

OSUMILITE: CHANNEL IONS, WATER AND BIAXIALITY

Goldman, Don S. and George R. Rossman, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91125

Osumilites from Sakkabira, Japan, Obsidian Cliffs, Oregon, and Nain, Labrador, have been studied to examine the correlation among channel ion content, water and optical properties. Nain osumilite is especially interesting because it shows a hexagonal X-ray pattern but has orthorhombic optics. The optical spectra show increasing anisotropy in the "(0001)" plane as 2V increases from 22 to 40°. Mössbauer and optical absorption spectra indicate that the Nain sample contains negligible Fe^{3+} and that ~40% of the Fe^{2+} resides in channel-like cavities along with the alkalis. This Fe^{2+} is responsible for optical absorption bands at ~970 and ~2140 nm and the inner doublet of the Mössbauer spectrum. Even after the ions in the cavities are considered, stoichiometry considerations suggest that vacancies exist in either the 6-fold or 4-fold sites. The Nain material is pink (Eic). When it is heated in air at 870°C the Fe^{2+} in the six-coordinate site remains unchanged, the amount of Fe^{2+} in the cavities is reduced, the color changes to blue, and the optical and Mössbauer spectra change to resemble the spectra of the blue Obsidian Cliffs sample. The Mössbauer spectra of the Obsidian Cliffs sample show a doublet (I.S.=0.25; Q.S.=1.71 mm/sec) assigned to tetrahedral Fe^{3+} . Neither the color nor the intensity of the channel Fe^{2+} features change upon heating. The Sakkabira and Obsidian Cliffs samples have been shown to be anhydrous by infrared spectroscopy. The Nain samples contain <0.01% H_2O . We do not find evidence for extensive differences in the Al/Si ordering among the samples, nor do we find evidence for tetrahedral Fe^{2+} . The ease with which the channel Fe^{2+} in osumilite and cordierite oxidizes is correlated with the channel water content.