

## **CRUISE SUMMARY**

### **14-Oct: Pensacola, FL**

**1500: scheduled departure**

**1700: actual departure**

**1930: begin transit to first site**

The ship was scheduled to leave port on slack tide at 1500 hrs. This was delayed in order for an agent from the American Bureau of Shipping to arrive at the port and renew the ship's annual certification. Once this was complete at approximately 1700, the Ron Brown left the pier.

Before leaving port, the ship conducted a series of stress tests on the propulsion system since it had undergone significant repairs during our port call in Pensacola. Once these tests were complete, the technician who was on board for these tests was dropped off, and the ship was underway to the first site at approximately 1930.

### **15-Oct: Viosca Knoll 826**

**0200: Arrival on station**

**0300: Elevator launch**

**0930: attempted current meter recovery**

**1130: sediment trap recovery**

**1500: Jason launch**

We arrived on station at approximately 0200 hrs. The first task was a calibration of the ultra-short baseline (USBL) navigation system by the Jason group. The elevator was equipped with a USBL transponder and was launched at approximately 0300 hrs. The survey consisted of the ship moving to the four cardinal points of the compass centered around the USBL beacon and recoding the readings on the position of the beacon. This was complete at approximately 0800 hrs.

Following the navigation survey, at approximately 0930, we began the recovery of two moorings that were placed on the seafloor last year. The first attempt was on the current meter. The both of the acoustic releases indicated that they had released, but as the ship approached the position of the mooring from a variety of headings, it was never sighted and the range to the beacon never declined below the water depth. This indicated that the mooring was likely to still be on the bottom. The sediment trap was called up at 1130 and was spotted shortly thereafter. It was recovered at approximately 1200 and secured.

Jason was ready to be deployed on lowering J2-526 at 1330 hrs over the position of the current meter mooring. Before the vehicle was launched, there was a sighting of what appeared to be the current meter floats. The small boat was launched at approximately 1345 and recovered the object, which turned out to be a beach ball. The small boat returned to the ship at 1400 and Jason was launched at approximately 1500 hrs.

**J2-526, VK826**

Jason dove on the site of the current meter and landed right on target. After troubleshooting some navigation issues, the ship was brought into position and the mooring was barely touched by the manipulator and it released. The ship drove forward as the mooring ascended. It was quickly sighted and recovered with the small boat. Once it was on board again, at approximately 1615, Jason remained in lay-back mode and the ship transited over to the T:2 waypoint.

There were a few issues with reconciling last year's navigation with this year's. While working through this, we transited over to the location marker T:1, found the physical marker, and collected the temperature probe at approximately 1530 hrs. We then proceeded north towards marker T:2. Along the way, the new cutting tool was used to collect a few black coral samples. A tubeworm was also collected into the RNA blender device. After searching for the marker T:2 at the approximate position of the marker from last year, it was finally found and collected at 2045 hrs.

After locating the T2 temperature probe and placing it on the basket, we collected several branches of live *L. pertusa* from the colony that was adjacent to the temperature probe. This sample was placed in the Port Biobox. We noted at this time that there was a school of hyperiid amphipods (*Phronima* sp.) in their salp housings. We then began to transit north-northwest towards Mosaic Marker M; however, some issues arose with Medea as it began to spin slowly for 20- 30 min. After this issue was solved, we made a few genetics collections, including an orange *Leiopathes* and *L. pertusa* into Quiver 8. We also filled an RNA chamber with 2 *Leiopathes* colonies (orange morphs) and branches from 2 *L. pertusa* colonies. This RNA chamber was pumped with RNALater when we were finished collecting. For the next 1-1.5 hours, we looked for the Mosaic Marker M. There were issues with the correct Marker Location (on our end) and the ship's navigation. During this time, we observed only orange and red color morphs of *Leiopathes* and both live and dead *L. pertusa* colonies. Few mobile megafauna were observed, including a few blackbelly rosefish, tinsel fish, *Echinus* urchins, and *E. picta*.

Following the genetics collections, we found marker M and began the first mosaic around 2400 hrs. We located mosaic Marker M (29° 9.487026 N, 88° 1.012206 W) after searching around the nav target in an area with dense live and dead *Lophelia*. The mosaic is in an area where the clumps of *Lophelia* become more patchy surrounded by areas of mud. When we located the marker, it was becoming difficult to see because it is heavily encrusted by animals. We took some time to play around with the strobes and camera settings. The F-stop and shutter speed on the camera can only be changed using the GUI on the engineer's computer. We photographed mosaic M at 4.5m altitude and ½ zoom. After finishing mosaic M (05:47), we fired Niskin E and moved on to the target for mosaic Marker N. Marker N was much easier to find (29° 9.461088 N, 88° 0.972018) and the marker remained clean of fouling organisms. This mosaic is in an area with many disarticulated clam shells and small patches of *Lophelia*. We photographed this mosaic at an altitude of 4 m and about 1/3 zoom (06:17). Some lines had to be repeated after more fiddling with the camera settings. We completed the mosaic at 07:03 and fired Niskin C. From the same heading from which the mosaic was photographed, the Jason backed up until just outside the mosaic area and settled down to take sediment cores.

Once the mosaics were complete, at approximately 0200, we set up to take a series of push cores near the mosaic site. At this point, the ship lost its dynamic positioning, and Jason was dragged off site. When DP was functional again, we had to move onto the

recovery of the time-lapse camera that was deployed at this site last year. Jason transited over to the camera site and it was quickly located at approximately 0300. When it was picked up off the seafloor, the handle broke off on one side and it was delicately placed onto the basket. Jason transited over to the elevator and began to place the camera on the elevator at 0330. The camera system continued to break in a number of places and all of the pieces were placed into the box on the elevator. The elevator was released at 0430 and Jason began its ascent shortly afterward.

#### **16-Oct: VK826, VK862, MC885**

**0530: Jason recovery**

**0645: elevator recovery, transit to VK862**

**0830: sediment trap recovery at VK862**

**1000: transit to MC885**

**1800: CTD cast at MC885**

**2000: Jason launch**

Jason was recovered first at approximately 0530. The elevator was recovered on the third attempt at approximately 0645. We then made the short transit over to VK862 to recover the sediment trap that was deployed on the NRDA Nancy Foster cruise in July. We were on station at approximately 0830 hrs and the sediment trap was released. It was spotted on the surface at 0900 but the ship lost thruster control. The sediment trap was recovered at approximately 1000. We then began the transit to Mississippi Canyon 885 for the next dive.

We arrived at MC885 at approximately 1800 and set up to make a CTD cast. We went to the Jason dive site, lowered the USBL pole and then deployed the CTD over the side. The cast was complete at approximately 1900. Jason was launched at MC 885 at 2000.

#### **J2-527: MC885**

Jason reached bottom at 650 m depth at approximately 2030 hrs. As we began to transit to the location of one of our markers from the Lophelia I project in 2004 we quickly came across a group of small boulders with *Callogorgia* and ophiuroids. We stopped to take a series of genetics samples at approximately 2100 hrs. We collected 4 sets of *Callogorgia* and associates as well as *Lophelia*, and a carbonate sample with solitary corals into the biobox.

We continued on towards the marker 4 site and began to survey the area for the *Madrepora* colony that was mosaicked in 2005. At approximately 2130 hrs we came across a series of boulders with *Madrepora* on them next to a large float (FF) and a series of small PVC sediment traps that were deployed in 2004. We decided to obtain two mosaics over *Madrepora* at this site, on the off chance that either of them was the same *Madrepora* colony that was previously imaged. We also took some down-looking pictures of the sediment traps, but decided not to collect them since they were originally deployed with mercuric chloride inside and we had no way of sealing the tops to prevent this from coming out or from the flushing of the traps at the surface.

The mosaics were complete at 2230 hrs and we set up to take a series of push cores associated with the mosaic site. From 2256-2303 hrs, four push cores were collected < 0.5

m apart, in close proximity to Mosaic U, at 633 m depth. Three of the four sediment cores were collected for macro and meiofaunal community analysis, while the fourth core was obtained for particle size, total organic carbon and nitrogen, and hydrocarbon analyses.

After the push core collections, we preserved corals at depth in the RNA chamber. At 2315 CDT, *Callogorgia americana* with an ophiuroid and *L. pertusa* polyps were added to the RNA chamber. Following this collection, we moved from the general area of the mosaic site towards Geo point #1 at 2330. The next 3 hours were spent transiting towards marker Geo point #1 and collecting *Callogorgia americana* with associates along the way. 3-4 coral and associate samples were collected every 50-70 m, and we dropped genetic markers at these sites. Most coral colonies had associated catshark eggcases, several of which were also collected. In addition, we put on *Astroschema* sp. in one RNA blender and a tubeworm in another. We noted that this took a significant amount of time, and did not blend the specimen completely. We arrived at Geo target 1 at ca. 0237. We dropped the genetic marker #21 and made a few coral collections. At ca. 0300, we moved towards Geo point #2.

