Records of the Australian Museum (1996) Vol. 48: 131–161. ISSN 0067-1975

An Unusual Tasmanian Tertiary Basalt Sequence, Near Boat Harbour, Northwest Tasmania

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ABSTRACT. The mineralogy and petrology of basalts near Boat Harbour, NW Tasmania, are described as this sequence is unusual for Tasmanian Tertiary basalts. The rocks are more sodic and evolved basalts carry more prolific anorthoclase and zircon megacrysts than is normal in Tasmania. Older nephelinites and melilite-nephelinites (26–27 Ma) and younger nepheline hawaiites and mugearites (14–15 Ma) are present and fission track zircon ages (13–14 Ma and 8–9 Ma) demonstrate that zircon was erupted during and after the evolved basalts. The nephelinites and some evolved basalts carry common spinel lherzolite xenoliths, some with rare alkaline reaction veins. Crustal xenoliths are ubiquitous as Precambrian country rocks but include rare 2-pyroxene granulite and anorthosite. Some nephelinites show mariolitic assemblages of olivine, diopside-augite-aegirine clinopyroxenes, nepheline, sodalite, barian sanidine, ulvospinel, titanian richterite, titanian phlogopite and carbonate.

The nephelinites and melilite nephelinite represent primary melts, while the evolved basalts can produce primary basanites by addition of a cumulate wehrlite mineralogy. However, crystal fractionation models for evolving these melts only give inadequate solutions. The low Zr contents, and presence of zircon and anorthoclase megacrysts do not fit into fractionation processes.

Nephelinitic geochemistry indicates 4–7% degrees of partial melting of an amphibole-dominated metasomatised garnet peridotite. Low H_2O+CO_2 contents favour melilite nephelinite melt derived from deeper levels than for the nephelinite melts. Evolved basalts from such metasomatised sources may mark limited fractional crystallisation, while minor early initial melting may produce sodic Zr-rich felsic melts that crystallise anorthoclase and zircon without significant fractionation.

The rocks show an isotopic HIMU imprint, but unlike older east Tasmanian basalts lack trace element signatures related to the Tasman Balleny plume system.

SUTHERLAND, F.L., D.F. HENDRY, B.J. BARRON, W.L. MATTHEWS & J.D. HOLLIS, 1996. An unusual Tasmanian Tertiary basalt sequence, near Boat Harbour, northwest Tasmania. Records of the Australian Museum 48(2): 131–161.