

ZIRCON-INCLUSION MINERALOGY OF THE DIAMOND-GRADE ECLOGITE IN THE KOKCHETAV MASSIF, NORTHERN KAZAKHSTAN

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In order to determine the stability field of hydrous phases in the subducting crust in deep mantle, we have systematically investigated mineral inclusions in zircons and compositions of major silicates in diamond grade eclogites from Kumdy-Kol of the Kokchetav Massif of northern Kazakhstan. These eclogites contain Grt + Cpx + Rt + Coe / Qtz + Zo + Am ± K-spar ± Bi. Minor phengites occur as inclusions in Cpx, and zircon. Clinopyroxenes are zoned; the cored augite contains high K₂O up to 0.24 wt% and has phengite inclusions whereas the rimmed omphacite contains secondary K-feldspar (Kokchetavite?) inclusions. Phengite may have been consumed during prograde reaction, and K would have been fixed in Cpx or in the fluid or melt phase. The peak metamorphic condition was estimated at about 950 °C and the minimum pressures at 5 GPa defined by the diamond stability. No hydrous phase including phengite should be stable in these P-T conditions in the MORB system.

More than 500 zircons were separated from the studied high K augite bearing eclogite from the Kumdy-kol area. Approximately 200 zircons were mounted on epoxy disc and polished; mineral inclusions from 78 zircons on the polished surface were examined. Inclusions of Cpx, phengite and garnet were identified in the zircon cores, whereas garnet, rutile, quartz and composite inclusions are in the rims. Zircon rims overgrew on the edge of matrix minerals including quartz. Textural characteristics indicate that zircon cores grew at the peak UHP stage whereas the rims grew in the quartz stability field during decompression. The composite inclusions have assemblages of Ab + Phe + Ep, Rt + Ilm, Qtz + Rt, and Rt + Ab. The three-phase composite inclusion of Ab + Phe + Ep has triple-junction grain boundary, suggesting crystallization from fluid or melt in the zircon. Parageneses of mineral inclusions in both core and rim of zircon delineate a phengite-consuming reaction as follows: Phe + Cpx + Coe = Grt + Rt + Qtz + melt / fluid. With continuous growth of zircon from the core to rims, phengite was consumed, and new garnet, rutile and fluid or melt were formed.