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#### Purpose of the Dive

Explore the biology and geomorphology of Ryan Canyon

#### Description of the Dive:

**Setting:** Dive 13 took place in Nantucket Canyon, at the deep mouth of the canyon where the steep canyon walls drop away and sediments empty onto the abyssal plain. A major goal of the dive was to explore greater canyon depths, so the dive path was selected to traverse the steepest slopes available at this depth range (1600 – 1900 m). The dive track ascended the southwestern canyon wall.

**Exploration:** The ROV touched down on the silty canyon floor at about 1875 m. Almost immediately we observed angular white carbonate debris boulders sourced from the nearby canyon wall. Both hard and soft surfaces were extensively burrowed, including small pits dug in the soft sediment. Uprturned subsurface sediments were lighter and greyer than the surface layer. Among (and on) the debris field were octocorals *Acanthogorgia*, *Anthomastus*, small *Distichoptilum* sea pens, and stoloniferous cornulariids; an echiuran proboscis extended from a burrow in rock, and *Echinus*-like urchin, two morphotypes of ophiuroids, green sponges and an interesting smooth mounded morph sponge with osculum arising as a cone at top were seen. The only *Umbellula* (Pennatulacea) of the cruise was seen at 1870 m. *Hygrosoma* urchins were common, many large and white rather than smaller and purple (without juvenile cusk eels, but some had a small ophiuroid on the surface of the test) and there were many many *Ophiomusium*-type ophiuroids on canyon floor, several with oral disk raised above the sediment. At 1861 m depth we began to see tall whip-like sea pens (?*Distichoptilum* - misidentified in video as *Funiculina*) that had large *Asteronyx* ophiuroids clinging to them, with some arms extended “fishing” in the water column (we saw several more along the dive track).

At 1825 m we reached the main canyon wall, in a section highly modified by collapse processes. On the debris field at base of wall several *Paramuricea* sea fans (with associated *Ophiocreas* ophiuroids, and some with anemones) and stalked crinoids were observed. The lithology of the base of the wall seemed slightly different

from the chalk unit commonly seen in other canyons. It seemed to have a higher siliciclastic content, and could have been a sandstone or mudstone. Mn-crust veneers and the crumbled and scraped nature of the slope made it difficult to identify lithology. The cliff seemed highly unstable, with many large and small debris boulders found at the base and a dusting of sediment covering all non-vertical slopes. Vertical jointing patterns, radial fractures, and sharp break-off surfaces indicated that rockfall may be the main method of canyon modification here. *Anthomastus*, *Bathypathes* black coral, brisingid asteroids (?*Freyella*), and corallimorphs were present and an *Asteroschema* ophiuroid, the type typically seen entwined on the branches of *Paramuricea* sea fans, was seen moving across the wall face.

We spent the rest of the dive ascending the cliff diagonally in order to reach a steeper part of the wall. Overall the wall seemed only sparsely colonized. The first bamboo (*Keratoisis*) was seen at 1783 m (1608 UTC), and *Isidella* was also observed. At 1619 UTC, 1774 m depth, a pair of possible aplousobranchs (Caudofoveata?) were seen associated with recent *Anthomastus* recruits just below the upper part of the outcrop feature, where cup corals, *Isidella* bamboo corals and brisingid asteroids (?*Freyella*) were increasing in abundance. Nearby, an extensive yellowish-brown zoanthid mat covered about 1 m<sup>2</sup> of the upper lip of the wall. Overhangs seemed the preferred location for an abundance of cup corals and brisingid seastars. Along the lip of the wall at 1772 m depth large brisingid asteroids (?*Freyella*) became particularly abundant with more frequent clumps of cup corals tucked into depressions in the wall (slight overhangs). *Lepidisis* bamboo coral, *Clavularia* stoloniferous coral, *Parantipathes* black coral, *Actinurus* and edwardsiid anemones, cerianthid tube anemones and blue sponges were also seen here on the upper wall. *Acanella* bamboo corals, *Paramuricea* sea fans and *Pennatula* sea pens were seen growing on the flat cap of the outcrop.

At 1760 m we observed a Mn-encrusted debris cobble that stood out from the otherwise Mn-free wall. Closer examination revealed a granitic texture and confirmed that this must be a glacial dropstone. *Chrysogorgia* colonies began to appear at 1750 m (1720 UTC), at least some with a shrimp associate. Along the general depth contour being followed other new taxa we observed included *Eknomisis* bamboo coral and different morphs of hexactinellid sponges; a *Hygrosoma* urchin with a polynoid polychaete among the spines was also seen. At 1730 m we began moving up a more vertical part of the wall. We moved quickly over this surface in order to reach 1690 m, a depth important for validation of coral habitat models. This face provided a better view of the more typical scraped carbonate surface texture seen on chalks exposed in other canyons. At 1717 m we observed distinct 20-cm alternating light and dark bands in the wall, the colors being created by sediment accumulating on the slightly-protruding harder layers. At about 1695 m we reached an intermediate cliff terrace. The flat terrace top appeared unbroken except by a narrow pit where a portion of the cliff seemed to have collapsed directly downward. The terrace was also broad enough that we could not see the continuation of the cliff at its far end, although bathymetry indicated we were only half way up the canyon wall.

