CRYSTAL CHEMISTRY OF BELGIAN ARDENNITES

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Introduction

Ardennite is a rare Mn-rich aluminium silicate containing arsenate and/or vanadate groups. The two mineral species, ardennite-(As) and ardennite-(V), are occurring in highly oxidized and manganiferous metasediments that were affected by low to high-grade metamorphism. Several substitution mechanisms occur on various crystallographic sites, explaining the complex chemical compositions of ardennite. During last decades, investigations carried out in the Stavelot-Venn Massif (Belgian Ardennes) have made it possible to identified 12 new ardennite occurrences in the region. Single-crystal X-ray diffraction measurements and structure refinements were then performed.

Ardennite

•**First described** by von Lasaulx and Pisani in 1872.

•**General formula:** $A_4M_6T_6O_{22}(OH)_6$

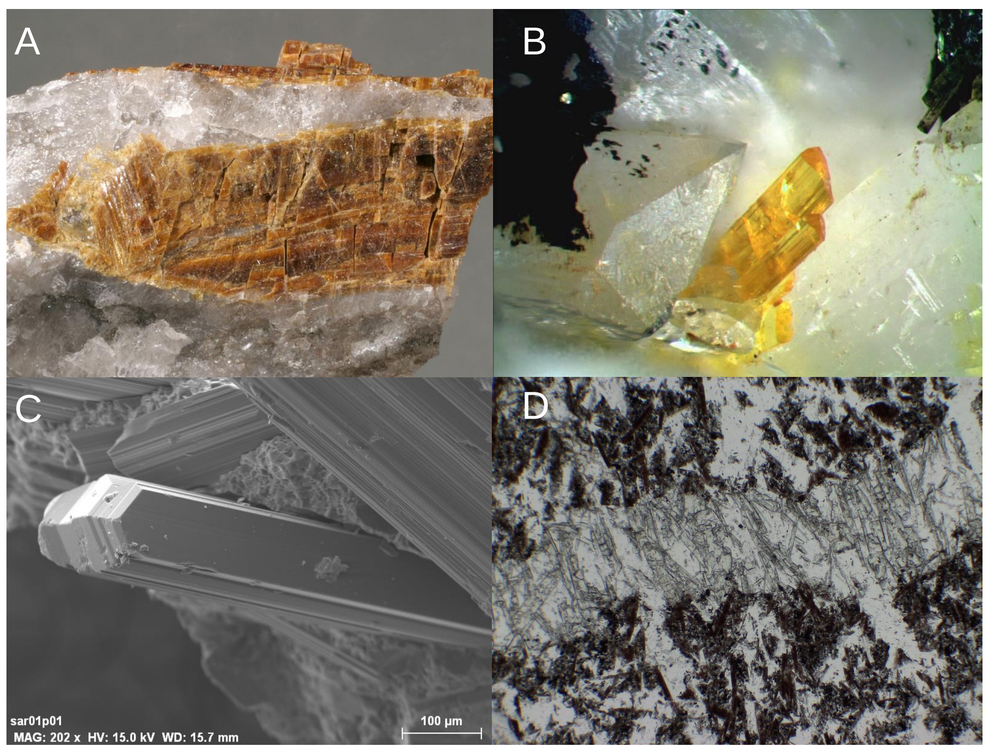
$Mn^{2+}{}_4(Al,Mg)_6(Si_3O_{10})(SiO_4)_2[(As,V)O_4](OH)_6$

•**Crystallography:** orthorhombic, space group *Pnnm*, $a \approx 8.8$ Å, $b \approx 5.8$ Å, $c \approx 18.6$ Å, $Z = 2$

•**Type localities:**

Salmchâteau (Belgium), Piedmont (Italy)

