GEOCHEMICAL IMPLAMENTATIOS OF THE FORMATION OF THE EARTH-MOON SYSTEM BY WAY OF FRAGMENTATION OF THE ORIGINAL GAS-DUST CLOUD.

E.M.Galimov. Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian academy of Sciences, 119991 Moscow.Kosygin str., 19

Introduction. The strong isotopic similarity of the Earth and the Moon indicates their origin from a common source. On other hand they are different in chemical composition. The Moon is depleted in iron and volatiles and enriched in the refractory elements. The hypothesis of "megaimpact" origin of the Moon fails to satisfy the geochemical constraints. Therefore we have worked out entirely different concept [1].

Result and Discussion. We have shown that the Earth and the Moon could have formed by fragmentation of a common massive gas-particle body (a cloud). The present-day rotational moment of the Earth-Moon system is sufficient for the fragmentation provided that evaporation of the particles is taken into account. The evaporation occurs during contraction of the cloud due to adiabatic heating. The partial evaporation of the particles causes loss of iron in form of FeO and volatiles. The experiment shows that evaporation of 40% of the chondritic material makes the composition of the residue similar to that of the Moon. Fragmentation leads to the formation of two condensed high temperature bodies - the embryos of the Earth and Moon. The computer modeling shows that the larger fragment (eventual the Earth) collects the overwhelming part of the surrounding material, while the smaller one grows insignificantly. Thus the Earth acquires the initial (chondritic) composition of the cloud, whereas the Moon retains high temperature composition of its embryo. Analysis of the isotopic systems: Hf-W, Rb-Sr, Xe-I-Pu, and U-Pb allow dating the main events: the fragmentation with the formation of the Moon approximately 50 million years and the completion of the Earth formation about 120 million years after the origin of the Solar system. The vapor is expelled from the inter-particles space by the carrier gas, which are primordial hydrogen and the water forming due to reduction of the iron oxide. Isotope exchange between particle and the vapor in the inter-particle space, excludes isotope fractionation during loss of volatiles in our model. The model offers solutions for some long-debated problem, for instance: the excess of siderophile elements in the Earth mantle, loss of heavy volatiles like Pb and Rb etc.

References: References: [1] Galimov E. M. and Krivtsov A.M. (2012) *Origin of the Moon. New Concept. Geochemistry and Dynamics.* De Grueter, Berlin/Boston, 168 pp.