# Detrital zircons as provenance indicators: The Middle Ordovician Lower Turbidite System, NW Argentina

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Provenance studies of sedimentary rocks can play an important role for palaeogeographic reconstructions. Such reconstructions are aided by varietal studies of detrital heavy minerals. In an ogoing varietal study of detrital zircons from sedimentary rocks of the Palaeozoic Gondwana margin of NW Argentina and N Chile, the detrital sources are traced. We will present the first morphology, zoning and U-Pb age data of zircon grains of the Middle Ordovician Lower Turbidite System of the Puna Turbidite Complex in NW Argentina (ca. 23°S, 66°30'W). The zircon analyses from two samples indicate a dominance of grains 100-150 µm in length that are euhedral or slightly abraded. Cathodoluminescence images reveal that most analysed zircons in the two samples are oscillatorily zoned, which is indicative of a magmatic origin. Less than 10 % of the grains are metamorphic. Zircons with only one visible growth phase are common. *In situ* U-Pb dating was applied to 50-60 grains from each of the two samples. The outer zoning was preferrably dated in grains with several growth phases. Concordant preliminary U-Pb ages (uncorrected for common Pb) are mostly < 600 Ma. The morphology, zoning and U-Pb data make it probably that most zircons are of local origin, which also can be expected, because the Lower Turbidite System was deposited in a retro-arc foreland basin position with a magmatic arc to the (present-day) west, and the Gondwana mainland to the east. The many zircons with only one visible age zoning point to only a minor importance for sedimentary recycling. Preliminary $^{238}U/^{206}Pb$ ages (uncorrected for common Pb) from rims and cores from the same indivicual zircons are mostly < 600 Ma, indicative of two growth stages in late Proterozoic to early Palaeozoic time. The metamorphic zircons are mostly > 600 Ma. For Middle Ordovician time, most palaeocurrent directions in the central part of the basin are indicative of northward directed detrital transport, whereas turbidite channel morphology points to original transport from the west. The zircon age distribution make it possible that western sources dominated, but that also minor transport took place from the Gondwana mainland.

# Proterozoic diamond formation at the Kaapvaal craton edge: Re-Os of Jagersfontein sulfide inclusions

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The mantle sampled by the ~90 Ma Jagersfontein kimberlite, near the southern edge of the Kaapvaal craton block in South Africa, is unusual as the diamonds contain asthenospheric, transition zone and a preponderance of eclogitic inclusions. This unusual depth range of diamond provenance may indicate that the multiple episodes of diamond formation seen in other Kaapvaal kimberlites (3.4 to 1 Ga; Richardson *et al*. 1993; Shirey *et al*. 2004) are distinct at Jagersfontein.

Sixteen diamonds, examined for N levels and aggregation states, hosted Fe-sulfide inclusions that were analyzed for composition and Re-Os isotopes. Eleven stones have low N contents (15 – 57 ppm) similar to, but not exclusive of, sublithospheric diamonds (Tappert *et al*. 2005), N contents in four stones range from 62 to 94 ppm, one stone contains 756 ppm. Based on N aggregation state, two diamond groups exist (<20 % vs. >33 % $N_{total}$ as B centers) suggesting different mantle residence temperatures and/or ages. The majority of the sulfide Re/Os ratios lie between >0.5-46, typical of eclogite with komatiitic to basaltic precursors.

Sulfides from crack-free diamonds fall on two arrays in the Re-Os isotope diagram: one with a 1.7 +/- 0.11 Ga age and a highly radiogenic initial $^{187}Os/^{188}Os$ (0.45 +/- 0.07), the other with an overlapping age of 1.42 +/- 0.40 Ga and a less radiogenic initial $^{187}Os/^{188}Os$ of 0.11 +/- 0.13. The former may indicate Proterozoic diamond growth by remobilisation of Archaean mafic components in the lithosphere, whilst the latter may represent growth from new fluids added to the lithosphere. N aggregation states and inferred temperature of provenance suggest diamond crystallization at multiple depths. In stark contrast to all other Kaapvaal eclogitic sulfide suites studied to date, Archaean ages are absent in the present suite. This result may relate to unique aspects of the Jagersfontein kimberlite, which has transported and preserved very deep diamonds, or be a consequence of its location on the craton edge.

## References

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