Melting phase relations in Udachnaya-East kimberlite and search for parental melt composition

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Udachnaya-East kimberlite (UEK) is an unique example of unaltered Group I kimberlites, exhibiting lack of serpentinisation and containing abundant alkaline carbonate and chloride minerals in the groundmass [1]. We studied phase relation in UEK in using multianvil experiments at 3-6.5 GPa and 900-1500 ºC [2]. Super-solidus assemblage consists of olivine (Ol), Ca-rich garnet (Gt), Al-spinel (Sp), perovskite (Pv), $CaCO_3$, and apatite at 3-6.5 GPa with addition of clinopyroxene at 3-4 GPa and Na-Ca carbonate at 6.5 GPa and 900 ºC. The subliquidus phase assemblage (Ol + Gt + Sp + Pv) differs from common mantle lithologies, which may be due to unaccounted CO_2 lost during kimberlite degassing at shallow depth. UEK did not achieve complete melting even at 1500°C and 6.5 GPa. This indicates that kimberlite magma below 90 km depth was a mixture of the melt and xenogenic materials (mainly Ol). In the studied *P-T* range, melt has Ca-carbonatite composition (Ca/(Ca+Mg) = 0.6-0.8) with high alkali and Cl contents (2.8-6.7 wt.% K_2O, 7.3-11.6 wt.% Na_2O, 1.2-3.7 wt.% Cl). The K, Na and Cl contents and Ca/(Ca+Mg) ratio decrease with temperature. The SiO_2 content in the partial melt increases with temperature and decreases with pressure (Fig. 1). Consequently, the ascending melt dissolved increasingly more SiO_2 (Fig. 1) and evolved from essentially carbonatite (<5 wt.% SiO_2) toward carbonate-silicate composition (up to 25 wt.% SiO_2).

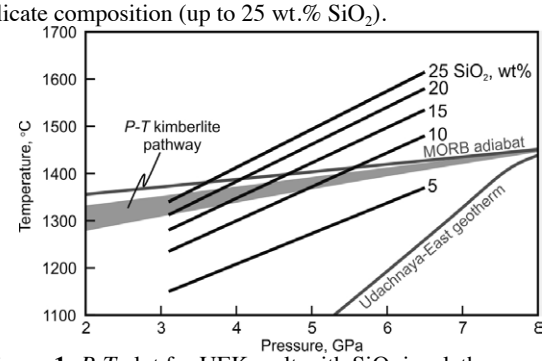

Figure 1: *P-T* plot for UEK melt with SiO_2 isopleths.

[1] Kamenetsky *et al*. (2012) *Lithos* **152**, 173-186. [2] Sharygin *et al*. (2013) *Dokl. Earth Sci*. **448**, 200-205.

Mineralogy of the Chelyabinsk meteorite, Russia

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The entry in the Earth's atmosphere, further blasting and impact of the Chelyabinsk meteor body have been fixed 15 February 2013. We studied small fragments collected in the area of abundant meteorite shower (nearby towns Emanzhelinsk and Korkino, South Urals).

The Chelyabinsk meteorite was classified as an ordinary LL5 chondrite (S4, W0) [GEOKHI RAS]. It is very similar in mineral composition to other LL5 chondrites such as Salzwedel, Hautes Fagnes and Al Zarnkh [1-3]. All meteorite fragments consist of coarse- to fine-grained matrix, rare submillemetre chondrules and thin fusion crust. Some fragments show brecciated texture.

Olivine ($Fo_{68-72}Fa_{28-31}Ln_{<0.5}$), orthopyroxene ($En_{70-74}Fs_{25-28}Wo_{1-2}$), Fe-Ni-metal, troilite, chromite and Na-plagioclase ($Ab_{77-86}An_{10-20}Or_{3-10}$) are major primary minerals in the inner part. Ilmenite, Cr-diopside ($Wo_{46-48}En_{43-45}Fs_{16-18}$, Cr_2O_3 – 0.6-0.8 wt%), chlorapatite, merrillite and feldspathic glass are minor. Coarse- to meduim-grained matrix mainly contains primary minerals (olivine, pyroxenes, etc.); some areas show fine recrystallization due to melting and further quenching with formation of skeletal crystals of olivine ($Fa_{29-46}Ln_{1-3}$), orthopyroxene, subcalcium pyroxene ($Wo_{22-42}En_{45-65}Fs_{13-22}$) in feldspathic glass (plagioclase). Metal-sulfide assemblage (up to 10 vol%) is represented by kamasite-taenite intergrowths (or their individuals) and troilite; pentlandite and native copper occur rarely. Chondrules are different in mineralogy. Some of them show well-oriented "barred" texture and consist of olivine and Na-plagioclase (feldspathic glass) with minor chromite and chlorapatite. Other chondrules are similar in mineral composition to the matrix and their oriented texture is less pronounced.

Fusion crust (up to 1 mm) contains relics of primary minerals, mafic-ultramafic brown glass, abundant gas bubbles, newly-formed minerals (zoned skeletal crystals of Cr-Ni-rich magnetite, forsterite-fayalite, wüstite, etc.) and Ni-rich metal-sulfide globules (heazlewoodite, awaruite-taenite, godlevskite, rarely Os-Ir-Pt-Ni alloy).

[1] Matthes (1995) *Chem Erde-Geochem* **55**, 257-261. [2] Gismelseed *et al*. (2005) *Meteorit Planet Sci* **40**, 255-259. [3] Vandeginste *et al*. (2012) *Geol Belg* **15**, 96-104.

DOI:10.1180/minmag.2013.077.5.19