We arrived at Geo point #2 at approximately 0430 hrs. There was very little surface expression associated with this target, except for a few observations of white, seep-related sediment and small bacterial mats. As we continued on towards Geo #3 at approximately 0500 we went into a small bathymetric low between the targets. This consisted of plain mud. As we began to ascend once again towards Geo #3, we saw a small carbonate with *Callogorgia* and ophiuroids on it and we sat down and collected it into the last open quiver on the basket. As we continued on, we began to see seep sediment once again and a bed of what appeared to be live clams was observed. These continued as we approached Geo #3 and may be the cause of the seismic anomaly at this site. After passing over Geo #3, we found another small outcrop with *Callogorgia* and settled down to sample it.

Once this sample was secured in the quiver on the starboard swing arm, we spent a few minutes scouting around the area, but the hydraulic leak in the port arm was resulting in a very low reservoir of hydraulic fluid. At approximately 0700, the biobox was moved to the basket and secured for recovery. We began recovery of Jason at 0720, and it was on deck by 0800.

#### **17-Oct: MC885, MC751, GC246**

- 0800: recovery of Jason, transit to MC751**
- 0900: recovery of sediment trap at MC751**
- 1000: transit to GC246**
- 1400: CTD cast at GC246**
- 1600: launch Jason**

At 0900, we arrived at MC-751 to recover the sediment trap that was deployed last year on the *Lophelia II* cruise. The trap was released and was quickly spotted on the surface. The collection of the trap went smoothly and it was secured on deck and we were underway to GC246 by 1000 hrs. We arrived at GC246 at approximately 1400 hrs. We lowered the USBL pole into the water and then deployed the CTD for a water column cast. After this was complete, we launched Jason at the same position at 1600 hrs.

The next series of dives are all on a 1600 hrs launch and 0800 recovery, and the Jason team has agreed to do a series of 8 hour turn-arounds if the deck interval is during the day and we keep on this schedule for at least 4 days. They have switched to three 5-

hour shifts instead of 4 4-hour shifts for the duration of this schedule. (Note: after a few days of this, all of the pilots seemed to agree that they like this mode of operation.)

## **J2-528: GC246**

We launched Jason on the edge of the highest amplitude target at 1600 hrs. On the bottom, a hard ground in the starboard manipulator was detected and it was secured. Our survey began around the northern edge of the mound where some seep sediment and a few shell hash beds were noted. An area of reduced sediment with white bacterial mats and a few live mussels was noted. At 1700 we sat down to collect some of the mussels into the RNA later chamber to get a confirmed ID. There were a number of these small patches of seep sediment on this northern flank of the mound.

We proceeded to Geo target #2, but had some difficulty with the ship holding position or responding to the controls in the Jason van. After some trouble-shooting and a heading change, we decided to head directly for Geo target #4 at the crest of the local bathymetric high. There were a few recent flow features of extremely smooth sediment, but fewer distinct seep features and no other organisms visible on the surface. We then began our transit over to the ridge on the northern end of the regional bathymetric high from the multibeam. There were few organisms on the way, with the exception of a number of swimming sea cucumbers. There was more bathymetric relief in this area, in some cases with near vertical sediment features. When we arrived at Geo #5, we stopped to collect a few sea cucumbers into the slurp chamber while the Jason pilots went to set up a hose on the winch, which was showing high temperature readings.

At approximately 2100 hrs, we began to transit south along the ridge towards Geo target #6, the distinct bathymetric high of approximately 770m in the multibeam and the seismic line through the mound. The crest of the hill was relatively barren of life, with an occasional sea cucumber or crab. The seafloor was mottled, grey mud, with fish burrows scattered randomly. We next transited down the steep hillside to Geo target #7, approximately 950m away. Target #7 was an abrupt plateau, about three to four acres in size. In the center of the plateau we located an area of live mussels, arranged in distinct clumps of six to seven, with hundreds of snails coving the area. Vertical coned features of extinct brine seeps were also present, about five inches in height, and we slurped some snails off their peaks. We also collected three push-cores of seepy sediment around the cones, and collected a mussel pot. Upon letting the sediment settle, we collected a water sample above the mussel bed with the niskin.

Moving towards the south of the plateau, we discovered many active brine seep vents, barren of life in the area, and decided to follow a prominent brine flow uphill to its source. We discovered the source to be a massive brine lake, approximately six to ten inches deep, rimed with mussel shells, with active brine seeps in its center. Also in the center of the pool was a deceased isopod, which we collected and sat on the Jason's tray. We sat down in the pool and brine waves propagated outward, lapping its shoreline.

We next proceeded south one kilometer to Geo target #8, a skyscraper sized mud volcano. The steep flanks were exceptionally barren of life, but we did collect a solitary sea star. The peak of the volcano was active with fresh mudflows, however not during this particular visit, and few small fish present. We descended the volcano on its southern side and proceeded south 600m to Geo target #9, an area with locally high relief.

The seafloor to target 9 was again mottled mud, with larger, inhabited fish burrows. We continued to approach the final Geo target and came across a small trench on the slope of the mound. On the edge of this trench, there were a series of small exposed carbonates that were inhabited by Callogorgia and symbiotic ophiuroids. Between 0530 and 0730, a series of 6 paired samples were collected into the quivers and into the RNALater chambers. Jason left bottom at approximately 0730 for an 0800 recovery.

**18-Oct: GC246, GC354**

**0800: recovery of Jason, transit to GC354**

**1400: CTD cast at GC354**

**1600: launch Jason**

During ascent, the ground fault that disabled the starboard manipulator disappeared. Upon recovery of the vehicle, no problems were apparent. The electrical connectors were cleaned and reattached in the hopes that this would solve the problem. We recovered Jason, handed the giant isopod around for everyone to take pictures with it, and headed to GC354. The CTD cast went smoothly and Jason was launched at 1600 hrs.

**J2-529: GC354**

We began the dive on a deeper part of the site that we had not previously explored. We spent the first ~ 1hr of the dive examining the base of the slope that had been visited before. There were a few outcropping carbonates in this area, and a few tubeworms around the base of the carbonates. As we proceeded upslope, a few species of gorgonians (including *Acanthagorgia* sp and *Nicella* sp.) were observed and collected in this area at approximately 2215, followed by a few black corals. Outcrops increased in number and size (by **2300**) when these antipatharians and bamboos were collected (including *Stichopathes* with a “candyland” ophiuroids and *Paracalyptophora*). We then at **2325** collected five tubeworms and placed them into one of the RNALater chambers and flushed-depth was 567m. We arrived and surveyed the outcrop area around ball marker #2 at **0012** (566m) **Lat** 27° 35.87 N **Lon**: 91° 49.38W. Sediments proximal to a tubeworm colony were sampled via push cores. Once the deeper portion of the site was explored, we tried to relocate some of the markers left at the tubeworm collection sites in 2003. By moving west exploring sonar targets proceeded west and sighted old (v-shaped) **Marker #6** on a low relief outcrop with old tubeworms at the base (**0047**). We continued to survey the area and collect octocoral and black coral diversity samples. We traversed to the west and sighted a giant isopod in a burrow. Unsuccessful attempts were made to collect this individual. Proceeded again in a westerly fashion, and located gorgonians and black corals at **0121**. We sampled black corals (including *Stichopathes* at **0142** as well as gorgonians (including white *Muricedes* at 0215) by **0230**. At **0240**, we deployed a small syntactic foam marker, **Marker 33 (Lat: 27° 35.87 N Lon: 91° 49.51 W at 527m)**. We continued to explore sonar targets as we worked toward the west. Each of the targets was found to be small mounds or boulders of carbonate that hosted corals and crabs. As we proceeded toward ball marker “GG”, we found more and more of these to host dense groups of *Hoplostethus* fish and also increasing abundances of *Lophelia*. Perhaps less than 5% of the *Lophelia* on these mounds were alive. We arrived in the area of Ball Marker “GG” and

traversed east and west, then north and south, exploring sonar targets with any relief. At **0350**, we discovered a large mound with the greatest amount of live *Lophelia* and *Hoplostethus*. We sampled *Lophelia* and a *Paramuricid* ("B"), fired the single **Nisken (0418)** on Jason, and deployed a small syntactic foam marker, **Marker 37 Lat: 27° 35.89 N Lon: 91° 49.57 W**. We proceeded to the east and found more mounds with live tubeworms and fish. At **0444**, we located Ball Marker "GG" out on smooth sediment at **Lat: 27° 35.90 N Lon: 91° 49.60 W**. During this run between **Marker 6** and **Ball Marker "GG"**, we collected more than 16 samples of octocorals, black, and *Lophelia* corals, and a few associates (note that the gorgonian corals hosted very few invertebrate associates at this site- dominated by galatheid crabs). From Marker "GG", we proceeded to the starting point for the photo transects.

At approximately 0500 hrs, we arrived at the starting point for the transects of the *Lophelia* mound area of the site. A series of 7 transect lines were run from 0500 to 0900 GMT. During the transect survey, we located a number of our markers from the *Lophelia* I and previous studies. However, due to the issues with the ship's dynamic positioning system during the transect surveys, we only had time to re-image one of the mosaic sites.