Ardennite samples and their crystallographic forms

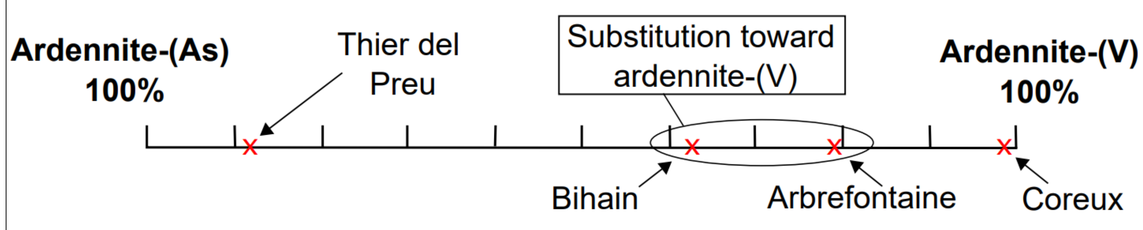


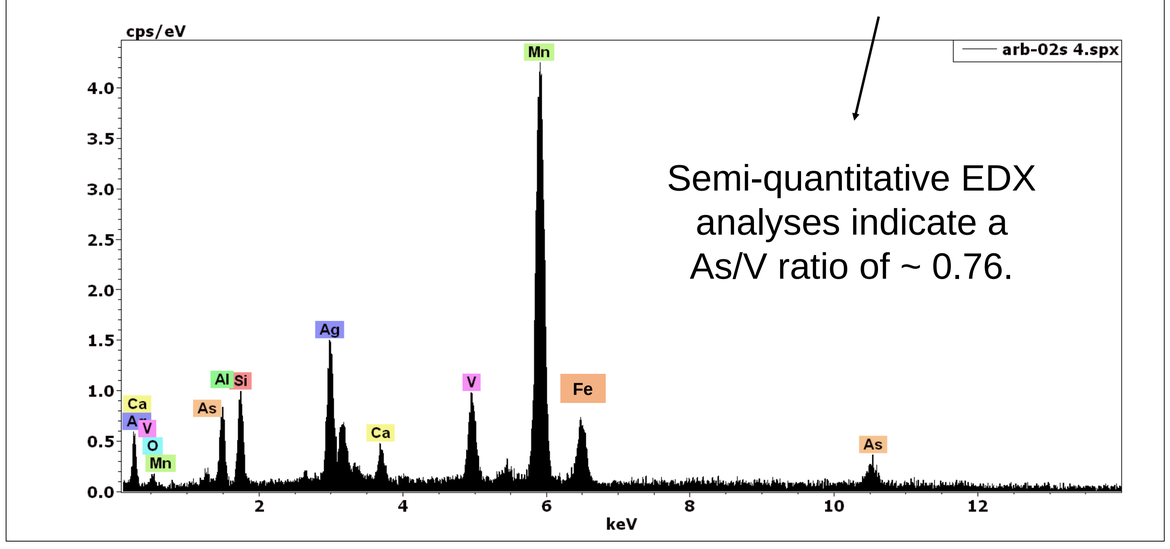
(A) & (B). Ardennite-(As) samples on quartz from Salmchâteau. (C). Ardennite crystal, Thier del Preu. Scanning electron microscope, secondary electrons image (M. Blondieau). (D) Acicular crystals of ardennite in a quartz vein, plane-polarized light.

New Belgian occurrences

Samples	a (Å)	b (Å)	c (Å)	V (Å^3)	Occ in T4
Thier del Preu	5.798	18.477	8.695	931.515	0.96
Bihain	5.804	18.479	8.696	932.583	0.81
Arbrefontaine	5.803	18.474	8.704	933.056	0.76
Coreux	5.810	18.506	8.703	935.707	0.70

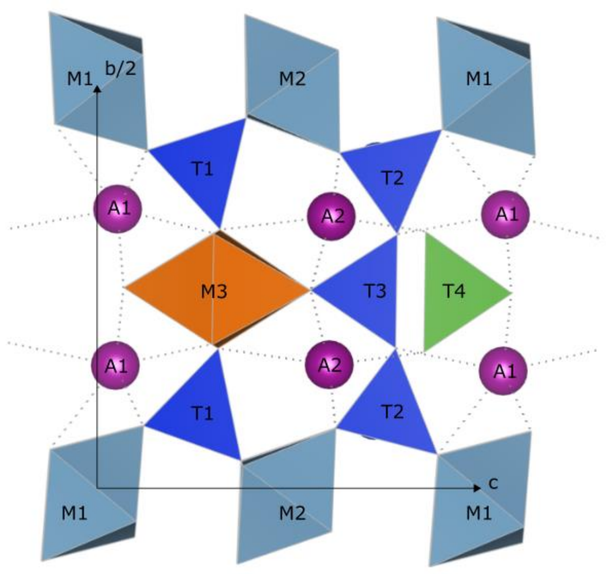
Proportions of As and V calculated from refined occupancies on the T4 site





Semi-quantitative EDX analyses indicate a As/V ratio of ~ 0.76.

Crystal structure



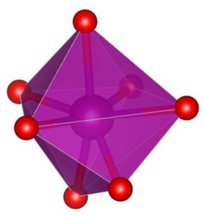
•A1, A2 = Mn^{2+}, Ca^{2+}

•M1, M2 = Al

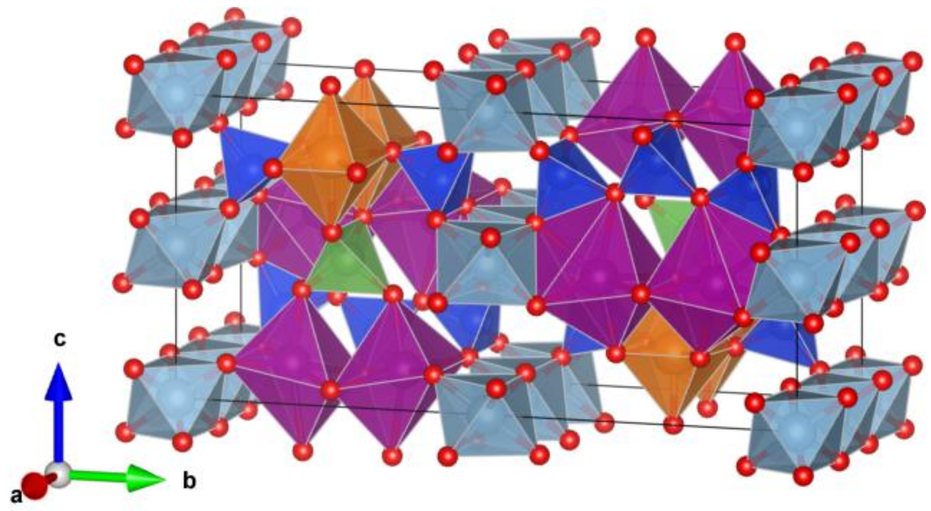
•M3 = Mg, Fe^{3+}

•T1,T2,T3 = Si

•T4= As^{5+}, V^{5+}, P^{5+}



A2: seven-fold coordination



The knowledge of the cation distributions in these 12 new occurrences, combined with chemical data, will help us to better understand the crystal chemistry of the complex ardennite group.

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