Crystallographic relationships between diamond and its olivine inclusions. An update

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We have investigated the crystallographic relationships between olivine inclusions and their diamond hosts by in-situ single-crystal X-ray analysis. We studied 21 diamonds, all from the same kimberlite source (Udachnaya, Yakutia), containing a total of 51 olivine inclusions with diamond-imposed morphology. Each diamond contained up to nine individual olivines. On a statistical basis, no preferential orientation could be found. In particular, only 3 olivines showed an orientation comparable to that found by Mitchell & Giardini [1], i.e. (101)oli // (101)dia *and* (010)oli // (111)dia, which is believed to be the most favourable in the case of epitaxy. Based on our data, such orientation cannot be considered as "typical" of olivines included in diamonds. Although olivines in different diamonds showed random crystallographic orientations, multiple olivines within the *same* diamond often showed very similar orientations. Up to three sets of iso-oriented inclusions have been found within a single diamond. Our unprecedented data set clearly refutes the long assumed existence of a systematic crystallographic relationship for olivine inclusions in diamonds [1, 2]. The implications in terms of syngenesis vs. protogenesis of the inclusions will be discussed.

[1] Mitchell & Giardini (1953), *Am. Mineral.* **38**, 136-138. [2] Futergendler & Frank-Kamenetsky (1961), *Zapisky Vsesoyuznogo Mineralogicheskogo Obshestva* **90**, 230-236.

Colloid-associated iron and arsenic transport in streams

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Significant correlations between concentrations of arsenic (As), iron (Fe), and natural organic matter (NOM) are often observed in wetland draining streams. However it is not yet understood how the transport of Fe and As along with NOM and iron hydroxide colloids is affected under variable hydrological and hydrochemical conditions.

Analysis with Flow Field-Flow Fractionation coupled to UV-Vis spectroscopy and inductively coupled plasma mass spectrometry revealed that As was associated with NOM and, if present, Fe-organo-mineral colloids in the size range below 25 nm.

The colloid composition in the studied streams was highly variable on a temporal and spatial level: Short-term groundwater level fluctuations affected the release of Fe, NOM and As, and colloid composition with respect to NOM and Fe-hydroxides changed within hours. This is due to changing flow paths of the groundwater that feeds the stream as well as the chemical composition of the hydraulically active soil layers. Under all conditions, 25 to 50% of the total As was associated with NOM. However, the mass of As exported per mass of NOM was considerably higher under baseflow conditions.

The colloid composition was also affected when stream water moved from first order, acidic streams to more basic, larger streams. Fe was mainly transported as Fe-NOM complexes in acidic first order streams. In contrast, in the more basic higher order streams, Fe-hydroxide colloids and particles were present. The amount of colloid-associated As decreased from 75% to 26% with increasing pH, and As in the colloidal size range was mainly associated with NOM.

There is growing interest in quantifying the riverine fluxes of Fe to the oceans. Association with NOM enhances the Fe mobility in streams. Concentrations of NOM bound Fe in the studied catchments were high compared to literature data. In conclusion, wetland-draining catchments are of special importance for riverine Fe and trace element transport.

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DOI:10.1180/minmag.2013.077.5.14