Melting and breakdown of $MgCO_3$ at high pressures

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Studies inclusions in ultra-deep diamonds suggest that magnesite can be major stable carbonate in the lower mantle. It can play an importatnt role for the carbon cycle in the Earth's interior. New form of magnesite II was reported at the high-pressure and high-temperature [1]. However, the information about melting of magnesite at high pressure is limited [2].

We study high-pressure high-temperature behavior of magnesite, stability of the melt and its decomposition in static compression experiments between 10 and 60 GPa and temperatures up to 3500 K using diamond anvil cell technique with laser heating. Special methodology was used for determing the melting point. The spherical boron doped diamonds were used as a heat absorber for laser heating.

In accordance with thermodinamic analysis [3] our experimental results showed that magnesite does not decompose to MgO and CO_2 under conditions of the Earth's lower mantle and demonstrate extended field of congruent melting of magnesite. We observed also formation of MgO and diamond or graphite as a result of decomposition of $MgCO_3$ melt. Formation of diamond and graphite may be explained by a two stage reaction: $MgCO_3$=MgO+CO_2; CO_2=C+O_2.

The obtained results allow to determine the phase relations of $MgCO_3$ at high pressures and high temperatures, and important for constraining the conditions of diamond crystallization from the carbonate-bearing parental media in the Earth's lower mantle.

[1] Isshiki, Irifune, Hirose & Ono (2004), *Nature* 427, 60-62. [2] Katsura & Ito (1990), *Earth and Planetary Sience Letters* 99, 110-117. [3] Dorogokupets (2007), *Geokhimiya* 6, 624-631.

This work was funded by grant RFBR 12-05-33044.

Complex C-O-H-N-S fluids and sulphide-silicate melt immiscibility in the upper mantle

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The minerals (Ol, Opx, Cpx) of metasomatized garnet lherzolite xenoliths from East Antarctica contain diverse microinclusions of melt, fluid, and fluid–silicate–sulphide inclusions with typical liquid immiscibility textures. At room temperature, the fluid inclusions contain one (liquid), two (liquid and gas) or three (H_2O and CO_2 liquids and gas) phases. All the inclusions are CO_2-dominated. The obtained data suggest the existence of two sources of fluids. Fluid of fluid–silicate–sulphide inclusions show homogenization temperatures of up to –64.8°C, and densities of up to 1.17 g/cm^3, which correspond to pressures ≥13 kbar at the moment of fluid entrapment (at 1000°C). Phase transitions at –151°C are close to the critical point of N_2 (–147°C). The Raman spectra of fluid inclusions display lines of CO_2, H_2S and N_2. The high-pressure fluid inclusions have low C/N_2 and N_2/Ar, heavy nitrogen isotope compositions and elevated ^{40}Ar/^{36}Ar values (up to 530). Second type inclusions have lower densities (≤0.82 g/cm^3) and, correspondingly, lower entrapment pressures (≤7 kbar). Their Raman spectra exhibit a distinct H_2O line. Their fluid has higher C/N_2 and C/Ar, lower δ^{13}C, and close to atmospheric N_2/Ar and ^{40}Ar/^{36}Ar values. It is suggested that the observed fluids are products of mixing between a mantle derived fluid and atmospheric air or/and seawater.

DOI:10.1180/minmag.2013.077.5.19