MINERALOGICAL CHARACTERIZATION OF A GREEN CLAY FROM ITABORAÍ AREA, RIO DE JANEIRO, BRAZIL

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Introduction

The objective of this work is to present the mineralogical characterization of a green clay deposit that occurs in the Itaboraí region in the Rio de Janeiro State, Brazil. They are used commercially to produce bricks and ceramics in general. It is a widely spread layer that occurs beneath the Tertiary Macacu Formation. In the area studied, the green layer are represented by the 11 and 12 level (fig.1) that occurs with abrupt contact (fig.2) with the above reddish layers of the Macacu Formation composed mainly of kaolinite and iron oxides.

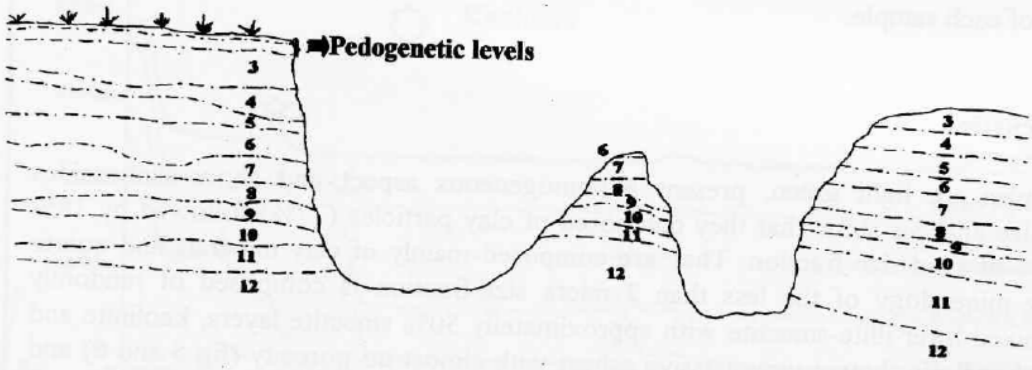

Fig.1: Esquematic demonstration of positions 11 and 12 on sedimentary sequence.

Fig.2. Abrupt contact between the green clayey layer and the upper level.

Methods

Several green samples were collected in the mining area. They were microscopically described and grain size analysis were performed. Detailed analysis including x-ray diffraction, SEM/EDS analysis were done in order to mineralogically characterize them.

X-ray diffraction analysis were performed both in the powder sample and in the less than 2 micra fraction. The powder sample was obtained by finely grinding the sample using a mortar and pestle and the randomly oriented powder was analysed in the diffractometer. For clay mineral identification the samples were size fractionated and the less than 2 micra fraction was mounted in a glass slide by the smearing process. The samples were analysed in the air-dried state and, after the removal of iron (according to Mehra & Jackson, 1960), several treatments including glycol solvation, heating at 550 degrees for 4 hours, potassiun and magnesium saturation were performed. The glass slides were then analysed in a SEIFERT X-ray diffractometer model XRD7 with copper radiation. The x-ray interpretation followed Brindley and Brown (1980) as described in Anjos (1986).

SEM/EDS analysis were performed in a Jeol 840A SEM operating at 20 KV and with 39 mm of working distance with a Noran/Voyager EDS with SI-Li detector after the samples being carbon coated in a Jeol JEE 4x vacuum evaporator. Secondary electrons images that were digitally obtained in a tiff format using a SUN/Sparc 5 workstation. EDS spectrum were obtained in several points of each sample.

Results and Discussion

The samples are light green, present a homogeneous aspect and show slickensides features. Grain size analysis show that they composed of clay particles (77%) followed by 18% silte and only 5% of sand size fraction. They are composed mainly of clay minerals and quartz (fig.3). The clay mineralogy of the less than 2 micra size-fraction is composed of randomly interestratified mixed layer illite-smectite with approximatelly 50% smectite layers, kaolinite and illite (fig.4). SEM analysis show a very massive aspect with almost no porosity (fig 5 and 6) and rare altered k-feldspars (fig 7). EDS analysis (fig. 8) of several points show a chemical composition of predominantly silica (58.5%), aluminum (28.29%), iron (9.05%), potassium (1.35%) and titanium (1.25%) and the other elements occur with less than 1% (table 1).

