

32nd IGC - Florence, 2004

ORIGIN OF GARNET PERIDOTITE FROM THE WESTERN GNEISS REGION, NORWAY: REFERTILISATION OF DEPLETED ARCHEAN LITHOSPHERE

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Keywords

mantle peridotite, mantle sulfides, Archean, lithospheric mantle

Abstract

Orogenic peridotites in Proterozoic gneisses at several localities in the Western Gneiss Region (WGR) of western Norway typically occur as small garnet-bearing volumes within larger masses of garnet-free dunite. Previous work on the Almklovdalen peridotite body in the southern WGR focussed on the garnet peridotites rather than the dunites. This study integrates geochemical and geochronological data for both rock types and shows that the garnet peridotites represent zones of refertilised dunite.

The mineralogical and compositional similarity between the WGR garnet peridotites and high-T sheared peridotite xenoliths from kimberlites suggests that the former represent refertilisation of a depleted precursor. The juxtaposition of the fertile garnet peridotites with the highly depleted dunites at Almklovdalen is consistent with the garnet peridotite bodies representing zones of refertilised dunite. This is supported by the common association of the garnet peridotites with bands of eclogite and garnet pyroxenite, which may record the crystallisation of percolating mafic melts.

This possibility is supported by in situ Re-Os isotopic analysis of sulfides in the garnet peridotites and whole-rock Re-Os analysis of the dunites. Recent work by Griffin et al. (2002) has concluded that at least some Proterozoic lithosphere may represent strongly reworked Archean lithospheric mantle. If this is the case for the garnet peridotite bodies from the WGR, which are generally considered to be Proterozoic in age, then it might be expected that Archean isotopic signatures may be preserved in the reworked peridotite. Re-Os TRD model ages for the sulfides from the garnet peridotites define a strong peak at ~1.7 Ga which falls within the age range for the Gothian orogeny and matches previous age estimates for the peridotites. However, peaks at 2.8 and 3.2 Ga do not correspond with any known event in the WGR crust and suggest that the peridotites experienced an Archean partial melting event. The dunites have also yielded Archean whole-rock Re-Os TRD ages (~2.7-3.1 Ga) which further strengthens the case that they are the original depleted precursor to the garnet peridotites.

Reference

Griffin, W.L. et al. 2002. G3, 31073, doi:10.1029/2002GC000298.