

Voltammetric determination of Te(IV) and Te(VI): Sorption behaviour on Fe and Mn oxides

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Sorption experiments by Koschinsky *et al.* (2004) had shown an extremely fast and effective enrichment of tetravalent tellurium (Te(IV)) on Mn and Fe oxides, but no comparable enrichment of the geochemically very similar Se(IV). This Te enrichment was related to a surface oxidation process of Te(IV) to Te(VI) on the Fe-Mn oxide surfaces, which apparently does not take place for Se(IV). In order to compare the behavior of tetravalent and hexavalent Te and Se species, which can both exist in natural waters, new sorption experiments were carried out with the hexavalent species of Te and Se.

Te(IV) was determined by differential pulse cathodic stripping voltammetry (DPCSV) using a 0.1 M HCl and 1 mg L⁻¹ Cu²⁺ medium according to Ferri *et al.* (1998). As Te(VI) cannot be reduced electrochemically, a UV-reduction step was required after the sorption experiments and before the voltammetric analysis. For the UV-irradiation procedure, best results were obtained by using a 0.4 M HCl medium for 3 ½ h irradiation time at 90°C (Hg-high pressure lamp, 500 W).

The results of the sorption experiments indicate sorption of Te(VI) on all Mn and Fe oxides used in the experiment, however, the sorption rate was significantly lower than in the experiments with Te(IV). This supports our assumption that Te(IV) is preferentially removed from aqueous solution by Fe and Mn oxide phases compared to Te(VI) and compared to Se(IV) and Se(VI). Comparison of solid phase concentrations of Te and Se in marine oxides indicates that this different sorption behaviour leads to a significant fractionation of the two elements in the marine environment.

Reference

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Trace element distributions in hydrothermal quartz: Fluid or structural control?

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Quartz is probably the most common hydrothermal vein mineral and its isotopic composition and the chemical composition of its included fluids are widely used for petrogenetic interpretations. In contrast, its own chemical composition is often close to being pure SiO₂. A number of studies have, however, shown that some trace elements may enter its structure. While the factors governing such an incorporation are, as yet, not clearly understood, it is obvious that they can potentially be useful for petrogenetic interpretations.

A number of Alpine fissure quartz crystals having formed from chemically different fluids were analyzed for a range of possible trace elements (Li, Na, Mg, Al, P, K, Ca, Ti, Fe, Ge, and H) using different *in situ* methods (electron and ion microprobes, LA-ICP-MS, and FTIR spectroscopy) after cathodoluminescence (CL) analyses to determine the growth zones. CL bright zones were associated with high Al (up to 7000 ppm), Ge, and Li contents, these elements being strongly correlated, in particular within zones of discontinuous grown crystals. No correlation was found between Al and Na and K. The Al-Li-Ge correlation remains the same in quartz analyzed from different localities as well as along the same growth sector within any one crystal, suggesting that differences in the chemical composition of the fluids (also monitored through the oxygen isotope compositions of the quartz) do not control this correlation. However, the Li/Al ratio (i.e. compensating ion/ substituting ion) can be changed along a growth sector and within different crystals and it never appears to approach unity. While significant quantities of H (deduced from OH⁻ absorption spectra) are also present within the quartz, with high amplitude IR-spectra corresponding to Al-Li rich zones, the H-content alone does not compensate for the charge difference between a Si⁴⁺ and (Al³⁺,Li⁺) coupled substitution. Also, while no significant differences in trace element content have been observed between the two rhombohedral faces (*r* and *z*, where *z* generally grows faster than *r*), the prismatic face (*m*) always has lower trace element content compared to *r* and *z*.

It can be concluded that the incorporation of trace elements into hydrothermal quartz is strongly influenced by the growth mechanism, structure, and probably by surface effects, but less so by the chemical composition of the fluid.