

Fig. 4: Effect of crystallinity degree of initial kaolinite and dickite on the formation of swelling phases and of hexagonal analogue of anortite ($P_{H_2O}=1$ kbar; 400°C ; 22 hrs.; CaCl_2). Mechanically triturated for 10 min.: a kaolinite, c dickite; initial samples: b kaolinite, d dickite (for symbols see Fig. 1, 7).

of 7 Å-phase and anortite their structures are different; the former is a layered silicate¹³ and, probably, is similar in structure to kimrite,¹⁴ whereas the latter is a typical framework aluminosilicate. In this way, the appearance of swelling phases and a layered analog of anortite is connected in this instance with a specification of transformation of kaolinite and keeps the structural similarity.

The relative quantitative correlations of swelling and non-swelling phases (Fig. 3, 4) show their different formation, depending on the regime of experiments and of structural state of initial material. Therefore, as the increase of temperature (Fig. 3a and by 450 – 500°C) it can be seen that the amount of 7 Å-phase increases and that of the swelling phase decreases. When triturated kaolinite was used (increasing of edge surfaces relative to cleavage surfaces) only the swelling phases are formed (montmorillonite and mica-montmorillonite 1:1), while when non-triturated materials

were used, both swelling and non-swelling 7 Å-phases are formed (Fig. 4a, b). Similar results were obtained in the case of dickite (Fig. 4e, d), in which case, however, the reaction was less intensive, which is inferred to the difference in sizes of crystals between kaolinite and dickite. From the data of electron microscopy and electron-microdiffraction^{15,7} one can see clearly that the swelling phases develop from the side portion of kaolinite crystals. The skeleton hexagonal appearance of the 7 Å-phase suggests that it is formed most likely on the surface of kaolinite crystals and the formation of these two different phases is controlled by the relation of an edge and cleavage surfaces of crystals.

Somewhat different behaviour in transformation is seen in the case of sepiolite and palygorskite, in which transformation is mainly controlled^{15,10} by three-layered talc- and/or montmorillonite-like structural elements which are the basic structural elements of these minerals,¹⁰ with the formation of different bands stretched along *b* axis.

The results of somewhat simple experiments, carried out under room or somewhat higher temperature conditions, in order to study the influence of stress and quasihydrostatic pressure ($P=151$ – 3000 kg/cm², 120–480 hrs.) on the structure of these minerals showed that the structure under these conditions is not steady. Morphologically this is shown in disturbance

** With similar structure, compositions vary remarkably. The investigated specimens have the following compositions:

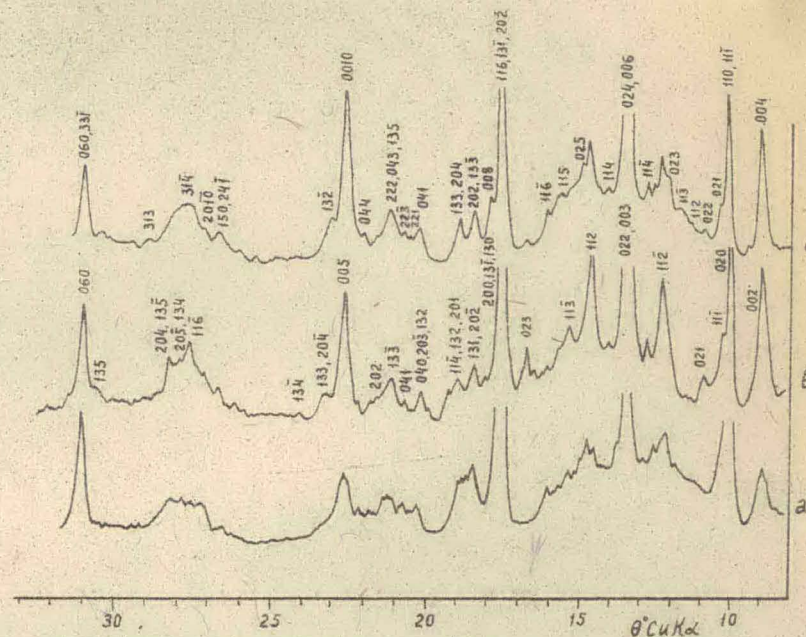
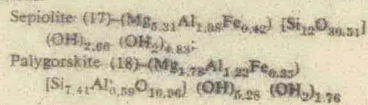


Fig. 5: Effect of polytypic modifications of initial kaolinites on the polytypes of hydromicas ($P_{H_2O}=1$ kbar; 500°C ; 3 hrs.; with KCl). Diffractograms of hydromicas formed: a metaalloysite, b kaolinite, c dickite.

of fibrous texture of the minerals, which is accompanied by relatively weakening of reflections Okl and simultaneous increase of common reflections-hkl. The degree of disturbance can be estimated, for example, by comparing I_{0100}/J_{173} , depending on the duration of experiments and the size of P. This shows that the most weak links in the structure of layer-ribbon silicates are the "oxygen-bridges," that link the three-layered packets in the ribbons. The transformation of structure goes in the direction of disturbing the ribbons, maintaining layered nature even in the fragments of the structure. It is of great interest that under hydrothermal condition this sort of transformation goes much easier than in the transformation under the stress and the "pure" vapour phase ($P_{H_2O}=1$ – 2 kbar) conditions. Especially in the case of transformation with K, Na, Ca, Mg chlorides^{9,10} at T 250– 350°C in 24 hrs, these chlorides accelerate the rapid formation at the cost of sepiolite-Mg-montmorillonite and talc, and at the cost of palygorskite di- and tri-octahedral montmorillonites. Further structural transformation of these smectites at T 400– 450°C essentially depends on the chemical environment—the character of mineralizer (see Table 1): from the concentrated Al^{IV} dioctahedral montmorillonite cordierite is formed in

the presence of pure water, feldspars and nepheline is formed with K, Na, Ca chlorides, from the concentrated Mg-trioctahedral montmorillonite-disordered mica-montmorillonite is formed with K, Ca chlorides and chlorite-montmorillonite in the case of Mg chloride.

The Tendency to Conserve the Sequence of Alteration of Layers (Inheritance of Polytypism)

A complete disorder of packets in the basal plane in the swelling phases previously mentioned which are formed from the side part of kaolinite crystals is not in accordance with the character of changing of the carcass of structure. In order to clarify the regularity of such type, a few experiments for shorter duration (3 hrs.) on the transformation of kaolinite minerals in KCl solution were carried out. As can be expected, dioctahedral mica is formed, and this is formed through the intermediate disordered mica-montmorillonite mixed-layered phase (Fig. 2). X-ray and electron-micrographic analyses of synthesized mica show that their polytypic modifications are controlled to some extent by the initial structure (Fig. 5). So, from metaalloysite a disordered hydro-mica is formed, and