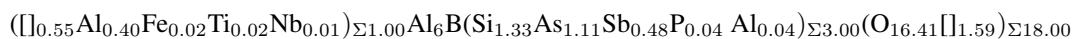


Re-examination of the dumortierite group: A proposal for a new classification

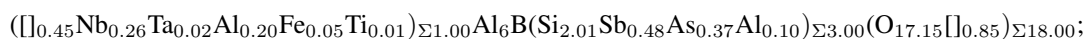
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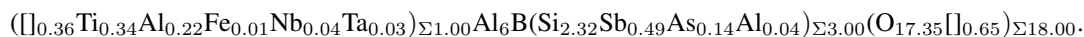
Currently, the dumortierite group comprises three minerals: dumortierite, $(Al, \square)Al_6BSi_3O_{16}(O,OH)_2$, magnesiodumortierite, $(Mg, \square)Al_6BSi_3O_{16}(O,OH)_2$, and holtite, $(Al, Ta, \square)Al_6B(Si, Sb, As)_{\Sigma 3}O_{12}(O, OH, \square)_{\Sigma 3}$, where \square denotes vacancies. Although the distinction between magnesiodumortierite and dumortierite, i.e., Mg vs. Al dominance at the partially vacant octahedral Al1 site, meets current criteria of the IMA Commission on New Minerals, Nomenclature and Classification (CNMNC) for distinguishing mineral species, the distinction between holtite and dumortierite does not, since Al and Si are dominant over Ta and (As, Sb) at the Al1 and two Si sites, respectively, in both minerals. Recent studies have revealed extensive solid solution between Al, Ta and Nb at Al1 and between Si, As and Sb at the two Si sites or nearly coincident (As, Sb) sites in dumortierite and holtite, further blurring the distinction between the two minerals. In addition, a mineral from the Szklary pegmatite (Lower Silesia, Poland) giving EBSD patterns consistent with the dumortierite structure is the first example of a dumortierite-group mineral with trivalent cations dominant at the Si-(As, Sb) sites. The analysis having the lowest SiO₂ content yields in weight %, SiO₂ 12.34, Al₂O₃ 50.66, Fe₂O₃ 0.29, As₂O₃ 16.89, Sb₂O₃ 10.87, P₂O₅ 0.48, Nb₂O₅ 0.16, Ta₂O₅ below detection, TiO₂ 0.27, B₂O₃(*calc*) 5.37 ($\Sigma 97.32$), corresponding to the composition



with Si/(As+Sb) = 0.84. Other holtite-like minerals from Szklary have Ta, Nb or Ti dominant at Al1 if allowance is made for charge balance, which requires that Al³⁺ be replaced by 0.6(Ta⁵⁺, Nb⁵⁺) + 0.4 \square and by 0.75Ti⁴⁺ + 0.25 \square , respectively. For example, from Nb-rich material the analysis with the highest Nb₂O₅ content (5.42 wt%) has the composition



and from Ti-rich material, the analysis with the highest TiO₂ content (4.30 wt%) has the composition



Both these compositions show EBSD patterns consistent with the dumortierite structure. The holtite- and dumortierite-like material from Szklary is highly zoned, and all three compositions represent single point analyses. On the basis of these findings, we propose more specific end-member compositions for dumortierite and holtite together with a classification of a dumortierite supergroup based on occupancy of the Al1 site. The supergroup comprises 3 groups: (1) Dumortierite group, with Al1 = Al³⁺, Mg²⁺, and \square with charge balance provided by OH substitution for O; this includes dumortierite, AlAl₆BSi₃O₁₈ and magnesiodumortierite, MgAl₆BSi₃O₁₇(OH), plus a hypothetical “hydroxydumortierite” end-member, $\square Al_6BSi_3O_{15}(OH)_3$; (2) Holtite group, with Al1 = Ta⁵⁺, Nb⁵⁺, Ti⁴⁺, with \square created for charge balance and to reduce repulsion between highly charged cations; this includes holtite, (Ta_{0.6} \square _{0.4})Al₆BSi₃O₁₈ and its Nb analogue, (Nb_{0.6} \square _{0.4})Al₆BSi₃O₁₈ and Ti analogue, (Ti_{0.75} \square _{0.25})Al₆BSi₃O₁₈; and (3) a new group with Al1 = \square caused by loss of coordinating O due to replacement of Si⁴⁺ by As³⁺ or Sb³⁺, which includes the new mineral from Szklary with an end-member formula $\square Al_6BAS_3^3O_{15}$.