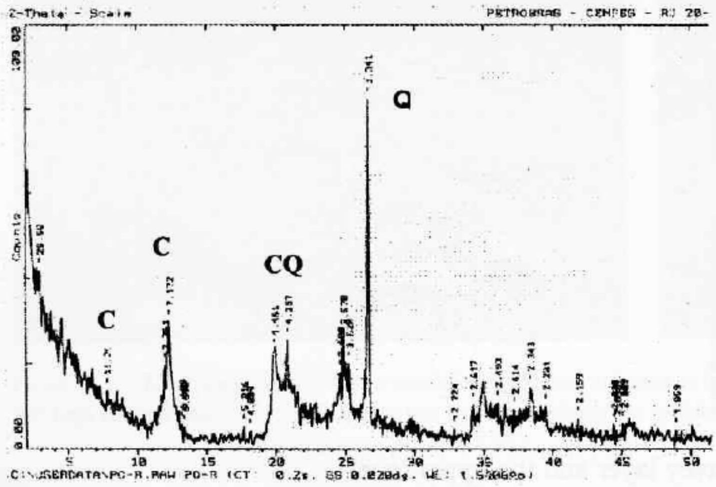

Fig. 3: X-ray patterns (Cu Kα) of random sample 11. (C) clay minerals and (Q) quartz.

