EXPERIMENTAL MODELING OF IMPACT-INDUCED HIGH-TEMPERATURE PROCESSING OF SILICATES. M.V.Gerasimov[1], Yu.P.Dikov[2], and O.I.Yakovlev[3]. [1]Space Research Institute, RAS, Moscow 117997, Profsoyuznaya st., 84/32, mgerasim@mx.iki.rssi.ru, [2]Institute of Ore Deposits, Petrography, Mineralogy and Geochemistry, RAS, Moscow 109017, Staromonetny per., 35, dikov@igem.ru, [3]Vernadsky Institute of Geochemistry and Analytical Chemistry, RAS, Moscow 117975, GSP-1, Kosygin st., 19, yakovlev@geokhi.ru.

Introduction: Large scale impacts of asteroids and meteorites play an important role in the evolution of planets and their satellites. Pulse input of huge energy during an impact results in noticeable changes in both mechanical and geochemical state of colliding material. The complexity of geochemical processes during an impact suggests experimental modeling as the main tool of its investigation rather than computing approach. On the other side, the modeling of mechanical issues of large scale impacts is mainly a success of computations. We need to have a good cooperation between both computer modeling of mechanical issues of an impact and experimental investigations of geochemical processes to build up a more or less realistic picture of a large-scale impact.

Experimental investigation of high-temperature modification of silicates. Experiments were done by use of hypervelocity gun facilities and laser pulse installation [1]. Some principal effects of high-temperature processing of silicates are:

Formation of clusters during vaporization. Volatilization of elements during impact-induced vaporization proceeds not only as classical volatilization of atoms and oxides but by formation of molecular clusters which can assemble a number of elements with different individual volatility. Experiments prove the formation of "enstatite", "netheline", and "wollastonite" clusters [2,3]. The formation of clusters provides less specific energy of vaporization of silicates compared to that calculated in assumption of total dissociation of materials and must be accounted for in computations.

Noticeable redox processes. The main element of silicates is oxygen which is also mobile during high-temperature processes and provide noticeable redox processes in the system. Experiments indicate simultaneous formation of mainly all possible redox states of elements [4]. Highly oxidized states of elements coexist with their reduced states. Phases of reduced carbon, iron, and other elements can be formed during impacts despite of oxidizing conditions.

Abnormal volatility of refractory elements. Experiments show a rather high mobility of elements which are usually considered as refractory and are accounted for as indicators of parts of different materials during mixing [5]. Among such elements are REE, highly siderophile elements (HSE), and other. The mechanism of abnormal volatility need more investigation but it can be a result of formation of specific clusters. HSE can be mobilized into forming and dispersing metallic iron droplets [6].

Problem of mixing of colliding materials. Chemical composition of forming objects during an impact is the result of mixing of parts from naturally heterogeneous projectile and target materials and also due to selective mobility of elements. The mixing of projectile and target materials does not have sufficient coverage by computing modeling and the estimation of the volume and degree of mixing is still uncertain. Usually, the input of projectile material is considered by an account for of the increase of HSE in impactites and by isotopical considerations. None of methods is strict and can be applied only to individual samples. There is a reasonable deficit of impactites which represents a pure projectile material. Mixing seems to be a valuable factor of modification of projectile material and it should be considered using computing methods. The mechanism of mixing of projectile and target materials probably can be simulated involving Kelvin-Helmholtz and/or Reyley-Taylor instability mechanisms.

Experimental investigation of the possibility of impact-induced formation of so called "pristine" lunar glasses shows that they could be formed by an impact of a chondritic projectile into lunar basalts. The mixing of basaltic and chondritic materials together with high-temperature processing develop impact glasses with the composition similar to lunar "pristine" glasses, which is characterized by: high Mg/Mg+Fe ratio, high Al/Mg ratio, homogeneity, surface correlated volatiles, etc. [7]. The formation of metallic iron drops and their dispersion from high-temperature melts is an important mechanism for depletion of silicate melts in siderophile elements and for formation of agglutinitic glasses.

Acknowledgment. The research was supported by RFBR grant No 01-05-64564.

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