

A NEW LOVERINGITE OCCURRENCE: ORIENTED RODS IN GARNET FROM THE FOLTEA LHERZOLITE, SOUTH CARPATHIANS, ROMANIA

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Loveringite - $(\text{Ca, REE})(\text{Ti, Fe, Cr, ...})_{21}\text{O}_{38}$ is a relatively rare mineral, belonging to the crichtonite group, identified so far in a number of occurrences related to layered mafic intrusions and their metamorphosed equivalents. TARKIAN & MUTANEN (1974) suggested that it could be more widespread than actually recognised, being overlooked due to its small grain size and optical properties similar to those of other oxide minerals. The material described as lunar Cr-, Ca-, Zr-, Nb- armalcolite (HAGGERTY, 1973) (CCZNA) displays strikingly similar chemical composition and optical properties (*e. g.* LÉVY *et al.*, 1972), implying that the first discovery of loveringite precedes by a few years its official recognition as a new mineral species by GATEHOUSE *et al.* (1978), though in a completely different setting. A remarkable occurrence was described by WANG *et al.* (1999) in the Garnet Ridge (Arizona) kimberlite pipe, where loveringite is cited together with other oxides (rutile, crichtonite, srilankite, carmichaelite) as oriented rod-like inclusions in garnet crystals.

The Foltea garnet lherzolite is an isolated ultramafic body enclosed in upper crustal metapelitic and gneissic rocks of the polymetamorphic basement (the Lotru Metamorphic Suite) of the Getic Nappe in the South Carpathians. Pyrope-rich garnet is a common component in the rock itself or in garnet-clinopyroxenite veins and nests, hosting a variety of oxide, silicate, sulfide and carbonate-rich inclusions. Oxide inclusions usually occur as a net of μm -sized rods and blades oriented along four directions consistent with $\langle 111 \rangle$ of host garnet, and consist chiefly of rutile and loveringite.

Loveringite appears as rods up to 5 μm thick and 300 μm long, blades up to 300 μm and rare elongated grains bordered by crystal faces, all oriented with respect to the host garnet. It is almost opaque, being however translucent in deep olive-green shades in very thin grains. SAED patterns are consistent with a loveringite cell (trigonal symmetry, $a_H = 10.34 \text{ \AA}$, $c_H = 20.68 \text{ \AA}$). The chemical composition recalculated after

WD microprobe analyses is given in Tab. 1 (average of 3 analyses).

Loveringite, together with associated microinclusions in garnet indicates metasomatic processes in the mantle fragment where the Foltea ultrabasite was sampled from. In particular, metasomatism is responsible for HFSE-enrichment recorded by the oxide microinclusions hosted by garnet. The topotactic relationships with host garnet most presumably resulted from epitaxial co-precipitation, a mechanism that has to be considered also in other instances in which garnet contains oriented oxide or silicate rods, usually deemed as exsolution features. An interpretative option between co-precipitation vs. exsolution has to be supported in particular cases by concurrent evidence, given its paramount consequences on the interpretation of the rock geodynamic history.

References

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Table 1: Chemical composition of loveringite from the Foltea ultrabasite.

Na ₂ O	K ₂ O	CaO	SrO	MgO	FeO	NiO	MnO	Fe ₂ O ₃	Cr ₂ O ₃	Al ₂ O ₃	TiO ₂	ZrO ₂	SiO ₂	VO ₂	Σ		
0.23	0.15	2.59	0.45	4.05	9.40	0.08	0.14	1.35	0.94	5.04	70.28	3.36	0.08	0.39	98.52		
K	Na	Sr	Ca	Σ	Mn	Fe ²⁺	Ni	Mg	Fe ³⁺	Cr	Al	V	Ti	Zr	Si	Σ	O
0.05	0.12	0.07	0.76	1.00	0.03	2.15	0.02	1.65	0.28	0.20	1.63	0.08	14.48	0.45	0.02	21.00	38.00