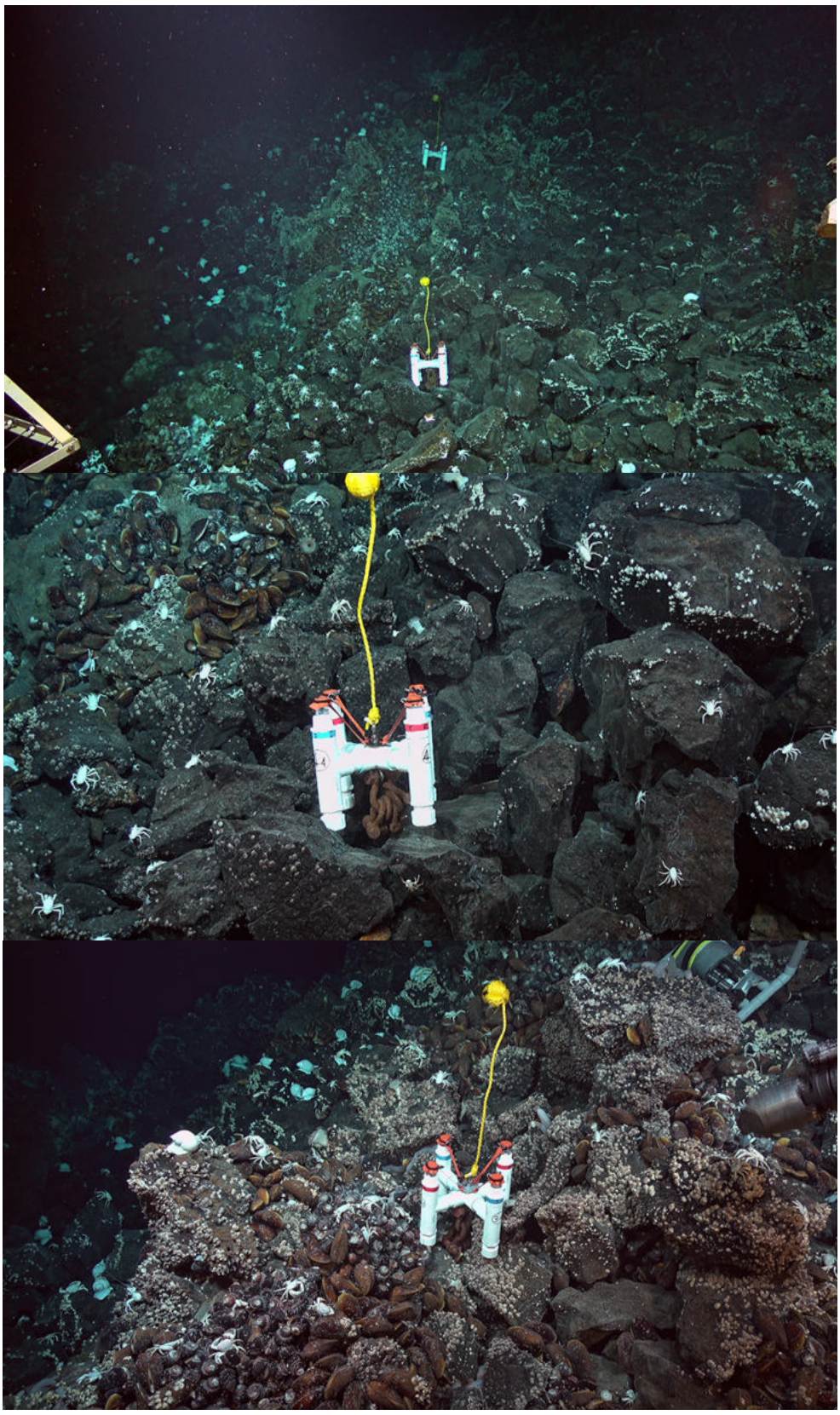


Figure 21: Tube-trap units deployed at Tow Cam on April 25th 2019. Top : global view of the two deployed units ; Middle : Unit #1 on rocky substratum with Eochionelasmus barnacles ; Bottom :Unit #2 deployed on Ifremeria snails and Bathymodiolus mussels.

II- Life-cycle of *Alviniconcha spp.*

Reproductive features of *Alviniconcha* snails remain poorly characterized although such knowledge would benefit to our understanding of their population dynamics, connectivity patterns and dispersal strategy.
During the cruise, samples of gonads of the three *Alviniconcha* species were collected on animals also preserved for symbiosis and genetic studies. Gonads were fixed whole in a borax buffered 10% formalin solution. Small pieces of gonads of some of the specimens were also preserved for DNA analysis, FISH imagery or electronic microscopy observations (see symbiosis report).
In total, gonads of 334 specimens were collected (see table). They will be used for histological studies aiming at assessing gametogenesis, fertilization processes, reproductive synchrony, and potential developmental mode of larvae.

Table summarizing *Alviniconcha* spp. sampled for gonads.

Bassin	Site	Sample	*A. kojimai*	*A. boucheti*	*A. strummeri*	*all Alviniconcha*
Lau	Tow Cam	PL721-GBT1	22*	-	2	24
		PL721-GBT6	10*	-	-	10
		PL721-GBT7	-	12	-	12
		tot TC	32*	12	2	46
	Tu'i Malila	PL722-GBT1	13	-	12	25
		PL722-GBT5	6*	-	3	9
		PL722-GBT7	23*	-	3	26
		tot TM	42*	0	18	60
	Mangatolo	PL726-GBT4	-	26	-	26
		PL726-PBT6	20	-	-	20
		tot Mangatolo	20	26	0	46
	ABE	PL731-GBT3	2	23	1	26
	tot LAU		96*	61	21	178
North Fiji	Phoenix	PL724-GBT4	36*	-	-	36
		PL724-PBT4	20	-	8	28
	tot FIJI		56*	0	8	64
Futuna	AsterX	PL727-GBT2	26	-	-	26
	Stephanie	PL727-GBT4	16	-	-	16
	Fati Ufu	PL728-GBT2	23	-	3	26
		PL728-GBT6	3	3	-	6
		PL728-PBT4	15	-	3	18
	tot FUTUNA		83	3	6	92
TOTAL			235*	64	35	334

* some of these specimens might be misidentified *A. boucheti*. Species identity will be confirmed through DNA barcoding.

Chubacarc Leg 2.

Immunity and antibiotics of *Paralvinella* sp. from the Back-Arc Basin Hydrothermal Vents of the western Pacific

Aurélie Tasiemski, Université de Lille, Centre d'Infection et d'Immunité de Lille (CIIL), CNRS UMR8204 INSERM U1019, Lille, France

6 may - 7 june 2019
Bassins arrière-arcs du Pacifique ouest

Polychaetes annelids are amongst the rare metazoans to have evolved physiological tolerance, symbiotic association, regenerative/repair properties that allow them to succeed under harsh conditions and habitats where they can reach high biomass. Thanks to the MESCAL 1 and 2 scientific cruises (N/0 Atalante, Nautile, 2010 and 2012, East Pacific Rise 9°50 and 13 °N, chief scientists N. Lebris and F. Lallier), we gave evidence that annelids (notably *Alvinella pompejana* and *A. caudata*) inhabiting the hottest part of hydrothermal chimneys produced original antimicrobial peptides (AMPs) belonging to a newly identified family of AMPs called the alvinellacin family. The alvinellacin AMP secreted by the epidermal cells of the annelid, participates in the control and selection of the environmental filamentous Epsilon-proteobacteria forming the vital and obligatory ectosymbiotic complex that covers the dorsal tegument and allows the worm to thrive in such ecosystem. Data of the evolving story of the alvinellacin gene family showed that a high selection at the inter- and intra-specific levels has probably occurred in relation to the ecology, the symbionts and anatomy of these organisms devoid of barriers (i.e. exoskeleton or shell) to physically protect their skin from direct biotic/abiotic interactions.

In this context, the goal of this work package is to enlarge the studies of the evolution and the immunological functions of alvinellacin (to date mainly focused on the *Alvinella* genus from the eastern Pacific) to the members of the *Paralvinella* genus (*i.e.* P. *hessleri*) inhabiting the active chimneys of the Back-Arc Basin in the Western Pacific. *Paralvinella* like the former genus *Alvinella* belongs to the Alvinellidae, a family of deep-sea polychaete worms endemic to hydrothermal vents in the Pacific Ocean.

Sampling, experimental challenges and conditioning aboard (RNA later, fixative for microscopy, dissections…) of *Paralvinella* were performed in order to later identify the Alvinellacin orthologs and to study their function in the immunity and in the symbiostasis of the annelids. To boost the immune response, *Paralvinella* were injected with 10µl of a mix of environmental bacteria (that will be identified in Lille) collected from the white mat that covers the tubes of the annelids. The coelomic liquid was collected to study the humoral and cellular immunity of the worms.

The sampling procedure was as follow:

- Collection of the worms with the suction sampler and/or the claw of the ROV on the white bacterial mat at the basis of the active chimneys where tubeworms are visible
- Pictures
- When tubeworms were inside or close to a community of *Alviniconcha* (as it was the case in Fenway): 3 points of Chemini Sulfide in distinct areas and 3 PIF fluid collection were performed Chemical analysis of the habitat by PIF and Chemini will allow to assess the role of the physico-chemical environment on the selection/production of the AMPs by the worm.
- Temperatures were measured by the ROV at the entrance of the tube of the worms

The bacterial challenge was performed as follow:

- Alive *Paralvinella* sp (at least 4 individuals per group) were split into three groups: unchallenged, injected with sterile sea water and injected with environmental bacteria
- 6h later either entire animals were fixed in Paraformaldéhyde (PFA) 4%, in RNA later or directly frozen OR animals were meticulously dissected under binocular and all organs and tissues (feeding tentacules, gills, digestive tract, nephridia, gonads, nerve cord, plasma, circulating cells, dorsal and ventral tegument, vascular system) were separately conserved in RNA later or in PFA4%.

In addition to this fundamental research, alvinellacin was patented for its use as a novel antibiotic to fight human pathogens that are multi-resistant (MDR) to conventional antibiotics. Assays on mice will be performed next year (SATT project) at the Pasteur Institute of Lille, CILL. Consequently and because of the therapeutic interest of this new family of antibiotics, the antimicrobial activities of the alvinellacin like produced by *Paralvinella* will also be chemically synthesized and tested against human pathogen.

1.7. Manus basin

1.5. PL733-14: Pac Manus vent field (1600 m)

Amongst the active sites, *Paralvinella* were only found in the fourth explored vents: Fenway. No *Paralvinella* were observed at Big Papi, a very active site with a black smoker where the annelids were still abundantly present 10 years ago (Stephane Hourdez, personal communication). Detailed informations on biological samples collected during this dive are given in Table 1

One *Paralvinella hessleri* community of 300 individuals was collected inside a patch surrounded by an *Alviniconcha* community. Animals were bacterially challenged for 6 hours, dissected and tissues were fixed or frozen for further analyses back to the lab. 15 specimens of *Paralvinella unidentata* were also collected from the same batches of sampling: 5 were directly frozen, 5 were fixed in RNA later and 5 in PFA4%

Table 1. *Paralvinella hessleri* and *P. unidentata* sampling at Pac Manus during dive Pl733-14 on May 16-18. Date and time are given in UT.

Dive	Date	Site	Community	Sampling		PIF		Chemini
				Sampler	Time	Syringe	Time	# points (Tp max)
733	17/05	Fenway	Alviniconcha and *Paralvinella hessleri* and *P unidentata*	GBT 8	10:32	1 2 3	10:13 10:19 10:28	1: 10:13 (6.12°C) 2: 10:19 (13.06°C) 3: 10:26 (5.05°C) After sampling 1 : 11:06 (4.57°C)
733	18/05	Fenway	*Paralvinella hessleri* and *unidentata*	GBT6	1:59			

Figure 1. *Picture of Paralvinella after their collection, out and inside its tube*

1.6. PL735-16: Desmos vent field

No *Paralvinella* were observed in the eastern part of the Caldera from Solwara 12 (inactive chimney) to the north of the Caldera near the Onsen site.

1.7. PL736-17: North Su vent field

Few *Paralvinella* were collected on the black smokers of the volcano Suzette. No *Paralvinella* were observed during the survey of the second volcano: North Su. Animals were put in ethanol for genetic analyses (see the report "genetics"). None of them were used for the immune approach

Table 2. Sampling at North Su during dive 736-17 on May 23-24. Date and time are given in UT.

Dive	Site	Habitat	Sampling		
736		Paralvinella	Aspi 5	23/05	1:35
736	Suzette	Paralvinella	Aspi 8	23/05	18:44

1.8. PL737-18: South Su vent field

Paralvinellids were collected in the southern flanks of this volcano. Detailed information on biological samples collected during this dive are given below.
Table 3. *S*ampling at South Su during dive 737-18 on May 24-25. Date and time are given in UT.

Dive	Site	Habitat	Sampling		
			Sampler	Date	Time
737	South Su	Paralvinella	PBT 1	25/05	00:00
737	South Su	Paralvinella	Aspi 7	25/05	20:04

12 *Paralvinella hessleri* and 12 of the new species of *Paralvinella* were collected and used for immune challenges as described before. Animals were bacterially challenged for 6 hours, dissected and tissues were fixed or frozen for further analyses back to the lab. Part of the gills as well as entire moribund worms (10 of the new species of Paralvinella) were put in ethanol for genetic analyses (see section "genetics").

1.8. Woodlark basin

PL738-19 and 20: Scala vent field

25 *Paralvinella* were collected during the opportunistic sampling on the *Alviniconcha* community. Animals were moribund and so could not be used for functional approaches. They were put in ethanol directly for genetic analysis (see section "genetics").

Additional opportunistic sampling

Tubeworms (15 *Oasisia* and 20 *Arcovestia*), 2 *C*apitellids and 12 *Amphisamytha* were also collected and directly frozen or fixed in PFA4% or in RNA later. The hemolymph of 10 individuals per community of *Alviniconcha* (except for the one sampled at the Scala site) was also collected during the dissection of the animals by Jean Mary, Thomas Broquet and Didier Jollivet for the research of antimicrobial peptides (see the "ecology" part of the report).

Dive	Site	Habitat	Sampling		
733	Fenway	Arcovestia	PBT3 Chimie		
736	North Su	Tubeworms - *Oasisia*	PBT 6	23/05	14:28
737	South Su	*Oasisia* and Capitellids	PBT 2	25/05	00:51
738	La Scala	*Amphisamytha* in *Alviniconcha* 1	GBT10		18:27

VI. APPENDIX. Deployments and dive plans

For dive summaries see the Chubacarc SeaLog pdf file in appendix 1

SEALOG : Résumé de campagne

CHUBACARC
Résumé de campagne

Dates : 25/03/2019-07/06/2019
Zone : Kilo Moana (Lau Basin)
Navire : L'Atalante
Instituts : INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST
INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, STATION DE SETE
GENAVIR
Universite Lille1
CNRS Banyuls
STATION BIOLOGIQUE DE BANYULS (UPMC)
CNRS Roscoff
UBO LM2E BREST
Universite Montpellier
CNRS Montpellier
STATION BIOLOGIQUE DE ROSCOFF (UMPC)
INCONNU / UNKNOWN
Chef(s) de mission :
HOURDEZ Stéphane (CNRS Banyuls)
JOLLIVET Didier (CNRS Roscoff)

Participants :

Nom	e-mail	Institut	Pays
BEAUJOT Francine		CNRS Banyuls	FRANCE
HOURDEZ Stéphane		CNRS Banyuls	FRANCE
JOLLIVET Didier		CNRS Roscoff	FRANCE
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ROSAZZA Franck		GENAVIR	FRANCE
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POITRIMOL Camille		STATION BIOLOGIQUE DE ROSCOFF (UMPC)	FRANCE
ROUXEL Olivier		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
LELAYEC Victor		STATION BIOLOGIQUE DE ROSCOFF (UMPC)	FRANCE
TASIEMSKI Aurélie		Universite Lille1	FRANCE
ROMAIN Julien		GENAVIR	FRANCE
FOURNIER Pierre-Yves		GENAVIR	FRANCE
SAINT LAURENT Xavier		GENAVIR	FRANCE
BONNET Loic		GENAVIR	FRANCE
FENOUIL Julien		GENAVIR	FRANCE
FAUVIN Olivier		GENAVIR	FRANCE
TRAN LU Y Adrien		Universite Montpellier	FRANCE
BAUSSAN Clément		GENAVIR	FRANCE
BROQUET Thomas		CNRS Roscoff	FRANCE
MICHEL Loic		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
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LAJOIE David		GENAVIR	FRANCE

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GAYET Nicolas		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
KUAMA Darren		Ministere de l'environnement	Papouasie
BONHOMME Francois		CNRS Montpellier	FRANCE
HENNEBELLE Franck		GENAVIR	FRANCE
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SUDA Rémi		GENAVIR	FRANCE
CAMBON-BONAVITA Mariane		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
COMTET Thierry		CNRS Roscoff	FRANCE
MARY Jean		STATION BIOLOGIQUE DE ROSCOFF (UMPC)	FRANCE
SCALABRIN Carla		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
BIERNE Nicolas		CNRS Montpellier	FRANCE
L'HARIDON Stéphane		UBO LM2E BREST	FRANCE

Objectifs de la campagne :

Nom	e-mail	Institut	Pays
PELLETER Ewan		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
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THIEBAUT Eric		STATION BIOLOGIQUE DE ROSCOFF (UMPC)	FRANCE
FREMONT Yoann		GENAVIR	FRANCE
TUIMANONO Keresi		Universite Suva	Fidji
BOUILLET Heinrich		GENAVIR	FRANCE
NAVARRANNE Augustin		GENAVIR	FRANCE
PLACAUD Xavier		GENAVIR	FRANCE
POMEE Christina		Nautilus Minerals	Tonga
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BOISSIER Audrey		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	FRANCE
LE BRIS Nadine		STATION BIOLOGIQUE DE BANYULS (UPMC)	FRANCE
BOULART Cédric		CNRS Roscoff	FRANCE
GAGNAIRE Pierre-Alexandre		CNRS Montpellier	FRANCE
RINNERT Emmanuel		INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, CENTRE DE BREST	France

Bilan des opérations :

Ont été effectués à partir de la surface :

0	Opérations de prélèvement
0	Mesures
19	Mouillages
0	Images

Bilan de la campagne :

Stations visitées :

Station	Latitude Nord	Latitude Sud	Longitude Ouest	Longitude Est	Profondeur minimum (m

Plongées :

Date	PL	Station	Observateur(s)
30/03/2019	720	Kilo Moana (Lau Basin)	PELLETER Ewan, POITRIMOL Camille, BOISSIER Audrey, LE BRIS Nadine, BEAUJOT Francine, MA Nicolas, RINNERT Emmanuel
31/03/2019	721	Tow Cam TC1	PELLETER Ewan, LALLIER Francois, POITRIMOL Camille, CAMBON-BONAVITA Mariane, MATAI Victor, COMTET Thierry, POMEE Christina, CATHALOT Cécile, BOISSIER Audrey, CASTEL Jade, E Nadine, BIERNE Nicolas, PRADILLON Florence, GAGNAIRE Pierre-Alexandre, RINNERT Emn
03/04/2019	722	Tui Malila	PELLETER Ewan, LALLIER Francois, POITRIMOL Camille, CAMBON-BONAVITA Mariane, MATAI Victor, COMTET Thierry, POMEE Christina, CATHALOT Cécile, BOISSIER Audrey, CASTEL Jade, Francine, BIERNE Nicolas, PRADILLON Florence, RINNERT Emmanuel, GAGNAIRE Pierre-Ale
05/04/2019	723	Tow Cam TC1	CATHALOT Cécile, LALLIER Francois, CASTEL Jade, CAMBON-BONAVITA Mariane, MATABOS M RINNERT Emmanuel
09/04/2019	724	White lady	PELLETER Ewan, POITRIMOL Camille, LALLIER Francois, CAMBON-BONAVITA Mariane, MATABO Keresi, LELAYEC Victor, COMTET Thierry, POMEE Christina, CATHALOT Cécile, BOISSIER Audre Francine, LE BRIS Nadine, BIERNE Nicolas, PRADILLON Florence, GAGNAIRE Pierre-Alexandre, R Nicolas
15/04/2019	725	Mangatolo, point triple	COMTET Thierry, POMEE Christina, PELLETER Ewan, BIERNE Nicolas, MATABOS Marjolaine, CAI RINNERT Emmanuel, GAGNAIRE Pierre-Alexandre
16/04/2019	726	Mangatolo, point triple	PELLETER Ewan, LALLIER Francois, POITRIMOL Camille, CAMBON-BONAVITA Mariane, TUIM Christina, BOISSIER Audrey, BEAUJOT Francine, LE BRIS Nadine, BIERNE Nicolas, JOLLIVET D Alexandre, RINNERT Emmanuel, GAYET Nicolas
18/04/2019	727	Fatu kapa (Futuna)	PELLETER Ewan, POITRIMOL Camille, LALLIER Francois, CAMBON-BONAVITA Mariane, TUIMA Marjolaine, LELAYEC Victor, COMTET Thierry, POMEE Christina, CATHALOT Cécile, BOISSIER Au Nadine, BIERNE Nicolas, PRADILLON Florence, GAGNAIRE Pierre-Alexandre, RINNERT Emn
20/04/2019	728	FK Fati ufu 1	PELLETER Ewan, POITRIMOL Camille, LALLIER Francois, TUIMANONO Keresi, MATABOS Marjol Mariane, LELAYEC Victor, COMTET Thierry, POMEE Christina, CATHALOT Cécile, BOISSIER Auc Nadine, BIERNE Nicolas, JOLLIVET Didier, RINNERT Emmanuel, GAGNAIRE Pierre-Alexar
23/04/2019	729	Kulo Lasi	PELLETER Ewan, LALLIER Francois, POITRIMOL Camille, LE BRIS Nadine, CAMBON-BONAVIT Marjolaine, PRADILLON Florence, LELAYEC Victor, GAGNAIRE Pierre-Alexa
25/04/2019	730	Tow Cam TC1	COMTET Thierry, POMEE Christina, BOISSIER Audrey, POITRIMOL Camille, CASTEL Jade, CAMI TUIMANONO Keresi, GAGNAIRE Pierre-Alexandre
26/04/2019	731	ABE (Lau Basin)	PELLETER Ewan, LALLIER Francois, POITRIMOL Camille, TUIMANONO Keresi, MATABOS Marjol Mariane, LELAYEC Victor, COMTET Thierry, POMEE Christina, BOISSIER Audrey, BEAUJOT Fr RINNERT Emmanuel, GAYET Nicolas
11/05/2019	732	Zone TVG150 (Woodlark)	CUEFF-GAUCHARD Valérie, L'HARIDON Stéphane, BONHOMME Francois, KUAMA Darren, TH Camille, ROUXEL Olivier, MICHEL Loic, LEPORT Anne-Sophie, BROQUET Thomas, LELAYEC Victor Jean, SCALABRIN Carla, BOULART Cédric, ARNAUD-HAOND Sophie, TRAN LU
16/05/2019	733	PacManus - Solwara 8 (Manus)	
18/05/2019	734	PacManus - Solwara 8 (Manus)	CUEFF-GAUCHARD Valérie, L'HARIDON Stéphane, KUAMA Darren, BONHOMME Francois, THIE POITRIMOL Camille, BROQUET Thomas, LEPORT Anne-Sophie, LELAYEC Victor, TASIEMSKI Auré Carla, BOULART Cédric, ARNAUD-HAOND Sophie
20/05/2019	735	Desmos Caldeira (Manus)	
22/05/2019	736	Susu volcano North Su (Manus)	CUEFF-GAUCHARD Valérie, L'HARIDON Stéphane, BONHOMME Francois, THIEBAUT Eric, POIT Thomas, MICHEL Loic, LEPORT Anne-Sophie, LELAYEC Victor, TASIEMSKI Aurélie, MARY Jean, S Cédric, ARNAUD-HAOND Sophie, TRAN LU Y Adrien
24/05/2019	737	South Su 1	L'HARIDON Stéphane, BONHOMME Francois, THIEBAUT Eric, ROUXEL Olivier, POITRIMOL Cam MICHEL Loic, BROQUET Thomas, LELAYEC Victor, TASIEMSKI Aurélie, MARY Jean, SCALABRIN ARNAUD-HAOND Sophie, TRAN LU Y Adrien
27/05/2019	738	Zone TVG150 (Woodlark)	CUEFF-GAUCHARD Valérie, L'HARIDON Stéphane, BONHOMME Francois, THIEBAUT Eric, POI Olivier, MICHEL Loic, LEPORT Anne-Sophie, BROQUET Thomas, LELAYEC Victor, MARY Jean, SC Cédric, ARNAUD-HAOND Sophie, TRAN LU Y Adrien
29/05/2019	739	Zone TVG150 (Woodlark)	CUEFF-GAUCHARD Valérie, L'HARIDON Stéphane, BONHOMME Francois, KUAMA Darren, THIE POITRIMOL Camille, BROQUET Thomas, LEPORT Anne-Sophie, MICHEL Loic, LELAYEC Victor, Jean, SCALABRIN Carla, BOULART Cédric, ARNAUD-HAOND Sophie, TRAN LU

Leg 1 -Chubacarc (Lau and North Fiji basins & the Futuna volcanic arc

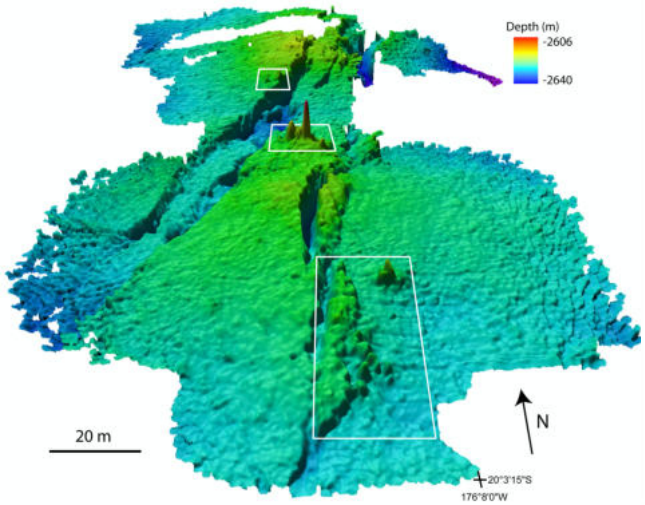
Dive 1 – March 30th 2019 (local time)

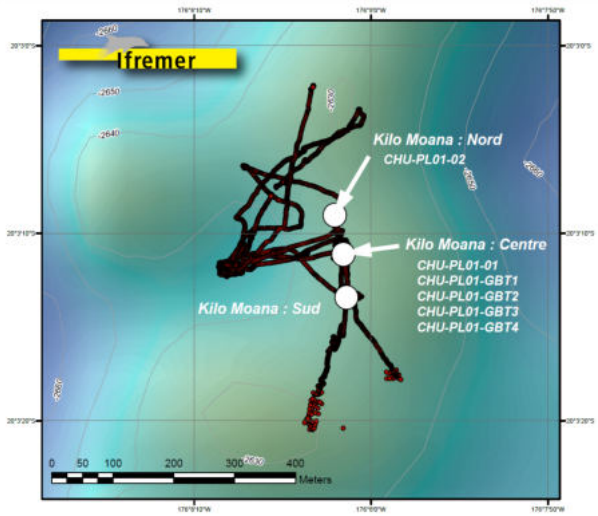
Kilo Moana, depth 2620 m

Time	Duration	Action	Notes
17:00	1:00	Deployment of elevator with 2 SALSA	
18:00	1:30	ROV in water, descent	
19:30		ROV on the bottom	Depth 2600 m
20:00	3:00	Survey of the area, choice of sites for deployment of SALSA, choice of chimney to sample, choice of sites for sampling fauna	Drop digital markers if necessary
23:00	1:30	Find elevator, and deploy the two SALSA, one away from vent influence, the other near vent community.	Call Florence for this
00:30	2:30	Sampling of mussel community - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals - Chemistry (PIF, electrodes, Chemini)	Nadine for SPOT Cécile for other chemistry Marjolaine for sampling mussels
03:00	2:30	Sampling of *Ifremeria* community - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals - Chemistry (PIF, electrodes, Chemini)	Cécile for chemistry and Didier +Marjolaine for fauna sampling
5:30	3:00	Sampling of chimney - Measure temperature of fluid - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan, Emmanuel
8:00	1:00	Transit to elevator and transfer the titanium syringes, BEG bottle, and 3 GBT collection boxes	
9:00		Release elevator	
10:00		Samples at the surface	
9:00	3:30	Video and photo surveys. Tests of SPOT when not in wait for elevator operations	Call Nadine for SPOT

		- Collection of a piece of basalt with cirripeds into the basket	
11:30		Deployment elevator 2 with 2 GBT collection boxes and 1 PBT collection box	
12:30		Elevator 2 at the bottom	
12:30	1:00	Heading to elevator and transfer of boxes to ROV Release of (empty) elevator	
13:30	1:30	Suction sampler on chimney for fauna	
15:00	2:00	Sampling of *Alviniconcha* community - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals Chemistry (PIF, electrodes, Chemini)	Cécile for chemistry and Didier +Marjolaine for fauna sampling
17:00	1:00	Sampling of *Alviniconcha* on chimney wall	Didier for sampling
18:00		ROV leaves bottom	
19:15		ROV and Samples on board	

Dive Roadmap





Dive 2 – March 31st- April 1st-2nd 2019 (local time)

Tow Cam, depth 2690 m

31 Mars 2019 (attention heures en heure bord)

17:00 Mise à l'eau Ascenseur 1 avec 2 Salsa
19:00 ROV avec dans le panier :
- 4 GBT
- 2 bouteilles titane
- 1 bouteille PEG
- marqueur Casimir
- 2 petits marqueurs site Marjolaine
- SPOT

1er Avril 2019

10:00 Retour ascenseur 1 avec 3 GBT, 2 bouteilles titane et 1 bouteille PEG
11:30 Mise à l'eau ascenseur 2 avec 2 GBT, 1 PBT, 2 seringues titane, 1 BEG, and 2 arrays of Nadine's sensors
17:00 Retour ascenseur 2 avec 1 GBT

2 Avril 2019

06:00 Déploiement ascenseur 3 POMME 1, 2 GBT
10:00 Retour ascenseur 3 avec 2 GBT et 1 PBT
11:30 Déploiement ascenseur 4 en configuration SALSA (vide)
16:00 Retour ascenseur 4 avec 2 SALSA

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

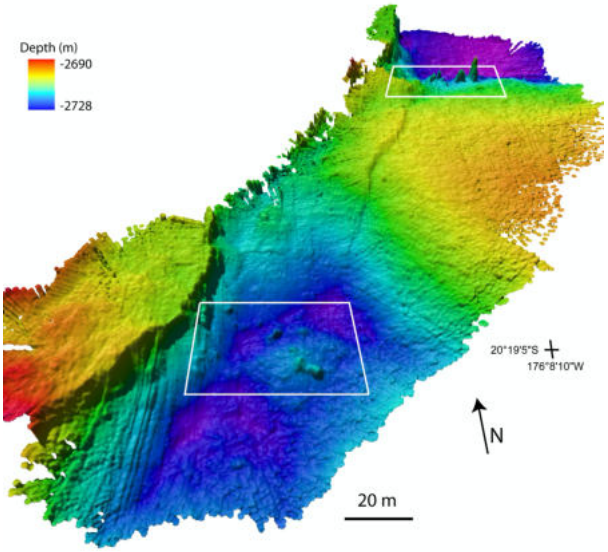
Time	Duration	Action	Notes
17:30	1:00	Deployment of elevator (with SALSA 1 and 2)	
19:00	1:45	ROV in water, descent	
20:45		ROV on the bottom. Calibration of electrodes and Chemini	Depth 2690 m
20:45	2:15	Survey of the area, choice of sites for deployment of SALSA, choice of chimney to sample, choice of sites for sampling fauna	Drop digital markers if necessary
23:00	2:30	Find elevator, and deploy the two SALSA, one away from vent influence, the other near vent community.	
01:30 April 1st	2:00	Sampling of mussel community 1 - Chemistry (PIF, electrodes, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar) Chemistry (electrodes, Chemini)	Cécile for other chemistry Marjolaine for sampling mussels
03:30	2:30	Sampling of *Ifremeria* community 1 - SPOT - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) Chemistry (electrodes, Chemini)	Nadine for SPOT Cécile for chemistry and Didier + Marjolaine for fauna sampling
5:30	2:15	Sampling of chimney 1	Ewan, Emmanuel

		- Measure temperature of fluid - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	
7:45	1:15	Transit to elevator and transfer the titanium syringes, BEG bottle, and 3 GBT collection boxes	
9:00		Release elevator	
10:00		Samples at the surface. Change configuration and ready (2h).	
9:00	3:00	Video and photo surveys. Tests of SPOT when not in wait for elevator operations - If convenient, collection of a piece of basalt with cirripeds into the basket	Call Nadine for SPOT
12:00		Deploy elevator with 2 GBT, 1 PBT, 2 titanium syringes, and 1 BEG bottle. 2x Nadine's autonomous sensors	
13:00		Elevator on the bottom	
12:00	2:30	Sampling of *Alviniconcha* community 1 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier for fauna sampling
14:30	2:00	Go to elevator, transfer the last GBT (*Alviniconcha* community). Pick up 2 GBT, 1 PBT, 2 titanium syringes, and 1 BEG bottle. 2x Nadine's autonomous sensors. These latter two will be deployed right after and can be kept in the arms	
16:30		Release elevator	No later than 17:00 if the schedule slips
17:30		Samples at the surface	
16:30	1:30	Deploy Nadine's 2 autonomous sensors arrays Head to starting point for mosaic	Call Nadine Keep in mind ROV may need to move if elevator drifts too much
18:00	5:00	Mosaic the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%, interlane distance 3.6 m (?). From the active site towards the periphery.	
23:00	2:00	Work on a lower temperature edifice - Temperature measurement - PIF 'gradient' sampling	Ewan, Cécile

		Break off a piece of rock and place it into the basket [THIS COULD BE CANCELLED IF TOO SHORT ON TIME]	
01:00 April 2nd	1:30	Sampling of chimney *Alviniconcha* community into PBT. Temperature measurement. SPOT?	Nadine, Didier
02:30	2:30	Sampling of mussel community 2 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar) Chemistry (electrodes, Chemini)	Cécile for chemistry and Marjolaine for fauna sampling
05:00	2:30	Sampling of *Alviniconcha* community 2 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect animals Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier or Marjolaine for fauna sampling
06:00		Deployment of elevator 3 with POMME 1 and 2 GBT	
07:00		Elevator 3 on the bottom	
07:30	1:30	Go to elevator, place the 2 GBT with samples in it, and the PBT with samples. Pick up 2 GBTs and POMME 1. Deploy POMME 1.	
09:00		Release elevator 3	
10:00		Elevator 3 at the surface with 2 GBT and one PBT	
09:00	2:30	Sampling of *Ifremeria* community 2 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals Chemistry (electrodes, Chemini)	
11:30		Deploy elevator 4 in SALSA configuration	
12:30		Elevator 4 (empty) at the bottom	
11:30	1:30	Suction sampler on chimney for fauna (scaleworms and shrimp)	
13:00	2:00	Move the 2 SALSA to the elevator.	
15:00		Release elevator 4	
16:00		Elevator 4 at the surface with the two SALSA	
15:00	4:30	Sampling of chimney 2 - Measure temperature of fluid - PIF gradient sampling - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan and Cécile

20:00		ROV leaves bottom	
21:30		ROV and Samples on board	

Targeted sites



Dive 3 – April 3-5 2019 (local time)

Tu'i Malila, depth 1890 m
Total duration: 55 h

3 Avril 2019 (attention heures en heure bord)	
10:00	Mise à l'eau Ascenseur 1 avec 2 Salsa
11:00	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille PEG - marqueur Casimir - 2 petits marqueurs site Marjolaine - SPOT
4 Avril 2019	
07:30	Retour ascenseur 1 avec 3 GBT, 2 bouteilles titane et 1 bouteille PEG (+ roche?)
11:00	Mise à l'eau ascenseur 2 avec 3 GBT, 1 PBT, 2 seringues titane, 1 BEG, and 2 pièges à larves USA
17:00	Retour ascenseur 2 avec 2 GBT
5 Avril 2019	

06:30 Déploiement ascenseur 3 2 GBT et Niskin
10:00 Retour ascenseur 3 avec 2 GBT et 1 PBT
12:00 Déploiement ascenseur 4 en configuration SALSA (vide)
16:00 Retour ascenseur 4 avec 2 SALSA
18:00 Retour ROV

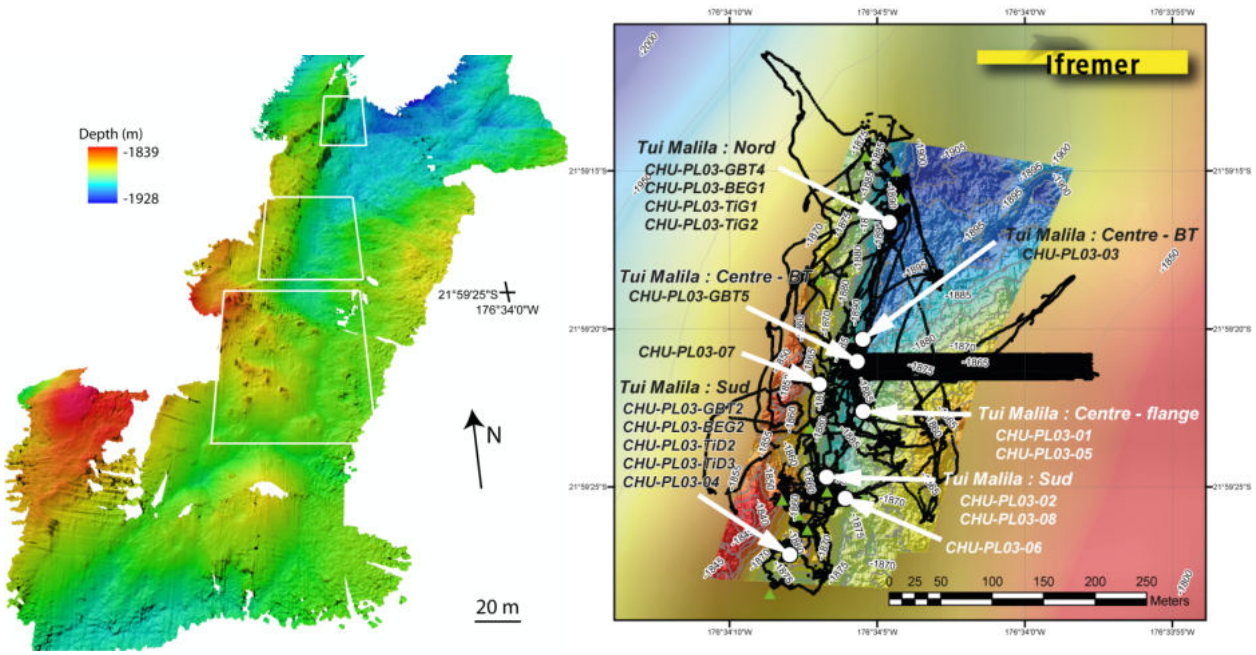
Time	Duration	Action	Notes
10:00	1:00	Deployment of elevator (with SALSA 1 and 2)	
11:00 April 3rd	1:30	ROV in water, descent	
12:30		ROV on the bottom. Calibration of electrodes and Chemini	Depth ~1890 m
12:45	2:15	Survey of the area, choice of sites for deployment of SALSA, choice of chimney to sample, choice of sites for sampling fauna	Drop digital markers if necessary
15:00	2:00	Find elevator, and deploy the two SALSA, one away from vent influence, the other near vent community.	Call Florence
17:00	2:30	SPOT measurements on selected communities	Call Nadine
19:30	2:00	Work on a lower temperature edifice - Temperature measurement - PIF 'gradient' sampling Break off a piece of rock and place it into the basket	Ewan, Cécile
21:30	4:00	Sampling of chimney 1 - Measure temperature of fluid - Sample for gradient with PIF - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan, Emmanuel, Cécile
01:30 April 4th	2:00	Sampling of *Ifremeria* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier + Marjolaine for fauna sampling
03:30	2:00	Sampling of mussel community 1 - Chemistry (PIF, electrodes, Chemini) - Deploy Casimir + photo/video - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar)	Cécile for other chemistry Marjolaine for sampling mussels

		- Chemistry (electrodes, Chemini) - Recover Casimir	
05:30	1:15	Transit to elevator and transfer the titanium syringes, BEG bottle, and 3 full GBT collection boxes	
06:45		Release elevator	
07:45		Samples at the surface. Change configuration and ready (2h).	
6:45	2:00	Further exploration of the area, good videos and pictures while the elevator is on the way up. Do SPOT measurement in chosen locations	Call Nadine
8:45	2:30	Sampling of *Alviniconcha* community 1 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier for fauna sampling
11:00		Deploy elevator 2 with 3 GBT, 1 PBT, 2 titanium syringes, and 1 BEG bottle. 2 x American larval traps	
12:00		Elevator 2 on the bottom	
11:15	0:45	If time available, more exploration while getting closer to elevator.	
12:00	1:30	Go to elevator, transfer the last GBT (*Alviniconcha* community). Pick up 3 GBT, 1 PBT, 2 titanium syringes, and 1 BEG bottle. 2 x American larval traps. Do not close side with samples.	
13:30	1:30	Sampling of chimney *Alviniconcha* community into GBT. Temperature measurement. SPOT. Go drop the GBT with *Alviniconcha* into the elevator.	Nadine, Didier
15:00		Release elevator	
16:00		Samples at the surface	
15:00	1:30	Deploy the 2 American larval traps (one close to community, one further away)	Call Florence
16:30	5:30	Mosaic the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%, interlane distance 3.6 m (?). From the active site towards the periphery.	Coordinates will be decided during the first part of the dive. Marjolaine for beginning
22:00	2:30	Sampling of *Ifremeria* community 2 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini)	Cécile/Nico G., Marjo/Camille/Didier

		- Recover Casimir	
00:30 April 5th	2:30	Sampling of chimney 2 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan/Emmanuel
03:00	2:30	Sampling of *Alviniconcha* community 2 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect animals (1 jar) Chemistry (electrodes, Chemini)	Cécile/Nico G., Didier
05:30	2:00	Suction sampler on chimney for fauna (scaleworms and shrimp + limpets and *Paralvinella*)	Victor/Didier/Stéph
06:30		Deployment of elevator 3 and 2 GBT + Niskin	
07:30		Elevator 3 on the bottom	
07:30	1:30	Go to elevator - trigger the Niskin - place the 2 GBT with samples in it, and the PBT with chimney sample - If rock nearby with fauna, pick it up and place it into the elevator - Pick up 2 GBTs	
09:00		Release elevator 3	
10:00		Elevator 3 at the surface with 2 GBT and one PBT + Niskin	
09:00	1:30	Sampling of chimney *Alviniconcha* community into GBT. Temperature measurement. SPOT. Go drop the GBT with *Alviniconcha* into the elevator.	Nadine, Didier
10:30	2:30	Sampling of mussel community 2 - Chemistry (PIF, electrodes, Chemini) - Deploy Casimir + photo/video - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	
12:00		Deploy elevator 4 in SALSA configuration	
13:00		Elevator 4 (empty) at the bottom	
13:00	2:00	Move the 2 SALSA to the elevator.	
15:00		Release elevator 4	
16:00		Elevator 4 at the surface with the two SALSA	

15:00	1:30	Pick (small) rocks with peripheral attached fauna and place them into the drawer (starfish, anemones, sponges). Peripheral scaleworms with suction sampler.	
16:30		ROV leaves bottom	
18:00		ROV and Samples on board	

Dive Roadmap



Dive 4 – April 6 2019 (local time)

Tow Cam, depth 2690 m
Total duration: 14 h

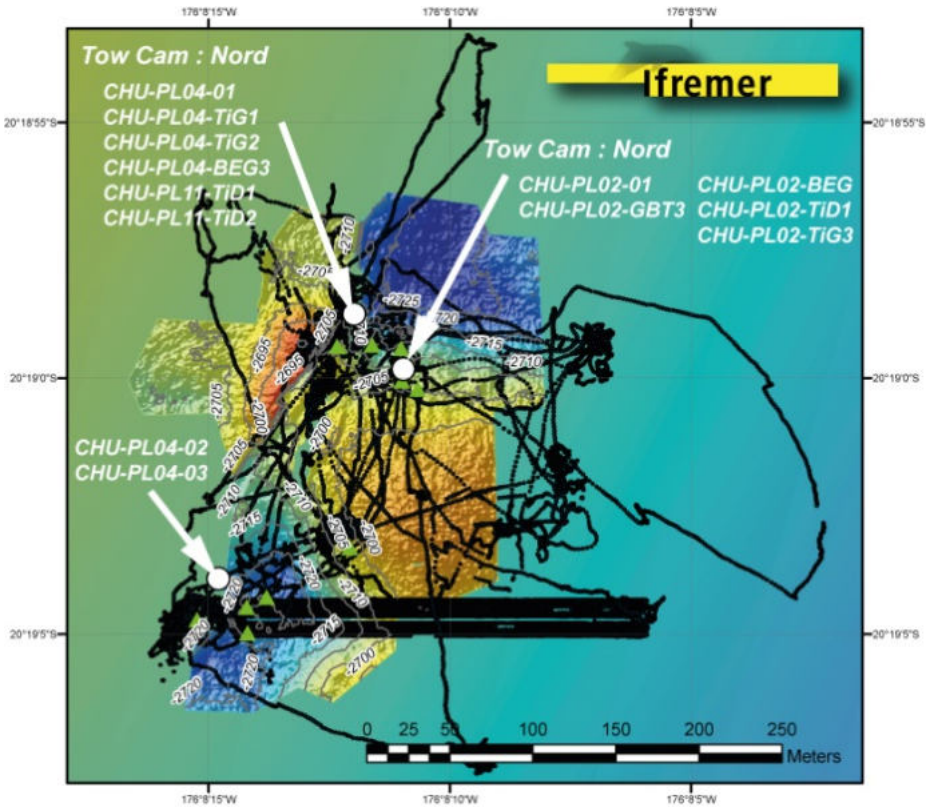
6 Avril 2019	
06:00	Mise à l'eau Ascenseur 1 avec Pomme 2 et Curious + FISH
06:30	ROV avec dans le panier : - 2 PBT - 2 bouteilles titane - 1 bouteille BEG - FISH en place dans le panier - CHARMS (module colonization Thierry Comtet) - SPOT
13:00	Retour ascenseur (à bord 13:30)

20:30 Récupération ROV

Nuit suivante: carottier multi-tubes dans les eaux de Tonga sur le chemin de Suva.

