

Orthorhombic polymorph of rengerite from Ohmi region, central Japan

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ABSTRACT

Rengerite, $\text{Sr}_4\text{ZrTi}_4(\text{Si}_2\text{O}_7)_2\text{O}_8$, is a Sr-analog mineral of perrierite and occurs as an accessory mineral in natrolite, pectolite, and itoigawaite veins associated with jadeitic rock from Ohmi-Itoigawa region, Japan. The symmetry of this mineral is reported to be monoclinic. Here, we found an orthorhombic polymorph of rengerite that occurs as micro domains up to 5 μm in width in monoclinic rengerite crystals using electron diffraction and high-resolution TEM analyses. X-ray diffraction analysis using a Gandolfi camera also revealed the presence of the orthorhombic phase in monoclinic rengerite crystals. The unit-cell dimensions of the orthorhombic polymorph are $a = 14.0$, $b = 5.7$, $c = 21.9$ \AA , $V = 1748$ \AA^3 , and $Z = 4$. Although the space group of orthorhombic polymorph of rengerite has not been determined, the possible space group is *Pbca* or a similar one from theoretical consideration by Ito (1950). The chemical composition was determined by ATEM-EDS analysis to be $\text{SiO}_2 = 22.5$, $\text{TiO}_2 = 30.2$, $\text{SrO} = 39.4$, $\text{Nb}_2\text{O}_5 = 0.2$, $\text{Fe}_2\text{O}_3 = 0.3$, and $\text{ZrO}_2 = 7.5$, totaling 100.1 wt%, and the ideal chemical formula is $\text{Sr}_4\text{ZrTi}_4(\text{Si}_2\text{O}_7)_2\text{O}_8$. Detailed HRTEM imaging revealed that the unit cell of the orthorhombic polymorph of rengerite can be interpreted as a superstructure of monoclinic rengerite, accompanied by repeated twinning on (001) plane. The HRTEM images taken were consistent with the simulated images.

Keywords: Rengerite, perrierite, polymorph, jadeite, HRTEM