

New possible end-members in the ardennite group

Martin DEPRET¹, Frédéric HATERT¹, Florent BOMAL¹

Introduction

Ardennite is a rare Mn-rich aluminium silicate first discovered in a quartz vein at Salmchâteau (Belgian Ardennes) during the second half of the 19th Century. Samples were simultaneously investigated by A. von Lasaux and F. Pisani, who considered the species initially as vanadium-bearing, and then as arsenic-rich. F. Pisani decided to name the species dewalquite, in honour of the famous Belgian geologist Gustave Dewalque, while A. von Lasaux named the mineral ardennite for the Ardennes region in Belgium where it was found.

Ardennite

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

• **General formula:** $A^{2+}_4(M^{3+}_5M^{2+})(T^{4+}_5T^{5+})O_{22}(OH)_6$

$Mn^{2+}_4Al_4(AlMg)(Si_3O_{10})(SiO_4)_2[(As,V)O_4](OH)_6$

• **Crystallography:** orthorhombic, space group *Pnmm*, $a \approx 8.8 \text{ \AA}$, $b \approx 5.8 \text{ \AA}$, $c \approx 18.6 \text{ \AA}$, $Z = 2$

• **Type localities:**

Salmchâteau (Belgium), Piedmont (Italy)



Substitution mechanisms

Structural formula :

