EXPERIMENTAL DATA ON IMPACT-VAPOUR DIFFERENTIATION

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The impact experiments (5.0-6.5 km/s) which we carried out using the two stage hypervelocity launch facility (the experimental technique is described in [1]) showed that the impact vaporization (IMPVAP) is selective that is the impact melt and vapor have different compositions. Some typical data of the impact vapor (≡ condensate) and initial rock compositions are presented in the Table.

	Ultramafic target		**Mafic target**		**Acid target**	
wt.%	*harzburgite*	*condensate*	*basalt*	*condensate*	*granite*	*condensate*
SiO_2	45.2	52.6	51.8	61.7	70.2	50.8
Al_2O_3	1.7	2.7	15.4	16.7	16.0	19.2
FeO	7.8	9.6	9.9	1.7	2.3	1.1
MgO	43.6	25.1	8.2	3.7		
CaO	1.5	4.3	11.7	8.2	1.1	3.5
Na_2O	0.1	3.8(?)	2.8	7.0	3.8	22.7
K_2O	0.1	1.9(?)	0.2	1.0	6.6	2.7

At least 5 conclusions follows from the experiments: 1) The IMPVAP of ultramafic rocks tends to more SiO_2 and less MgO contents in the vapor. A comparison between target rocks and vapors shows that the SiO_2 /MgO ratio is as a rule higher a 1.5-2 times in vapor phase; 2) The IMPVAP of a basalt gives rise the more silica- and alkalies-rich vapors. The total apobasaltic vapor compositions are formally similar to granodiorite ones; 3) The IMPVAP of acid rocks tends to silica decrease in the vapor. The total apogranitic vapor compositions are formally similar to nepheline-syenite ones; 4) It was detected the systematic increase of a number low volatile lithophile elements (U, Th, Hf, REE) in the vapor phase; 5) It was measured and estimated that at the impact velocity ~6 km/s the total mass of silicate vapor reached amounts comparable to ~10% of the projectile mass.

The behaviour of the elements during IMPVAP does not obey the classic row of volatility. This is result of specific cluster mechanism of IMPVAP under conditions of impulse high temperature heating. Molecular cluster can join together elements with different individual volatility that is responsible for joint vaporization, transport and condensation. The main detected clusters had enstatite (Mg:Si=1:1) [2] and nepheline (Na:Al:Si=1:1:1) [3] types.

If we take into account that all the planet mass is just a sum of former projectiles, the portion of the planet material which was involved in IMPVAP and possible differentiation is about and more ≥ 10%. Hence, the obtained data permit to suggest that the impact protoEarth accretion was accompanied by profound changes of the planetary substance as a result of IMPVAP and later vapor condensation. Through all accretionary time the main petrochemical tendency of the surface rocks was increase of silica contents due to cyclic impact vaporization-condensation process and increasingly more admixture of condensate materials into surface regolith. It is not difficult to imagine that the impact differentiation could lead (or promote) to the formation of primary basalt crust and even zones with primitive granitic-like rocks.

1. Gerasimov M.V. et al., 1999. In: "Laboratory Astrophysics and Space Research", ASSL.236, eds. P.Ehrenfreund et al., KAP, 279-330.
2. Dikov Yu.P. et al., 1994. LPS XXV (Abs.), 329-330.
3. Yakovlev O.I. et al., 1997. Geokhimiya, N12, 1181-1195 (in Russian).