The age and origin of the Limpopo sub-continental lithospheric mantle

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The Limpopo Mobile Belt (LMB) represents the suture zone between the Kaapvaal and Zimbabwe cratons, but the timing of the collision is still highly debated. Mantle tomography indicates a clear continuation of subcratonic mantle beneath LMB and the adjacent cratons. The origin of both the crust and lithospheric mantle of the LMB is also the subject of controversy and a Zimbabwean, Kaapvaal and allochtonous origin have all been proposed.

The Venetia kimberlite cluster is located within the central zone of the mobile belt and mantle xenoliths from the diamond mine provide an excellent opportunity to address the origin of LMB. We present an extensive petrology-geochemical dataset on a selection of Venetia peridotitic xenoliths, including 24 Re-Os isotope analyses.

Whole rock and mineral major element analyses of garnet-harzburgites and lherzolites indicate that the Venetian lithospheric mantle underwent up to 50% melt depletion, at least partially in the absence of garnet and by implication <70km. The depleted residue was subsequently re-enriched in silica and incompatible elements by subduction-related and asthenospheric melts. The mode of whole rock rhenium depletion ages is 2.6 Ga, which is significantly younger than both the Zimbabwe and Kaapvaal cratons.

Based on combined Os-Nd-Hf isotope systematics of the xenoliths we argue that the majority of the SCLM beneath LMB stabilised at ~2.6 Ga in a separate terrain, which is coeval with major crust forming recorded by zircon Hf and U-Pb model ages

Patterns of cosmogenic age distributions for Late Quaternary moraines in Tibet

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Uncertainties in moraine exposure ages have been recognized as a difficulty when trying to reconstruct past climate changes or comparing moraine exposure ages with known paleo-climate proxys such as $\delta^{18}O$ variations. Many moraines have been dated although the number of samples on each moraine vary widely and may often be too small to assess the true geological scatter of the dated landform. Here we present cosmogenic age distributions for moraines of Tibet and present various explanations to explain the shape of the distributions for moraines dated with large numbers of samples. While it is true that the more samples are dated the more complexity may arise just by adding more information to the data set, it is also true that by targeting to few samples complex depositional or post-depositional processes may be completely overlooked. We focus on moraines deposited in comparable glacial setting from the last glacial maximum and before, and will show that similar geomorphologies are not necessarily correlated with age but most probably to similar glacier ice dynamics. Distributions of ages need to be explained by some independent assessment of depositional or post-depositional model, that can be further tested by the addition of observations, such as, for instance, the relative ages of inset moraines, or the amount of cumulated tectonic offset when available. True and independent moraine age assessments are preferable whenever possible, but it is noticeable that some patterns of ages can be recognized over large sets of data covering large areas of Tibet that argue for at least some synchronous glacial advances and moraine retreats, that with no surprise do correlate with global climate variations.