Time	Duration	Action	Notes
06:00	1:00	Deployment of elevator (with POMME 2 and CURIOUS+second FISH Canister)	
07:00	2:00	ROV in water, descent	
09:00		ROV on the bottom. Calibration of Cécile's systems.	Depth ~2690 m
09:00	1:00	FISH sampling: shrimp and 2-3 mussels (crushed). A few mussels into PBT for reference.	Marie-Anne and François
10:00	1:00	Recover POMME 1 Adjust position of Nadine's sensor array on mussel (horizontal rotation 180˚). Pick up the one in *Alviniconcha* and place it into the basket	Call Marjo and Nadine
11:00	1:00	Go to elevator and place POMME 1 into one side +Nadine's array. Drop first FISH canister and get the second one. Pick up POMME 2 and CURIOUS.	Marjo and Nadine
12:00		Elevator released	
13:30		Elevator on board	
12:00	1:30	Deploy POMME 2 and CURIOUS on the same site as Nadine's sensor array. Deploy CHARMS there too. Do second FISH	Call Marjo, Nadine, and Thierry
13:30	1:30	Sample chimney fauna with suction sampler: *Paralvinella* and scaleworms. As many jars as necessary. Coord. -20˚19.071, -176˚08.229	Call Stéph/Didier/Victor
15:00	2:30	Sampling of chimney - Measure temperature of fluid - Sample for gradient with PIF - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan, Emmanuel, Cécile
17:30	0:30	Find Marjolaine's Casimir marker and recover it Coordinates: -20.3175013; -176.1368049: depth 2696 m	Marjo
18:00	X:XX	If time permits, place rocks with peripheral fauna into the ROV basket.	
18:30		ROV leaves bottom	No later than 18:30
20:30		ROV and Samples on board	

Dive Roadmap



Dive 5 – April 9-11 2019 (local time)

Pere Lachaise – Ivory Tower, depth 2000 m
Total duration: 48 h

9 Avril 2019	
Zone du site Pere Lachaise	
20:00	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille BEG - SPOT - Casimir
10 Avril 2019	
Zone du site Ivory Tower	
06:30	Mise à l'eau ascenseur 1 avec 2 SALSA
10:00	Retour ascenseur 1
14:30	Mise à l'eau ascenseur 2 avec 2 GBT, 2 seringues Titane, 1 BEG et 1 PBT + Nadine capteurs

18:30 Retour ascenseur 2

11 Avril 2019

Zone du site Ivory Tower

06:30 Mise à l'eau ascenseur 3 avec 2 GBT

10:30 Retour ascenseur 3

14:00 Mise à l'eau ascenseur 4 en configuration SALSA (vide)

18:00 Retour ascenceur 4 à bord

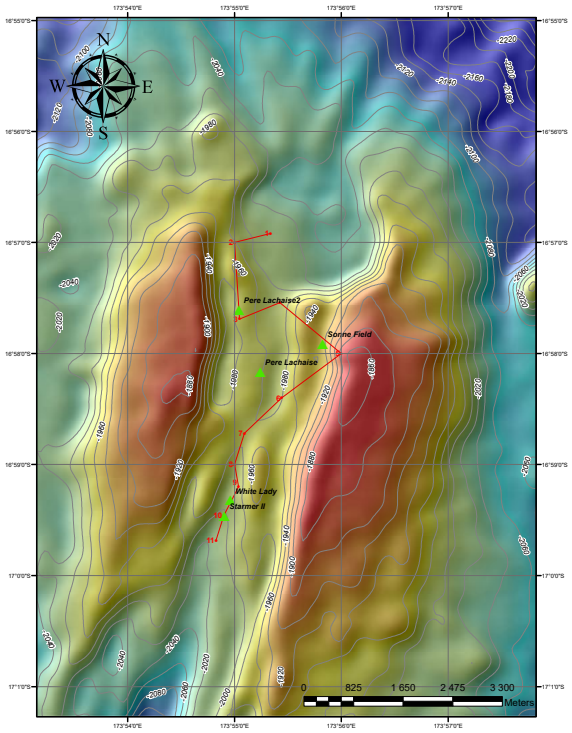
20:00 Retour ROV à bord

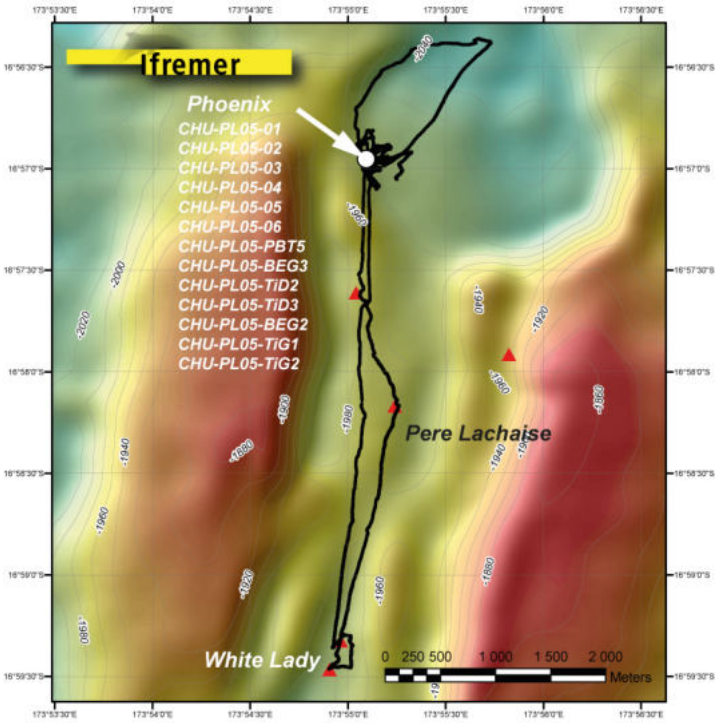
Time	Duration	Action	Notes
20:00 April 9th	1:30	ROV in water, descent	
21:30		ROV on the bottom. Calibration of electrodes and Chemini	Depth ~2000 m
21:45	2:15	Exploration of Pere-Lachaise/Corner Mound/Yogi Mound.	Drop digital markers for second dive
00:00 April 10th	2:00	Transit to Ivory Tower while surveying	Ewan
02:00	2:00	Exploration of known sites in Ivory Tower area in preparation for sampling and SALSA deployment	
04:00	1:45	Sampling of mussel community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample mussel into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier + Marjolaine for fauna sampling
06:00	1:45	Sampling of *Alviniconcha* community 1 - SPOT? - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	
06:30		Deploy elevator 1 with 2 SALSA on point selected early in the dive	
07:30		Elevator 1 on the bottom	
07:30	1:00	Pull SALSA 1 out and deploy nearby Place the 2 GBT with fauna into elevator	Florence
08:30		Release elevator 1	
10:00		Samples on board. Change configuration (2h).	
08:30	1:00	Deploy SALSA 2 near active community.	Florence

09:30	1:45	Sampling of *Ifremeria* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier + Marjolaine for fauna sampling
11:15	2:45	Sampling of chimney 1 - Measure temperature of fluid - Sample for gradient with PIF - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan/ Emmanuel/ Cécile
14:00	2:00	SPOT measurements on selected communities	Nadine
14:30		Deploy elevator 2 with 2 GBT, 2 titanium syringes and 1 BEG + 1 PBT + Nadine's array	
16:00		Elevator 2 on the bottom	
16:00	1:00	Transit to elevator and transfer the titanium syringes, BEG bottle, and 2 full GBT collection boxes. Recover 2 GBT+ Titanium syringes + BEG + 1 PBT	
17:00		Release elevator 2	
18:30		Samples on board	
17:00	5:30	Deploy Nadine's array Mosaic the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%, interlane distance 3.6 m (?). From the active site towards the periphery.	Coordinates will be decided during the first part of the dive. Marjolaine for beginning
22:30	1:30	Suction sampler on chimney fauna 1	Steph/Victor/Didier
00:00 April 11th	4:00	Explore further south and pick up rocks with peripheral fauna (including cirripeds), suction scaleworms on rocks, and if new chimneys, suction chimney fauna. If *Alviniconcha* on chimney is found, place some into PBT	
04:00	1:45	Sampling of mussel community 2 - Chemistry (PIF, electrodes, Chemini) - Deploy Casimir + photo/video - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for other chemistry Marjolaine for sampling mussels
05:45	1:45	Sampling of *Alviniconcha* community 2 - SPOT	

		- Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	
06:30		Deploy elevator 3 with 2 GBT	
07:30		Elevator 3 at the bottom	
07:30	1:00	Recover Nadine's array. Transfer 2 GBT with samples (+PBT if full) + Nadine's array to elevator and pick up the two other GBTs	
08:30		Release elevator 3	
10:30		Elevator and samples on board	
08:30	1:45	Sampling of *Ifremeria* community 2 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier + Marjolaine for fauna sampling
10:15	1:45	Sampling of chimney 2 - Measure temperature of fluid - Place fragment of top of chimney into GBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan/ Emmanuel/ Cécile
12:00	1:30	SPOT measurement on selected communities	Nadine
13:30	1:30	Peripheral mobile fauna (shrimp, scaleworms)	
14:00		Deploy elevator 4 in SALSA configuration	
15:00		Elevator 4 (empty) at the bottom	
15:00	1:30	Move the 2 SALSA to the elevator.	
16:30		Release elevator 4	
18:00		Elevator 4 on board with the two SALSA	
16:30	1:30	Pick (small) rocks with peripheral attached fauna and place them into the drawer (starfish, anemones, sponges). Peripheral scaleworms with suction sampler.	
18:00		ROV leaves bottom	
20:00		ROV and Samples on board	

Dive Roadmap





Dive 6 – April 16+ 2019 (local time)

Mangatolo Triple Junction, depth 2100 m
Main goals: Exploration dive and sampling when possible
Total duration: 24+ h

16 Avril 2019	
Zone Mangatolo Triple Junction	
09:00	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille BEG - SPOT - Casimir
15:00	Mise à l'eau ascenseur 1 3 PBT, 2 seringues Titane, 1 BEG, Niskin
18:30	Retour ascenseur 1 avec échantillons Exploration de la zone et retour/ou prolongation de la plongée selon découverte de sites actifs

Time	Duration	Action	Notes
09:00	2:00	ROV in water, descent	
10:45		ROV on the bottom on the first point provided by Ewan. Calibration of Cécile's systems. Quick survey.	Depth ~2100 m
11:00	4:00	Exploration following Ewan's profile. If no community was found at 15:00, do not deploy elevator and keep exploring.	
XX:XX		Sampling of *Ifremeria* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier / Marjolaine for fauna sampling
XX:XX		Sampling of *Alviniconcha* community 1 - SPOT - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	Nadine for SPOT Cécile for chemistry and Didier / Marjolaine for fauna sampling
15:00		Elevator deployed with 3 PBT, 1 Niskin, + 2 titanium syringes, 1 BEG syringe?	
16:00		Elevator on the bottom	
16:15	0:45	Go to elevator, pick up syringes, BEG, and PBT boxes. Trigger the Niskin	
17:00		Elevator released	
18:30		Elevator on board	
17:00	X:00	Continue exploration overnight	
		Opportunistic sampling: mussels, chimney?	
		More *Alviniconcha*, *Ifremeria*	
08:00		ROV leaves bottom if no site was found	
10:00		ROV and Samples on board	

Dive 7 – April 17+ 2019 (local time)

Mangatolo Triple Junction, depth 2100 m
Main goals: Exploration dive and sampling when possible
Total duration: 24 h?

17 Avril 2019

Zone Mangatolo Triple Junction

07:00 ROV avec dans le panier :
- 4 GBT
- 2 bouteilles titane
- 1 bouteille BEG
- SPOT
- Casimir

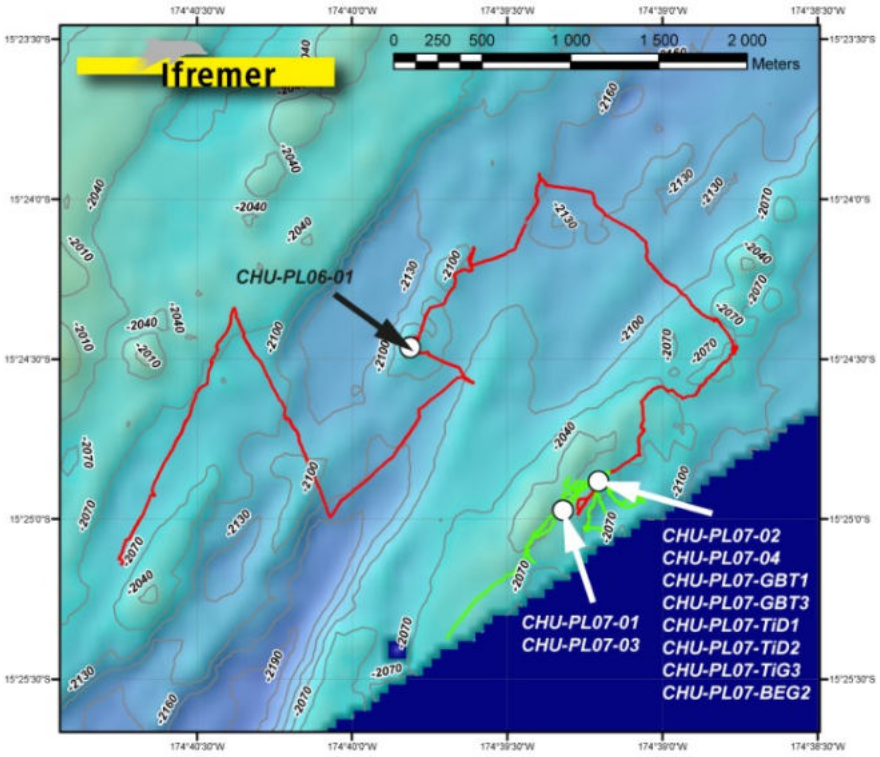
15:00 Mise à l'eau ascenseur 1 3 PBT, 2 seringues Titane, 1 BEG, Niskin

18:30 Retour ascenseur 1 avec échantillons

Time	Duration	Action
07:00	2:00	ROV in water, descent. Heading for about 500 m south west of point where dive was ended.
09:00		ROV on the bottom on the first point provided by Ewan. Calibration of Cécile's systems. Quick survey.
09:15	1:00	Head north-east towards known site and explore on the way
10:15	1:30	Sampling of *Ifremeria* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir
11:45	1:30	Sampling of *Alviniconcha* community 1 - SPOT - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)
13:15	1:30	Sampling of *mussel* community 1 or isolated mussels if a community is not found - SPOT - Chemistry (PIF, electrodes, Chemini) - Sample *mussels* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)
14:45	1:30	Sample chimney fauna with suction sampler
15:00		Elevator deployed with 3 PBT, 1 Niskin, + 2 titanium syringes, 1 BEG syringe?
16:00		Elevator on the bottom
16:15	0:45	Trigger the Niskin. Place boxes with samples into the elevator and release it.

17:00		Elevator released
18:30		Elevator on board
17:00	1:00	If a chimney is appropriate, do chimney sampling - Measure temperature of fluid - Sample for gradient with PIF - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect pieces of sulfide at the base of chimney and place it into the basket
18:00	X:00	Continue exploration in the Northern part
		Opportunistic sampling: mussels, chimney?
		More *Alviniconcha*, *Ifremeria*
XX:00		ROV leaves bottom if no site was found
XX+2:00		ROV and Samples on board

Dive Roadmap



Dive 8 – April 18-20 2019 (local time)

Fatu Kapa, depth 1600 m Stéphanie ← 3 km → Aster'X, Idef'X …

Total duration: 42 h

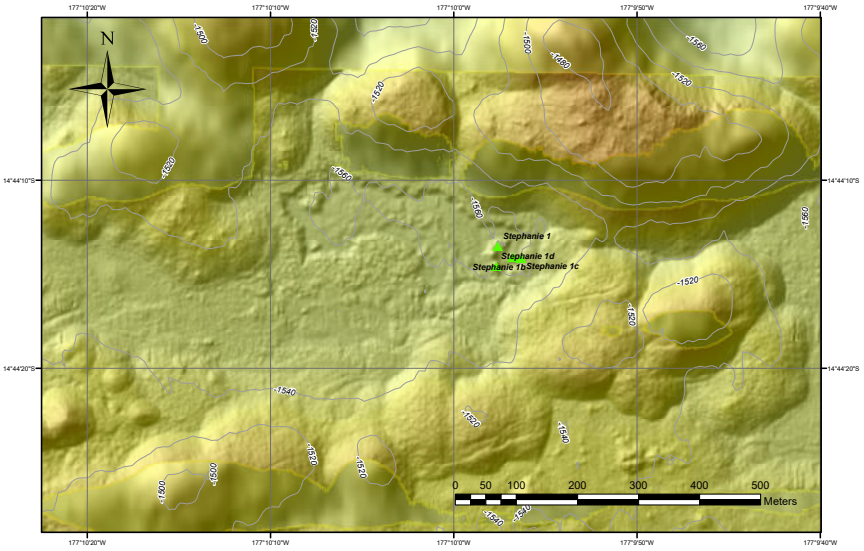
18 Avril 2019	
Zone Fatu Kapa	
23:00	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille BEG - SPOT - Casimir + Marqueur spécial
19 Avril 2019	
07:15	Mise à l'eau ascenseur 1 avec 2 SALSA et POMME 1
11:30	Retour ascenseur 1 avec échantillons
15:00	Mise à l'eau ascenseur 2 avec 2 GBT seringues Titane et BEG. Niskin au dessus
18:00	Retour ascenseur 2 avec échantillons
20 Avril 2019	
07:15	Mise à l'eau ascenseur 3 en configuration avec fond
09:30	Retour ascenseur 3 avec échantillons
12:30	Mise à l'eau ascenseur 4 en configuration SALSA
16:00	Retour ascenseur 4 avec SALSA

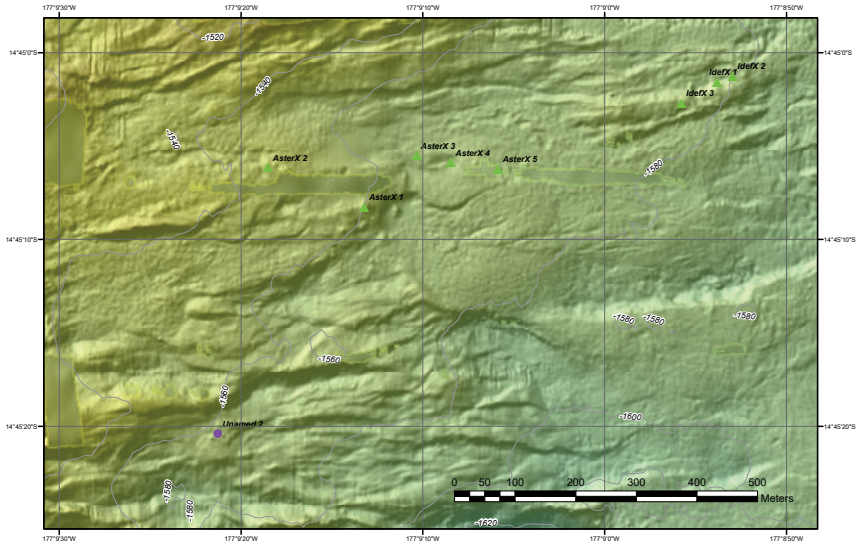
Time	Duration	Action
23:30	1:30	ROV in water, descent
01:00 April 19th		ROV on the bottom near Aster'X. Calibration of Cécile's systems. Quick survey.
01:15	1:00	Survey of the area, search for high temperature chimneys, and animal communities
02:15	1:30	Do SPOT measurements on a series of communities. Leave SPOT in one place for later pick-up.
03:45	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir + Marjo's special marker + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir
05:15	2:00	Sampling of chimney 1 + Gradient - Measure temperature of fluid - Place a piece of chimney into GBT box - Do PIF gradient

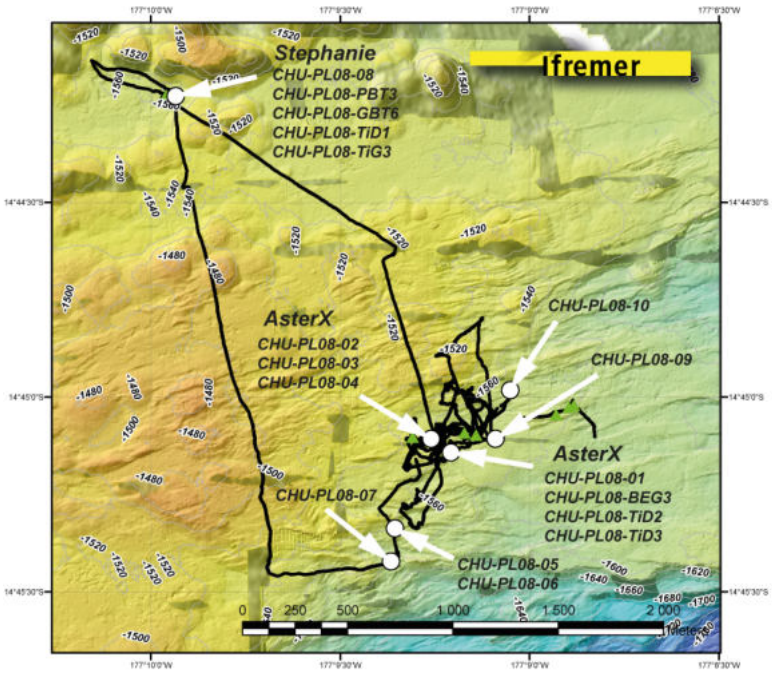
		- Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket
07:15	1:00	Deployment of elevator (with SALSA+POMME 1) near Aster'X
08:15		Elevator on the bottom
07:15	1:30	Sampling of scaleworms with suction sampler: peripheral (white) ones (1 jar) and chimney fauna sampling (1 jar).
08:45	1:30	If mussels were found, sample them after quick SPOT survey. If mussels form a bed, do the usual sampling of the community into a GBT.
09:15 or 10:30	1:30	Deploy Salsa 1 away from active site. Place the 2 GBTs (possibly 3 if mussels were found) into the elevator. Place the 2 titanium syringes and BEG into elevator as well. Deploy Salsa 2 and POMME 1
10:30 or 12:00		Elevator released
11:30 or 13:00		Elevator on board with first set of samples 2 GBTs (possibly 3 if mussels were found), titanium syringes and BEG
10:30 or 12:00	1:30	Sampling of *Alviniconcha* community 1 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)
12:00 or 13:30	2:30-4:00	Mosaick the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%, interlane distance 3.6 m (?). From the active site towards the periphery.
15:00	1:00	Deployment of elevator (with 2 GBTs (or 3), 1 PBT, 2 titanium syringes and BEG) near Aster'X. Niskin on top.
16:00		Elevator on the bottom
16:00	1:00	Go to elevator, transfer GBT with *Alviniconcha* and pick up 1 PBT, 2 GBTs (or 3), 2 titanium syringes and BEG. Pick up POMME 1 (will be deployed on *Alviniconcha* community). Trigger Niskin
17:00		Elevator released
18:00		Elevator on board with second set of samples GBT
17:00	1:00	Deploy POMME 1 on *Alviniconcha* community. + Marjo's special marker Pick SPOT up
18:00	4:00	Transit to Stéphanie and exploration on the way. If mussels are found on the way, place them into a PBT.
22:00	1:30	Survey the Stephanie area and search for communities and chimney to sample
23:30	1:30	Do SPOT measurements on selected communities
01:00 April 20th	1:30	Sampling of *Ifremeria* community 2 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini)

		- Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir
02:30	2:00	Sampling of chimney 2 - Measure temperature of fluid - Place a piece of chimney into GBT box - PIF Gradient - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket
04:30	1:30	Sampling of *Alviniconcha* community 2 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)
06:00	1:30	If mussels were found, sample them after quick SPOT survey. If mussels form a bed, do the usual sampling of the community into a GBT.
06:30	1:00	Deployment of elevator near Stéphanie (empty, in configuration with bottom)
07:30		Elevator on the bottom
07:30 or 05:30	1:30	Sampling of scaleworms with suction sampler: peripheral (white) ones (1 jar) and chimney fauna sampling (1 jar). Grab rock with cirripeds
09:00 or 07:30	1:00	Go to elevator and place all GBTs, PBT (if used) and titanium syringes + BEG into elevator. Keep just one PBT in basket. If there is an unused GBT, place it into elevator
08:30		Elevator released
09:30		Elevator on board with samples
09:30	3:00	Return transit to Aster'X and light exploration on the way.
12:30	1:00	Pick up POMME 1 + Marjo's special marker. Place them into the drawer
12:30		Elevator deployed in SALSA configuration, and SPOT on the side
13:30		Elevator on the bottom
13:30	1:30	Go pick up SALSAs and place them into the elevator
15:00		Elevator released
16:00		Elevator on board
15:00	2:00	Grab rock with cirripeds Grab rock with peripheral fauna (sponges) Additional exploration if time permits
17:00		ROV leaves bottom
18:00		ROV on board

Dive Roadmap







Dive 9 – April 21-22 2019 (local time)

Fati Ufu, depth 1530 m Several areas, total maximum distance ~1.5 km

Sites by clumps: 3,4,5 6,7 8 9 at the center, then 13, 14, 15 (350 m North), and 10, 11 (600 m South)

Total duration: 36 h

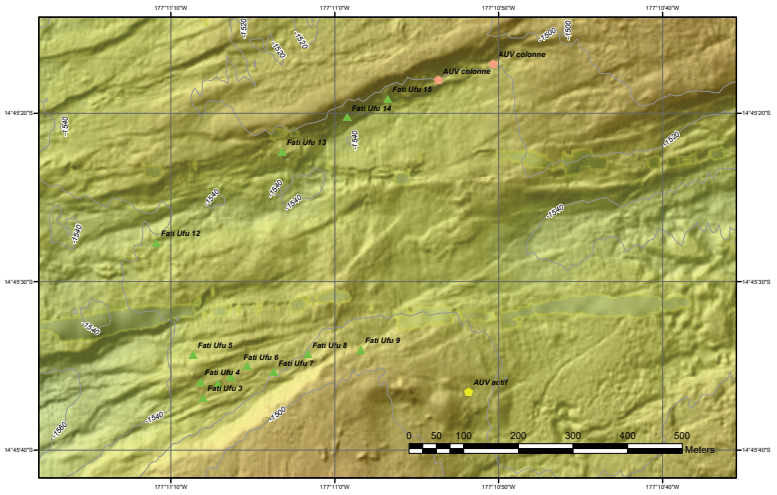
21 Avril 2019	
Zone Fati Ufu	
06:30	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille BEG - SPOT - Casimir + Marqueur special
08:30	Mise à l'eau ascenseur 1 avec 2 SALSA
18:30	Retour ascenseur 1 avec échantillons
22 Avril 2019	
06:30	Mise à l'eau ascenseur 2 GBT, seringues Titane et BEG. Niskin au dessus
09:30	Retour ascenseur 2 avec échantillons de faune
14:30	Mise à l'eau ascenseur 3 en configuration SALSA
17:30	Retour ascenseur 3 avec SALSA
18:30	Retour ROV

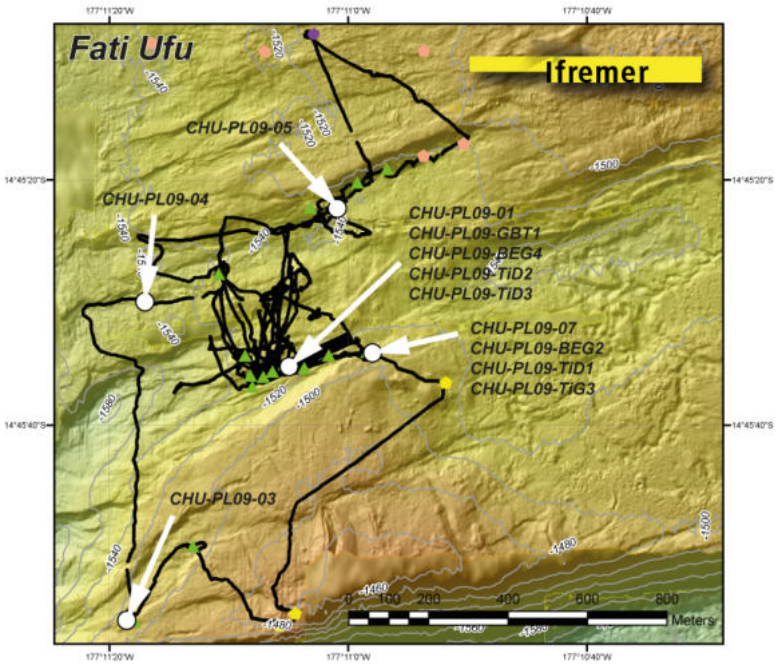
Time	Duration	Action	Notes
06:30	1:30	ROV in water, descent	
08:00		ROV on the bottom near Fati Ufu 4. Calibration of Cécile's systems. Quick survey.	Depth ~1530 m
08:15	1:15	Survey of the area, search for high temperature chimneys, and animal communities	
08:30	1:00	Deployment of elevator (with SALSA+2 PBT) near Fati Ufu 4 (unless exploration indicates this is not good)	
09:15		Elevator on the bottom	
09:15	1:00	Deploy Salsa 1 away from active site. Deploy Salsa 2 near active area and mark a 25-m circle to not go there	
10:15	1:15	Do SPOT measurements on a series of communities. Leave SPOT in one place for later pick-up.	Nadine
11:30	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir + Marjo's special marker + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjo for fauna sampling
13:00	1:30	Sampling of *Alviniconcha* community 1 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier / Marjolaine for fauna sampling
14:30	2:15	Sampling of chimney 1 + Gradient - Measure temperature of fluid - Place a piece of chimney into GBT box - Do PIF (short) gradient - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan/ Emmanuel/ Cécile
16:45	0:45	Go to elevator, transfer GBTs with samples, 2 titanium syringes and BEG. Pick up the two PBTs.	
17:30	1:00	Elevator released	
18:30		Elevator on board with first set of samples	
17:30	1:30	Sample a rock with cirripeds Sampling of scaleworms with suction sampler: peripheral (white) ones (1 jar) and chimney fauna sampling (1 jar). Do not break suction sampler…	Steph/ Victor

		PICK SPOT UP?	
19:00	1:30	Transit to Fati Ufu 10 and 11 (600 m Southwest) and explore the area. In search for mussels! If mussels are found there, spend some time to sample them	
20:30	2:00	Transit to area North of area Fati Ufu 13-15, when AUV signal was detected (from Fati Ufu to this area, about 1500 m). Try to see Fati Ufu 12 on the way	Ewan
22:30	1:30	Explore this area with AUV signal from west to east, record communities, and high temperature chimneys	
00:00 April 22nd	1:30	Move on the other side of the ridge (slightly South from the eastern end) and explore the area on the way to Fati Ufu 13. Look for communities to sample. At the end, decide where we want to sample: Area North (newly explored) or this area.	
01:30	1:30	Sampling of *Ifremeria* community 2 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjo for fauna sampling
03:00	1:30	Sampling of *Alviniconcha* community 2 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into PBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjolaine for fauna sampling
04:30	1:30	Sample a rock with cirripeds Sampling of scaleworms with suction sampler: peripheral (white) ones (1 jar) and chimney fauna sampling (1 jar).	Steph/ Victor
06:00	1:30	Look around, makes videos, take pictures	This can be cut off if necessary
06:30	1:00	Deployment of elevator (with 2 GBTs, 2 titanium syringes and BEG) near Fati Ufu 14. Niskin on top.	
07:30		Elevator on the bottom	
07:30	1:00	Go to elevator, place full boxes inside, pick up syringes and BEG. Trigger Niskin	
08:30		Elevator released	
09:30		Elevator on board with 1 GBT, 1 PBT, 1 Niskin	
08:30	3:00	Sampling of chimney 2 + Gradient - Measure temperature of fluid - Place a piece of chimney into GBT box	Ewan/ Emmanuel/ Cécile

		- Do PIF (long?) gradient - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	
11:30	3:00	Mosaick the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%. From the active site towards the periphery.	
14:30	1:00	Collect peripheral fauna. If suction sampler possible, try to collect some specimens of crinoids, sponges, … There should be 2 GBTs left for this too	This can be cut or shortened if necessary
14:30	1:00	Deployment of elevator in SALSA configuration	
15:30		Elevator on the bottom	
15:30	1:00	Go pick up SALSAs and place them into the elevator	
		PICK SPOT UP?	
16:30	1:00	Elevator released	
17:30		Elevator on board	
16:30	0:30	If did not have time, do peripheral fauna sampling. If suction sampler possible, try to collect some specimens of crinoids, sponges, … There should be 2 GBTs left for this too	This can be cut off if necessary and start ROV ascent
17:00	1:30	ROV leaves bottom (following elevator)	
18:30		ROV on board	

Dive Roadmap





Dive 10 – April 23-24 2019 (local time)

Kulo Lasi, 1500 m

Main goals: Sampling of mussels, Exploration dive and sampling when possible

Total duration: ~26 h

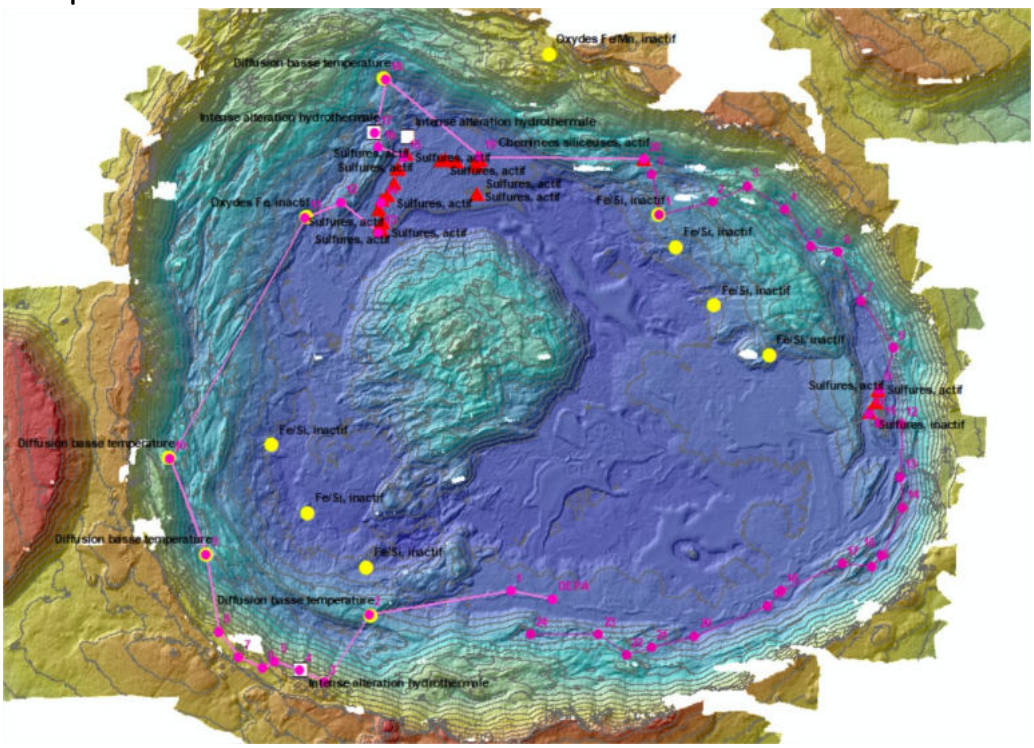
While exploring, remember to take OTUS pictures if fauna is found

23 Avril 2019	
Zone Kulo Lasi	
06:30	ROV avec dans le panier : - 4 GBT - 2 bouteilles titane - 1 bouteille BEG - SPOT - Casimir + Marqueur special
15:45	Mise à l'eau ascenseur 1 3 PBT
18:30	Retour ascenseur 1 avec échantillons
24 Avril 2019	
08:00	ROV de retour à bord

Time	Duration	Action	Notes
06:30	1:30	ROV in water, descent	
08:00		ROV on the bottom on the first point provided by Ewan. Calibration of Cécile's systems. Quick survey.	Depth ~1500 m
08:15	1:00	Go to the location of tubeworms+mussels in the South	
09:15	0:45	Do SPOT measurements on mussels and tubeworms	Nadine
10:00	1:00	Sampling of mussel community 1 - SPOT - Chemistry (PIF, electrodes, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	Nadine for SPOT Cécile for chemistry and Didier for fauna sampling
11:00	2:00	Exploration to the diffusion areas in the west of the caldera. Collect cirripeds here	Ewan
13:00	0:30	Move to the next diffusion area	
XX:XX		Sampling of *Ifremeria* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier / Marjolaine for fauna sampling
XX:XX		Sampling of *Alviniconcha* community 1 - SPOT - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Nadine for SPOT Cécile for chemistry and Didier / Marjolaine for fauna sampling
13:30	1:30 + 0:30	Transit to high-temperature area and explore the area in search of chimney to sample for fluids and for chimney fauna (shrimp, *Paralvinella*, and scaleworms)	Ewan, Stephane for chimney fauna
15:30	2:15	Sampling of chimney 1 + Gradient - Measure temperature of fluid - Place a piece of chimney into GBT box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid - Do PIF (short) gradient Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan/ Emmanuel/ Cécile If too tight, do gradient after elevator operations
15:45		Elevator deployed with 3 PBT, 1 Niskin	

		Coordinates to be decided by pilot+scientist based on sampling area and terrain	
16:30		Elevator on the bottom	
17:00	0:30	Go to elevator, drop syringes, BEG, 2 GBTs and pick up 3 PBT boxes. Trigger the Niskin.	
17:30		Elevator released	
18:30		Elevator on board	
17:30	1:30	SPOT measurements Suction sampler on the chimney surface Pick up a rock with cirripeds	Nadine, Stephane/Victor
18:30	0:30	Move on to the low-temperature fluid area to look for associated fauna	
19:00	2:00	Keep moving east to the silicate area	
21:00	X:XX	Keep exploring the eastern side of the caldera in search for communities to sample	
		If chimneys are found later in the dive, use the suction sampler	
06:30		ROV leaves bottom if no site was found	
08:00		ROV and Samples on board	

Dive Roadmap



Dive 11 – April 26 2019 (local time)

Tow Cam, 2690 m

Main goals: recovery of all deployments (CHARMS, CURIOUS, POMME 2), collect of fluids and mussels, chimney fauna, deployment of American larval traps

Total duration: 12-14 h

26 Avril 2019

Zone Tow Cam

06:30 Mise à l'eau ascenseur avec pièges à larves américains + 1 GBT

07:00 ROV avec dans le panier :

- 3 GBT
- 2 bouteilles titane
- 1 bouteille BEG
- Casimir

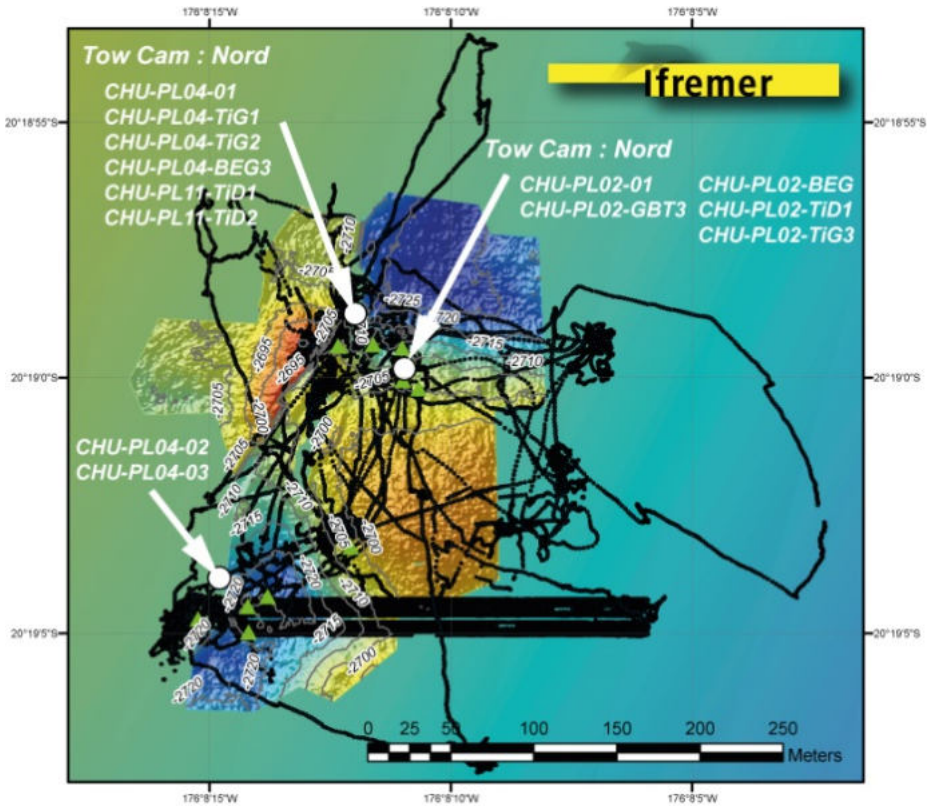
16:00 Récupération ascenseur

19:00 Récupération ROV

Time	Duration	Action	Notes
06:30	1:30	Deployment of elevator with 2 American larval traps just east of active site	
08:00		Elevator on the bottom	
07:00	2:00	ROV in water, descent	
09:00		ROV on the bottom near site for all deployments	Depth 2690 m
09:15	0:30	Go to the site with POMME and CURIOUS	
09:45	0:15	Pick up CHARMS and place it into a GBT	Thierry
10:00	1:30	Pick up CURIOUS and place it into basket, pick POMME 2 and hold it into the arm. Go to the elevator and place these into one side, along with the GBT containing the CHARMS.	Nadine, Marjo
11:30	0:45	Pick up the American larval trap and place them at the site were CURIOUS and POMME were.	Florence
12:15	1:30	Sampling of mussels for genetics (not near the American larval traps) - Choose a mussel bed that is dense - Deploy Casimir - PIF and Chemini - Place the mussels into a GBT (2 GBTs if the mussels are big) - Recover Casimir Sample white scaleworms into jars	Nico B., Didier, Cécile or Nico G.
13:45	0:45	Go to elevator and place the GBTs into one side.	
14:30	1:30	Elevator released	

16:00		Elevator on board	
14:30	0:30	Go to the chimney area and look for fauna	
15:00	2:00	If possible with elevator, start fluid sampling into titanium syringes and BEG. Otherwise, do fauna sampling (suction sampler jars) and then fluids	Ewan or Emmanuel Stephane or Victor
		Try sampling peripheral fauna	
17:00	2:00	ROV leaves bottom (following elevator)	
19:00		ROV on board	

Dive Roadmap



Dive 12 – April 27 2019 (local time)

ABE, depth 2150 m

Main goals: Sampling for fauna and fluids

Total duration: 27 h

27 Avril 2019

Zone ABE

07:00 ROV avec dans le panier :

- 4 GBT
- SPOT
- 2 bouteilles titane
- 1 bouteille BEG
- Casimir

15:00 Mise à l'eau ascenseur avec 3 PBT et Niskin

18:30 Récupération ascenseur

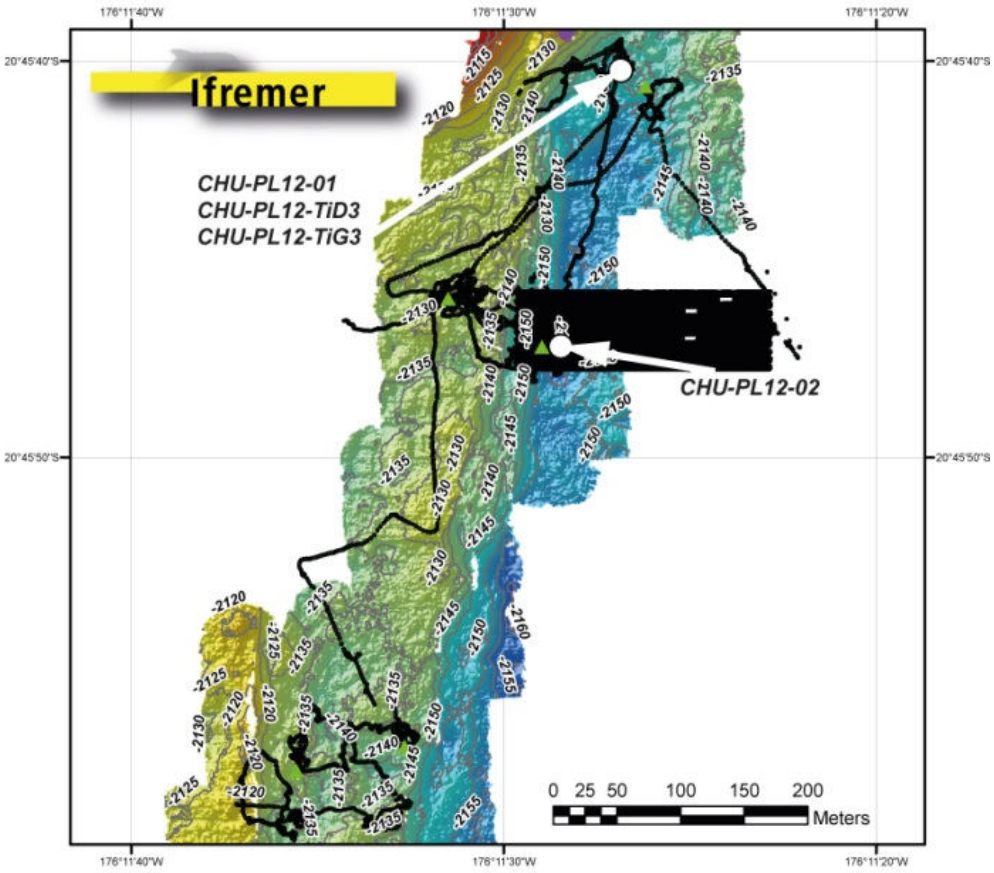
28 Avril 2019

10:30 Récupération ROV

Time	Duration	Action	Notes
07:00	1:45	ROV in water, descent	
08:45		ROV on the bottom on the first point provided by Ewan. Calibration of Cécile's systems. Quick survey.	Depth ~2150 m
09:00	1:30	Survey of the central area with diffuse-flow communities.	Call Stephane
10:30	1:00	SPOT measurements on different communities	Nadine
11:30	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjolaine for fauna sampling
13:00	1:30	Sampling of Mussel community 1 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjolaine for fauna sampling
14:30	1:30	Sampling of *Alviniconcha* community 1 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier / Marjolaine for fauna sampling
15:00		Elevator deployed with 3 PBT, 1 Niskin	
16:00		Elevator on the bottom	
16:15	0:45	Go to elevator, deposit GBTs boxes, pick up PBT boxes. Trigger the Niskin.	

