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Mapping evaporite minerals and associated sediments in Lake Magadi, Kenya, using Hyperspectral Hyperion data

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Hyperion hyperspectral (VNIR-SWIR) satellite image data was used to map the spatial distribution of mineral precipitates at Lake Magadi area, in the southernmost part of the eastern Kenya rift, Kenya. Mapping was coupled with laboratory analysis, including reflectance spectroscopic measurements and X-ray diffraction for selected rock and soil samples.

The spectral responses of 92 rock and soil samples including trona, chert, diatomite, basalt/trachyte, erionite, Green bed and High Magadi bed were studied and identified. The spectral signatures of Chert samples show the broad Si-OH absorption feature at 2.2 μm while, Green bed, High Magadi bed and diatomite exhibit carbonate absorption feature at 2.35 μm with broad Si-OH absorption feature at 2.2 μm . Trona exhibits six common absorption features at 1.50, 1.74, 1.94, 2.03, 2.22 and 2.39 μm . These characteristics spectral absorption features with general shape of the spectral curve are used to identify the surface minerals of the area.

In the mapping of different stages of evaporites and other surface minerals using Hyperion data, various image processing techniques including, the Minimum Noise Fraction (MNF), Pixel Purity Index (PPI) and Mixture Tuned Matched Filtering (MTMF) were applied. These spectral mapping methods coupled with geochemical knowledge of the area substantially improved the existing geological knowledge and enhanced the capability to derive substantial information related to the distribution and formation of precipitates and evaporites in the area.

Keywords: Hyperion; Lake Magadi; Reflectance spectroscopy; X-ray Diffraction; Surface mineral mapping; Trona; Chert; Diatomite; Remote sensing