

"SWELLING CLAY MINERALS IN SEDIMENT-PETROGRAPHICAL ANALYSIS"¹⁾

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Anyone who takes an interest in clay minerals in the clay fraction of a rock is confronted with two main problems:

- a) what properties, chemical, physico-chemical or mineralogical, should be used for the optimal analysis of a natural mixture of clay minerals,
- b) in what way can a large number of specimens be studied in a realistic time without loss of accuracy or detail.

In daily practice it appears that the work done is restricted to only that analysis which can establish "differences" in the material.

Such a technique can indeed be rewarding enough for a geographical or stratigraphical survey, but, such a method is of little use for the mineralogy of clay minerals per se.

One may take the swelling 2:1 clay mineral as an example to illustrate what the clay mineralogist would like to see employed when his colleague, the sedimentologist, is intending to use the clay fraction for a sediment-petrographical analysis. Well, the clay mineralogist would be extremely pleased if the research programme was such that information was obtained concerning the charge density and the occupancy of the octahedral layers of the phases present. Firstly, the classical minus two micron clay fraction needs to be separated into smaller size fractions.

It is a well known fact that the low-charged swelling 2:1 minerals in general consist of very small crystals indeed, and that their high-charged derivatives have larger particle.

With the aid of homocationized glycerol complexes a second step may be done using an x-ray diffractometer. In this way a first impression can be obtained of the charge household of the clayey material, provided that clear nomenclature rules are formulated (being a function of the charge density of the clay minerals).

Information concerning the di- and trioctahedral character of the clay mineral can be obtained by a relatively simple x-ray re-hydration test.

This test is one where a cation-saturated pipette sample is analysed at 300°C (in situ) in an x-ray diffractometer. Trioctahedral swelling clay minerals (Mg^{++} , K^+ or NH_4^+ saturated) rehydrate completely and with a rate proportional to their crystal platelet size; dioctahedral smectites (montmorillonitic materials) do not exhibit this effect.

With the use of the above method it is possible to satisfy the requirements of both the sedimentologist and the clay mineralogist. With good laboratory organization such routine investigation should be possible.

REFERENCES

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 Weaver, C.E. and L.D. Pollard (1973) – The chemistry of clay minerals. *Dev. Sed.* 15 Elsevier p. 1-213.

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