We did a circle around the target for Marker M2, but did not find the marker or mosaic site from 2005, so we headed toward a digital target dropped during the transect. The target was for a boulder containing a lot of dead and some live *Lophelia* and soft corals. We determined that this was in fact the same mosaic site (marker M1) from JSL dive 4861. Marker M1 is close to the mosaic so not in the site, so we dropped mosaic Marker V on top of the boulder before taking the photos. The camera was having issues with auto-focus so even after playing with the camera settings, the images were still blurry. Also one of the lasers was not visible, so the ball marker is the only measure of scale. The mosaic was photographed from 4 m altitude with no zoom and a heading of 165 (lined up visually with the 2004 mosaic) starting at 09:52 and ending at 10:18. Before setting up to do a mussel pot on the coral rubble just outside the mosaic area, we did several frame grabs with the science HD cam in order to use the ball marker as a measure of the vertical height of the boulder. In the first set of frame grabs at 10:21 from a heading of 165, the camera was parallel with the frame up-and-down, but possibly not squared left-and-right. In the second set around 10:24 from the other side of the boulder (heading: 6), the science camera was squared with the both the basket and the frame. We set down outside the edge of the mosaicked area at a heading of 224 and took a mussel pot. The first attempt was not successful because the action of pushing the arm into the coral rubble, pushed the Jason off the bottom and stirred up a lot of mud. On the second attempt, we got a pot, but the drawstring would not close because the bottom of the pot was plugged with mud. Along with a lot of mud, the pot contained a lot of dead coral rubble with a tiny bit of live coral. Following the mosaic at 1100, we took a series of push cores.

After the pushcores, at approximately 1200, we began collecting *Lophelia* and other genetics samples. After the pushcores, at approximately 11:30, we began collecting *Lophelia* and other genetics samples. Our first *Lophelia* sample was taken in close proximity to the mussel pot, just outside of the mosaic. We then moved towards a digital target set earlier called 'Rocks with good corals', about 50 m to the SW. We stopped about half way between the mosaic site and the target for Amanda to take a set of background cores. The rock target consisted of several large boulders covered with sponges and diverse octocorals, but only a few small *Lophelia* colonies. We made 4 *Lophelia* collections here,

including some for Ian that included live and dead branches for aging. It turns out that last sample was not alive, so 3 colonies were collected for genetics from this rocky area. Marker '36' was placed on the top of a boulder here just before leaving bottom and ending the dive. Jason left the bottom at approximately 1230.

## **19 October**

**0800: recover Jason, transit to GB299**

**1300: single pass of multibeam over site**

**1400: CTD cast at GB299**

**1600: launch Jason at GB299**

After the Jason recovery, there was a very short transit over to GB299. The ship used this time to conduct a man-overboard drill and a series of maneuvering drills.

There was no good bathymetric data for the GB299 site, so we obtained one line of multibeam data before the dive. The new Kongsberg multibeam system on the Brown worked extremely well, was processed by James Pelowski of the Jason group in time to use it as an underlay for the dive. We also made a CTD cast before the dive, and were on site and ready to go for a 1600 hrs launch.

## **J2-530: GB299**

Jason was launched over one of the mosaic sites from the previous year at 2100 hrs GMT. When the ROV reached the bottom, it was apparent that we were 300 m from the target. We landed in an area of high *Callogorgia* density, so we deployed a short-term time-lapse camera aimed at a *Callogorgian* fan with an associated ophiuroid. We then proceeded towards the mosaic site. During our transit, we stopped at every opportunity to collect *Leiopathes*. On the way to the mosaic site, we collected 6 *Leiopathes* (and nearby octocorals) into the quivers. *Leiopathes* is one of the targeted species for population genetics, and we have thus far not encountered a site in this area of the Gulf where they are highly abundant. This is the primary focus of this dive.

We located the mosaic site at approximately 0040 hrs. We re-photographed mosaic B at an altitude of 4m with no zoom (0055 hrs.). The focusing issues from the previous dive were resolved, and as this was a flat area of mud with scattered *Callogorgia* and associated ophiuroids, the picture were consistent with respect to lighting. The mosaic was completed at 0130 hrs. We dropped DVL targets on the four corners of the mosaic to avoid sampling within it. The mosaic was complete at 0140 hrs and a series of push cores were taken.

At 0200, we located marker D and set up to take another repeat mosaic. The character of this mosaic was the same as marker B, in that it was a flat mud bottom with scattered *Callogorgia*. We photographed the mosaic at 4 m altitude with no zoom and finished at 0236 hrs. Again, we dropped digital targets on the corners of the mosaic to avoid sampling within it. At 0240, the mosaic was complete and an appropriate place for push cores was selected and 3 push cores taken.

At **0255**, we began to transit to the next geo target and make *Leiopathes* (and other) genetics collections as we explored different areas of the site. This was largely in an easterly direction. The area contained mostly mottled sediment with patches of

*Callogorgia* hosting *Asteroschema*. *Stichopathes* and *Bathypathes* black corals were also present in smaller numbers. Collected *Leiopathes* and observed fish, like *Benthocometes*. The region was relatively flat and almost completely sedimented with patches of cobbles and rocks hosting corals, including *paramuricids* distributed almost continuously over several hundred meters. Numerous cerianthid anemones would dominate small patches in depressions. Once past these clusters of anemones, we increased speed to proceed to Geo2 site, a known site to have corals. Along this transit, we observed single *paramuricids* and *Stichopathes* on small outcrops. Bamboo corals were also observed (**0608**). Continued to sample *Leiopathes* and observe increasing numbers of *paramuricids*, bamboo corals and *Leiopathes* (sampled them) with small outcrops. Observed associates, in particular, “candyland” ophiuroids on bamboo corals (heading trended 112). At **0702**, came upon a large *Callogorgia* field with some *Leiopathes* (**Lat:** 27° 41.15 N **Lon:** 92° 13.13 W). We were in this “field” until ~**0745**, when we observed more anemones (depth 353m) and schools of fish. Made additional collections of *Leiopathes* (include a “pink” morph) and corals from diverse outcrops, now larger than before, covered with corals and basket stars. Deployed **Marker 35** at this rock outcrop referred to as “**Leio Rock**”, where extensive collections were made. Noted large number of free-living ophiuroids on the seafloor and sampled them (**0942**). At **1004**, sample *Callogorgia* with *Asteroschema* into Blue RNA Chamber, and at **1022**, sampled venus flytrap anemone. At 1024, took four sediment push core samples (#5,6,7,8), finishing at **1043**.

By 1030, we had collected 30 *Leiopathes* individuals into almost all of our available sample containers, and we began to transit back to the short term camera deployment to pick it up. When we arrived at this location at 1130, we closely inspected the camera. The LED array was on and the pressure housing appeared intact. With the remaining available time, we transited to a nearby spot where we had dropped a digital target at the beginning of the dive. We collected one unidentified antipatharian, one *Callogorgia* plus ophiuroid, and one *Paramuricea*. We then returned to the camera location, set it on the quiver rack on the basket, held on to it with the manipulator and left the bottom at approximately 1230 GMT.

## **20 October**

0800: recover Jason, transit to GB535

1400: CTD cast at GB535

1600: launch Jason at GB535

Recovery, transit, and the CTD cast all went smoothly. The Gulf was flat calm today, and there were Mahi sighted off the port bow. Fishing ensued and a Mahi was caught off the starboard quarter in between the CTD cast and the Jason launch at 1600 hrs.

## **J2-531: GB535**

Jason was launched at 2100 hrs GMT and hit the bottom at the exact coordinates for the start of the dive. The short term time-lapse camera was deployed at the location of mosaic marker C so that it was not impacting anything in the mosaic site and was facing a few different species of corals.

At 2221 hrs. we began photographing the repeat mosaic at Marker C. This mosaic site is on top of a tall boulder, so the auto altitude made it difficult for the sub to stay steady. Instead we used auto-depth and photographed at an altitude of 4 m above the marker, but this became 6 m altitude at the deeper parts of the mosaic. The photos at the greater depth seemed very dark, so it might be better next time to just struggle with the auto altitude in order to get clear photos. We completed the mosaic at 2246 and looked for a spot to mussel pot. The immediate area of the mosaic had no coral, only dead clam shells, but we located a small clump of live and dead *Lophelia* on a boulder about 10 m from the mosaic. Genetic marker 20 was right next to the patch we intended to pot. We attempted to mussel pot a small clump, but were unsuccessful because of the way the coral broke apart. The bag on the pot got caught on a large chunk of coral and was pulled off of the rim of the pot so that it was flopping around. We decided to try the pot later in the dive and instead set up to take push cores associated with this mosaic.

At 0049 we located mosaic Marker F. This was a vertical mosaic that, in 2009, was photographed using the digital still camera mounted on the front of the basket in the forward-looking position. This time we set up to "photograph" the mosaic using the frame grabs from the HD science camera. We started with the sub on the bottom as close as we could get and still have the bottom of marker F in the frame. The camera position was lined up by visually squaring left-to-right with the basket and then with the frame up-and-down by using the pilot cam to look over at the science camera. We first took frame grabs only moving the sub up slightly to get the top of the mound, but most of the area fit into one shot. This was completed at 0052. It seemed we may have been missing some information in the right side, so zoomed in and used the camera pan-and-tilt to get closer images of the mosaic area. Imaging of Marker F was completed at 0057 and we moved over to repeat the Marker E mosaic located only a few meters away from F.

