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INFLUENCE OF Fe AND Al POLYCATIONS ON CLAY PROPERTIES

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The influence of iron and aluminum on the clay properties was determined experimentally by observing the action of polycation solutions with a ratio r = OH/cation from O to 3 upon clays (montmorillonite Na and kaolinite Na).

Mineralogical (X-ray diffraction - table II) and chemical studies using selective extraction by KCl N (fig. 1) and NH_4 oxalate in the dark (fig. 2 and table I), allowed to determine the form (cationic, exchangeable or more or less polymerized) and localization (interlayer or external) of polycations as compared to clays.

For Fe compounds the red color of the associations increases as a function of the ratio r. For Al and Fe compounds, the effect of associations upon dispersion (fig. 3 and 4) and water retention capacity (fig. 6) were studied.

Marked differences were found as a function of ratio r. Thus, little polymerized exchangeable forms (Al^3 Fe^{3+}) cause clay flocculation and a decrease in clay water retention capacity.

Polymerized forms in non exchangeable external position, do not prevent clay dispersion and do increase clay water retention capacity before dehydration. Any dehydration (pF 4) irreversibly changes the properties of Fe and Al alone or associated with clays (table 5).

Scanning electron microscopic examination is done with a special technic rapid freezing and lyophilization of moist samples. It is possible to determine the modifications obtained in tactoïds (for smectites) and particle associations (for kaolinites). Al^{3+} or Fe^{3+} species give floculation of clay characterized by particle association for kaolinite and layer association with an increase of particle size in smectites (see attached picture 2). Polycations species with ratio r = 2 — 2.8 cause for smectite the formation of microaggregates of 10 to 20 µm (pictures 3 and 4).

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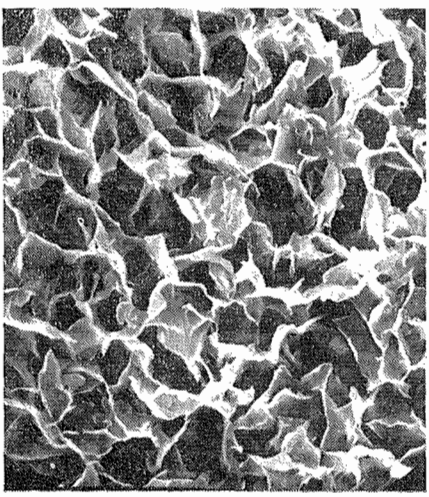
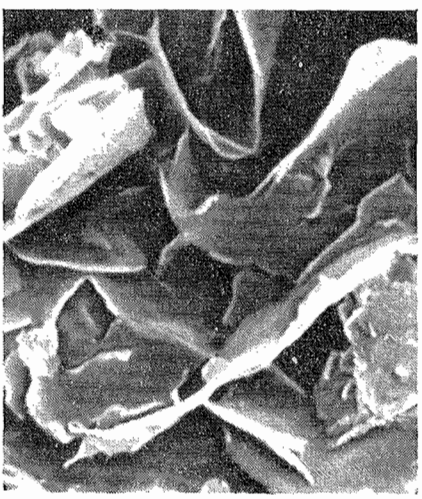
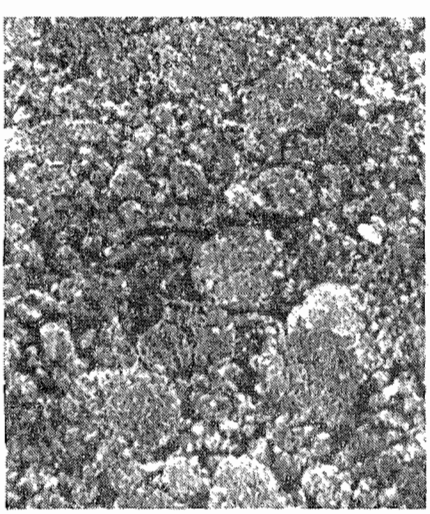


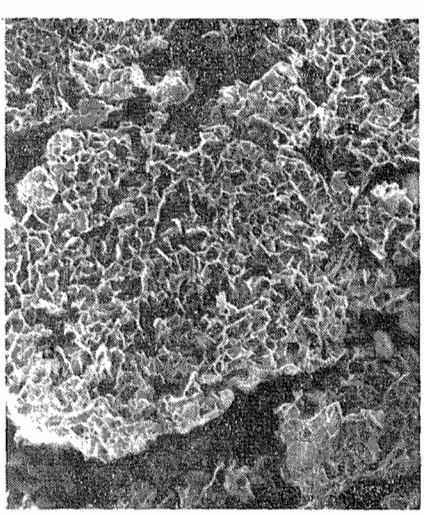
1 10 µm



2 2 µm



3 10 µm



4 10 µm

Picture 1 to 4 : Clay morphological aspect with scanning electronic microscope (JEOL J SM 35)

1 - Montmorillonite Na — 2 - Montmorillonite Fe^{3+} (r = 0)
3-4 - Montmorillonite Fe - Al (r = 2)