Hg as a proxy for volcanic activity during extreme environmental turnover: the K-T boundary

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Hg tends to concentrate in sediments deposited right after major glacial events as a result from leaching of volcanogenic Hg from land surface and accumulation along argillaceous sediments. Low geological background concentrations of Hg makes it suitable for identifying accumulation pulses during sedimentation that can be tentatively related to weathering processes and thus to climatic changes. Intense volcanism was, perhaps, responsible for climatic changes, decrease in biodiversity and mass extinction in the K-T boundary (KTB).

We have used Hg as a proxy for volcanic activity and atmospheric Hg and CO_2 buildup across the KTB in the Yacoraite Fm., Argentina, where Hg up to 250 ng.g^{-1} has been found. In drill cores across the KTB in the Paraiba Basin, NE Brazil, Hg also increased from late Maastrichtian to early Danian. Hg spikes predating the KTB are, perhaps, the record of volcanic activity very close to this transition. At Stevns Klint, Denmark, Hg contents reached ~ 250 ng.g^{-1} within a clay layer that comprises the KTB, and exhibits marked $^{87}Sr/^{86}Sr$ positive excursion and $^{206}Pb/^{204}Pb$ and $^{187}Os/^{188}Os$ (t = 65Ma) negative ones. Highest Hg values in the Yacoraite Fm. and at Stevns Klint (~250 ng.g^{-1}) are similar to volcanogenic Hg contents in Neoproterozoic cap carbonates (~ 280 ng.g^{-1}), deposited in the aftermath of Snowball glaciation, a comparative extreme environmental turnover, in absence of meteorite impact. Co-variation between Hg and Al_2O_3 is observed in all studied sections suggesting that Hg is adsorbed onto clays. Thermo-desorption experiments in samples from the Yacoraite Fm. showed Hg^{+2} as the major species present, in agreement with a volcanic origin. Combined Hg and C-isotope stratigraphies may become a powerful tool for the eventual assessment of the role of volcanic activity during extreme climatic and biotic events, such as those during the Cretaceous-Tertiary or Permian-Triassic boundaries.

The age of eclogitisation underneath the Kaapvaal craton – A composite xenolith from Roberts Victor

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We have studied a composite, 16x11x5 cm sized, bimineralic eclogite xenolith (texturally Type II) from the Roberts Victor diamond mine (South Africa) with a 1 cm thick layer along its longer side of green, Cr-rich cpx with exsolution lamellae (presumably opx which is now completely replaced by calcite) plus a Cr-rich garnet (up to 6 wt% Cr_2O_3) which gradually change into the dark coloured cpx's (without exsolution lamellae and heavily altered in places) and Cr-free garnets in the major part of the eclogite. Electron microprobe traverses across the xenolith show that the individual mineral grains (~4 mm in size) are homogeneous but that there is a gradient of mineral compositions from the Cr-rich layer into the Cr-free part which appears like a diffusional gradient. For example, Al_2O_3 in garnet increases from 18 to a constant level of 23 wt% over a distance of 3 cm and Cr concomitantly decreases from 6 to practically zero wt%. The Mg-value increases over the same distance from 50 to 57. Clinopyroxenes change in composition complementary to the garnets. This concomitant change also holds for the trace elements which were determined by laser ablation ICP MS. The grt-cpx partitioning of the trace elements is the same throughout the xenolith except for a dependency on the Cr-content of garnet.

The temperature of 915 °C of last equilibration were calculated with the Krogh 1988 grt-cpx thermometer at 4.2 GPa.

We interpret the compositional profile as the reflection of the passage of a basaltic melt through peridotite. A contact zone with Cr-rich cpx and a compositional gradient was formed and the whole package was subsequently metamorphosed to eclogite. The aim is to determine the age of eclogitisation with the Sm-Nd and Lu-Hf isotope systems from garnet separates obtained from rock slices parallel to the Cr-rich layer.

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