The Marker E mosaic is a downlooking mosaic of a tall mound with a lot of dead *Lophelia* rubble and many live *Stichopathes* and sponges. Similarly to the Marker C mosaic, the topography of this mound made it difficult to use auto-altitude so we decided to use auto depth. Again, when we started with an altitude of 4 m and ½ zoom at the highest point, the photos at the lowest points (around 6m) were quite dark. We tried increasing the exposure compensation to the highest setting, but this didn't help much. The re-photographing of mosaic E began at 0114 and was completed at 0150. After the mosaic, we looked for a spot to mussel pot, but did not find anything that looked suitable. One of the niskins was fired at this point. At 0205, we set up for a series of push cores near the *Lophelia* mosaic.

We began to transit south-west along the ridge to explore for additional *Lophelia* mounds in an area that was not covered last year. At 0220 a small gorgonian was collected, but nothing else was noted along this ridge line until live *Lophelia* was collected at 0300. Another niskin was fired at 0315. We continued on in this direction until finding another very small carbonate with a small octocoral on it at approximately 0320. There were numerous small pieces of carbonate like this along the way, occasionally colonized by small coral colonies. At **0330**, a larger carbonate boulder was found with numerous sponges and galatheids. A small piece of *Lophelia* was sampled from this boulder. At **0345**, another boulder was found and a small piece of a black coral was collected. It appeared that this was actually an old dead antipatharian with another species colonizing its skeleton. At approximately **0400**, another outcropping boulder was found and *Lophelia* and an

octocoral were sampled. At approximately 0420, Jason was being pulled offsite by Medea and there was a short period of tether management. Between **0430** and **0500**, a series of low-lying outcrops were seen, primarily colonized by sponges and a few octocorals. At **0500**, a larger outcrop was sampled for *Lophelia* and a Paramuricea. At **0515**, a niskin sample was attempted, but the bottle failed to fire immediately, but appeared to have fired by **0540**. A few more low outcrops were observed, and at **0545** another *Lophelia* sample was taken. Another outcrop was found at **0600**, followed by another with live *Lophelia* and octocorals which were sampled between **0630** and **0720**. Another low-lying carbonate rubble patch was found, and a small colony of *Lophelia* was sampled into the biobox for physiological experiments at **0825**.

This was the furthest south that our survey went. We began a series of transects running north along the ridge at approximately **0900**. There were 9 transects run along the ridge until we had returned to the site of the camera deployment at approximately 1100 hrs. We then returned to the mosaic C site and took a mussel pot sample of coral rubble with a small piece of live coral at the base of the outcrop where the mosaic was shot. The dead coral framework under the mussel pot collection was also collected for radiocarbon analysis. Jason was brought around the outcrop where the time-lapse camera was positioned to get a series of photographs of the vehicle, and then the camera was placed on the basket shortly before recovery of the vehicle. Jason left the bottom at approximately **0700** for an early recovery at **0730**.

## **21 October**

0730: recover Jason, transit to GC140

1700: launch Jason at GC140

This was a long transit, so Matt Heintz agreed to come up a bit early to get underway, and to go in at 1700 rather than 1600 to accommodate the longer transit, but stay on the same Jason watch schedule.

## **J2-532: GC140**

This was a very shallow site (360 m to start) so Jason was on the bottom very quickly. We began at the bottom of a small depression, which appeared to be a fairly active seep when we first saw the seafloor. There were numerous patches of dark, apparently brine-stained sediments with white bacterial mats at the bottom of this depression. We examined the area to try to find the local bathymetric low in case it contained a distinct brine feature, but none was found. As we began to climb up the slope towards the previously surveyed mound, we stopped to sample a few octocorals at approximately 2300 hrs GMT. We then found a carbonate mound with tubeworms growing on the side. We stopped to collect the tubeworms into the RNAlater blender at 2325. At 320 m depth, this represents that shallowest collection of tubeworms (appeared to be the relatively rare *Escarpia* sp.) in the Gulf of Mexico. We fired a niskin in this area at approximately 2345. At the base of the slope, we encountered another carbonate outcrop and stopped to collect octocorals into the quivers at approximately 2400. When we left this outcrop, we noticed a bubble stream rising from below an overhang, but we could not locate the source. At the

same time, the bridge called to see if we were over a natural seep since they had noticed an oil sheen on the surface.

As we climbed the slope, we stopped to collect *Callogorgia* (appears to be *C. gracilis*) on another outcropping carbonate at 0030 hrs. This collection was at approximately 280 m depth. We continued up the slope to 260 m depth when we encountered a wrap in the tether that began to form a knot. The pilots worked on resolving the issue with the tether before it got any worse between 0100 and 0130, at which point we continued on to the next way point at the top of the mound.

Between **0130** and **0300**, a series of genetics collections were made, focusing on *Leiopathes* and octocorals. The terrain consisted of large slabby outcrops surrounded by sediments. A variety of corals, including *Callogorgia*, *Leiopathes*, *Paramuricea*, hydroids, tuna, and snowy grouper were observed. The tether remained a problem as did the doppler tracking- the vehicles experienced Doppler loss at times and would simply lurch and move forward. We continued a general transit to Geo target #4. We collected *Callogorgia* with a previously unseen banded ophiuroid (**0132**). At **0141**, we collected an orange *Leiopathes*. *Lophelia* was not observed in this area. At **0154**, observed catshark egg cases and gooseneck barnacles associated with *Leiopathes* (depth 261m). Between this time and **0306**, we sampled 12 corals including *Callogorgia*, *Leiopathes*, *Paramuricea*, as well as hydroids, stalked and non-stalked barnacles on two large neighboring outcrops. Following this sampling, we deployed **Marker 39 (0315)**. At approximately 0300, the decision was made that *Leiopathes* and octocorals were in sufficient densities in this area to warrant making collections in this area for the majority of the dive.

We set up to take a forward-looking mosaic of several very large *Leiopathes* colonies at 0300. A *Leiopathes* colony on the right of the mosaic (heading: 218) and a tiny *Callogorgia* were sampled for genetics and genetics marker 39 was deployed in front of the corals in a saddle created by a fuzzy spherical sponge. The HD science camera was squared with the basket and frame, but tilted slightly upward to account for the 10 degree downward pitch of the vehicle. First, a farther mosaic was photographed in a single line by moving the Jason from the bottom to the top of the corals. Then, the camera was zoomed in about halfway and a second set of frame grabs were taken in two lines, moving downward on the left and then up again on the right. Finally, we took some downward-looking photos with the digital still camera (0330 hrs.) to get a sense of the distance from the marker to the corals. However, the coral branches mostly obscured the marker, but the top edge is visible in some shots.

We then took a series of push cores between 0340 and 0400 hrs. Genetics collections followed after this, with approximately 20 *Leiopathes* and 10 *Callogorgia* and associates collection between 0400 and 0700 hrs. We came across more blocky outcrops on which white *Leiopathes*, yellow paramuricids, black bushy corals were observed and sampled. Black and yellow striped ophiuroids (different from what we have observed during *Lophelia* II) were observed on the seafloor. Collection attempts were unsuccessful. One outcrop at **250m** depth (**Lat:** 27° 48.62 N **Lon:** 91° 32.21 W) had several bushy *Leiopathes* with basketstar, cat shark egg case, and barnacle associates, which were collected. Deployed mosaic **Marker W (0545)** and thought this site worthy of a downlooking mosaic. (In total, approximately 8 *Leiopathes*, 1 paramuricid, and 1 antipatharian coral and associates were collected between **0420** and **0541** hrs.

At 0545, we established a new horizontal mosaic site marked with mosaic Marker W. The site is a large boulder with several colonies of *Leiopathes* and other black corals. Several genetics collections were made here prior to photographing the mosaic. The entire boulder was photographed using more-or-less manual control of Jason's altitude because neither auto altitude or auto depth gave satisfactory results (either the sub was too unstable or photos too dark because we couldn't stay close to the uneven boulder). This was the first mosaic so far this cruise in which we used both strobes to get enough light on the edges of the boulder (usually this makes it way too bright) and then took pictures rapidly so as to not allow the strobes to recharge completely.

Just after 0700 hrs, we set up for a series of photo transects. One transect line was complete, and another was begun when the Doppler on the vehicle went out. A series of attempts to resolve this issue failed, and after a series of still images were obtained, we cancelled the transects due to the inability to hold a straight line.

At approximately 0900, we began to sample for genetics once again, while making our way south to the end of the large mound that the efforts had been centered on. A series of *Leiopathes* collections were made as we moved south. The terrain of the mound did not change much as we moved to the south, and included numerous large *Leiopathes* colonies. At the southern end, at approximately 1000, we transitioned to a series of mounds apparent on the bathymetry and completed our collections. At this point, nearly every quiver had a sample in it.