17:00		Elevator released	
18:30		Elevator on board	
17:00	1:30	Pick a rock with cirripeds and place it into basket Sample peripheral scaleworms (white or pink) with suction sampler.	Stephane and Victor
18:30	4:00	Mosaick an area as defined by Marjolaine (Possibly including ABE1 mosaicked in 2006 and 2009?)	Marjo
22:30	1:00	Move to northern area and survey to locate black smokers and diffuse-flow communities	Stephane
23:30	1:30	Sampling of *Ifremeria* community 2 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir	Cécile for chemistry and Didier / Marjolaine for fauna sampling
01:00	1:30	Sampling of Mussel community 2 - Deploy Casimir + photo/video - Chemistry (PIF, electrodes, Chemini) - Sample mussels into PBT collection box - Suction sampler to collect animals (1 jar) - Chemistry (electrodes, Chemini) - Recover Casimir Grab a rock with cirripeds	Cécile for chemistry and Didier / Marjolaine for fauna sampling
02:30	1:30	Sampling of *Alviniconcha* community 2 - Chemistry (PIF, electrodes, Chemini) - Sample *Alviniconcha* into PBT collection box - Suction sampler to collect remaining animals (1 jar) - Chemistry (electrodes, Chemini)	Cécile for chemistry and Didier / Marjolaine for fauna sampling
04:00	2:15	Sampling of chimney 1 + Gradient - Measure temperature of fluid - Place a piece of chimney into PBT box - Collect 2 titanium syringes of hot fluid - Collect 1 BEG bottle of hot fluid - Do PIF (short) gradient Collect a piece of sulfide at the base of chimney and place it into the basket	Ewan and Cecile
06:15	1:00	SPOT measurements on different communities	Nadine
07:15	1:30	Sampling of chimney fauna (*Paralvinella* and scaleworms) If possible, grab a rock with sponges	Stéphane or Victor
08:45		ROV leaves bottom	
10:30		ROV and Samples on board	

Dive roadmap



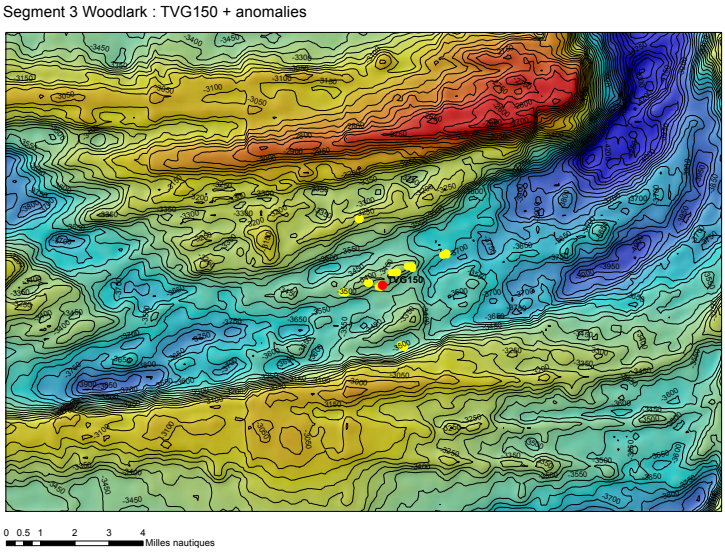
Leg 2 -Chubacarc (Manus basin & the Woodlark ridge)

Dive 13 – May 11th- May 13th 2019 (local time)

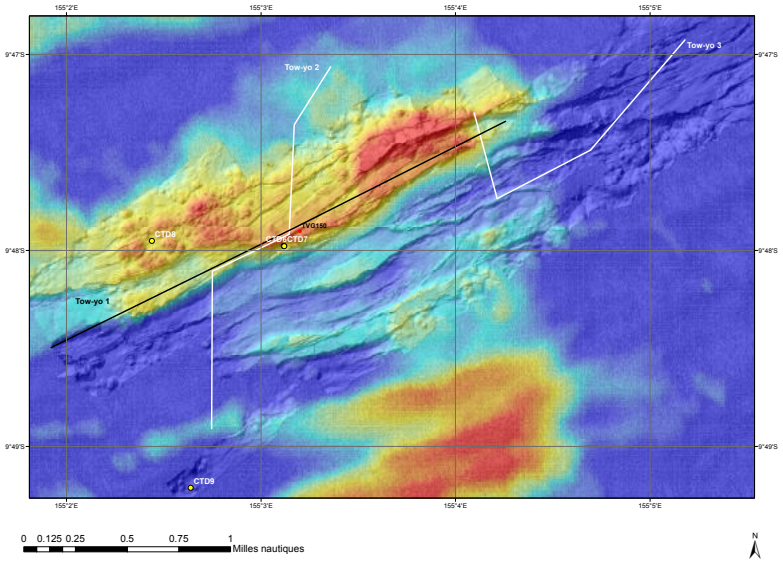
Woodlark Ridge on TGV 150 – Microbathymetry (56 hours)

Dive roadmaps (exploratory dive for microbathymetry following Tow Yow + CDT localization of the hydrothermal plume with the first EM12 bathymetry of L'Atalante

Bathymetry EM12 – L'Atalante



Microbathymetry ROV – done on board during the cruise



The microbathymetric data for the TGV 150 zone was obtained during the following 52-hour MMR dive.

CHUBACARC
Résumé de plongée

Plongée : 732 - 13
Date : **11/05/2019**
Observateur(s) :

Date	Heure	Observateur(s)
11/05/2019	20:00	BONHOMME Francois
11/05/2019	22:00	L'HARIDON Stéphane
12/05/2019	24:00	THIEBAUT Eric
12/05/2019	02:00	KUAMA Darren
12/05/2019	04:00	BROQUET Thomas
12/05/2019	06:00	LELAYEC Victor
12/05/2019	08:00	MARY Jean
12/05/2019	10:00	MICHEL Loic
12/05/2019	12:00	ARNAUD-HAOND Sophie
12/05/2019	14:00	LEPORT Anne-Sophie
12/05/2019	16:00	SCALABRIN Carla
12/05/2019	18:00	SCALABRIN Carla
12/05/2019	20:00	TASIEMSKI Aurélie
12/05/2019	22:00	TRAN LU Y Adrien
13/05/2019	24:00	BOULART Cédric
13/05/2019	02:00	THIEBAUT Eric
13/05/2019	04:00	POITRIMOL Camille
13/05/2019	06:00	CUEFF-GAUCHARD Valérie
13/05/2019	08:00	BONHOMME Francois
13/05/2019	10:00	TRAN LU Y Adrien
13/05/2019	12:00	ARNAUD-HAOND Sophie
13/05/2019	14:00	KUAMA Darren
13/05/2019	16:00	SCALABRIN Carla
13/05/2019	18:00	SCALABRIN Carla
13/05/2019	20:00	MARY Jean
13/05/2019	22:00	MICHEL Loic
14/05/2019	24:00	LEPORT Anne-Sophie
14/05/2019	02:00	BOULART Cédric
14/05/2019	04:00	BROQUET Thomas
14/05/2019	06:00	ROUXEL Olivier

Station : **Zone TVG150 (Woodlark)**
Submersible : **Victor 6000**
Latitude : **S 09 47.900**
Longitude: **E 155 03.200**
Localités prospectées :**Zone TVG150 (Woodlark)**
Objectifs : MMR Transect on the TGV 150 zone (Woodlark) for microbathymetry

Bilan des opérations

0 Opérations de prélèvement
0 Mesures
0 Mouillages
0 Images

Bilan de la plongée : 11/05/19 21:41 – ROV on the seabed – 14/05/19 06:10 - ROV on lift

Rapport chronologique :

Date	Heure	Localité	Latitude	Longitude	Prof(m)	Photo	Commentaire
11/05/19	19:41	Zone TVG150 (Woodlark)	S 09 48.660	E 155 03.124	4		rov at sea

6 juin 2019 11:51

Dive 14 – May 16th- May 18th 2019 (local time)

Sites Tsukushi/Snowcap/Fenway/Big papi/Satanic Mills/Solwara 8, depth 1720 m

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

16 Mai 2019 (attention heures en heure bord)	
16:00	Mise à l'eau Ascenseur 1 avec carottier tube, 3GBTs, 2 PBTs et 2 titanes sur SnowCap
17:00	Mise à l'eau ROV sur Tsukushi avec dans le panier : - 3 GBT - 2 bouteilles titane - 2 PBT - marqueur Casimir
17 Mai 2019	
7:30	Largage ascenseur 1 avec 3 GBT, 2 bouteilles titane et 2 PBT + carottier vide
8:30	Récupération ascenseur 1 et échantillons, reconditionnement des boîtes et titanes
11:00	Envoi ascenseur 2 avec 1 GBT + 1 PBT + carottier tube sur Satanic Mills
15:00	Retour ascenseur 2 avec carottier + sediments + roches + 2 titanes + 1 PBT (cheminée) + 1 GBT (tubeworms)
18 Mai 2019	
6:00	Envoi ascenseur 3 avec 3 GBT, 2 bouteilles titane et 2 PBT sur Solwara 8
11:00	Retour ascenseur avec 3 GBTs
18:30	Retour ROV avec 3 GBT, 2 titanes et 2 PBTs et bols aspirateur

Time	Duration	Action	Notes
16:00	1:00	Deployment of elevator 1 near Snowcap (with pushcore sampler, 3 GBT, 2PBT and 2 titanes)	
17:00	1:30	ROV in water, descent (with 3GBT, 2 PBT and 2 titanes, and Casimir) + Chemini & Pif	
17:30		ROV on the bottom. Calibration of Chemini	Depth 1720 m
18:00	3:00	Survey of Tsukushi and Snowcap, videos/pictures on habitats, temperature probing, choice of sites for communities, choice of chimney to sample, choice of sites for sampling fauna, and Find elevator	Drop digital markers if necessary
21:00	1:30	Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #1) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna

22:30	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna
00:00 May 17th	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (jar #3) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Thomas for fauna
01:30	1:30	Sampling chimney fauna with slurp gun (jar #4) and collection of *Paralvinella* in 1 PBT if a soft sediment area is found (on Big Papi). Sampling rocks with cirripeds and peripheral fauna (lollipop sponges) on either Tsukushi or SnowCap	Victor, Stephane H., Aurélie, Jean
03:00	1:00	Video and photo surveys of chimneys	
04:00	2:00	Sampling of chimney 1 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier, Cedric, Stéphane L.
06:00	1:30	Transit to elevator and transfer the titanium syringes, 3 GBT collection boxes and 2 PBT (chimney and chimney fauna (*Paralvinella*/scaleworms) and get the new collection boxes and titanium syringes	
07:30		Release elevator	
08:30		Elevator 1 at the surface. Collect animals and boxes and titanium syringes change for new elevator deployment at 12:00 on Satanic Mills	
07:30	2:30	Go to Satanic Mills, visit Fenway/Big papi on the way and find a suitable area for core sampling and a new chimney for fluid sampling	Call Sophie for core sampling and Olivier for chimney selection
10:00	1:30	Sampling of chimney 2 (Satanic Mills) - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid	Stéphane L et Olivier

		- Collect a piece of sulfide at the base of chimney and place it into the basket	
11:00		Deploy elevator 2 near Satanic Mills with 1 GBT, 1 PBT, and 1 pushcore sampler.	
12:00		Elevator 2 on the bottom near Satanic Mills	
11:30	0:30	Sample tubeworms and fauna in sediment near the core sampling in GBT (Big papi or Satanic Mills)	Aurélie/Stéphane H.
12:00	1:00	Got to elevator and proceed with the pushcore sampling for sediment collection at Satanic Mills	Sophie/François
13:00	1:00	Transfer pushcore sampler, GBT with tubeworms, PBT with chimney and 2 titanium syringes in the elevator 2. Pick up 1 GBT and 1 PBT + Syringes	
14:00		Release elevator 2	
15:00		Elevator 2 at the surface with samples	
14:30	5:00	Mosaic the predefined area: a box of 250x25 m, altitude 3 m, speed 0.2 m/s, overlap 70%, interlane distance 3.6 m. From the active site towards the periphery in the area around Big Papi/Fenway	Loic
19:30	1:00	Sample peripheral fauna (sponges, corals) on rocks in the ROV basket	Loic
20:30	1:30	Go on Big papi and sample *Paralvinella* and scaleworms with slurp gun on flanges (jar #5)	Stephane H./Aurélie/Jean
22:00	1:30	Sampling of mussel community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), no jar - Recover Casimir	Eric/Cedric
23:30	1:30	Sampling of Ifremeria community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), no jar - Recover Casimir	Eric/Cedric
01:00 May 18th	1:30	Sampling of *Alviniconcha* community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), no jar - Recover Casimir	Thomas/Olivier
02:30	3:00	Go to Solwara 8 and Solwara 6, Visit the sites, make videos and photos on experimented sites and select appropriate site for sampling communities 3	
05:30	3:00	Mosaic along a 800 m transect between Solwara 6 and Solwara 8 (3 profils)	

06:00		Deployment of elevator 3 on Solwara 8 with 3 GBT and 2 titanium syringes	
07:00		Elevator 3 on the bottom	
08:30	1:30	Go to elevator, place the 3 GBT with samples and transfer the 3 empty GBT boxes and two titanium syringes	
10:00		Release elevator 3	
11:00		Elevator 3 at the surface with 3 GBT	
10:00	1:00	Sampling of *Alviniconcha* on chimney in PBT at Solwara 8	
11:30	1:30	Sampling of mussel community 3 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #6) - Chemistry after sampling (Chemini) - Recover Casimir	Eric, Olivier
13:00	1:30	Sampling of *Ifremeria* community 3 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #7) - Chemistry after sampling (Chemini) - Recover Casimir	Eric, Olivier
14:30	1:30	Sampling of *Alviniconcha* community 3 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #8) - Chemistry after sampling (Chemini) - Recover Casimir	Thomas, Cedric
16:00	1:30	Sampling of chimney 3 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier/Cedric
17:30		ROV leaves bottom	
18:30		ROV and Samples on board	

Dive 15 – May 19th- May 20th 2019 (local time)

Sites Solwara 7, Roger's ruins, Romans Ruins, Solwara6 (or return on Fenway), depth 1760m

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

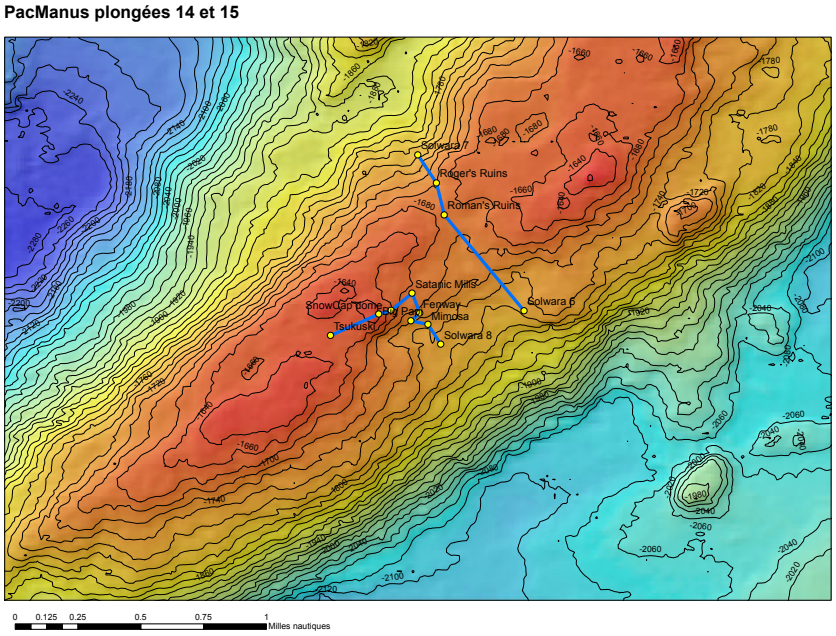
19 Mai 2019 (attention heures en heure bord)	
07:00	Mise à l'eau Ascenseur 1 avec carottier tube (LEP), 3 GBTs + 1 PBT (in option in space in the basket) sur Roman Ruins (3°S 43.240 – 151°E 40.468)
08:00	Mise à l'eau ROV sur Big Papi (3°S 43.725 – 151°E 40.332) avec dans le panier : - FISH 1 (RNALater) - FISH 2 (RNALater) - 1 GBT - 2 bouteilles titane - 1 PBT - marqueur Casimir - bypass FISH + Chemini et PIF
19 Mai 2019	
17:00	transfert FISH1, FISH2, 1 PBT (chimney), 1 GBT (Alviniconcha) et 2 titanes dans ascenseur et récupérer 3 GBT et carottier et PBT (option if enough space)
18:00	Récupération ascenseur 1 en surface
20 Mai 2019	
6:00	Envoi ascenseur 2 avec 3 GBT + PBT (option if space) sur Solwara 6 (3°S 43.668 – 151°E 40.870)
9:00	Retour ascenseur en surface avec 3 GBT et carottier tube et + PBT (option if space)
13:30	Retour ROV avec 3 GBT + bols aspirateur + bypass FISH et + PBT (option if space)

Time	Duration	Action	Notes
7:00 May 19th	1:00	Deployment of elevator 1 near Roman Ruins (with pushcore sampler, 3 GBT + 1 PBT (option if space)	
8:00	1:30	ROV in water on Big Papi, descent (with FISH1, FISH2, 1 GBT, 1 PBT, 2 titanes, and Casimir) + Chemini & PIF	
9:30		ROV on the bottom. Calibration of Chemini	Depth 1640 m
9:30	1:00	Go on Big Papi sulfide mount and collect shrimps with FISH1	Valérie
10:30	1:00	Go on Roman Ruins	
11:30	1:00	On Roman Ruins, Find active chimneys with shrimps and black smokers	

12:30	2:00	Collect shrimps with FISH2, remove FISH2, add bypass and collect shrimps, scaleworms and a zoarcid fish (if any) with slurp gun (jar #1) and collect *Alviniconcha* on a chimney in GBT	Valérie
14:30	1:30	Sampling of chimney 1 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier/Stéphane L.
16:00	1:00	Transit to elevator and transfer FISH1, FISH2 and PBT (chimney) and pick up 3 GBT boxes and + 1 PBT (option if space) Get the pushcore sampler in the rack in front of the ROV basket	
17:00		Release elevator	
18:00		Elevator 1 on board. Collect FISH1, FISH2 and PBT (chimney), 1 GBT with *Alviniconcha* of chimney and 2 titanium syringes	
17:00	1:30	If a sediment area found, do the core sampling on Roman Ruins or Rogers Ruins Else move from Rogers Ruins to Solwara 7 and do core sampling on the road	Sophie/Francois
18:30	1:30	After core sampling, go to Solwara 7, visit the site and select appropriate areas for sampling communities	Eric/Camille
20:00	1:30 GBT	Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	Cedric for chemistry Eric for fauna
21:30	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #3) - Chemistry after sampling (Chemini) - Recover Casimir	Cedric for chemistry Eric for fauna
23:00	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample gastropod into PBT collection box - Chemistry after sampling (Chemini),	Olivier for chemistry Eric for fauna

		- Suction sampler to collect animals (jar #4) - Recover Casimir	
00:30 May 20th	1:00	If any, Sample chimney fauna with slurp gun (jar #5) Sampling cirripeds (in PBT if option space OK) and rocks with peripheral fauna (lollipop sponges) in ROV basket on Solwara 7	Stephane H/Victor
01:30	1:30	Go to Fenway (*Paralvinella* spot) for OTUS mosaicking on mussel beds/vestimentiferan clusters	Loic
03:00	3:00	OTUS Mosaicking on mussels beds/galatheid crabs/vestimentiferans Slurp a zoarcid fish in the same jar (jar #5) if not collected previously	Loic
06:00	1:00	Go to Solwara 6	
06:00		Deploy elevator 2 near Solwara 6 with 3 GBT and 1 PBT (option if space).	
07:00	1:00	Elevator 2 on the bottom near Solwara 6.	
08.00		Release elevator	
07:00	1:00	Go to elevator and transfer pushcore samples, 3 GBT (*Alviniconcha, Ifremeria*, mussels) and 1 PBT (option if space) and get 3 new GBTs + 1 PBT (option if space) and get cirripeds in PBT (option if space) or on rocks	
08:00	1:30	Sampling of mussel community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini) - Suction sampler to collect animals (jar #6) Recover Casimir	Eric and Camille
09:30	1:30	Sampling of Ifremeria community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #7) - Recover Casimir	Eric/Camille
11:00	1:30	Sampling of Alviniconcha community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini) - Suction sampler to collect animals (jar #8) - Recover Casimir	Thomas/Didier
12:30		ROV leaves bottom	
13:30		ROV and Samples on board, departure to DESMOS	

Dive roadmap



Dive 16 – May 20th- May 21th 2019 (local time)

Sites Caldeira DESMOS and Solwara 12, depth 1920m: 36 h dive

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

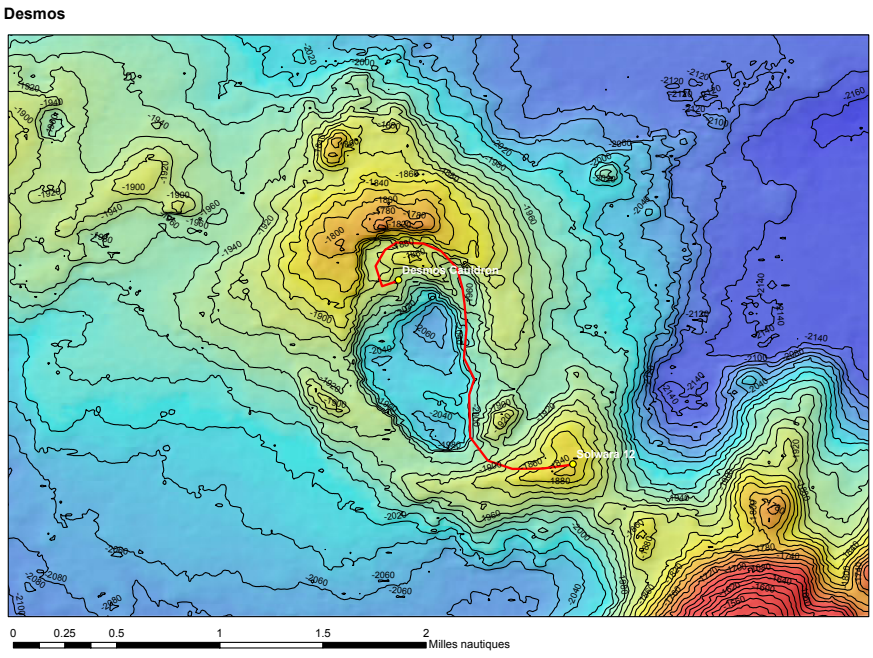
20 Mai 2019	(attention heures en heure bord)
22:00	Mise à l'eau ROV sur Solwara 12 (3°S 42.516 – 151°E 53.040) avec dans le panier : - Drawer - 2 GBT - 2 bouteilles titane - 1 PBT - marqueur Casimir + Chemini et PIF
21 Mai 2019	
08:00	Mise à l'eau Ascenseur 1 avec carottier tube (LEP), 2 GBTs + 2 PBT + 2 titanes entre Onsen site (3°S 41.300 – 151°E 51.996) et Caldeira cauldron site (3°S 41.568 – 151°E 52.104)
16:30	Récupération ascenseur 1 en surface (2 PBT (1 chimney, 1 community), 2 GBT (2 communities), carottier tube et 2 titanes dans ascenseur)
22 Mai 2019	
08:30	ROV en surface avec 2 GBT + 1 PBT + 2 titanes + bols aspirateur + Drawer

Time	Duration	Action	Notes
22:00 May 20th	1:30	ROV in water on Solwara 12, descent (with drawer, 2 GBT, 1 PBT, 2 titanium syringes, pushcore holder in front of the basket and Casimir) + Chemini & PIF	
23:30		ROV on the bottom. Calibration of Chemini	Depth 1920 m
23:30 May 21th	2:30	Visit the Upper part of the South East of the Caldeira near Solwara 12 to find active diffuse emissions and gastropod and mussel communities	Valérie
02:00		If communities found, do the communities sampling Else go down in the caldeira to start the exploration over the 2 km transect (follow the exploration route on Mimosa) on its eastern part to reach the Onsen site	
02:00	1:30	If communities on Solwara 12 (151°E 53.04 – 3°S42.516), Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #1) - Chemistry after sampling (Chemini) Recover Casimir	Cedric for chemistry Camille for fauna
03:30	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	Cedric for chemistry Camille for fauna
05:00	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample gastropod into PBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #3) - Recover Casimir	Olivier for chemistry Eric for fauna
02:00	4:00	If no communities, go down in caldeira and start exploration along the 2 km transect, if peripheral fauna or patches of vent fauna different from gastropod/mussel communities, sample them in the drawer and Suction sampler to collect animals if a new valuable community found (jar #4 and jar #5). If gastropod or mussel communities found in the caldeira, sample them in GBTs	Loic, Stephane H., Didier
09:00		AT THE END OF TRANSIT + SAMPLING OF COMMUNITIES, THE OVERALL TIME SPENT FOR SOLWARA 12 + CALDEIRA	

		EXPLORATION SHOULD NOT BE GREATER THAN 9 hours in total	
08:00		Deploy elevator 1 near Onsen with 2 GBT, 2 PBT and 2 titanium syringes and pushcore sampler	
09:00	1:00	Elevator 1 on the bottom	
09:00	0.30	Find and go to Elevator 1. Transfer 2 GBT and 1 PBT (if communities collected), get 2 PBT	
09:30	1:00	Visit Caldeira cauldron (big terrace with chimneys)	
10:30	1:30	On cauldron (151° 52.104 – 3° 41.568) Sampling of chimney 1 (1910-1920 m depth) - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier/Stéphane L.
12:00	1:00	Go to Elevator 1. Transfer 1 PBT (chimney 1) and get 2 GBT and exchange pairs of titanium syringes, get pushcore sampler	
13:00	2:00	Go down to the caldeira near 1950 m at the end of the chimney terrace, and find sediments with cold seepages. On sediments with *Calyptogena*, do a pushcore sampling	Stephane H/Victor
15:00	0:30	Go back to Elevator 1. Transfer Pushcore sampler with cores	
15:30		Release Elevator 1	
16:30		Elevator 1 on board. Get samples (2 titaniums syringes, pushcore, 2 GBT and 2 PBT	
15:30	1:00	Sample scaleworms and associated fauna on chimneys (jar #6), Sampling cirripeds on rocks if any	
16:30	1:30	Go to Onsen site (3°S 41.30 – 151°E 52.00 on cliff 1900 m depth) Base of the cliff, sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini) - Suction sampler to collect animals (jar #7) Recover Casimir	
18:00	1:30	On the cliff, sampling of *Arcovestia/Lamellibrachia* community - Deploy Casimir - Chemistry (PIF, Chemini) - Sample tubeworms into GBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #8)	Sophie/Francois

		Recover Casimir	
19:30	1:30	Go on the base of the terrace where the chimneys are located to find sedimented area with *Calyptogena* (1950-1960 m depth) Sampling of *Calyptogena* community - Deploy Casimir - Chemistry (PIF, Chemini) - Sample clams into PBT collection box - Chemistry after sampling (Chemini) - Recover Casimir	Eric/Camille
21:00	5:00	OTUS Mosaicking from the terrace with chimneys to sedimented area with Calyptogena and galatheid crabs	Loic
02:00 22th May	1:00	Move to the terrace, sample a second chimney 2 (second type)(1910-1920 m depth) - Measure temperature of fluid - Collect 2 titanium syringes of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier/Stéphane L.
03:00	1:00	Collect cirripeds and lollipop sponges if any on rocks	loic
04:00	3:00	Explore the western flank of the Caldeira to find new sites	
07:00		ROV leaves bottom	
08:30		ROV with 2 GBT and 1 PBT, 2 titanium syringes on board, departure to North Su if no new sites	

Dive roadmap



Dive 17 – May 22th- May 24th 2019 (local time)

Sites Solwara 1 (Suzette) and North Su, depth 1500 m

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

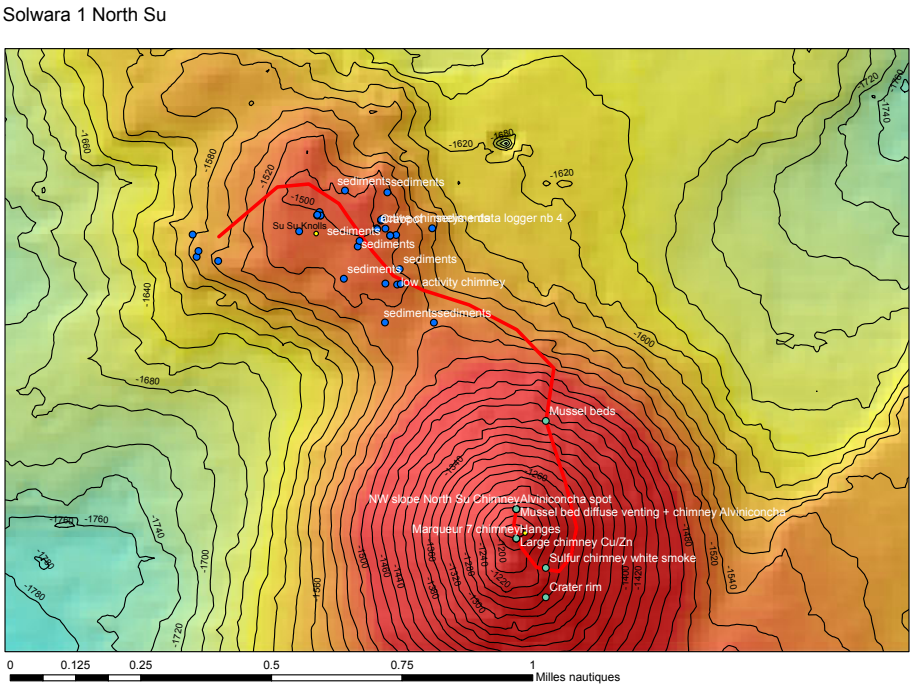
22 Mai 2019	(attention heures en heure bord)
18:00	Mise à l'eau Ascenseur 1 avec carottier tube, 3GBTs, 2 PBTs et 2 titanes sur Solwara 1 (Crabspot)
19:00	Mise à l'eau ROV sur Solwara 1 (Crabspot) avec dans le panier : - 3 GBT - 2 bouteilles titane - 2 PBT - marqueur Casimir
23 Mai 2019	
11:00	Largage ascenseur 1 avec 3 GBT, 2 bouteilles titane et 2 PBT + carottier avec échantillons
12:00	Récupération ascenseur 1 en surface
24 Mai 2019	
8:00	Retour ROV avec 3 GBT, 2 titanes et 2 PBTs et bols aspirateur

Time	Duration	Action	Notes
18:00 22th May	1:00	Deployment of elevator 1 on the top of suzette near crabspot (with pushcore sampler, 3 GBT, 2PBT and 2 titanes)	
19:00	1:00	ROV in water, descent (with 3 GBT, 2 PBT and 2 titanes, and Casimir) + Chemini & PIF	
20:00		ROV on the bottom. Calibration of Chemini	Depth 1500 m
20:00	3:00	Survey of Solwara 1, videos/pictures on habitats, find markers of long-tem temperature logger, choice of sites for communities (avoid experimented sites), choice of chimney to sample, choice of sites for sampling fauna, and find elevator	Drop digital markers if necessary
23:00	1:30	On Crabspot (top of suzette) Sampling of chimney 1 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier, Cedric, Stéphane L.

00:30 23th May	1:30	Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #1) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna
02:00	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna
03:30	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *Alviniconcha* into GBT collection box - Suction sampler to collect remaining animals (jar #3) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Thomas for fauna
04:30	1:00	Video and photo surveys of chimneys and data loggers	
05:30	1:00	Sampling chimney fauna (*Branchinotogluma Paralvinella)* with slurp gun (jar #4) If diffuse venting with *Paralvinella*, sample in PBT and sample rock with cirripeds in basket else sample rock with cirripeds in PBT	Victor, Stephane H., Aurélie, Jean
07:00	1:00	Transit to elevator and transfer the titanium syringes, 3 GBT collection boxes and 2 PBT (chimney and chimney fauna (*Paralvinella*/scaleworms) and get pushcore sampler and the new collection boxes and new titanium syringes	
08:00	2:00	Go to sedimented areas between suzette and North Su, do core sampling near Nautilus marked site with low activity ()	Call Sophie for core sampling
10:00	1:00	Go to Elevator 1, transfer pushcore in elevator	
11:00		Release Elevator 1	
12:00		Elevator 1 at the surface. Collect animals in boxes, titanium syringes and pushcore	
11:00	1:00	Sample peripheral fauna (sponges, corals) on rocks in the ROV basket	Loic
12:00	5:00	Do OTUS Mosaicking between suzette and North Su from low active sites to the northern flank of North Su	Loic

17:00	2:00	Move to the northern flank of North Su and find mussel beds at mid-height of the volcano (1400 m)	
19:00	1:30	Sampling of mussel community 2 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #5) - Chemistry after sampling (Chemini) Recover Casimir	Eric/Camille
20:30	3:00	Go to the top of North Su and find the sulfur candle site, survey rims, flanges and chimneys to find gastropod communities and flanges with Paralvinella and scaleworms	Stephane H./Olivier
23:30	1:30	Sample *Paralvinella* and scaleworms with slurp gun on rim flanges (jar #6)	Stephane H./Aurélie/Jean
01:00 24th May	1:30	Sampling of Ifremeria community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #7) - Recover Casimir	Eric/Cedric
02:30	1:30	Sampling of *Alviniconcha* community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #8) - Recover Casimir	Thomas/Olivier
4:00	1:30	Sampling of chimney 2 (sulfur candles) or sulfur emissions on the south part of the volcano - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 1 titanium syringes of hot fluid Collect a piece of sulfide at the base of chimney and place it into the basket Sample a titanium syringe on SO2 white fluid onto the rim of the volcano	Olivier/Cedric
05:30	1:30	Collect rocks with cirripeds in PBT and peripheral fauna in the basket	
07:00		ROV leaves bottom	
08:00		ROV and Samples on board	36 h

Dive roadmap



Dive 18 – May 24th- May 25th 2019 (local time)

Sites South Su, depth 1500 m

This dive is very time-constrained. I have allotted plenty of time for each action and if time can be saved, please do so!

24 Mai 2019 (attention heures en heure bord)	
17:00	Mise à l'eau Ascenseur 1 avec carottier tube, 3GBTs, 2 PBTs et 2 titanes sur South Su (in SSU caldeira 152°6.300E-3°48.480S)
18:00	Mise à l'eau ROV in the north of South Su (base of caldeira: 152°6.339E-3°48.370S) avec dans le panier : - 3 GBT - 2 bouteilles titane - 2 PBT - marqueur Casimir
25 Mai 2019	
08:30	Largage du fond ascenseur 1 avec 3 GBT, 2 bouteilles titane et 2 PBT + carottier avec échantillons
09:30	Récupération ascenseur 1 en surface
20:00	Retour ROV surface avec 3 GBT, 2 titanes et 2 PBTs et bols aspirateur

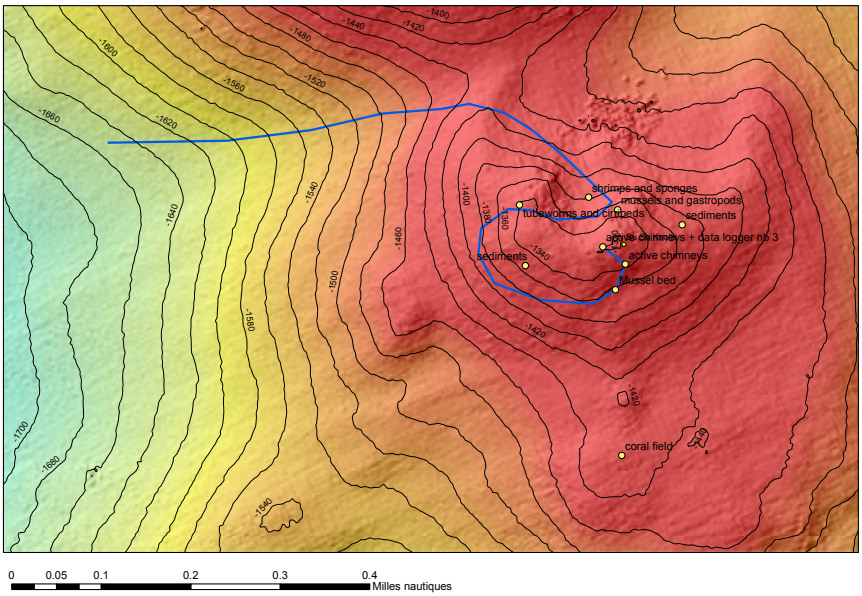
Time	Duration	Action	Notes
17:00 24th May	1:00	After CTD, deployment of elevator 1 on the top of south Su near shrimp & sponges (152°6.300E-3°48.480S) with pushcore sampler, 3 GBT, 2PBT and 2 titanes)	
18:00	1:00	ROV in water, descent in the northern part of South Su caldeira (152°6.339E-3°48.370S) with 3 GBT, 2 PBT and 2 titanes, and Casimir) + Chemini & PIF	
19:00	0:30	ROV on the bottom. Calibration of Chemini	Depth 1500 m
19:30	1:30	Survey of the northern part of the South Su Caldeira from north to south to find active vent chimneys and communities, videos/pictures of habitats, but no sampling	Drop digital markers if necessary
21:00	1:00	Go to the caldeira crest further south and find active chimneys associated with point datalogger#3 videos/pictures on habitats, find markers of long-tem temperature logger, choice of sites for communities (avoid experimented sites), choice of chimney to sample, choice of sites for sampling fauna	Drop digital markers if necessary
22:00	1:30	On top of south Su (chimney with datalogger#3) Sampling of chimney 1 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier, Cedric, Stéphane L.
23:30	1:00	Sampling chimney fauna (*Branchinotogluma Paralvinella)* with slurp gun (jar #1 et jar#6): SAMPLING MUST BEEN DONE WITH #1 and #6 (without crepine) If diffuse venting with *Paralvinella*, sample in PBT	Victor, Stephane H., Aurélie, Jean
00:30 25th May	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *Alviniconcha* into GBT collection box - No suction sampler on Alviniconcha - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Thomas for fauna
02:00	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna

03:30	0:30	Go to the point mussel bed to collect mussels on the southern flank of the volcano	
04:00 23th May	1:30	Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #3) - Chemistry after sampling (Chemini) - Recover Casimir	Eric/Camille/Cedric
05:30	1:00	Transit to elevator and transfer the titanium syringes, 3 GBT collection boxes and 2 PBT (chimney and chimney fauna (*Paralvinella*/scaleworms) and get pushcore sampler and the new collection boxes and new titanium syringes	
06:30	1:00	Go to sedimented area in the centre of Caldeira, do core sampling	Call Sophie for core sampling
07:30	1:00	Go to Elevator 1, transfer pushcore in elevator	
08:30		Release Elevator 1	
09:30		Elevator 1 at the surface. Collect animals in boxes, titanium syringes and pushcore	
08:30	1:00	Go across the top of South Su on point tubeworms/cirripeds on the northern flank of the volcano. Sample cirripeds, tubeworms and peripheral fauna (sponges, corals) on rocks in the ROV basket and in one PBT (if tubeworms)	Loic
09:30	1:30	If diffuse venting and chimneys, sample shrimps, *Paralvinella* and scaleworms with slurp gun on white smokers on the northern flank if any (jar #4 & jar #7) BEWARE ADDITIONAL SCALEWORM SAMPLING MUST BEEN DONE WITH #7 (without crepine)	Stephane H./Aurélie/Jean
11:00	1:30	Find new mussel bed on the northern flank of the volcano (near the tubeworm/cirriped point) and, if any or in the northern part of the Caldeira if mussel beds have been localized at the beginning of the dive Sampling of mussel community 2 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #5) - Chemistry after sampling (Chemini) Recover Casimir	Eric/Camille
12:30	2:00	If gastropod communities found at the beginning of the dive in the northern part of the Caldeira, go down to the caldeira to sample communities	

		Else look for seeps and reduced sediments to see if there is specific fauna (Calyptogena/tubeworms) to sample and move to Solwara 9	
14:30	1:30	On the northern part of Caldeira (or on transect to Solwara 9 if no fauna found (Calyptogena included), Sampling of Ifremeria community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), - Suction sampler to collect animals (jar #8) - Recover Casimir	Eric/Camille
16:00	1:30	Sampling of *Alviniconcha* community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample mussels into GBT collection box - Chemistry after sampling (Chemini), - No Suction sampler - Recover Casimir	Thomas/Camille
17:30	1:30	ROV Test on the lest	
19:00		ROV leaves bottom	
20:00		ROV and Samples on board and go back to Woodlark	26 h

Dive roadmap

Dive 18 South Su (high resolution bathy by Pierre)



Dive 19 – May 27th- May 29th 2019 (local time)

Site TVG 150 Woodlark, depth 3350 m

This dive is an exploration dive: follow the profile but this profile may change according to findings on the bottom. Do not follow the profile exactly and do zig zag along the profile if some indices (sulfures, accumulation of peripheral faune (anemones, galathean crabs) are found along the road.

27 Mai 2019 (attention heures en heure bord)	
11:00	Profil bathymetrie (MSF) Carla sur TVG 150
13:00	Mise à l'eau bathysonde pour un profil vertical (CDT N°6) au dessus du point de Carla (155°03.114E - 9°47.978S, profondeur 3398 m)
16:00	Mise à l'eau ROV en contrebas de TVG150 (base de la ride: 155°03.055E - 9°48.017S) avec dans le panier : - tiroir à faune avec compartiments 1,2 et 3 - 2 GBT - 2 bouteilles titane - 1 PBT - marqueur Casimir

prévoir remplissage des compartiments du tiroir de l'arrière vers l'avant

29 Mai 2019	
	operation ascenseur selon découvertes sur le fond avec 3 GBT, 2 bouteilles titane et 2 PBT + carottier tube
08:00	ROV sur le pont

Time	Duration	Action	Notes
16:00 27th May	2:00	After CTD, ROV in water, descent near the Carla echo (9°48.017S – 155°03.055E) with drawer for rocks and fauna, 2 GBT, 1 PBT and 2 titanes, and Casimir) + Chemini & PIF	
18:00	1:00	ROV on the bottom. Calibration of Chemini	Depth 3380 m
19:00	0:30	Go to the Carla box for exploration of the slope of the ridge where Carla echoes have been detected	Depth 3380 m
20:00	6:00	Do an ascent exploration of the slope following the profile design and sample rocks or fauna if some peripheral or new communities are found (eg aggregations of suspensivorous fauna: anemones, lollipops, galathean crabs).	Drop digital markers if necessary
02:00 28th May	1:00	If hydrothermal vents found, do a survey of the area, take photos/videos	Drop digital markers
03:00	1:30	Sampling of chimney 1 - Measure temperature of fluid	Olivier, Cedric, Stéphane L.

		- Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	
04:30	1:00	Sampling chimney fauna (*Branchinotogluma Paralvinella)* with slurp gun (jar #1	Victor, Stephane H., Aurélie, Jean
05:30	1:30	Sampling of *Alviniconcha* community 1 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *Alviniconcha* into GBT collection box - suction sampler to collect animals (jar #2 - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Thomas for fauna
07:00	1:30	Sampling of *Ifremeria* community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #3) - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Eric for fauna
08:30	1:30	Sampling of mussel community 1 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points) - Sample mussels into GBT collection box - Suction sampler to collect animals (jar #4) - Chemistry after sampling (Chemini) - Recover Casimir	Eric/Camille/Cedric
07:30	1:00	Deploy Elevator 1, with pushcore, 3 GBT, 2 PBT, and 2 titanium syringes	
10:00	1:00	Transit to elevator and transfer the titanium syringes, 2 GBT collection boxes and 1 PBT (chimney) and get pushcore sampler and get 1 GBT and 1 PBT and new titanium syringes	
11:00	1:00	If possible, go to sedimented area near the vent, do core sampling	Call Sophie for core sampling
12:00	1:30	Sample extra vent communities with 1 GBT (exemple anemones or barnacles) and 1 PBT (exemple Paralvinella)	Call Sophie for core sampling
13:30	1:00	Go to Elevator 1, transfer pushcore in elevator, and extra PBT (1) and GBT (1) boxes	
14:30		Release Elevator 1	
16:00		Elevator 1 at the surface. Collect animals in boxes, titanium syringes and pushcore	

02:00 28th May	24:00	If no hydrothermal vents found, pursue the profile to the other waypoints following the profile South-west to North East profile	Drop digital markers
16:00	14:00	After the sampling of hydrothermal vent communities, pursue the profile to the other waypoints following the profile South-west to North East profile	Drop digital markers
06:00		ROV leaves bottom	
08:00		ROV and Samples on board and go back to Woodlark	38 h

Dive 20 – May 30th- May 31th 2019 (local time)

Site TVG 150 Woodlark, depth 3350 m

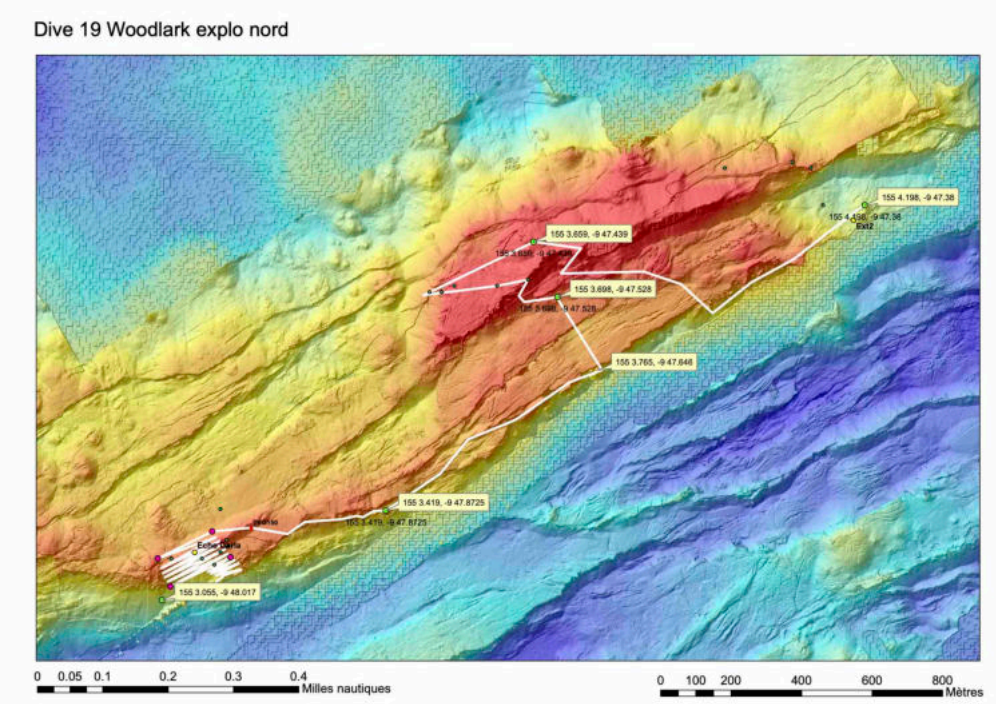
30 Mai 2019 (attention heures en heure bord)	
08:00	Mise à l'eau ROV sur le site La Scala (près de TVG 150) avec dans panier : - 3 GBT - 2 bouteilles titane - 2 PBT - marqueur Casimir
13:00	Mise à l'eau ascenseur sur le site La Scala (près de TVG 150) avec carottier tube (8 tubes), 3 GBT, 2 PBT, 2 titanes
18:00	Retour ascenseur avec 3 GBT, 2 PBT, 2 Titanes et le carottier tube
31 Mai 2019	
07:00	Mise à l'eau ascenseur sur le site La Scala (près de TVG 150) avec 3 GBT, 2 PBT, 2 titanes
11:00	Retour ascenseur avec 3GBT, 2 PBT, 2 Titanes et le carottier tube
17:00	largage ROV sur le fond
19:00	Retour ROV sur le pont avec 3 GBT, 2 PBT et 2 titanes

Time	Duration	Action	Notes
08:00 30th May	2:00	ROV in water, descent on the new site La Scala near TVG150 with 3 GBT, 2 PBT and 2 titanes, and Casimir) + Chemini & PIF (READY FOR USE)	
10:00	0:30	ROV on the bottom. Calibration of Chemini. On La Scala site, do replicates on communities and one additional chimney	Depth 3350 m
10:30	1:00	Sampling big *Alviniconcha* at the top of a chimney in PBT	Thomas/Didier
11:30	1:30	Sampling of *Ifremeria* community 2 - Deploy Casimir - Chemistry (PIF, Chemini on 3 points)	Olivier/Cedric for chemistry Eric for fauna

		- Sample *Ifremeria* into GBT collection box - Suction sampler to collect animals (jar #2) - Chemistry after sampling (Chemini) - Recover Casimir	
13:00	1:30	Sampling of chimney 1 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier, Cedric, Stéphane L.
13:00	1:00	Deploy Elevator 1 near the site TVG150 (La Scala) on the top of the ridge with pushcore, 3 GBT, 2 PBT, and 2 titanium syringes	
14:30	1:00	Go to elevator and transfer the titanium syringes, 1 GBT and 2 PBT (alviniconcha, chimney) and get pushcore sampler and transfer new titanium syringes and empty boxes	
15:30	1:00	Go to a sedimented area near the vent, do core sampling	Call Sophie for core sampling
16:30	0:30	Go to elevator and put the pushcore sampler back	
17:00		Release Elevator 1	
18:00		Elevator 1 at the surface. Collect animals in boxes, titanium syringes and pushcore	
17:00	1:00	Evaluate the size of the main black smokers, strength and number of fluid emissions	Carla/Olivier
18:00	1:00	Sampling inactive chimney fauna (*Shinkailepas patches)* with slurp gun (jar #1)	Loic/ Didier
19:00	1:00	Sampling active chimney fauna (*Branchinotogluma Paralvinella)* with slurp gun (jar #2)	Victor, Stephane H., Aurélie, Jean
20:00	1:30	Sampling of *Alviniconcha* community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *Alviniconcha* into GBT collection box - suction sampler to collect animals (jar #3 - Chemistry after sampling (Chemini) - Recover Casimir	Olivier/Cedric for chemistry Thomas for fauna
21:30	1:30	Sampling of *Vulcanolepas* community 2 - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *vulcanolepas* into GBT collection box - suction sampler to collect animals (jar #4) - Chemistry after sampling (Chemini) - Recover Casimir	Eric/Camille

23:00	1:30	Sampling of chimney 2 - Measure temperature of fluid - Place fragment of top of chimney into PBT collection box - Collect 2 titanium syringes of hot fluid - Collect a piece of sulfide at the base of chimney and place it into the basket	Olivier, Cedric, Stéphane L.
00:30 31th May	2:00	Find rock/inactive chimney bloc with sessile cirripeds *Eochionelasmus* and put it in the basket in the periphery of the site and also search for mussel patches	Loic/Stéphane L.
02:30	4:00	Explore the other side of the ridge where anomalies were found (not far from the active site), do a survey of the area, take photos/videos, and look more specifically for mussel beds	Drop digital markers if necessary
06:30	1:30	At the end, if mussels found - Deploy Casimir - Chemistry (PIF, Chemini) - Sample *mussels* into GBT collection box - suction sampler to collect animals (jar #5) - Chemistry after sampling (Chemini) Recover Casimir	Depth 3320 m
07:00	1:00	Deploy Elevator 2 near the site TVG150 (La Scala) on the top of the ridge with 3 GBT, 2 PBT, and 2 titanium syringes	
08:30	1:00	Go to elevator and transfer the titanium syringes, 3 GBT and 1 PBT (chimney) and transfer new titanium syringes and empty boxes	
09:30		Release Elevator 2	
11:00		Elevator 2 at the surface. Collect animals in boxes, titanium syringes	
09:30	7:30	Start exploration on the southwestern part of the ridge where anomalies have been detected, Search for diffuse venting around small mounds in this area. If active sites found, collect the associated fauna in GBTs, and if an active smoker is found, sample fluid with titanium syringes and collect a piece of chimney in a PBT	Eric/Camille/Cedric
17:00		ROV leaves bottom	32 h
19:00		ROV and Samples on board and go back to Nouméa	

Dive roadmap

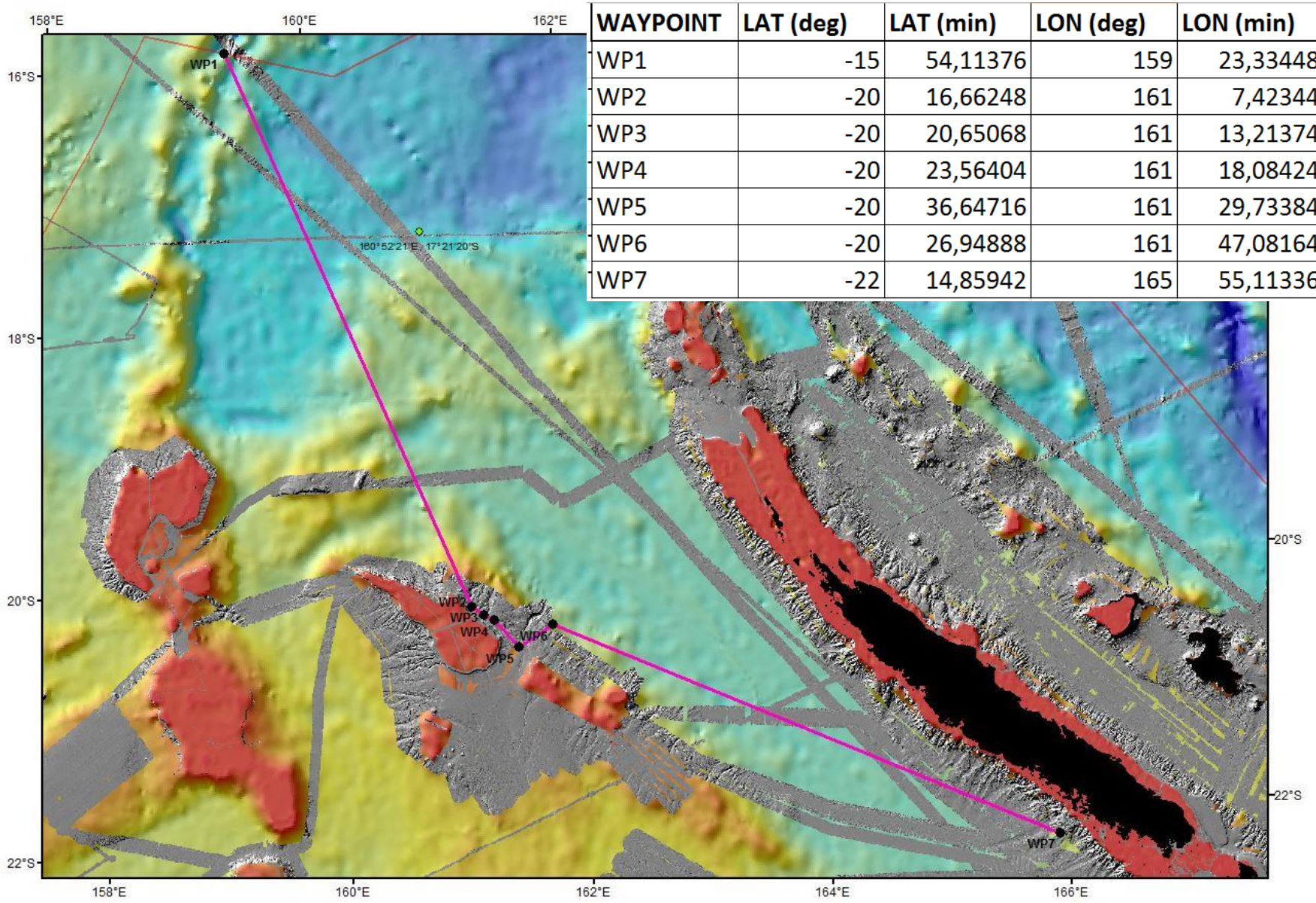


OPTION 1 RETOUR

Distance totale = 589 mn

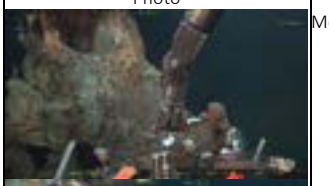
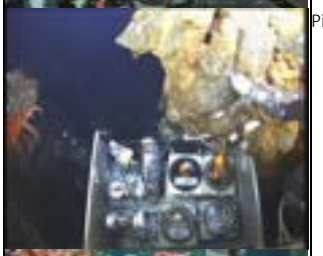
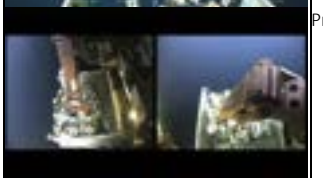
Temps supplémentaire par rapport transit direct = ~5,5 heures

WAYPOINT	LAT (deg)	LAT (min)	LON (deg)	LON (min)
WP1	-15	54,11376	159	23,33448
WP2	-20	16,66248	161	7,42344
WP3	-20	20,65068	161	13,21374
WP4	-20	23,56404	161	18,08424
WP5	-20	36,64716	161	29,73384
WP6	-20	26,94888	161	47,08164
WP7	-22	14,85942	165	55,11336



Plongée : 720 -Kilo Moana (Lau basin)

Liste des opérations :

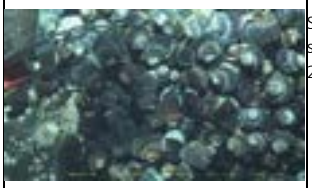
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte	3	30/03/2019	11:23	S 20 03.222	W 176 08.021	2615	Kilo Moana (Lau Basin)	x					Moule dans GBT3 (CHU-PL01-GBT3)
Aspirateur bouteille		30/03/2019	11:34	S 20 03.224	W 176 08.020	2615	Kilo Moana (Lau Basin)	x					ASPI 01 Suction sampler
Grande Boite de collecte	2	30/03/2019	11:46	S 20 03.222	W 176 08.022	2617	Kilo Moana (Lau Basin)	x					Mussel in GBT2 (CHU-PL01-GBT2)
Grande Boite de collecte	2	30/03/2019	11:57	S 20 03.220	W 176 08.023	2619	Kilo Moana (Lau Basin)			x			Piece of sulfide rock on GBT2
Grande Boite de collecte	4	30/03/2019	12:27	S 20 03.223	W 176 08.021	2620	Kilo Moana (Lau Basin)	x					Brisingid star in GBT4
Panier		30/03/2019	13:11	S 20 03.177	W 176 08.027	2617	Kilo Moana (Lau Basin)	x					Sulfure avec balane (CHU-PL01-01)
Bouteille titane A (D) 750 ml		30/03/2019	16:52	S 20 03.198	W 176 08.132	2625	Kilo Moana (Lau Basin)		x				Prélèvement Ti G2
Bouteille de prŽl vement d'eau (TYPE NON PRECISE)		30/03/2019	16:56	S 20 03.201	W 176 08.124	2625	Kilo Moana (Lau Basin)		x				Prélèvement BEG1
Bouteille titane B (G) 750 ml		30/03/2019	17:00	S 20 03.203	W 176 08.125	2625	Kilo Moana (Lau Basin)		x				Prélèvement Ti G1

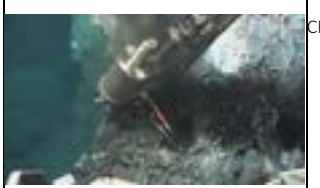
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
PEPITO bouteille A		30/03/2019	17:32	S 20 03.140	W 176 08.079	2631	Kilo Moana (Lau Basin)		x				PEP started
Seringue/Bouteille Titane		30/03/2019	17:32	S 20 03.135	W 176 08.079	2631	Kilo Moana (Lau Basin)		x				PIF sirynge 3 started

Plongée : 721 -Tow Cam (Lau basin)

Liste des opérations :

Équipement	Equip.	Date	Heure	Lat	Long	Prof (m)	Localité	Biol.	Fluid.	Geol.	Mes.	Photo	Commentaire
Pompe a larves		31/03/2019	12:52	S 20 19.044	W 176 08.122	2704	Tow Cam TC1	x					Good positionning RELEASE OK for SALSA 1
Pompe a larves		31/03/2019	13:19	S 20 18.978	W 176 08.185	2720	Tow Cam TC1	x					SALSA 2 LANDED ON ITS SITE
Sonde de temperature ROV		31/03/2019	14:20	S 20 19.076	W 176 08.247	2711	Tow Cam TC1				x		Temperature sensor started
Preleveur d'Eau par Pompage (PEP)		31/03/2019	14:48	S 20 19.076	W 176 08.248	2711	Tow Cam TC1		x				PEP started
PEPITO bouteille B		31/03/2019	14:51	S 20 19.075	W 176 08.249	2711	Tow Cam TC1		x				Start sampling fluid with PIF serynge #25 on point #1
Chemini		31/03/2019	14:53	S 20 19.075	W 176 08.248	2711	Tow Cam TC1		x				Chemini on point #1 finished
Chemini		31/03/2019	14:57	S 20 19.076	W 176 08.248	2711	Tow Cam TC1		x				Start Chemini sulphide on point #2
Chemini		31/03/2019	15:03	S 20 19.074	W 176 08.248	2711	Tow Cam TC1		x				Start Chemini sulphide point#3, on the mussel not in the shimmering

Équipement	Equip.	Date	Heure	Lat	Long	Prof (m)	Localité	Biol.	Fluid.	Geol.	Mes.	Photo	Commentaire
Grande Boite de collecte		31/03/2019	15:14	S 20 19.074	W 176 08.249	2712	Tow Cam TC1	x					GBT4 opened
Preleveur d'Eau par Pompage (PEP)		31/03/2019	15:45	S 20 19.076	W 176 08.251	2712	Tow Cam TC1		x				PEP started
Aspirateur faune		31/03/2019	15:49	S 20 19.074	W 176 08.251	2712	Tow Cam TC1	x					Two crabs in jar #1
Chemini		31/03/2019	16:01	S 20 19.076	W 176 08.249	2712	Tow Cam TC1		x				Chemini started
Sonde autonome multiparametre		31/03/2019	16:28	S 20 19.047	W 176 08.201	2697	Tow Cam TC1		x				1rst point SPOT on ifremeria
Chemini		31/03/2019	16:50	S 20 19.048	W 176 08.203	2698	Tow Cam TC1		x				Starting Chemini sulphides on point #1, T°C 2.65°C
Preleveur In-situ de Fluide (PIF)		31/03/2019	16:51	S 20 19.048	W 176 08.203	2698	Tow Cam TC1		x				Starting fluid sampling with PIF syringe 26, PEP wheel moved a bit
Chemini		31/03/2019	16:56	S 20 19.048	W 176 08.201	2698	Tow Cam TC1		x				Start Chemini point #2 - temperature 3.05°C
Chemini		31/03/2019	17:01	S 20 19.047	W 176 08.204	2698	Tow Cam TC1		x				Start Chemini point #3

Équipement	Equip.	Date	Heure	Lat	Long	Prof (m)	Localité	Biol.	Fluid.	Geol.	Mes.	Photo	Commentaire
Grande Boite de collecte		31/03/2019	17:13	S 20 19.047	W 176 08.202	2698	Tow Cam TC1	x					GBT2 opened
Aspirateur faune		31/03/2019	17:41	S 20 19.048	W 176 08.201	2697	Tow Cam TC1	x					Suction sampler jar 2
Sonde de temperature ROV		31/03/2019	18:19	S 20 18.996	W 176 08.183	2704	Tow Cam TC1				x		Temperature probe mesurment max 180°C but probe not totally in the flux
Grande Boite de collecte		31/03/2019	18:33	S 20 18.995	W 176 08.182	2704	Tow Cam TC1			x			Chimney sampling Biobox 3
Panier		31/03/2019	19:02	S 20 18.995	W 176 08.184	2704	Tow Cam TC1			x			Rocksampling CHU-PL02-01
Sonde de temperature ROV		31/03/2019	19:06	S 20 18.995	W 176 08.182	2704	Tow Cam TC1				x		Temperatrure probe max 315
Grande Boite de collecte		31/03/2019	19:10	S 20 18.994	W 176 08.185	2704	Tow Cam TC1			x			Anhydrite piece on bio box 4
Seringue Titane		31/03/2019	19:16	S 20 18.995	W 176 08.185	2704	Tow Cam TC1		x				CHU-PL02-TIG3
Seringue Titane		31/03/2019	19:25	S 20 18.994	W 176 08.186	2704	Tow Cam TC1		x				CHU-PL02-TID1

Équipement	Equip.	Date	Heure	Lat	Long	Prof (m)	Localité	Biol.	Fluid.	Geol.	Mes.	Photo	Commentaire
PEGAZ - Echantillonneur de gaz		31/03/2019	19:38	S 20 18.995	W 176 08.187	2704	Tow Cam TC1		x				CHU-PL02-BEG2
Sonde autonome multiparametre		31/03/2019	19:54	S 20 19.046	W 176 08.144	2686	Tow Cam TC1				x		schrimp on SPOT
Sonde autonome multiparametre		31/03/2019	20:49	S 20 18.988	W 176 08.189	2712	Tow Cam TC1	x					Starting measurement SPOT 1 on Ifremeria
Sonde autonome multiparametre		31/03/2019	20:57	S 20 18.986	W 176 08.187	2712	Tow Cam TC1	x					Starting measurement SPOT 3 on barnacles
Sonde autonome multiparametre		31/03/2019	22:09	S 20 19.074	W 176 08.259	2716	Tow Cam TC1	x					Start SPOT #4. Alviniconcha, Ifremeria, crabs.
Panier		31/03/2019	22:32	S 20 19.074	W 176 08.260	2713	Tow Cam TC1	x					try to pick up rock with barnacles
Chemini		31/03/2019	22:58	S 20 19.075	W 176 08.260	2716	Tow Cam TC1		x				chemini S cycle 3 started
Preleveur d'Eau par Pompage (PEP)		31/03/2019	23:01	S 20 19.074	W 176 08.259	2716	Tow Cam TC1		x				PEP started
Chemini		31/03/2019	23:01	S 20 19.074	W 176 08.258	2716	Tow Cam TC1		x				CHEMINI started on Alviniconcha patch one

Équipement	Equip.	Date	Heure	Lat	Long	Prof (m)	Localité	Biol.	Fluid.	Geol.	Mes.	Photo	Commentaire
Preleveur In-situ de Fluide (PIF)		31/03/2019	23:03	S 20 19.074	W 176 08.259	2716	Tow Cam TC1		x				Pif seringe 27 started
Chemini		31/03/2019	23:06	S 20 19.074	W 176 08.259	2716	Tow Cam TC1		x				CHEMINI started point 2 patch one (Alviniconcha)
Preleveur d'Eau par Pompage (PEP)		31/03/2019	23:14	S 20 19.074	W 176 08.258	2716	Tow Cam TC1		x				PEP started
Chemini		31/03/2019	23:15	S 20 19.074	W 176 08.258	2716	Tow Cam TC1		x				CHEMINI S starded
Grande Boite de collecte		31/03/2019	23:26	S 20 19.074	W 176 08.257	2716	Tow Cam TC1	x					Alviniconcha sample start in GBT 1

Équipement	Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mes	Photo	Commentaire
Aspirateur faune		31/03/2019	23:49	S 20 19.075	W 176 08.259	2716	Tow Cam TC1	x					Suction sampling on bol 3 start
Sonde de temperature ROV		01/04/2019	02:41	S 20 18.981	W 176 08.212	2712	Tow Cam TC1				x		temperqture mesurment
Sonde autonome multiparametre		01/04/2019	08:57	S 20 19.083	W 176 08.263	2711	Tow Cam TC1	x					SPOT 8 on Alvinichoncha
Preleveur d'Eau par Pompage (PEP)		01/04/2019	09:59	S 20 19.078	W 176 08.260	2711	Tow Cam TC1		x				PEP started
Chemini		01/04/2019	09:59	S 20 19.076	W 176 08.259	2711	Tow Cam TC1		x				start Chemini point #1, T = 4.9°C
Preleveur In-situ de Fluide (PIF)		01/04/2019	10:05	S 20 19.083	W 176 08.263	2711	Tow Cam TC1		x				PIF sampling serynge 28
Chemini		01/04/2019	10:07	S 20 19.081	W 176 08.262	2711	Tow Cam TC1		x				Start Chemini on point #2, T = 6.63°C
Preleveur d'Eau par Pompage (PEP)		01/04/2019	10:14	S 20 19.083	W 176 08.263	2711	Tow Cam TC1		x				Start PEP pump
Chemini		01/04/2019	10:14	S 20 19.083	W 176 08.263	2711	Tow Cam TC1		x				Begin Chemini point #3, T = 4.9°C

Équipement	Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mes	Photo	Commentaire
Chemini		01/04/2019	10:20	S 20 19.080	W 176 08.261	2711	Tow Cam TC1		x				Point #1 for measurement Chemini in Alviniconcha
Preleveur d'Eau par Pompage (PEP)		01/04/2019	10:21	S 20 19.081	W 176 08.262	2711	Tow Cam TC1		x				PEP and chemini started on point #1 on Alviniconcha, T = 12.4°C
Chemini		01/04/2019	10:27	S 20 19.083	W 176 08.263	2711	Tow Cam TC1		x				Start chemini point #2 on Alviniconcha, T = 20 °C
Preleveur In-situ de Fluide (PIF)		01/04/2019	10:28	S 20 19.082	W 176 08.263	2711	Tow Cam TC1		x				PIF fluid sampling serynge 29 on Alviniconcha
Preleveur d'Eau par Pompage (PEP)		01/04/2019	10:33	S 20 19.082	W 176 08.262	2711	Tow Cam TC1		x				PEP started
Chemini		01/04/2019	10:33	S 20 19.081	W 176 08.261	2711	Tow Cam TC1		x				Chemini point #3 on Alviniconcha started, T = 11,18 °C
Sonde de temperature ROV		01/04/2019	10:40	S 20 19.085	W 176 08.264	2711	Tow Cam TC1				x		Sonde de température dans Alviniconcha, 21°C
Sonde de temperature ROV		01/04/2019	10:44	S 20 19.083	W 176 08.263	2711	Tow Cam TC1				x		Tempearture measurements on Ifremeria, 14°c, keeps going up
Grande Boite de collecte		01/04/2019	10:52	S 20 19.084	W 176 08.263	2711	Tow Cam TC1	x					Start collection of Ifremerai, first scoop in GBT5

Équipement	Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte		01/04/2019	11:16	S 20 19.083	W 176 08.263	2711	Tow Cam TC1	x					2nd scoop in box GBT#6
Aspirateur faune		01/04/2019	11:43	S 20 19.084	W 176 08.263	2711	Tow Cam TC1	x					1rst Suction in jar 4 in alviniconcha community
Aspirateur faune		01/04/2019	11:48	S 20 19.084	W 176 08.262	2711	Tow Cam TC1	x					2nd suction in jar 5 in alviniconcha community
Petite Boite de collecte		01/04/2019	12:24	S 20 18.987	W 176 08.210	2714	Tow Cam TC1	x					Biobox 7 Alviniconcha
Sonde autonome multiparametre		01/04/2019	16:29	S 20 19.002	W 176 08.209	2703	Tow Cam TC1	x					2nd SPOT on Alvini (without periostracum)
Preleveur d'Eau par Pompage (PEP)		01/04/2019	20:15	S 20 19.054	W 176 08.210	2696	Tow Cam TC1		x				starting temperature sensor
Chemini		01/04/2019	20:16	S 20 19.054	W 176 08.210	2696	Tow Cam TC1		x				pep and chemini sulure started
Preleveur In-situ de Fluide (PIF)		01/04/2019	20:17	S 20 19.052	W 176 08.209	2696	Tow Cam TC1		x				PIF started on seryngue 30 on mussel point #1
Chemini		01/04/2019	20:20	S 20 19.050	W 176 08.209	2696	Tow Cam TC1		x				PEP Chemini s started on point #2

Équipement	Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mes	Photo	Commentaire
Preleveur d'Eau par Pompage (PEP)		01/04/2019	20:23	S 20 19.052	W 176 08.210	2696	Tow Cam TC1		x				
Preleveur d'Eau par Pompage (PEP)		01/04/2019	20:26	S 20 19.052	W 176 08.210	2696	Tow Cam TC1		x				PEP and Chemini S started on point #3
Chemini		01/04/2019	20:29	S 20 19.056	W 176 08.210	2696	Tow Cam TC1		x				PEP ended
Petite Boite de collecte		01/04/2019	20:46	S 20 19.051	W 176 08.211	2696	Tow Cam TC1	x					collecting mussel started
Petite Boite de collecte		01/04/2019	22:07	S 20 19.051	W 176 08.212	2695	Tow Cam TC1	x					Grabbing PBT#3 to fill it up with mussels
Aspirateur faune	6	01/04/2019	23:44	S 20 19.053	W 176 08.208	2695	Tow Cam TC1	x					aspi on mussels site 2 near CASIMIR Jar 6
Aspirateur faune		02/04/2019	24:03	S 20 18.984	W 176 08.204	2718	Tow Cam TC1	x					aspi bowl 7 shrimps
Aspirateur faune		02/04/2019	24:14	S 20 18.988	W 176 08.203	2718	Tow Cam TC1	x					sticky tiny worms... bowl8 for scaleworms
Aspirateur faune		02/04/2019	02:04	S 20 18.977	W 176 08.201	2719	Tow Cam TC1	x					aspi grabbed for scaleworms sampling

Équipement	Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mes	Photo	Commentaire
Preleveur In-situ de Fluide (PIF)		02/04/2019	02:27	S 20 18.982	W 176 08.205	2720	Tow Cam TC1		x				Lancement de la seringue 19 PIF par erreur PIF19.

Plongée : **722 – Tui Malila**

Liste des opérations :

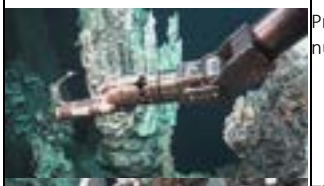
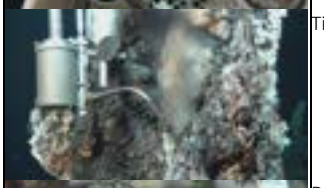
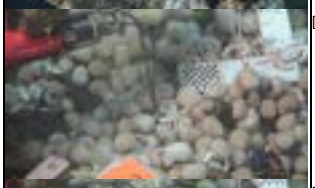
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur d'Eau par Pompage (PEP)		03/04/2019	04:49	S 21 59.344	W 176 34.096	1879	Tui Malila		x				PEP started
Pompe a larves		03/04/2019	05:47	S 21 59.432	W 176 34.056	1861	Tui Malila	x					SALSA 1 deployed
Pompe a larves		03/04/2019	06:24	S 21 59.355	W 176 34.098	1880	Tui Malila	x					SALSA 2 deployed close to a gastropod patch
Sonde autonome multiparametre		03/04/2019	06:46	S 21 59.374	W 176 34.091	1873	Tui Malila	x					SPOT1 on a small patch mussel +ifremeria
Sonde de temperature ROV		03/04/2019	08:22	S 21 59.280	W 176 34.075	1891	Tui Malila				x		Temperature probe CHU-PL03-TEMP01
Grande Boite de collecte		03/04/2019	08:46	S 21 59.277	W 176 34.074	1891	Tui Malila	x					end biobox sampling GBT4
Sonde de temperature ROV		03/04/2019	08:51	S 21 59.280	W 176 34.074	1891	Tui Malila				x		Temperature probe CHU-PL03-TEMP02
PEGAZ - Echantillonneur de gaz		03/04/2019	09:00	S 21 59.282	W 176 34.073	1891	Tui Malila		x				CHU-PL03-BEG01
PEGAZ - Echantillonneur de gaz		03/04/2019	09:01	S 21 59.281	W 176 34.075	1891	Tui Malila		x				CHU-PL03-BEG01

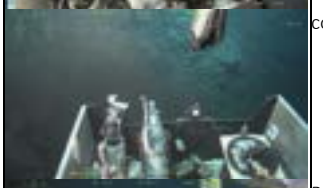
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Seringue Titane	1	03/04/2019	09:13	S 21 59.279	W 176 34.076	1891	Tui Malila		x				Fluide sampling CHU-PL03-TiG1
Seringue Titane		03/04/2019	09:20	S 21 59.276	W 176 34.075	1891	Tui Malila		x				Fluide sampling CHU-PL03-TiG2
Chemini		03/04/2019	09:28	S 21 59.274	W 176 34.074	1891	Tui Malila		x				Gradient 155C CHEMINI01 H2S et Fe 120-150°C
PrŽleveur In-situ de Fluide (PIF)		03/04/2019	09:29	S 21 59.273	W 176 34.072	1891	Tui Malila		x				Gradient PIF 155 a 160
Chemini		03/04/2019	11:02	S 21 59.271	W 176 34.070	1890	Tui Malila		x				END CHEMINI 11 3-10c
Panier-Geologie		03/04/2019	13:01	S 21 59.413	W 176 34.113	1865	Tui Malila			x			Ewan's rock in basket from "Alviniconcha chenminée" POI
Chemini		03/04/2019	13:59	S 21 59.349	W 176 34.089	1874	Tui Malila		x				Start PEP and CHEMINI Fe S
Grande Boite de collecte		03/04/2019	14:10	S 21 59.351	W 176 34.088	1874	Tui Malila	x					filling the box start
Aspirateur ˆ faune		03/04/2019	14:28	S 21 59.352	W 176 34.089	1874	Tui Malila	x					cleanning zone for aspi in bowl 1
PrŽleveur d'Eau par Pompage (PEP)		03/04/2019	14:41	S 21 59.354	W 176 34.094	1877	Tui Malila		x				Start PEP

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		03/04/2019	14:41	S 21 59.354	W 176 34.094	1877	Tui Malila		x				PIF 26 +VHEMINI Fe S on ifremeria community one
Sonde autonome multiparametre		03/04/2019	15:12	S 21 59.353	W 176 34.094	1877	Tui Malila				x		Preparing to SPOT measurement
Grande Boite de collecte		03/04/2019	16:02	S 21 59.354	W 176 34.094	1877	Tui Malila	x					1rst claw of ifremeria in GBT3 - few individuals
Sonde autonome multiparametre		03/04/2019	16:24	S 21 59.354	W 176 34.094	1877	Tui Malila				x		SPOT24 on the crack
Sonde autonome multiparametre		03/04/2019	19:07	S 21 59.348	W 176 34.099	1886	Tui Malila				x		SPOT 27 on Alvinichoncha
PrŽleveur In-situ de Fluide (PIF)		03/04/2019	19:40	S 21 59.347	W 176 34.100	1886	Tui Malila		x				CHU-PL3-PIF-27
Chemini		03/04/2019	19:42	S 21 59.349	W 176 34.099	1886	Tui Malila		x				CHU-PL3-CHEMINIS FE and S point #1 alviniconcha
Grande Boite de collecte	1	03/04/2019	20:07	S 21 59.348	W 176 34.099	1886	Tui Malila	x					1st scoop of alviniconcha in GBT1
Aspirateur ˆ faune	2	03/04/2019	20:34	S 21 59.348	W 176 34.100	1886	Tui Malila	x					suction in process (BOL2)
Aspirateur ˆ faune	3	03/04/2019	21:12	S 21 59.350	W 176 34.093	1882	Tui Malila	x					start suction of small mussels (BOL3)

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Aspirateur ^ faune	3	03/04/2019	21:28	S 21 59.351	W 176 34.094	1880	Tui Malila	x					fish inside the suction sampler (BOL3)
Grande Boite de collecte		03/04/2019	23:34	S 21 59.419	W 176 34.115	1860	Tui Malila	x					Box#7 ifremeria prelevement
Petite Boite de collecte	7	04/04/2019	0:37	S 21 59.254	W 176 34.070	1899	Tui Malila	x					Box#7 alviniconcha prelevement
Appareil photo		04/04/2019	03:35	S 21 59.348	W 176 33.989	1852	Tui Malila	x			x		Red shrimp in water column (just before)
Appareil photo		04/04/2019	08:01	S 21 59.360	W 176 33.962	1838	Tui Malila	x					End of line 13, end of mosaic
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	08:32	S 21 59.350	W 176 34.098	1886	Tui Malila		x				mesures chimiques sur communaute ifremeria
Chemini		04/04/2019	08:33	S 21 59.352	W 176 34.097	1886	Tui Malila		x				tempertures mesurees 12-13°C
Grande Boite de collecte	6	04/04/2019	08:57	S 21 59.355	W 176 34.098	1886	Tui Malila	x					Prélèvement Ifremeria GBT6
Panier		04/04/2019	09:34	S 21 59.341	W 176 34.092	1886	Tui Malila			x			Morceau de roche encroutement manganèse avec cirripèdes

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Panier		04/04/2019	10:04	S 21 59.451	W 176 34.135	1849	Tui Malila			x			Moceau de cheminée dans panier
Petite Boite de collecte	3	04/04/2019	10:09	S 21 59.454	W 176 34.136	1849	Tui Malila			x			Mise d'un autre morceau de cheminée dans PB3 + température 267.2°C

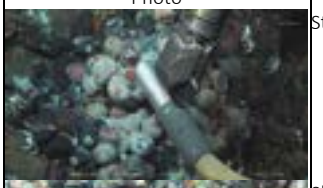
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
PEGAZ - Echantillonneur de gaz	2	04/04/2019	10:30	S 21 59.452	W 176 34.134	1849	Tui Malila		x				Prélèvement fluide avec BEG numéro 2
Seringue Titane	2	04/04/2019	10:37	S 21 59.454	W 176 34.134	1849	Tui Malila		x				Titane
Seringue Titane	3	04/04/2019	10:42	S 21 59.452	W 176 34.135	1849	Tui Malila		x				Titane
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	11:55	S 21 59.352	W 176 34.097	1884	Tui Malila		x				Démarrage PEP et Chemini
PrŽleveur In-situ de Fluide (PIF)		04/04/2019	11:57	S 21 59.353	W 176 34.096	1884	Tui Malila		x				Démarrage PIF
Grande Boite de collecte	5	04/04/2019	12:24	S 21 59.356	W 176 34.091	1884	Tui Malila	x					Prélèvement Alviniconcha sur GBT5
Aspirateur ˆ faune	4	04/04/2019	12:56	S 21 59.375	W 176 34.089	1873	Tui Malila	x					Prélèvement aspirateur sur Paralvinella bols 4, 5, 6, et 7
Aspirateur ˆ faune	8	04/04/2019	13:39	S 21 59.381	W 176 34.088	1873	Tui Malila	x					Prélèvement crevettes dans bol 8
Panier		04/04/2019	13:54	S 21 59.378	W 176 34.088	1873	Tui Malila			x			Prélèvement d'un morceau d'anhydrite de cheminée

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Panier		04/04/2019	14:20	S 21 59.422	W 176 34.104	1869	Tui Malila			x			Prélèvement d'un morceau d'anhydrite de cheminée
Sonde de temperature ROV		04/04/2019	14:48	S 21 59.424	W 176 34.105	1867	Tui Malila				x		Série de mesures de température 218°C miroir, 60°C dans paralvinella, 6°C dans crevettes, 3°C dans les moules
Panier		04/04/2019	16:10	S 21 59.468	W 176 34.115	1866	Tui Malila			x			collection rock
Panier	7	04/04/2019	17:41	S 21 59.363	W 176 34.117	1869	Tui Malila			x			collection rock
Bouteille NISKIN		04/04/2019	18:34	S 21 59.385	W 176 34.097	1867	Tui Malila		x				Bouteille Niskin fermée
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	20:31	S 21 59.354	W 176 34.098	1887	Tui Malila		x				PEP started, PIF syringe started, chemini started on point 1 of mussels community
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	20:38	S 21 59.351	W 176 34.097	1887	Tui Malila		x				Start PEP, CHEMINI on point 2 of mussel community
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	20:43	S 21 59.352	W 176 34.096	1886	Tui Malila		x				Start PEP, Chemini on point 3 of mussel community
Grande Boite de collecte	8	04/04/2019	20:56	S 21 59.352	W 176 34.097	1886	Tui Malila	x					1st scoop of mussels in GBT8
Aspirateur ˆ faune	8	04/04/2019	21:15	S 21 59.352	W 176 34.096	1886	Tui Malila	x					Suctionning in the 8th jar

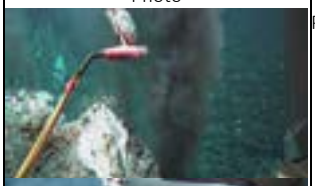
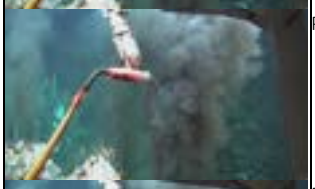
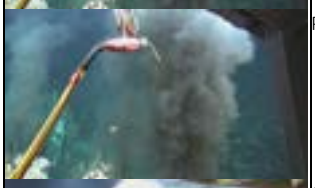
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Chemini		04/04/2019	21:27	S 21 59.351	W 176 34.097	1886	Tui Malila		x				start PEP and CHEMINI on point1 where the suction was processed (mussel community 2)-PURGE5
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	21:32	S 21 59.354	W 176 34.097	1886	Tui Malila		x				start point 2 PEP and CHEMINI on mussels community 2-PURGE5
PrŽleveur d'Eau par Pompage (PEP)		04/04/2019	21:36	S 21 59.350	W 176 34.097	1886	Tui Malila		x				start point 3 PEP and CHEMINI on mussels community 2-PURGE5
Grande Boite de collecte	9	04/04/2019	22:03	S 21 59.280	W 176 34.077	1892	Tui Malila	x					1st scoop in GBT 9
Panier	8	04/04/2019	23:52	S 21 59.415	W 176 34.111	1869	Tui Malila	x		x			sponges

Plongée : **723 -Tow Cam TC1**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Boite FISH	1	05/04/2019	20:34	S 20 19.069	W 176 08.241	2718	Tow Cam TC1	x					Start suction fish sampling
Boite FISH	2	05/04/2019	22:51	S 20 19.074	W 176 08.260	2711	Tow Cam TC1	x					Shrimpi hunt started
Préleveur d'Eau par Pompage (PEP)		06/04/2019	24:07	S 20 18.974	W 176 08.209	2716	Tow Cam TC1		x				PEP Started
PEGAZ - Echantillonneur de gaz	3	06/04/2019	24:31	S 20 18.962	W 176 08.184	2716	Tow Cam TC1		x				CHU-PL04-BEG3
Panier	1	06/04/2019	24:39	S 20 18.970	W 176 08.200	2710	Tow Cam TC1			x			CHU-PL04-01
Bouteille titane B (G) 750 ml	1	06/04/2019	24:49	S 20 18.975	W 176 08.209	2716	Tow Cam TC1		x				CHU-PL04-TiG1
Bouteille titane B (G) 750 ml	2	06/04/2019	24:57	S 20 18.977	W 176 08.211	2716	Tow Cam TC1		x				CHU-PL04-TiG2
Préleveur d'Eau par Pompage (PEP)	1	06/04/2019	01:06	S 20 18.974	W 176 08.206	2716	Tow Cam TC1		x				PEP On
Chemini	1	06/04/2019	01:06	S 20 18.975	W 176 08.207	2716	Tow Cam TC1		x				CHEMINI H2S and Fe

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	1	06/04/2019	01:07	S 20 18.975	W 176 08.208	2716	Tow Cam TC1		x				PIF serynge 115-130c
Chemini	2	06/04/2019	01:10	S 20 18.972	W 176 08.204	2716	Tow Cam TC1		x				CHEMINI H2S Restarted because first one didn't recorded any H2S signal
Préleveur In-situ de Fluide (PIF)	2	06/04/2019	01:12	S 20 18.969	W 176 08.200	2716	Tow Cam TC1		x				PIF serynge 2
Chemini	3	06/04/2019	01:16	S 20 18.963	W 176 08.197	2716	Tow Cam TC1		x				CHEMINI Fe and H2S
Préleveur In-situ de Fluide (PIF)	3	06/04/2019	01:16	S 20 18.963	W 176 08.197	2716	Tow Cam TC1		x				PIF serynge 3
Préleveur In-situ de Fluide (PIF)	4	06/04/2019	01:21	S 20 18.978	W 176 08.210	2716	Tow Cam TC1		x				PIF serynge 4
Chemini	4	06/04/2019	01:23	S 20 18.978	W 176 08.211	2716	Tow Cam TC1		x				CHEMINI Fe and H2S
Préleveur In-situ de Fluide (PIF)	5	06/04/2019	01:23	S 20 18.977	W 176 08.211	2716	Tow Cam TC1		x				PIF serynge 5
Préleveur In-situ de Fluide (PIF)	6	06/04/2019	01:28	S 20 18.978	W 176 08.210	2716	Tow Cam TC1		x				PIF serynge 6
Chemini	5	06/04/2019	01:30	S 20 18.978	W 176 08.210	2716	Tow Cam TC1		x				CHEMINI Fe H2S start

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	7	06/04/2019	01:30	S 20 18.978	W 176 08.211	2716	Tow Cam TC1		x				PIF serynge 7
Chemini	6	06/04/2019	01:35	S 20 18.973	W 176 08.207	2716	Tow Cam TC1		x				CHEMINI H2S and Fe
Préleveur In-situ de Fluide (PIF)	8	06/04/2019	01:36	S 20 18.973	W 176 08.208	2716	Tow Cam TC1		x				PIF serynge 8
Préleveur In-situ de Fluide (PIF)	9	06/04/2019	01:41	S 20 18.967	W 176 08.192	2716	Tow Cam TC1		x				PIF serynge 9
Chemini	7	06/04/2019	01:43	S 20 18.971	W 176 08.203	2716	Tow Cam TC1		x				CHEMINI Fe H2S
Préleveur In-situ de Fluide (PIF)	10	06/04/2019	01:43	S 20 18.972	W 176 08.204	2716	Tow Cam TC1		x				PIF 10
Préleveur In-situ de Fluide (PIF)	11	06/04/2019	01:48	S 20 18.970	W 176 08.200	2716	Tow Cam TC1		x				PIF 11
Chemini	8	06/04/2019	01:50	S 20 18.974	W 176 08.210	2716	Tow Cam TC1		x				CHEMINI Fe H2S
Préleveur In-situ de Fluide (PIF)	12	06/04/2019	01:50	S 20 18.974	W 176 08.210	2716	Tow Cam TC1		x				PIF 12
Chemini	9	06/04/2019	01:57	S 20 18.971	W 176 08.209	2716	Tow Cam TC1		x				CHEMINI Fe H2S start

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	13	06/04/2019	01:57	S 20 18.973	W 176 08.211	2716	Tow Cam TC1		x				PIF 13
Préleveur In-situ de Fluide (PIF)	14	06/04/2019	02:03	S 20 18.974	W 176 08.209	2716	Tow Cam TC1		x				PIF 14
Préleveur In-situ de Fluide (PIF)	15	06/04/2019	02:05	S 20 18.974	W 176 08.209	2716	Tow Cam TC1		x				PIF 15 and CHEMINI Fe H2S
Préleveur In-situ de Fluide (PIF)	16	06/04/2019	02:10	S 20 18.973	W 176 08.209	2716	Tow Cam TC1		x				PIF 16
Chemini	11	06/04/2019	02:12	S 20 18.973	W 176 08.209	2716	Tow Cam TC1		x				CHEMINI Fe H2S
Préleveur In-situ de Fluide (PIF)	17	06/04/2019	02:12	S 20 18.973	W 176 08.209	2716	Tow Cam TC1		x				PIF 17
Préleveur In-situ de Fluide (PIF)	18	06/04/2019	02:18	S 20 18.972	W 176 08.205	2716	Tow Cam TC1		x				PIF 18
Aspirateur ^ faune	1	06/04/2019	02:25	S 20 18.975	W 176 08.208	2716	Tow Cam TC1	x					Jar 1 for faunahere
Aspirateur ^ faune	2	06/04/2019	02:35	S 20 18.977	W 176 08.209	2717	Tow Cam TC1	x					Jar 2
Aspirateur ^ faune	3	06/04/2019	02:51	S 20 18.991	W 176 08.207	2708	Tow Cam TC1	x					Jar3

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Aspirateur ^ faune	4	06/04/2019	02:55	S 20 18.987	W 176 08.203	2708	Tow Cam TC1	x					SWitching to jar 4

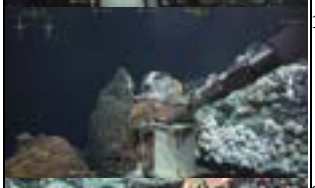
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Petite Boite de collecte	1	06/04/2019	03:25	S 20 19.074	W 176 08.249	2713	Tow Cam TC1	x					Preparing to collect mussels
Aspirateur ^ faune	5	06/04/2019	03:46	S 20 19.074	W 176 08.232	2718	Tow Cam TC1	x					starting slurping on paralvinellids
Aspirateur ^ faune	6	06/04/2019	03:50	S 20 19.075	W 176 08.232	2718	Tow Cam TC1	x					slurping on new bol : number 6
Panier	2	06/04/2019	04:50	S 20 19.070	W 176 08.246	2714	Tow Cam TC1	x		x			Rock with anemone
Aspirateur ^ faune	8	06/04/2019	04:52	S 20 19.071	W 176 08.246	2714	Tow Cam TC1	x					Moving to bowl 8: holothurian in bowl 8
Panier	3	06/04/2019	05:09	S 20 19.074	W 176 08.247	2714	Tow Cam TC1	x		x			Rock with cirripeds and anemone in drawer

Plongée : **724 – Phoenix near Père Lachaise**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur d'Eau par Pompage (PEP)		09/04/2019	21:45	S 16 57.012	E 173 55.127	1963	Phoenix, point triple Fiji		x				PEP started, wheel turning for calibration
Chemini		09/04/2019	21:47	S 16 57.002	E 173 55.140	1959	Phoenix, point triple Fiji		x				Start Chemini calibration
Sonde autonome multiparametre		09/04/2019	21:53	S 16 57.002	E 173 55.139	1961	Phoenix, point triple Fiji				x		SPOT #1 measurement, 30 colouring
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:28	S 16 57.004	E 173 55.136	1961	Phoenix, point triple Fiji		x				PEP started
Chemini		09/04/2019	22:29	S 16 57.004	E 173 55.137	1961	Phoenix, point triple Fiji		x				CHEMINI iron and sulphide started on point #1 in Ifremeria
Préleveur In-situ de Fluide (PIF)		09/04/2019	22:30	S 16 57.004	E 173 55.137	1961	Phoenix, point triple Fiji	x	x				Start collecting PIF serynge 25 on Ifremeria point#1
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:34	S 16 57.004	E 173 55.136	1961	Phoenix, point triple Fiji		x				PEP started
Chemini		09/04/2019	22:34	S 16 57.004	E 173 55.136	1961	Phoenix, point triple Fiji		x				CHEMINI iron and sulfide started on point #2 Ifremeria, T = 10°C
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:40	S 16 57.004	E 173 55.138	1961	Phoenix, point triple Fiji		x				PEP started