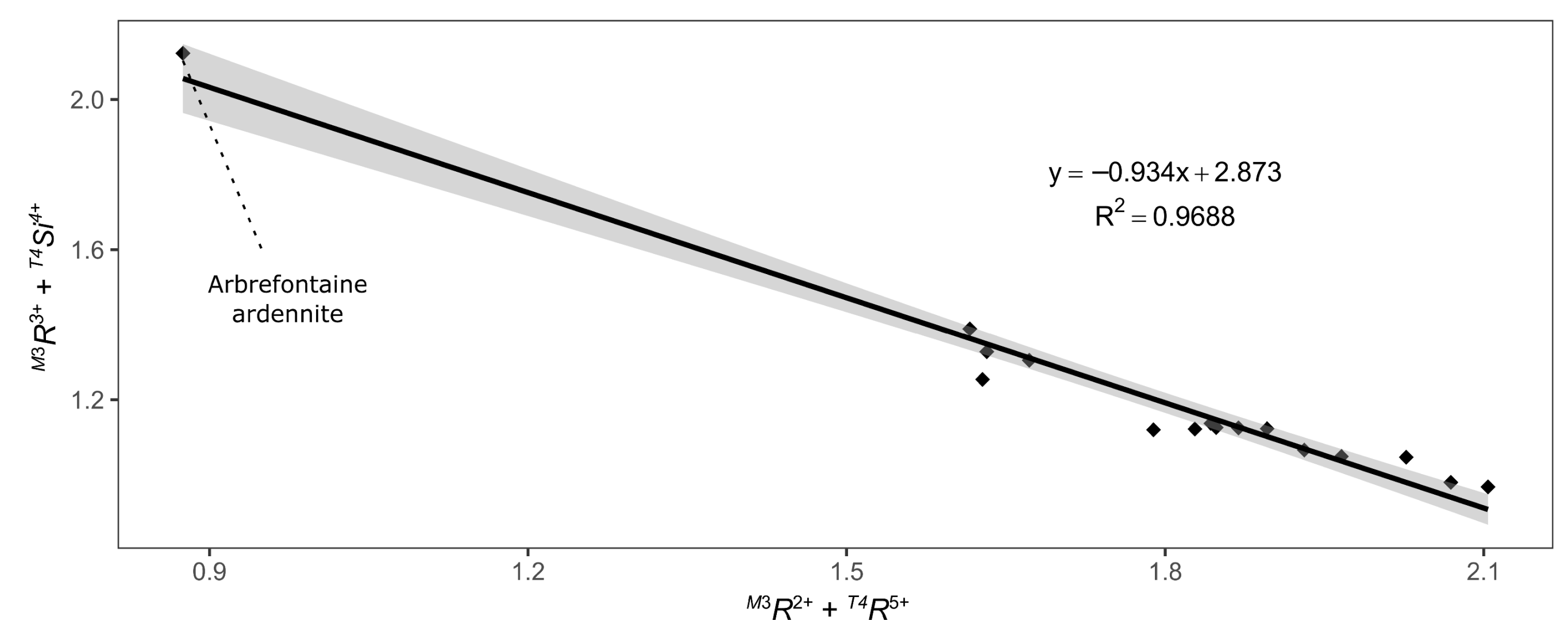
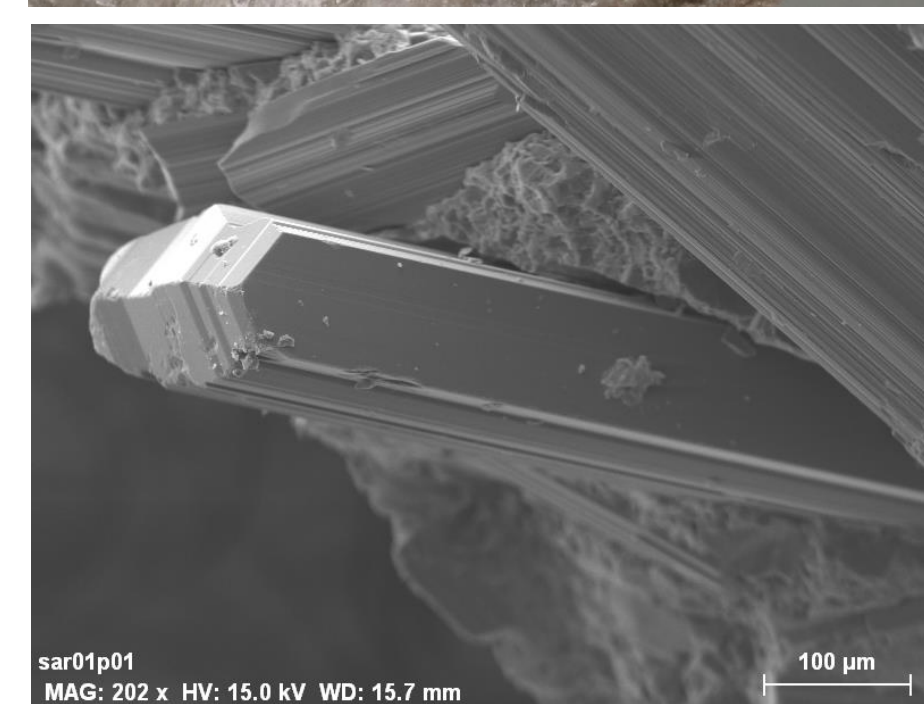
