ORIGIN OF MELT IMPACTITE AND ITS DIAMOND POTENTIAL AS DISPLAYED BY DEEP DRILLING DATA

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A deep borehole (5374 m) is driven in the center of Puchezh-Katunka, a large diamondiferous ring structure, Russia. Origin of this structure remains disputable: an endogeneous explosion (alkali basic volcanism or hydrogen degassing) versus cosmogenic impact. The results of geological and geochemical studies of the drillcore material of the deep borehole are: (1) Within the 550-5374 m interval, the impact metamorphism occurred isochemically, in the Precambrian basement its grade is uneven and decreases with depth; (2) Melt impactite (MI) occurs within a crater and along a sedimentary cover/basement interface (a diamondiferous variety) either at the top of the basement (550-1500 m); (3) MI is formed in situ and either inherits its chemistry from totally melted parent rock, or gains alkali, siderophiles, and rare earths (selective melting); (4) Within the crater and in the basement MI were formed autonomously at no significant vertical movements of the melt, as indicated by I0Sr values. Those typical of MI (0.705-0.709) and parent basement rocks (0.704-0.708) are close, whereas diamondiferous MI of the crater displays higher I0Sr (0.711-0.713): it is a product of polymictic breccia's melting, and breccia contains fragments of sediments (I0Sr 0.720-0.738). As diamond-lonsdailite intergrowings contain graphite and chaoite, we conclude that the impact influenced Corg-rich varieties of the cover. Absence of such varieties in the basement, along with in situ formation of MI do not favor occurrence of diamonds in the basement of the ring structure. Low 3He/4He in impactite (1.9-4.7)x10-8 comparable to that of continental crust indicate that no mantle fluids influenced MI's formation.