ANALELE ŞTIINŢIFICE ALE UNIVERSITĂŢII „AL. I. CUZA” IAŞI
Geologie. Tomul LVI, nr. 1, 2010

# THE RAMAN STUDY OF AMPHIBOLES

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**Abstract**

Raman spectroscopy is a simple, powerful and fast method to identify and distinguish between different minerals from the amphibole group of the inosilicate class. We analyzed samples of grunerite, actinolite, nephrite, Cr – actinolite (smaragdite), uralite (var. of actinolite), tremolite, pargasite, glaucophane and riebeckite in order to determine their Raman spectra and their fingerprint. The structure of these amphiboles belongs to the space group *C*2/*m*. Also, through this work we intend to show types of linkages between Si and bridging O ($O_b$) or non-bridging O ($O_{nb}$), and complex vibrations that occur in all amphibole spectra, corresponding to the symmetric stretching modes ($\nu_s$) of the Si-$O_b$-Si bridges or O-Si-O linkages and to the asymmetric stretching modes ($\nu_{as}$) of the Si-$O_b$-Si bridges and O-Si-O linkages. The most distinct Raman peak detected in this Raman study of amphiboles is around 660-675 $cm^{-1}$, which is assigned to the $\nu_1/\nu_s$ (symmetric stretching vibrations) of the Si-$O_b$-Si bridges. Some spectra present two very weak peaks at ~2330 $cm^{-1}$ and ~2437 $cm^{-1}$, respectively, due to the substitution of K or Na with $H_3O^+$ (K, Na ↔ $H_3O^+$) and $NH_4^+$ (K, Na ↔ $NH_4^+$); these spectral bands were identified at potassium micas.

**Keywords**: amphiboles, Raman spectra, double chain silicates, $Si_4O_{11}$ vibrations, smaragdite, uralite.

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