Lithium isotope composition of lower mantle ferropericlase inclusions in diamanods from Sao Luiz, Brazil

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Ferropericlase is a major constituent of the lower mantle and it is also the major host for lithium. Kaminsky et al. [1] and Seitz et al. [2] reported extremely high Li concentrations in ferropericlase inclusions from Juina (Brazil) and Kankan (Guinea). The latter authors estimated from mass balance considerations that the lower mantle in the source region of these diamonds contained 5–6 times more lithium than the primitive mantle. The Mg-values (Mg#) of the Kankan ferropericlases center around 86, the established value for ferropericlases grown in a peridotitic mantle, whereas those from Juina range from mantle values to very Fe-rich compositions with Mg# = 35. The latter was explained by [3] as a result of hybridisation of a peridotitic lithology with eclogite and sedimentary rocks at the boundary between the transition zone and the lower mantle. The high and variable Li-contents may be explained similarily by a process involving subducted material including serpentinized former oceanic mantle.

We obtained further ferropericlase samples from Brazil which we analyzed by EPMA for their major element composition, by SIMS for their Li-contents and by MC ICP MS for their δ^7Li from solution. The ranges of Mg# and Li-contents are the same as reported in the literature. Four individual inclusions were large enough for the determination of δ^7Li. They are the first δ^7Li values reported for samples from the lower mantle. One sample with intermediate Mg# has a very heavy δ^7Li of +9.6‰ the other three have -3.9, +1.4 and +2.1‰, whereby the intermediate value is from a ferropericlase with a mantle Mg#. This contrasts to a bulk earth value of around +4‰ but encompasses values for serpentinized ocean floor peridotites, alpine eclogites and eclogite xenoliths and clay sediments. Thus, the δ^7Li values also seem to report a subduction related history for the source region of diamonds from the lower mantle or the lower part of the transition zone.

References

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