

***Jason Dive J2-220, August 14-15, 2006 (GMT) DESMOS CALDERA***

**08:19 Off Deck**

**09:40 On Bottom: 3°41.80' S, 151°52.30'E, 2080 mbsl**

**00:00 Off Bottom: 3° 41.49'S, 151° 51.93'E, 1906 mbsl**

**01:06 On Deck**

**Aim:**

The goal of the dive is to explore and sample the Onsen hydrothermal field and the surrounding area on the northern wall of the DESMOS caldera.

- (1) Examine WP1 for presence of hydrothermal activity
- (2) Examine diffuse venting at WP2, T measurements, possibly rock sampling
- (3) Sample hydrothermal fluids, precipitates, and altered rock from Onsen and surrounding areas. WP3 and 4 are within the Onsen hydrothermal field. We need to explore this field (c.30x30m) and measure temperatures to find good locations for fluid sampling. It will be important to recover solid samples to go with the fluids. The Onsen field is surrounded by an area of highly altered hyaloclastite that needs to be sampled. Fresh hyaloclastite needs to be collected from parts of the hyaloclastite field that are unaffected by hydrothermal activity. If possible, sampling should be targeted at recovering a range of apparent alteration intensities with increasing distance from Onsen.
- (4) Map the caldera wall around Onsen as good as possible and describe and sample the most prevalent lithologies
- (5) Collect deep-sea water with Niskins in areas unaffected by hydrothermal venting

**Co-ords for the landing site:**

- **Lat/long: 3° 41.80' S, 151° 52.30'E, 2080 m**
- **UTM: 358864, 9581040 (WGS84 Zone 56S)**

**Summary**

Vanko: During the course of the normal lowering, we noticed that there was smoke in all three cameras (BrowCam, PilotCam and SciCam), first noticed at a depth of 1682m (398 altitude by difference from 2080), down to about 1763 m (altitude 317 m). We speculated that this might be from Desmos caldera, or from a more distant location. It was agreed to look for this on the way back up at the end of the dive, and to reserve one Niskin bottle in case smoke is observed again.

Bach: Fired Niskin bottle at a depth of 2078 m for another deep-sea water sample. We then went up the slope of the caldera heading 290 through monotonous, sediment-dusted pillow lava. We sample that pillow lava at x1800, y 2455, z1995 (sample J2-220-2-R1, vvan# 48864). Further up the slope are several terraces that strike roughly E-W. Shortly before we reached the main terrace, we came across scattered clam shells and occasional crabs, but surveying around for 45 minutes did not allow us to locate the source of the clams or indicate hydrothermal activity in the area bar a small patch with microbial mat(?). A heavily sedimented area with thousands of little pockmarks with lapilli in the centers (vvan#49100) indicates that we are approaching the main terrace with the hyaloclastite deposits. That large terrace east of the Onsen site begins at x1528, y2650, z1916. Here we find fields of fresh hyaloclastite in otherwise sedimented, flat terrain

(vvan# 49117). The Eh begins to drop, suggesting vent sites are in the vicinity. Continuing on to the NW, we cross heavily sedimented fields (vvan# 49127) with abundant white microbial mats. This particular area looks exactly like the top of the Snowcap dome. A few meters past little Snowcap, we find shimmering water in an area of fissures in the sediments and dead vestimentiferan colonies (x1501, y2678, z1911; vvan#49135). That area is followed by a field of mainly fresh hyaloclastite with extensive patches of bleaching and staining. We sample a bleached and sulfur-veined rock at x1423, y2724, z1918 (sample J2-220-3-R1, vvan# 49169).

