

Crystal chemistry of the 1M mica polytype: The octahedral sheet

MARIA FRANCA BRIGATTI,^{1,*} STEPHEN GUGGENHEIM,² AND MARCO POPPI¹

¹Dipartimento di Scienze della Terra-Università di Modena e Reggio Emilia, Via S. Eufemia, 19, I-41100 Modena, Italy

²Department of Earth and Environmental Sciences, University of Illinois at Chicago, 845 West Taylor Street, M/C 186, Chicago, Illinois 60607, U.S.A.

ABSTRACT

This work provides a crystal-chemical description of the trioctahedral sheet in 1M mica polytypes of $C2/m$ symmetry. Some octahedral parameters were found to be related strictly to octahedral chemical composition, whereas others were related to the overall layer chemistry. As a general rule, the M1 site is more affected by octahedral chemical composition than the M2 site, and octahedral distortions are more affected than octahedral size. This behavior is attributed to the constraints related to edge-sharing octahedra and octahedral-tetrahedral coupling, which involves the sharing of the apical tetrahedral oxygen atom between the tetrahedron and octahedron. A more quantitative explanation was sought by considering expressions that relate octahedral parameters as a function of atomic coordinates and unit-cell parameters. This procedure identified those parameters affected by local distortions and those that are a function of a more global effect and whose variation greatly affects the layer. Local distortions are obviously more likely a result of local chemical composition. The size and distortion of the octahedral sheet seem to be independent for the database of samples considered. The α angle was found to be a complex parameter required to: (1) fit tetrahedral and octahedral lateral dimensions; (2) fit tetrahedral topology to its local chemical composition, and (3) fit the interlayer cation electrostatic interactions.