

IODP Expedition 329: Subseafloor Life in the South Pacific Gyre

Site U1368 Summary

Site U1368 was selected as a drilling target because (1) its microbial activities and cell counts were expected to be characteristic of the gyre center, and (2) its basement age renders it a reasonable location for testing the extent of microbial habitability and basalt alteration in a thinly sedimented region of ~13.5-Ma basaltic basement.

The principal objectives at Site U1368 are (1) to document the habitats, metabolic activities, genetic composition and biomass of microbial communities in subseafloor sediment with very low total activity, (2) to test how oceanographic factors control variation in sedimentary habitats, activities and communities from gyre center to gyre margin, (3) to quantify the extent to which these sedimentary communities may be supplied with electron donors by water radiolysis, (4) to determine how habitats, potential activities and, if measurable, communities in subseafloor basalt vary with crust age and hydrologic regime (from ridge crest to abyssal plain).

Site U1368, at 3738 m water depth, is located in ocean crust formed during magnetic polarity Chron 5ABn (13.4 – 13.6 Ma). Most or all of the sedimentary succession was recovered by APC coring in Holes U1368B through U1368E. Basalt fragments were recovered from the basal cores of Holes U1368B and U1368D. The upper ~100m of basalt was cored at Hole U1368F. Approximately 60 m of the basaltic basement was downhole logged with both the triple combo and the FMS tools string.

Principal Results

Sediment

The sediment at Site U1368 is 15-16 m thick and consists of calcareous ooze, pelagic clay and lithic sand. An additional 1 m of volcanoclastic breccia was recovered from an interval between basalt flows, 80 m below the upper sediment/basalt interface. The principal components of the ooze are calcareous nannofossils, accompanied by red-brown to yellow-brown semi-opaque oxide (RSO) and foraminifera. Clay minerals are in relatively low abundance throughout the sediment. The lowermost sediment contains one to three sandy intervals that collectively contain a wide variety of minerals. Titanomagnetite is extremely abundant in the lowermost sandy layer. The volcanoclastic breccia contains altered basaltic lithic and vitric grains.

Direct microbial cell counts decline rapidly in the uppermost few meters of sediment and then hover near the minimum detection limit for the remainder of the sediment column.

Total nitrogen and total organic carbon decline rapidly in the first meter of sediment. Dissolved nitrate, dissolved phosphate, dissolved inorganic carbon and dissolved oxygen are present in the sediment to great depth. Dissolved hydrogen concentration is below detection in most sediment samples.

Basalt

The recovered sequence of basement rock is composed of pillow basalt fragments with prominent chill margins. Estimates of basaltic potassium content derived from downhole natural gamma logging agree closely with potassium concentration estimates derived from natural gamma logging of whole-round cores.

A wide range of microbiology experiments was initiated shipboard. Experiments on major microbial processes and experiments for enumeration of viable microbes were initiated at selected depths ranging from near the sediment/water interface to ~30 m into the basaltic basement. Subsamples were routinely taken from all of the distinct lithologic units for post-cruise molecular assays and microbiological experiments.