Effects of silicate melt migration on the differentiation of planetesimals

N. MOSKOVITZ[1,2]* AND E. GAIDOS[2]

[1]Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC 20008, USA (*correspondence: nmoskovitz@dtm.ciw.edu)

[2]Department of Geology & Geophysics, University of Hawaii, Honolulu, HI 96822, USA (gaidos@hawaii.edu)

Meteoritic and asteroidal evidence suggests that the differentiation of planetesimals was a common occurence in the early Solar System [1, 2]. Fueled by the decay of short-lived radioactive isotopes such as ^{26}Al, differentiation only would have occurred for large bodies (at least several tens of km in diameter) that accreted within a few Myr after the earliest Solar System solids (CAIs) condensed [3, 4]. This process necessarily involved the migration of partially molten material to form the lithologic units that are represented by differentiated achondrites and iron meteorites [2]. However, the migration of partial melt was not without thermal consequences. Aluminum is well known to preferentially partition into the early stages of a silicate melt [5]. Subsequent migration of Al-enriched melt would have resulted in a spatial redistribution of this primary heat source.

We will present simulations designed to quantify the effects of silicate melt migration on the internal temperatures of planetesimals. These calculations rely upon the parameterization of a characteristic timescale for melt migration, which is dependent upon several key physical properties such as melt viscosity and silicate grain size. Comparison of this timescale to expected heating and cooling rates allows for the identification of two broadly defined scenarios. The first of these is distinguished by high degrees of silicate partial melting (> 50%). Such systems would be likely to develop magma oceans. The second outcome is characterized by rapid migration of molten silicates, which would act to preferentially remove ^{26}Al, preclude further heating and thus prevent full differentiation. These scenarios will be discussed in the context of meteoritic evidence for the full and partial differentiation of planetesimals.

[1] Burbine *et al*. (2002) In: *Asteroids III*, Eds. W.F. Bottke, A. Cellino, P. Paolicchi, R. Binzel, (Tucson: University of Arizona Press) p. 653–667. [2] McCoy *et al*. (2006) In: *Meteorites & the Early Solar System II*, Eds. D. Lauretta, H. McSween, (Tucson: University of Arizona Press) p. 733–745. [3] Ghosh & McSween (1998) *Icarus* **134**, 187–206. [4] Hevey & Sanders (2006) *MAPS* **41**, 95–106. [5] Agee & Walker (1990) *Contrib. Mineral. Petrol*. **105**, 243–254.

Carbon isotope fractionation in the oil of the Lake Baikal

V.I. MOSKVIN[1], D.V. SEMENOVA[2], V.A. PONOMARCHUK[2] AND O.M. KHLISTOV[3]

[1]Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, Novosibirsk, Acad. Koptyug av., 3, Russia

[2]Sobolev Institute of Geology and Mineralogy SB RAS, Novosibirsk, Acad. Koptyug av., 3, Russia

[3]Limnological Institute SB RAS, Irkutsk, Ulan-Batorskaya st.,3, Russia

The detailed study of natural oil shows of the lake Baikal was started at the end of last – the beginning of present centuries [1]. The oil passes the boundary: solid phase – water during the migration process from the center of oilformation that occurs in Cenozoic lacustrine sediments. The δ^{13}C values were determined using the Thermo Finnigan 253 mass spectrometer in combination with the Finnigan Elemental Analyser (EA) + ConFlo III preparation unit. Carbon isotope composition of initial paraffin oil is of -27, 7‰. As a result of different surface processes (predominantly dewaxing of oil) the cone-shaped bituminous buildups with size of 2m^3 to 25000m^3 are formed at the lake bottom. The bituminous formations are quite rapidly occupied by living organisms. The latter utilize oil hydrocarbons. Isotope composition of total carbon of organic matter of the buildups at the depths of 870-900 meters in the area of Gorevoi Utes cape varies from -25, 1‰ to -27, 0‰ depending on duration of the biodegradation process.

The specific structures – 'droppers' – are formed on the buildups under conversion from solid to liquid state (melting). The oil globules of 0, 3 – 1, 5 cm in diameter rise to the lake surface with certain periodicity from the 'droppers'. Carbon isotope composition of oil changes from -27, 1‰ to -26, 6‰ depending on the biodegradation extent.

[1] Kontorovich *et al*. (2007) *Russian Geology & Geophysics* **48**, 1046–1053.