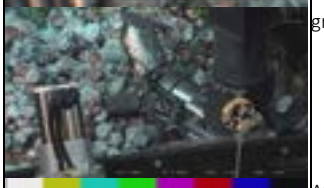
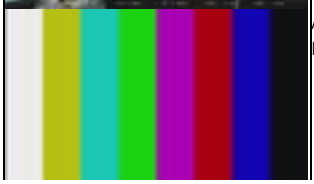
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Chemini		09/04/2019	22:40	S 16 57.004	E 173 55.137	1961	Phoenix, point triple Fiji		x				CHEMINI iron and sulfide started on point #3 Ifremeria, T ~ 5°C
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:46	S 16 57.005	E 173 55.136	1961	Phoenix, point triple Fiji		x				PEP started
Chemini		09/04/2019	22:46	S 16 57.005	E 173 55.136	1961	Phoenix, point triple Fiji		x				Chemini sulfide and iron started on point #1 mussels, T ~ 8°C
Préleveur In-situ de Fluide (PIF)		09/04/2019	22:47	S 16 57.004	E 173 55.136	1961	Phoenix, point triple Fiji		x				Sampling with PIF in syringe 26 started on point #1 mussels
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:51	S 16 57.004	E 173 55.135	1961	Phoenix, point triple Fiji		x				PEP started
Chemini		09/04/2019	22:52	S 16 57.005	E 173 55.136	1961	Phoenix, point triple Fiji		x				Cheminis started on point #2 mussels, T ~ 6°C
Préleveur d'Eau par Pompage (PEP)		09/04/2019	22:57	S 16 57.005	E 173 55.136	1961	Phoenix, point triple Fiji		x				PEP pump started
Chemini		09/04/2019	22:57	S 16 57.005	E 173 55.135	1961	Phoenix, point triple Fiji		x				Cheminis on mussels point #3 started
Préleveur d'Eau par Pompage (PEP)		09/04/2019	23:03	S 16 57.005	E 173 55.133	1961	Phoenix, point triple Fiji		x				PEP pump started on point #1 Alviniconcha
Chemini		09/04/2019	23:03	S 16 57.006	E 173 55.133	1961	Phoenix, point triple Fiji		x				Cheminis started on point #1 Alviniconcha, T ~9/11 °c

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)		09/04/2019	23:04	S 16 57.006	E 173 55.134	1961	Phoenix, point triple Fiji		x				Start collecting PIF syringe 27 on point #1 Alviniconcha, T ~13°C
Préleveur d'Eau par Pompage (PEP)		09/04/2019	23:10	S 16 57.005	E 173 55.134	1961	Phoenix, point triple Fiji		x				pep and Cheminis started on point #2 Alviniconcha, T ~26 °c
Préleveur d'Eau par Pompage (PEP)		09/04/2019	23:15	S 16 57.006	E 173 55.134	1961	Phoenix, point triple Fiji		x				Pep and Cheminis started on point #3 Alviniconcha, T ~18 °c
Grande Boite de collecte	1	09/04/2019	23:26	S 16 57.005	E 173 55.133	1961	Phoenix, point triple Fiji	x					start sampling ifremeria to GBT1
Grande Boite de collecte	4	09/04/2019	23:41	S 16 57.000	E 173 55.127	1961	Phoenix, point triple Fiji	x					start sampling of alviniconcha to GBT4
Grande Boite de collecte	3	09/04/2019	23:58	S 16 57.003	E 173 55.127	1961	Phoenix, point triple Fiji	x					1st scoop of mussels in GBT3
Aspirateur ^ faune	1	10/04/2019	24:29	S 16 57.003	E 173 55.127	1961	Phoenix, point triple Fiji	x					Suction sampler on bowl 1 - Alviniconcha community
Aspirateur ^ faune	2	10/04/2019	24:32	S 16 57.001	E 173 55.127	1961	Phoenix, point triple Fiji	x					suction sampler bowl 2 - flange polynoids
Aspirateur ^ faune	3	10/04/2019	24:34	S 16 57.002	E 173 55.127	1961	Phoenix, point triple Fiji	x					suction samplerbowl 3 - mussels community
Aspirateur ^ faune	4	10/04/2019	24:38	S 16 57.002	E 173 55.126	1961	Phoenix, point triple Fiji	x					Bowl 4 on Ifremeria community

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Aspirateur ^ faune		10/04/2019	24:45	S 16 57.003	E 173 55.126	1960	Phoenix, point triple Fiji	x					Bowl 5 on cyripeds community
Préleveur d'Eau par Pompage (PEP)		10/04/2019	24:52	S 16 57.004	E 173 55.127	1960	Phoenix, point triple Fiji		x				Pep start
Chemini		10/04/2019	24:52	S 16 57.003	E 173 55.126	1960	Phoenix, point triple Fiji		x				Start CHEMINI Fe et H2S (T environ 3°C) on cirripedes
Chemini		10/04/2019	24:57	S 16 57.004	E 173 55.127	1960	Phoenix, point triple Fiji		x				Start 2nd CHEMINI H2S measurement on cirripedes
Préleveur d'Eau par Pompage (PEP)		10/04/2019	01:05	S 16 57.002	E 173 55.126	1961	Phoenix, point triple Fiji		x				Start PEP
Chemini		10/04/2019	01:06	S 16 57.003	E 173 55.126	1961	Phoenix, point triple Fiji		x				Start Chemini Fe et H2S on mussels (T=3.4°C)
Préleveur d'Eau par Pompage (PEP)		10/04/2019	01:11	S 16 57.003	E 173 55.126	1961	Phoenix, point triple Fiji		x				Start PEP
Préleveur d'Eau par Pompage (PEP)		10/04/2019	01:17	S 16 57.005	E 173 55.130	1961	Phoenix, point triple Fiji		x				Start PEP
Chemini		10/04/2019	01:17	S 16 57.005	E 173 55.130	1961	Phoenix, point triple Fiji		x				Start Chemini Fe et H2S on alviniconcha
Préleveur d'Eau par Pompage (PEP)		10/04/2019	01:25	S 16 57.005	E 173 55.132	1961	Phoenix, point triple Fiji		x				PEP start

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Chemini		10/04/2019	01:26	S 16 57.005	E 173 55.132	1961	Phoenix, point triple Fiji		x				Start chemini under the flange

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	1	10/04/2019	01:27	S 16 57.005	E 173 55.132	1961	Phoenix, point triple Fiji		x				Start PIP seringue 1 T=146.8°C
Préleveur In-situ de Fluide (PIF)	2	10/04/2019	01:32	S 16 57.006	E 173 55.131	1961	Phoenix, point triple Fiji		x				Start sampling in seryngue PIF2
Panier	1	10/04/2019	01:36	S 16 57.005	E 173 55.132	1961	Phoenix, point triple Fiji			x			Flange sampleling : CHU-PL05-01
Panier	2	10/04/2019	01:39	S 16 57.004	E 173 55.132	1961	Phoenix, point triple Fiji			x			Rock Sampling, massive sulfur at the basement of flange CHU-PL05-02
Aspirateur ^ faune	2	10/04/2019	05:07	S 16 56.972	E 173 55.083	1973	Phoenix, point triple Fiji	x					sampling polynoids in ASPI 2
Panier	3	10/04/2019	05:32	S 16 56.971	E 173 55.079	1973	Phoenix, point triple Fiji			x			Top of a small chimney for microbiology
Petite Boite de collecte		10/04/2019	05:35	S 16 56.969	E 173 55.079	1973	Phoenix, point triple Fiji			x			Same chimney
Préleveur In-situ de Fluide (PIF)	3	10/04/2019	07:11	S 16 56.970	E 173 55.087	1973	Phoenix, point triple Fiji		x				Cécile's Gradient 1st chemini PIF Syringe 3
Préleveur In-situ de Fluide (PIF)	11	10/04/2019	07:50	S 16 56.966	E 173 55.087	1973	Phoenix, point triple Fiji		x				chemini PIF syringe 11
Panier	4	10/04/2019	08:01	S 16 56.967	E 173 55.084	1973	Phoenix, point triple Fiji			x			CHU-PL05-04 cheminee sulfures

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Chemini		10/04/2019	15:37	S 16 56.937	E 173 55.110	1973	Phoenix, point triple Fiji		x				iron and sulfur measure starts
Préleveur In-situ de Fluide (PIF)	28	10/04/2019	15:38	S 16 56.937	E 173 55.110	1973	Phoenix, point triple Fiji		x				statring PIF seringe 28
Préleveur d'Eau par Pompage (PEP)		10/04/2019	15:42	S 16 56.937	E 173 55.110	1973	Phoenix, point triple Fiji		x				start PEP & Chemini
Grande Boite de collecte	2	10/04/2019	15:54	S 16 56.938	E 173 55.111	1973	Phoenix, point triple Fiji	x					first mussel
Préleveur d'Eau par Pompage (PEP)		10/04/2019	17:49	S 16 56.937	E 173 55.112	1973	Phoenix, point triple Fiji		x				pomp PEP started on ifremeria
Préleveur In-situ de Fluide (PIF)	29	10/04/2019	17:50	S 16 56.937	E 173 55.112	1973	Phoenix, point triple Fiji		x				PIF syringe 29 started
Préleveur d'Eau par Pompage (PEP)		10/04/2019	17:55	S 16 56.937	E 173 55.113	1973	Phoenix, point triple Fiji		x				PEP pump started on ifremeria 2, T=6.5-7°C
Préleveur d'Eau par Pompage (PEP)		10/04/2019	18:01	S 16 56.937	E 173 55.112	1973	Phoenix, point triple Fiji		x				PEP and cheminy started on ifremeria 3
Petite Boite de collecte	6	10/04/2019	18:59	S 16 56.936	E 173 55.111	1974	Phoenix, point triple Fiji	x					grabbing Ifremeria
Aspirateur ^ faune	6	10/04/2019	19:52	S 16 56.938	E 173 55.110	1974	Phoenix, point triple Fiji	x					ASPI6: on rock underneath Ifremeria : shrimps, one snail

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	2	10/04/2019	20:04	S 16 56.936	E 173 55.111	1974	Phoenix, point triple Fiji	x					Mussel sampling (GBT2)
Préleveur d'Eau par Pompage (PEP)		11/04/2019	24:15	S 16 56.964	E 173 55.083	1973	Phoenix, point triple Fiji		x				PEP started
Préleveur In-situ de Fluide (PIF)	30	11/04/2019	24:16	S 16 56.964	E 173 55.083	1973	Phoenix, point triple Fiji		x				CHEMINIs H2S and Fe Started
Préleveur d'Eau par Pompage (PEP)		11/04/2019	24:21	S 16 56.959	E 173 55.079	1973	Phoenix, point triple Fiji		x				PEP started
Préleveur d'Eau par Pompage (PEP)		11/04/2019	24:27	S 16 56.961	E 173 55.081	1973	Phoenix, point triple Fiji		x				PEP started and CHEMINIS
Petite Boite de collecte	4	11/04/2019	24:37	S 16 56.963	E 173 55.078	1973	Phoenix, point triple Fiji	x					sampling of Alviniconcha (3rd species) in PBT4
Aspirateur ^ faune	8	11/04/2019	01:13	S 16 56.951	E 173 55.080	1973	Phoenix, point triple Fiji	x					Pot 7 is not working. We change for pot 8
Aspirateur ^ faune	7	11/04/2019	01:53	S 16 56.949	E 173 55.087	1973	Phoenix, point triple Fiji	x					Suction on Alviniconcha 2 Jar 7
Seringue Titane	3	11/04/2019	02:35	S 16 56.953	E 173 55.085	1973	Phoenix, point triple Fiji		x				PL5-TiD3
Seringue Titane	2	11/04/2019	02:40	S 16 56.955	E 173 55.087	1973	Phoenix, point triple Fiji		x				PL5-TiD2

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
PEGAZ - Echantillonneur de gaz	2	11/04/2019	02:50	S 16 56.955	E 173 55.088	1973	Phoenix, point triple Fiji		x				PL5-BEG2
Panier	5	11/04/2019	04:48	S 16 56.988	E 173 55.112	1965	Phoenix, point triple Fiji			x			rock sampling
Aspirateur ^ faune		11/04/2019	05:03				Phoenix, point triple Fiji	x					suction sampling for chimney worms
Panier	6	11/04/2019	05:27	S 16 56.966	E 173 55.089	1972	Phoenix, point triple Fiji	x		x			sampling bernacles

Plongée : **725 – Mangatolo (exploratory dive)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Grande Boite de collecte	5	16/04/2019	01:48	S 15 24.440	W 174 39.790	2028	Mangatolo, point triple			x			Fe-Si oxide sampling CHU-PL06-GBT5

Plongée : **726 – Mangatolo triple junction**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Panier	1	16/04/2019	20:33	S 15 24.963	W 174 39.335	2040	Mangatolo, point triple			x			Sampling CHU PL07-01
Préleveur d'Eau par Pompage (PEP)		16/04/2019	21:58	S 15 24.879	W 174 39.212	2031	Mangatolo, point triple		x				PEP started point 1
Préleveur In-situ de Fluide (PIF)		16/04/2019	21:59	S 15 24.880	W 174 39.211	2031	Mangatolo, point triple		x				PIF Started seringue 25
Chemini		16/04/2019	22:00	S 15 24.880	W 174 39.212	2031	Mangatolo, point triple		x				Chemini started
Chemini		16/04/2019	22:04	S 15 24.880	W 174 39.211	2031	Mangatolo, point triple		x				Chemini point 2 started
Chemini		16/04/2019	22:09	S 15 24.880	W 174 39.210	2031	Mangatolo, point triple		x				Chemini point 3 started Temperature 15°C
Grande Boite de collecte	4	16/04/2019	22:16	S 15 24.880	W 174 39.211	2031	Mangatolo, point triple	x					Sampling Alviniconcha in GBT #4
Préleveur d'Eau par Pompage (PEP)		16/04/2019	22:40	S 15 24.874	W 174 39.208	2031	Mangatolo, point triple		x				PEP started Chemini Fe & H2S started, T=16°C
Chemini		16/04/2019	22:44	S 15 24.875	W 174 39.208	2031	Mangatolo, point triple		x				Fin chemini Fe & H2S

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Chemini		16/04/2019	22:45	S 15 24.875	W 174 39.208	2031	Mangatolo, point triple		x				Start Chemini Fe, a little bit after Chemini H2S, Chemini H2S pumping while probe was moving, T=21°C - on point #2 after sampling
Préleveur d'Eau par Pompage (PEP)		16/04/2019	22:53	S 15 24.873	W 174 39.209	2031	Mangatolo, point triple		x				Point #1 Ifremeria 1, PEP started and end of chemini iron
Préleveur In-situ de Fluide (PIF)		16/04/2019	22:54	S 15 24.874	W 174 39.209	2031	Mangatolo, point triple		x				Trigger PIF syringe 26 on point #1 Ifremeria 1, T=14.86°C and Cheminis started
Préleveur d'Eau par Pompage (PEP)		16/04/2019	22:59	S 15 24.874	W 174 39.208	2031	Mangatolo, point triple		x				PEP restarted
Chemini		16/04/2019	23:00	S 15 24.873	W 174 39.208	2031	Mangatolo, point triple		x				Start Chemini Fe and sulphide on point #2 Ifremeria 1
Chemini		16/04/2019	23:06	S 15 24.874	W 174 39.209	2031	Mangatolo, point triple		x				PEP started point 3 Ifremeria 1 and Chemini Fe and S
Grande Boite de collecte	2	16/04/2019	23:16	S 15 24.874	W 174 39.208	2031	Mangatolo, point triple	x					Sampling of Ifremeria 1 started in GBT #2
Aspirateur ^ faune	1	16/04/2019	23:26	S 15 24.873	W 174 39.208	2031	Mangatolo, point triple	x					Suction sample of Ifremeria 1 in bol 1
Aspirateur ^ faune	2	16/04/2019	23:36	S 15 24.874	W 174 39.208	2031	Mangatolo, point triple	x					start suction of Alviniconcha in bol 2
Préleveur d'Eau par Pompage (PEP)		16/04/2019	23:42	S 15 24.875	W 174 39.207	2031	Mangatolo, point triple		x				PEP started point #4 Ifremeria 1

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Chemini		16/04/2019	23:43	S 15 24.875	W 174 39.208	2031	Mangatolo, point triple		x				Chemini Fe and S Started
Préleveur d'Eau par Pompage (PEP)		16/04/2019	23:48	S 15 24.876	W 174 39.209	2031	Mangatolo, point triple		x				PEP chemini Fe and S started point #5 Ifremeria 1
Préleveur d'Eau par Pompage (PEP)		16/04/2019	23:56	S 15 24.876	W 174 39.209	2031	Mangatolo, point triple		x				PEP started
Chemini		16/04/2019	23:56	S 15 24.876	W 174 39.208	2031	Mangatolo, point triple		x				Chemini Fe and Sulphide started on Mussels
Grande Boite de collecte	3	17/04/2019	24:10	S 15 24.877	W 174 39.208	2032	Mangatolo, point triple	x					Open GBT3, mussels prelevement
Aspirateur ^ faune	3	17/04/2019	01:30	S 15 24.871	W 174 39.207	2028	Mangatolo, point triple	x					Start sunction prelevement on jar#3 ("cold" spot)
Aspirateur ^ faune	4	17/04/2019	01:38	S 15 24.867	W 174 39.205	2027	Mangatolo, point triple	x					Start sunction sampling on jar#4 ("hot" spot)
Panier	2	17/04/2019	01:50	S 15 24.868	W 174 39.205	2027	Mangatolo, point triple			x			Sulfur sampling on chimney CHU-PL07-02
Bouteille titane B (G) 750 ml	3	17/04/2019	02:54	S 15 24.868	W 174 39.204	2028	Mangatolo, point triple		x				TiG3 launched

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Bouteille titane A (D) 750 ml	2	17/04/2019	03:12	S 15 24.868	W 174 39.206	2027	Mangatolo, point triple		x				TiD2 launched
Bouteille NISKIN		17/04/2019	03:25	S 15 24.855	W 174 39.174	2029	Mangatolo, point triple		x				Niskin triggered - on elevator 2028m depth
Sonde autonome multiparametre	1	17/04/2019	06:14	S 15 24.877	W 174 39.207	2028	Mangatolo, point triple				x		SPOT1
Sonde autonome multiparametre	10	17/04/2019	07:24	S 15 24.961	W 174 39.328	2040	Mangatolo, point triple				x		starting CHU-SPOT-10
Préleveur d'Eau par Pompage (PEP)		17/04/2019	08:13	S 15 24.960	W 174 39.329	2040	Mangatolo, point triple		x				PEP started, on point #1 Ifremeria 2
Chemini		17/04/2019	08:15	S 15 24.959	W 174 39.329	2040	Mangatolo, point triple		x				Chemini Fe started and H2S started, PIF syringe 27 triggered on point #1 on Ifremeria 2
Chemini		17/04/2019	08:19	S 15 24.959	W 174 39.329	2040	Mangatolo, point triple		x				Chemini H2S stopped and restarted, PEP topped and restarted (weak signal of H2S)
Chemini		17/04/2019	08:23	S 15 24.958	W 174 39.329	2040	Mangatolo, point triple		x				Chemini H2S and Fe started, T=11.6°C on point #2 Ifremeria 2
Préleveur d'Eau par Pompage (PEP)		17/04/2019	08:28	S 15 24.958	W 174 39.330	2040	Mangatolo, point triple		x				PEP started
Chemini		17/04/2019	08:28	S 15 24.958	W 174 39.330	2040	Mangatolo, point triple		x				Chemini Fe and H2S started on point #3 Ifremeria 2, T=4.7°C

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Petite Boite de collecte	4	17/04/2019	08:36	S 15 24.959	W 174 39.330	2040	Mangatolo, point triple	x					PBT4 in Sherpa
Aspirateur ^ faune	5	17/04/2019	09:03	S 15 24.956	W 174 39.330	2040	Mangatolo, point triple	x					Start suction szmpler jar #5

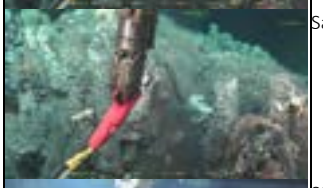
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur d'Eau par Pompage (PEP)		17/04/2019	09:08	S 15 24.959	W 174 39.329	2040	Mangatolo, point triple		x				PEP started
Chemini		17/04/2019	09:09	S 15 24.959	W 174 39.328	2040	Mangatolo, point triple		x				Chemini Fe and H2S started on point #1 after sampling Ifremeria 2, T=17.45°C
Préleveur d'Eau par Pompage (PEP)		17/04/2019	09:26	S 15 24.962	W 174 39.336	2039	Mangatolo, point triple		x				pep started
Chemini		17/04/2019	09:27	S 15 24.962	W 174 39.335	2039	Mangatolo, point triple		x				Starting CHEMINIS Fe and S on mussel community 1
Petite Boite de collecte	5	17/04/2019	09:32	S 15 24.962	W 174 39.335	2039	Mangatolo, point triple	x					sampling mussel in PBT#5
Préleveur d'Eau par Pompage (PEP)		17/04/2019	10:12	S 15 24.963	W 174 39.329	2039	Mangatolo, point triple		x				PEP started on point #1 Alviniconcha 2
Chemini		17/04/2019	10:14	S 15 24.962	W 174 39.329	2039	Mangatolo, point triple		x				Chemini Fe & H2S started on point#1 Alviniconcha 2, PIF syringe 28 triggered, T = 4.7°C
Chemini		17/04/2019	10:18	S 15 24.963	W 174 39.330	2039	Mangatolo, point triple		x				End of Cheminis Fe & HS, Cheminis restarted on point #2 ALviniconcha 2 - T=18.5°C
Chemini		17/04/2019	10:23	S 15 24.962	W 174 39.330	2039	Mangatolo, point triple		x				Start Cheminis Fe & H2S at point #3 Alviniconcha, T = 24.5°C
Petite Boite de collecte	6	17/04/2019	10:28	S 15 24.962	W 174 39.331	2039	Mangatolo, point triple	x					PBT6 open

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur d'Eau par Pompage (PEP)		17/04/2019	10:56	S 15 24.960	W 174 39.328	2040	Mangatolo, point triple		x				PEP pump started
Chemini		17/04/2019	10:57	S 15 24.960	W 174 39.328	2040	Mangatolo, point triple		x				Cheminis Fe and H2S started on point #1 after sampling Alviniconcha 2, T=3.5-4.5°C
Chemini		17/04/2019	11:01	S 15 24.960	W 174 39.328	2040	Mangatolo, point triple		x				End of cheminis and start new Cheminis on point #1 after sampling Alviniconcha 2, 8°C
Préleveur d'Eau par Pompage (PEP)		17/04/2019	11:06	S 15 24.961	W 174 39.329	2040	Mangatolo, point triple		x				PEP started
Chemini		17/04/2019	11:07	S 15 24.960	W 174 39.329	2040	Mangatolo, point triple		x				Start of cheminis on point #2 after sampling Alviniconcha 2
Aspirateur ^ faune	6	17/04/2019	11:14	S 15 24.960	W 174 39.329	2040	Mangatolo, point triple	x					Starting suction sample jar #6 on ALviniconcha 2 sampling area
Aspirateur ^ faune	7	17/04/2019	11:18	S 15 24.960	W 174 39.328	2040	Mangatolo, point triple	x					starting suction jar 7
Panier	3	17/04/2019	11:52	S 15 24.959	W 174 39.327	2040	Mangatolo, point triple			x			sampling piece of active flange
PEGAZ - Echantillonneur de gaz	2	17/04/2019	12:43	S 15 24.872	W 174 39.203	2027	Mangatolo, point triple		x				starting BEG2
Préleveur d'Eau par Pompage (PEP)		17/04/2019	12:54	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				Starting PEP

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	1	17/04/2019	12:55	S 15 24.872	W 174 39.208	2027	Mangatolo, point triple		x				starting PIF seringe 1
Chemini	1	17/04/2019	12:55	S 15 24.872	W 174 39.208	2027	Mangatolo, point triple		x				starting chemini Fe S
Préleveur In-situ de Fluide (PIF)	2	17/04/2019	13:01	S 15 24.873	W 174 39.206	2027	Mangatolo, point triple		x				starting PIF seringe 2
Chemini	2	17/04/2019	13:01	S 15 24.874	W 174 39.207	2027	Mangatolo, point triple		x				starting chemini 2 sulfur
Préleveur In-situ de Fluide (PIF)	3	17/04/2019	13:05	S 15 24.873	W 174 39.206	2027	Mangatolo, point triple		x				starting PIF seringe 3
Chemini	3	17/04/2019	13:06	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				starting chemini 3 sulfur
Chemini	4	17/04/2019	13:10	S 15 24.872	W 174 39.206	2027	Mangatolo, point triple		x				starting chemini 4 Fe sulfur
Préleveur In-situ de Fluide (PIF)	4	17/04/2019	13:11	S 15 24.872	W 174 39.205	2027	Mangatolo, point triple		x				starting PIF seringe 4
Préleveur In-situ de Fluide (PIF)	5	17/04/2019	13:16	S 15 24.871	W 174 39.205	2027	Mangatolo, point triple		x				starting PIF seringe 5
Chemini	5	17/04/2019	13:17	S 15 24.872	W 174 39.205	2027	Mangatolo, point triple		x				starting chemini 5 Fe sulfur

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	6	17/04/2019	13:22	S 15 24.875	W 174 39.206	2027	Mangatolo, point triple		x				starting PIF seringe 6
Préleveur In-situ de Fluide (PIF)	7	17/04/2019	13:23	S 15 24.872	W 174 39.205	2027	Mangatolo, point triple		x				starting PIF seringe 7
Chemini		17/04/2019	13:24	S 15 24.872	W 174 39.205	2027	Mangatolo, point triple		x				starting chemini Fe Sulfur
Préleveur In-situ de Fluide (PIF)	8	17/04/2019	13:24	S 15 24.873	W 174 39.205	2027	Mangatolo, point triple		x				Starting PIF seringe 8
Préleveur In-situ de Fluide (PIF)	9	17/04/2019	13:30	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				Starting PIF seringe 9
Chemini		17/04/2019	13:31	S 15 24.871	W 174 39.207	2027	Mangatolo, point triple		x				Starting chemini Fe sulfur
Préleveur In-situ de Fluide (PIF)	10	17/04/2019	13:32	S 15 24.872	W 174 39.206	2027	Mangatolo, point triple		x				Starting PIF seringe 10
Chemini		17/04/2019	13:36	S 15 24.875	W 174 39.206	2027	Mangatolo, point triple		x				starting chemini on grad 5
Préleveur In-situ de Fluide (PIF)	11	17/04/2019	13:41	S 15 24.873	W 174 39.210	2027	Mangatolo, point triple		x				starting PIF seringe 11 grad 6
Préleveur In-situ de Fluide (PIF)	12	17/04/2019	13:42	S 15 24.872	W 174 39.208	2027	Mangatolo, point triple		x				starting PIF seringe 12 grad 6

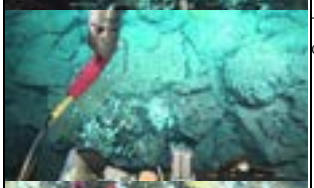
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	13	17/04/2019	13:48	S 15 24.874	W 174 39.204	2027	Mangatolo, point triple		x				starting PIF seringe 13 grad 7
Chemini		17/04/2019	13:48	S 15 24.874	W 174 39.204	2027	Mangatolo, point triple		x				starting chemini Fe sulfur
Préleveur In-situ de Fluide (PIF)	14	17/04/2019	13:53	S 15 24.877	W 174 39.208	2027	Mangatolo, point triple		x				starting PIF seringe 14 grad 7
Préleveur In-situ de Fluide (PIF)	15	17/04/2019	13:54	S 15 24.875	W 174 39.207	2028	Mangatolo, point triple		x				starting PIF seringe 15 grad 8
Chemini		17/04/2019	13:54	S 15 24.875	W 174 39.207	2028	Mangatolo, point triple		x				starting chemini Fe sulfur
Chemini		17/04/2019	13:58	S 15 24.870	W 174 39.207	2028	Mangatolo, point triple		x				starting 2nd chemini Fe sulfur
Préleveur In-situ de Fluide (PIF)	16	17/04/2019	14:00	S 15 24.872	W 174 39.207	2027	Mangatolo, point triple		x				Staring PIF seringe 16 grad 8
Préleveur In-situ de Fluide (PIF)	17	17/04/2019	14:02	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				Staring PIF seringe 17 grad 9
Chemini		17/04/2019	14:02	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				starting chemini Fe sulfur > arrest
Chemini		17/04/2019	14:04	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				restarting chemini Fe sulfur

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	18	17/04/2019	14:07	S 15 24.873	W 174 39.207	2027	Mangatolo, point triple		x				Starting PIF seringe 18 grad 9
Préleveur In-situ de Fluide (PIF)	19	17/04/2019	14:08	S 15 24.873	W 174 39.206	2027	Mangatolo, point triple		x				Starting PIF seringe 19 grad 10
Préleveur In-situ de Fluide (PIF)	20	17/04/2019	14:09	S 15 24.872	W 174 39.205	2027	Mangatolo, point triple		x				Starting PIF seringe 20 grad 10
Chemini		17/04/2019	14:09	S 15 24.872	W 174 39.204	2027	Mangatolo, point triple		x				Satring chemini Fe sulfur
Préleveur In-situ de Fluide (PIF)	21	17/04/2019	14:16	S 15 24.874	W 174 39.207	2028	Mangatolo, point triple		x				Starting PIF seringe 21 grad 11
Préleveur In-situ de Fluide (PIF)	22	17/04/2019	14:17	S 15 24.874	W 174 39.207	2028	Mangatolo, point triple		x				Starting PIF seringe 22 grad 11
Chemini		17/04/2019	14:17	S 15 24.874	W 174 39.207	2028	Mangatolo, point triple		x				starting chemini Fe sulfur
Préleveur In-situ de Fluide (PIF)	23	17/04/2019	14:23	S 15 24.874	W 174 39.206	2028	Mangatolo, point triple		x				Starting PIF 23 and chimini
Préleveur In-situ de Fluide (PIF)	24	17/04/2019	14:24	S 15 24.873	W 174 39.206	2028	Mangatolo, point triple		x				Starting PIF 24 and chimini
Chemini		17/04/2019	14:29	S 15 24.872	W 174 39.208	2027	Mangatolo, point triple		x				

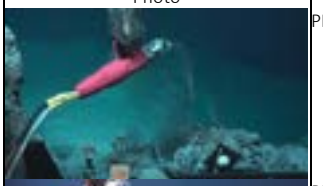
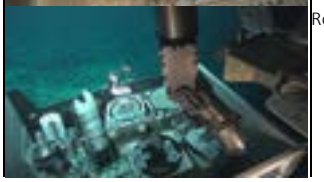
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	1	17/04/2019	14:33	S 15 24.870	W 174 39.203	2028	Mangatolo, point triple			x			opening chimney GBT1
Bouteille titane A (D) 750 ml	1	17/04/2019	15:25	S 15 25.048	W 174 39.388	2031	Mangatolo, point triple		x				titane

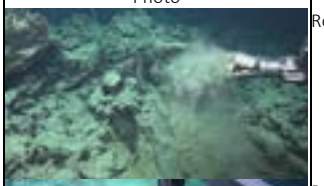
Plongée : **727 – Futuna (Fatu kapa)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		18/04/2019	19:05	S 14 45.109	W 177 09.133	1562	Fatu kapa (Futuna)		x				start PEP, electrode recording, chemini Fe and chemin S
Préleveur In-situ de Fluide (PIF)	25	18/04/2019	19:05	S 14 45.110	W 177 09.134	1562	Fatu kapa (Futuna)		x				Start PIF, temperature 5 to 6 degre point 1 Ifremeria1 synringe 25 of PIF
Chemini		18/04/2019	19:09	S 14 45.109	W 177 09.135	1562	Fatu kapa (Futuna)		x				restart chemini Ifremeria 1 point 2, temperature 8.8
Chemini		18/04/2019	19:13	S 14 45.110	W 177 09.134	1562	Fatu kapa (Futuna)		x				Start Ifremeria 1 point 3, end of cheminis point2
Grande Boite de collecte	3	18/04/2019	19:20	S 14 45.110	W 177 09.133	1562	Fatu kapa (Futuna)	x					GBT3 to collect Ifremeria 1
Préleveur In-situ de Fluide (PIF)		18/04/2019	19:37	S 14 45.109	W 177 09.132	1561	Fatu kapa (Futuna)		x				Take probe for PIF after Ifremeria 1 collection
Chemini		18/04/2019	19:40	S 14 45.110	W 177 09.132	1562	Fatu kapa (Futuna)		x				start PEP, both chemins
Chemini		18/04/2019	19:51	S 14 45.110	W 177 09.132	1561	Fatu kapa (Futuna)		x				Start cheminis
Chemini		18/04/2019	19:56	S 14 45.110	W 177 09.132	1561	Fatu kapa (Futuna)		x				Start PEP on Alviniconcha1 point 2. Start cheminis, temperature 21,4°C

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		18/04/2019	20:02	S 14 45.110	W 177 09.133	1561	Fatu kapa (Futuna)		x				Start PEP Alviniconcha point3, start both cheminis
Préleveur In-situ de Fluide (PIF)	26	18/04/2019	20:06	S 14 45.111	W 177 09.131	1561	Fatu kapa (Futuna)		x				PIF start syringe 26 at 20h06
Grande Boite de collecte	2	18/04/2019	20:10	S 14 45.110	W 177 09.130	1561	Fatu kapa (Futuna)	x					Take GBT2 for Alviniconcha sampling
Chemini		18/04/2019	20:27	S 14 45.111	W 177 09.130	1562	Fatu kapa (Futuna)		x				Start chemini Fe and Sul
Aspirateur ^ faune	1	18/04/2019	20:34	S 14 45.110	W 177 09.131	1562	Fatu kapa (Futuna)	x					slurp in Bol1 area after prelevment Alviniconcha1
Aspirateur ^ faune	2	18/04/2019	20:37	S 14 45.110	W 177 09.131	1562	Fatu kapa (Futuna)	x					Bol2 on Ifremeria 1
Grande Boite de collecte	1	19/04/2019	24:26	S 14 45.157	W 177 09.232	1550	Fatu kapa (Futuna)	x					GBT01 microbiology anhydrite chimney
PEGAZ - Echantillonneur de gaz		19/04/2019	24:41	S 14 45.157	W 177 09.233	1550	Fatu kapa (Futuna)		x				Trigger BEG3
Seringue Titane	3	19/04/2019	24:53	S 14 45.157	W 177 09.232	1550	Fatu kapa (Futuna)		x				TID3 triggered
Seringue Titane	2	19/04/2019	24:59	S 14 45.156	W 177 09.232	1551	Fatu kapa (Futuna)		x				TID2 triggered

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	1	19/04/2019	01:06	S 14 45.157	W 177 09.233	1551	Fatu kapa (Futuna)		x				PIF serynge 1
Préleveur In-situ de Fluide (PIF)	12	19/04/2019	01:45	S 14 45.152	W 177 09.229	1551	Fatu kapa (Futuna)		x				PIF 12
Panier	1	19/04/2019	01:56	S 14 45.154	W 177 09.229	1551	Fatu kapa (Futuna)			x			Chimney border CHU-PL08-01
Aspirateur ˆ faune	3	19/04/2019	02:28	S 14 45.164	W 177 09.256	1544	Fatu kapa (Futuna)	x					Sucction sampler jar 3
Aspirateur ˆ faune	4	19/04/2019	02:42	S 14 45.165	W 177 09.257	1545	Fatu kapa (Futuna)	x					ASPI-bol4 annelidés et paralvinella
Carottier a lame Grand		19/04/2019	03:46	S 14 45.101	W 177 09.278	1545	Fatu kapa (Futuna)	x		x			Corring
Panier		19/04/2019	04:11	S 14 45.120	W 177 09.297	1538	Fatu kapa (Futuna)			x			piece of silica plate collected: PL08-02.
Panier	3	19/04/2019	04:33	S 14 45.115	W 177 09.275	1546	Fatu kapa (Futuna)			x			CHU-PL08-03 : small piece of sulfides
Panier	4	19/04/2019	04:34	S 14 45.117	W 177 09.276	1546	Fatu kapa (Futuna)			x			CHU-PL08-04 : very oxidized chimney
Panier	5	19/04/2019	05:27	S 14 45.349	W 177 09.364	1552	Fatu kapa (Futuna)			x			Rock sampling CHU-PL08-05

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Panier	6	19/04/2019	05:36	S 14 45.349	W 177 09.362	1555	Fatu kapa (Futuna)			x			Rock sampling
Panier	7	19/04/2019	05:57	S 14 45.426	W 177 09.364	1572	Fatu kapa (Futuna)			x			Rock sampling CHU-PL08-07
Aspirateur ^ faune	7	19/04/2019	08:33	S 14 44.236	W 177 09.964	1547	Fatu kapa (Futuna)	x					Starting suction sampler in jar #7
Préleveur In-situ de Fluide (PIF)	27	19/04/2019	09:39	S 14 44.242	W 177 09.960	1548	Fatu kapa (Futuna)		x				Starting PIF 27
Chemini		19/04/2019	09:39	S 14 44.243	W 177 09.960	1548	Fatu kapa (Futuna)		x				End PIF 27. Start CHEMINI (point 1) Fe & S (6-7°C)
Chemini		19/04/2019	09:44	S 14 44.243	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start CHEMINI (point 2) Fe & S (5.5-9.5°C)
Chemini		19/04/2019	09:49	S 14 44.243	W 177 09.961	1548	Fatu kapa (Futuna)		x				Start CHEMINI point 3, Fe & S (4-7°C)
Grande Boite de collecte	5	19/04/2019	10:01	S 14 44.243	W 177 09.960	1548	Fatu kapa (Futuna)	x					Sampling Ifremeria : direct in GBT 5 !
Chemini		19/04/2019	10:19	S 14 44.244	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start Chemini Fe & S point 1 after sampling Ifremeria 2 (7-9°C)
Chemini		19/04/2019	10:23	S 14 44.244	W 177 09.961	1548	Fatu kapa (Futuna)		x				Start Chemini Fe & S point 2 after sampling Ifremeria 2 (9-11°C)

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		19/04/2019	10:28	S 14 44.244	W 177 09.959	1548	Fatu kapa (Futuna)		x				Start Chemini Fe & S point 1 Alviniconcha 2 (8-10.5°C). Start electrodes

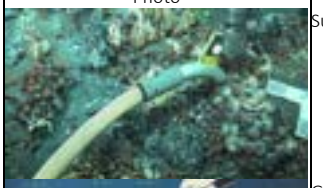
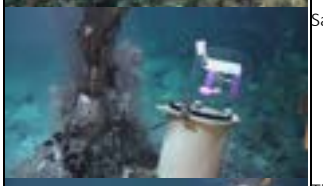
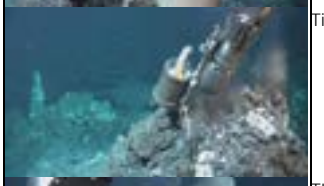
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		19/04/2019	10:32	S 14 44.244	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start Chemini Fe & S point 2 Alviniconcha 2
Préleveur In-situ de Fluide (PIF)	28	19/04/2019	10:34	S 14 44.244	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start PIF 28 (11°C)
Chemini		19/04/2019	10:37	S 14 44.245	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start Chemini Fe & S point 3 Alviniconcha 2 (8°C)
Grande Boite de collecte	4	19/04/2019	10:52	S 14 44.245	W 177 09.960	1547	Fatu kapa (Futuna)	x					Start sampling Alviniconcha 2 (scoop 1)
Chemini		19/04/2019	11:12	S 14 44.243	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start CHEMIN Fe-H2S aviniconcha 2 point 1 after sampling (8°C)
Chemini		19/04/2019	11:17	S 14 44.244	W 177 09.960	1548	Fatu kapa (Futuna)		x				Start CHEMIN Fe-H2S aviniconcha 2 point 2 after sampling (8°C)
Panier		19/04/2019	11:24	S 14 44.243	W 177 09.961	1548	Fatu kapa (Futuna)			x			Rock sample with cirripetes on basket (CHU-PL08-08)
Petite Boite de collecte	7	19/04/2019	11:35	S 14 44.232	W 177 09.965	1548	Fatu kapa (Futuna)			x			Rock sampling for microbiology CHU-PL08-PBT7
Grande Boite de collecte	6	19/04/2019	11:48	S 14 44.232	W 177 09.967	1548	Fatu kapa (Futuna)			x			Rock sampling : CHU-PL08-GBT6
Seringue Titane	1	19/04/2019	12:04	S 14 44.232	W 177 09.967	1548	Fatu kapa (Futuna)		x				Trigger of CHU-PL08-TiD1

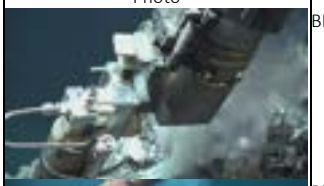
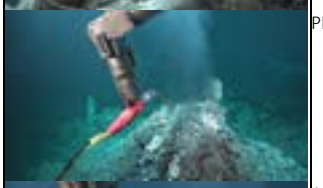
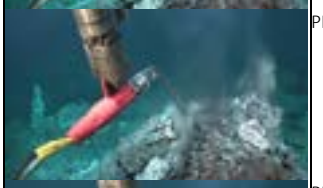
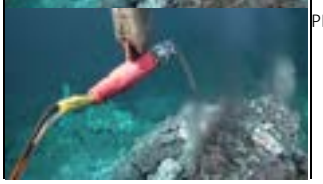
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Seringue Titane		19/04/2019	12:08	S 14 44.233	W 177 09.966	1548	Fatu kapa (Futuna)		x				CHU-PL08-TiG3 triggered
Préleveur In-situ de Fluide (PIF)	13	19/04/2019	12:15	S 14 44.231	W 177 09.967	1548	Fatu kapa (Futuna)		x				CHU-PL08-PIF13 started trigger (T=109-127°)
Chemini		19/04/2019	12:15	S 14 44.231	W 177 09.967	1548	Fatu kapa (Futuna)		x				Start CHEMINI Fe-H2S
Préleveur In-situ de Fluide (PIF)	24	19/04/2019	12:54	S 14 44.231	W 177 09.963	1548	Fatu kapa (Futuna)		x				Start CHU-PL08-PIF24 and CHEMIN Fe-H2S (3-9°C passage à 12)
Panier		20/04/2019	24:48	S 14 44.991	W 177 09.047	1565	Fatu kapa (Futuna)			x			gorgone on small rock
Panier		20/04/2019	03:28	S 14 45.111	W 177 09.100	1566	Fatu kapa (Futuna)			x			Docking for cirrpeds sampling

Plongée : **728 – Futuna (Fati Ufu)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Sonde autonome multiparametre	1	20/04/2019	21:48	S 14 45.597	W 177 11.102	1518	FK Fati ufu 1				x		SPOT 1 started alviniconcha
Chemini		20/04/2019	23:06	S 14 45.597	W 177 11.112	1519	FK Fati ufu 1		x				chemini s f started alviniconcha 1 point 1 mesure chemini
Préleveur In-situ de Fluide (PIF)	25	20/04/2019	23:07	S 14 45.597	W 177 11.112	1519	FK Fati ufu 1		x				PIF seringue 25 alviniconcha 1 point chemini 1
Chemini		20/04/2019	23:11	S 14 45.598	W 177 11.114	1519	FK Fati ufu 1		x				Chemini f et s point 2 début
Chemini		20/04/2019	23:16	S 14 45.598	W 177 11.113	1519	FK Fati ufu 1		x				PEP started and start Cheminis F & S on point #3 Alviniconcha 3, T=7.3°C
Chemini		20/04/2019	23:22	S 14 45.598	W 177 11.114	1519	FK Fati ufu 1		x				Cheminis F & S started on point #1 Ifremeria 1, PIF syringe 26 triggered, T = 8°C
Chemini		20/04/2019	23:27	S 14 45.596	W 177 11.112	1519	FK Fati ufu 1		x				Chemini F & S started on point #2 Ifremeria 1, T = 6.6°C
Chemini		20/04/2019	23:33	S 14 45.598	W 177 11.113	1519	FK Fati ufu 1		x				Cheminis F & S started on point #3 Ifremeria 1, T = 17.6°C
Grande Boite de collecte	4	20/04/2019	23:43	S 14 45.601	W 177 11.113	1519	FK Fati ufu 1	x					GBT4 opened

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Aspirateur ^ faune	1	21/04/2019	24:01	S 14 45.599	W 177 11.112	1519	FK Fatiufu 1	x					Suction sampler jar #1
Grande Boite de collecte	2	21/04/2019	24:07	S 14 45.597	W 177 11.114	1519	FK Fatiufu 1	x					GBT2 opened ready for Alviniconcha 1 sampling
Aspirateur ^ faune	2	21/04/2019	24:18	S 14 45.599	W 177 11.114	1519	FK Fatiufu 1	x					Suction started on jar #2
Chemini		21/04/2019	24:23	S 14 45.599	W 177 11.113	1519	FK Fatiufu 1		x				PEP started on point #1 after sampling Ifremeria 1, cheminis F & S started, electrods started
Chemini		21/04/2019	24:28	S 14 45.597	W 177 11.114	1519	FK Fatiufu 1		x				PEP started on point #2 after sampling Ifremeria 1, started Cheminis F & S, T = 8.2°C
Chemini		21/04/2019	24:33	S 14 45.596	W 177 11.112	1519	FK Fatiufu 1		x				Start Cheminis F & S on point #1 after sampling Alviniconcha 1, T = 5.3°C
Chemini		21/04/2019	24:38	S 14 45.599	W 177 11.115	1519	FK Fatiufu 1		x				PEP and Cheminis F & S started on point #2 after sampling Alviniconcha 1
Grande Boite de collecte	1	21/04/2019	01:20	S 14 45.588	W 177 11.070	1514	FK Fatiufu 1	x					Sampling for microbiology GBT1
Bouteille titane A (D) 750 ml	2	21/04/2019	01:51	S 14 45.586	W 177 11.069	1514	FK Fatiufu 1		x				TiD2 triggered
Bouteille titane A (D) 750 ml	3	21/04/2019	02:00	S 14 45.589	W 177 11.069	1514	FK Fatiufu 1		x				TID3 re-triggered

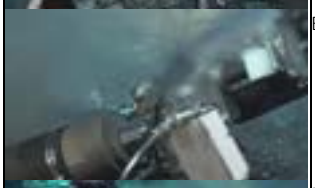
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
PEGAZ - Echantillonneur de gaz	4	21/04/2019	02:07	S 14 45.592	W 177 11.069	1514	FK Fatiufu 1		x				BEG4 triggered
Préleveur In-situ de Fluide (PIF)	1	21/04/2019	02:17	S 14 45.589	W 177 11.069	1515	FK Fatiufu 1		x				PIF 1 CHEMINIS grad :68-132
Chemini		21/04/2019	02:22	S 14 45.590	W 177 11.070	1515	FK Fatiufu 1		x				An other CHEMINIs in the same gradient
Préleveur In-situ de Fluide (PIF)	2	21/04/2019	02:24	S 14 45.590	W 177 11.070	1515	FK Fatiufu 1		x				PIF 2 in the same gradient
Préleveur In-situ de Fluide (PIF)	3	21/04/2019	02:26	S 14 45.589	W 177 11.068	1515	FK Fatiufu 1		x				PIF 3 gradient : 58-107
Chemini		21/04/2019	02:27	S 14 45.587	W 177 11.067	1515	FK Fatiufu 1		x				CHEMINIs started grad 2
Préleveur In-situ de Fluide (PIF)	4	21/04/2019	02:32	S 14 45.588	W 177 11.069	1515	FK Fatiufu 1		x				PIF 4
Préleveur In-situ de Fluide (PIF)	5	21/04/2019	02:34	S 14 45.588	W 177 11.070	1515	FK Fatiufu 1		x				PIF 5 grad 4 : 20-78
Chemini		21/04/2019	02:36	S 14 45.587	W 177 11.070	1515	FK Fatiufu 1		x				CHEMINIS
Préleveur In-situ de Fluide (PIF)	6	21/04/2019	02:40	S 14 45.586	W 177 11.069	1515	FK Fatiufu 1		x				PIF6

