5.7.21

Age constraints for diamonds from Koffiefontein mine, S. Africa, a Re-Os isotope and N-aggregation study

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A new suite of sulfide-bearing diamonds has been studied from the Koffiefontein mine, South Africa, complimenting an earlier study [1], with the aim of refining constraints on the timing of diamond genesis from this mine. Single sulfide inclusions have been analysed for Re-Os isotopes (N-TIMS), Ni-Fe-Cu contents (PIMMS) and N-aggregation (FTIR). On the basis of Re-Os abundances and Ni-Fe-Cu contents, all the sulfides analysed in the new study belong to the Eclogite (E-type) paragenesis, a result that supports the general abundance of E-type sulfides inclusions in diamonds from southern Africa (e.g., [1, 2]). N-aggregation systematics are used to evaluate criteria for defining isochron regressions through the different samples. Although the nitrogen data do not define tight isotherms there is relatively restricted scatter. Most of the new sulfide inclusions have considerably less radiogenic Os than samples analysed previously from southern Africa [1, 2]. A single diamond containing 4 separate sulfide inclusions defines a Re-Os isochron of ~2.6 +/- 0.3 Gyr (MSWD < 1). Two other inclusions from different diamonds, with similar N-aggregation characteristics, plot on an extension of this isochron. Five sulfides included in single diamonds define a Re-Os isochron array that gives an age of ~ 1 Gyr (+/- ~ 0.04 Gyr) and an elevated initial γOs (>110). Despite the relatively good precision, the high MSWD of this regression indicates scatter, possibly due to such factors as the non-recovery of heterogeneous sulfide fragments or the small differences in the age of diamond crystallisation. The latter possibility might explain the variation in N-aggregation systematics. N concentrations range from 274 to 918 ppm with between 3 and 55 % in the B-aggregated form. There appears to be no modality in the data set. These Re-Os data confirm the earlier suggestion [1] that there are different generations of E-type diamond growth in the mantle beneath the cratons of southern Africa. The circa 1 Gyr age is within error of that obtained for E-type silicate diamonds from the Orapa mine, Botswana [3], and is also similar to the Namaqua tectono-thermal event that affected the entire southern African crust. These data thus provide further support for a link between diamond growth in discrete events linked to either initail craton development or later tectono-thermal events.

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5.7.22

Trace element for Archangelsk diamonds: LAM ICP MS study

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LAM ICP MS study of cubic grey desorbed diamonds filled with microinclusions show REE/PM near 0.1 -1, inclined La/Yb_n =12-1400. High Pb* =22-307 and smaller Hf-Zr peaks and minima Eu* =0.45-0.05 and elevated values of Rb, U without Nb-Ta dips and Pb and U peaks allow to conclude origin with continental subduction fluids/melts with addition of the rich in incompatible element mater continental crust. The values of µ. and 206Pb/204Pb- 207Pb/204Pb ratios for diamonds show wide range referred to low continental crust and subducted sediments suggesting ancient age. The TRE for Archangelsk diamonds differ from those determined for kimberlitic and carbonatitic [1] types. Eclogites and hybrid pyroxenites with Phl metasomatism [2,3] highly developed in mantle there prove participation of the continental subducted mater beneath Zimny Bereg. Grants RFBR : 03-05-64146, 03-05-65083.

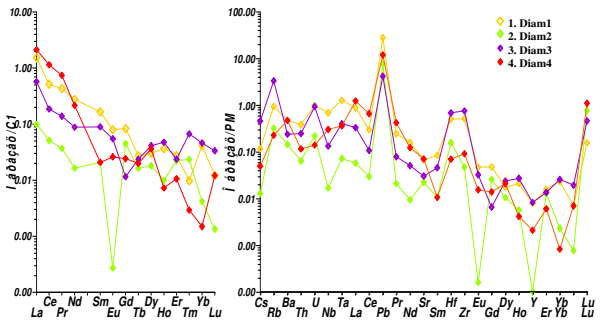

Figure 1. TRE for Arhangelsk diamonds

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