Volcanology and geochemistry of the Cambrian Mount Read Volcanics in the Basin Lake area, western Tasmania

by

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Abstract

The Basin Lake area is located in western Tasmania approximately 12 km north of Queenstown. A stratigraphic section through the late Middle Cambrian Mount Read Volcanics and overlying Late Cambrian to Early Ordovician Owen Conglomerate is exposed in outcrop and diamond drillcore. In this area, the Mount Read Volcanics consist of the Yolande River Sequence, Anthony Road Andesite and Tyndall Group.

The Great Lyell Fault and South Henty Fault were active normal faults during the Cambrian and bounded the extensional basin into which the lithologic associations of the study area were deposited. NW to NNW striking fault sets present in the area may represent Cambrian transfer faults. Silica-sericite-pyrite alteration has been focussed along these transfer faults and facies changes occur across them. Devonian orogenesis has reactivated faults across the area.

The Yolande River Sequence forms the basal unit within the area and comprises volcaniclastic turbidites and non-volcanic black mudstone deposited in a below-wave-base, probably deep water setting. Components in the volcaniclastic units suggest a dacitic provenance and include abundant pumice and volcanic crystals (feldspar, quartz) that were most likely supplied by explosive eruptions at subaerial or shallow marine, extrabasinal or basin-margin vents.

Intrusive into and overlying the Yolande River Sequence is the Anthony Road Andesite, an intrabasinal submarine dome, lava and intrusive complex largely comprising coherent and autoclastic facies of basaltic andesite, hornblende andesite and rhyolite. Interleaved with the coherent and autoclastic facies are black mudstone, limestone and ironstone. Limestone and ironstone occur towards the stratigraphic top of the Anthony Road Andesite and at the base of the overlying Tyndall Group.

The hornblende andesite and rhyolite associations of the Anthony Road Andesite have high-K calc-alkaline affinities whereas the stratigraphically higher basaltic andesite association is shoshonitic, with high P_2O_5 and light REE-enrichment. A similar transition from calc-alkaline to shoshonitic compositions has been noted in the Que-Hellyer Volcanics and the Lynch Creek basalts (Crawford et al., 1992). The rhyolite association of the Anthony Road Andesite has no recognised geochemical analogues in the Mount Read Volcanics.

Ironstone contains single strand filamentous textures similar to bacterial mats found at hydrothermal vent sites on the modern seafloor. Modern analogues favour deposition from low temperature (< 100°C) iron- and silica-rich, hydrothermal fluids on or within metres of the seafloor. Base and precious metal-rich barite veins in Tyndall Creek and hematite-carbonate-barite alteration with associated silver mineralisation at Howards Anomaly occur at a stratigraphically similar position to the ironstone facies. It is inferred that the limestone facies is laterally equivalent to this stratigraphic position.

The Tyndall Group is the youngest lithostratigraphic unit of the Mount Read Volcanics and records the final phases of volcanism and denudation of the source volcanic terrain. The group is dominated by thick, crystal-rich volcaniclastic sandstone, breccia and conglomerate with lesser limestone and rhyolite deposited in a marine below-wave-base setting by mass-flows. The volcaniclastic mass-flow units in the Mount Julia Member and Zig Zag Hill Formation are thick, coarse, and lacking finer interbeds which may suggest a shallower and more proximal depositional setting than for the Yolande River Sequence. The occurrence of welded ignimbrite and the dominantly dacitic to rhyolitic provenance of the Tyndall Group suggest the presence of felsic caldera volcanoes in the source area.

The Owen Conglomerate conformably overlies the Tyndall Group in the Basin Lake area. Sedimentary facies include conglomerate, sandstone and mudstone mainly derived from Precambrian metamorphic basement. The conglomerates are well sorted and the clast population is commonly well rounded indicating significant reworking in a high energy environment. Facies variations indicate a change in conditions from below-wave-base to above-wave-base, with deposition interpreted to have occurred in subaerial to submarine alluvial fans and fan deltas.

Modern analogues for the palaeogeography of the Basin Lake area can be found in deep marine settings offshore from active subaerial volcanic terrains, such as the Bay of Plenty offshore from the Taupo Volcanic Zone, New Zealand. The high-K calc-alkaline hornblende andesite and rhyolite associations of the Anthony Road Andesite have geochemical analogues in modern arc settings. The closest modern analogues of the shoshonitic basaltic andesite association occur in post-collisional arc settings in Papua New Guinea, Turkey and the Himalayas.

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