Pyroxenites from mantle section of Voykar Ophiolite (Polar Urals) – pathways for melt and fluid migration

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Late stages of formation of rocks from mantle section of Voykar Ophiolite were shown to take place in SSZ environment [1,2]. Dunite bodies and pyroxenite veins mark different stages of melt migration [2]. Best evidence for SSZ environment is preserved in mineral compositions from pyroxenite veins – high #Cr of spinel and LILE enrichments in Cpx and high-Al amphibole. Pyroxenite compositions display variability which is a function of their modal compositions, morphological features and spatial location.

Minerals from orthopyroxenites usually have high mineral #Mg, are most depleted in incompatible elements, show low Al in pyroxenes and spinel ($\#Cr^{Spl}$ >0.6). Other group of pyroxenites with high mineral #Mg is represented by thin (cm-scale) clinopyroxenites and websterites and complex dunite-pyroxenite veins. Their major element compositions were equilibrated with adjacent harzburgites. Minerals from thicker websterites and clinopyroxenites have lower #Mg and subparallel boninite-like trace element patterns of Cpx [1]. Cpx compositions across harzburgite-pyroxenite contacts show depletion in HREE (opposite to harzburgite-dunite contacts) and Zr and enrichment in LREE and Sr. High-Al amphibole from websterites display trace element patterns with different LREE/HREE and MREE/HREE ratios, which could reflect their formation from melt to fluid-like agent.

Therefore, Voykar mantle section pyroxenite veins represent pathways for melts variously depleted in incompatible elements or in some cases fluids with boninite-like trace element patterns and elevated silica contents. Those melts were produced by melting of hybridized mantle source formed as a result of transformation of mantle olivine to orthopyroxene under the influence of slab-derived fluids/melts [2]. Different areas of massif could be arranged in order of increasing HREE contents in Cpx from dominated type of pyroxenite which could reflect relative depth or degree of melt fractionation.

[1] Belousov *et al*., 2009. Dokl Earth Sci, **429** (1), p.1394-1398. [2] Batanova *et al*., 2011. JP, **52** (12), p.2483-2521.

New insights into the history of an ophiolite from zircons

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The Coolac Serpentinite Belt is part of the Tumut ophiolitic complex in the Lachlan Fold Belt, southeastern Australia. The 63 km belt contains a high proportion of massive (unfoliated) ultramafic rocks that have undergone only lower greenschist-facies metamorphism [1]. New U-Pb, Hf- and O-isotope and trace-element data have been obtained for zircons from the rocks of the belt. These include zircons separated from two (high-Al and high-Cr) massive chromitites and rodingites and grains recovered from gullies draining mainly weakly serpentinised massive porphyroclastic harzburgite. The Belt is either faulted against, or intruded by, the S-type Young Granodiorite. Zircons from the Young Granodiorite collected at the contact with the serpentinite belt were also studied to refine the tectonic relation and timing of the granitic magmatism,

The U-Pb age obtained on the zircons from the serpentinite belt display a wide range of ages, from Silurian to Paleo-Proterozoic, with the main age population clustering around 430 Ma. This main peak coincides within the analytical error with the age obtained for the Young Granodiorite (427.6 ± 3.2 Ma) and inherited zircon ages for plagiogranites from the Belt [1]. The ages for the inherited zircon populations in the granodiorite correlate well with the older zircon populations from the Coolac ultramafic rocks.

Most of the Coolac zircons have negative εHf and heavy (>6) $\delta^{18}O$ indicative of a crustal origin. Combined with U-Pb age information, this implies that the zircons in the peridotites are xenocrystic. One possibility is that zircons derived from subducted sediments were incorporated into the ophiolitic rocks (as in the Luobusa (Tibet) ophiolite [2]). However, the similarity of the Coolac ophiolite-derived zircons with those from the Young Granodiorite may indicate that they were introduced into the Coolac peridotitic complex during the granitoid magmatism and thus may carry no information on the origin of the Tumut ophiolitic rocks. In the latter case, the Coolac rocks should be older than the granitic magmatism of the 420–390 Ma age of the Lachlan Fold Belt.

[1] Graham *et al*. (1996) Geology **24**, 1111-1114. [2] Yamamoto *et al*. (2013) *Island Arc* 22, 89-103.

DOI:10.1180/minmag.2013.077.5.2
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