American Mineralogist, Volume 86, pages 790–806, 2001

Characterization and comparison of structural and compositional features of planetary quadrilateral pyroxenes by Raman spectroscopy

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ABSTRACT

This study reports the use of Raman spectral features to characterize the structural and compositional characteristics of different types of pyroxene from rocks as might be carried out using a portable field spectrometer or by planetary on-surface exploration. Samples studied include lunar rocks, martian meteorites, and terrestrial rocks. The major structural types of quadrilateral pyroxene can be identified using their Raman spectral pattern and peak positions. Values of Mg/(Mg + Fe + Ca) of pyroxene in the (Mg, Fe, Ca) quadrilateral can be determined within an accuracy of ±0.1. The precision for Ca/(Mg + Fe + Ca) values derived from Raman data is about the same, except that corrections must be made for very low-Ca and very high-Ca samples. Pyroxenes from basalts can be distinguished from those in plutonic equivalents from the distribution of their *Mg′* [Mg/(Mg + Fe)] and Wo values, and this can be readily done using point-counting Raman measurements on unprepared rock samples. The correlation of Raman peak positions and spectral pattern provides criteria to distinguish pyroxenes with high proportions of non-quadrilateral components from (Mg, Fe, Ca) quadrilateral pyroxenes.