Melt modified mantle lithosphere beneath Dalnyayay pipe

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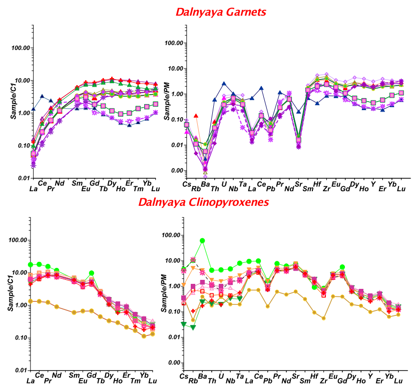
Mantle xenoliths (>100) from Dalnaya pipe (Yakutia) were studied by EPMA and LAM ICP MS. In deformed and porphyroclastic Cpx is mor Fe- rich and HT and may associate with picroilmenites. The splitted geotherm (33 to 45mwm-2) are traced by course and deformed varieties varieties respectively from 7.5 to 2GPa. Essential inflection and heating detected by PT for OPx ~3GPa referring to Ca-enriched pyroxenitic garnets two more heating intervals are found ~ 7-6 and 5GPa. Continuous branches of growth with decreasing P of Fe# for Gar and low - Fe Cpx Fe# 6 to 12# suggest that primary mantle layering beneath this pipe was smoothed by interaction with melts. The refertilization trend (Fe#9-15% rising upward in two branches refer to the joint crystallization of Ilm - low-Cr Ilm – Cpx - Gar found in intergrowth referring to protokimberlite melts evolution.

In the PFO2 diagrams garnets and Cpx show continuous reduction to the lithosphere base to 4ΔQMF, and a bit higher for Cpx. Ilm - garnet trend is rising upward between -2 -0 ΔQMF. The diamond grade is higher for the porfiric kimberlites containing higher sub Ca garnet from dunites representing melt path veins. Trace elements for olivine show lower Ni and higher Al, Ca, Ti for the deformed veins. Trace elements determined for Gar and Cpx from 13 xenoliths from the middle part of mantle section reveal very similar patterns in the incomatible part in general suggesting reactions with the protokimberlite melts.



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Composition and interior structure of the HED Parent Body

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Estimates for the major and trace element compositions of the Howardite-Eucrite-Diogenite (HED) parent body mantle have been derived using geochemical information from the HED meteorites [1] and the observation that refractory lithophile elements occur in chondritic relative proportions [2]. The putative mantle compositions (Table 1) were then used to investigate differentiation processes within Vesta.

	MgO	Al_2O_3	SiO_2	CaO	FeO
PM1	29.7	3.01	42.3	2.40	22.6
PM2	32.8	3.33	46.7	2.65	14.6

Table 1. Major element composition (wt%) of two putative mantle compositions (PM1 and PM2).

These estimates were combined with new information from *DAWN* [3] to model the interior structure of Vesta. Mantle compositions imply a mantle mineralogy of approximately 60% olivine and 40 % pyroxene. We estimate crustal thickness of 10-20 km and a core mass fraction of 15 % for a body with mantle composition PM1, and 20-30 km and 19 % respectively for PM2. Combining this information with experimentally determined crystal-melt and melt-metal partition coefficients (e.g. [4]), the trace element distribution throughout the protoplanet was then calculated, including estimates of Ba/W for Bulk Silicate Vesta of 29-32 for PM1 and 48-67 for PM2.

Initial results from one-atmosphere and piston cylinder experiments confirm that basaltic melts can be derived from these putative mantle compositions with olivine replacing pyroxene as the 1 atm liquidus phase as increasing amounts of mantle are added to eucritic starting compositions. We are currently determining crystal-melt partitioning behaviour for a diverse range of refractory trace elements. The data will be used to further constrain the igneous history of Vesta.

[1] Sack *et al* (1991) *Geochim. Cosmochim. Acta* **55**, 1111-1120. [2] MetBase™ [3] Russell *et al* (2012) *Science* **336**, 684-686. [4] Wade *et al* (2012). *Geochim. Cosmochim. Acta* **85**, 58-74

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