Deformation features of superdeep diamonds

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Much of our knowledge of the Earth's deep interior comes from theoretical models, which are based on the results of experimental petrology and seismology. Diamonds in such models are the unique natural samples because they contain and preserve inclusions of mantle materials that have been entrapped during diamond growth and remained unchanged for long geologic time. In the present study for superdeep sublithospheric diamonds from Saõ-Luiz (Juina, Brazil) and northeastern Siberian Platform with mineral inclusions of the Transition Zone and Lower Mantle (majorite garnet, coesite (stishovite), ferropericlase and Mg-Si-, Ca-Si-, Ca-Ti, Ca-Si-Ti-perovskite), the diffraction of backscattered electrons technique (EBSD) revealed features of the internal structure.

Superdeep diamonds are characterized by a defective and imperfect internal structure, which is associated with the processes of growth and post-growth plastic deformation. The deformation is manifested both in the form of stripes parallel to the (111) direction, and in the form of an unordered disorientation of crystal blocks up to 2°. In addition, for many crystals, a block structure was established with a greater disorientation of the sub-individuals, as well as the presence of "diamond-in-diamond" inclusions and microtwins. Additional stresses are often observed around inclusions associated with the high remaining internal pressure. It has previously been shown that the crystal structure of superdeep diamonds is significantly deformed around inclusions of perovskites, SiO_2 (stishovite?), and Mg_2SiO_4 (ringwoodite?). The significant plastic deformations detected by the EBSD around inclusions testify to phase transitions in superdeep minerals (perovskites, stishovite, and ringwoodite) [1].

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