

## Plagioclase lamellae in peridotite-hosted orthopyroxene

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The solubility of low-Ca orthopyroxene (opx) in calcic clinopyroxene (cpx) and vice versa is temperature dependent. During cooling, pyroxenes develop subparallel exsolution lamellae. Deviations from this canonical behaviour are very rare. Here we present results from porphyroclastic plagioclase lherzolites from the Ozren ultramafic massif (Dinaride ophiolite belt) that contain plagioclase (plag), which seems to be texturally exsolved from opx.

Plag lamellae are parallel to cpx exsolution lamellae and occupy up to 10 vol-% of opx. Spacing is irregular between different porphyroclasts and within the single porphyroblast, but generally ranges between 30 and 500µm. Some plag lamellae are interrupted by trace amounts of spinel, cpx or amphibole (very rare). In places, opx porphyroclasts are devoid of plag lamellae, but instead contain irregular plag blebs and trails. Opx have very well developed alumina concentration gradients around the Na-poor (An90) plag lamellae and blebs.

Opx-hosted plag exsolutions are very difficult to recognize, both in thin section and BSE images. They are easily overlooked and probably more widespread than commonly assumed. We have also observed them in harzburgite opx near a highly evolved gabbro dike (Central Indian Ridge). To our knowledge they have been described only in peridotites from the Ronda massif (Obata 1980). In contrast, cpx-hosted plag exsolution lamellae are apparently more widespread in peridotites (e.g. Rampone *et al.* 1993). Closed-pyroxene exsolution requires additional silica in form of Eskola component to produce plag ( $2\text{CaAl}_2\text{SiO}_6 + 2\text{Ca}_{0.5}(-)0.5\text{AlSi}_2\text{O}_6 = 3\text{CaAl}_2\text{Si}_2\text{O}_8$ ), as known from HP and UHP mafic rocks. However, Eskola pyroxene is not expected in silica undersaturated rocks (Gasparik, 1985) and additionally non-stoichiometric pyroxenes don't occur in spinel facies at same massif. Alternatively, spinel exsolution from pyroxene could provide the Si to produce plag, but spinel contents are too low to balance all observed plag. A third possibility is that Si is brought in by a melt or fluid, reactively replacing pre-existing lamellar cpx (in the absence of olivine). This would require that the peridotites were lithospheric and that heating was sufficiently fast to reach near-solidus conditions to allow for grain boundary melt migration without rehomogenizing exsolved pyroxenes.

### References

- Obata M. (1980). *J. Petrol.* **21** 533–572
- Gasparik T. (1985) *Geochim Cosmochim Acta* **49** 865–870
- Rampone E. *et al.*, (1993), *Contrib. Mineral. Petrol.* **115** 1–17

## Speciation and long-term sequestering of Zn in a naturally enriched soil

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Recent XAS investigations of Zn-impacted soils have identified Zn-phyllosilicates, Zn/Al-Layered Double Hydroxides, Zn sorbed on Mn and Fe oxides and Zn complexed to soil organic matter as the most probable chemical forms for anthropogenic Zn in soils (e.g. Kirpichtchikova *et al.*, 2006 and reference therein). However, the long-term stability of these Zn species has been rarely investigated. This question, which is of primary importance to assess the fate of anthropogenic Zn, can be partly addressed by studying the chemical forms of Zn occurring in naturally Zn-enriched soils overlying geochemical anomalies. Such approach has already allowed us to identify chemical forms of lead and arsenic able to resist to long-term weathering (Morin *et al.*, 2001; 2002).

In the present study, the selected soil has developed upon sulfides mineralized sandstone (Ardeche, France) and exhibit Zn concentrations (up to 500 mg/kg) similar to those found in impacted soils. Molecular-level information gained by EXAFS indicate the occurrence of two main Zn species (Zn-bearing clay minerals and Zn-sorbed Fe oxides), with varying proportions as a function of depth. In the topsoil (A<sub>0</sub>- and B<sub>s</sub>-horizons), about 50 % of Zn is hosted by the clay minerals, whereas this proportion decreases to less than 10 % at depth (C-horizon) where no clay minerals could be detected by XRD. These results suggest that Zn-sorption onto Fe oxides represents the first-stage of weathering of the ZnS-mineralized sandstone (C-horizon). After longer weathering (A<sub>0</sub>- and B<sub>s</sub>-horizons), Zn is progressively incorporated in neofomed clay minerals which likely represent long-term hosts for this element in soils.

### References

- Morin *et al.* (2002). *Bulletin de la Société Géologique de France*, **173**, n°3.
- Morin *et al.* (2001). *American Mineralogist*, **86**, 92–104.
- Kirpichtchikova *et al.* (2006) *Geochimica et Cosmochimica Acta* **70**, 2163–2190.