Between the mounds and the southern extent of our dive track there was an area of plain, sedimented, flat bottom. As we approached the end of this area, we arrived at a nearly vertical wall of carbonate that we followed almost 50 m directly upward. The surveyed area in the southern end of the site consisted of very high relief carbonate structures with very abundant *Leiopathes* of all of the color morphs that we have previously observed. Unfortunately, the navigation in this area was extremely difficult, we had very little room for additional samples, and we were nearly out of time. We surveyed a small part of this area, and began our ascent to the surface at 1230 GMT.

## **22 October**

0800: recover Jason, transit to GC852

1200: recover current meter mooring at GC852

1400: CTD cast at GC852

1500: depart GC852 and transit to GC249

1900: multibeam survey of GC249

2400: launch Jason at GC249

As soon as Jason was recovered, we transited approximately 4 hrs to GC852 where the second year-long current meter deployment was located. Upon arrival, we called up the mooring using the acoustic release. This release worked perfectly, and the current meter array was quickly on the surface. After an attempt to come alongside and use the boat hook to retrieve the array failed, the small boat was launched and brought the array over to the ship where the crane was used to haul the array up through the A-frame. At approximately 1400 hrs, the mooring array was secure on deck and we performed a CTD cast at the site. In addition to our sampling, we supplied water samples to a NOAA collaborator of the survey technician on board.

Once the CTD cast was complete, we transited approximately 4 hours to GC249, one of the exploratory sites of the cruise. Since we had not previously visited this site, we conducted a multibeam survey over the area prior to lowering the ROV. The multibeam survey went very well, and the features apparent in the 3-D seismic were also visible in the backscatter data from the multibeam survey. In addition, as we passed over an apparent mud flow feature in the southwest corner of the survey we observed a series of gas plumes rising from the center of the feature, interpreted as an active mud volcano. Once the survey was complete and processed (by James Pelowski of the Jason group) we used it as an underlay for the dive, which began at 2400 hrs.

### **J2-533: GC249**

This was scheduled as a 16 hour dive. We surveyed a high-amplitude point in the 3D seismic, a few targets picked out by Bill Shedd and Harry Roberts two years ago, and a few targets chosen from the newly acquired multibeam survey. Jason reached bottom at 0530 GMT at 830 m depth. The seafloor was soft bottom in this area, although the seismic map indicated high reflectivity. A series of low lying mounds were observed, possibly consisting of buried gas hydrates. A single push core was taken at 0600 in an attempt to see if the gas hydrate was near the surface, but none was visible in the core. Some small seep areas were also seen beginning at approximately 0630, primarily composed of brine-stained sediments, bacterial mats and occasional small clam shell beds. No living clams were observed.

At 0710, a larger seep area was found, but still was primarily composed of dead clam shells and bacterial mats. There were also a few Callogorgia with symbiotic ophiuroids seen growing on the clam shells, and we stopped to make some genetics collections at 0720, and a series of push cores at 0730. A larger bed of dead clams and some live mussels was found at 0810. At approximately 0900, a small carbonate with a few live mussels and tubeworms was observed, and samples of the seep fauna were collected. As we continued to survey between the geo targets, a few more small clam beds were found colonized by Callogorgia. We stopped to collect the gorgonians at 1115, 1125, and at 1230.

Although some Callogorgia were sampled, there was little else at the geo targets, so the decision was made to call the ROV up early at 1230 for a 1300 recovery. This allowed for an increased amount of time on the seafloor at one of our primary study sites, VK906.

### **23 October**

0800: recover Jason at GC249, transit to VK906

2000: launch Jason at VK906

### **24 October**

0800: recover sediment trap at VK906

### **J2-534, VK906**

Jason reached bottom at 0150 hrs GMT. We were on the eastern edge of Roberts Reef and began to search for an appropriate place to leave the short-term time lapse camera. As we moved to the north along the eastern edge of the coral at 390m depth, we

quickly found a flat area where we could set the camera down looking at Lophelia and a few mobile fauna. The camera was deployed at 0200 and we moved on to search for mosaic marker J. We located the marker at 0210, 10-20 m to the N of the position in the target file.

We began the mosaic at marker J at 0220 hrs. This mosaic consisted of 7 lines and was complete at 0237 hrs. We then moved on to mosaic marker L. This marker was quickly located at 0245 hrs, and the mosaic was begun. There were 5 lines run and the mosaic was complete at 0310. A niskin was fired shortly after completing the second mosaic while over the Lophelia at an altitude of 2m at 0313 hrs. Niskin B was fired just after at 0322 at an altitude of 2.5m over Lophelia.

A series of push cores were then obtained near each of the mosaic sites. The first set of 5 cores was near mosaic marker L from 0335 to 0430. The ROV moved over to mosaic marker J and took the second set of push cores between 0445 and 0505. After the push cores, we moved on to collect one of the temperature probes (T1). This marker was quickly found and collected at 0510 hrs.

Over the next 7 hours, a series of collections were made for the genetics work, the live coral work, and the hydrocarbon analysis of tissues. Lophelia were collected in pairs into the biobox for the live experiments and into the quivers for genotyping. Lophelia and Leiopathes were also collected into the chamber pot for RNA fixation at depth. Leiopathes was collected into the quivers when it was found as well. Larger mobile fauna were also sampled for tissue analysis of hydrocarbons. Between 0525 and 1200 a total of 11 Lophelia, 6 white Leiopathes, and 5 red Leiopathes were collected. In addition, anemones, urchins, and galatheids were collected for the hydrocarbon analysis. During these collections, at 1045 GMT, temperature probe T3 was found and retrieved.

At 1200, Jason came up off the bottom to use the forward-looking sonar to find the sediment trap. It was located at approximately 1240 to the north of the position that it was deployed from the Nancy Foster in July. At 1300, the acoustic release was triggered and the mooring came to the surface. By 1400 hrs it was secured on deck and Jason returned to the bottom.

Once Jason was on the bottom, we began to run a series of 10 transect lines centered around the Roberts Reef site. A total of 10 transect lines were run between 1425 and 1730 hrs. When the transects were complete, we fired a niskin in this area off of the mound. We then began sampling for Leiopathes genetics and Lophelia live corals/genotyping once again.

Between 1745 and 2400 hrs, we completed our Leiopathes collections such that a total of 30 red and 30 white Leiopathes had been collected at this site. In this time period, we stopped at 14 different points on the seafloor, set down the blank white marker, imaged the corals, and collected from different points within the reach of the manipulator. During this time, we collected 10 pairs of Lophelia (one into a quiver and one larger piece into the biobox), 14 red Leiopathes, 9 white Leiopathes, and 4 pink Leiopathes. We then moved to the NW corner of the mound and at 2400 hrs we fired a niskin among the Lophelia, but with bare sediment directly below the vehicle. We then set down to take one more pair of Lophelia samples.

Once the sampling on Roberts Reef was complete, we moved off to the west to explore the mounds that we had not previously seen and to attempt to collect Callogorgia and ophiuroid samples. We arrive at the first mound at 0045 hrs and set down to collect a gorgonian.

Tim and Andrea...

## 25 October

0400: recover Jason

0700: meet Acadiana for at-sea transfer of personnel

1000: heading back to station

1200: CTD cast to VK 906

1600: **J2-535 VK906/862**

**Launched on Roberts Reef in VK 906 at 1100 GMT.** We had a slow start on the bottom due to some issues with start up of Doppler navigation system. After sorting that out we were able to locate mosaic location 1 (which did not have markers) within about 20 minutes and **deployed a marker XX** then set up and repeated this mosaic, originally done in 2009. We then transited N about 10 meters and confirmed the second mosaic site and **deployed marker XX** in this mosaic and took a niskin water sample here. We did not repeat this mosaic, but did obtain a series of pictures as we raised above the marker in order to document the location of the marker in the mosaic for future visits. During these operations a fluid leak in starboard manipulator was discovered and this manipulator (with the cutter) was stowed for the balance of the dive. As a result, the Starboard biobox and quivers were also not usable. We then took 4 pushcores and a niskin within 5 meters of these mosaics. After the push cores, collections of *Leiopathes* and *Lophelia* were made into RNA later and a sample of live *Leiopathes* was placed in the biobox. We then embarked on a search for rocks. NONE were found on top of Roberts Reef despite a serious effort. This is consistent with the hypothesis for the formation of this mound from coral skeleton. We moved to the edge of the reef top, about 50 meters away from abundant *Lophelia* and took 4 background push cores. Work on Roberts Reef was concluded with collection of another live *Leiopathes* sample and then Jason was moved off the bottom and **a 3 km transit to the VK 862 mound was initiated at about 0430 GMT.**