At 1691 m we left the terrace and climbed to a depth of 1200 in order to conduct midwater transects before returning to the surface. We conducted 10 minute midwater transects at 100 m depth intervals between 1200 - 800 meters depth. Among the excellent images were hydromedusae, siphonophores, scyphozoans (?*Poralia* and ?*Periphylla*), lobate ctenophores, *Mastigoteuthis* squid, salp chain, larvaceans and a dragonfish (?*Stomias* *boa*).

**Other biological observations:** Fish diversity and abundance from shore-based scientist Peter Auster: 16 individuals and 7 species (excluding the mid-water beasts on the way down and up): Halosaur (*Aldrovandia* sp) Ophidiid cusk eel - juv in urchin (*Barathrides*), Cutthroat eel, Halosaur (*Halosauropsis macrochir*), blue hake (*Antimora*), Morid codling (*Guttigadus* sp?), Grenadier (unidentified sp)

Porifera: *Euplectella* like hexactinellids, and several other glass sponge morphs, some with many small ophiuroids on upper surface.

Cnidaria: Actiniaria Hormathiidae; Hydroida several pennate hydroid colonies; Octocorallia *Swiftia*,

Platyhelminthes: lemon yellow planaria-like (1501 UTC)

Mollusca: Nudibranch (1447 UTC)

Pycnogonida: *Colossendeis* sp. (individual at 1536 UTC had valviferan isopod riding on oviparous leg)

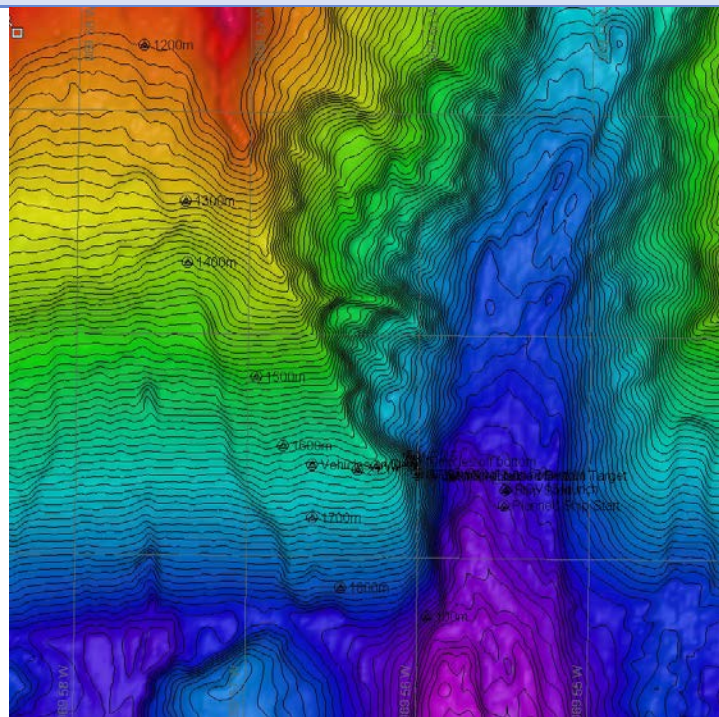
Crustacea: Isopoda - flabelliferan

Echinodermata: Crinoidea stalked crinoids and comatulid feather stars (?*Xenomestra*); Holothuroidea;

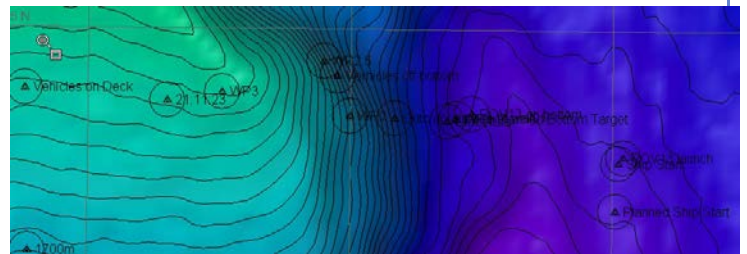
Asteroidea ?*Neomorphaster*

**Interesting highlights:** Granitic glacial dropstone; valviferan isopod riding on oviparous leg of pycnogonid sea spider; quality images of midwater fauna during designated midwater transects.

**Overall Map of ROV Dive Area**



**Close-up Map of Main Dive Site**



**Representative Photos of the Dive**





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