Implications for sources of Jack Hills metasediments: detrital chromite

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We present XRF, EPMA, oxygen isotope, and field data to interrogate possible relations between detrital chromite and previously reported 3.1-4.4 Ga zircons in siliciclastic rocks from the Jack Hills, NW Yilgarn Craton. Differences between two measured sections are summarized, with emphasis on chromite. The ‘western transect’ (WT) spans 60 m across Eranondoo Hill, and includes the original W-74 site. The ‘eastern transect’ (ET) is 20 m long, 0.5 km east of WT. Chromite and zircon are the two main detrital accessory phases in the mature sediments (>95 wt. % SiO_2). Whole rock Zr, Y, and Nb correlate to zircon, with the highest average values found in WT conglomerates (352, 47, and 15 ppm) compared to lower values for ET conglomerates (52, 3, and 2 ppm, values similar to all analyzed quartzites). Cr correlates to chromite, and is variable: one ET quartzite = 5300 ppm, ET conglomerates = 272 ppm, and WT conglomerates = 884 ppm. All conglomerates contain well-rounded chromite octahedra that range from 100-400 _m in diameter, and appear to be far traveled. In contrast, chromites from the ET quartzite with 5300 ppm Cr are euhedral, 100-400 _m, and display little evidence of rounding during sedimentary transport, favoring a local source. EPMA shows all chromites are unzoned and preserve unusual compositions. Rounded grains in conglomerates from both transects have relatively constant average wt. % oxides: Cr (45.0), Fe (27.0), Al (18.0), low Mg (1.0-1.4), elevated Zn (2.0) and bimodal Mn (1.6 (ET) vs. 3.8 (WT)). In contrast, euhedral chromites from the ET quartzite show similar values for Cr (45.0), Mg (1.6), and Mn (1.3, see ET), lower Fe (24.0), and higher Al (21.0) and Zn (3.8; highest=4.9). Oxygen isotope ratios for quartz define a local meter-scale oxygen isotope ‘stratigraphy’ from each section ($_^{18}$O: WT = 10.4-11.6‰, ET = 12.1-12.6‰), despite demonstrable re-equilibration at the hand-sample scale.

The chromites appear to share a common zinc-rich source. Zn-rich chromite is notably uncommon, and usually interpreted to result from sulphide mineralization of an ultramafic host. The chromites appear to be proximal detritus, yet are restricted to the clastic section of the belt that contains >4.0 Ga zircons. Thus the ultramafic and felsic source rocks for both chromites and ancient zircons may have been spatially and temporally related during deposition of the clastic rocks ca. 3.0 Ga. We emphasize the age of the chromites is unknown, and cannot currently be coupled to any of the known zircon age populations. The source of the chromites may have been a mineralized greenstone belt, analogous to those in the Eastern Yilgarn. Similar origins have been proposed for detrital chromites in Au-bearing conglomerates from Witwatersrand and elsewhere.

New $^{40}Ar/^{39}Ar$ and K-Ar age implications and geochemical constrains on metamorphic rocks of the Tauride Belt Ophiolites (Southern Turkey)

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Tauride belt ophiolites are located on both side of Mesozoic aged Tauride Calcerous Axis in southern Turkey. The metamorphic soles located at the base of the peridotites show an inverted metamorphic zonation from amphibolite to greenschist facies. The upper part of the metamorphic sole starts with garnet or pyroxene amphibolite, then towards the base of the sole continues with the epidote-amphibolites. The lower part of the metamorphic sole are composed of kyanite and garnet bearing micaschist, micaschist, quartzite and marble.

The amphibolites present three different REE pattern and are represented by OIB, IAT and MORB. They were metamorphosed not only in subduction zone but also at the base of hot oceanic crust in oceanic environment. The metamorphic soles are crosscut by doleritic and gabbroic dikes. Along all Tauride Belt they show an approximately E-W direction. They are enriched in LILE and depleted in HFSE and flat-lying REE pattern indicate island arc tholeiites source. Additionally, albitite and pyroxenite dikes were observed in the metamorphic sole of the Pozanti-Karsanti Ophiolite. Pyroxenite dikes in contrary to doleritic and gabbroic dikes present LREE enrichment and refer to alkali basalt source. A large set of $^{40}Ar/^{39}Ar$ and K/Ar data were obtained on the metamorphic soles and their doleritic dikes. Amphibolite ages range from 91 to 93 Ma, corresponding to Late Cretaceous. Muscovite and biotite ages from the lower part of the sole rocks range from 83 to 93 Ma. Doleritic dikes crosscutting metamorphic sole rocks present scattered age results between 63 to 88 Ma indicating their probable subsequent emplacement.

Conclusions

All metamorphic events, regarding to metamorphic sole developments along the Tauride Belt ophiolites happened approximetaly at the same time. Doleritic and gabbroic dike emplacement were probably postdated but time span between metamorphic sole development and dike emplacement is more than 2-3 Ma.

Alkali pyroxenites cutting amphibolites were interpreted as developing during the death stage of the suprasubduction type ophiolite life cycle.

References

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