

Simultaneous determination of Se and Te in different geological matrices with DRC-ICP-MS

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An investigation of ferro-manganese crusts conducted by Hein, Koschinsky *et al.* (2003) had shown an extreme enrichment of tellurium, but no comparable concentrations of the geochemically very similar element selenium. 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). Therefore the element pair Se and Te seems to have an interesting potential as paleo-proxy to investigate *in situ* redox conditions. In a next step Se and Te are investigated in more detail in different geological matrices to gain knowledge of the usability of this element pair to describe geopaleontological redox processes. Very little Te data of different geological materials have been available so far. A first challenge to be addressed is the precise determination of these two elements with quadrupole DRC-ICP-MS. In this context an analytical approach was developed, using different methods for sample digestion, enrichment and analysis.

Two well known problems connected with the determination of Se and Te with standard quadrupole ICP mass spectrometry are low sensitivities (max. ~3 kcps and ~15 kcps for 10 ppb Se and Te respectively) and severe interferences, especially on Se (e.g. $^{40}\text{Ar}_2^+$ on ^{80}Se). This fact is accompanied by the overall low concentrations in the different matrices, especially in water. Another problem with respect to the acid pressure digestion is the instability of Se in chloride matrix and at temperatures above 80 °C.

All these analytical problems were addressed by optimizing the ICP-MS conditions, the digestion procedure and by the use of thiol cotton separation for samples with very low Te and Se concentrations, first described by Mu-Qing and Gui-Qin (1983). Data for Te and Se in various sample types including marine ferromanganese crusts, weathered basalt and dolomites will be presented.

References

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Influence of Hydrogen on electrical conductivity in enstatite

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Hydrogen has a significant influence on several physical properties of upper mantle rocks. Models for electrical conductivity, for instance, are mainly based on conductivity data for olivine. Therefore, systematic laboratory data on electrical conductivity of other H-bearing nominally anhydrous minerals (e.g. enstatite, MgSiO_3) are needed. An important mechanism for electrical conduction in enstatite requires the presence of protons, because they are the major mobile charge carriers. Key factors for this conduction mechanism are concentration and mobility of protons. In this study, we measured electrical conductivity and H-diffusivity in pure, Al-, and Fe-doped synthetic enstatite. As incorporation of additional cations, such as Al and Fe, create new point-defects in the crystal lattice, transport mechanisms might depend on the defect chemistry.

Diffusion experiments were conducted at 1 bar and 800°C to 1000°C in air. Electrical conductivity was measured at same conditions with an impedance analyzer (0.1 - 10000 Hz), and H-concentration was monitored by FTIR-spectroscopy.

Initial results show that H-diffusivity from dehydration experiments in Fe-bearing enstatite is about one order of magnitude faster than in pure enstatite, whereas it is slower in Al-bearing enstatite. A similar behaviour was observed for electrical conductivity.

Application of the Nernst-Einstein equation to the diffusivity results for pure enstatite are in good agreement with our preliminary conductivity data; this supports the hypothesis that H is the major mobile charge carrier.