

Jason Dive J2-209, August 3-4, 2006 (GMT)

09:34 Off Deck

10:51 On Bottom: 3° 43.62'S, 151° 40.40'E, 1695 mbsl.

23:50 Off Bottom: 3° 43.59'S, 151° 40.29'E, 1907 mbsl

01:03 On Deck

Aim:

The target of the dive was another hydrothermally active area within the Pacmanus field, the Satanic Mills Site in about 1700 m water depth. Highest priority is to sample two solid / fluid sample pairs at sites of active venting of high-T fluids area. Further, the extent and characteristics of hydrothermal activity in the area will be examined and documented. Part of that operation will be the description of location of ODP Leg 193 drill hole 1191A. It will be particularly interesting to learn whether or not the drill hole produces fluids. Upon surveying the area, samples of sulfides as well as fresh and altered rocks characteristic of the area should be collected.

Co-ords for the landing site:

- **Lat/long: -3°43.63' S, 151°40.40'E**
- **UTM: 352672, 9587919 (WGS84 Zone 56S)**

Summary

Murky water and Eh dropping to 175 mV around a depth of 1500 mbsl indicate hydrothermal plume activity. After reaching bottom, we headed 289 for 124 m with Hole 1190A as target. The terrain is characterized by steep slopes of lightly sedimented felsic lava flows with big, broken up sheets of lava with ropey to irregular and rough surface. Steepest parts of slopes are draped with elongate and striated lava sheets/fingers that are also broken up. Overall, the lava is massive and blocky.

The first indication of hydrothermal activity was encountered at x2517, y2550, z1692 in the form of diffuse venting and mussel beds with crabs and worms near the base of a near vertical wall (vvan# 21977). On top of that wall is more biota: microbial mats, snail beds, shrimps; also some oxide staining. At the target point is a white patch (x2483, y2568, z1690, vvan# 21997) filled with flocculent material. This is likely the location of Hole 1190A. We follow smoke in westerly direction and find active gray smokers at x2458, y2565, z1684 (vvan# 22016). All the way between the white pond and the active chimneys is patchy diffuse venting and biota, mostly crabs. The active chimney field has large inactive structures with rusty outer surface and colonies of barnacles and anemones. Few small spires are active; one that is venting dark gray smoke is picked for sampling. It is a double-spired feature, one of three active orifices, with venting through a small beehive one side and unobstructed venting on the other side (x2448, y2576, z1685, vvan# 22097). The spires are part of a multi-spired complex that is 6-7 m high. Most of the neighboring features, however, are inactive. Sampling tip of active double spire (vvan# 22099). Fluid sampling of gas-tight samplers records temperatures between 293 and 295°C. The orifice that corresponds to the little beehive is 298°C. Majors sample is also taken here as is the temperature on the outside of the spire (7°C, IGT T-probe). An

inactive chimney is collected from an area a few m WSW of the active chimney (x2451, y2575, z1986, vvan# 22220).

Heading 230 we find the chimney field to continue to x2438, y2570 with gray smoker activity through few structures of varied size and shape. The volcanic ridge that hosts the chimney fields ends abruptly in a 5 m deep depression that has few talus pieces on the bottom and very minor biota, but is mostly surrounded by steep flow fronts. The Eh in the depression is 1-6 mV and the temperature goes up by 0.1 to 0.5°C. We fire both Niskin bottles here (x2432, y2561, z1685).

We continue with a heading of 230 over block lava terrain that lacks hydrothermal activity. A 30-minute survey shows that the entire area SW of the chimney fields appears to be block lava flow and hydrothermally inactive / devoid of vent biota. Heading 015 to explore area north of the chimney field, we come across vestimentiferans, mussels, snails, and scaleworms, when going up a steep wall at x2419, y2574, z1682). There are dead chimneys and patchy biota where diffuse venting at x2426, y2604, z1678). Continuing heading 015 gets us to a site of gray smoker activity at x2429, y2604, z1678). A massive chimney with a thick stem and a mushroom-like cap that is colonized by snails and appears to be composed of coalesced diffusers is the central landmark of this chimney field (vvan# 22380). It is venting gray smoke at a slow pace. Other chimneys in the field are spires that are commonly inactive except occasional light gray smoke. We explore the area up to 50 m north of the mushroom chimney and find no further smoker activity, but scattered crabs and patches of diffuse venting through cracks in the volcanic basement. A single small gray smoker was sighted NE of the mushroom chimney at x2445, y2589. We are only 35 m NW of sampling station 1 and decide to deploy a marker there (Marker 3).

Headed northeast to check out small ridges of large slabby-lava flow that stick out from the terrain and form small gullies. Chris Yeats mentioned that sulfide chimneys seemed to occur up at the beginning of these gullies. We stopped at a small localized area a meter or more across that had white staining and some shimmering water, shrimp and galatheid crabs, gastropods, etc. Took a rock sample that was bathed in shimmering water (3-R1 – Target#18), there were no sulfides here and the measured water temp was only 8 degrees but probably not a true reading as it was diffuse flow of fluid. Moved on, heading to north (320) and traversed up a series of small scarps/benches that are likely to be a flow front of dacitic lava. On top we find smooth flow tops, little to no sediment. Fe-oxide staining on lavas around cracks is localized. Turn and head east again and continue across massive slabby lava flow with striated or stretched flow features. Lava becomes more knobby looking on its surface towards north and we reach what is probably another flow front of lava. We turn and head east and find blocky talus out in front of the flow front but otherwise devoid of any hydrothermal activity. At 16:06 we turn to head south west (240) back to the presumed sulfide area where the Shinkai 2000 program sampled sulfides at 239 degrees (target=x2475 y2547). Continue to cross striated lineated slabby lava flows with little to no sediment cover. Start to see oxide staining at x2496 y2569 and then biota density picks up with crabs and white bacterial coatings (?). Come into a small group of extinct chimneys, some collapsed with a small white-coated, lazily gray smoking chimney (x2469, y2544). Shimmering clear fluid from cracks at base of sulfide structure, gastropods, shrimp, crabs etc. Whole area is a couple of meters across. Check temperature of shimmering clear fluid (136 degrees) and small gray smoker (219 degrees)

