

## 1.3.P11

### Oxidation of olivine and Cr-spinel to forsterite, ferrite-chromite and magnetite, recorded in a recent basalt from Iceland

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The Hraunsvik basaltic lava, a primitive olivine tholeiite on Reykjanes peninsula in SW-Iceland, contains numerous gabbroic xenoliths. These typically range from a few centimeters to one or two decimeters in maximum diameter. The main constituent phases are plagioclase, olivine and clinopyroxene, representing a relatively high-temperature fractionation of basaltic magma at depth.

An unusual mineral assemblage occurs in a "nodule" that is comprised of several closely associated crystals of olivine and included spinel. These are separated by a basaltic groundmass, and probably represent a dunitic nodule disintegrating in the host basalt.

The olivine crystals contain abundant magnetite. The magnetite occurs either as small discrete grains or in thin veins (~1  $\mu\text{m}$ ) cross cutting the olivine crystals. Apparently they formed around cracks in the crystals that were infiltrated by an oxidizing agent, alternatively the magnetite grains may have aggregated (Ostwald ripening) to form these narrow veins. The spinel phase included in the olivine is interpreted to be Cr-spinel that has re-equilibrated (altered) to a more Fe-rich variety similar in composition to ferrite-chromite described from serpentinites [1].

Icelandic picrites contain abundant olivine and Cr-spinel. The composition of olivine in the Icelandic picrites is commonly between Fo 86 and Fo 91 with a large population around Fo 89. Cr spinels in the Icelandic picrites commonly show a large variation in Cr/(Cr+Al) at low Fe/Mg+Fe (the Cr-Al trend [2])

The composition of the oxidized olivine ranges from Fo 89 to Fo 93 reflecting magnetite formation and loss of SiO<sub>2</sub>. The ferrite-chromite crystals are rich in Fe<sup>+3</sup> compared to Cr-spinels in the Icelandic picrites and show a compositional trend similar to accessory Cr-spinels in some serpentinites ("trend a" [1])

Apparently oxidizing conditions may develop, in this relatively reduced and dry magmatic environment, where reactions take place that mimic the initial steps leading toward serpentinite formation.

#### References

- [1] Burkhard D.J.M. (1993) *GCA*. **57**, 1297-1306.  
[2] Barnes S.J. and Roeder P.L. (2001) *J. Petrol.* **42**, 2279-2302.

## 1.3.P12

### Speciation of Os in iron meteorite and PGE ores by SR-XAFS

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Reported here are the first SR (synchrotron radiation)-based XAFS (X-ray absorption fine structure) spectra of Os at LIII-edge in geo- and cosmo-chemical samples (Negrillos, II-A type iron meteorite, and three platinum-group-element ores), which provide the information on Os species in these samples. XANES (X-ray absorption near-edge structure) spectra of Os are given for Negrillos with an Os abundance of 65 ppm as well as for three PGE (platinum-group-element) ores with Os contents of 50, 0.3 and 1.6 %, respectively.

The XANES spectra clearly showed that Os in the iron meteorite and PGE ores chiefly exists as a metallic species. In addition, three PGE ores give Os EXAFS (extended X-ray absorption fine structure) spectra with the quality enough to analyze the interatomic distance, while the EXAFS spectrum of Os in Negrillos is worse for the analysis of interatomic distances because of low Os abundances. Analysis of Os EXAFS for PGE ores showed that obtained interatomic distances reflects first neighboring atom of Os in PGE ore samples, which could be useful to identify the host phase of Os in natural samples. Neighboring atoms of Os were concluded to be Pt and Fe for our Pt ores and Os and Ir for our iridosmine sample. The interatomic distances of Os-Pt and Os-Fe for Pt ores and Os-Os and Os-Ir for an iridosmine obtained by EXAFS are shorter than expected values from metallic bond radii of these elements, although a reasonable explanation for this discrepancy is still unclear.

This study verified that the chemical state of PGEs in natural samples can be determined using XAFS. It is expected that further application of XAFS technique to Os speciation in natural samples clarify Re/Os fractionation processes in the Re-Os isotopic system.