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# The crystal structure of the new mineral lavoisierite: the link between sursassite and "ardennite"

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Sursassite [$Mn_4^{2+}Al_6(SiO_4)_2(Si_2O_7)_2(OH)_6$], "pumpellyite" [$Ca_4M_6^{3+}(SiO_4)_2(Si_2O_7)_2(OH)_6$], and "ardennite" [$Mn_4^{2+}(M_5^{3+}Mg)(SiO_4)_2(T^{5+}O_4)(Si_3O_{10})(OH)_6$] ($M^{3+}$ = Al, Mn; $T^{5+}$ = As, V) are mixed anion silicates. The common feature in the crystal structures of these minerals is represented by the occurrence of columns of edge-sharing [$AlO_6$] octahedra, which are connected to each other by [$SiO_4$] and [$Si_2O_7$] groups ("pumpellyite" and sursassite) or by [$SiO_4$] and [$Si_3O_{10}$] groups ("ardennite"). In "ardennite" additional [$T^{5+}O_4$] tetrahedra occur, together with other [$MO_6$] octahedral columns; the latter are present in "pumpellyite" and sursassite, too. Structural relationships between "pumpellyite" and "ardennite" [1] and between sursassite and "pumpellyite" [2] have been depicted; in the latter case intergrowths at the unit-cell scale have been revealed through HRTEM. More recently, it has been shown that the three structure-types represent three of the four maximum degree of order (MDO) polytypes within a family of OD structures built up by two kind of layers [3]. SAED patters collected on a sample of "ardennite" from Evvia (Greece) showed the occurrence of a potentially non MDO-polytype with a doubled $c$ parameter ($\approx$ 37 Å, instead of 18.5 Å of "ardennite"). The correct structural interpretation of that polytype was made difficult by the lack of high resolution lattice images.

Recently, a new mineral related to these phases was found in the Viù Valley (Piedmont, Italy) and approved with the name lavoisierite (IMA #2012-009). It has $c$ $\approx$ 37 Å and its crystal structure represent the missing link between sursassite and "pumpellyite", on one side, and "ardennite", on the other side. In fact in the structure of lavoisierite all the three type of ligands between octahedral column are present, namely [$SiO_4$], [$Si_2O_7$], and [$Si_3O_{10}$] groups. The structure of lavoisierite displays a regular alternation of sursassite-type and ardennite-type slabs. In OD terms, lavoisierite is the first non-MDO polytype, maybe corresponding to the one already observed at Evvia, within the same family including sursassite, "pumpellyite", and "ardennite". The ideal crystal chemical formula of lavoisierite is $Mn_8^{2+}[Al_{10}(Mn^{3+}Mg)](SiO_4)_4(Si_2O_7)_2(PO_4)(Si_3O_{10})(OH)_{12}$.

[1] Allman, R. & Donnay, G.: *Acta Crystallogr.*, **B27**, 1871 (1971).

[2] Mellini, M., Merlino, S., Pasero, M.: *Phys. Chem. Minerals*, **10**, 99 (1984).

[3] Pasero, M. & Reinecke, T.: *Eur. J. Mineral.*, **3**, 819 (1991).