At **0631**, Jason II was back on bottom (341m; **Lat:** 29 6.300 N **Lon:** 88 23.066 W; DVDs started) after traversing since **0245**. The bottom was almost entirely covered with coarse to pebbly-grained sediments. Immediately, we noted large/expansive populations of white anemones, both singly and in groups of 3 to 5. Venus fly-trap anemones (likely *Actinoscyphia aurelia*) were also present. We traversed west north-west (~290) along an oblique ridge south of VK862. Small cup corals were occasionally observed the sediments as well. At **0652**, we noted a large steel-looking cable on the seafloor, cutting through the population of anemones (noted the cable for ~30 meters). Did not observe any anemones on this cable. We traverse more northerly to follow the ridge feature (~344m) and started to see black corals (red and white *Leiopathes*; **0704**)( **Lat.** 29 6.433 N **Lon:** 88 23.218 W). Our goal was to try to locate and sample *Callogorgia* and *Asteroschema* in RNA Later and for population genetic analysis. Occasional fish were observed amongst the anemones, who's distribution is almost continuous through this traverse. Black corals were observed with a frequency of 1 to 10 per minute. As long as we stayed on the ridge, there were anemones and corals to be observed. The sedimented bottom continued and at **0735**, we observed

(and then sampled into the red RNA Later Chamber) *Callogorgia* with an asterochemid ophiuroid (**Lat.** 29 6.544'N **Lon:** 88 23.255'W; **355m**). Pencil urchins, actinostolid-like anemones, and a paramurcid coral were near the *Callogorgia*. Leiopathes and anemones dominated as we continued to search northward for more *Callogorgia*, as we were now on a easterly heading following the ridge. At **0822**, we noted a large paramurcid (likely *Paramurcea multispina*) among anemones with an urchin at its base, and sampled it along with its asterochemid ophiuroid in an RNA Later chamber (blue)(350m; **Lat:** 29° 6.540 N **Lon:** 88° 23.237 W). From here, we traversed on a general heading of ~106. The abundance of observed *Leiopathes*, white and red color morphs, increased to the north northeast as slopes were steeper (**0910**). We collected a piece of carbonate on one of these slopes and placed it behind the quivers (**0912**). Aneomone abundance (with slightly larger individuals) increased as did black corals and primnoid corals- creating dense fields. In fact, at **0930**, we observed many color morphs of *Leiopathes* (red, pink/salmon, white, and orange) in a single HD image frame. At this point, we were transiting upslope to the east to southeast (general heading ~113), and started to see small stands of *Lophelia* (**0932**). At **0937**, came across a boulder outcrop on carbonate pavement hosting a large white *Leiopathes*, *Actinoscyphia* anemones, and primnoids. Deployed **Marker 28** and **0941** to set up a vertical imaging station. Imaged the large *Leiopathes* and its associates (3 Eumunida, and 2 galatheids), as well as fauna on the bolder. Heading was **156** at **Lat.** 29° 6.460 N **Lon:** 88° 23.103 W. Snowy grouper were present in this area. Less than 10 meters away was another boulder outcrop with another large *Leiopathes*. Less than 2 meters away we took carbonate sample #2 (**0954**) at 317m. We then traversed at heading ~142 to locate previous mosaic sites (specifically marked as R, S, and T). Large field of primnoids over flat-topped and cracked carbonate blocks. At **1024**, sited mosaic **Marker T** (**Lat:** 29° 6.40'N **Lon:** 88° 23.055'W. At **1026**, sited Marker 26 (**Lat:** 29° 6.388 N **Lon:** 88° 23.056'W) on a small hill with white anemones, *Actinoscyphia*, and primnoids. At **1027**, sited **Marker R** at **Lat:** 29° 6.383'N **Lon:** 88° 23.052'W (**316m**). Set up to start mosaic at **1041**. The Marker R was completely re-mosaicked and then another attempt was made to find Marker S. It was not located so we moved back to Marker T and re-mosaicked a portion of this site. Time was running out, so 2 push cores were taken in association with this mosaic **and Jason left the bottom at 1200 GMT for a 0730 local time recovery.**

## **26 October**

**0745: Recovered Jason**

**0800: Begin transit to MC751**

**1540: arrive on station**

**1600: Launch Jason. J2 536 to MC 751**

We launched on the coordinates for marker H and quickly found the marker and the 2 mosaics associated with it. Both were re-done, the niskin was fired here, we settled near the marker and gathered images for horizontal mosaics and documentation for longer term observations of this area. From **2313-2328** GMT, Amanda took 4 pushcores near marker H (440m). At **2350**, at live and dead *Lophelia* site with Marker 8. Imaged and then left to search for Marker G, after 55 minutes of searching it was found about 20 E of where of the waypoint. This site was remosaicked (downlooking), pushcores were taken (**0200**), and horizontal images collected to assess coral and associate species identification and distribution for future comparisons. We then began collecting coral and associate pairs.

We collected a *Callogorgia* with *Asteroschema* just away from the mosaic site (**0252; 441m**). Several meters away, we located a large *Callogorgia/Asteroschema* community, Deployed Marker 41 and collected horizontal images for mosaicking. We noted “brown detrital-like debris” on the upper branches of this coral colony and collected them for inspection. We then remosaicked the community. From 0330 to 0415, we collected *Lophelia* colonies to the south, followed by a muricid octocoral with an *Asterogomphus*. Continued to see large bushes of *Callogorgia* with ophiuroids (ex. **0435** and **0528**) as we transited north. We also encountered Marker 4, 9 and Site Marker (bucketlid) on the way north. Each of these sites contained tubeworms and *Lophelia* (and *Callogorgia*). At **0625**, came across an area with diverse coral (with a goose fish), where we collected a paramuricid with ophiuroids, and a *Callogorgia* with *Asteroschema* in RNA Later (Chamber and blender; **441m**).

We then began a search to the south for a mixed coral and tubeworm community to sample for a study of trophic interactions between these normally very different communities. We checked out communities near marker 4, 9 and the site marker, and tubeworms were present among corals in these two areas (marker 9 and the site marker are within 2 m of each other). Horizontal observatories were established near these markers. A suitable tubeworm-coral site was found to the S (labeled tubeworm/*lophelia*) and at this site we first slurped crabs and blindly from among tubeworms and adjacent corals. Two *acesta* and an *Echinus* were collected. We finished collections for this study with a “coral pot” among a mixture of live and dead *lophelia* with a few tubeworms intermixed. To finish the dive we collected two carbonates, one vary close to the tubeworm/coral mix and one on an adjacent carbonate mound.

Oct 27, 2010:

0800: Recovered Jason

0830: conducted a CTD Rosette cast

1000: began a slow transit to the Gulf Oil site

1600: Launched Jason J2 537 for a dive on the GulfOil

### **Western Debris Field**

Jason arrived on bottom approximately 300 m west of the main wreck site to determine the origin of an isolated debris field. Once on bottom we flew a southerly heading towards the debris field. Immediately noticeable on the seafloor was an unusually large constellation of brittlestars (*Ophiacantha* sp. ?). Nearing the debris field we began to note small non-descript metal debris. Moving through the debris field we noted several pieces of grating, steel plate, and vent hoods indicating the wreckage is associated with the *GulfOil*.

Having determined the debris field was associated with the *GulfOil*, we began transiting east towards the main wreck site. As we approached the wreck small fragments of wreck debris were observed on the seafloor. Nearing the *GulfOil*, we noted large debris east of the starboard bow.

### **Reconnaissance**

Arriving at the *GulfOil*, *Jason II* moved toward the bow to begin the reconnaissance dive. The ROV camera images show the vessel is listing to port. The port and starboard bow

anchors are still stowed against the hull. At the top of the bow large *Lophelia* colonies are growing around the edge of the foredeck partially obscuring the anchor windlass and anchor chain. Hovering just outboard of the port bow in view of the deck we began to move the ROV slowly down the port side of the wreck following the deck line and watching for any potentially threatening entanglements to *Jason II*. Although colonies of *Lophelia* have enveloped much of the foredeck, the main deck is free of any growth only along either of the ship's railings are *Lophelia colonies in abundance*. Dropping down from the foredeck to the main deck, we identified the forward mast and deck machinery used for hoisting cargo. The main hold and the two adjacent portside deck plates are buckled reflecting the force of the bow torpedo explosion.

The *Lophelia* density dramatically increases near the central deckhouse. The top of the bridge is missing, however the remaining two stories are completely overgrown with *Lophelia* to the point of being only recognizable by the outline. Part of the portside bridge observation deck has collapsed and hangs out over the portside of the hull. Aft of the central deckhouse the partially collapsed catwalk runs back to the rear deckhouse. Dense *Lophelia* obscures much of the catwalk structure. The mainmast, like the foremast, is lying across the deck pointing toward the bow. Small winches and valves remain in place along the deck. Another two missing deck plates inline with the collapsed catwalk suggests the position of another torpedo explosion.

Continuing aft toward the stern we noted that the ship's funnel is missing. The aft deckhouse is intact but like its counterpart forward is covered in *Lophelia*. A box of empty 4-inch deck gun casings is strewn across the port stern deck. The areas of exposed steel railing and superstructures at the stern are also heavily overgrown with *Lophelia* obscuring much of the structural details here. Moving around the stern we saw the name *GulfOil* arched across the transom, partially hidden by *Lophelia* hanging over the stern railing. Pointing aft off the stern, sits the defensive 4-inch deck gun on the fantail deck. At this point the hull is buried the seafloor up to the rudder head leaving only 2 m. of relief.