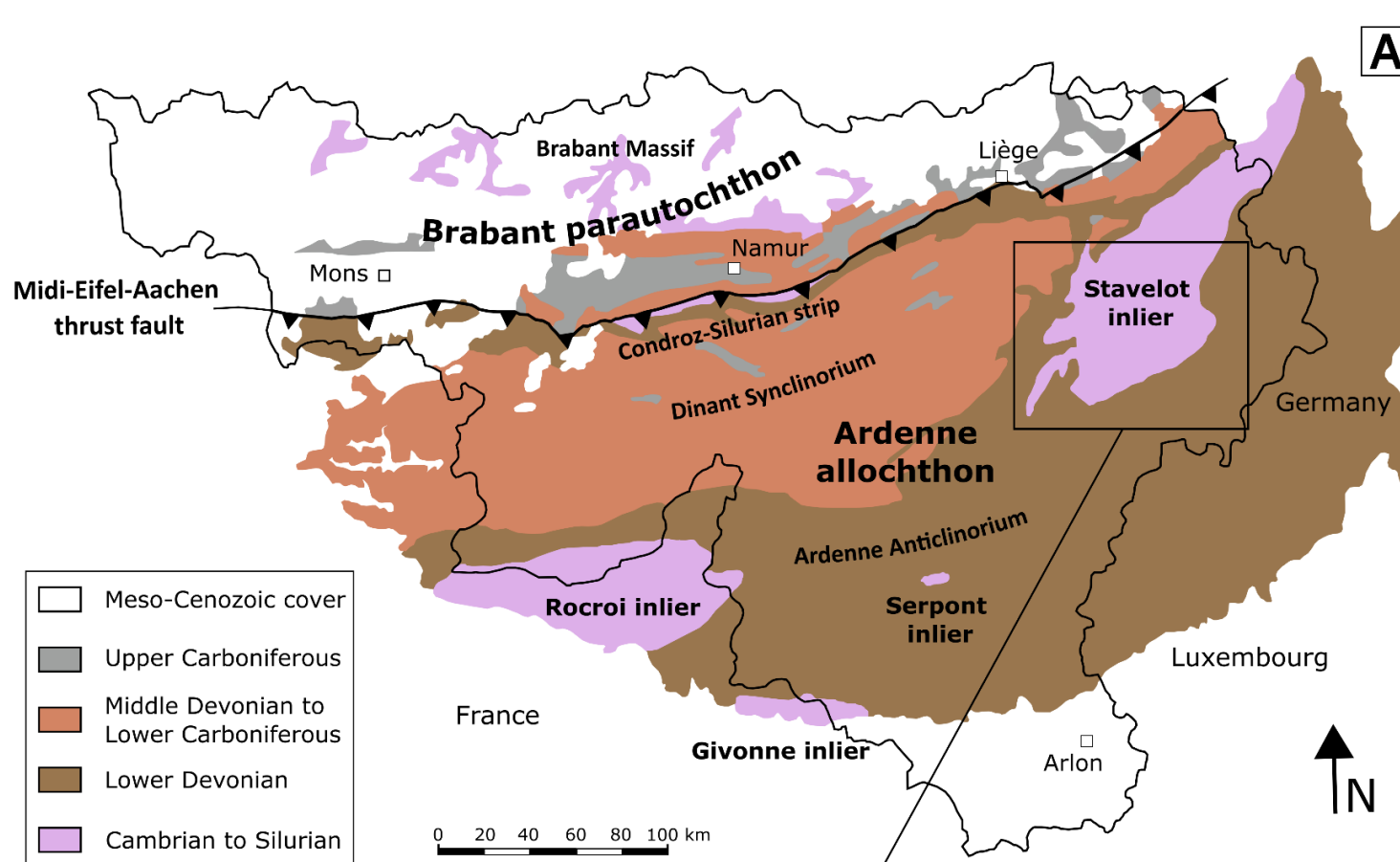
$A1_2A2_2(M1_2M2_2M3_2)(T1_2T2_2T3_2T4)O_{22}(OH)_6$

