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Mobility of chemical components by shock wave loading of rocks

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The behavior of main rock-forming elements in a some rocks were revealed by using the spherical explosive experiments according to the technique experiments developed in the RFNC – VNIITF, Snezhinsk, Russia. In the region of diaplectic transformations (before a melting of rocks), it was established, that the sequence and the intensity of minerals destroy and chemical components migration have the multilevel crystallo-chemical control (CC).

The first level of CC divide all minerals into two distinct groups: 1) tecto- and cyclosilicates (quartz, feldspars, cordierite) – it is rendered amorphous, being transformed into diaplectic glass; and 2) the all other minerals (sheet-, band-, chain-, ortho- and the others silicates and alumosilicates) – it undergo shock-thermal decomposition (STD), being transformed into shock-thermal aggregates (STA) of secondary minerals.

The second level of CC is determined the shock wave amplitude for starts STD: 25 – 30 GPa for a sheet alumosilicate biotite, 35 – 40 GPa for a band alumosilicate amphibole, 40 – 50 GPa for a chain silicate clinopyroxene, 50 – 55 GPa for a silicate with isolated tetrahedron epidote and so on.

The third level of CC is determined the sequence and intensity of chemical compo-

nents migration by the coordination number (CN) of ions being constituents of the mineral relative to oxygen atoms. The intensity of the migration of chemical components decreases from CN = 12 (potassium in micas) to CN = 6 (iron in biotite and staurolite, magnesium in biotite). Ions with CN = 4 do not migrate up to the onset of matter melting in shock waves. This sequence migration of components preserves also in each mineral of complicate composition. As an example, migration of potassium from biotite (CN = 12) begins from 15 GPa, but magnesium from the same biotite (CN = 6) only from 27 GPa; natrium from plagioclase (CN = 10) from 19 GPA, but calcium from the same plagioclase (CN = 8) from 21 GPa; and so on.

The fourth level of CC is an ion radius. Chemical components with the lesser ion radius migrate formerly. As an example, six-coordinated aluminium (R_i = 0.57 Å) migrate from garnet more intensive than iron (R_i = 0.67 Å).

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