Moving around the stern we continued our recon up the starboard side of the wreck. The heel of ship exposes a greater portion of the starboard side. Moving forward we passed the remnants of the catwalk, central deckhouse, and railings all covered in *Lophelia* with little evidence of entanglement. Forward of the central deck house we saw the top of the torpedo damage in the starboard hull. We continued forward imaging the starboard main deck before returning to the bow to begin the profile mosaic. Because of the higher risks of entanglements on the port side and the necessity to document the torpedo damage areas, project biologists and archaeologist agreed to mosaic the starboard profile of the *GulfOil*.

Setting up on the starboard bow we ran several mosaic test lines to determine the best way to approach the mosaic and fine tune the automatic image timer on *Jason's* high-definition camera system. Ultimately, we opted to run lines vertically capturing stations along the hull, instead of horizontally capturing sheers. We began profiling the hull at 0:38 GMT. Moving from the bow to stern we ran 35 vertical lines at 4 meters intervals to provide sufficient overlap in imagery. Images for each line were collected at 15 second intervals. Minute adjustments of 2-5 degrees in *Jason's* heading, kept the ROV perpendicular to the hull. We completed the profile mosaic at 4:35 GMT, then came up into position above the stern aligned to the centerline of the shipwreck. Running 4 m. off the

top of the deck we flew two transects down the length of the ship to either side of the centerline. All mosaics were completed by 5:38 GMT.

Following the mosaic we collected detailed imagery of specific wreck components and features. While collecting images of the torpedo damage on the starboard hull forward of the deckhouse we located the remnants of the ship's funnel outboard of the starboard bow. The funnel has collapsed on itself with only the base ring remaining upright on the seafloor at the base of the funnel. The funnel ladder and ship's whistle are still intact and clearly visible on the side of the funnel. We completed the detail imagery at 0800 GMT.

At 0800 GMT the chief scientist was notified that the archaeological survey of the *GulfOil* main hull was completed. The next task was to determine the extent of the southern debris. *Jason II* took up position at the bow of the *GulfOil* then proceeded on a southerly heading into the debris field. Moving through the debris field, we noted non-descript hull fragments, structural components, and a single 55 gallon drum in direct association with a vent hood. The debris scatter ended at approximately 230 meters south of the wreck. After reaching the limit of the debris field we reversed course heading back through the debris field towards the main hull. On this course we observed more non-descript hull fragments as well as the remnants of a modern sea or weather buoy that is intrusive to the site.

We arrived back at the main hull site between approximately 0930 and 1000 GMT. At this time the survey was turned over to the Chief Scientist to carry out the biological objectives at the site.

The first biological objective was to pick a portion of the hull with representative biological communities and gather the imagery for a higher resolution photo-mosaic to next within the mosaic of the entire ship. We chose an area over the largest torpedo hole in the hull because there was a combination of dense lophelia, sparse lophelia, and anemone coverage in this area. A portion of the hull about 8 meters long was imaged from the rail down to (and around) the hole in the hull. After this we did some targeted imaging designed to allow measurements of lophelia growth away from substrate for estimation of maximum growth rates of some of the larger colonies encountered. After about one hour of these measurements, the vehicle was turned over to our USGS partners for collection of lophelia samples for genetic analyses (taken from colonies in the sediment below the ship to avoid ALL impacts on the wreck) and push cores from areas close to the corals. Shortly after the minimum number of genetic samples had been taken (10) we were told that we would have to surface in 15 minutes to avoid recovery during an oncoming storm. Push cores were quickly collected near the Lophelia on the sediment under the ship. As a result of the early recovery, we were not able to: Complete the planned genetic collections (10 more were desired), take the control push cores away from the ship, or complete the planned additional biological photo mosaic and additional measurements for growth planned with the down looking digital still camera. We also did not conduct targeted fish transects away from the ship, however, as part of the investigation of the two debris fields several hours of down looking HD video was obtained away from the wreck and this should make a robust comparison to video obtained during the survey of the ship.

One aspect of the wreck that impressed all biologists was the mono-culture nature of the colonial cnidarians. None of us noticed any colonial cnidarians except *Lophelia pertusa*. And there was more *Lophelia pertusa* on the wreck than at any of the coral sites we have

discovered in the central Gulf of Mexico. Some of the sites in VK and on the W FL slope may have similar numbers of colonies, but now show the density seen over parts of this wreck.

28 October

1200: Jason was recovered early because of storm front moving toward the Brown at high speed. After recovery, the USBL pole was secured and the ship began its transit towards MC 118

1930: Arrived on station at MC 118. **WOW** (Waiting on Weather). Decision was made to delay the dive until at least 0800 Friday and the ship proceeded to multibeam the NRDA survey sites within 15 miles of the DWH.

29 October

0000: Multibeam of NRDA sites is continuing with likely finish of all sites before noon

0600: Decision made to delay dive until at least 1200

1200: Multibeam complete, on station, **WOW**: Seas are calming, but wind would complicate a launch. Since both seas and winds are dropping quickly, the decision is made to postpone launch until 1600.

1600: Launched Jason **J2 538 for a 16 hr dive on MC 118**

This dive is to MC 118, the Ole Miss Hydrate Observatory Site. This site has been well mapped by AUV and numerous ROV and JSL dives since 2005 and numerous geophysical, geochemical and microbiological instruments are on the sea floor. This site has not been well studied by macrobiologists and we have established a collaboration between our team and Ole Miss to combine forces and add macrobiological observatory stations to this area. A interdisciplinary graduate student from The University of Rome, La Sapienza who has been working at Ole Miss is on board for this collaborative project. Michela Ingrassia led the dive to MC 118 and was present in the Jason control van for the entire dive.

We began the dive looking for the northern most instrument ("CSA") deployed at this site and found it within 5 meters of where we expected in our navigation net. There was some confusion as to whether this was the expected instrument for this location, but we documented the position and state of this instrument and then proceeded to the predicted location of the PFA instrument and similarly located it very close to its expected location. This was very encouraging as there is one (~60-tall) mooring we must avoid when we reach the most active areas of this observatory. The northern-most "coral site" was then visited, but upon closer investigation (and careful imaging) we discovered that what had been suspected to be a small whip coral in this area were actually pogonophorans. We did encounter a field of clams here, with many live *Calyptogena ponderosa*, and obligate seep clam with sulfur-oxidizing symbionts. This collection was also consistent with the presence of the chemoautotrophic pogonophorans in this area. Several were collected, along with push cores in this habitat. We then proceeded to the South to an area with abundant *Paramuricea* with numerous individuals of *Asteroschema* ophiuroids on each colony, mostly attached to carbonate boulders. Marker #43 was deployed among the first 3 of these sited and small samples were taken from the colonies

to confirm their identification. We also sampled 2 individual ophiuroids from these colonies. By chasing sonar targets in this immediate area many more large and impressive colonies of this species were confirmed on the carbonates and imaged. We also observed and collected one *Chrysogorgia* sp. Also abundant in the area were golden crabs, and one was sampled (primarily for population genetic analysis of its barnacle population) and *Acesta* (two of these scallops were sampled, primarily for stable isotope analyses and for NRDA analyses of hydrocarbon load). A large dead *Madrepora* colony was found and sampled and shortly after. A moderate-sized colony of live *Madrepora* was found on the edge of this boulder field, and Marker # 42 was deployed and this colony imaged. We then proceeded north following sonar targets and looking for a previous Marker 9, as gorgonian corals are reportedly near this marker. We noted dark gray/black patches in depressions, areas of brine seepage, and observed small gastropods as the dominant fauna (these were collected at 0331). We continued north and observed paramuriceids growing on bits of hard bottom surrounded by sediment (sampled these at 0351), and encountered Marker 6 deployed Sept 6 (monkey fist and rope) at 0407. From here, we drove west to discover a large area containing many colonies of *Madrepora* (0420; dropped a DVL target here to come back to later), live and dead patches with shell debris around the base as well as chrysogorgid corals hosting shrimp and crabs. At 0513, we located a Mooring 60m tall that was deployed here in 2010 (mooring was imaged). At 0545 (886m) we discovered Marker 9 (a meter-long line with a ball of rope at the top). No corals were in the immediate area. We proceeded north to find small clam shells on the sediment and a unused push core on the seafloor (0550). As hard bottom rocks became more prevalent, we observed and collected several paramuricids and asteroschemids, urchins, more Chaceon crabs with barnacles on their carapaces, and urchins. Noted the presence of hagfish and holothurians (white) over the sediment. We also came across small patches of brine at 0622 and 0626, and then small tubeworms at the base of carbonate outcrops. Further outcrops to the north harbored paramuricids, ophiuroids, urchins and more crabs. At 0653, we reached a hydrate area with bubbles rising from the sea floor and yellow frozen methane in overhanging cracks in the carbonate, The hydrates were occupied by ice worms (*Hesiocaeca methanicola*) and covered by bacterial mat (*Beggiatoa* sp.). Bivalve shells littered the surrounding area, and small gastropod snails were observed near the hydrate. Here we dropped DVL target #29. Less than ten meters away, we encountered a small outcropping of (white and pink) *Madrepora* adjacent to a carbonate ledge. North of this was a sedimented region, mottled mud, that hosted some seastars, fish, broken shells, and Chaceon crabs.

