

New possible end-members in the ardennite group

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Ardennite is a rare Mn-rich aluminium silicate originally found in Salmchâteau, Stavelot Massif, Belgium, during the second half of the 19th Century. Samples were simultaneously investigated by A. von Lasaulx and F. Pisani leading to some controversies between the two scientists as they initially considered the mineral as vanadium-bearing (von Lasaulx, 1872; Pisani, 1872), and then as arsenic-rich (Pisani, 1873). Nowadays, two distinct species were defined: ardennite-(As) with the ideal formula $Mn^{2+}_4Al_4(AlMg)(AsO_4)(SiO_4)_2(Si_3O_{10})(OH)_6$ and with type-locality Salmchâteau (Belgium), and ardennite-(V) with the ideal formula $Mn^{2+}_4Al_4(AlMg)(VO_4)(SiO_4)_2(Si_3O_{10})(OH)_6$ and with type-locality Sparone (Piedmont, Italy, Barresi et al., 2007). During the past years, new occurrences of *ardennite* were discovered in the southern part of the Stavelot Massif, initiating the crystal-chemical investigation of eleven Belgian *ardennite* samples originated from various localities or mineralogical and petrographic associations.

Chemical compositions obtained from electron-microprobe analyses are in good agreement with single-crystal structure refinements. An heterovalent substitution mechanism involving the *T4* and *M3* sites, ${}^T4Si^{4+} + {}^M3(Al, Fe)^{3+} \leftrightarrow {}^T4(As, V, P)^{5+} + {}^M3Mg^{2+}$ clearly occurs. Due to the various multiplicities of the *M3* and *T4* sites, 4 and 2 respectively, a valency-imposed double-site occupancy on *M3* is necessary to preserve charge-balance (Hatert and Burke, 2008) in the ideal end-member formulae of ardennite-group minerals. The $As^{5+} \leftrightarrow V^{5+}$ homovalent substitution on the *T4* tetrahedral site explains the existence of a complete solid solution between ardennite-(As) and ardennite-(V), while the incorporation of Si^{4+} and P^{5+} seems to be more restricted. Solid solutions towards the potential new species "ardennite-(P)" and "ardennite-(Si)" appear to be relatively limited although some samples show significant enrichments, with up to 0.28 P^{5+} atoms per formula unit (apfu) and 0.74 Si^{4+} apfu. Therefore, the existence of possible Si-rich and P-rich end-members is discussed.

The existence of both As- and V-bearing species in the original samples from Salmchâteau is certainly at the origin of the disagreement between A. von Lasaulx and F. Pisani, who decided to give different names to these minerals. Ardennite was named by von Lasaulx (1872) for the Ardennes mountains where the mineral was found, and dewalquite was named by Pisani (1873) for the famous Belgian geologist Professor Gustave Dewalque from the University of Liège (1826-1905). Nowadays, only the name ardennite is retained.

Our second nomenclature suggestion for the ardennite group concerns the revalidation of the name dewalquite. Indeed, since the early samples of the V-rich variety were named ardennite by von Lasaulx (1872), and since the presence of arsenic was first demonstrated by Pisani (1873) on samples that he named *dewalquite*, it seems logical to rename ardennite-(V) as *ardennite*, and ardennite-(As) as *dewalquite*. However, if a suffix-based nomenclature is preferred for the group, we could define *dewalquite* as a new root-name, corresponding to a V^{3+} - and Si-rich species recently observed in Arbrefontaine. These decisions, however, have to pass through the IMA Commission on New Minerals, Nomenclature, and Classification for validation.

References:

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