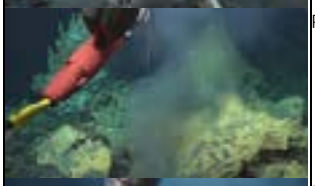
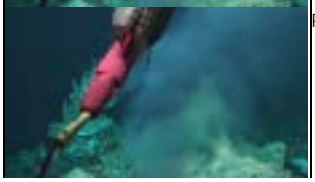
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	7	21/04/2019	02:42	S 14 45.587	W 177 11.069	1515	FK Fatiufu 1		x				PIF7 grad : 23-62
Préleveur In-situ de Fluide (PIF)	8	21/04/2019	02:43	S 14 45.588	W 177 11.069	1515	FK Fatiufu 1		x				PIF 8 CHEMINIS
Préleveur In-situ de Fluide (PIF)	9	21/04/2019	03:07	S 14 45.590	W 177 11.070	1515	FK Fatiufu 1		x				PIF9 grad5 chemini fe and S
Préleveur In-situ de Fluide (PIF)	10	21/04/2019	03:08	S 14 45.591	W 177 11.071	1515	FK Fatiufu 1		x				PIF 10 grad 5 T20°C
Préleveur In-situ de Fluide (PIF)	11	21/04/2019	03:15	S 14 45.588	W 177 11.069	1515	FK Fatiufu 1		x				PIF 11 grad 6 5-10°C
Préleveur In-situ de Fluide (PIF)	12	21/04/2019	03:15	S 14 45.588	W 177 11.070	1515	FK Fatiufu 1		x				PIF 12 grad6 chemini Fe and S
Panier-Geologie	1	21/04/2019	03:29	S 14 45.588	W 177 11.068	1515	FK Fatiufu 1			x			sulfide sampling
Aspirateur ˆ faune	3	21/04/2019	04:22	S 14 45.576	W 177 11.149	1519	FK Fatiufu 1	x					sampling worms Bol 3
Aspirateur ˆ faune	4	21/04/2019	04:35	S 14 45.484	W 177 11.179	1526	FK Fatiufu 1	x					sampling worms tower Bol 4 paralvinella
Panier-Geologie	2	21/04/2019	05:20	S 14 45.598	W 177 11.115	1520	FK Fatiufu 1	x		x			sampling bernacles with rock

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Petite Boite de collecte	7	21/04/2019	08:03	S 14 45.920	W 177 11.303	1500	FK Fatiufu 1	x					PBT7 opened

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Aspirateur ^ faune	8	21/04/2019	08:34	S 14 45.921	W 177 11.302	1500	FK Fatiufu 1	x					Suction sampler started
Panier-Geologie	3	21/04/2019	08:51	S 14 45.921	W 177 11.303	1501	FK Fatiufu 1			x			Pick up rock CHU-PL09-03
Panier-Geologie	4	21/04/2019	09:52	S 14 45.501	W 177 11.286	1535	FK Fatiufu 1			x			Rock Sampling CHU-PL09-04
Panier-Geologie	5	21/04/2019	11:06	S 14 45.395	W 177 11.031	1534	FK Fatiufu 1			x			CHU-PL09-05 rock sampling
Chemini		21/04/2019	13:19	S 14 45.326	W 177 10.971	1516	FK Fatiufu 1		x				Starting Chemini Fe Sulfur Point 1 Ifremeria 2
Préleveur In-situ de Fluide (PIF)	27	21/04/2019	13:20	S 14 45.326	W 177 10.971	1516	FK Fatiufu 1		x				Starting PIF seringe 27 temperature 12.5
Chemini		21/04/2019	13:24	S 14 45.325	W 177 10.970	1516	FK Fatiufu 1		x				Starting Chemini Fe Sulfur Point 2 Ifremeria 2 temperature 3.45
Chemini		21/04/2019	13:29	S 14 45.326	W 177 10.971	1516	FK Fatiufu 1		x				Starting Chemini Fe Sulfur Point 3 Ifremeria 2 temperature 6
Grande Boite de collecte	3	21/04/2019	13:38	S 14 45.325	W 177 10.968	1516	FK Fatiufu 1	x					Sampling Ifremeria into GBT3
Aspirateur ^ faune	5	21/04/2019	13:47	S 14 45.326	W 177 10.969	1516	FK Fatiufu 1	x					Suction sampling into Jar 5

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Chemini		21/04/2019	13:54	S 14 45.327	W 177 10.970	1516	FK Fatiufu 1		x				Starting PEP electrode Fe Sulfur Point 1 after sampling Ifremeria 2
Chemini		21/04/2019	13:59	S 14 45.325	W 177 10.970	1516	FK Fatiufu 1		x				Starting PEP electrode Fe Sulfur Point 2 after sampling Ifremeria 2
Chemini		21/04/2019	15:12	S 14 45.587	W 177 11.081	1519	FK Fatiufu 1		x				Chemini Fe & S started on alviniconcha 2
Préleveur In-situ de Fluide (PIF)	28	21/04/2019	15:12	S 14 45.589	W 177 11.082	1519	FK Fatiufu 1		x				PIF started - temp=4°C
Chemini		21/04/2019	15:16	S 14 45.590	W 177 11.082	1519	FK Fatiufu 1		x				PEP & Chemine Fe & S started #2 - temp=19°C
Chemini		21/04/2019	15:21	S 14 45.590	W 177 11.079	1519	FK Fatiufu 1		x				PEP & Chemini Fe & S started #3 - temp=5°C
Petite Boite de collecte	4	21/04/2019	15:32	S 14 45.589	W 177 11.082	1519	FK Fatiufu 1	x					Sampling of alviniconcha in PBT#4
Aspirateur ^ faune	6	21/04/2019	15:54	S 14 45.587	W 177 11.082	1520	FK Fatiufu 1	x					Suction sampling on rocks: jar#6
Chemini		21/04/2019	16:00	S 14 45.587	W 177 11.080	1520	FK Fatiufu 1		x				PEP & chemini Fe&S started: #1 after sampling Temp=16°C
Chemini		21/04/2019	16:05	S 14 45.587	W 177 11.080	1520	FK Fatiufu 1		x				PEP Chemini Fe&S #2 after sampling Temp=5°C

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Aspirateur ^ faune	7	21/04/2019	16:33	S 14 45.590	W 177 11.093	1520	FK Fatiufu 1	x					Sampling of white polynidae near Fati Ufu 6 in jar#7
Panier		21/04/2019	17:03	S 14 45.600	W 177 11.112	1520	FK Fatiufu 1	x		x			Rock (big) with cirripeds sampling #2
Aspirateur ^ faune	7	21/04/2019	17:26	S 14 45.458	W 177 11.178	1531	FK Fatiufu 1	x					Suction sampling of polynidae in jar#7
Sonde autonome multiparametre	12	21/04/2019	18:55	S 14 45.576	W 177 11.141	1517	FK Fatiufu 1				x		SPOT12 shimmering = on polychate location
Grande Boite de collecte	7	21/04/2019	19:44	S 14 45.569	W 177 10.983	1498	FK Fatiufu 1			x			GBT 7 opened
Bouteille titane A (D) 750 ml	1	21/04/2019	20:13	S 14 45.570	W 177 10.983	1498	FK Fatiufu 1		x				TiD1 ended
Bouteille titane B (G) 750 ml	3	21/04/2019	20:27	S 14 45.571	W 177 10.983	1498	FK Fatiufu 1		x				TiG3 ended
PEGAZ - Echantillonneur de gaz	2	21/04/2019	20:34	S 14 45.572	W 177 10.984	1498	FK Fatiufu 1		x				BEG2 triggered
Préleveur In-situ de Fluide (PIF)	13	21/04/2019	20:47	S 14 45.570	W 177 10.983	1498	FK Fatiufu 1		x				PIF 13 gradient : 63-114 CHEMINIS
Préleveur In-situ de Fluide (PIF)	14	21/04/2019	20:54	S 14 45.567	W 177 10.983	1498	FK Fatiufu 1		x				PIF 14 97-107

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	15	21/04/2019	20:55	S 14 45.572	W 177 10.985	1498	FK Fatiufu 1		x				PIF 15 98-148 CHEMINIS
Préleveur In-situ de Fluide (PIF)	16	21/04/2019	21:01	S 14 45.570	W 177 10.983	1498	FK Fatiufu 1		x				PIF 16 106-123
Préleveur In-situ de Fluide (PIF)	17	21/04/2019	21:02	S 14 45.571	W 177 10.983	1498	FK Fatiufu 1		x				PIF 17 54-80 CHEMINIS
Préleveur In-situ de Fluide (PIF)	18	21/04/2019	21:08	S 14 45.572	W 177 10.985	1498	FK Fatiufu 1		x				PIF 18 54-70
Préleveur In-situ de Fluide (PIF)	19	21/04/2019	21:10	S 14 45.572	W 177 10.983	1498	FK Fatiufu 1		x				PIF 19 : 44-50
Préleveur In-situ de Fluide (PIF)	20	21/04/2019	21:10	S 14 45.571	W 177 10.984	1498	FK Fatiufu 1		x				PIF 20 : 28-55 CHEMINIS
Préleveur In-situ de Fluide (PIF)	21	21/04/2019	21:18	S 14 45.571	W 177 10.983	1498	FK Fatiufu 1		x				PIF 21 19-26
Préleveur In-situ de Fluide (PIF)	22	21/04/2019	21:19	S 14 45.571	W 177 10.984	1498	FK Fatiufu 1		x				PIF 22 12-29 CHEMINIS
Préleveur In-situ de Fluide (PIF)	23	21/04/2019	21:25	S 14 45.570	W 177 10.984	1498	FK Fatiufu 1		x				PIF 23 7-11
Préleveur In-situ de Fluide (PIF)	24	21/04/2019	21:26	S 14 45.571	W 177 10.983	1498	FK Fatiufu 1		x				PIF 24 4-15 CHEMINIS

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	6	22/04/2019	04:49	S 14 45.598	W 177 11.101	1518	FK Fatiufu 1	x					First collection in claw

Plongée : **729 – Futuna (Kulo lasi)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Sonde autonome multiparametre	1	23/04/2019	12:21	S 14 56.540	W 177 15.008	1414	Kulo Lasi				x		SPOT1 start
Chemini		23/04/2019	13:18	S 14 56.538	W 177 15.007	1414	Kulo Lasi		x				PEP started on point #1 Siboglonids, Cheminis F & S started, T=5°C
Préleveur In-situ de Fluide (PIF)	25	23/04/2019	13:19	S 14 56.537	W 177 15.007	1414	Kulo Lasi		x				PIF syringe triggered on point #1 Siboglonid
Chemini		23/04/2019	13:23	S 14 56.538	W 177 15.007	1414	Kulo Lasi		x				End Cheminis F & S on point #1, start Cheminis F & S on point #2, T=6.4°C
Chemini		23/04/2019	13:27	S 14 56.538	W 177 15.008	1414	Kulo Lasi		x				End Cheminis F & S on point #2, start Cheminis F & S on point #3, T=5°C
Aspirateur ˆ faune	1	23/04/2019	13:32	S 14 56.538	W 177 15.007	1414	Kulo Lasi	x					Suction sampler on jar 1
Grande Boite de collecte	1	23/04/2019	13:42	S 14 56.538	W 177 15.007	1414	Kulo Lasi	x					Placing worms in GBT1
Aspirateur ˆ faune	2	23/04/2019	13:52	S 14 56.538	W 177 15.006	1413	Kulo Lasi	x					Start suction sampler jar 2
Préleveur In-situ de Fluide (PIF)	26	23/04/2019	14:05	S 14 56.538	W 177 15.006	1413	Kulo Lasi		x				PIF 26 triggered, T=21.5°C

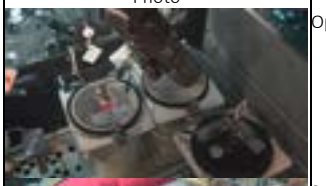
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		23/04/2019	14:06	S 14 56.539	W 177 15.006	1413	Kulo Lasi		x				Cheminis F & S started in diffusing area siboglonids
Aspirateur ^ faune	3	23/04/2019	14:13	S 14 56.537	W 177 15.004	1412	Kulo Lasi	x					jar 3 for succion sampler on mussel for larvae and postlarvae
Panier		23/04/2019	14:32	S 14 56.539	W 177 15.007	1414	Kulo Lasi			x			picking rock with cirripedes and mussels
Sonde autonome multiparametre	11	23/04/2019	14:37	S 14 56.538	W 177 15.006	1413	Kulo Lasi				x		spot 11
Panier	3	23/04/2019	15:38	S 14 56.746	W 177 15.233	1270	Kulo Lasi			x			CHU-PL10-03
Chemini		23/04/2019	16:55	S 14 56.468	W 177 15.550	1371	Kulo Lasi		x				start chemini Fe and S on point 1
Préleveur In-situ de Fluide (PIF)	27	23/04/2019	16:58	S 14 56.468	W 177 15.549	1371	Kulo Lasi		x				PIF 27 started
Chemini		23/04/2019	16:59	S 14 56.468	W 177 15.549	1371	Kulo Lasi		x				PEP started and cheminis point 2
Chemini		23/04/2019	17:04	S 14 56.467	W 177 15.549	1371	Kulo Lasi		x				Start cheminis point 3
Grande Boite de collecte	2	23/04/2019	17:11	S 14 56.468	W 177 15.551	1371	Kulo Lasi	x					starting Ifremeria collection in GBT 2

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		23/04/2019	17:21	S 14 56.470	W 177 15.551	1371	Kulo Lasi		x				PEP started and chemini Fe and S point 1 after sampling.
Chemini		23/04/2019	17:26	S 14 56.470	W 177 15.553	1371	Kulo Lasi		x				Cheminis started on point 2 after sampling
Aspirateur ^ faune	4	23/04/2019	17:31	S 14 56.468	W 177 15.552	1371	Kulo Lasi	x					Aspi 4 started
Aspirateur ^ faune	5	23/04/2019	17:37	S 14 56.469	W 177 15.555	1371	Kulo Lasi	x					Aspi 5 on Paralvinella started
Panier		23/04/2019	17:47	S 14 56.469	W 177 15.556	1371	Kulo Lasi			x			Basalt with cirripeds collected, CHU-PL10-04
Aspirateur ^ faune	6	23/04/2019	18:02	S 14 56.384	W 177 15.565	1407	Kulo Lasi	x					Aspi 6 on mussels
Panier		23/04/2019	18:10	S 14 56.387	W 177 15.567	1408	Kulo Lasi			x			collecting one block with small siboglinids, CHU-PL10-05
Panier		23/04/2019	18:17	S 14 56.388	W 177 15.566	1407	Kulo Lasi			x			Basalt block with stalked cirripeds collected, CHU-PL10-06
Grande Boite de collecte	4	23/04/2019	22:52	S 14 54.950	W 177 14.038	1409	Kulo Lasi			x			Silica chimney sampling 1st scoop inchemistry GBT#4
Panier		24/04/2019	24:55	S 14 55.727	W 177 13.192	1459	Kulo Lasi	x					sampling sunken wood

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Bouteille titane A (D) 750 ml	3	24/04/2019	02:49	S 14 56.343	W 177 13.161	1442	Kulo Lasi		x				Ti D3 OK
Bouteille titane A (D) 750 ml	2	24/04/2019	02:52	S 14 56.346	W 177 13.346	1439	Kulo Lasi		x				Ti D2 OK

Plongée : **730 – Tow Cam**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte	1	25/04/2019	23:21	S 20 19.082	W 176 08.265	2710	Tow Cam TC1	x					Open GBT1
Préleveur d'Eau par Pompage (PEP)		26/04/2019	24:25	S 20 19.082	W 176 08.262	2710	Tow Cam TC1		x				Starting PEP
Chemini		26/04/2019	24:26	S 20 19.081	W 176 08.263	2711	Tow Cam TC1		x				Starting chemini Fe Sulfur
Préleveur In-situ de Fluide (PIF)	25	26/04/2019	24:27	S 20 19.081	W 176 08.263	2710	Tow Cam TC1		x				Starting PIF 25
Chemini		26/04/2019	24:32	S 20 19.083	W 176 08.262	2711	Tow Cam TC1		x				Starting chemini
Chemini		26/04/2019	24:38	S 20 19.078	W 176 08.261	2710	Tow Cam TC1		x				Starting 2 cheminis
Grande Boite de collecte	3	26/04/2019	24:45	S 20 19.079	W 176 08.261	2710	Tow Cam TC1	x					sampling mussels 1
Grande Boite de collecte	2	26/04/2019	24:58	S 20 19.080	W 176 08.262	2711	Tow Cam TC1	x					opening GBT2
Bouteille NISKIN		26/04/2019	01:25	S 20 19.080	W 176 08.314	2679	Tow Cam TC1		x				Niskin triggered

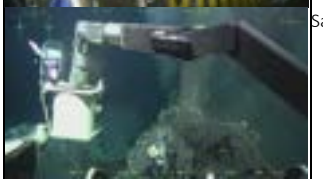
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Aspirateur ^ faune	1	26/04/2019	03:59	S 20 18.981	W 176 08.205	2716	Tow Cam TC1	x					Sampling of Polynoidea on cheminy in Jar 1
Aspirateur ^ faune	2	26/04/2019	04:04	S 20 18.982	W 176 08.207	2716	Tow Cam TC1	x					Sampling of scaleworms in jar 2 and 3
Bouteille titane A (D) 750 ml	2	26/04/2019	04:27	S 20 18.974	W 176 08.206	2715	Tow Cam TC1		x				declenchement titanium sampling D2
PEGAZ - Echantillonneur de gaz	4	26/04/2019	04:40	S 20 18.974	W 176 08.205	2715	Tow Cam TC1		x				BEG sampling BEG4
Aspirateur ^ faune	4	26/04/2019	05:11	S 20 19.074	W 176 08.245	2717	Tow Cam TC1	x					Sampling Paralvinella in Jar 4
Aspirateur ^ faune	6	26/04/2019	05:26	S 20 19.051	W 176 08.215	2696	Tow Cam TC1	x					Suction on anemones and polynoids in Jar 6

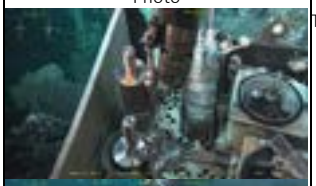
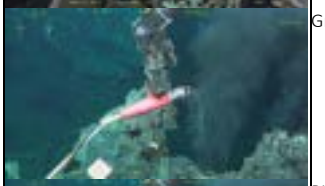
Plongée : **731 - ABE**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Sonde autonome multiparametre	1	26/04/2019	21:16	S 20 45.788	W 176 11.479	2153	ABE				x		SPOT1 ALviniconcha shimmering area with shrimps
Préleveur In-situ de Fluide (PIF)	25	26/04/2019	22:35	S 20 45.784	W 176 11.479	2153	ABE		x				PIF syringe 25 started on point #1
Chemini		26/04/2019	22:35	S 20 45.784	W 176 11.479	2153	ABE		x				Cheminis Fe & S started on point #1 Ifremeria 1
Chemini		26/04/2019	22:41	S 20 45.780	W 176 11.479	2153	ABE		x				Cheminis Fe & S started on point #2 Ifremeria 1, T = 4°C
Chemini		26/04/2019	22:46	S 20 45.783	W 176 11.479	2153	ABE		x				Cheminis Fe & S started on point #3 Ifremeria 1, T = 5°C
Chemini		26/04/2019	22:53	S 20 45.782	W 176 11.478	2153	ABE		x				Cheminis Fe & S started on point #1 Alviniconcha 1, T = 16°C
Chemini		26/04/2019	23:01	S 20 45.783	W 176 11.481	2153	ABE		x				Cheminis Fe & S started on point #2 Alviniconcha 1, T = 8°C
Préleveur In-situ de Fluide (PIF)	26	26/04/2019	23:02	S 20 45.782	W 176 11.480	2153	ABE		x				PIF syringe 26 triggered on point #2 Alviniconcha 1
Chemini		26/04/2019	23:06	S 20 45.783	W 176 11.478	2153	ABE		x				Cheminis Fe & S started on point #3 Alviniconcha 1, T = 11°C

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte	2	26/04/2019	23:25	S 20 45.784	W 176 11.479	2153	ABE	x					GBT2 opened
Aspirateur ^ faune	1	26/04/2019	23:54	S 20 45.785	W 176 11.480	2153	ABE	x					Start suction sampler jar1
Chemini		27/04/2019	24:03	S 20 45.785	W 176 11.480	2154	ABE		x				Cheminis F & S started on point #1 Mussels 1, PIF syringe 27, T = 2.6°C
Chemini		27/04/2019	24:09	S 20 45.781	W 176 11.478	2154	ABE		x				PEP started, Cheminis F & S started on point #2 Mussels 1, T = 2.76°C
Chemini		27/04/2019	24:14	S 20 45.785	W 176 11.481	2154	ABE		x				PEP started, Cheminis F & S started on point #3 Mussels 1, T = 2.66°C
Grande Boite de collecte	1	27/04/2019	24:22	S 20 45.785	W 176 11.481	2154	ABE	x					GBT1 open in drawer
Aspirateur ^ faune	2	27/04/2019	24:33	S 20 45.782	W 176 11.482	2154	ABE	x					Suction sampler started on jar 2
Chemini		27/04/2019	24:39	S 20 45.784	W 176 11.480	2154	ABE		x				Start Chemini Fe & S on point #1 after sampling mussels 1,T = 3.14°C
Chemini		27/04/2019	24:44	S 20 45.781	W 176 11.479	2154	ABE		x				Start Chemini Fe & S on point #2 after sampling mussels 1, T = 5°C
Grande Boite de collecte	3	27/04/2019	01:11	S 20 45.785	W 176 11.481	2149	ABE	x					GBT 3 opened

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Aspirateur ^ faune	3	27/04/2019	01:21	S 20 45.786	W 176 11.480	2153	ABE	x					Suction sampler on jar 3 started
Chemini		27/04/2019	01:28	S 20 45.784	W 176 11.478	2153	ABE		x				Cheminis Fe & S started on point #1 after sampling Alviniconcha 1, PEP wheel stopped, T = 12°C
Chemini		27/04/2019	01:33	S 20 45.782	W 176 11.478	2153	ABE		x				PEP started, cheminis Fe & S started on point #2 after sampling Alviniconcha 1, T = 15°C
Chemini		27/04/2019	01:41	S 20 45.783	W 176 11.480	2153	ABE		x				Cheminis Fe & S started on point #1 after sampling Ifremeria 1, T = 4.5°C
Chemini		27/04/2019	01:46	S 20 45.784	W 176 11.478	2153	ABE		x				PEP started on point #2 after sampling Ifremeria 1, T = 6°C
Aspirateur ^ faune	4	27/04/2019	01:57	S 20 45.788	W 176 11.478	2154	ABE	x					Jar 4 with shrimps
Aspirateur ^ faune	5	27/04/2019	02:01	S 20 45.788	W 176 11.480	2153	ABE	x					on jar 5
Aspirateur ^ faune	6	27/04/2019	02:23	S 20 45.762	W 176 11.526	2127	ABE	x					start jar 6
Grande Boite de collecte	4	27/04/2019	03:24	S 20 45.668	W 176 11.448	2137	ABE	x					Sampling chimney into GBT4

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Bouteille titane B (G) 750 ml	3	27/04/2019	03:54	S 20 45.668	W 176 11.447	2138	ABE		x				Taking titanium syringe D3
Préleveur In-situ de Fluide (PIF)	1	27/04/2019	04:22	S 20 45.668	W 176 11.448	2137	ABE		x				Grad1 : 96-112 PIF1 CHEMINIS
Préleveur In-situ de Fluide (PIF)	2	27/04/2019	04:28	S 20 45.666	W 176 11.447	2137	ABE		x				PIF2 : seawater?
Préleveur In-situ de Fluide (PIF)	3	27/04/2019	04:32	S 20 45.666	W 176 11.447	2137	ABE		x				PIF 3 and Cheminis : 50-66
Préleveur In-situ de Fluide (PIF)	4	27/04/2019	04:37	S 20 45.667	W 176 11.448	2137	ABE		x				PIF 4 : seawater?
Préleveur In-situ de Fluide (PIF)	5	27/04/2019	04:39	S 20 45.666	W 176 11.447	2137	ABE		x				PIF5 Cheminis grad 3 : 4-16
Panier-Geologie	1	27/04/2019	04:47	S 20 45.667	W 176 11.447	2137	ABE			x			Rock sampling few pieces of sulfides. CHU-PL12-01
Panier-Geologie	2	27/04/2019	05:21	S 20 45.786	W 176 11.479	2151	ABE	x		x			Rock sampling with cirripede and a mussel CHU-PL12-02. In two piece in the basket
Aspirateur ˆ faune	7	27/04/2019	05:58	S 20 45.766	W 176 11.530	2129	ABE	x					start ASPI 7 on polynoids
Aspirateur ˆ faune	8	27/04/2019	06:04	S 20 45.766	W 176 11.530	2129	ABE	x					Start ASPI 8 on Paralvinella

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Sonde autonome multiparametre	1	27/04/2019	07:40	S 20 45.797	W 176 11.489	2144	ABE				x		SPOT1
Sonde autonome multiparametre	14	27/04/2019	17:05	S 20 45.992	W 176 11.594	2133	ABE				x		SPOT 14 On mussels on the top

CHUBACARC
Résumé de plongée

Plongée : 732 - 13

Date : **11/05/2019**

Observateur(s) :

Date	Heure	Observateur(s)
11/05/2019	20:00	BONHOMME Francois
11/05/2019	22:00	L'HARIDON Stéphane
12/05/2019	24:00	THIEBAUT Eric
12/05/2019	02:00	KUAMA Darren
12/05/2019	04:00	BROQUET Thomas
12/05/2019	06:00	LELAYEC Victor
12/05/2019	08:00	MARY Jean
12/05/2019	10:00	MICHEL Loic
12/05/2019	12:00	ARNAUD-HAOND Sophie
12/05/2019	14:00	LEPORT Anne-Sophie
12/05/2019	16:00	SCALABRIN Carla
12/05/2019	18:00	SCALABRIN Carla
12/05/2019	20:00	TASIEMSKI Aurélie
12/05/2019	22:00	TRAN LU Y Adrien
13/05/2019	24:00	BOULART Cédric
13/05/2019	02:00	THIEBAUT Eric
13/05/2019	04:00	POITRIMOL Camille
13/05/2019	06:00	CUEFF-GAUCHARD Valérie
13/05/2019	08:00	BONHOMME Francois
13/05/2019	10:00	TRAN LU Y Adrien
13/05/2019	12:00	ARNAUD-HAOND Sophie
13/05/2019	14:00	KUAMA Darren
13/05/2019	16:00	SCALABRIN Carla
13/05/2019	18:00	SCALABRIN Carla
13/05/2019	20:00	MARY Jean
13/05/2019	22:00	MICHEL Loic
14/05/2019	24:00	LEPORT Anne-Sophie
14/05/2019	02:00	BOULART Cédric
14/05/2019	04:00	BROQUET Thomas
14/05/2019	06:00	ROUXEL Olivier

Station : **Zone TVG150 (Woodlark)**
Submersible : **Victor 6000**
Latitude : **S 09 47.900**
Longitude: **E 155 03.200**
Localités prospectées :**Zone TVG150 (Woodlark)**
Objectifs : MMR Transect on the TGV 150 zone (Woodlark) for microbathymetry

Bilan des opérations

0 Opérations de prélèvement
0 Mesures
0 Mouillages
0 Images

Bilan de la plongée : 11/05/19 21:41 – ROV on the seabed – 14/05/19 06:10 - ROV on lift

Rapport chronologique :

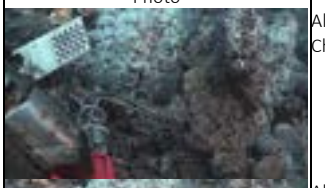
Date	Heure	Localité	Latitude	Longitude	Prof(m)	Photo	Commentaire
11/05/19	19:41	Zone TVG150 (Woodlark)	S 09 48.660	E 155 03.124	4		rov at sea

Plongée : **733 – Pacmanus (Snowcap, Fenway, BigPapi)**

Liste des opérations :

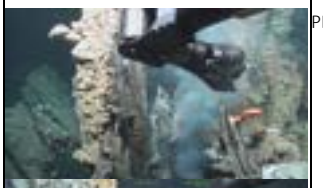
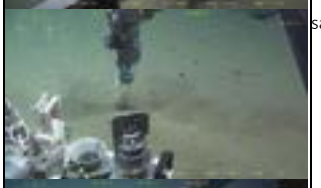
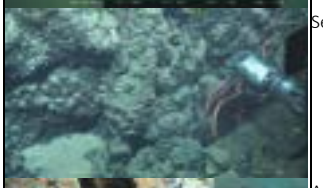
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)		16/05/2019	10:25	S 03 43.691	E 151 40.213	1640	SnowCap dome		x				Chemini deployment
Préleveur In-situ de Fluide (PIF)	4	16/05/2019	10:27	S 03 43.691	E 151 40.213	1640	SnowCap dome		x		x		Bathymodiolus 1 point 1 Chemini S and PIF syringe 2 started - Tp = 3.60
Préleveur In-situ de Fluide (PIF)	5	16/05/2019	10:34	S 03 43.691	E 151 40.213	1640	SnowCap dome		x		x		Bathymodiolus 1 point 2 chemini S and PIF syringe 3 started (Tp= 4.0)
Préleveur In-situ de Fluide (PIF)	4	16/05/2019	10:40	S 03 43.690	E 151 40.214	1640	SnowCap dome		x		x		Bathymodiolus 1 point 2 chemini S and PIF syringe 4 started (Tp= 4.04)
Préleveur In-situ de Fluide (PIF)	6	16/05/2019	10:49	S 03 43.691	E 151 40.214	1640	SnowCap dome		x		x		Bathymodiolus 1 point 1 chemini S and PIF syringe 5 ended (Tp= 3.15-4.95)
Préleveur In-situ de Fluide (PIF)	6	16/05/2019	10:50	S 03 43.691	E 151 40.213	1640	SnowCap dome		x		x		Bathymodiolus 1 point 3 chemini S and PIF syringe 6 started (Tp= 3.49)
Grande Boite de collecte	1	16/05/2019	11:01	S 03 43.691	E 151 40.213	1640	SnowCap dome	x					Opening of GBT1
Aspirateur ^ faune		16/05/2019	11:27	S 03 43.691	E 151 40.214	1640	SnowCap dome	x					Aspi1 on Bathymodiolus 1 started
Chemini		16/05/2019	11:34	S 03 43.691	E 151 40.214	1640	SnowCap dome				x		Bathymodiolus 1 after sampling point 1 Chemini S started (Tp = 6.66)

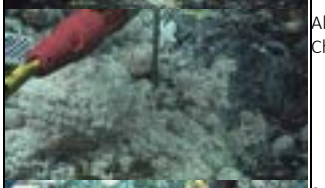
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		16/05/2019	11:40	S 03 43.691	E 151 40.213	1640	SnowCap dome				x		Bathymodiolus 1 after sampling point 2 Chemini S started (Tp = 3.9)
Chemini		16/05/2019	11:45	S 03 43.691	E 151 40.214	1640	SnowCap dome				x		Bathymodiolus 1 after sampling point 3 Chemini S started (Tp = 4.7)
Préleveur In-situ de Fluide (PIF)		16/05/2019	12:50	S 03 43.730	E 151 40.336	1708	Big Papi		x		x		Alviniconcha 1 point 1 Chemini S and PIF syringe 7 started (Tp = 16.25) - the probe position changed slightly après the picture
Préleveur In-situ de Fluide (PIF)	8	16/05/2019	12:56	S 03 43.731	E 151 40.335	1708	Big Papi		x		x		Alviniconcha 1 point 2 Chemini S and PIF syringe 8 started (Tp = 7.61)
Préleveur In-situ de Fluide (PIF)	9	16/05/2019	13:03	S 03 43.731	E 151 40.334	1708	Big Papi		x		x		Alviniconcha 1 point 3 Chemini S and PIF syringe 9 started (Tp = 13.83)
Grande Boite de collecte	2	16/05/2019	13:36	S 03 43.731	E 151 40.336	1708	Big Papi	x					Sampling of Alviniconcha 1 in GBT2 ended
Aspirateur ^ faune	2	16/05/2019	13:48	S 03 43.731	E 151 40.335	1708	Big Papi	x					Aspi bol 2 on Alviniconcha 1 ended
Aspirateur ^ faune	3	16/05/2019	14:04	S 03 43.731	E 151 40.335	1708	Big Papi	x					Aspi bol 3 for Branchypolynoe sample ended
Chemini		16/05/2019	14:11	S 03 43.731	E 151 40.335	1708	Big Papi				x		Alviniconcha 1 after sampling point 1 Chemini S Started T°C 11.5
Chemini		16/05/2019	14:20	S 03 43.730	E 151 40.335	1708	Big Papi				x		Alviniconcha 1 after sampling point 2 Chemini S started T°C 5.7

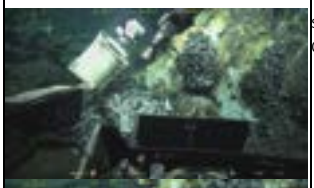
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		16/05/2019	14:27	S 03 43.732	E 151 40.334	1708	Big Papi				x		Alviniconcha 1 after sampling point 3 Chemini S started T°C 5.3 - 6
Chemini		16/05/2019	14:31	S 03 43.731	E 151 40.335	1708	Big Papi				x		Alviniconcha 1 after sampling point 3bis Chemini S started T°C 7.31 - 8.10
Bouteille titane B (G) 750 ml	1	16/05/2019	15:17	S 03 43.729	E 151 40.329	1704	Big Papi		x				start sampling hydrothermal fluid with Titanium seringe TiG1 Big Papi
Petite Boite de collecte	1	16/05/2019	15:39	S 03 43.728	E 151 40.330	1703	Big Papi			x			closing PBT1
Bouteille titane A (D) 750 ml	3	16/05/2019	15:54	S 03 43.730	E 151 40.330	1705	Big Papi		x				Start Second Titanium seringe collection of hydrothermal fluid (Ti D3)
Panier-Geologie	1	16/05/2019	16:08	S 03 43.728	E 151 40.329	1708	Big Papi			x			R1 Rock sampling on the base of the chimney where Titanium sampling carried of
Préleveur In-situ de Fluide (PIF)	10	16/05/2019	17:26	S 03 43.706	E 151 40.343	1703	Fenway		x		x		
Préleveur In-situ de Fluide (PIF)	11	16/05/2019	17:30	S 03 43.708	E 151 40.341	1703	Fenway		x		x		Ifremeria community 1 sampling area, CHEMINI PIF position 2
Préleveur In-situ de Fluide (PIF)	12	16/05/2019	17:35	S 03 43.707	E 151 40.342	1703	Fenway		x		x		Ifremeria community 1 sampling area, CHEMINI PIF position 3
Grande Boite de collecte	3	16/05/2019	18:01	S 03 43.707	E 151 40.342	1703	Fenway	x					end of sampling IFREMERIA community 1

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		16/05/2019	18:08	S 03 43.705	E 151 40.341	1703	Fenway				x		
Chemini		16/05/2019	18:11	S 03 43.705	E 151 40.341	1703	Fenway				x		Ifremeria community 1, Chemini position2 post sampling
Chemini		16/05/2019	18:16	S 03 43.706	E 151 40.341	1703	Fenway				x		Ifremeria community 1, Chemini position3 post sampling
Petite Boite de collecte	3	16/05/2019	18:41	S 03 43.704	E 151 40.344	1701	Fenway	x					sampling Oasisia PBT chimie 3
Grand carottier tube	1	16/05/2019	22:28	S 03 43.710	E 151 40.192	1635	SnowCap dome	x					core 1b
Grand carottier tube	2	16/05/2019	22:33	S 03 43.710	E 151 40.192	1635	SnowCap dome	x					surface disturbed core 2
Grand carottier tube	3	16/05/2019	22:40	S 03 43.710	E 151 40.192	1635	SnowCap dome	x					core 3
Grand carottier tube	4	16/05/2019	22:43	S 03 43.710	E 151 40.192	1635	SnowCap dome	x					core 4
Seringue/Bouteille Titane		17/05/2019	24:09	S 03 43.628	E 151 40.330	1686	Satanic Mills		x				hot fluid sampling in titane G3
Seringue/Bouteille Titane		17/05/2019	24:15	S 03 43.629	E 151 40.329	1686	Satanic Mills		x				hot fluid sampling in titane G2 start

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Panier		17/05/2019	24:23	S 03 43.629	E 151 40.329	1686	Satanic Mills			x			extinct chimney sampling, in drawer, rock 2

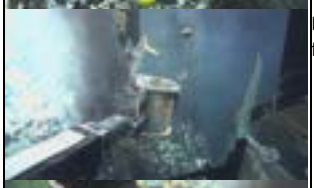
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Petite Boite de collecte		17/05/2019	24:28	S 03 43.630	E 151 40.331	1686	Satanic Mills			x			PBT 4, top of active chimney
Grande Boite de collecte	4	17/05/2019	01:25	S 03 43.625	E 151 40.328	1685	Satanic Mills	x		x			crounch 1 in GBT 4
Grande Boite de collecte	6	17/05/2019	01:54	S 03 43.684	E 151 40.374	1698	Fenway	x					First crounch
Carottier Multitubes 8 tubes 100mm INSU		17/05/2019	03:33	S 03 43.711	E 151 40.273	1680	Satanic Mills	x					pushcore 14 first try
Carottier Multitubes 8 tubes 100mm INSU		17/05/2019	03:36	S 03 43.712	E 151 40.272	1680	Satanic Mills	x					sampling with pushcore 23
Carottier Multitubes 8 tubes 100mm INSU		17/05/2019	03:40	S 03 43.711	E 151 40.272	1680	Satanic Mills	x					sampling with pushcore 1
Carottier Multitubes 8 tubes 100mm INSU		17/05/2019	03:42	S 03 43.711	E 151 40.272	1680	Satanic Mills	x					going to sample with pushcore 15
Panier		17/05/2019	08:16	S 03 43.668	E 151 40.248	1664	Fenway	x					Sampling anemone
Panier		17/05/2019	08:45	S 03 43.714	E 151 40.319	1707	Fenway	x					Sea star on the dead chimney
Aspirateur ^ faune	4	17/05/2019	09:13	S 03 43.729	E 151 40.334	1709	Big Papi	x					Aspi bol 4 for scaleworms started

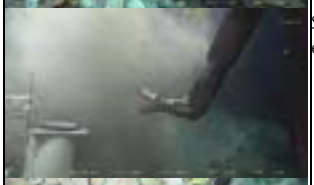
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	13	17/05/2019	10:12	S 03 43.685	E 151 40.373	1698	Fenway		x		x		Alviniconcha 2 point 1 Chemini S and PIF syringe13 started (Tp = 4.98)
Préleveur In-situ de Fluide (PIF)	14	17/05/2019	10:19	S 03 43.684	E 151 40.373	1698	Fenway		x		x		Alviniconcha 2 point 2 Chemini S and PIF syringe14 started (Tp = 8.14)
Préleveur In-situ de Fluide (PIF)	15	17/05/2019	10:26	S 03 43.684	E 151 40.372	1698	Fenway		x		x		Alviniconcha 2 point 3 Chemini S and PIF syringe15 started (Tp = 4.24)
Grande Boite de collecte	8	17/05/2019	10:32	S 03 43.684	E 151 40.372	1698	Fenway	x					Sampling of Alviniconcha 2 in GBT 8 started
Chemini		17/05/2019	11:06	S 03 43.682	E 151 40.370	1698	Fenway				x		Alviniconcha 2 after sampling point 1 Chemini S started (Tp =4.70)
Grande Boite de collecte	5	17/05/2019	11:49	S 03 43.681	E 151 40.370	1698	Fenway	x					Sampling of Bathymodiolus 2 in GBT 5 started
Aspirateur ^ faune	5	17/05/2019	13:10	S 03 43.662	E 151 40.349	1696	Fenway	x					Aspi Bol 5 - Goose barnacles started
Grande Boite de collecte	7	17/05/2019	14:12	S 03 43.665	E 151 40.367	1699	Fenway	x					Sampling of Ifremeria 2 in GBT 7 started
Petite Boite de collecte	5	17/05/2019	21:18	S 03 43.875	E 151 40.353	1715	SW8 Th2	x					seastar in the PBT5 (the one that was in the basket before)
Petite Boite de collecte	7	18/05/2019	01:14	S 03 43.834	E 151 40.443	1734	SW8 Th2	x					START SAMPLING PBT7 Alviniconcha chimney

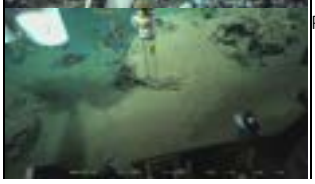
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	11	18/05/2019	02:06	S 03 43.825	E 151 40.441	1739	SW8 Th2	x					sampling of Ifremeria community 3 in GBT11 STARTED
Aspirateur ^ faune	6	18/05/2019	02:28	S 03 43.825	E 151 40.441	1739	SW8 Th2	x					ASPI bol 6 on Ifremeria community 3 STARTED
Grande Boite de collecte	9	18/05/2019	03:25	S 03 43.821	E 151 40.458	1737	SW8 Th2	x					sampling of Alviniconcha community 3 (Solwara 8) in GBT9 STARTED
Aspirateur ^ faune	7	18/05/2019	03:46	S 03 43.820	E 151 40.452	1737	SW8 Th2	x					ASPI bol7 on Alviniconcha community 3 (Solwara 8) STARTED
Grande Boite de collecte	10	18/05/2019	04:11	S 03 43.825	E 151 40.451	1736	SW8 Th2	x					START SAMPLING cirripeds in GBT10
Seringue/Bouteille Titane		18/05/2019	04:49	S 03 43.818	E 151 40.459	1736	SW8 Th2		x				START sampling Ti D2 inside the active chimney Solwara8
Petite Boite de collecte	2	18/05/2019	04:57	S 03 43.820	E 151 40.460	1737	SW8 Th2	x					chimney sampling for microbiology in PBT
Panier		18/05/2019	05:07	S 03 43.820	E 151 40.460	1737	SW8 Th2	x					basket post sampling of the chimney for microbiology
Aspirateur ^ faune	8	18/05/2019	05:23	S 03 43.821	E 151 40.460	1736	SW8 Th2	x					shrimp sampling jar8

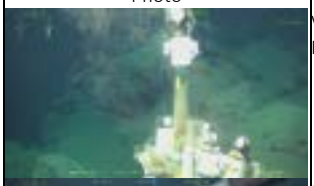
Plongée : **734 – Pacmanus (Romans ruins, Solwara 7,8,9)**

Liste des opérations :

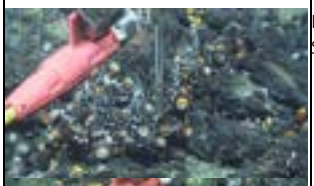
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Boite FISH	1	18/05/2019	23:15	S 03 43.733	E 151 40.327	1708	Romans Ruins	x					sampling shrimp with slurp gun
Boite FISH	2	19/05/2019	01:27	S 03 43.267	E 151 40.486	1671	Romans Ruins	x					Area for FISH 2
Grande Boite de collecte	9	19/05/2019	02:46	S 03 43.287	E 151 40.469	1659	Romans Ruins	x					Sampling of alviniconcha chimney Started in GBT 9
Panier-Geologie	1	19/05/2019	03:55	S 03 43.263	E 151 40.487	1669	Romans Ruins			x			Rock 1 in basket fragment of black smoker
Petite Boite de collecte	7	19/05/2019	03:57	S 03 43.263	E 151 40.486	1669	Romans Ruins	x		x			PBT 7 closed Sampling of chimney for microbiology ended
Bouteille titane B (G) 750 ml	3	19/05/2019	04:05	S 03 43.263	E 151 40.486	1669	Romans Ruins		x				Sampling of hot fluid in TiG3 started, but it failed
Bouteille titane A (D) 750 ml	3	19/05/2019	04:13	S 03 43.263	E 151 40.486	1669	Romans Ruins		x				Sampling of hot fluid ended in TiD3
Aspirateur ˆ faune	1	19/05/2019	07:20	S 03 43.287	E 151 40.463	1666	Romans Ruins	x					collect shrimp with slurp gun (jar #1) and 1 branchinotogluma
Aspirateur ˆ faune	2	19/05/2019	09:13	S 03 43.038	E 151 40.369	1765	Romans Ruins	x					Ifremeria - difficult to sample

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	3	19/05/2019	09:52	S 03 43.040	E 151 40.375	1769	Romans Ruins		x		x		Ifremeria 1 point 1 Chemini S and PIF syringe 3 started (Tp = 4.60)
Préleveur In-situ de Fluide (PIF)	4	19/05/2019	09:58	S 03 43.040	E 151 40.375	1769	Romans Ruins	x			x		Ifremeria 1 point 2 Chemini S and PIF syringe 4 started (Tp = 6.27)
Préleveur In-situ de Fluide (PIF)	5	19/05/2019	10:07	S 03 43.040	E 151 40.375	1769	Romans Ruins		x		x		Ifremeria 1 point 3 Chemini S and PIF syringe 5 started (Tp = 3.60)
Grande Boite de collecte	5	19/05/2019	10:41	S 03 43.042	E 151 40.374	1769	Romans Ruins	x					Sampling of Ifremeria 1 in GBT5 ended
Aspirateur ^ faune	3	19/05/2019	10:45	S 03 43.039	E 151 40.375	1769	Romans Ruins	x					Aspi bol 3 on Ifremeria 1 started
Préleveur In-situ de Fluide (PIF)	6	19/05/2019	10:53	S 03 43.039	E 151 40.375	1769	Romans Ruins	x			x		Ifremeria 1 after sampling point 1 Chemini and PIF syringe 6 started (Tp = 4.71)
Chemini		19/05/2019	10:59	S 03 43.041	E 151 40.375	1769	Romans Ruins				x		Ifremeria 1 after sampling point 2 Chemini started (Tp = 7.26)
Préleveur In-situ de Fluide (PIF)	7	19/05/2019	11:06	S 03 43.041	E 151 40.373	1769	Romans Ruins		x		x		Ifremeria 1 after sampling point 3 Chemini started (Tp = 3.67) + PIF syringe 7
Aspirateur ^ faune	4	19/05/2019	11:35	S 03 43.033	E 151 40.377	1765	Romans Ruins	x					Aspi bol 4 sampling of chimney fauna (shrimps + Polynoidae) ended
Préleveur In-situ de Fluide (PIF)	8	19/05/2019	13:20	S 03 43.675	E 151 40.360	1696	Romans Ruins		x		x		pif (syringe 8) and chemini 1 on mussel community 1

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	9	19/05/2019	13:29	S 03 43.675	E 151 40.359	1696	Romans Ruins		x		x		pif (syringe 9) and cheminy 2 on musselcommunity 1
Préleveur In-situ de Fluide (PIF)	10	19/05/2019	13:37	S 03 43.675	E 151 40.361	1696	Romans Ruins		x		x		pif (syringe 10) and chemini 3 on mussel community 1
Grande Boite de collecte	1	19/05/2019	14:10	S 03 43.675	E 151 40.360	1696	Romans Ruins	x					GBT1 closed
Préleveur In-situ de Fluide (PIF)	11	19/05/2019	14:16	S 03 43.675	E 151 40.360	1696	Romans Ruins	x			x		Pif (syringe 11) and chemini started point 1 post-sampling on mussel community 1
Chemini		19/05/2019	14:23	S 03 43.675	E 151 40.361	1696	Romans Ruins				x		Chemini 2 post-sampling on mussel community 1
Chemini		19/05/2019	14:36	S 03 43.674	E 151 40.360	1696	Romans Ruins				x		Chemini point 3 post-sampling on mussel community 1
Aspirateur ^ faune	5	19/05/2019	14:45	S 03 43.675	E 151 40.360	1696	Romans Ruins	x					Suction sampling in jar 5
Panier		19/05/2019	19:26	S 03 43.681	E 151 40.841	1742	Romans Ruins	x					wood sample
Petite Boite de collecte	3	19/05/2019	19:47	S 03 43.680	E 151 40.842	1740	Romans Ruins	x					cirripeds sampling for PBT3
Grand carottier tube	1	19/05/2019	20:49	S 03 43.730	E 151 40.781	1769	Romans Ruins	x					PUSHCORE 11

