

SHOCK METAMORPHISM OF QUARTZ OF THE ZAPADNAYA CRATER, UKRAINE. T. M. Sokur, Institute of Geological Science, National Academy of Sciences of Ukraine, 55-b, Oles Gontchar Str., Kiev, 252054, Ukraine.

The Zapadnaya impact structure is placed in the western part of the Ukrainian Shield. Interest to this structure was originated by the presence of impact diamonds in it [1].

Detailed investigations of shock metamorphosed quartz from all structural units of the crater were carried out.

Shock pressures were reconstructed by three independent methods: (a) determination of planar deformation features (PDF) orientation in quartz [2–4]; (b) immersion method [3,5]; and (c) X-ray method [3,6].

Shocked quartz from the autogenous breccia of the central uplift contains

PDFs with predominant orientation parallel to {1013}. The basal system occurs in some quartz grains (Fig. 1a). Refractive indices of quartz are lowered up to 1.538 by n_e . Shock pressures of quartz range between 9 ± 2 GPa and 16 ± 2 GPa.

Shocked quartz from the autogenous breccia and crushed rocks of the ring depression basement contains PDFs with predominant orientation parallel to {1013} and {1014}; the later is described in [1]. Refractive indices are decreased down to $n_e = 1.542$., although the quartz prevails with $n_e = 1.544$. Shock pressures of quartz reach up to 12 GPa.

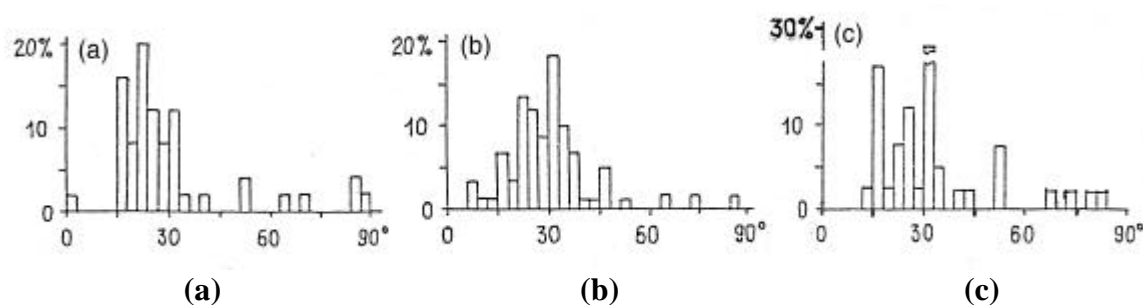


Fig. 1. Frequency distribution of angles between the c-axis and planar microstructures of quartz from shocked crystalline rocks of Zapadnaya crater: (a) autogenous breccia of the central uplift (drill core 102, depth 176 m); (b) allogenous breccia of the ring depression (drill core 3, depth 214 m); (c) suevites of the ring depression (drill core 48, depth 88 m and 96 m).

Deaplectic quartz from the allogenous breccia from the ring depression contains numerous PDFs. Predominant orientation is parallel to {1012} and {1013} in several samples of shocked granite from breccia (Fig. 1b). The lowest refractive index of quartz is up to $n_e = 1.536$. Shock pressures achieve up to 18 GPa [5].

Common differences are observed for refractive indices of diaplectic quartz both from matrix (for example, $n_e = 1.541$) and from inclusion (for example $n_e = 1.536$) in limits of one core specimen both from allogenous and autogenous breccias.

The content of quartz without PDFs increases in the layer of suevites which

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contains the impact diamonds. Two system of PDFs in quartz predominates with orientation parallel to {1012} and {1014} (Fig. 1c). Refractive indices are lowered from $n_e = 1.542$ down to $n_e = 1.537$, that corresponds to the shock pressures from 12 GPa up to 17 GPa [5].

Absence of quartz with signs of shock pressures above 18–20 GPa, diaplectic quartz glass and lechatelierite and simultaneous presence of recrystallized quartz in suevites of Zapadnaya crater testify about their following annealing and recrystallization of shocked quartz by autohydrothermal processes. It is confirmed by the intense hydrothermal transformation of rocks and is expressed in zeolitization, chloritization, carbonization [7]. Surface waters and underground ones were the sources of the hydrothermal solutions.

At the basis of data described above we can judge about the preservation of signs of shock pressure of quartz to the secondary transformations from about 20 GPa and lower.

Degree of shock metamorphism of quartz from all rock types of the Zapadnaya crater corresponds to 1a, rarely 1b stages accordingly to classification of D. Stöffler [3]. Presence of impact diamonds and simultaneous absence of pressure traces up to 20 GPa confirm the permanence to signs of shock pressures up to 20 GPa to the hydrothermal influences.

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