

m. Solubility of thermodynamically stable diamond in $MgCO_3$ – $FeCO_3$ – Na_2CO_3 carbonate melts at 6 GPa (A. Spivak and Y. Litvin/Chernogolovka; G. Khachtryan/Moscow, I. Chuvashova, D. Simonova, N.A. Dubrovinskaia/Bayreuth and L.S. Dubrovinsky)

The diamond content of kimberlite bodies depends in part on the amount of diamonds formed in the parental silicate-carbonate-carbon melts at depths of 150-250 km, and in part on their survival during the transport to shallow levels. Diamonds lose part of their mass via dissolution into the transporting carbonate-containing kimberlite melts during the short ascent time and the solidification of the melts within the continental crust. The interaction of transporting kimberlite melts and diamonds is indicated by shape and crystal face changes due to natural dissolution. The scale of the loss of diamond mass during dissolution can be determined experimentally.

An experimental study of diamond solubility was carried out in the multicomponent carbonate system $MgCO_3$ (30 wt. %) – $FeCO_3$ (35 wt. %) – Na_2CO_3 (35 wt. %) at 6 GPa and 1400 °C with durations of 1, 2, 3 and 4 hours using the large-volume toroidal anvil press MavoPress LPRU 1200 -555/50.

In the 3 hour experiment (approximate time of kimberlite magma ascent from the upper mantle to the surface), the diamond crystals lost 6-7.5 wt. % of their mass by dissolution into the surrounding carbonate melt (Fig. 3.2-15). After quenching, the bulk material is composed of dendritic carbonate microphases. The diamond faces are entirely covered with a thin, black graphite film, which seems to have formed during quenching after partial dissolution of the diamond. Thus, the experimental results reveal the processes of dissolution of thermodynamically stable diamonds by a carbonate melt.

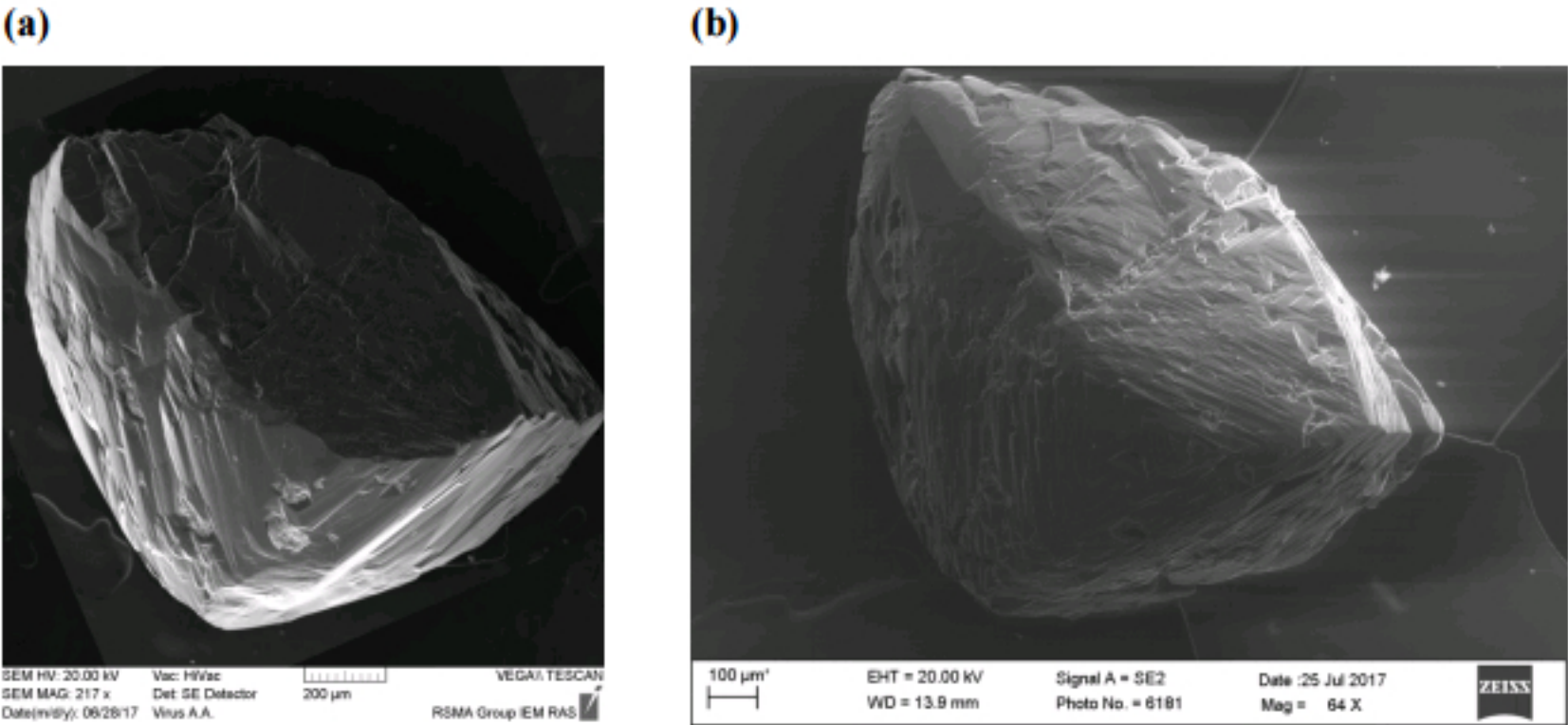


Fig. 3.2-15: SEM images of natural single crystal diamond before (a) and after (b) interaction with carbonate melt at 6 GPa and 1400 °C with a duration time of 3 hours (mass loss was 7.3 wt. %).