Paper Number: 237

SPECTRAL CHARACTERISTICS OF PLANTS GROWING ON CHROMITE MINERALIZATION IN WEST POKOT DISTRICT, KENYA

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Abstract

In West Pokot District of Kenya, podiform chromite mineral deposits occur within a serpentine ore body. Detailed spectral analysis was undertaken in order to assess the influence of the chromite mineralization on the spectral reflectance characteristics of the chromite indicator plants growing within the area of mineralization [1].

Using a Spectron Engineering SE590 portable field spectroradiometer, spectral reflectance data were obtained in the field from the plants associated with the chromite mineralization. The instrument records spectral data from 256 discrete spectral bands with a 3nm spectral resolution. The plant samples used to measure spectral reflectance data in the field were retained in sample bags for trace element analysis in the laboratory. In the laboratory, the samples were ashed at 500°C in a muffle furnace, digested in ANAL sulfuric acid, and analyzed for the chromite pathfinder elements using a Perkin-Elmer Atomic Absorption Spectrophotometer. In the laboratory, independent spectral reflectance parameters at the red edge of the vegetation spectra were derived by analysis of all the plant spectra using the Floating R_o spectral analysis technique and the Fixed R_o technique [1]. At the red edge, R_o represents the minimum reflectance of the chlorophyll absorption feature which occurs at about 680nm [3]. By simple correlation analysis, the degree of association between the spectral parameter (R_o) and element concentrations in the plants was established.

Using the Floating R_o spectral analysis technique, the results show that with respect to the three chromite pathfinder elements, namely chromium, manganese and nickel, 48% of the plants show a strong shift of the spectral reflectance curve at the red edge towards shorter wavelengths (blue shift), while 13.7% of the plants showed a weak blue shift. 28.8% show a strong spectral shift towards longer wavelengths (red shift) and only 9.6% show a weak red shift. Using the Fixed R_o technique, 74.7% of the plants show a strong blue shift, 10.7% show a weak blue shift; and 9.3% show a strong red shift while only 5.3% of the plants showed a weak red shift. Correlation analyses results between spectral reflectance parameters and the concentrations of the three chromite indicator pathfinder elements in the indicator plants are equal strong; and it is therefore concluded that analysis of plant spectra can be used to map the chromite mineralization in the study area.

References:

[1] Odhiambo B. D.O. (1993) Influence of Chromite Mineralization on Vegetation: A Geobotanical Investigation in West Pokot District, Kenya; Ph.D. Thesis, University of Waterloo, Ontario, Canada, 247p

[2] Odhiambo, B. D. O., and P. J. Howarth (2008) East African Journal of Pure and Applied Science v.1 (1): 52-56

[3] Hare E.W., G. R. Edwards and J. R. Miller (1984) Geobotanical Remote Sensing of small localized swamps and bogs in Northern Ontario. Int. Symposium on Remote Sensing of Environment, 3rd Thematic Conference on Remote Sensing for exploration Geology, Colorado Springs, pp.672-682.