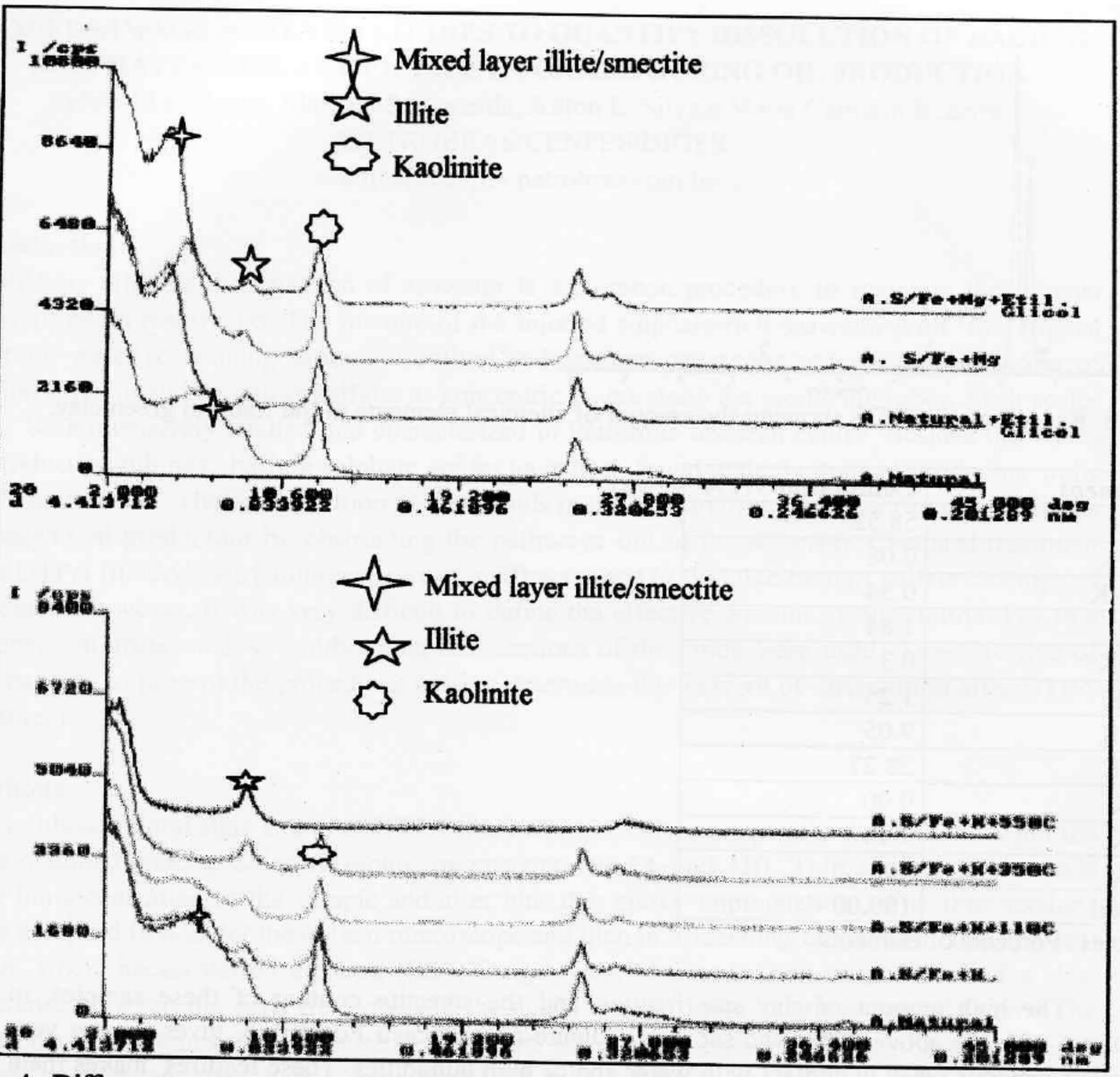

Fig.4: Diffractometer patterns (CuKα) for ordered clay minerals. Basal line relates to air dry sample and upper lines relate to treatments.

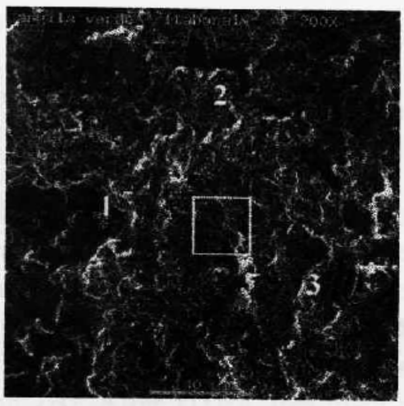

Fig.5: Points of EDS analysis.

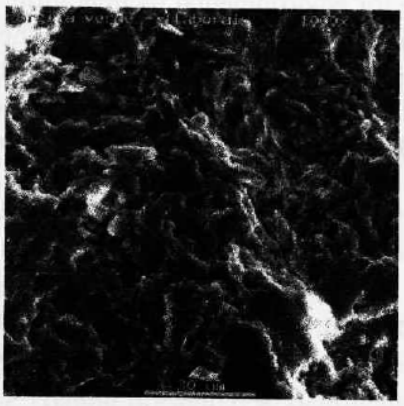

Fig.6. Detail of fig.5. Clay minerals with massif aspect.

Fig.7: Highly weathered K-feldspar.

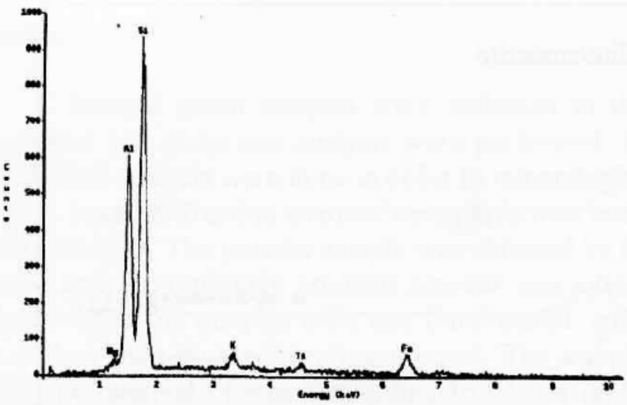

Fig.8: Representative EDS showing the amount of chemical elements in the Itaborai green clay.

Element	Compound Wt%
Si-K	58.52
Na-K	0.08
Mg-K	0.54
K-K	1.84
Ca-K	0.3
Ti-K	1.25
Fe-K	9.05
Al-K	28.27
P-K	0.00
S-K	0.14
0-K	------
Total	**100.00**

Table1: Percents of elements.

The high amount of clay size fraction and the smectite content of these samples, in contrast with the above 60% sand/silt size kaolinite-rich Macacu Formation, gives them a very plastic behaviour when in contact with water and/or high humidities. These features makes them suitable for pottery and other industry applications. In addition, this smectitic composition promote a high cation exchange capacity (CEC) of these sediments which favors the development of plants and therefore are suitable for environmental recuperation.

The high amount of clay of smectitic composition of these samples and a wide spread occurrence of the layer with top and botton abrupt contacts suggest that they may have originated from volcanic activity. However additional information based on petrography and chemical composition of trace and rare earth elements are necessary to prove such origin.

References

Anjos, S.M.C (1986) Absence of clay diagenesis in Cretaceous-Terciary, marine shales, Campos basin, Brazil. Clays and Clay Minerals 34, 424-434.

EMBRAPA-CNPS (1998) Caracterização geoambiental de áreas antropizadas no município de Itaboraí-RJ/ Brazil. Relatório interno.