Paper Number: 2381

Granite-greenstone relationships in the oldest mafic rocks of the Barberton Greenstone Belt, South Africa

Schneider, K.P.[1], Hoffmann, J.E.[1], Münker, C.[2], Kröner, A.[3] and Patyniak, M.[2]

[1]Freie Universität Berlin, Institut für Geologische Wissenschaften, Malteserstraße 74-100, 12249 Berlin, Kathrin.schneider@fu-berlin.de

[2]Affiliation Universität zu Köln, Institut für Geologie und Mineralogie, Zülpicher Straße 49a, 50674 Köln

[3]Johannes Gutenberg-Universität Mainz, Institut für Geowissenschaften, 55099 Mainz

---

Constraining the formation history of Archean greenstone belts is of great interest for understanding the tectonic environment on the early Earth. For instance, mafic to ultramafic rocks in the lower Onverwacht Group of the Barberton Greenstone Belt (South Africa) have been considered to be representative of typical early Archaean oceanic crust [1]. However, based on heterogeneous Hf-in-zircon isotopic compositions [2] as well as inherited zircon grains (up to 3.7 Ga; [X]) in felsic volcanic rocks interlayered with mafic units of the lower Onverwacht Group, it is proposed that older felsic crustal material was involved in their petrogenesis. Likewise, the Hf-in-zircon isotopic compositions of some adjacent Eoarchean rocks of the Ancient Gneiss Complex (Swaziland), that could possibly represent a basement to the lower Onverwacht Group, also show significant input of older crustal components in their genesis [4]. Moreover, inherited zircon grains in younger intruding granitoids [5] lead to the suggestion for the existance of an older crustal basement.

We investigated whether the mafic and ultramafic rocks of the lower Onverwacht Group interacted with older crustal material and aimed to characterise the mantle sources from which our samples were generated. Hafnium and Nd isotope combined with trace element analyses were performed on the oldest rocks of the lower Onverwacht Group, namely the Theespruit, Sandspruit and Komati Formations (3.46 to 3.53 Ga; [6]). Our results show that initial Hf-Nd isotope and trace element compositions of all tree formations resemble those of modern ocean plateau basalts, similar to previous studies on Barberton komatiites [7;8], with only a few samples showing traces of possible crustal contamination. Typical values for the Sandspruit and Theespruit Formations are $\varepsilon Hf = 0 – 4.6$ and $\varepsilon Nd = -2.3 – 1.8$ representing their primitive mantle sources. In agreement with published data of previous studies, the Komati Formation has more depleted values of $\varepsilon Hf = 1.8 – 8.6$ and $\varepsilon Nd = 0.3 – 2.4$. This implies that assimilation of older crustal material in the mafic and ultramafic rocks was a minor feature in the formation of these rocks. Moreover, the whole rock Hf-Nd isotope compositions of the samples indicate that the Eo- to Palaeoarchean Ancient Gneiss Complex did not serve as possible contaminant. More likely, a different, but also much older, crustal source beneath the lower Onverwacht Group characterized by depleted LREE abundances and unradiogenic Hf-Nd isotopic compositions similar to what would be expected in lower continental crust would match.

References:

[1] De Wit et al. (1987) J Afr Earth Sci 5:681-730

[2] Kröner et al. (2013) Earth Planet Sci Lett 381:188-197

[3] Roerdink (2013) Dissertation, University of Utrecht

[4] Kröner et al. (2014) Precambrian Res 258:823-846

[5] Kröner et al. (1989) In: *Growth of the Continental Crust:* Tectonophysics 161:271-298

[6] Armstrong et al. (1990) Earth Planet Sci Lett 101:90-106
[7] Chavagnac (2004) Lithos 75:253-281
[8] Pearce (2008) Lithos 100:14-48