Acta Microscopica, Vol. 8 Supplement A October 1999
Proc. XVII Congress of the Brazilian Society for Microscopy and Microanalysis and X Congress of the Brazilian Society for Cell Biology

APATITE CHEMICAL AND PHYSICAL SUPERFICIAL HETEROGENEITY

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The apatite chemical and physical superficial heterogeneity constitutes one major factor of its flotation behavior.

SEM (Nupegel-IAG-USP: Jeol T330A and LCT-EPUSP: Leo 440) coupled to optical microscopy allowed the characterization of the apatite varieties from open pit spot samples and industrial mineral dressing plant products from Tapira, MG.

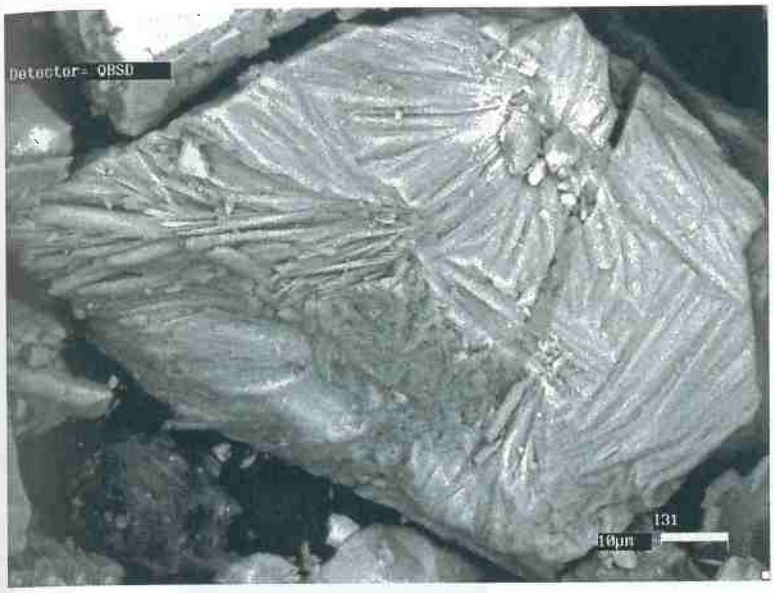
As usual in all Brazilian residual phosphate deposits, also in Tapira, it is common that the apatite present some superficial coating by iron oxi-hydroxides films and other secondary alteration plasms of diverse composition, as well as some surface roughness related to recrystallization and breakup (photos 1 ant 2 - apatite dissolution).

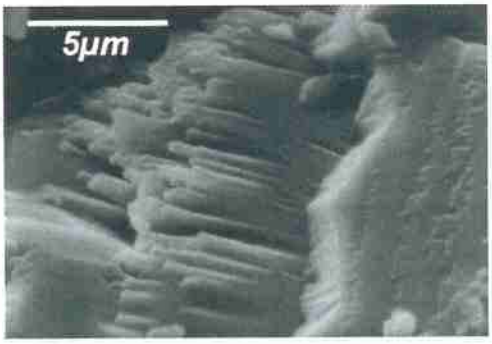
The apatite grains from different open pit spot samples showed a variety of superficial coatings. It could be found very porous and discontinuous secondary plasms (photos 3 to 5), whose chemical composition reflects the chemical elements in the alteration solutions (mainly Fe, Al, Si, Ca and P), as well as smaller grains of calcite, quartz, phyllosilicates, secondary aluminum phosphates and supergenic botrioidail apatite.

Being taken in consideration the SEM analysis results and the P_2O_5 distribution in the magnetic separations, it was evaluated the apatite superficial coating percentage for the industrial plant products (photos 6 and 7). The concentrate presented 7% approximately of particles with superficial coating, while the tailings showed results between 25 and 30%, rising up to 55% for the tailings of the coarse friable flotation circuit, showing the influence of the apatite surface properties in its flotability.

The apatite nature in the ore deposit depends directly on the degree of the weathering alteration process, that is to say, the more altered is the rock, larger are the roughness problems and presence of irregularities related to apatite partial dissolution and superficial coating by iron oxi-hydroxides, as well as and the presence of secondary phosphates (aluminum phosphates as well as apatite) and plasms that can harm the flotation concentration process. We should stand out, however, that is very common that the products more phosphorous rich, generally with the largest apatite amounts, are the more altered and developed, since the weathering process was the responsible for the relative apatite enrichment. In smaller extension, the pre-meteoric apatite also presents some different characteristics from the primary ones.

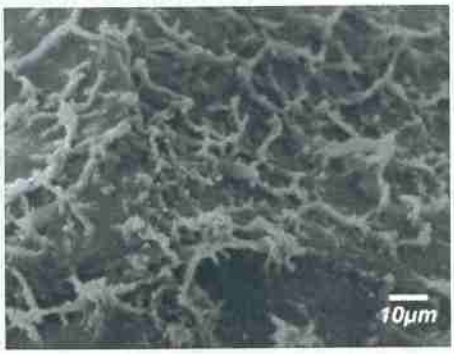
Thus, it was verified that the weathering process has a double role in the ore deposit formation. By one side it is responsible for the phosphorous enrichment, due to the leaching loss of another elements; on the other hand, it harms the ore, printing to the apatite grains a number of undesirable modifications that are significant on its behavior in the flotation concentration process, besides ending up recycling the phosphorous, forming secondary aluminum phosphates minerals, which are not recoverable by current mineral dressing processes.



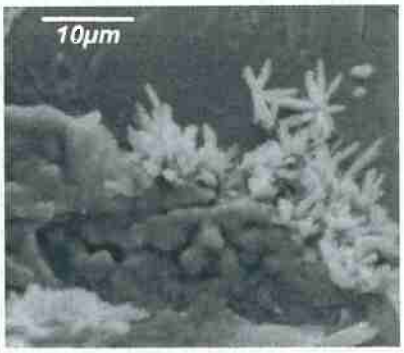


1- Apatite grain showing dissolution cracks
2- Detail of apatite dissolution

3- Apatite surface covered by secondary aluminum phosphates - crandalite

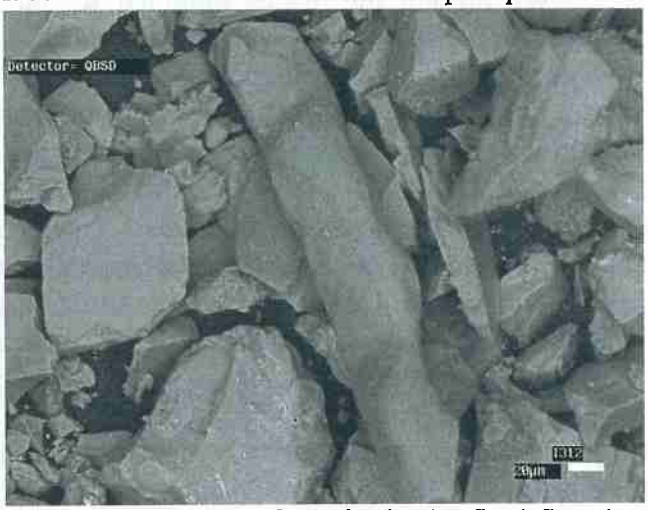


4- Plasm of variable composition (Si, Mg, Fe, Al) covering the apatite grain surface



5- Primary apatite (at back) covered by secondary apatite and aluminum phosphates

6- General aspect of apatite in the feed of the coarse friable flotation circuit



7- General aspect of apatite in the final flotation concentrate

Note: photos 2 to 4 are referred to secondary electron images; others to backscattered electrons