

RADIOMETRIC DATING OF ECLOGITE XENOLITHS FROM KIMBERLITES

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Unlike orogenic eclogites, those brought up from the Earth's mantle often consist only of clinopyroxene, garnet and rutile. Phases that would be especially interesting for dating purposes such as zircon (e.g. HEAMAN et al., 2002) are very rare in these rocks. Sm-Nd age determinations of eclogite xenoliths worldwide based on garnets and clinopyroxenes (internal ages) yield results that scatter over several orders of magnitude between 4 Ga and ages in the future and are not easy to interpret. The eclogite whole-rock system, however, often gives reliable age information (e.g. JAGOUTZ et al., 1984; PEARSON et al., 1995; JACOB & FOLEY, 1999). Re-Os isotopes can be applied to the bulk eclogites, but may give ages with high uncertainty, whereas Sm-Nd and Lu-Hf isotopic systems require a reconstruction of the whole rock eclogite based on mineral analyses to avoid erroneous results due to infiltration of the xenoliths by kimberlitic material. However, reconstruction of a "clean" bulk eclogites requires knowledge of the rock's exact modal composition which strongly depends on the sample size. In the case of Lu-Hf it could be shown that reconstructed whole rock eclogite ages can be too young if rutile occurs as an accessory with unknown exact modal amount (JACOB et al., 2005). Applying the U-Pb and Pb-Pb systems to eclogite silicates is probably the most promising method, because partitioning of Pb strongly favours cpx over gt ($D(\text{cpx} / \text{gt}) = 16$ for Udachnaya eclogites, JACOB & FOLEY, 1999) so that bulk rock reconstructions are not necessary. In the case of eclogite xenoliths from the Udachnaya pipe, it could be shown that the Pb-Pb isochron age on cpx was within error of the Os age on whole rock eclogites (JACOB & FOLEY, 1999; PEARSON et al., 1995). Pb contents in eclogitic minerals, however, are generally below 1 ppm and this method therefore requires low-blank chemistry procedures.

References

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