

Identification of Fe-rich carbonates through Reflectance Spectroscopy in the Barreiro Alkaline Carbonatitic Complex: Carbonate's role as phosphate ore hosts

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Abstract: In order to avoid Fe contaminants that bypass initial screenings and jeopardize industrial processing of phosphate ores, a quick, non-destructive measurement of reflectance spectroscopy was carried out over 1354 spectral measurements collected over sections of a rock core of the Barreiro Alkaline Carbonatitic Complex, Brazil. Spectral measurements were performed with a FieldSpec 4 Hi Resolution spectrometer, collecting 8 measurements per spot (2,25cm diameter) and angle variations of 45 degrees over each spot, to guarantee correct spectral sampling of the entire spot over the sample. Out of a 178m soil-rock core, soil measurements collected until 160m display mainly absorption features of goethite>Nd-rich apatite(-F)>hematite and monazite in the VNIR while resulting in identification of dolomite, ankerite, siderite, calcite, phlogopite, zoisite, phlogopite, hornblende, saponite and nontronite and montmorillonite in the SWIR. For the whole rock section, calcite, ankerite and dolomite are the main modal carbonates, with ankerite present throughout the whole vertical sequence and calcite appearing until 170m. Dolomite is present in badges over 163m-164m-and towards the last end of the core at 170m until 174.90m that corresponds to the last sampled section of the core. While Nd-rich apatite(-F) and monazite display absorption features when carbonates are not present, they also tend to showcase themselves in spectral mixtures that include calcite (23.45% of total REE-indicative measurements, TREEM), calcite>ankerite>dolomite>siderite (52.7% TREEM) and dolomite (22.85% TREEM) respectively, with siderite being almost an exception as phosphate mineral host (1% TREEM). REE features in carbonates were compared with parasite spectra from other authors, but none of the measured spectra gave matching scores that could be considered reliable. ($r^2=0.543$, maximum value). These results are complementary of previous work on the recognition and identification of phosphate ores in other Alkaline Carbonatitic Complexes of the Alto Paraniíba Igneous Province (Tapira, Catalão I) in indicating of REE-rich phosphates in soils and rocks. Results also allow us to pinpoint depth of conflictive minerals before mining operation begins so that they can be used to perform better reconciliation reports for mine modelling of reserves and tailings. Also, the measurements are plausible of being considered ground-truthing for image spectroscopy measurements of hyperspectral imagers like the SisuRock or Hylogging imaging spectrometers, as well as other sensors for remote sensing applications.

KEYWORDS: CARBONATES, PHOSPHATES, REE.