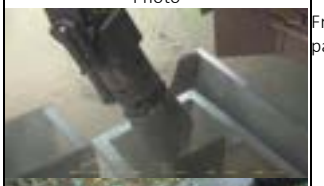
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Grand carottier tube	2	19/05/2019	20:57	S 03 43.730	E 151 40.782	1769	Romans Ruins	x					VIEW OF THE SEDIMENT PUSHCORE2
Grand carottier tube	3	19/05/2019	21:03	S 03 43.731	E 151 40.782	1766	Romans Ruins	x					PUSCHCORE3
Préleveur In-situ de Fluide (PIF)	12	19/05/2019	22:46	S 03 43.647	E 151 40.869	1725	Romans Ruins		x		x		MUSSELS1 CHEMINI1 AND PIF SYRINGUE12 STARTED
Préleveur In-situ de Fluide (PIF)	13	19/05/2019	22:51	S 03 43.650	E 151 40.867	1725	Romans Ruins	x			x		MUSSELS CHEMINI S PIF SYRINGUE13 STARDED
Préleveur In-situ de Fluide (PIF)	14	19/05/2019	22:56	S 03 43.651	E 151 40.867	1725	Romans Ruins	x			x		MUSSELS CHEMINI S PIF SYRINGUE14 STARTED
Préleveur In-situ de Fluide (PIF)	15	19/05/2019	23:04	S 03 43.643	E 151 40.857	1725	Romans Ruins		x		x		MUSSELS CHEMINI S PIF SERINGUE15 STARTED
Grande Boite de collecte	2	19/05/2019	23:28	S 03 43.649	E 151 40.867	1725	Romans Ruins	x					SAMPLING OF MUSSELS IN GBT2 ENDED
Préleveur In-situ de Fluide (PIF)	16	19/05/2019	23:34	S 03 43.651	E 151 40.868	1725	Romans Ruins		x		x		MUSSELS AFTER SAMPLING CHEMINI S PIF SYRINGE16
Aspirateur ^ faune	6	19/05/2019	23:51	S 03 43.645	E 151 40.861	1725	Romans Ruins	x					ASPI BOL 6 ON MUSSELS
Aspirateur ^ faune	7	19/05/2019	23:59	S 03 43.644	E 151 40.863	1724	Romans Ruins	x					BOL7

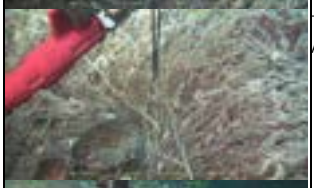
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	17	20/05/2019	24:18	S 03 43.651	E 151 40.851	1729	Romans Ruins		x		x		IFREMERIA CHEMINI S PIF SYRINGE17 STARTED 11°C

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	18	20/05/2019	24:22	S 03 43.655	E 151 40.854	1729	Romans Ruins		x		x		IFREMERIA CHEMINI S PIF SYRINGE18 9,5°C
Préleveur In-situ de Fluide (PIF)	19	20/05/2019	24:29	S 03 43.654	E 151 40.854	1729	Romans Ruins		x		x		IFREMERIA CHEMINI PIF SYRINGE19 4°C
Grande Boite de collecte	4	20/05/2019	24:48	S 03 43.654	E 151 40.854	1729	Romans Ruins	x					SAMPLING OF IFREMERIA IN GBT4 ENDED
Préleveur In-situ de Fluide (PIF)	20	20/05/2019	24:52	S 03 43.655	E 151 40.854	1729	Romans Ruins		x		x		IFREMERIA AFTER SAMPLING CHEMINI S PIF SYRINGE20 11,5°C
Préleveur In-situ de Fluide (PIF)	21	20/05/2019	24:57	S 03 43.654	E 151 40.854	1729	Romans Ruins	x			x		IFREMERIA AFTER SAMPLING CHEMINIS PIF SYRINGE21 4,5°C
Préleveur In-situ de Fluide (PIF)	22	20/05/2019	01:03	S 03 43.655	E 151 40.854	1729	Romans Ruins		x		x		IFREMERIA AFTER SAMPLING CHEMINIS PIF SYRINGE22 5.4 à 6.7°C Chemini upper right corner of the patch start
Aspirateur ^ faune	8	20/05/2019	01:25	S 03 43.653	E 151 40.853	1729	Romans Ruins	x					ASPI jar 8 End
Panier-Geologie	2	20/05/2019	01:29	S 03 43.655	E 151 40.854	1729	Romans Ruins			x			rock sampling
Préleveur In-situ de Fluide (PIF)	23	20/05/2019	01:36	S 03 43.654	E 151 40.851	1723	Romans Ruins		x		x		PEP ON PIF seringe 23 CHEMINI start

Plongée : **735 – DESMOS Caldera (Manus)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Panier		20/05/2019	20:35	S 03 41.592	E 151 52.106	1933	Desmos Caldeira	x					Fragment coquille dans gde boîte du panier
Grande Boite de collecte	7	20/05/2019	21:42	S 03 41.537	E 151 52.039	1906	Desmos Caldeira	x					
Aspirateur ^ faune	1	20/05/2019	22:01	S 03 41.536	E 151 52.039	1905	Desmos Caldeira	x					
Grand carottier tube	1	21/05/2019	24:33	S 03 41.480	E 151 52.047	1912	Desmos Caldeira	x		x			core 1 (8)
Grand carottier tube	2	21/05/2019	24:37	S 03 41.480	E 151 52.048	1912	Desmos Caldeira	x		x			core 2 (3)
Grand carottier tube	3	21/05/2019	24:47	S 03 41.481	E 151 52.046	1912	Desmos Caldeira	x		x			core 3b (1)
Grand carottier tube	4	21/05/2019	24:50	S 03 41.479	E 151 52.047	1912	Desmos Caldeira	x		x			core 4 (2)
Préleveur In-situ de Fluide (PIF)	2	21/05/2019	01:31	S 03 41.476	E 151 51.989	1923	Desmos Caldeira		x				PIF (syringe 2) is on
Préleveur In-situ de Fluide (PIF)	3	21/05/2019	01:34	S 03 41.461	E 151 51.957	1923	Desmos Caldeira		x				PIF (syringe 3) is launched

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Seringue/Bouteille Titane		21/05/2019	03:02	S 03 41.483	E 151 51.948	1919	Desmos Caldeira		x				Firing TiD2 titane sampling
Seringue/Bouteille Titane		21/05/2019	03:22	S 03 41.460	E 151 51.955	1923	Desmos Caldeira		x				Firing TIG2 bottle
Petite Boite de collecte	2	21/05/2019	03:29	S 03 41.461	E 151 51.957	1923	Desmos Caldeira			x			Angular volcanic rock sample in PBT2. Rock covered with microbial mats
Aspirateur ˆ faune	2	21/05/2019	03:33	S 03 41.462	E 151 51.955	1923	Desmos Caldeira	x					Suction sampler jar 2 for microbial mats and associated fauna
Préleveur In-situ de Fluide (PIF)	4	21/05/2019	04:34	S 03 41.543	E 151 51.984	1912	Desmos Caldeira		x				PIF (syringe 4) and chemini started in Arcovestia. But chemini was launched by mistake on channel 2.
Chemini		21/05/2019	04:39	S 03 41.542	E 151 51.985	1912	Desmos Caldeira				x		Chemini restarted at same position (channel 1 this time).
Préleveur In-situ de Fluide (PIF)	5	21/05/2019	04:43	S 03 41.543	E 151 51.986	1912	Desmos Caldeira		x		x		Chemini started exactly on gills, and PIF as well (syringe 5).
Préleveur In-situ de Fluide (PIF)	6	21/05/2019	04:50	S 03 41.542	E 151 51.986	1912	Desmos Caldeira		x		x		Third chemini on this patch of Arcovestia, and PIF (syringe 6)
Grande Boite de collecte	4	21/05/2019	05:06	S 03 41.542	E 151 51.985	1912	Desmos Caldeira	x					arcovestia sampling in GBT4
Aspirateur ˆ faune	3	21/05/2019	05:19	S 03 41.543	E 151 51.986	1912	Desmos Caldeira	x					suction sampler

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	7	21/05/2019	05:41	S 03 41.542	E 151 51.986	1912	Desmos Caldeira		x		x		Chemistry after sampling: chemini and PIF. First location.
Chemini		21/05/2019	06:18	S 03 41.548	E 151 51.993	1912	Desmos Caldeira				x		chemini post sampling spot2
Chemini		21/05/2019	06:26	S 03 41.550	E 151 51.992	1912	Desmos Caldeira				x		chemini post sampling spot3
Aspirateur ^ faune	4	21/05/2019	08:15	S 03 41.554	E 151 51.986	1911	Desmos Caldeira	x					slurp gun jar 4, gasteropods
Aspirateur ^ faune	5	21/05/2019	09:26	S 03 41.496	E 151 51.946	1921	Desmos Caldeira	x					Start Aspi 5 to collect scale worms
Grande Boite de collecte	8	21/05/2019	09:52	S 03 41.545	E 151 51.949	1910	Desmos Caldeira	x					Start sampling fauna in GBT 8
Panier		21/05/2019	10:22	S 03 41.545	E 151 51.948	1910	Desmos Caldeira	x		x			Bivalves and galatheids
Aspirateur ^ faune	6	21/05/2019	10:39	S 03 41.548	E 151 51.945	1908	Desmos Caldeira	x					Start Aspi 6 to sample gastropods
Panier		21/05/2019	18:47	S 03 41.512	E 151 51.924	1895	Desmos Caldeira	x	x	x			Anemone sampled with rock, in drawer
Panier		21/05/2019	19:10	S 03 41.528	E 151 51.933	1896	Desmos Caldeira	x					Mussel in drawer

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Panier		21/05/2019	19:14	S 03 41.532	E 151 51.933	1896	Desmos Caldeira	x					Rock with mollusk, in drawer
Panier		21/05/2019	19:34	S 03 41.546	E 151 51.935	1905	Desmos Caldeira	x					Gastropod in drawer
Panier		21/05/2019	19:38	S 03 41.546	E 151 51.937	1906	Desmos Caldeira	x					Rock with gastropods in ROV Basket
Panier		21/05/2019	19:52	S 03 41.545	E 151 51.936	1906	Desmos Caldeira	x					Another mussel in drawer (sampled close to siboglinids)

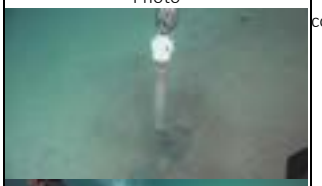
Plongée : **736 – Solwara 1 - Susu (Manus)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Petite Boite de collecte	2	22/05/2019	12:12	S 03 47.370	E 152 05.782	1505	Solwara 1 (Manus)			x			PBT2
Bouteille titane A (D) 750 ml	1	22/05/2019	12:28	S 03 47.369	E 152 05.782	1505	Solwara 1 (Manus)		x				TiD1 sampling
Bouteille titane B (G) 750 ml	3	22/05/2019	12:35	S 03 47.369	E 152 05.783	1505	Solwara 1 (Manus)		x				TiG3 sampling
Préleveur In-situ de Fluide (PIF)	2	22/05/2019	13:19	S 03 47.368	E 152 05.784	1505	Solwara 1 (Manus)		x		x		Alviniconcha 1.1 Chemini and PIF seringe 2 started 5.80°C
Préleveur In-situ de Fluide (PIF)	3	22/05/2019	13:25	S 03 47.368	E 152 05.783	1505	Solwara 1 (Manus)		x		x		Alviniconcha 1.2 Chemini and PIF seringe 3 started between 5 and 9 °C
Préleveur In-situ de Fluide (PIF)	4	22/05/2019	13:31	S 03 47.368	E 152 05.783	1505	Solwara 1 (Manus)		x		x		Alviniconcha 1.3 Chemini and PIF seringe 4 started between 4.80 and 5.86 °C
Préleveur In-situ de Fluide (PIF)	5	22/05/2019	13:37	S 03 47.368	E 152 05.784	1505	Solwara 1 (Manus)		x		x		Ifremeria 1.1 Chemini and PIF seringe 5 started between 3.07 and 5 °C
Préleveur In-situ de Fluide (PIF)	6	22/05/2019	13:43	S 03 47.368	E 152 05.783	1505	Solwara 1 (Manus)		x		x		Ifremeria 1.2 Chemini and PIF seringe 6 started between 4.38 and 5.15 °C
Préleveur In-situ de Fluide (PIF)	7	22/05/2019	13:50	S 03 47.368	E 152 05.783	1505	Solwara 1 (Manus)		x		x		Ifremeria 1.3 Chemini and PIF seringe 7 started between 4.5 and 9 °C

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte	4	22/05/2019	14:11	S 03 47.368	E 152 05.784	1506	Solwara 1 (Manus)	x					End of sampling Ifremeria 1 and closing GBT4
Aspirateur ^ faune	2	22/05/2019	14:19	S 03 47.367	E 152 05.784	1506	Solwara 1 (Manus)	x					Ifremeria 1 ASPI 2 OFF
Chemini		22/05/2019	14:33	S 03 47.367	E 152 05.785	1506	Solwara 1 (Manus)				x		Ifremeria 1 after sampling 1 CHEMINI started
Chemini		22/05/2019	14:39	S 03 47.367	E 152 05.784	1506	Solwara 1 (Manus)				x		Ifremeria 1 after sampling 2 CHEMINI started 6.5°C
Chemini		22/05/2019	14:45	S 03 47.368	E 152 05.785	1506	Solwara 1 (Manus)				x		Ifremeria 1 after sampling 3 CHEMINI started 9.5°C
Grande Boite de collecte	3	22/05/2019	15:03	S 03 47.368	E 152 05.785	1505	Solwara 1 (Manus)	x					GBT3 closed
Chemini		22/05/2019	15:11	S 03 47.368	E 152 05.783	1505	Solwara 1 (Manus)				x		Alviniconcha community 1 after sampling CHEMINI 1 started 8.7°C
Chemini		22/05/2019	15:17	S 03 47.368	E 152 05.784	1505	Solwara 1 (Manus)				x		Alviniconcha community 1 after sampling CHEMINI 2 started 6.8°C
Panier-Geologie	1	22/05/2019	16:03	S 03 47.374	E 152 05.819	1520	Solwara 1 (Manus)	x		x			Rock 1 with barnacles sample
Préleveur In-situ de Fluide (PIF)	8	22/05/2019	19:13	S 03 47.942	E 152 06.060	1210	North Su chimney		x		x		Mussel1 point 1 chemini S and PIF syringe

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		22/05/2019	19:23	S 03 47.942	E 152 06.060	1210	North Su chimney				x		Mussel1 point 2 chemini S
Préleveur In-situ de Fluide (PIF)	9	22/05/2019	19:31	S 03 47.942	E 152 06.060	1210	North Su chimney		x		x		Mussel1 point 3 cheminiS and PIF syringe 9
Préleveur In-situ de Fluide (PIF)	10	22/05/2019	19:37	S 03 47.942	E 152 06.060	1210	North Su chimney		x		x		Mussel1 point 4 cheminiS and PIF syringe 10
Grande Boite de collecte	7	22/05/2019	20:00	S 03 47.942	E 152 06.061	1210	North Su chimney	x					Sampling of mussel1 in GBT7, 8th scoop
Aspirateur ^ faune	3	22/05/2019	20:22	S 03 47.942	E 152 06.060	1210	North Su chimney	x					Slurp gun on Mussel community1 jar 3
Chemini		22/05/2019	20:27	S 03 47.942	E 152 06.060	1210	North Su chimney				x		Mussel1 after sampling point1 cheminiS
Chemini		22/05/2019	20:32	S 03 47.942	E 152 06.060	1210	North Su chimney				x		Mussel1 after sampling point2 cheminiS
Chemini		22/05/2019	20:38	S 03 47.943	E 152 06.060	1210	North Su chimney				x		Mussel1 after sampling point3 chemini
Grand carottier tube	8	22/05/2019	23:11	S 03 47.382	E 152 05.794	1523	North Su chimney	x					core 8
Grand carottier tube	3	22/05/2019	23:22	S 03 47.408	E 152 05.805	1529	North Su chimney	x					core 3

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grand carottier tube	2	22/05/2019	23:25	S 03 47.408	E 152 05.804	1529	North Su chimney	x					core2
Grand carottier tube	1	22/05/2019	23:31	S 03 47.407	E 152 05.804	1529	North Su chimney	x					core 1
Aspirateur ^ faune	4	23/05/2019	24:36	S 03 47.375	E 152 05.783	1503	North Su chimney	x					sampled B. segopnsazi and shrimp
Aspirateur ^ faune	4	23/05/2019	24:48	S 03 47.357	E 152 05.732	1493	North Su chimney	x					sampling branchinotogluma
Aspirateur ^ faune	5	23/05/2019	01:14	S 03 47.348	E 152 05.733	1497	North Su chimney	x					slurp gunon b seg + paralvinella jar 5
Bouteille titane B (G) 750 ml	1	23/05/2019	11:25	S 03 48.067	E 152 06.097	1225	North Su chimney		x				TiG1 sampling
Petite Boite de collecte	5	23/05/2019	12:00	S 03 47.999	E 152 06.048	1155	North Su chimney			x			Chimney sampling in PBT5
Bouteille titane A (D) 750 ml	3	23/05/2019	12:20	S 03 48.000	E 152 06.049	1155	North Su chimney		x				TiD3 sampling
Panier-Geologie	4	23/05/2019	12:33	S 03 47.999	E 152 06.049	1155	North Su chimney			x			Rock 4
Préleveur In-situ de Fluide (PIF)	11	23/05/2019	13:11	S 03 47.957	E 152 06.089	1195	North Su chimney		x		x		Bathymodiolus 2 CHEMINI 1 PIF seringe 11 started 9.3 °C

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	12	23/05/2019	13:19	S 03 47.957	E 152 06.090	1195	North Su chimney		x		x		Bathymodiolus 2 CHEMINI 2 PIF seringe 12 started 8.4 °C

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	13	23/05/2019	13:25	S 03 47.957	E 152 06.090	1195	North Su chimney	x			x		Bathymodiolus 2 CHEMINI 3 PIF seringe 13 started
Grande Boite de collecte	9	23/05/2019	13:41	S 03 47.957	E 152 06.089	1195	North Su chimney	x					8th scoop
Aspirateur ^ faune	6	23/05/2019	13:51	S 03 47.957	E 152 06.089	1195	North Su chimney	x					Bathymodiolus 2 ASPI jar 6 ended
Chemini		23/05/2019	13:52	S 03 47.957	E 152 06.090	1195	North Su chimney				x		Bathymodiolus 2 CHEMINI 1 after sampling started
Chemini		23/05/2019	13:57	S 03 47.957	E 152 06.090	1195	North Su chimney				x		Bathymodiolus 2 CHEMINI 2 after sampling started
Chemini		23/05/2019	14:06	S 03 47.957	E 152 06.090	1195	North Su chimney				x		Bathymodiolus 2 CHEMINI 3 after sampling ended 7.4-8.4°C
Petite Boite de collecte	6	23/05/2019	14:32	S 03 47.957	E 152 06.090	1195	North Su chimney	x					
Préleveur In-situ de Fluide (PIF)	14	23/05/2019	14:45	S 03 47.935	E 152 06.045	1218	North Su chimney		x		x		Alviniconcha 2 CHEMINI 1 PIF 14 started
Préleveur In-situ de Fluide (PIF)	15	23/05/2019	14:51	S 03 47.934	E 152 06.045	1218	North Su chimney	x			x		Alviniconcha 2 CHEMINI 2 PIF 15 started
Préleveur In-situ de Fluide (PIF)	16	23/05/2019	14:57	S 03 47.935	E 152 06.045	1218	North Su chimney		x		x		Alviniconcha 2 CHEMINI 3 PIF 16 started

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	10	23/05/2019	15:17	S 03 47.933	E 152 06.045	1218	North Su chimney	x					12th scoop
Chemini		23/05/2019	15:20	S 03 47.933	E 152 06.046	1218	North Su chimney				x		Alviniconcha 2 CHEMINI 1 after sampling started
Chemini		23/05/2019	15:25	S 03 47.933	E 152 06.046	1218	North Su chimney				x		Alviniconcha 2 CHEMINI 2 after sampling started
Chemini		23/05/2019	15:29	S 03 47.933	E 152 06.045	1218	North Su chimney				x		Alviniconcha 2 CHEMINI 3 after sampling started
Préleveur In-situ de Fluide (PIF)	17	23/05/2019	15:43	S 03 47.934	E 152 06.046	1216	North Su chimney		x		x		Ifremeria 2 CHEMINI 1 PIF 17 started
Préleveur In-situ de Fluide (PIF)	18	23/05/2019	15:47	S 03 47.935	E 152 06.045	1216	North Su chimney		x		x		Ifremeria 2 CHEMINI 2 PIF 18 started
Préleveur In-situ de Fluide (PIF)	19	23/05/2019	15:53	S 03 47.935	E 152 06.046	1216	North Su chimney		x		x		Ifremeria 2 CHEMINI 3 PIF 19 started
Grande Boite de collecte	8	23/05/2019	16:05	S 03 47.935	E 152 06.047	1216	North Su chimney	x					
Aspirateur ˆ faune	7	23/05/2019	16:13	S 03 47.935	E 152 06.045	1216	North Su chimney	x					Ifremeria 2 ASPI jar 7 ended

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Chemini		23/05/2019	16:17	S 03 47.935	E 152 06.045	1216	North Su chimney				x		Ifremeria 2 CHEMINI 1 after sampling started
Chemini		23/05/2019	16:22	S 03 47.935	E 152 06.046	1216	North Su chimney				x		Ifremeria 2 CHEMINI 2 after sampling started
Chemini		23/05/2019	16:28	S 03 47.935	E 152 06.046	1216	North Su chimney				x		Ifremeria 2 CHEMINI 3 after sampling started
Panier-Geologie	5	23/05/2019	16:39	S 03 47.936	E 152 06.045	1216	North Su chimney	x		x			Rock 5 with cirripedes
Panier-Geologie	6	23/05/2019	16:45	S 03 47.937	E 152 06.045	1215	North Su chimney	x		x			rock 6 second sample with cirripedes
Aspirateur ^ faune	8	23/05/2019	18:44	S 03 47.411	E 152 05.412	1579	North Su chimney	x					Sampling Paralvinella in jar 8

Plongée : **737 – Susu - South Su (Manus)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Petite Boite de collecte	6	24/05/2019	13:19	S 03 48.566	E 152 06.314	1331	South Su 1			x			chimney sampling
Seringue/Bouteille Titane		24/05/2019	13:40	S 03 48.564	E 152 06.314	1330	South Su 1		x				Ti D1 well fired
Panier		24/05/2019	13:49	S 03 48.565	E 152 06.314	1330	South Su 1			x			Rock 1 sample
Seringue/Bouteille Titane		24/05/2019	13:57	S 03 48.564	E 152 06.314	1330	South Su 1		x				Ti D2 fired
Panier		24/05/2019	14:03	S 03 48.565	E 152 06.314	1330	South Su 1			x			Rock 2 sampling
Petite Boite de collecte	5	24/05/2019	14:31	S 03 48.530	E 152 06.299	1300	South Su 1	x					Sampling chimney Alviniconcha in the PBT5 start
Préleveur In-situ de Fluide (PIF)	2	24/05/2019	15:11	S 03 48.582	E 152 06.310	1353	South Su 1		x		x		Bathymodiolus 1 CHEMINI 1 PIF seringe 2 started
Préleveur In-situ de Fluide (PIF)	3	24/05/2019	15:18	S 03 48.583	E 152 06.310	1353	South Su 1		x		x		Bathymodiolus 1 CHEMINI 2 PIF seringe 3 started
Préleveur In-situ de Fluide (PIF)	4	24/05/2019	15:24	S 03 48.582	E 152 06.310	1353	South Su 1		x		x		Bathymodiolus 1 CHEMINI 3 PIF seringe 4 start

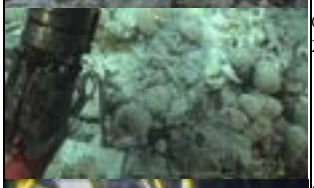
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Grande Boite de collecte	9	24/05/2019	15:34	S 03 48.583	E 152 06.310	1353	South Su 1	x					Scoop 1 Bathymodiolus 1 in GBT9
Aspirateur ^ faune	1	24/05/2019	15:44	S 03 48.583	E 152 06.309	1353	South Su 1	x					ASPI 1 Bathymodiolus 1
Chemini		24/05/2019	15:53	S 03 48.584	E 152 06.309	1353	South Su 1				x		Bathymodiolus 1 CHEMINI 1 after sampling start
Chemini		24/05/2019	15:59	S 03 48.584	E 152 06.309	1353	South Su 1				x		Bathymodiolus 1 CHEMINI 2 after sampling start
Chemini		24/05/2019	16:05	S 03 48.584	E 152 06.309	1353	South Su 1				x		Bathymodiolus 1 CHEMINI 3 after sampling start
Préleveur In-situ de Fluide (PIF)	5	24/05/2019	16:21	S 03 48.584	E 152 06.309	1353	South Su 1	x			x		Alviniconcha 1 CHEMINI 1 PIF seringe 5 start
Préleveur In-situ de Fluide (PIF)	6	24/05/2019	16:27	S 03 48.584	E 152 06.309	1353	South Su 1		x		x		Alviniconcha 1 CHEMINI 2 PIF seringe 6 started
Préleveur In-situ de Fluide (PIF)	7	24/05/2019	16:33	S 03 48.583	E 152 06.309	1353	South Su 1		x		x		Alviniconcha 1 CHEMINI 3 PIF seringe 7 started
Grande Boite de collecte	10	24/05/2019	16:40	S 03 48.583	E 152 06.310	1353	South Su 1	x					Alviniconcha 1 sampling start in GBT10
Chemini		24/05/2019	16:52	S 03 48.584	E 152 06.309	1354	South Su 1				x		Alviniconcha 1 CHEMINI 1 after sampling started

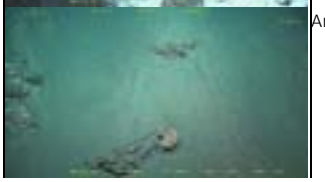
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		24/05/2019	16:59	S 03 48.584	E 152 06.310	1354	South Su 1				x		Alviniconcha 1 CHEMINI 2 after sampling start
Chemini		24/05/2019	17:07	S 03 48.584	E 152 06.309	1354	South Su 1				x		Alviniconcha 1 CHEMINI 3 after sampling started
Préleveur In-situ de Fluide (PIF)	8	24/05/2019	17:38	S 03 48.583	E 152 06.310	1352	South Su 1		x		x		Ifremeria1 point 1 chemini S and PIF syringe8 (17h33 started-17h36 ended) Temp range=4,06-5.03 C
Préleveur In-situ de Fluide (PIF)	9	24/05/2019	17:40	S 03 48.583	E 152 06.310	1352	South Su 1		x		x		Ifremeria1 point 2 chemini S and PIF syringe9 (17h41 started)
Préleveur In-situ de Fluide (PIF)	10	24/05/2019	17:47	S 03 48.583	E 152 06.310	1352	South Su 1		x		x		Ifremeria1 point 3 chemini S and PIF syringe10 (17h47 started)
Grande Boite de collecte	8	24/05/2019	17:56	S 03 48.583	E 152 06.310	1352	South Su 1	x					Ifremeria1 sampling in GBT8 2nd scoop
Aspirateur ^ faune	2	24/05/2019	18:23	S 03 48.582	E 152 06.310	1352	South Su 1	x					Slurping gun on Ifremeria 1 (jar2)
Chemini		24/05/2019	18:31	S 03 48.582	E 152 06.309	1352	South Su 1				x		ended 18h32, T range 3.96-5.07C
Chemini		24/05/2019	18:35	S 03 48.582	E 152 06.310	1352	South Su 1				x		Ifremeria1 after sampling point2 chemini S started 18h33
Chemini		24/05/2019	18:39	S 03 48.582	E 152 06.310	1353	South Su 1				x		Ifremeria1 after sampling point3 chemini S started 18h39

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Aspirateur ^ faune	6	24/05/2019	19:26	S 03 48.501	E 152 06.294	1341	South Su 1	x					slurping gun jar 6 Scaleworms
Aspirateur ^ faune	7	24/05/2019	20:04	S 03 48.499	E 152 06.294	1343	South Su 1	x					paralvinella sampling slurp gun in Jar7
Grand carottier tube	8	24/05/2019	21:31	S 03 48.503	E 152 06.266	1357	South Su 1	x					Push core 8
Grand carottier tube	3	24/05/2019	21:40	S 03 48.503	E 152 06.266	1357	South Su 1	x					Push core 3
Grand carottier tube	1	24/05/2019	22:02	S 03 48.503	E 152 06.266	1357	South Su 1	x					Pushcore 1
Grand carottier tube	2	24/05/2019	22:04	S 03 48.503	E 152 06.267	1357	South Su 1	x					Push core 2 2ème
Petite Boite de collecte	1	24/05/2019	23:58	S 03 48.497	E 152 06.292	1343	South Su 1	x					sampling paralvinella in PBT1
Petite Boite de collecte	2	25/05/2019	24:46	S 03 48.483	E 152 06.301	1358	South Su 1	x					Sampling vestimentiferans PBT2
Préleveur In-situ de Fluide (PIF)	11	25/05/2019	01:21	S 03 48.482	E 152 06.300	1360	South Su 1		x		x		PIF 11 +cheminy S on mussel com2
Préleveur In-situ de Fluide (PIF)	12	25/05/2019	01:29	S 03 48.482	E 152 06.299	1360	South Su 1		x		x		CHeminy S PIF 12 (2nd point on mussel community2)

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	13	25/05/2019	01:35	S 03 48.482	E 152 06.299	1360	South Su 1		x		x		CHeminy S 3 PIF13 on mussel com2

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Grande Boite de collecte	3	25/05/2019	01:41	S 03 48.483	E 152 06.299	1360	South Su 1	x					first crounch
Aspirateur ^ faune	8	25/05/2019	01:48	S 03 48.483	E 152 06.299	1360	South Su 1	x					slurp in jar 8 Musselcom2
Préleveur In-situ de Fluide (PIF)	14	25/05/2019	01:54	S 03 48.483	E 152 06.299	1360	South Su 1		x		x		CHeminy 1 post sample on mussel com2 +pif14
Chemini		25/05/2019	01:59	S 03 48.483	E 152 06.299	1360	South Su 1				x		Chemini 2 on mussel com2 at "la lisiere de la cicatrice"
Chemini		25/05/2019	02:04	S 03 48.482	E 152 06.299	1360	South Su 1				x		CHemini 3 on musselcom2
Préleveur In-situ de Fluide (PIF)	15	25/05/2019	02:31	S 03 48.498	E 152 06.292	1343	South Su 1		x		x		CHEMINI 1 ALVI COM 2 + PIF 15
Préleveur In-situ de Fluide (PIF)	16	25/05/2019	02:39	S 03 48.497	E 152 06.292	1343	South Su 1		x		x		CHIMINI2 on alivi2 +PIF 16
Préleveur In-situ de Fluide (PIF)	17	25/05/2019	02:49	S 03 48.497	E 152 06.292	1343	South Su 1		x		x		PIF17 +CHEMINI 3 on ALVI 2
Grande Boite de collecte	7	25/05/2019	02:55	S 03 48.497	E 152 06.292	1343	South Su 1	x					GBT 7 open
Préleveur In-situ de Fluide (PIF)	18	25/05/2019	03:06	S 03 48.497	E 152 06.292	1343	South Su 1		x		x		Chemini 1 +PIF 18 alvi com2 post sample

Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Préleveur In-situ de Fluide (PIF)	19	25/05/2019	03:10	S 03 48.498	E 152 06.292	1343	South Su 1	x			x		PIF 19 CHEMINI2 ALVI2 post sample
Préleveur In-situ de Fluide (PIF)	20	25/05/2019	03:17	S 03 48.497	E 152 06.292	1343	South Su 1		x		x		CHEMINI 3 POST SAMPLEALVI 2 + PIF 20
Aspirateur ^ faune	3	25/05/2019	03:30	S 03 48.498	E 152 06.294	1343	South Su 1	x					fish in jar 3
Préleveur In-situ de Fluide (PIF)	21	25/05/2019	03:44	S 03 48.499	E 152 06.291	1341	South Su 1		x		x		Chemini1 ifre2 +PIF21
Préleveur In-situ de Fluide (PIF)	22	25/05/2019	03:53	S 03 48.499	E 152 06.292	1341	South Su 1		x		x		Chemini 2 ifre2+ PIF 22
Préleveur In-situ de Fluide (PIF)	23	25/05/2019	04:02	S 03 48.500	E 152 06.291	1341	South Su 1		x		x		CHEMINI3 ifre2 +PIF23
Grande Boite de collecte	4	25/05/2019	04:08	S 03 48.499	E 152 06.291	1341	South Su 1	x					crounch 1 ifre2
Aspirateur ^ faune	4	25/05/2019	04:19	S 03 48.500	E 152 06.291	1340	South Su 1	x					slurp on ifre2
Préleveur In-situ de Fluide (PIF)	24	25/05/2019	04:24	S 03 48.499	E 152 06.291	1341	South Su 1		x		x		chemini1 post sample ifre2 +PIF24

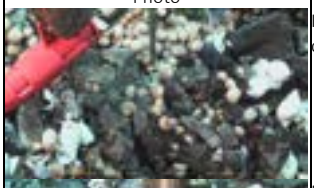
Équipement	Num Eq	Date	Heure	Lat	Long	Prof (m)	Localité	Bio.	Fluide	Geol.	Mesures	Photo	Commentaire
Chemini		25/05/2019	04:28	S 03 48.500	E 152 06.291	1341	South Su 1				x		chemini2 postsample ifre2
Chemini		25/05/2019	04:32	S 03 48.499	E 152 06.291	1341	South Su 1				x		chemini3 postsample ifre2
Seringue/Bouteille Titane		25/05/2019	04:54	S 03 48.500	E 152 06.292	1340	South Su 1		x				TI G3 percuted
Seringue/Bouteille Titane		25/05/2019	05:19	S 03 48.564	E 152 06.313	1330	South Su 1		x				TI GG2 on chimney
Aspirateur ^ faune	5	25/05/2019	06:18	S 03 48.383	E 152 06.189	1428	South Su 1	x					Sampling bacterial mat & branchinotogluma with slurp gun (jar#5)
Panier		25/05/2019	07:04	S 03 48.428	E 152 06.225	1404	South Su 1	x					Anémone

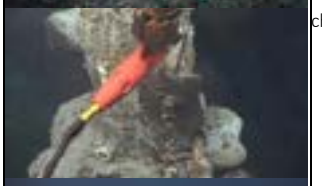
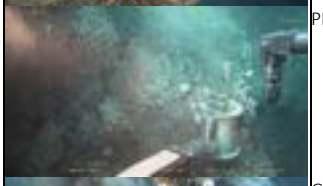
Plongée : **738 – Woodlark ridge (site LaScala)**

Liste des opérations :

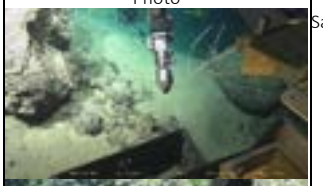
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio	Fluid	Geol.	Mes	Photo	Commentaire
Petite Boite de collecte	2	27/05/2019	15:27	S 09 47.950	E 155 03.114	3379	Zone TVG150 Woodlark			x			PBT2 close
Bouteille titane A (D) 750 ml	3	27/05/2019	15:40	S 09 47.950	E 155 03.117	3380	Zone TVG150 Woodlark		x				taking fluid chimney sample
Panier-Geologie	1	27/05/2019	15:43	S 09 47.950	E 155 03.117	3380	Zone TVG150 Woodlark			x			moving the piece of chimney in the ROV basket
Bouteille titane B (G) 750 ml	1	27/05/2019	15:57	S 09 47.950	E 155 03.117	3378	Zone TVG150 Woodlark		x				Ti-G1 fluid sampling
Panier-Geologie	2	27/05/2019	16:05	S 09 47.950	E 155 03.119	3379	Zone TVG150 Woodlark			x			
Préleveur In-situ de Fluide (PIF)	1	27/05/2019	17:56	S 09 47.945	E 155 03.160	3388	Zone TVG150 Woodlark		x		x		Alviniconcha 1 point 1 Chemini and PIF syringe 1 Started
Préleveur In-situ de Fluide (PIF)	2	27/05/2019	18:08	S 09 47.945	E 155 03.160	3388	Zone TVG150 Woodlark		x		x		Alviniconcha 1 point 2 chemini and PIF syringue 2 Started
Préleveur In-situ de Fluide (PIF)	3	27/05/2019	18:15	S 09 47.945	E 155 03.160	3388	Zone TVG150 Woodlark		x		x		Alviniconcha 1 point 3 chemini S and PIF syringue 3 started
Grande Boite de collecte	10	27/05/2019	18:34	S 09 47.945	E 155 03.160	3388	Zone TVG150 Woodlark	x					GBT10 closed

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		27/05/2019	18:39	S 09 47.945	E 155 03.160	3388	Zone TVG150 Woodlark				x		Alviniconcha 1 after sampling point 1 chemini S started
Chemini		27/05/2019	18:44	S 09 47.946	E 155 03.160	3388	Zone TVG150 Woodlark				x		Alviniconcha 1 after sampling point 2 started, temperature 9-20°C
Chemini		27/05/2019	18:50	S 09 47.946	E 155 03.160	3388	Zone TVG150 Woodlark				x		Alviniconcha 1 after sampling point 3 chemini S started. Temperature 7.5-11°C
Préleveur In-situ de Fluide (PIF)	4	27/05/2019	19:03	S 09 47.946	E 155 03.161	3388	Zone TVG150 Woodlark		x		x		Ifremeria 1 point 1 chemini S and PIF syringe 4 started
Préleveur In-situ de Fluide (PIF)	5	27/05/2019	19:10	S 09 47.946	E 155 03.161	3388	Zone TVG150 Woodlark		x		x		Ifremeria 1 point 2 Chemini and PIF syringe 5 started
Préleveur In-situ de Fluide (PIF)	6	27/05/2019	19:18	S 09 47.946	E 155 03.161	3388	Zone TVG150 Woodlark		x		x		Ifremeria 1 point 3 Chemini and PIF syringe 6 started
Grande Boite de collecte	9	27/05/2019	19:45	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark	x					GBT9 closed
Aspirateur ˆ faune	1	27/05/2019	20:00	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark	x					Aspi bol 1 on Ifremeria ended
Chemini		27/05/2019	20:06	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark				x		Ifremeria 1 after sampling point 1 chemini S started
Chemini		27/05/2019	20:11	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark				x		Ifremeria 2 after sampling point 1 chemini S started

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		27/05/2019	20:16	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark				x		Ifremeria3 after sampling point 1 chemini S started
Panier-Geologie	3	27/05/2019	20:26	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark	x		x			Roc in the ROV basket
Aspirateur ^ faune	3	27/05/2019	20:44	S 09 47.944	E 155 03.161	3388	Zone TVG150 Woodlark	x					End of sampling with slurp gun
Aspirateur ^ faune	2	27/05/2019	21:04	S 09 47.935	E 155 03.160	3374	Zone TVG150 Woodlark	x					Sampling of scale worms with slurp gun
Aspirateur ^ faune	2	27/05/2019	21:34	S 09 47.942	E 155 03.155	3385	Zone TVG150 Woodlark	x					Sampling of scale worms with slurp gun
Tiroir ROV	1	27/05/2019	22:09	S 09 47.940	E 155 03.155	3382	Zone TVG150 Woodlark	x					sampling anemone
Tiroir ROV	2	27/05/2019	22:19	S 09 47.940	E 155 03.155	3382	Zone TVG150 Woodlark	x					sampling second anemone
Tiroir ROV	3	27/05/2019	22:22	S 09 47.940	E 155 03.155	3382	Zone TVG150 Woodlark	x					collecting phymorhynchus
Tiroir ROV	4	27/05/2019	22:27	S 09 47.940	E 155 03.155	3382	Zone TVG150 Woodlark	x					collecting phymorhynchus
Tiroir ROV	5	27/05/2019	22:32	S 09 47.940	E 155 03.155	3382	Zone TVG150 Woodlark	x					collecting holothurian?

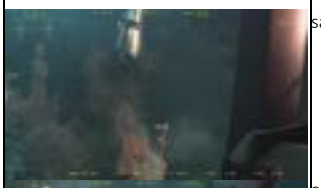
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio	Fluid	Geol.	Mes	Photo	Commentaire
Chemini		27/05/2019	22:55	S 09 47.942	E 155 03.156	3384	Zone TVG150 Woodlark				x		temperature on community: 12.8°C and PEP Chemini
Tiroir ROV	6	27/05/2019	23:09	S 09 47.943	E 155 03.155	3382	Zone TVG150 Woodlark	x					collecting holothuria
Préleveur In-situ de Fluide (PIF)	9	28/05/2019	24:01	S 09 47.936	E 155 03.155	3372	Zone TVG150 Woodlark		x		x		chemini pif seringue 9
Tiroir ROV	7	28/05/2019	24:26	S 09 47.924	E 155 03.160	3357	Zone TVG150 Woodlark	x					crinoids
Petite Boite de collecte	6	28/05/2019	02:26	S 09 47.939	E 155 03.152	3379	Zone TVG150 Woodlark			x			PBT6 is closed
Bouteille titane B (G) 750 ml	2	28/05/2019	03:09	S 09 47.948	E 155 03.125	3377	Zone TVG150 Woodlark		x				G2 titane sampling starts
Panier-Geologie	4	28/05/2019	03:18	S 09 47.948	E 155 03.125	3376	Zone TVG150 Woodlark		x				Taking another piece of chimney (fragile black smoker) (rock 4) put in ROV basket in front of TIG2
Bouteille titane A (D) 750 ml	2	28/05/2019	03:21	S 09 47.947	E 155 03.125	3376	Zone TVG150 Woodlark		x				TiD2 sampling
Grande Boite de collecte	3	28/05/2019	03:34	S 09 47.945	E 155 03.140	3373	Zone TVG150 Woodlark	x					
Aspirateur ˆ faune	4	28/05/2019	03:44	S 09 47.945	E 155 03.140	3373	Zone TVG150 Woodlark	x					Suction sampling in jar 4

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio	Fluid	Geol.	Mes	Photo	Commentaire
Tiroir ROV	8	28/05/2019	04:59	S 09 47.888	E 155 03.324	3344	Zone TVG150 Woodlark	x					look like a sponge

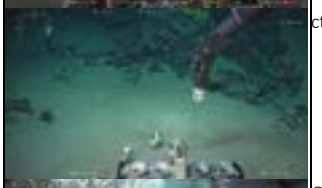
Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol.	Mes	Photo	Commentaire
Tiroir ROV	9	28/05/2019	10:01	S 09 47.518	E 155 03.581	3304	Zone TVG150 Woodlark	x					Sampling a hydrozoan
Panier-Geologie	5	28/05/2019	10:51	S 09 47.516	E 155 03.511	3327	Zone TVG150 Woodlark	x		x			Sampling rock + crinoid

Plongée : **739 – Woodlark (TGV150)**

Liste des opérations :

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Petite Boite de collecte	5	30/05/2019	01:50	S 09 47.934	E 155 03.135	3354	Zone TVG150 Woodlark	x		x			sampling oxidized chimney in PBT5
Petite Boite de collecte	2	30/05/2019	02:03	S 09 47.936	E 155 03.130	3357	Zone TVG150 Woodlark			x			Sampling sommital difuser of black smoker 8
Bouteille titane A (D) 750 ml	2	30/05/2019	03:00	S 09 47.938	E 155 03.126	3359	Zone TVG150 Woodlark		x				Fluid sampling with TiD2 on black smoker 8
Panier-Geologie	1	30/05/2019	03:11	S 09 47.939	E 155 03.129	3359	Zone TVG150 Woodlark			x			sampling the wall of black smoker 8, ROCK 1
Panier-Geologie	2	30/05/2019	03:19	S 09 47.939	E 155 03.127	3359	Zone TVG150 Woodlark			x			
Préleveur In-situ de Fluide (PIF)	2	31/05/2019	01:30	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark		x		x		Pump started and PIF syringe 2 and Chemini S started on Alviniconcha 2 point 1
Préleveur In-situ de Fluide (PIF)	3	31/05/2019	01:36	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark		x		x		Pump started and PIF syringe 3 and Chemini S started on Alviniconcha 2 point 2
Préleveur In-situ de Fluide (PIF)	4	31/05/2019	01:42	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark		x		x		Pump started and PIF syringe 4 and Chemini S started on Alviniconcha 2 point 3
Grande Boite de collecte	10	31/05/2019	01:55	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark	x					Sampling of alviniconcha 2 community ended GBT10 sclosed

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Chemini		31/05/2019	01:58	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark				x		Pump started Chemini S started on Alviniconcha 2 after sampling point 1
Chemini		31/05/2019	02:04	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark				x		Pump started Chemini S started on Alviniconcha 2 after sampling point 2
Chemini		31/05/2019	02:09	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark				x		Pump started Chemini S started on Alviniconcha 2 after sampling point 3
Aspirateur ^ faune	1	31/05/2019	02:20	S 09 47.939	E 155 03.117	3344	Zone TVG150 Woodlark	x					APSI 1 ended
Grand carottier tube	5	31/05/2019	02:56	S 09 47.852	E 155 03.208	3369	Zone TVG150 Woodlark	x					ct 5-4
Grand carottier tube	11	31/05/2019	02:57	S 09 47.852	E 155 03.209	3369	Zone TVG150 Woodlark	x					ct11
Grand carottier tube	7	31/05/2019	02:58	S 09 47.852	E 155 03.208	3369	Zone TVG150 Woodlark	x					Ct 7
Grand carottier tube	2	31/05/2019	02:59	S 09 47.852	E 155 03.208	3369	Zone TVG150 Woodlark	x					Ct 2 tube 4
Grand carottier tube	3	31/05/2019	03:41	S 09 47.914	E 155 03.207	3346	Zone TVG150 Woodlark	x					
Grand carottier tube	2	31/05/2019	03:44	S 09 47.914	E 155 03.207	3347	Zone TVG150 Woodlark	x					ct 2-8

Équipement	Eq	Date	Heure	Lat	Long	Prof	Localité	Bio.	Fluid	Geol	Mes	Photo	Commentaire
Grand carottier tube	1	31/05/2019	03:44	S 09 47.914	E 155 03.207	3347	Zone TVG150 Woodlark	x					Ct 1-3
Grand carottier tube	8	31/05/2019	03:46	S 09 47.915	E 155 03.206	3347	Zone TVG150 Woodlark	x					ct 8
Grande Boite de collecte	4	31/05/2019	04:18	S 09 47.947	E 155 03.135	3349	Zone TVG150 Woodlark			x			GBT4 closed
Grande Boite de collecte	3	31/05/2019	04:29	S 09 47.946	E 155 03.135	3348	Zone TVG150 Woodlark			x			peace of rock in chimney

CHUBACARC

N° Opération : **CHU-PL-01-01** | *30/03/2019* | *13:14:00*

Prélevé pour récupérer les cirripedes (balanes). Bordure de cheminée inactive

N° Echantillon : **CHU-PL-01-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Gros bloc prélevé sur la bordure d'une cheminée inactive (zone à balanes). Composé de chalcopyrite massive (4cm epaisseur) puis d'un mélange de sulfures finements cristallisés -parfois en pile d'assiette- (py/mc, sph, cp). Forte porosité. Si amorphe.

