Geophysical Research Abstracts,
Vol. 10, EGU2008-A-08080, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-08080
EGU General Assembly 2008

Impact-induced vaporization of magnesiosilicates: the role of "enstatite" clusters.

M. V. Gerasimov (1), Yu. P. Dikov (1,2), O. I. Yakovlev (1,3).

(1) Space Research Inst., Profsoyuznaya st., 84/32, Moscow, 117997, (2) Inst. of Ore Deposits, Petrography, Mineralogy and Geochemistry; (3) Vernadsky Inst. of Geochem. and Analytical Chemistry; Russian Academy of Sci., Moscow, Russia.

Ultramafic and mafic minerals are the main components which could represent the material of planetesimals impacting the growing Earth during the period of accretion. Transformation of chemical composition and structure of planetesimals material during impact processing and particularly during impact vaporization can result in some global evolutionary trends of the Earth during its growth. Most of experiments on evaporation are performed at vacuum chamber pressures and temperatures which are not compatible with impact related conditions. The goal of our experiments was to investigate behavior of Mg and Si during vaporization of ultramafic and mafic rocks and minerals at conditions typical for hypervelocity impact vaporization.

Experiments were performed using two stage light-gas-gun (LGG) and laser pulse (LP) simulation techniques [1]. Condensates were collected on Ni and Cu foils which were placed into the path of the vapor plume expansion. LGG experiments were performed with olivinite and serpentinite targets (Cu projectile v_{imp} $\sim$6 km/s). LP experiments were done with olivine, serpentine, pyroxene, enstatite, and meteorites: Tsarev (L5), Etter (L5), Allende (CV3), and Indarch (EH4).

Compositions of condensates are regularly shifted towards higher concentration of silicon and depletion in magnesium and iron except for pyroxene structures, which did not have much change from starting composition. Mg/Si ratio for olivine, serpentine and enstatite through the thickness of the condensed films was about unity. There is also a uniformity of chemical structure of condensed materials which is characterized

by dominant chain polymerization of silicon-oxygen tetrahedrons with sufficient portion of framework, some portion of isolated structures, and reduced forms of elements (Si^{+2}, Si^{0}, Fe^{0}, Mg^{0}).

Near critical point vaporization of complex systems is characterized by volatilization of molecular clusters [1] which can become a dominant part of the vapor. Cited effect provides strong evidence for volatilization of Mg and Si from high-temperature melts in the form of molecular clusters which have Mg/Si ratio about 1, or "enstatite" cluster.

Extrapolation of thermo-dynamic data to temperatures up to 5000 K shows that at temperatures over $\sim$2500 K melts looses the domination of "olivine" clusters and "enstatite" clusters become dominant.

Acknowledgment: This work was supported by RFBR grant 07-05-01054.

References: [1] Gerasimov M.V., et al. (1998) *Earth, Moon, and Planets*, vol. 80, Nos. 1-3, pp.209-259. [2] B.Fegley,Jr, A.G.W.Cameron. *Earth and Plenet. Sci. Lett.*, 82, 1987, p. 207.