Thermochemical calculations of condensation sequences in circumstellar envelopes and in the solar nebula

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A New Method

The major difference between our model and previous ones [1, 2] is that our model follows an initial gas bulk of "solar" composition while it is cooling. As temperature decreases and condensed species are formed, gas composition changes and gets more and more different from the initial elemental composition. This point has not been considered in previous models. We investigate the importance of this progressive compositional change on the behavior of the condensation sequences in circumstellar envelopes as well as in the primitive solar nebula

The second difference with previous models is that our calculations study an initial bulk composed of the 40th most solar abundant elements and look into a database containing up to two thousand species (gas and condensed).

Results

The first results we obtained show an important difference with previous models for the sulfur chemistry. In fact, solid iron sulfides never condense if the initial temperature of the initial bulk is too high (> 800 K for P=10^{-6}bar), because metallic iron condenses first at higher temperature (1180 K for P=10^{-6}bar) and completely exhausts iron from the remaining gas phase. Moreover, if solid iron sulfides do not condense, the remaining elements (Na, Mn…) that can form sulfides are not abundant enough to efficiently deplete the gas phase from sulfur. This result may explain why sulfur is not depleted in the diffuse interstellar gas phase [3] This also opens new horizons to explain some Stardust elemental abundances analyses [4] which suggest some sulfur depletion in the refractory phase of cometary material as compared to CI meteorites.

[1] Ebel (2000) *J. Geophys. Res*. **105, A5**, 10363-10370. [2] Pasek *et al*. (2005) *Icarus* **175**, 1-14. [3] Palme & Jones (2003) *Treatise on Geochemistry* **1**, 41-61. [4] Flynn *et al*. (2006) *Science* **314**, 1731-1735.

Abundances of PGE and gold in kimberlites from Eastern Dharwar Craton, Southern India

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Platinum group element (PGE) geochemistry has the potential to provide information on mantle processes and it might therefore provide an additional insight into kimberlite geochemistry and genesis. The restricted nature of the database has prevented detailed modeling of the geochemical behavior of PGE in Kimberlites Eastern Dhrawar Craton in Southern India consists of 27 kimberlite pipes that occur in mainly four clusters, namely Wajrakarur-Lattavaram, Chiggicherla, Kalyandurg and Timmasamudram. In this work, we reported for the first time the abundances of PGE and Au determined by a modified double NiS fire assay followed by Te co precipitation method using ICP-MS to understand the PGE signatures in kimberlite pipes in and around Anantapur area, which intruded the Achaean Craton, Southern India. Average ∑PGE in Southern Indian kimberlites is found to be 47 µg/g, which is higher when compared with that of South African kimberlites (23 µg/g) . Fig. 1 shows the field defining the chondrite-normalised PGE of kimberlites from Anantapur area and South African kimberlites. From this study it can be revealed that i) kimberlites contain relatively high concentrations of HTPGE and primitive signatures relative to other mantle melts, (ii) Cratonic Group I kimberlites in particular show high concentrations of PGE in comparison with other rocks with elevated Cu/Pd (e.g., MORB), (iii) Au abundances in Southern Indian kimberlites are relatively much higher when compared with South African Kimberlites.

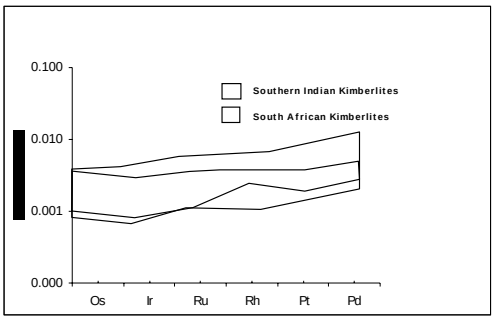

Figure 1: Rock/chondrite normalised PGE pattern of kimberlites from the present study. (*Data for South African kimberlite from McDonald et al., 1995.*