Lithologie : **Sulfures riche en Cu**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-01-02** | *30/03/2019* | *14:28:00*

Bloc de basalte altéré récupéré dans un plan de faille recoupant le site nord. Ce mur permet de voir la zone d'alimentation des cheminées aujourd'hui inactives

N° Echantillon : **CHU-PL-01-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Bloc prélevé dans un plan de faille sous les cheminées inactives. Il es recouvert d'un plaquage de sulfures Cu et sulfates. Il est altéré sur les bordures (jusqu'à 1cm) et relativement frais au coeur. Le halo d'altération est zoné et minéralisé.

Lithologie : **Basalte**
Sulfures ± sulfates

Morphologie : **Pillow lavas**
Stockwork ou réseau de veinules, impregnations

CHUBACARC

N° Opération : **CHU-PL-01-GBT1** | *30/03/2019* | *12:56:00*

Cheminée inactive du site central. Petit bloc d'une cheminé recouverte d'atacamite et d'oxyhydroxydes de fer. Cirripedes accrochés sur le bloc

N° Echantillon : **CHU-PL-01-GBT1**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Petit bloc de cheminé principalement composé de sulfures de fer finement cristallisés et associés à des sulfures de Zn et Cu. La bordure d'oxyhydroxydes de fer présente des structure filamenteuse d'origine bacterienne

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-01-GBT2** | *30/03/2019* | *11:57:00*

Site Central. Cheminée tombée sur le bord de la GBT2 lors du prélèvement des moules. Poussée dans la GBT2.

N° Echantillon : **CHU-PL-01-GBT2**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Cheminée ancienne de 8cm de diamètre à la base mais avec un conduit vide de 5cm. Elle est principalement composée de sulfures de zinc et de fer. Proche du conduit, la sphalérite domine même si de très rares grains de chalcopyrite ont pu être observés

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-01-GBT3** | *30/03/2019* | *11:18:00*

Site Central. Petite cheminée située au bord d'un flange ou ont été prélevées des étoiles de mer

N° Echantillon : **CHU-PL-01-GBT3**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Cheminées située sur la bordure d'un flange. Présnce d'au moins 3 conduits chacun caractérisé par la zonation (simplifiée) sulfures Zn (centre) - sulfures Fe (bordure) - Ox Fe. Le coeur des conduit est scellé et composé de wurtzites automorphes (mm).

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-01-GBT4** | *30/03/2019* | *12:29:00*

Blocs de cheminée proche de moules situé sur le site Central

N° Echantillon : **CHU-PL-01-GBT4**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Nb blocs d'une cheminée riche en sulfures Fe et Zn. Présence de wurtzite dont certaines avec l'habitus typique d'hexagone. La bordure est composée de Si amorphe et d'oxyde de Fe. Rares filaments Ox Fe.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-02-01** | *31/03/2019* | *19:02:00*

Partie basse de la cheminée active ou ont été réalisé les opérations de bouteille Titane, BEG, et GBT3

N° Echantillon : **CHU-PL-02-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Base de cheminée composée de chalcpyrite, wurtzite, sulfures de fer et de patch d'anhydrite. La zonation cp-wz-py/mc est très marquée. La wurtzite présente des reflets orangés ce qui indique un pauvreté en Fe. 2SP

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-02-GBT3** | *31/03/2019* | *18:30:00*

Sommet de cheminée d'anhydrite active. Prélevé pour analyse microbiologique

N° Echantillon : **CHU-PL-02-GBT3**

☐ Analyse XRF ☐ Analyse XRD ☑ Section polie

Petits blocs récupéré après prélèvement pour microbiologie. Composé principalement d'anhydrite et de quelques sulfures disséminés

Lithologie : **Sulfates riche en Ca**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-03-01** | *03/04/2019* | *08:02:00*

Prélèvement de la bordure d'un Flange situé dans la zone centrale.

N° Echantillon : **CHU-PL-03-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Pris au même endroit que CHU-PL03-05 et donc très similaire au niveau de la minéralogie et de la morphologie. Présence de tubes fossilisés de paralvinella sur la surface.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-03-02** | *03/04/2019* | *13:00:00*

Prélèvement de sulfures massifs à la base des monts sud

N° Echantillon : **CHU-PL-03-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

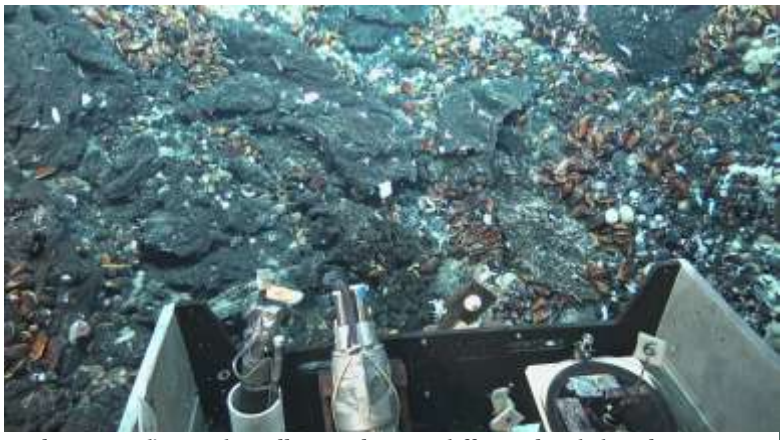
Sulfures semi-massifs présentant une texture quasi bréchique (blocs d'anciennes cheminées?). A certains endroits, on retrouve les zonations typiques des cheminées. Dans l'ensemble, l'échantillon est dominé par le sulfure de zinc (sphalérite), les sulfates et la silice. Les sulfures de fer (py/mc) sont aussi présents mais en plus faible quantité que la sph. Présence de sph orangées pauvre en Fe. Bcp de silice et de sulfates dans la porosité et dans le ciment qui lie les clastes.

Lithologie : **Sulfures riche en Zn**

Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-03-03** | *04/04/2019* | *09:34:00*



Prélèvement d'une échantillon sur la zone diffuse. Bloc de basalte recouvert d'une couche d'oxyhydroxydes de Mn

N° Echantillon : **CHU-PL-03-03**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Bloc de basalte moyennement vacuolaire (millimétriques à pluricentimériques). Il est recouvert d'une couche plurimillimétrique d'oxhydydroxydes de Mn.

Lithologie : **Basalte**
Minéralisation Fe-Mn

Morphologie : **Coulée de lave**
Encroûtement ou dépôts

N° Opération : **CHU-PL-03-04** | *04/04/2019* | *10:07:00*

Cheminée active d'anhydrite tombée dans le panier juste avant le prélèvement de la PBT3. Après la remontée, il reste un petit morceau du coeur de la cheminée

N° Echantillon : **CHU-PL-03-04**

☐ Analyse XRF ☐ Analyse XRD ☑ Section polie

Petit bloc d'un coeur de cheminée. Zonation très marquée avec du coeur vers la bordure : Wurtzite/sphalerite (5mm); Cp massive (1-3mm); Mélange cp, wz/sph, py, sulfates (1cm); Py/mc, anhydrite, barytine avec un peu de cp, wz/sph (3mm); silice amorphe et oxydes Fe (<1mm)

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-03-05** | *04/04/2019* | *13:51:00*

Flange actif prélevé dans la zone hydrothermale centrale.

N° Echantillon : **CHU-PL-03-05**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau de flange actif. La bordure blanchâtre est recouverte de tubes fossilisés de paralvinella et de rares bissus de moules. La partie blanchâtre fait 1 mm d'épaisseur et est composée de silice amorphe. La zone plus centrale est un mélange de silice, barytine et sphalérite (à confirmer en XRD). La barytine est très abondante et systématiquement automorphe.

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-03-06** | *04/04/2019* | *14:17:00*

Bloc prélevé à la basedu flange actif du sud

N° Echantillon : **CHU-PL-03-06**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Roche pseudo-bréchique à porosité moyenne composée de sulfures, sulfates et silice amorphe. Plusieurs clastes cimentés par un liseré plurimillimétrique de silice et d'un peu d'oxyhydroxydes de Fe. Le coeur des clastes est composé de sulfures de Zn et de sulfates. Qq clastes ont de la pyrite en quantité significative. Certains clastes présentent des structures équivalentes à CHU-PL03-01 et 05

Lithologie : **Sulfures ± sulfates**

Morphologie : **Brèche hydrothermale**

CHUBACARC

N° Opération : **CHU-PL-03-07** | *04/04/2019* | *17:40:00*

Bloc de basalte prélevé pour un échantillon d'éponge

N° Echantillon : **CHU-PL-03-07**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Basalte vacuolaire (petites vacuoles) et recouvert d'une fine couche d'oxyhydroxydes de Mn. Prélevé pour les éponges fixées.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-03-08** | *04/04/2019* | *23:51:00*

Bloc prélevé pour les éponges fixées dessus

N° Echantillon : **CHU-PL-03-08**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Bloc de lave présentant une morphologie de lave cordée. Il est altéré (proche d'une zone de BT) et revouvert par endroits d'oxyhydroxydes de Fe et Mn. Prélevé pour les éponges fixées

Lithologie : **Basalte**

Morphologie : **Lave cordée**

CHUBACARC

N° Opération : **CHU-PL-03-GBT2** | *03/04/2019* | *14:07:00*

Prélevé par les biologistes durant l'échantillonnage des moules. Bloc de lave

N° Echantillon : **CHU-PL-03-GBT2**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Petit bloc de 4cm de diamètre. Lave vacuolaire mélanocrate

Lithologie : **Roche basaltique**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-03-GBT4** | *03/04/2019* | *08:32:00*

Prélèvement de cheminée sur la zone nord (couplé à BEG, Ti et microbio).

N° Echantillon : **CHU-PL-03-GBT4**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Deux natures différentes: blocs de cheminée active à anhydrite dominante avec cp-wz-py/mc zoné (GBT4a) et blocs de cheminée inactive à bordure oxydée.

Lithologie : **Sulfates ± sulfures**
Sulfures riche en Zn

Morphologie : **Cheminée**
Cheminée

CHUBACARC

N° Opération : **CHU-PL-03-GBT5** | *04/04/2019* | *12:34:00*

Prélèvement d'un morceau de substrat des alviniconcha. Bloc de basalte légèrement altéré.

N° Echantillon : **CHU-PL-03-GBT5**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Roche mélanocrate aphyrique et très vacuolaire, probablement un basalte (s.l.). Les vacuoles sont nombreuses et petites (<1mm) à l'exception de vacuoles centimétriques. L'échantillon est recouvert de tubes de paralvinella.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-04-01** | *06/04/2019* | *00:39:21*

Petits morceaux de la cheminée active dont le fluide a été prélevé avec BEG et les bouteilles Titanes (315°C)

N° Echantillon : **CHU-PL-04-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

La plupart de morceaux sont constitués d'anhydrite sauf un qui est composé de cp massive, d'anhydrite, de py/mc, de sulfures de Zn et d'une bordure d'ox. Fe et silice. La zonation marque le gradient de température du coeur vers la bordure.

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-04-02** | *06/04/2019* | *04:50:12*

Bloc de basalte altéré récupéré pour prélevé une anémone. L'anémone s'est détachée à la remontée du ROV

N° Echantillon : **CHU-PL-04-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Basalte altéré et peu vacuolaire composée d'une matrice microcistalline et de quelques porphyrocristaux. Le peu de vacuoles présentes et les fractures ont subis la percolation d'un fluide hydrothermal. L'altération en bordure est de 1mm maximum

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-04-03** | *06/04/2019* | *05:08:29*

Bloc de basalte récupéré pour le prélèvement de cirripèdes

N° Echantillon : **CHU-PL-04-03**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Basalte prélevé par les biologiste pour les cirripèdes. Le bloc est conservé dans de l'ethanol pour traitement à terre.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

CHUBACARC

N° Opération : **CHU-PL-05-01** | *10/04/2019* | *01:36:39*

Flange actif situé au sud du site Phoenix

N° Echantillon : **CHU-PL-05-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau de flange actif composé de py/mc, sulfures de Zn, barytine, anhydrite, opale. Certaines phases sont automorphes (ex. py dans zone de conduit), d'autres sont collomorphes (ex. sph, mc). Des sulfates se sont développés sur les py automorphes.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-05-02** | *10/04/2019* | *01:39:35*

Sulfure semi-massif prélevé dans le talus à la base du flange actif (CHU-PL-01-01)

N° Echantillon : **CHU-PL-05-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sulfure semi-massif oxydé en bordure avec présence d'atacamite. La porosité es significative mais l'on note des imprégations de cp automorphes indiquant un début de maturation. Il est composé de cp, sph/wz, py/mc cimenté par de l'opale.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-05-03** | *10/04/2019* | *05:21:30*

Cheminée d'anhydrite tombée dans le panier après la tentative de prélèvement pour la PBT5

N° Echantillon : **CHU-PL-05-03**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Cheminée d'anhydrite (>90% d'anhydrite) avec quelques sulfures disséminés ; principalement du sulfure de zinc.

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-05-04** | *10/04/2019* | *08:01:18*

Bloc de base de cheminée prélevé après la prise du fluide hydrothermal (270°C) avec BEG et les bouteilles titanes

N° Echantillon : **CHU-PL-05-04**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Base de cheminée active. La zone du counduit est composé de wurtzite automorphe sur lesquelles précipitent des cp. Vers la bordure : wurtzite à différentes teneurs en Fe (oranges et noires) et de l'anhydrite. Ox Fe et silice en bordure exterieure.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-05-05** | *11/04/2019* | *04:49:45*

Petit bloc de sulfures semi-massif prélevé sur un site composés de blocs de cheminées anciennes. Site encore actif principalement sous forme de diffusion.

N° Echantillon : **CHU-PL-05-05**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sulfures semi-massifs composés principalement de sulfures de fer et de cp. La porosité est plus faible que celle d'une cheminée et la cp impregnent fortement l'échantillon (remplacement progressif). Un bloc présente est même recoupé par une veine de cp.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Minerai massif à submassif**

N° Opération : **CHU-PL-05-06** | *11/04/2019* | *05:16:37*

Sur la zone des bouteilles titanes et BEG, prélèvement d'un bloc de base de cheminée pour récupérer les cirripèdes.

N° Echantillon : **CHU-PL-05-06**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Ancienne base de cheminée composée de cp, wz, sph, py, mc assez proche minéralogiquement de CHU-PL-05-04. PLusieurs conduits sont présents et scellés par de la sph collomorphe; un est en partie oxydé.

Lithologie : **Sulfures ± sulfates**

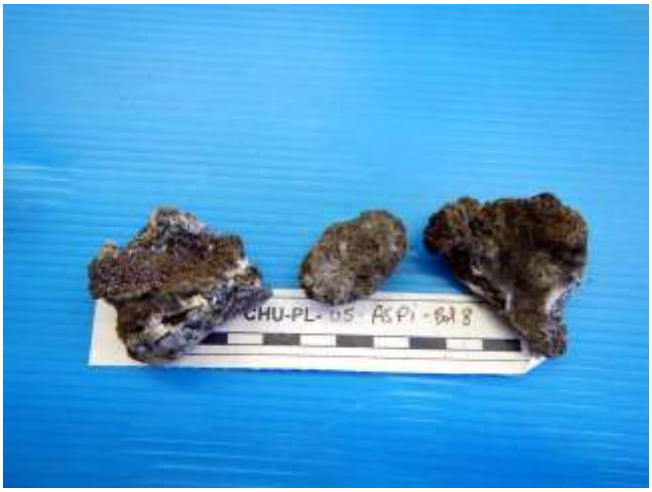
Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-05-ASPI-Bol** | *11/04/2019* | *01:16:32*

Petits blocs récupérés dans le bol 8 de de l'aspirateur à faune. Provient de deux sites actifs HT séparés de 30m

N° Echantillon : **CHU-PL-05-ASPI-Bol8**



☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Bloc de cheminées plus ou moins riches en sulfures ou en anhydrite.

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-05-PBT5** | *10/04/2019* | *05:35:47*

Prélèvement d'un petite cheminée d'anhydrite (après effondrement de la grande) pour la microbiologie.

N° Echantillon : **CHU-PL-05-PBT5**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Cheminée d'anhydrite similaire à CHU-PL-05-03

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-06-GBT4** | *16/04/2019* | *01:48:00*

Cheminée de Fe-Si prélevé au somment d'un mont volcanique

N° Echantillon : **CHU-PL-06-GBT4**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceaux de concretions Fe-Si de type cheminée. Certains morceaux sont couvert d'une fine couche de Mn. Presence de structures fibreuses (bacteriennes?). Zone interne des concretions siliceuse (blanche). Nb tubes de vers dans zone orange.

Lithologie : **Minéralisation Fe-Si-Mn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-07-01** | *16/04/2019* | *20:34:00*

N° Echantillon : **CHU-PL-07-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sulfures semi-massifs composés majoritairement de py et mc. L'échantillon présente une porosité encore importante indiquant une maturation assez faible. Dans les porosités, on observe de la barytine, py et mc automorphe et des "tubes" et/ou filaments de silice amorphe.

Lithologie : **Sulfures rche Fe**

Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-07-02** | *17/04/2019* | *01:50:00*

Prélèvement de la bordure d'une cheminée d'anhydrite. Zone finalement pas idéale pour le prélèvement de fluide

N° Echantillon : **CHU-PL-07-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Bordure de cheminée active assez récente. Principalement composée d'anhydrite avec un conduit zoné : cp - sph/py - py/mc. Les sulfures de zinc présentent des teneurs variés en fer (couleur noire et orange).

Lithologie : **Sulfates ± sulfures**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-07-03** | *17/04/2019* | *11:52:00*

Prélèvement d'un flange actif sur le site sud

N° Echantillon : **CHU-PL-07-03**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Flange actif prélevé sur la zone sud. La bordure est composée de Si et FeOx (<1mm) recouverts de paralvinella. Zonation plus ou moins complexe. Du bord vers le fluide: Ba, Si et sulfures disseminés - sulfures dendritiques - Ba automorphe avec un peu de sphalerite - py/cp automorphe.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-07-04** | *17/04/2019* | *14:25:00*

Prélèvement d'une cheminée couvert de cirripèdes à un mètre derrière la zone de prélèvement des fluides.

N° Echantillon : **CHU-PL-07-04**

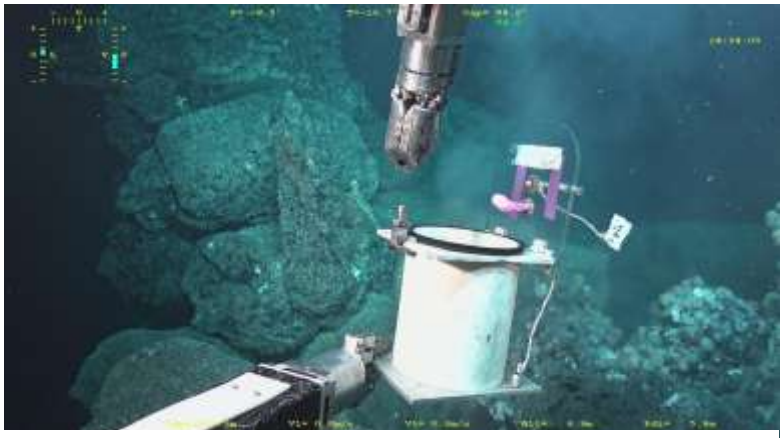
☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sommet de cheminée colonisé par des cirripedes. Structure poreuse et microcristalline. Les conduits sont oxydés. Majoritairement constitué d'un mélange de sulfure de fer, de digenite (irisations bien visible) et de barytine. Un peu de sph/wz (a vérifier en XRD).

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-07-GBT1** | *17/04/2019* | *14:33:00*



Prélèvement de cheminée pour microbiologie. Identifié au départ comme PBT3 mais pas trouvé dans le cahier de quart.

N° Echantillon : **CHU-PL-07-GBT1**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Similaire à CHU-PL07-02. Attention, identifié au départ comme PBT3?

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-07-GBT3** | *17/04/2019* | *00:26:00*

Prélèvement d'une cheminée pour les cirripèdes fixés

N° Echantillon : **CHU-PL-07-GBT3**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceaux de sulfures restant après prélèvement pour cirripèdes. Majoritairement constitué de sulfures de zinc associés a quelques py/mc. Présence de barytine automorphes. Deux morceaux de laves vitreuses vacuolaires sont également présentes.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-08-01** | *19/04/2019* | *01:56:00*

Prélèvement d'une bordure de la base d'une cheminée d'anhydrite. Même cheminée que pour les prélèvements de fluides.

N° Echantillon : **CHU-PL-08-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

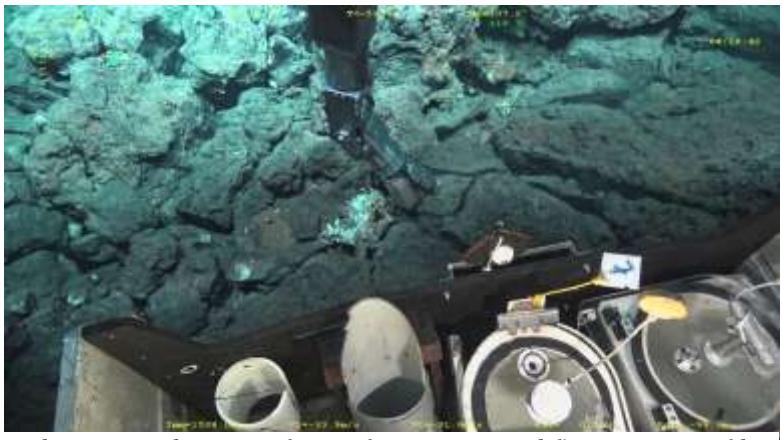
Bordure d'une cheminée active prélevé à la base de celle-ci. L'échantillon présente une épaisseur importante de sulfures de fer et cuivre et une porosité assez faible. Il est zonée de l'exterieur vers l'interieur : anh,sph, py/mc - sph, py, cp - py, cp. Quelques patchs d'anhdyrite au centre montrent les infiltrations d'eau de mer. Présence de py et cp automorphes visibles à l'oeil nu.

Lithologie : **Sulfures riche en Cu**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-08-02** | *19/04/2019* | *04:10:00*



Prélèvement réalisé au nord ouest du mont principal d'AsterX. Ressemble au slab siliceux prélevés en 2012, mais il s'agit d'une lave.

N° Echantillon : **CHU-PL-08-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Ressemblait au slab siliceux prélevé au coeur du mont. Il s'agit finalement d'une lave peu vacuolaire avec quelques phénocristaux et une bordure d'altération blanche de 1 à 2 cm.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-08-03** | *19/04/2019* | *04:33:00*

Petit bloc de sulfures massifs prélevés sur le talus nord-ouest d'AsterX

N° Echantillon : **CHU-PL-08-03**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Petit bloc de sulfure massif prélevé sur le talus nord-ouest d'AsterX. Composé principalement de pyrite et de chalcopyrite. La porosité faible indique une certaine maturité des sulfures.

Lithologie : **Sulfures ± sulfates**

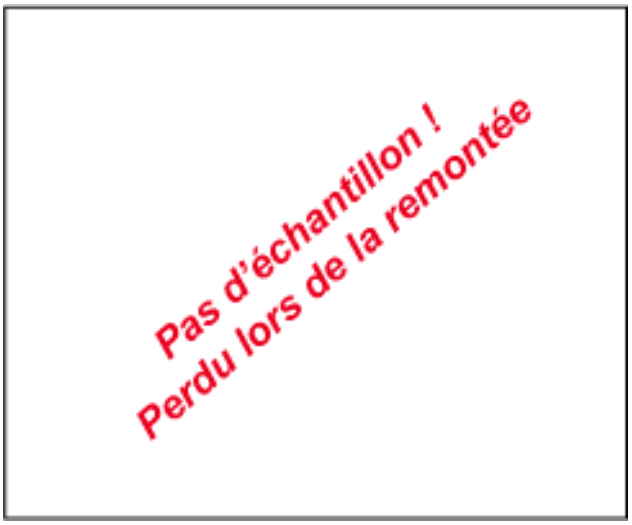
Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-08-04** | *19/04/2019* | *04:34:00*

Prélèvement d'une cheminée très oxydée. Le morceau a été totalement lessivé à la remontée du ROV et n'était donc plus présent.

N° Echantillon : **CHU-PL-08-04**

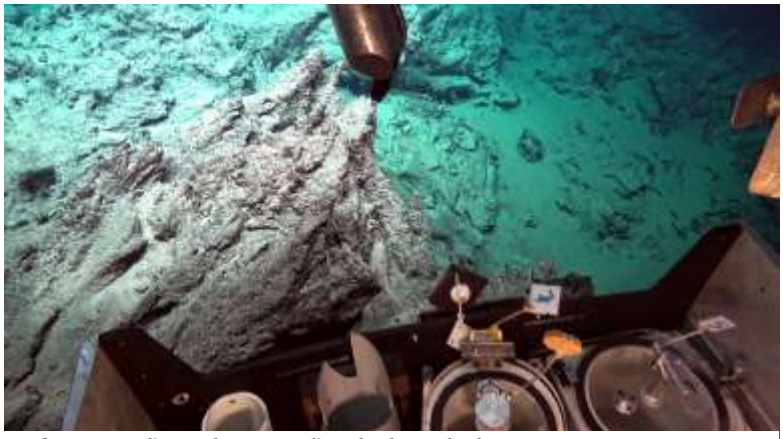


☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Lithologie :

Morphologie :

N° Opération : **CHU-PL-08-05** | *19/04/2019* | *05:27:00*



Prélèvement d'une cheminée d'oxyhydroxyde de manganese sur un site fossile situé au sud d'AsterX

N° Echantillon : **CHU-PL-08-05**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Précipité de basse température avec une morphologie de cheminée. Composé presque totalement d'oxyhydroxydes de Mn. Présence de structure concentriques. 2 zones concentriques visibles : une ellipsoidale et l'autre discoidale. Le lustre métallique des oxydes de Mn est caractéristique d'une origine hydrothermale.

Lithologie : **Minéralisation Fe-Mn**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-08-06** | *19/04/2019* | *05:36:00*

Prélèvement d'un morceau de cheminée de barytine effondrée sur site fossile situé au sud d'AsterX

N° Echantillon : **CHU-PL-08-06**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Cheminée principalement composée de barytine avec un peu de sulfures de Zn disséminés. Présence de zonations avec plus ou moins de sulfures avec la barytine. Certaines zonations noires > 1cm d'épaisseur. Oxydation au coeur et sur la bordure.

Lithologie : **Sulfates riche en Ba**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-08-07** | *19/04/2019* | *05:58:00*

Bloc de sulfures massifs prélevés sur un site (plusieurs?) fossile très étendu.

N° Echantillon : **CHU-PL-08-07**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Bloc de sulfures massifs recouvert d'une couche millimétrique d'ox Fe. Très riche en silice amorphe. Composée de sulfures de fer et cuivre disposés sous forme de "patchs" massifs. Présence de clastes blancs : clastes basaltiques totalement altérés. La porosité est très faible.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-08-08** | *19/04/2019* | *11:24:00*

Bloc de sulfure prélevé pour les cirripèdes sur le site Stéphanie.

N° Echantillon : **CHU-PL-08-08**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Probablement une cheminée (porosité assez forte). Composée principalement de sulfures de Zn et de Fe. Présence de chalcopyrite, d'anhydrite et de barytine. Les sulfures de Zn présentent différentes colorations (noirs et oranges). Assez riche en silice amorphe.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-08-09** | *20/04/2019* | *03:39:00*

Prélèvement de sulfures pour cirripèdes. Remarque: prélevé après le CHU-PL08-10 mais l'information n'était pas claire à l'arrivée du ROV sur le pont

N° Echantillon : **CHU-PL-08-09**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Cheminée riche en zinc prélevée pour les cirripèdes. Composée de sphalérite, d'un peu de sulfures de fer et de barytine. Présence de minéraux cubiques à reflets argentés : galène? Présence de silice amorphe

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-08-10** | *20/04/2019* | *00:36:00*

Prélèvement de laves pour une éponge

N° Echantillon : **CHU-PL-08-10**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Lave prélevé pour la gorgone. Lave très vitreuse et vacuolaire recouverte d'une fine couche d'oxyhydroxydes de Mn. Probablement une lave évoluée type trachydacite

Lithologie : **Roche intermédiaire à felsique**
Minéralisation Fe-Mn

Morphologie : **Coulée de lave**
Encroûtement ou dépôts

N° Opération : **CHU-PL-08-CL6** | *19/04/2019* | *03:47:00*

Prélèvement de sédiments hydrothermaux au nord d'AsterX. Au départ, echantillonnage prévu pour faire du barcoding

N° Echantillon : **CHU-PL-08-CL6**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Sédiments hydrothermaux situés en bordure nord du site AsterX. Riche en oxyhydroxydes de fer et en silice. Autres minéraux à determiner en XRD. Divisé en huit sous-echantillons : 0-1cm, 1-2cm, 2-3cm, 3-4cm, 5-6cm, 6-7cm, 7-9cm.

Lithologie : **Roche minéralisée (s.l.)**

Morphologie :

CHUBACARC

N° Opération : **CHU-PL-08-GBT5** | *19/04/2019* | *10:02:00*

Prélèvement d'Ifremeria par "raclage". Un morceau de sulfure est tombé dans la boite pendant le prélèvement.

N° Echantillon : **CHU-PL-08-GBT5**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau de cheminée riche en sulfures de Zn. Très poreuse avec des conduits bien définis. Présence de sulfures de fer et de sulfates.

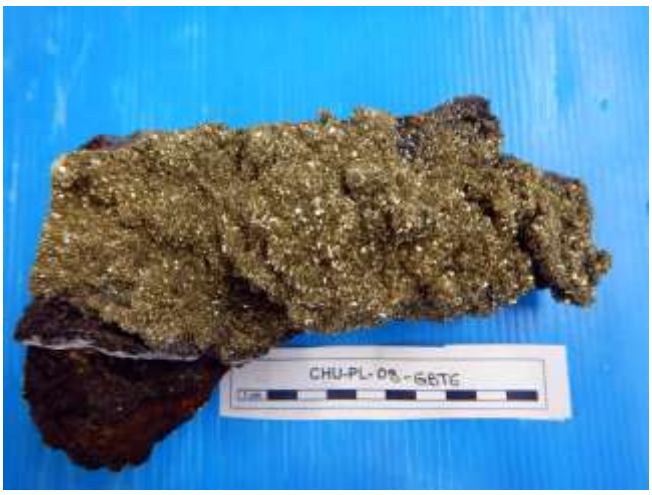
Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-08-GBT6** | *19/04/2019* | *11:42:00*

Sur même cheminée, prélèvement d'anhydrite pour microbiologie. D'abord avec la PBT7 et ensuite avec la GBT6. Récupération de morceaux de la GBT6 dont un enorme bloc riche en py et cp automorphes

N° Echantillon : **CHU-PL-08-GBT6**



☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Bordure de cheminée active (base de la cheminée) prélevé sur le site stephanie. Très similaire au CHU-PL08-01 avec de superbes chalcopyrite et pyrite automorphes (plurimillimétriques à centimétriques)

Lithologie : **Sulfures riche en Cu**

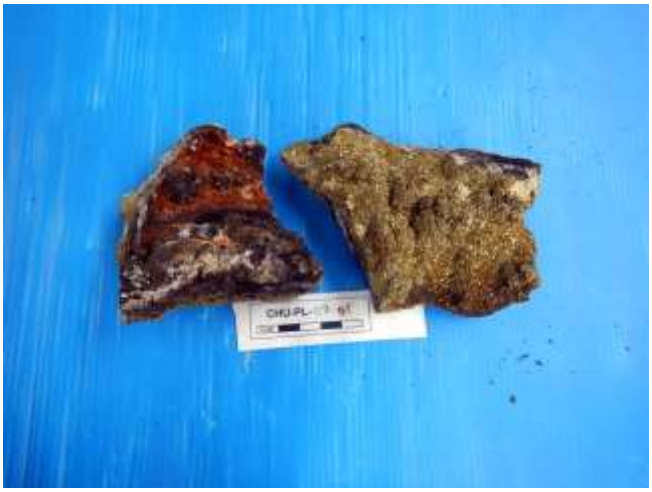
Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-09-01** | *21/04/2019* | *03:33:00*

Prélèvement de bordure de cheminée d'anhydrite (base de la cheminée). Même cheminée que pour les bouteilles titanes et la BEG.

N° Echantillon : **CHU-PL-09-01**



☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Plusieurs blocs d'une base de cheminée active. Composée de cp, py, sph/wz et anh avec des zonations traduisant les gradients de températures. Echantillon très similaire aux CHU-PL08-01 et CHu-PL08-02.

Lithologie : **Sulfures riche en Cu**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-09-02**

Bloc de basalte prélevé pour les cirripèdes

N° Echantillon : **CHU-PL-09-02**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

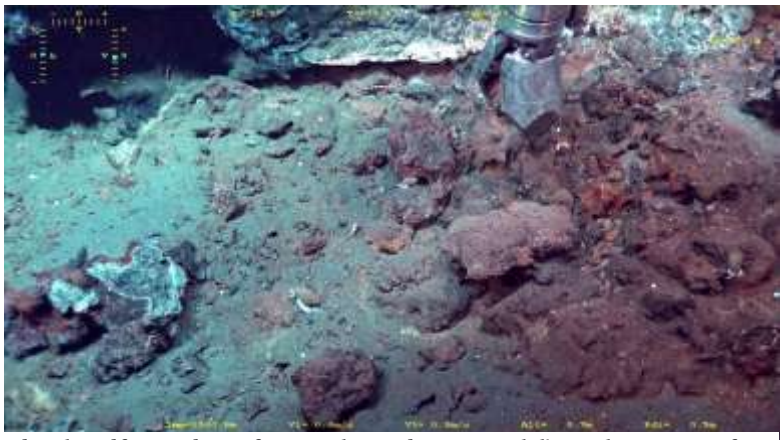
Basalte prélevé pour les cirripèdes. Texture microlithique. Présente des vacuoles de taille généralement inférieures à 1 mm. Seuls de rares vacuoles sont > 1mm. Pas de cristaux visibles à l'oeil nu mais de nombreux microlithes de plagioclases. Echantillon très fracturé et altéré (oxydation) le long des fractures

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

CHUBACARC

N° Opération : **CHU-PL-09-03** | *21/04/2019* | *08:51:00*



Bloc de sulfures à la surface oxydée prélevé au pied d'une cheminée en fin d'activité hydrothermale (diffusion).

N° Echantillon : **CHU-PL-09-03**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau de cheminée inactive caractérisé par une forte porosité. Composée principalement de py/mc associé à des sph noires et orangés et un peu de cp. Présence de silice et de barytine dans les porosités. Il y a également des reliques d'anciens conduits présentant des textures massives d'epaisseur millimétriques

Lithologie : **Sulfures rche Fe**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-09-04** | *21/04/2019* | *09:51:34*

Dans zone inactive, au sud du point appelé Fati Ufu 12, prélèvement d'un morceau de sulfures plutôt massifs.

N° Echantillon : **CHU-PL-09-04**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau de sulfures massifs, dense, à porosité faible indiquant une certaine maturation. Composée de py/mc, sph et cp. La py/mc et sph semblent dominantes bien que réparties de manière hétérogène. La cp se présente sous forme d'imprégnations (remplacement) et est automorphe.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Minerai massif à submassif**

CHUBACARC

N° Opération : **CHU-PL-09-05** | *21/04/2019* | *11:06:00*

Sur la zone nord de Fati Ufu, dans le secteur ou l'activité hydrothermale est très faible, prélèvement d'un bloc de sulfures massifs.

N° Echantillon : **CHU-PL-09-05**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sulfures semi-massifs présentant une porosité encore importante (relativement immature). Il est recouvert d'une couche millimétrique d'oxyhydroxydes de fer. L'échantillon est principalement composé de py/mc. La sph a été observée en faible quantité. On note une début de remplissage de la porosité par de la cp et de la py automorphe (taille jusqu'à 1-2mm). La silice amorphe se trouve dans les porosités mais également dans des zones centimétriques ou elle constitue la phase principale.

Lithologie : **Sulfures ± sulfates**

Morphologie : **Minerai massif à submassif**

N° Opération : **CHU-PL-09-06** | *21/04/2019* | *17:03:00*

Prélèvement d'un bloc de basalte pour les cirripèdes

N° Echantillon : **CHU-PL-09-06**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Basalte à texture microlithique et très vacuolaire. Les vacuoles sont de taille millimétrique à centimétrique et sont généralement remplies de phases secondaires. Pas de phénocristaux visibles à l'oeil nu.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

CHUBACARC

N° Opération : **CHU-PL-09-07**

Prélèvement d'une bordure de la base d'une cheminée d'anhydrite. Prise d'un morceau indurée qui finalement est composée quasi exclusivement d'anhydrite.

N° Echantillon : **CHU-PL-09-07**

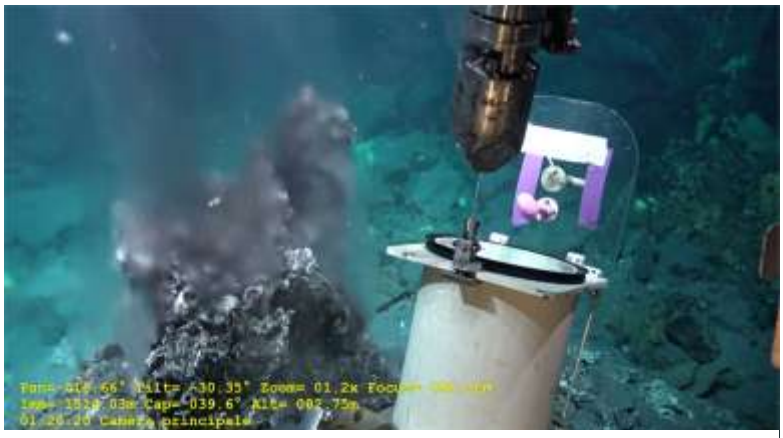
☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Morceau d'anhydrite indurée prélevée à la base d'une cheminée active. Composée à plus de 95% d'anhydrite aciculaires. L'échantillon est majoritairement grisatre mais plusieurs patchs ou veines d'anhydrite blanche sont visibles. Les sulfures sont rares et lorsqu'ils sont présents, ils sont collomorphes. Il s'agit principalement de sphalérite et on les observe dans les zones poreuses de l'échantillon.

Lithologie : **Sulfates riche en Ca**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-09-GBT1** | *21/04/2019* | *01:38:00*



Prélèvement d'une cheminée d'anhydrite pour mircobiologie.

N° Echantillon : **CHU-PL-09-GBT1**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Cheminée d'anhydrite prélevée pour les études de microbiologie.

Lithologie : **Sulfates riche en Ca**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-09-GBT3**

N° Echantillon : **CHU-PL-09-GBT3**

Morceau de cheminée associé aux ifremeria. Récupéré lors du prélèvement des ifremeria

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Petit morceau de cheminée composé majoritairement de sulfures de zinc associé à des sulfures de fer, sulfates. Egalement beaucoup de silice amorphe.

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-09-PBT4**

N° Echantillon : **CHU-PL-09-PBT4**

Morceau de cheminée associé aux alviniconcha. Récupéré lors du prélèvement des alviniconcha

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Morceau de cheminée composé majoritairement de sulfures de Zn associés à des sulfures de fer, barytine et silice. Surface recouverte de paralvinella.

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-09-PBT7**

N° Echantillon : **CHU-PL-09-PBT7**

Petit morceau de cheminée prélevé avec les moules

Plus d'échantillon de référence
Totalité prise pour les analyses

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Morceau de cheminée composé principalement de sulfures de zinc, de fer et de barytine. Présence importante de silice amorphe. Porosité importante de l'échantillon

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-10-01** *23/04/2019* *11:39:00*

Prélèvement de dépôts de basse température dans le sud de la caldéra. Echantillon lessivé lors de la remontée - plus rien dans le panier ROV sur le pont.

N° Echantillon : **CHU-PL-10-01**

Pas d'échantillon !
Perdu lors de la remontée

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Lithologie :

Morphologie :

CHUBACARC

N° Opération : **CHU-PL-10-02** | *23/04/2019* | *14:32:00*

Bloc de pillow lavas dans la zone de diffusion associée au siboglinidés. Prélèvement pour les études biologiques.

N° Echantillon : **CHU-PL-10-02**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Bloc de pillow lava avec la bordure vitreuse encore visible. Prélevé dans la zone de diffusion des siboglinidés, ce qui explique l'altération significative de l'échantillon. Il y a un "saupoudrage" blanc sur certaines zones qui n'a pas pu être identifié.

Lithologie : **Basalte**

Morphologie : **Pillow lavas**

N° Opération : **CHU-PL-10-03** | *23/04/2019* | *15:38:00*

Prélèvement de basalte très altéré et minéralisé sur le flanc sud de la caldéra. Pris sur la zone de stockwork repérée en 2010.

N° Echantillon : **CHU-PL-10-03**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Bloc de basalte intensement altéré. On reconnait encore la texture microlithique bien que la minéralogie soit totalement modifiée. Roche leucocrate assez peu vacuolaire. Les minéraux d'altération sont difficile à identifier (voir les résultats de XRD). La minéralisation (py et cp) est disséminé dans la totalité de l'échantillon. Pas de veines visibles sur les plans de coupe observés.

Lithologie : **Basalte**
Sulfures ± sulfates

Morphologie : **Coulée de lave**
Minéralisation disséminée

CHUBACARC

N° Opération : **CHU-PL-10-04** | *23/04/2019* | *17:47:00*

Prélèvement d'un bloc de basalte associé aux ifremeria

N° Echantillon : **CHU-PL-10-04**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Bloc de basalte prélevé pour les cirripèdes

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-10-05** | *23/04/2019* | *18:10:00*

Prélèvement de basalte dans la zone de diffusion avec ifremeria. Pour la biologie.

N° Echantillon : **CHU-PL-10-05**

☐ Analyse XRF ☐ Analyse XRD ☐ Section polie

Bloc de pillow lava altéré. Très vacuolaire avec des vacuoles millimétriques en grande partie remplies de minéraux secondaires.

Lithologie : **Basalte**

Morphologie : **Pillow lavas**

CHUBACARC

N° Opération : **CHU-PL-10-06** | *23/04/2019* | *18:17:00*

Prélèvement d'un bloc de basalte dans la zone de diffusion à Ifremeria. Egalement un prélèvement à vocation d'étude biologique.

N° Echantillon : **CHU-PL-10-06**

☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Lave sous forme de prisme. Lave prophyrique, presque microgrenue à l'oeil nu. Quelques vacuoles sont présentes (100aine de µm en taille). Nombreux phénocristaux de plagioclases. Pas d'olivine ou pyroxène visibles. Présence d'un halo d'altération sur les bords de l'échantillon.

Lithologie : **Basalte**

Morphologie : **Coulée de lave**

N° Opération : **CHU-PL-10-07** | *24/04/2019* | *01:19:00*

Prélèvement d'un sommet de cheminée inactive dans la partie sud-est de la caldéra. Secteur qui avait été visité par G. Chazot en 2010.

N° Echantillon : **CHU-PL-10-07**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Sommet de cheminée inactive. On trouve un seul conduit et une zonation concentrique très régulière. La bordure centrale du conduit est composée de cp (1mm d'épaisseur) puis on trouve une zone riche en sph avec plus ou moins de po (1-2cm). Enfin, une zone principalement composée de po (1cm). L'interieur du conduit est parfois totalement comblé par de la sph.

Lithologie : **Sulfures rche Fe**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-10-GBT4** | *23/04/2019* | *22:52:00*

Prélèvement des cheminées de silice et fer situé sur le mur nord de la caldéra. Ces cheminées diffusent toujours un fluide à 50-60°C.

N° Echantillon : **CHU-PL-10-GBT4**

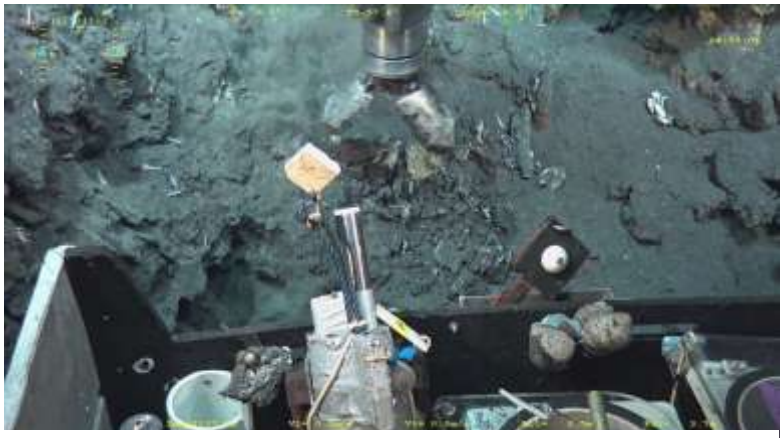
☑ Analyse XRF ☑ Analyse XRD ☐ Section polie

Morceaux de cheminées de silice et d'oxyhydroxydes de fer. La texture est essentiellement fibreuse/filamenteuse très probablement associée à une forte activité bactérienne. On observe également des trous correspondant à des tubes fossilisés (vers?)

Lithologie : **Minéralisation Fe-Si-Mn**

Morphologie : **Cheminée**

N° Opération : **CHU-PL-12-01** | *27/04/2019* | *04:45:00*



Prélèvement de la base d'une cheminée active. Très difficile à prélever mais plusieurs petits morceaux ont pu être récupérés

N° Echantillon : **CHU-PL-12-01**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Nombreux morceaux de la bordure d'une base de cheminée active. Composés de sulfures au coeur avec zonation du type : Cp et py - Sph et py - Ox Fe et silice. Plusieurs morceaux présentent des pacths importants d'anhydrite indiquant une interaction à l'eau de mer.

Lithologie : **Sulfures riche en Cu**

Morphologie : **Cheminée**

CHUBACARC

N° Opération : **CHU-PL-12-02** | *27/04/2019* | *05:21:00*

Sommet de cheminée inactive couvert de cirripèdes. Echantillon prélevé à la fois pour la biologie et pour la géologie

N° Echantillon : **CHU-PL-12-02**

☑ Analyse XRF ☑ Analyse XRD ☑ Section polie

Echantillon principalement composé de sulfures de zinc (majoritaires) et de fer. Certaines sphalérites sont orangées témoignant d'une teneur en fer assez faible. La porosité reste importante bien qu'elle soit en partie scéllée par la silice amorphe - qui est, par ailleurs, abondante dans l'échantillon.

Lithologie : **Sulfures riche en Zn**

Morphologie : **Cheminée**