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MICROINCLUSION OF LOWER-MANTLE ROCK IN DIAMOND

Felix Kaminsky (1) and Richard Wirth (2)

(1) KM Diamond Exploration Ltd., Canada (felixvkaminsky@aol.com), (2) GeoForschungsZentrum Potsdam, Potsdam, Germany

A microinclusion of a rock fragment was identified within one of the diamonds from the Rio Soriso placer deposit in the Juina area, Brazil. It is composed of iron carbide, magnesiowüstite and two orthorhombic, postspinel phases, Fe-Mg-Cr and Ca-Cr oxides. All mineral grains are closely intergrown, demonstrating their single-stage origin, except iron carbide, which is partly resorped that implies its early crystallization.

Diffraction patterns of iron carbide grains reveal two mineral species, nitrogen-containing analogues of chalypite Fe_7C_3 (or Fe_2C) [1] and yarlongite Fe_9C_4 [2]. They contain up to 17.5 at.% of N in the cation part (N/(C+N) = 0.47) and should be considered as nitrocarbides. In addition to N, admixtures of O and Si present in these mineral species. Magnesiowüstite has, in its cation composition, 47.75-67.16 at.% Fe, 36.72-47.75 at.% Mg, and minor admixtures of Mn and Cr. Among the two new oxides with orthorhombic structure, one is a polymorph of chromite (Fe^{2+},Mg,Mn) $(Cr,Fe^{3+},Al,V)_2O_4$, which is new in terrestrial environment. It is analogues to xieite, found in the Suizhou meteorite [3], but strongly enriched in Fe. The other orthorhombic mineral fits the stoichiometry $Ca(Cr,Fe^{3+})_2O_4$. This compound is new in the natural environment; the $CaCr_2O_4$ postspinel phase is known only as a synthetic compound [4].

The studied association was formed within the lower mantle at pressure conditions above 40 GPa (that correspond to the formation of $CaTi_2O_4$ [5]). The presence of magnesiowüstite and chalypite suggests the rock origin in the lower part of the lower mantle.

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