here at station 4. Decide not to sample fluids here and move on. Come upon several small groupings of chimneys. Tall ones (~2-3 m high) appear dead while shimmering fluid exits through lava cracks at base. Find another small white chimney on a crack in lava next to dead chimneys that is emanating clear shimmering fluid (Temp=5.6 on outside, 212 on inside after rock sample attempt). Tried to sample chimlet and it disintegrated. Got some pieces though (sample 5-R1). Move on and find another small field of white staining and a triplet of small active chimneys (vvan 23179). We sample one of the spires (6-R1; vvan).

Vanko watch: The sampling operation for 6-R1 began by knocking over one of the chimneys (compare vvan 23205 and 23206!). A nice piece of the broken chimney was sampled as 6R-1 (vvan 23213). An IGT sampler was picked up and the maximum outside T of the chimney stump was 11°C. The IGT sampler was disabled by a starboard manipulator spasm, so the fourth and last IGT sampler was deployed for the actual water sample. Maximum temperature was 240°C, but Ts jumped around quite a bit during sampling, finishing up at 184°C. A majors sampler was deployed and a water sample was taken despite a loose, dangling snorkel. Before leaving this station, a volcanic rock was chosen for sampling nearby (6-R2; vvan 23484; but this rock turned out to be massive sulfide!), and Marker #5 was dropped on the seafloor. To the left of the active chimney just sampled, an unusual inactive chimney seemed worthy of sampling owing to a unique palmate morphology exhibited by its upper extremities (the chimney is visible during the prior rock sampling in the left hand side of the pilot's camera – check out the shadow to see the tree-like shape, and more pictures starting at vvan 23523). This is sample 6-R3.

Believing that one objective of the dive was to locate the site of ODP Hole 1191A, where the dive plan stated to expect a reentry cone, we plotted a course of 045 degrees for 37 m to the spot. We passed station 4 (recognized by Chris Yeats, who was present back during station 4 operations), and noted a neat little chimney shaped like a holiday tree (vvan 23605). At our target we “rediscovered” the white pond deposit first seen by a different watch around 11:15GMT. Inserting the T probe about 15 cm gave a T reading of 7.9°C, or 5.3°C above ambient (which is 2.4 to 2.6°C). [After the dive we determined that Site 1191A was a bare-rock spud-in with no re-entry cone, so it seems likely that the white pond is a deposit of drilling mud and borehole cuttings. It is now warm, probably harbors microorganisms, and may reflect a producing Hole 1191A.] We set up at a close-by shimmering water site to the SW, measuring T = 16°C. We then moved about 20 m west to the next interesting chimneys, a group of spindly delicate-looking spires, with three or four of them spewing gray smoke. We decided to check temperatures and sample. On approach, Jason knocked over the top of the largest active chimney, which was white and covered with swarming shrimp (vvan 23796; 23805 to see smoke venting near base). Sample 7-R1 is one of the lower smoking conduits plucked off the base of the chimney (vvan 23877). The maximum T then measured at the orifice was 271°C. Sample 7-R2 is from an area adjacent to some “peacock ore” evident in the base of the chimney (vvan 23937 for the peacock ore; actual sample came from just left of this). A relict fallen pipe was then sampled (in two pieces, 7-R3 and 7-R4), and part of the upper chimney that fell earlier was picked up (sample 7-R5).

Exploring a little more near the white pond, and as the shift change approached, a white rock notably stood out near the base of an escarpment. It was talus from a group of light-

colored rocks mass-wasting away from the scarp (vvan 24128; see also 24160, taken after sampling). In the magnified science camera image, Chris Yeats recognized a pseudobreccia texture to the white material, and sulfide-like veins going through the rock. This was sampled (8-R1) as the watch changed.

We headed 216 for 70 m to examine the nature of a ridge southwest of the last sampling sites. Following the contours of a steep-sided block lava flow, we saw whitish and reddish mats(?) around rare inactive small chimneys. Further down the track, the area was more sedimented and the lava morphology changed to lobate flow with occasional large, striated pillows. At a small collapse pit, broken up lobate crust was sampled (x2428, y2494, z1689, vvan# 24227). Continuing with heading of 310 to explore terrain NW of chimney fields, we traversed a sharp contact of blocky felsic lava flow overlying the lobate flow unit that was just sampled (x2407, y2507, z1682, vvan#24323). We climb up several steep flow fronts with m-sized lava blocks, littered with scarce crabs. The nature of mounds we set out to explore is purely volcanic in the area around x2361, y2550. We head back to the Mushroom chimney field (bearing 050) to establish the northwesterly extent of active venting at Satanic Mills. Looking around midway between last location and the Mushroom chimney, we find a beautiful field of diffuse venting with a very rich fauna, consisting of vestimentiferans, mussels, crabs, shrimp, anemones, scaleworms, and limpets (x2396, y2607, z1679, vvan#24460). Got some nice DVCamTape and DigitalStill coverage here. Eh is as low as 60 mV in the area. Finally check out the area around x2390, y2590, but find only scarce biota and no obvious venting. Dropping weights and leave bottom after testing