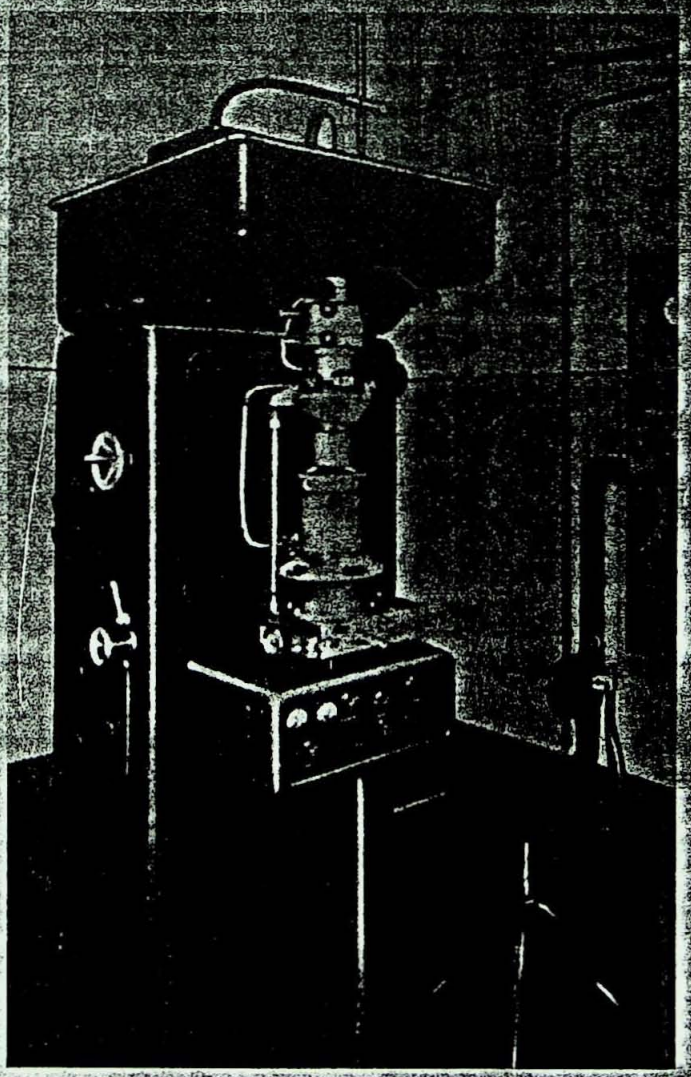
Acta Microscopica

Proceedings of the
XVII Congress of the Brazilian Society for Microscopy and Microanalysis
X Congress of the Brazilian Society for Cell Biology



Vol. 8 Supplement A October 1999

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

THE GEOCHEMISTRY OF REACTIONS OF PHOSPHATE WITH NATURAL CLAYS AND SYNTHETIC ALUMINUM HYDROXIDES

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The object of this investigation was to study the mechanism of phosphate fixation by natural clays and aluminum hydroxides. Since kaolinite and gibbsite are of wide occurrence in soils.

An indication of some of the types of phosphate minerals that may occur in acid soils can be obtained from fixation experiments in the laboratory and from a study of precipitated phosphates of aluminum. The term fixation include adsorption, chemisorption, absorption, and ion exchange. Most soils rapidly convert the soluble phosphate of agrochemicals into relatively insoluble forms. Phosphate (PO_4^{3-}) is adsorbed on gibbsite (α-$Al(OH)_3$) and kaolinite ($Al_2Si_2O_5(OH)_4$) minerals. The phosphate would thus be fixed by aluminum in a reaction which might be called "phosphatolysis". Adsorption is the predominant mechanism at low to medium concentration of phosphate, whereas at higher concentrations (2.0 M phosphate solution), dissolution and precipitation reactions occur with the formation of a new crystalline phase.

Each crystal phase may be recognized by microscopic observation, especially by SEM (Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy) which reveal important aspects of crystallinity, size and morphology.

Gibbsite (figure 1) was prepared synthetically by methods of proven reproducibility, whereas kaolinite was obtained from Rio-Capim, Amazonas, Brazil (figure 2). By treating these hydrous aluminum and silicate clay minerals with acidic solutions of potassium phosphate (KH_2PO_4) at room temperature, the authors obtained taranakite ($H_6K_3Al_5(PO)_8.18H_2O$) (figures 3 and 4).

Kittrick and Jackson (1954) reported that they were able, by using na electron microscope, to observe during the process the actual progressive formation of different aluminum phosphate crystals concomitantly with the decomposition of kaolinite crystals.

Taranakite (Hexagonal System) is the typical product of phosphatic alteration in perenially damp conditions, small amounts may well be present dispersed in wet soils, and that the possible formation of such a mineral should be considered by investigators interested in the fate of soluble phosphates added to soils.

References

KITTRICK, J. and JACKSON, M. L. (1954) Electron microscope observations of the formation of aluminum phosphate crystals. *Science*, 120: 508-509.

Acknowledgments

The authors greatly specially thank Isaac Jamil Sayeg (Scanning Electron Microscopy Laboratory - Geoscience Institute, São Paulo University) and Rudolf Giovanoli (Electron Microscopy Laboratory, Berna University) for assistance with SEM and TEM analyses. Financial support from Fapesp (grant 97/05481-2) has made this work possible.