We ended the dive by returning to the area with the most extensive *Madrepora* development and established two observatory stations, each of which included down-looking mosaics and horizontal documentation of selected colonies. One station was marked with marker X and the other with T1. Both mosaics included multiple impressive colonies of live *Madrepora* with areas of dead coral skeleton surrounding the live corals. After the documentation we attempted to make mussel pot collections on the edges of the mosaics in areas of predominately dead skeleton, but found that the growth form of *Madrepora* here (very planar) prevented efficient collections with our coral pot devices. (the robust and relatively flat surfaces of prone colonies did not yield much material into the pots.) Because we did not want to significantly impact these areas we chose to limit our collections to small pieces of coral laying on the ground (for genetic identification) and

push cores on the edges of the mosaics. All of the biologists were impressed with the planar nature of these colonies and the apparent age of the impressive plates of live coral. We are speculating that this planar growth form may be genetically distinct from *Madrepora* in the Atlantic and even what we have seen and sampled at other sites in the Gulf of Mexico. There was more live *Madrepora* at this site than any other we have visited in the Gulf. Also very impressive at this site were the numbers of golden crabs, that were associated with most habitats here and especially abundant in association with *Madrepora*.

30 October:

0800 Recover Jason head to new Desota Canyon site (80 miles away)

1430: Arrive on station and run a W to E multibeam line over the station.

**1620: Launch Jason J2 539 at DC673 for 16 hour dive.**

The dive started slowly because of several issues with Jason that needed attention early in this much deeper dive than previous work. As we were descending down the escarpment, it was noticed that navigation placed Medea over 50 meters away from its expected location under the ship and this nav issue was investigated and trouble-shot throughout the dive. As a result, Jason was located under the stern of the ship and our primary navigation tool was the doppler velocity log with resets under the stern of the ship. Bathymetry was not consistent between the 3D seismic map and the multibeam we used as an underlay (3D seismic indicated about 200m greater depth than the multibeam). Jason depth gauges agreed with the multibeam. The starboard arm developed a ground fault during descent and could not be used throughout the dive. As a result, use of the mussel pots was not really possible (no antirotation ram on the port manip and no use of the stbd manip for anti rotation). Science activities commenced at about 1800 local time. Nonetheless, after a slow start we had a very successful and biologically exciting dive.

We began the dive at the base of the escarpment at about 2600m and landed in an area with massive carbonates surrounded by sediment, finding tubeworms around the base of the first carbonate visited and a *Bathypathes* on top of the carbonate. The *Bathypathes* was collected. We then proceeded to survey the area and first collected a small aggregation of tubeworms into the port biobox, then later a mixed aggregation of tubeworms and mussels into the starboard biobox. Tubeworms in the second collection had very impressive roots. We then took push cores in this area and collected some carbonate samples. We continued to survey for mussel beds (because of the new species found in the other DC site in 2009). We encountered a large aggregation of tubeworms easily accessible for slurp samples and slurped shrimp, crabs and 3 holothurians from within the tubeworm aggregation in sufficient numbers for population genetic analyses to test our hypothesis that this area may be genetically isolated. At this point the decision was made to begin our transit up to the first way point approximately 200m up the escarpment. After approximately 20 minutes a mussel bed was spotted in a ravine of sorts and upon closer examination was found to be a bed of mostly dead mussels below a very impressive seep feature with live mussels covering an extensive area over an apparent 8 m Vertical crack in the wall, surrounded by a ring of thriving tubeworms. This large and cohesive community was imaged extensively before collections began. In addition to the impressive mixed community a very photogenic octopus formed a focal point for these images. We settled in to make some slurp and mussel collections and spotted a zoarcid fish. We were

able to collect this fish with the slurp sampler, along with many individuals of what appeared to be two species of shrimp and a few galatheids, all directly associated with the tubeworms and mussels at this very active seep site. Because fish in this family are often vent endemic and a species was described from the seeps on the upper slope, we hypothesize that this may also be an undescribed species. Also very impressive at this site was the coverage of polyps on the tubeworm tubes: what appeared to be zoanthids and a hydra-like species. We ended our collections at this site with a scoop of large mussels from the vertical face of the wall, fired another niskin and resumed our transect up the escarpment.

As we transited up the escarpment, we encountered a diversity of gorgonians, starting mostly with bamboo corals, then paramuricids with ophiuroids, and at least two black coral species (perhaps *Bathypathes* and *Stauropathes*). These species were mostly observed along the wall face, and many observed on top of the escarpment. We noted a strong current from the southeast and it appeared that most of the corals were attached to the wall facing the current. Three species of bamboo corals were abundant along the wall at ca. 2380-2400 m, including a *Lepidisis* whip coral and 2 possible *Keratoisis* spp. Along the wall, we also observed and collected *?Bathypathes*, *Chrysogorgia*, *?Acanthogorgia*, *Paramuricea*, *Sibogagorgia* and *Corallium*. A few associates were observed on the corals, including a brittle star *Asteroschema clavigerum* on the *Paramuricea* and a shrimp on the *Chrysogorgia*. Overall, however, associates were not commonly observed. We noted that this was the first time during this 2010 cruise that most of these species were collected and observed. Our impression was that the octocoral community structure was similar to that observed at DC583 in 2009.

We then headed to hard target #2 around 0730 local time, transiting over mostly mud. At times, a low relief outcrop/boulder was observed with white sediment accumulation around the base. We reached a second ridge at ca. 0330 local time. This ridge was at ~2250 m depth and was also covered with similar corals as the first ridge encountered. However, we did pick up a few more coral species, including two species of *Iridogorgia* and an additional paragorgid. We spent ca. 2.5 hrs at this ridge and then continued to move upslope. We transited over mostly mud bottom with scattered rock outcrops/boulders and collected a *?Bathypathes*, a *Paramuricea* with an *Asteroschema clavigerum* associate, and a rock in this area. We left the bottom at 0650 local time anticipating an on time recovery on the surface and on the way up we fired a niskin at 2000 m and another at 1233 m.

We left the bottom at 0640 local time anticipating an on time recovery on the surface.

31 October

0800 recover Jason and move to VK 826 (60 miles away)

### **1600 Launch Jason J2 540 at VK 826**

This will be our last dive at a site with the main organisms for laboratory study associated with this program and extensive genetic and live animal collections must be completed before leaving the site. Our plan was to dive until all objectives were met so we would have the option of skipping a second dive to this site if the live animals we collect remain in good shape and we obtain sufficient numbers for the planned studies.

The sub was launched over the coordinates of Mosaic Q and we spent most of the first watch working on problems with the tether, navigation problems, and then looking for our marker in the wrong location (from incorrectly communicated numbers). We then proceeded North and while looking for T3 determined that the location we had for Markers Q and O were incorrect, but our T3 location numbers were good. We recovered the T3 temperature recorder deployed last year and then transited up to Marker O (which was found quickly with the correct numbers) and we redid this mosaic for comparison to last year and the July NRDA cruise.

The two biggest challenges we expected during this dive were locating and collecting pieces of sufficient numbers of white *Leiopathes* (27 needed) and paired samples of *Callogorgia/Astrochema* (5-10 needed) for the planned population genetics work. After completing the mosaics we began working to the West and then South visiting known (and suspected) locations for these samples.

We transited west across a small ridge to a known location where *Callogorgia* were known. We surveyed this site and realized that no *Callogorgia* had any associates on the colonies. Therefore, we continued south towards a known *Leiopathes* area. After completing the *Leiopathes* collections for live animal and genetic studies, and RNA-later collections of all target species, we returned to Marker Q, which was quickly located with the correct coordinates, redid this mosaic and then made the remaining paired genetic/live *Lophelia* collections for return to Temple and laboratory studies. After the final *Lophelia* collection, we suction sampled for about 20 minutes to obtain galatheids and shrimp for the aquaria at PSU and Temple. We then went into "lay back mode" with Jason while the ship moved at .75 knots from our location in the SE corner to the extreme SW corner of the VK 826 site where we had found *Callogorgia* with *Astrochema* brittle stars at the very start of a dive in 2009 at a base of the slope. After a 1.3 km transit we landed in the midst of numerous colonies of *Callogorgia* with associated brittle stars attached to carbonate outcrops. We were successful in collecting a ~dozen *Callogorgia* and brittle star samples over the following 1.5 hours before leaving the bottom. We noted a PSU marker #9 across the carbonate platform that was lined with *Callogorgia*. We deployed a genetic marker that served as a scale for forward-looking imaging as well. We took some horizontal images of the many *Callogorgia* on this platform for long-term monitoring.

1 nov  
2000 recover  
proceed to MC 338

2 November  
0800 Launch  
2000 recover

3 November  
0800 Launch  
**Recover and Leave station at 2000**

4 November

Arrive in port in Pensacola between 0800 and 1000