A sites → homovalent substitutions of Mn^{2+} by Ca^{2+} and Mg^{2+}

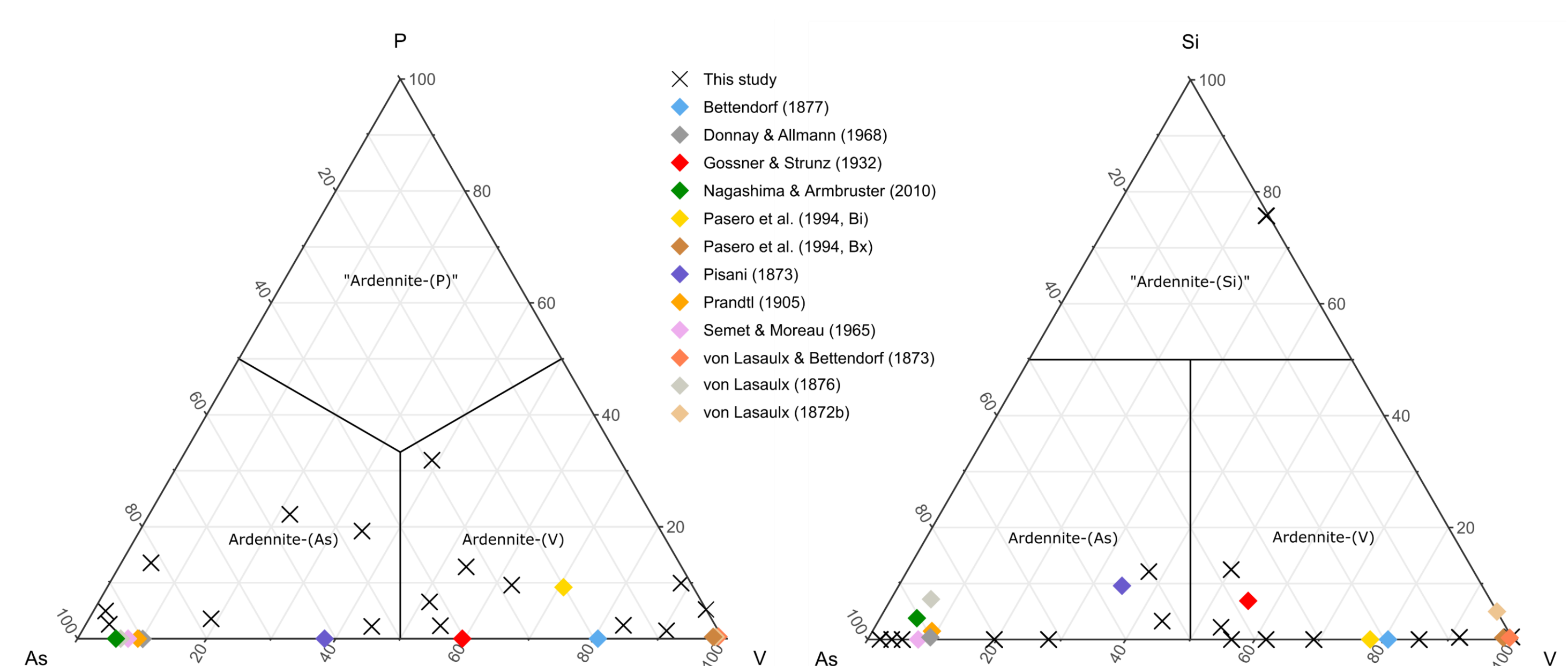
M sites → coupled heterovalent substitutions between M3 and T4

