Ludwigite within five occurrences of magnesian skarns from Romania: New mineralogical data

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Ludwigite samples from five boron-bearing magnesian skarns in Romania (Ocna de Fier, Maşca-Băişoara, Cacova Ierii, Băiţa Bihor and Pietroasa) were analysed in order to improve on optical, chemical, thermal, infrared and X-ray database. In all the five occurrences, the mineral is present in the outer skarn zones developed at the contact of igneous bodies of Upper Cretaceous-Paleocene age with dolomite sequences (dolostones or metasomatic dolomites). Ludwigite characteristically associates with kotoite, suanite, szaibelyite, exceptionally with fluoborite and pertsevite, in magnesian skarns containing humites (chondrodite, clinohumite, rarely norbergite), forsterite, magnetite, dolomite, calcite, rarely spinel and fluorite, and retrogressive minerals (i.e., lizardite, chrysotile, clinochlore, brucite, magnesite, pyroaurite, sjögrenite, lepidocrocite, goethite). Ludwigite can be a valuable source for boron. The analyzed samples are compositionally variable with vonsenite ranging from 0.74 to 25.95 mol.%, minor azoproite [up to 6.95 mol.% $(Mg,Fe^{2+})_2(Ti^{4+},Mg)(BO_3)O_2$] and less than 30.01 mol.% $(Mg,Fe^{2+})_2Al(BO_3)O_2$ in solid solution, generally lower, and with minor Sn, Sb, Cr, Ni, Co, Mn, Zn. The mean unit-cell parameters are: *a* 9.255(18), *b* 12.278(39) and *c* 3.048(9) Å at Ocna de Fier; *a* 9.259(28), *b* 12.268(35) and *c* 3.048(9) Å at Maşca Băişoara; *a* 9.246(21), *b* 12.274(32) and *c* 3.051(5) Å at Cacova Ierii; *a* 9.268(16), *b* 12.262(9) and *c* 3.052(6) Å at Băiţa Bihor; and *a* 9.262(33), *b* 12.255(21) and *c* 3.046(13) Å at Pietroasa. The splitting of internal vibrational modes of BO_3 group on the infrared spectra is consistent with its C_{3v} or C_s point symmetry, which is characteristic for magnesian ludwigite. The compositional data combined with experimental synthesis of borates, accounts for crystallization at temperatures of 600 - 650°C and oxygen fugacities of 10^{-18} - 10^{-14} atm.