DETRITAL RECORD OF LOWER CRUST EXHUMATION IN A FOSSIL MID-OCEAN SPREADING CENTER: MACQUARIE ISLAND, SOUTHERN OCEAN, 54º30'S, 158º56'E

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The study of sedimentary facies deposited in active mid-ocean seafloor spreading environments is limited to manned submersible dives, dredge hauls, drill cores and geophysical observations. Previous investigations have been based on ophiolites, which are often extensively deformed, altered and far removed from their original environment of deposition. Macquarie Island is the sole non-plume-related sub aerial exposure of oceanic crust still within its basin of formation. It gives us a unique opportunity to document the spatial relationship between sedimentary facies, transform fracture zones, and ridge axis grabens. Sedimentary rocks exposed on the island lack continental detritus and record active seafloor spreading processes between the Indo-Australian and Pacific plates during the Late Miocene.

Preliminary results show a discrete difference in clast composition for very thick (<130m) poorly stratified cobble to boulder sized breccia units and thin (2-15m) well-stratified successions of pebble-cobble breccia that fine up through sandstone into mudstone. Facies architecture in poorly stratified breccias is characteristic of mass flow surge deposits and is dominated by basalt clasts. In contrast, well stratified sequences contain a range of sedimentary structures that exhibit features indicative of a waning flow regime and typify turbidite flow processes. Basal breccia units and pebbly sandstones of turbidites contain a variety of clast types including basalt, diabase, gabbro, ultramafic cumulates, intra-formational rip up clasts, hydrothermaly altered rocks with epidote and pyrite. Linear scour features, imbrication and lateral coarsening trends indicate paleoflow away from currently exposed diabase, gabbro and upper mantle peridotites. Sedimentary facies described here are proximal to major spreading-related faults and were in part derived from syn-tectonic scarp erosion.

We plan to utilize U-Pb and (U-Th)/He techniques on turbidite detritus, Ar40/Ar39 ages of interbedded basalt flows, and the geochemistry of mafic clasts compared to existing Macquarie Island geochemical data. This multidisciplinary approach offers a detrital record of oceanic crust genesis, exhumation and unroofing during active seafloor spreading.