After crossing a field of fresh hyaloclastite with patchy diffuse venting and thousands of crabs (vvan# 49202), we see white smoke, but the ship's track forces us to continue on a heading that leads us away from the source of the smoke to a slope exposing a sharp contact between altered and fresh hyaloclastite (x1391, y2736, z1905; vvan# 49223). About 10 m north of that location is a wall exposing spectacular columnar jointing in large pillows exposed on that fault (vvan# 49231). We see white smoke in the southeast but cannot locate its source, due to the poor visibility. Had to go 60 m east to get out of smoke and finally settled down at x1415, y2773 and 45 m down slope to get a new doppler fix. The area is marked by a nice contact between a pillow flow overlying hyaloclastite (or talus). After the new fix, the coordinates here were x1398, y2763. Heading 210, we go back to the transition between altered and fresh hyaloclastite (now at x1371, y2741; vvan#49338). We worked our way into the Onset site from here going due east. A spectacular outcrop of hydrothermally altered pillow basalt was encountered just 15 m east of the fresh/altered transition (vvan# 49353). Going further to the east, we start seeing white smoke and spotted the source of venting: white smoke issuing from cracks and fissures in the caldera wall at x1370, y2787, z1913; vvan# 49367). Started to measure temperatures ( $T_{\max}=112^{\circ}\text{C}$ ) at the site of most vigorous venting of white smoke (yellow in places  $\rightarrow$  likely sulfur), when Tivey watch began.

Tivey: Sitting at a depth of 1910 m depth with white smoke venting in front of Jason coming from low-lying ledges or flanges. When we look in another direction 228) we see more white smoker areas at the same depth on the slope. We make a T-measurement of 112C (x1364 y2789 z1909). We move a little ways up hill and find another white smokers. We get lost for a while and retrace our steps. We are now a another nearby white smoker area. We make two more temp. measurements are get 117C from a focused flow smoker and 92.6C from a ledge (x1361 y2790 z1908). We decide to take fluid samples here as the flow is vigorous. Take a gas tight sample (J2-220-5-W1-IGT1, x1361 y? z1908). Finished with that sample at 15:08 and pickup the next gastight bottle and take fluid sample (J2-220-5-W2-IGT2). Note there is an offset in the temperature of the thermocouple of 10C. Max T is 129 minus 10 is 119C. Now we do the major sampler here (J2-220-5-W3-M4). We stowed the mottle as the end and pickup a rock sample (J2-220-5-R1). We also pick up a scoop sample of the ledge/flange material (J2-220-5-R2), very friable. WE move north ie laterally along the scarp face. At 16:13 we come across shimmering water and Fe-"floc-city". We make a T measurement of white material and shimmering water and get a max. T of 72C (x1355 y2754 z1980). We pick up a rock from the shimmering water (J2-220-6-R1). Fe-staining of talus. We see a smoking lava area with gray smoke but no focused activity. We see a "fossilized bunch of worms and snails". Continue traversing laterally along the scarp face at a constant

level. We cross a talus dominated slope. At 17:17 we start to see some lighter colored blocks of more flatter surfaced lava. At 17:27 we stop to sample what looks like an outcrop. The outcrop looks like an agglomeration of lava talus blocks loosely cemented together. We get a fragment of rock (J2-220-7-R1, x1437 y3025 z1894). We have reached the headwall of the caldera.

Vanko: We examined the headwall of the caldera: rocks in the wall are m-scale pillows with radial cracks, aphanitic rinds, abundant surficial oxidation and weathering. An outcrop of highly altered pillow lavas juts out at one place, and we sampled this (J2-220-8-R1; vvan 50151) to compare it to alteration at Onsen hydrothermal field. Thirty meters deeper, at the base of this wall, we found outcrop and associated talus of gray rock with white alteration rinds, and we sampled this, too (J2-220-9-R1, vvan 50172, 50177). There were two tube worms here, and a dip in Eh from 140 to 125, consistent with some hydrothermal activity here. We then moved toward the south, traversing a slope of blocky pillow talus dusted lightly with sediment. A few talus pieces had a brecciated and cemented texture (vvan 50228), but the vast majority appeared to be pillow fragments. Later, the talus became more irregular in size distribution, and one large block was clearly altered breccia (vvan 50280), and it looked like it had been sampled recently. Another unusual rock resembled a hedgehog (vvan 50313) and may have been a pillow with an unusually coarse-hackly outer surface. At x1446 y2827 z1921 we cross onto a morphologically young pillow flow, with long graceful tube-pillows, that may have flowed onto the talus pile (vvan 50327). The flow is dusted with sediment, not shiny, so although it is young it is not exceedingly recent. In one area there is a fog of thin white smoke hanging in the water amongst the pillows, as if they are gently venting from below (vvan 50388). At x1429 y2829 z1919, we see a strange rock growth rising up a meter or two. Looking like tufa, or taffy, or coral, it is rusty red in color and we think it is hydrothermal (vvan 50375). But sampling it we find that it's brittle like glass, the red color is just Fe-oxide floc, and the material is a mound of glassy lava that may have erupted with much gas escaping around it. It basically looks like scoria in a hand lens, except its much larger scale. This is sample J2-220-10-R1 (vvan 50422).

