Ti-andradite - nagelschmidtite highly oriented rod-like microstructures as indicator of overcooled melt crystallisation

E.V. SOKOL*, S.N. KOKH, V.V. SHARYGIN

V.S. Sobolev Institute of Geology and Mineralogy, Koptyuga 3, Novosibirsk, 630090 Russia (*correspondence: sokol@igm.nsc.ru)

Ti-andradite (up to 14 wt% TiO_2) and nagelschmidtite ($(K,Na)Ca_7(SiO_4)_3(PO_4)$) were found in Ca-rich and SiO_2-undersaturated paralavas from the Dead Sea region. The paralavas are UHT (up to 1200ºC) and ambient pressure combustion metamorphic melted rocks [1]. They consist of gehlenite, α- and β-$Ca_3Si_3O_9$, rankinite, kalsilite, and sulfate-rich fluorapatite, with minor perovskite and magnetite. Ti-andradite and rarer gehlenite and kalsilite include a set of regular, crystallographically controlled rod-like individuals of nagelschmidtite. Because of the very high CaO (39-41wt%) and low SiO_2 (31-37 wt%) and Al_2O_3 (6-11 wt%) contents, the cooling melts behaved like slag; with the rapid decrease in temperature, the low viscosity of the melt favored quick crystallization without quenching to glass. The homogenization temperature of melt inclusions falls into narrow range 1190-1050ºC and supports quenching.

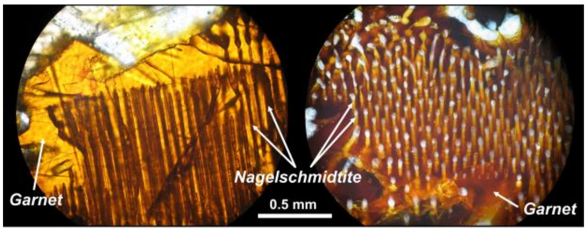

Figure 1: Ti-andradite – nagelschmidtite highly oriented microstructures.

Specific highly oriented microstructures may be classified as periodic eutectic structures or periodical two-phases structures formed via directional nonequilibrium crystallisation of overcooled eutectic melts [2]. Kinetic of overcooling is responsible for the instability of the interface boundaries that in its turn leads to spatial distortions and fluctuatuion of temperature and concentrations on the planar interface [2]. The variation of the interfiber spacing depends on the rate of overcooling and subsequent solidification. *Study was supported by RSF grant 17-17-01056.*

[1] Sokol *et al.* (2010) *Basin Res.* **22**, 414-438. [2] Guskov (2014) *ACES* **4**, 103-119.