Investigation of illite chemistry with middle infrared light (MW-IR) and ICP-AES (Case study on the clay deposit Stoob, East-Austria)

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Abstract: Infrared spectroscopy in the middle wave range (MW-IR: 4000-200 cm⁻¹) is a powerful tool to decipher the molecular groups in the minerals and thus to identify the chemical composition of the mineral phases. The purpose of this work is to determine the chemical composition of illite in the fraction 2-6.3 µm (fine silt) of the sample from the Stoob (East-Austria). The illite chemistry was determined on the basis of 10 oxygen and 2 hydroxyl ions, such as with the following structural formula:

\[(K, Na)_{1-x} Al_{2-x} (Mg, Fe_{tot})_x (Al_{1-x} Si_{3+x} O_{10}) (OH)_2, \quad z = H_2O^+\]

From the determination of the frequency position of the Al VI-O-Si deformation vibration (in the range of 550-510 cm⁻¹), the x value is obtained, which allows the chemical composition of the basic lattice (tetrahedron-octahedron tetrahedron) according to the above formula. The determination of the Mg content from the correlation between the measured Mg value (with ICP-AES) and the quantitative infrared spectroscopic determination of the illite (in the range of the OH valence vibrations) results in the Fe(tot) value of the octahedron. In the same way, the quantitative ratio of the interlayer cations K and Na is determined.

Keywords: Middle infrared spectroscopy (MW-IR); phase analysis; X-ray diffraction; fine silt; Illite chemistry.

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