Petrological constraints on carbonated eclogite as a source of carbonatites

G.M. YAXLEY[1] AND G.P. BREY[2]

[1]Research School of Earth Sciences, The Australian National University (Greg.Yaxley@anu.edu.au)
[2]Institut für Mineralogie, Universität Frankfurt (Brey@em.uni-frankfurt.de)

Eclogitic or pyroxenitic heterogeneities in dominantly peridotitic upper mantle may have important roles in genesis of a variety of magma types. Some of this heterogeneity was introduced by subduction of altered oceanic crust, of which calcitic carbonate is a common constituent. Experimental studies demonstrated that this carbonate may survive subduction into the upper mantle without melting or decarbonation. The resultant carbonate-bearing eclogite has been suggested as an upper mantle source for some carbonatites because of the similarity of their radiogenic isotope compositions to HIMU OIBs. The HIMU signature has been linked to the emplacement of previously subducted oceanic lithosphere into the OIB source after long term mantle storage.

We have experimentally determined phase and melting relations of ga+cpx+carbonate assemblages (2.5–5.5 GPa), to assess the feasibility of carbonated eclogite as a source for carbonatites. The solidus of our composition was1100°C at 2.5 GPa, 1220°C at 3.5 GPa and 1330°C at 5.0 GPa, conditions above the peridotite-CO_2 solidus. Carbonate melts were sodic calcio-dolomitic, and were more calcic and lower in Fe/Mg than the sodic dolomitic melts produced by partial melting of carbonated peridotite.

The potential temperature of convecting upper mantle may be as low as 1280°C or as high as 1450°C. Solidii for the carbonated eclogite and peridotite-CO_2 are $\geq 70°C$ below such an adiabat at 5.0 GPa. Solidii of natural upper mantle carbonated eclogites will vary with differing contents of Fe, alkalies and volatiles, but in many cases will lie above the peridotite-CO_2 solidus. If discrete carbonated eclogite bodies are present in the peridotite-dominated upper mantle, the carbonate would melt in the upper 250 or more kilometres. Carbonatite melt will segregate from its source eclogite at very low melt fractions and infiltrate surrounding peridotite. At PT conditions above the peridotite-CO_2 solidus, the carbonatite liquid will remain molten as it passes into the peridotite. However, its composition will change. Depending on PT conditions, liquids in equilibrium with wall rock peridotite may be sodic dolomitic carbonatites, or carbonated undersaturated silicate melts such as olivine melilitites, olivine nephelinites or possibly kimberlites. These liquids will carry a mixed isotopic signature reflecting those of peridotitic upper mantle and altered oceanic crust recycled through subduction.

A Cadmium-rich Zinc Deposit, For the Example of Niujiaotang Deposit, Duyun, Guizhou, China

LIN YE[1,2] AND CHAOYANG LI[1]

[1]Open Lab. of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002 yelin101010@yahoo.com.cn
[2]Graduate School of Chinese Academy of Sciences

As a dispersed element, cadmium is difficult to enrich and mineralize. In the study of Niujiaotang Pb-Zn deposit, Duyun, Guizhou Province, it was found that the content of Cd was abnormally high, generally ranging from (2248~ 9850) x 10^{-6}, with the maximum up to $13400 \mathrm{x} 10^{-6}$ (average $5366 \mathrm{x} 10^{-6}$), and that in sphalerite monomineral is generally greater than $1.20 \mathrm{x} 10^{-2}$ with a maximum of up to $1.97 \mathrm{x} 10^{-2}$. It is seen that Cd and other dispersed elements can be concentrated to from their independent ore deposits under special geological conditions.

Studies have shown that Cd in this deposit occurs dominantly in the following three forms: (I)Cd is present mainly as isomorphous impurity in sphalerite, and subordinately in wurtzite, pyrite, galena and smithstone; (II)Cd is present as independent minerals, (III) chemical adsorption. The independent minerals of Cd, which are mostly distributed in the oxidation zone of the deposit, seem to be of secondary origin. For example, Cd, which is oxidized and reduced from sphalerite, can from $CdSO_4$ to replace the sphalerite, froming greenockite. The oxides of Cd can be transformed into otavite under the action of CO_2.

$CdSO_4 + ZnS \rightarrow CdS + ZnSO_4$

$CdO + CO_2 \rightarrow CdCO_3$

The Niujiaotang deposit is a epithermal sedimentary-reworked strata-bound Zn deposit with carbonate rocks as the dominant host strata. It is evidenced that during the sedimentation of the Qingxudong Formation alga-bearing dolomite the mining the district would be the center where the enrichment of Cd and Zn and initial mineralization occurred. Cd and other dispersed elements are present largely as isomorphous impurities in sphalerite and partially occur as independent minerals such as greenockite, otavite or oxides of Cd in the oxidized zone of the deposit. These independent Cd minerals are probably secondary minerals formed during the wearhering-leaching processes.

Reference

Tu Guangchi, Dispersed elements could from independent deposit-one of new pioneer ore field, The New Development of Chinese Minerals and Rocks Geochemical (II), Lanzhou: Lanzhou University Press (in chinese), 1994,234