

3.3.P05

Boron and boron isotopes in sediments and pore-fluids in the Japan sea, ODP leg 127, and their implications for fluid-rock interaction and geochemical cycling

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The Japan Sea has been widely viewed as a prime example of a back-arc basin ever since the emergence of the plate tectonic concepts of convergent margin evolution. It constitutes one of the most intensely studied marginal seas rimming the western Pacific (Legs DSDP 31, ODP 127, 128). The Japan Sea was formed along the eastern edge of the Eurasian Plate and is nested between the Pacific, Phillipine and North American Plates. The basin is a classic example of a marginal sea fronted by a volcanic arc-trench complex, displaying high heat flow, highly variable geochemistry (Brumsack and Zuleger, 1992) as well as a large area underlain by oceanic-type crust. Drilling obtained the continuous Neogene ash record as well as hemipelagic background sedimentation with silty clays and diatom oozes and volcanic basement. Only very little is known about boron isotopic compositions of continuous siliceous sedimentary successions in backarc basins like the Japan Sea. It is well known, that marine, clay rich sediments constitute a major reservoir for boron. In order to evaluate the B geochemical cycle and fluid-rock interactions at convergent margins versus backarcs, the knowledge of the boron isotopic composition of a continuous sediment succession is important to investigate fluid rock interaction and diagenetic reactions. Pore fluid and sediment B concentrations and isotopic ratios can provide important insights into the hydrology, fluid-sediment interaction and sediment contribution to the arc volcanoes. Here we report the boron contents and isotopic compositions for four sediment profiles from ODP Leg 127, compared to B isotope pore water data from Brumsack and Zuleger (1992). Sediment B isotopic ratios (+4.6 to -24 permil) show typical values for marine sediments, while pore fluids vary widely from +11.5 to 51.3 permil. Profound variations from ca. 51ppm to 238ppm B in the sediments and 0.12 to 3.37mM B in pore fluids can be observed. These isotopic variations are partially lithology-dependent but more importantly a distinct shift to more negative B isotopes coupled with more depleted B contents is observed below the opal A/CT transition zone for both, fluids and sediments. This study on sediments and pore fluids clearly shows similar isotopic trends with depth in pore fluids and sediments. Furthermore, considering high B contents, backarc basins like the Japan Sea need to be considered an important B sink.

3.3.P07

Preliminary data on fluid inclusions in emeralds from Tocantins (Brazil)

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Geological context

The Tocantins Structural Province, Amazonia, Brazil [1], consists of Proterozoic metasedimentary folded belt and ensialic basement rocks of various ages, amalgamated in N-S structural trend during the Neoproterozoic continental collision of the Amazonas and the São Francisco cratons.

The fluid inclusion study

This study was undertaken in order to unravel the PTX conditions of emerald formation. The fluid inclusions (FI) are abundant, big (up to 100 μm) and the majority could be considered of primary origin. Filling water ratio ranges from 0.5 to 0.8. Two main fluid types were observed: Lc-w-s (high-salinity aqueous carbonic fluid with one or more daughter minerals) and Lc-w (low-salinity aqueous carbonic fluid). Microthermometric studies have permitted to observe the following temperatures: CO₂ melting (TmCO₂), clathrate melting (TmClath) and CO₂ homogenization (ThCO₂). No appreciable differences were observed between both FI types during criometry. Mode values for TmCO₂ and ThCO₂ are -57.0 ° and +23 °C, respectively. TmClath range from -10.5 ° to +8.6 °C. Seven wafers were subject to heating experiments, however, all the observed FI decrepitate during runnings between 300 ° and 530 °C. Assuming CO₂ and CH₄ as the only gas compounds and NaCl as the dominant salt in solution, the average composition for the Lc-w fluid is: 0.773H₂O + 0.173CO₂ + 0.005CH₄ + 0.0024Na⁺ + 0.0024Cl⁻. Average composition for the Lc-w-s fluids could not be determined due to variable number of daughter minerals and filling water ratio. Nevertheless the fluid could be assigned to the H₂O-CO₂-CH₄-Na⁺+Cl⁻+Ca²⁺ system. Data obtained until know are similar to previous studies on brazilian emeralds namely from Capoeirana and Socotó areas [2,3].

Ongoing research

The following procedures are planed to the near future: 1. Raman microspectroscopy on selected FI in order to quantify the volatile composition; 2. Scanning microscopy on broken surfaces of the emeralds with the purpose of access daughter-mineral composition; 3. Further heating experiments in order to get temperatures of final homogenization; 4. Determination of compositions and isochors of individual FI to achieve the PTX domain of emerald formation.

References

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