$T^4Si^{4+} + M^3(Al,Fe)^{3+} \leftrightarrow T^4(As,V,P)^{5+} + M^3Mg^{2+}$

Belgian ardennites

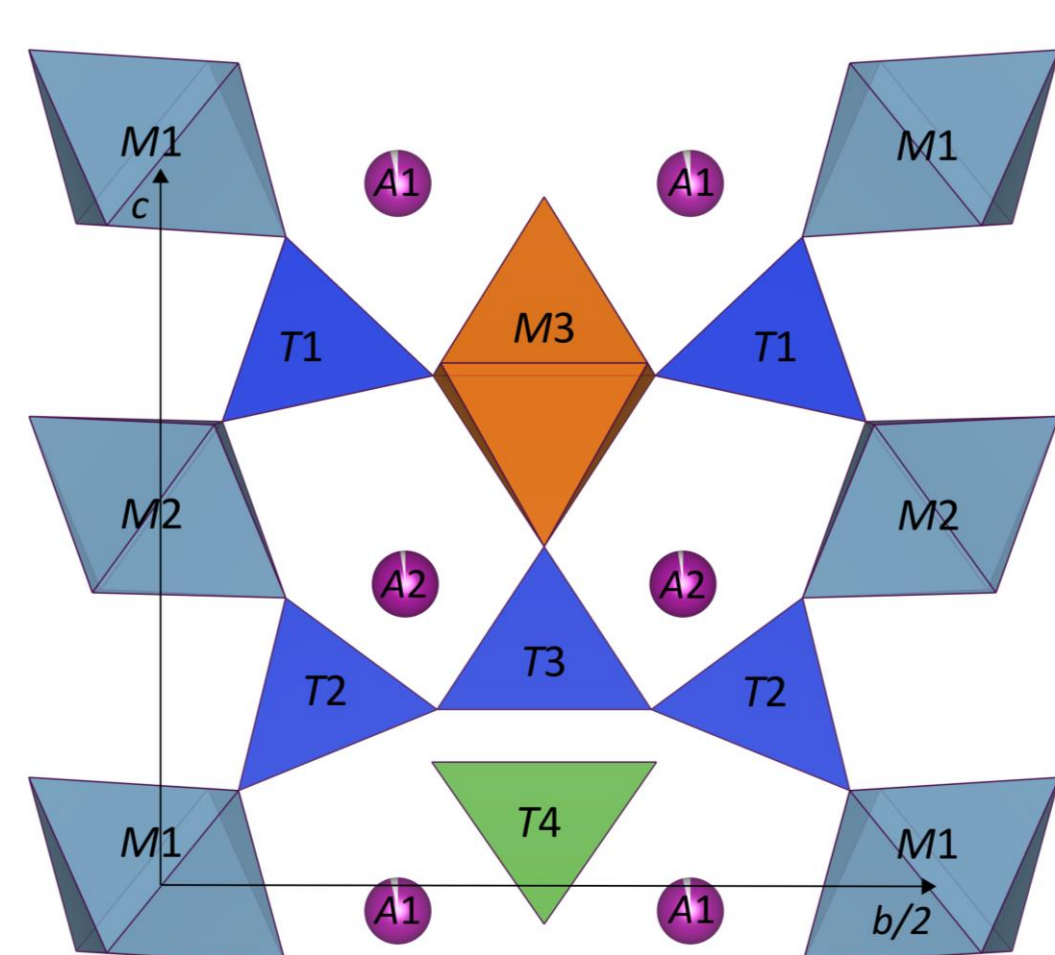


T4 site → homovalent and heterovalent substitutions



Crystal-chemical investigation of eleven Belgian ardennites originated from various localities or mineralogical associations.

