5.7.14

Geochemistry and origin of mantle sulfides in spinel peridotite xenoliths from Penghu Islands, Taiwan

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Abundant primary sulfides occur as inclusions in silicates and as discrete grains in spinel lherzolite and pyroxenite xenoliths from Miocene intraplate basalts on the Penghu Islands, Taiwan [1]. Metasomatised xenoliths with amphibole have the highest sulfide abundance up to 1.0 vol.%, whereas cryptically metasomatised samples have relatively low sulfide abundance (0.1~0.3 vol.%). These sulfides are mixtures of Fe-rich and Ni-rich monosulfide solid solutions (MSS), pentlandite, millerite and chalcopyrite, exsolved from high-temperature (>900°) MSS bulk compositions [2]. Both enclosed and interstitial sulfides in each sample have similar compositions. Sulfides from two localities are distinguished as two groups by their bulk compositions: the Kueipi (KP) sulfides are Fe-Cu-rich, S-deficient MSS (Ni/(Ni+Fe) = 0.19~0.59, with Metal/S_{ave} = 1.10) and the Tungchiyu (TCY) sulfides are Ni-rich (27.2~61.6 wt.%; Ni/(Ni+Fe) = 0.55~0.99) with unusual high Co contents up to 7.7 wt.% resulting in subchondritic Ni/Co ratios (< 21). These sulfides commonly have low Platinum Group Element (PGE) contents (e.g. Os_N < 100; Os/Pt = 0.08~32.7, median=1.1). Some sulfides with high P-PGE to I-PGE ratios (Pd/Ir > 1 (1.24~33)) are interpreted as MSS crystallized from evolved sulfide liquids, whereas rare grains with Pd/Ir < 1 (0.14~0.94) are products of reaction between residual MSS and evolved sulfide liquid [3]. Therefore, the KP and TCY sulfides with Pd/Ir < 1 are inferred to represent high-temperature mixtures between MSS and a Cu-rich fluid (KP) and a unique Ni-Co-rich liquid (TCY). Notably, the Ni-Co-rich sulfide liquid with subchondritic Ni/Co ratios requires formation conditions consistent with the very high pressures and temperatures occurring in the lower mantle to achieve appropriate metal-silicate partition coefficients for Ni and Co. The origin of these sulfides reflects evolution of lithospheric mantle beneath South China block, and can provide constraints on processes relevant to PGE distribution and composition in the mantle and the core.

References

[1] Wang, K.L. et al. (2003), *Geology* **31**, 709-712.
[2] Alard, O. et al. (2002), *EPSL* **203**, 651–663.
[3] Griffin, W.L. et al. (2002). *G-cubed* **3**, 1069.

5.7.15

Major element trends in zoned peridotitic garnets from Newlands and Bobbejaan kimberlites, RSA

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The diamondiferous kimberlites at Newlands and Bobbejaan, RSA, contain a wide compositional range of lherzolitic and harzburgitic garnets in xenoliths of 0.5 to 3 cm in diameter. Electron microprobe traverses of the garnets indicate: (1) Cr-Ca zonation approaching coexisting minerals included within the garnets and (2) Cr-Ca core to rim zonation. In (1) the composition profiles largely appear to reflect diffusional equilibrium under different P-T conditions. In (2) increases in Ca and Ti towards the rim are more suggestive of growth from a metasomatic melt/fluid possibly involving percolative fractional crystallisation [1, 2].

In lherzolites, clinopyroxene inclusions have the effect of buffering the garnet to a positive Cr:Ca slope (trend 1d, Fig. 1). Harzburgitic garnets display three sloped trends: (1s) adjacent to serpentine inclusions, (1c) adjacent to chromite, and (2) where a large CaO increase is accompanied by an increase in TiO_2.

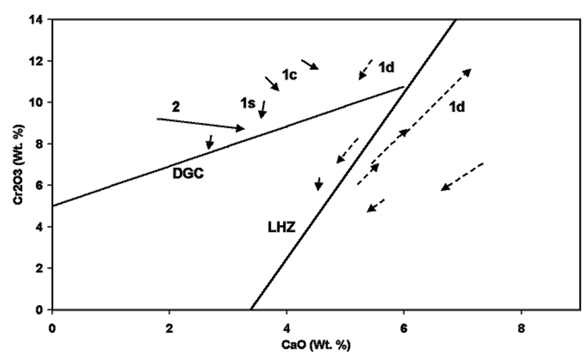

Figure 1: Cr_2O_3 against CaO plot of harzburgitic garnets and lherzolitic garnets (dotted) exhibiting zonation trends. DGC is diamond-graphite constraint [3], LHZ is the general lherzolite line of Gurney [4].

References

[1] Burgess S.R., Harte B. (1997) *Proc. VIIth Int. Kimb. Conf.***,** 66-80.
[2] Harte B., Hunter R.H., Kinny P.D. (1993) *Phil. Trans. Royal Soc. London* **A342**, 1-21.
[3] Grütter H.S., Menzies A.H. (2003) 8^{th} Int. Kimb. Conf. Abstracts.
[4] Gurney J.J. (1984) Geol. Dept. and Univ. Ext., Univ. W Aus. **8**, 143-166.