Bimodal komatiite-dacite volcanism in the Black Swan area, Norseman-Wiluna Greenstone Belt, Australia

S.J. BARNES, R.E.T. HILL, T. THORDARSON, S.E. DOWLING AND T.N. MATTOX

CSIRO Exploration and Mining, Kensington, WA, Australia. (Steve.Barnes@csiro.au)

The volcanic stratigraphy at Black Swan, 70km NE of Kalgoorlie in the Boorara Domain of the Kalgoorlie Terrain, consists of intercalated dacite lavas and tuffs with compound flow facies komatiite lava flows. The sequence can be subdivided into a Lower Felsic Unit (LFU), comprising coherent and autobrecciated facies of multiple dacite lava flows; a Lower and Upper Ultramafic Unit (LUU, UUU), each showing marked lateral facies variation, and an Upper Felsic Unit (UFU) co-aeval with the UUU.

The LUU represents a complex series of overlapping flow lobes, 2km long and up to 500m thick, with major lava pathways represented by thick, homogenous olivine mesocumulate piles at its northern and southern ends: respectively, the Northern Pathway, 400m thick, and the Cygnet Pathway, 200m thick. The sequence between the two major pathways consists of olivine orthocumulates with minor intercalated spinifex units. The Unit is capped by a persistent spinifex textured crust less than 1m thick, and is locally vesicular.

The UUU is divided into three domains: the central Black Swan Pathway, a Northern Sequence and a Southern Flanking Sequence, over a total exposed strike length of 1.5km. The Black Swan Pathway is believed to be the feeder pathway to the entire unit, and consists of a 500m thick sequence of very coarse grained hopper-textured, vesicular olivine orthocumulates containing disseminated sulfides in its lower 200m. The pathway is flanked to the north by a complexly interdigitated sequence of highly irregular spinifex-capped, olivine cumulate-rich flow units between 1 and 100m thick, and dacitic lavas and tuffs. The complexity of the 3-D spatial relationship of these units suggests a combination of simultaneous eruption of dacite and komatiite, combined with thermal erosion of and possible invasion of unconsolidated tuff by komatiite lava. The Southern Flanking Zone consists of multiple olivine-rich komatiite flows with pyroxene spinifex A zones, intercalated with tuffaceous units and sulfidic felsic breccias.

The Upper and Lower Felsic Units are both plagioclase-phyric calc-alkaline dacite; the UFU is distinguishable by the presence of phenocryst quartz. Subaerial and shallow water emplacement are inferred from lithofacies associations.

Both LUU and UUU are dominated by cumulus olivine with a restricted range of compositions between Fo_{91} and Fo_{93}, with parent magma compositions predominantly between 20 and 25% MgO. Geochemical signatures of up to 20% crustal contamination are ubiquitous within both komatiite units, implying extensive erosion and assimilation of substrate both before and during emplacement.

Hf isotopes from the Ninetyeast ridge

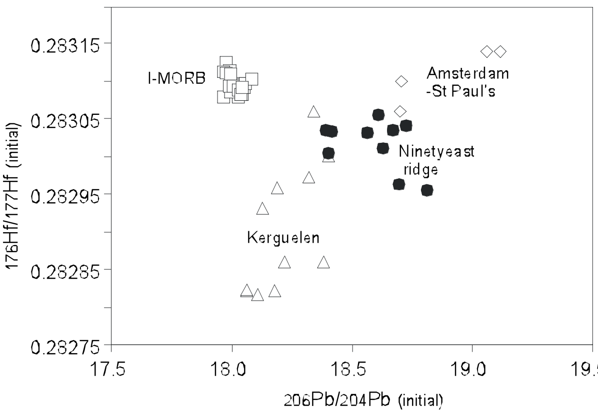
T. L.BARRY[1, 2], P. D. KEMPTON[2], A. D. SAUNDERS[3]

[1] Cardiff University, Wales. CF1 3YE. (tbarry@bgs.ac.uk)
[2] NERC Isotope Geosciences Lab, Keyworth, NG12 5GG.
[3] Leicester University, Leicester, UK. LE2 3WN.

The Ninetyeast Ridge, in the Indian Ocean, is a classic example of an aseismic ridge attributed to a mantle plume. Formed 82 to 38 Ma (Duncan, 1978), the ridge tracks the Kerguelen hotspot. Palaeo-reconstructions of the Indian Ocean are poorly constrained and uncertainty remains regarding the relative position of the Kerguelen plume during the formation of the Ninetyeast Ridge. Consequently, it is unknown whether the plume was in an intraplate setting, on a ridge crest or close to a ridge crest (Saunders et al., 1991). Further complication in the relationship of the Kerguelen plume to the Ninetyeast Ridge is the possibility that a second plume, the Amsterdam-St. Paul's hotspot (ASP) may have contributed to the petrogenesis of the Ninetyeast lavas.

On the basis of isotopic data Saunders et al., 1991 recognised that whilst three-component mixing was evident in the Ninetyeast basalts, there was no obvious contribution from depleted MORB mantle, but Weis and Frey (1991) stressed the importance of MORB mantle in the formation of the basalts. Two questions remain (1) are the Ninetyeast basalts a mixture of Kerguelen plume component with depleted MORB, and (2) is there any evidence to support contribution from the ASP hotspot?

In this study we use high precision MC-ICP-MS Pb and, for the first time, Hf isotopes to examine the relative contribution of plume(s) and MORB mantle in the formation of the Ninetyeast basalts. We find that the basalts plot intermediate between Kerguelen and ASP basalts and that a contribution from depleted MORB mantle is unnecessary. Thus, if the Ninetyeast Ridge formed close to, or on, a ridge segment, it suggests that the upper MORB mantle was entirely displaced by the plume components and contributes little, if any, material to the formation of the basalts.



References

Duncan, R., (1978), *J. Volcanol. Geotherm. Res.*, **4**, 283-305.

Saunders A., Storey M., Gibson I., Leat P., Hergt J. and Thompson R., (1991), *Proc.ODP Sci. Res.*, **121**, 559-590.

Weis D. and Frey F., (1991), *Proc. OD PSci. Res.*, **121**, 591-610.