Crystal structure



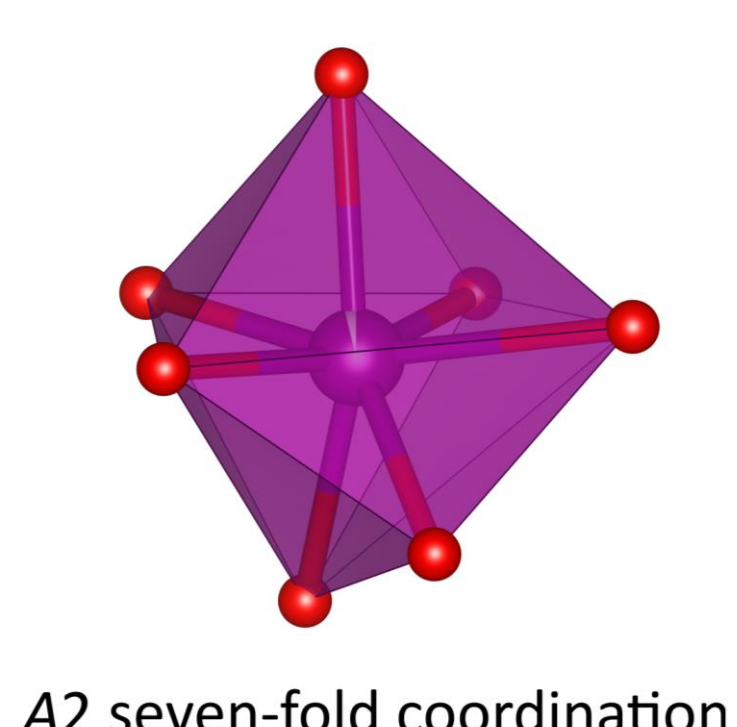
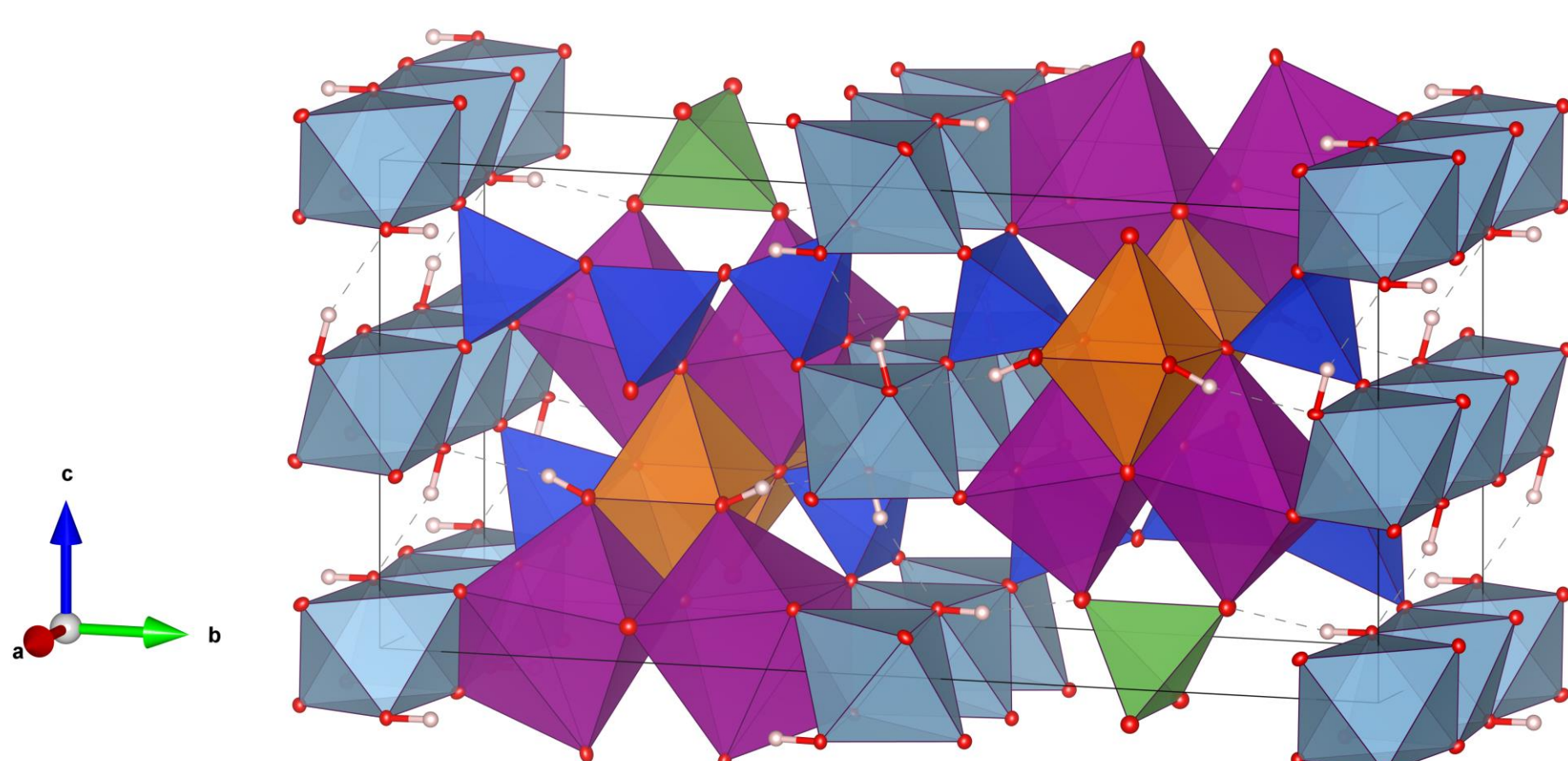
• A1, A2 = Mn^{2+} , Ca^{2+}