We take off eastward, re-enter the pillow lava, but have to wait a bit for a good navigational fix. We see more young pillows, then circle north and see the scoria again. At x1399 y2803 z1917 there are pillows dusted in white microbial floc (vvan 50483), the water column contains lots of floating floc, and the Eh plummets to 70. Moving to the west we encounter a large block of oxidized bleached rock. There are piles of dead tube worms in front of it (vvan 50511). Realizing that this must be the "footwall" to Onsen, we take a sample, which is soft, has a gray interior and a white exterior (Sample J2-220-11-R1; vvan 50523). Next we move on a 290° heading and pass Onsen as we traverse blocky well-sorted talus, so we turn back and see the vents (vvan 50547). The left-hand vent is surrounded by altered blocky talus, while the vents on the right are sited in unaltered rocks (except for immediately next to the vents).

We traverse south then west, keeping the smoking vents in view, passing the mound whose base was sampled at station 11, then up to the left where there is a spine of outcrop topped by native sulfur (vvan 50591). To the left of the spine is a uniform slope of talus ("hyaloclastite"), and off the right hand side of the spine is the southwest margin of the bowl of Onsen. We take two samples here: the first is very fragile native sulfur from

lower in the outcrop that can barely be sampled (J2-220-12-R1, vvan 50631), and the second is more robust platey gray and yellow sulfur from the top of the spine (J2-220-12-R2, vvan 50660).

Bach: We first tried to explore the extent of the Onsen field to the west but could not see the sources of venting due to poor visibility being engulfed in billowing white smoke for most of the time. With less than two hours left and a lot of sampling to do, we swiftly headed back to the location of the prominent fresh/alterd transition spotted earlier and sampled a pillow outcrop on the way (Sample J2-220-13-R1, x1348, y2778, z1903; vvan# 50777). On our way we again crossed the crab-infested field of fresh volcanic clasts with minor diffuse venting of milky-white fluids again (x1381, y2729, z1913; vvan#50823), a fault wall exposing pillows at x1362, y2715, z1906; vvan# 50843), and another fault wall exposing highly altered pillow and breccia at x1368, y2757, z1915; vvan# 50854). The coordinates for the transition now were x1371, y2732, z1903. We sampled three rocks here, an altered clast (J2-220-14-R1), a fresh clast with no visible vesicles (J2-220-14-R2), and one with obvious large vesicles (J2-220-14-R3). It was then decided to go to the site of 72°C diffuse venting located earlier and sample fluids. On our way to the diffuse vent site we again crossed the crab-infested field of fresh volcanic clasts with minor diffuse venting of milky-white fluids again (x1381, y2729, z1913; vvan#50823), a fault wall exposing pillows at x1362, y2715, z1906; vvan# 50843), and another fault wall exposing highly altered pillow and breccia at x1368, y2757, z1915; vvan# 50854). A full set of bottles was fired successfully at the diffuse vent site (x1358, y2785, z1910; vvan#50990) with temperature readings of 68 and 72°C during IGT bottle sampling. The outcrop here was entirely coated with microbial mats and filaments that became dislodged and formed large floc-balls that floated around and decreased visibility during sampling notably (vvan# 51000). Came off bottom at 00:00 GMT just in time for an 11 am recovery.