# Intraplate hypersthene bearing trachyandesites: Evidence for multiple magma sources in the Newer Volcanic Province, Australia

ZARAH HEYWORTH, IAN NICHOLLS AND BRUCE F. SCHAEFER

School of Geosciences, Monash University, Clayton 3800, Vic, Australia

Hypersthene-bearing trachyandesites are relatively rare on a global scale, particularly in basaltic-dominated intraplate settings. The Gisborne complex in Victoria, Australia, contains lavas ranging from highly alkaline basalts to hypersthene-bearing trachyandesites. It includes up to nine lava flows, the earliest in the K-rich basanite- hawaiite-mugearite range, followed by voluminous more strongly alkaline basalts. Later phases produced at least three major trachyandesite flows, with a final extrusion of transitional basalts. The trachyandesites contain prominent partly resorbed plagioclase, alkali feldspar and quartz crystals as well as fine grained "quench"- textured plagioclase-hypersthene-augite enclaves.

Plagioclase composition ranges from $An_{51-62}$ in the transitional basalt and $An_{40-60}$ in the enclaves in the northern trachyandesites. The trachyandesites themselves have plagioclase compositions from $An_{27-58}$. Opx in the transitional basalt is dominantly Mg-rich. The trachyandesites have an unusually large compositional range from $En_{39-83}$ indicating complex processes rather than simple fractionation. It is also significant that the enclaves do not contain any of the Fe-rich opx found in the northern and western trachyandesites. The McGeorge Hill trachyandesite has a more restricted compositional range of only $En_{52-55}$. The transitional basalt has a cpx composition of $Mg_{70-72}$. The northern and western trachyandesites again have a much larger compositional range ($Mg_{48-60}$) than the McGeorge Hill trachyandesite ($Mg_{72-75}$). Olivine is forsteritic with relatively uniform compositions ranging from $Fo_{72-77}$ in all samples.

A basic petrogenetic model inferred for Mt Gisborne involves fractionation of a transitional basaltic parent magma in addition to magma mingling. The parent magma for the trachyandesite is a transitional to weakly tholeiitic basalt. Enclaves in the northern trachyandesite flow are preserved evidence of mingling with a more tholeiitic parent magma. Fe-rich orthopyroxene in the northern and western flows represent highly evolved material that was originally sourced from the more tholeiitic magma but underwent independent fractionation.

# A PREMA asthenospheric component for the Permian alkaline dykes of the Spanish Central System

D. OREJANA[1], C. VILLASECA[1] AND K. BILLSTRÖM[2]

[1]Complutense University of Madrid, Spain (dorejana@geo.ucm.es, granito@geo.ucm.es)
[2]Swedish Museum of Natural History of Stockholm, Sweden (kjell.billstrom@nrm.se)

Post-Hercynian dyke swarms of basic to ultrabasic alkaline lamprophyres and diabases outcrop within the Spanish Central System (SCS) granite batolith. They intruded in Mid Permian (near 264 Ma). Most of the previous studies have suggested an enriched lithospheric mantle as their main source. Nevertheless, recent analytical studies reveal geochemical and isotopic variations within these dykes which indicate wider compositional ranges and the presence of a heterogeneous mantle under the SCS.

Lamprophyres are characterised by high contents in incompatible elements, with Rb, Ba generally up to 300 times the primitive mantle, Nb-Ta positive anomalies, Pb negative anomalies and a highly fractionated pattern of REE.

The lack of primary geochemical characteristics (low Cr and Ni contents) and the positive correlation of Cr, Ni and CaO with Mg#, points to differentiation mainly due to crystal fractionation of olivine + clinopyroxene. Significant crustal contamination may be rejected due to the following: absence of a negative correlation between $SiO_2$ and Ce/Pb or $^{143}Nd/^{144}Nd$ isotopic signatures and positive between $SiO_2$ and Rb/Sr and high Ce/Pb and low Ba/Nb values (14-28 and 5-15, respectively).

The low Y/Nb and Zr/Nb values and the high Th/Yb and Ta/Yb ratios, together with the Ta-Nb positive anomaly and the Pb negative anomaly, indicate enriched mantle sources not related to a subduction event, similar to an OIB-type mantle. High $(Dy/Yb)_N$ values (1.2-2) suggest formation within the garnet stability field. Presence of phlogopite in the mantle sources, as the principal metasomatic phase, is highlighted by positive K anomalies, high Rb/Sr ratios and positive correlation between K/La and Ba/La or Rb/La. Nevertheless, the presence of amphibole in the mantle can not be ruled out and apatite involvement during melting seems clear for some dykes with positive anomaly of P and high U/Pb and Th/Pb ratios.

Sr-Nd-Pb isotopes suggest the involvement of a PREMA source with a subordinate EMII component for lamprophyres with high $^{87}Sr/^{86}Sr$ (up to 0.7052) and $^{207}Pb/^{204}Pb$ (up to 15.62) ratios. The very low magmatic volume, the restricted geographical location and the small degree of asthenospheric melting favour a non-plume, passive stretching model.