$(K,Sr,\square)(Ca,\square)_3Al_6Si_{10}O_{32}$, a dmisteinbergite-like phase from the Luobusa ophiolite, China: Evidence for quenching at mantle depths?

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Corundum extracted from chromitite body Cr-11 in the Luobusa ophiolite near Kangjinla (Tibet, China) contains inclusions of super-reduced Ti phases, largely TiN-TiC. The dmisteinbergite-like mineral consitutes part of a halo around a spheroid 20 μm across composed of 50% of a $Ti_{10}(Si,P)_7$ – $Ti_{11}(Si,P)_{10}$ mixture and 50% $TiSi_2$ with minor TiP. Chemical analysis (EDX) of a crystal *ca*. 4 x 1 μm across yielded a composition $(K_{0.50}Sr_{0.25}\square_{0.25})(Ca_{0.83}\square_{0.17})_3Al_6Si_{10}O_{32}$. 3-dimensional electron diffraction collected on the same crystal allowed structure solution and refinement (dynamical) in the hexagonal space group *P*6/*mcc*, a = 10.2(2) Å, c = 14.9(3) Å, Z = 2. The structure is topologically identical to that of dmisteinbergite, but site occupancies differ, *e.g*., one quarter of the Ca sites in dmisteinbergite are occupied by K and Sr in the halo phase, resulting in considerable rotation of the tetrahedra and doubling of *a* and *b* cell parameters. A phase of this composition and structure has not been reported either as a mineral or as a synthetic compound. Compositionally, the dmisteinbergite-like phase corresponds to 63% anorthite, 11% orthoclase, 5% $SrAl_2Si_2O_8$ and 21% quartz, *i.e*., a Ca-rich silica melt. The spheroid can be interpreted as a droplet of Ti-Si-P melt that crystallized to a mixture of ternary and binary phases. According to Griffin *et al*. [1] and Xiong *et al.* [2], super-reduced phases associated with corundum appear to reflect the local interaction of mantle-derived $CH_4 \pm H_2$ fluids with basaltic magmas in the shallow lithosphere (~30–100 km). Quenching of the silica melt gave a metastable dmisteinbergite-like phase instead of feldspar [3].

[1] Griffin et al. (2016) *J. Petrology*, **57**, 655–684. [2] Q. Xiong *et al.* (2017) *Eur. J. Mineral*, **29**, 557-570. [3] Krivovichev et al. (2012) *Can. Mineral*., **50**, 585-592.