University of Canberra

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The Setting, Structural Control, Geochemistry and Mantle Source of the Monaro Volcanic Province, southeastern New South Wales, Australia.

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To Baby X: I'll never do another PhD!

Abstract

The Monaro Volcanic Province (MVP) is an Oligocene-Eocene intraplate basaltic lava field situated in the Southern Highlands of New South Wales between the towns of Cooma and Bombala. The lava pile of the MVP consists of basal sub-alkali rocks (olivine tholeiite, transitional basalt) capped by a number of thick ankaramite lavas, above which lie less numerous alkali rocks including alkali olivine basalt, nepheline basanite and olivine nephelinite. Intercalated with the lava flows are massive and matrix-supported alkali and ankaramitic hyaloclastites, alkali pillow basalts, rare tuffs, bauxitic weathering profiles, lacustrine sediments and reworked late Cretaceous to early Tertiary river gravels. The lava pile is intruded through by numerous volcanic plugs and dykes and rare maars. Volcanic centres are principally concentrated in two NW-SE trending zones parallel to major crustal-scale fractures in the Palaeozoic basement. Centres almost always lie over the intersections of two or more conjugate strike-slip or transverse fractures. The stratigraphy, whole-rock geochemistry and Sr and Nd isotopic signatures of rocks from the MVP indicate magma-genesis initially from an asthenospheric source with EM1 characteristics, gradually becoming more lithospheric with DM source characteristics. The long-lived nature of the MVP rules out a mantle plume-type source for magmas. Instead, a diapiric source is envisaged. The MVP mantle xenolith suite appears to have equilibrated at slightly higher temperatures for given pressures than the Newer Volcanics Province suite suggesting the palaeogeotherm for the MVP was slightly hotter than the "South East Australian" geotherm. Large amounts of amphibole (pargasitic hornblende, pargasite, ferroan pargasite and kaersutite) occuring within the more silica-undersaturated rocks of the MVP, and rarely within lherzolitic xenoliths, are interpreted to have formed as selvages on mantle veins in contact with peridotite beneath the MVP. Amphiboles were later sampled by magmas rising through the same conduits and were brought to the surface. MVP ankaramite lavas feature < 2cm clinopyroxene porphyrocrysts, the cores of which are shown to have crystallised at ca. 18 kb pressure or ca. 54 km depth. This defines the base of the local crust within the MVP region. Data from the MVP support a landscape evolution model based on the isostatic rise of the Southern Highlands due to voluminous magmatic underplating since the Cretaceous. Data further support limited denudation since the Early Tertiary based on a pulsatory but high palaeogeotherm.

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