The stability of wöhlerite in agpaitic nepehline syenite: The effect of oxygen fugacity

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Wöhlerite is one of the most common zirconium disilicate minerals in nepheline syenite pegmatites in the Larvik Plutonic Complex (LPC) in the Oslo Rift (Sunde et al, this conference). It commonly occurs as euhedral to subhedral primary crystals formed during early magmatic crystallization, and is commonly intergrown with aegirine, amphibole and magnetite. Unlike related minerals such as hiortdahlite and låvenite, wöhlerite does not occur in stable coexistence with fluorite. Instead, assemblages with hiortdahlite + fluorite replace primary wöhlerite. These observations suggest that wöhlerite and fluorite, and possibly also wöhlerite and biotite, are unstable together, or that the stability field of the relevant assemblages are small and situated at physicochemical conditions not encountered in the pegmatites. The semi-quantitative phase diagram in $\log a_{Na2Si2O5} - \log a_{H2O} - \log a_{Hf}$ a_{H2O}- *log* a_{Hf} space constructed by Andersen et al. (2010) assumed f_{O2} controlled by coexisting microcline + biotite + magnetite. At higher f_{O2} (microcline + magnetite without biotite), the stability fields of wöhlerite + fluorite and hiortdahlite + fluorite expand at the expense of låvenite and eudialyte. Since Fe^{2+} is essential for låvenite and eudialyte, the reason for this change of stability relationships is probably the lesser abundance of Fe^{2+} at higher levels of oxygen fugacity.

References:

Andersen, T., Erambert, M., Larsen, A.O., Selbekk, R. 2010. Petrology of nepheline syenite pegmatites in the Oslo Rift, Norway: Zirconium silicate mineral assemblages as indicators of alkalinity and volatile fugacity in mildly agpaitic magma. Journal of Petrology, 51, 2303-2325.