• M1, M2 = Al

• M3 = Mg, Al

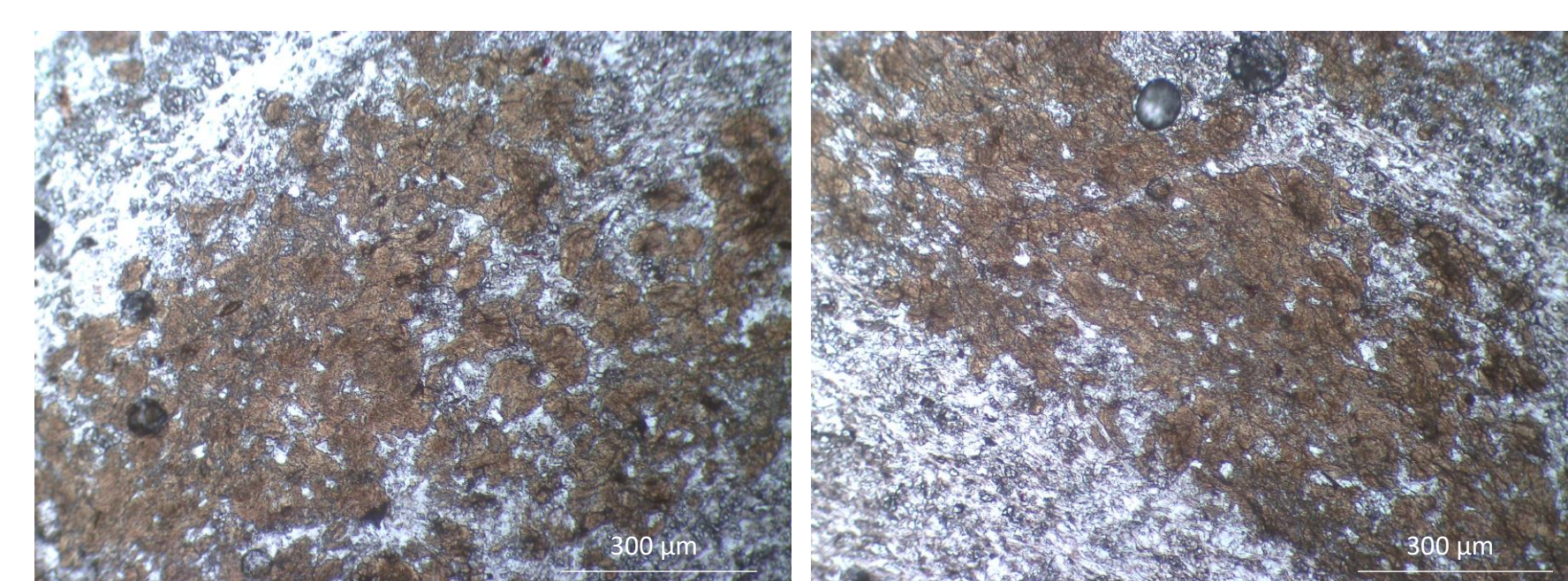
• T1, T2, T3 = Si

• T4 = As^{5+} , V^{5+} , P^{5+}



End-members and nomenclature

- Both species originally present in the Salmchâteau area
→ Legitimacy of the type locality for ardennite-(V) ?
- Possible Si- and V^{3+} -rich end-member of the ardennite group
→ Dewalquite as a "new" root-name ?



$(Mn^{2+}_{3.77}Ca^{2+}_{0.18}Mg^{2+}_{0.05})_{\Sigma=4.00}(Al^{3+}_{4.60}V^{3+}_{0.70}Mg^{2+}_{0.60}Fe^{3+}_{0.09}Cu^{2+}_{0.01})_{\Sigma=6.00}(Si^{4+})_{\Sigma=5.00}(Si^{4+}_{0.74}V^{5+}_{0.23}P^{5+}_{0.03})_{\Sigma=1.00}O_{22}(OH)_{6.59}$

Addresses:

1. Laboratoire de Minéralogie, Université de Liège, B-4000 Liège, Belgium.

References:

1. von Lasaulx, A.: Ardennit, ein neues Mineral, Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, 930–934, 1872a.
2. Pisani, F.: Sur un nouveau silico-aluminate de manganese vanadifère, trouvé à Salm Château, en Belgique, Comptes-Rendus de l'Académie des Sciences de Paris, 75, 1542–1544, 1872.