THE BENTONITES FROM THE VOLCANIC REGION OF CABO DE GATA (ALMERIA)

By

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ABSTRACT

The smectic clay from Sierra de Gata, Cabo de Gata region, Almería, Spain, is montmorillonoidal like the smectic clay from Serrata de Nijar in the same region. These clays are formed by alteration of calco-alkaline volcanic rocks by marine and/or hydrothermal action.

The Cabo de Gata region consists of an extensive platform of Neogene strata of marine origin. From this platform, two parallel mountain chains emerge: the Serrata de Nijar and the Sierra de Gata. Both are composed of a variety of volcanic rocks of calco-alkaline type, and mark two important lines of fracture. Deposits of smectic clay are being worked in the northeastern extremities of both ranges. Field observations show that these clays come from the alteration in situ of the volcanic material.

Previous publications (González García and Martín Vivaldi, 1949; Martín Vivaldi and González García, 1951; Cano Ruiz and López González, 1955) have identified the Serrata de Nijar material as bentonite. The fundamental mineral component is sodium montmorillonite of high iron content. This mineral is accompanied by one of fibrous nature, probably of the palygorskite-sepiolite group.

In this paper, we describe the Sierra de Gata material (Fig. 1). A microscopic study of the least-altered samples of the original volcanic rock (Fig. 2) shows a typical porphyritic structure, with mostly a microcrystalline groundmass. There are abundant quartz phenocrysts, medium-basic plagioclase, and hornblende. The plagioclase phenocrysts have a well-marked zonal structure, and their interior, richer in anorthite, contains some secondary calcite. All these characteristics suggest that the rock is a hornblende dacite, although chemical analyses are not yet available. The other samples show various stages of alteration, the principal constituent of all of them being a montmorillonoid, as shown by the various powder diagrams of preparations that had been heated or treated with ethylene glycol (Fig. 3), by thermal weight-loss and D.T.A. curves, and by their swelling capacity.

In one of the working faces, veins and fissures contain a material which weathers to a rose color. Its powder diagram shows a wide line between 10.5 and 12 A, which does not change on ethylene-glycol treatment (Fig. 3), but becomes diffuse and moves to larger angles on heating to 500° C. Characteristic montmorillonoid lines are also seen. The existence of a 10.5 to 12 A spacing with these properties, together with the thermal weight-loss curves (inflections at 200°, 400°, and 600° C), and the D.T.A. curves (endothermic peaks at 115°, 300°, 380°, 580°, 810° C and an exothermic peak at 840° C) seem to point to a

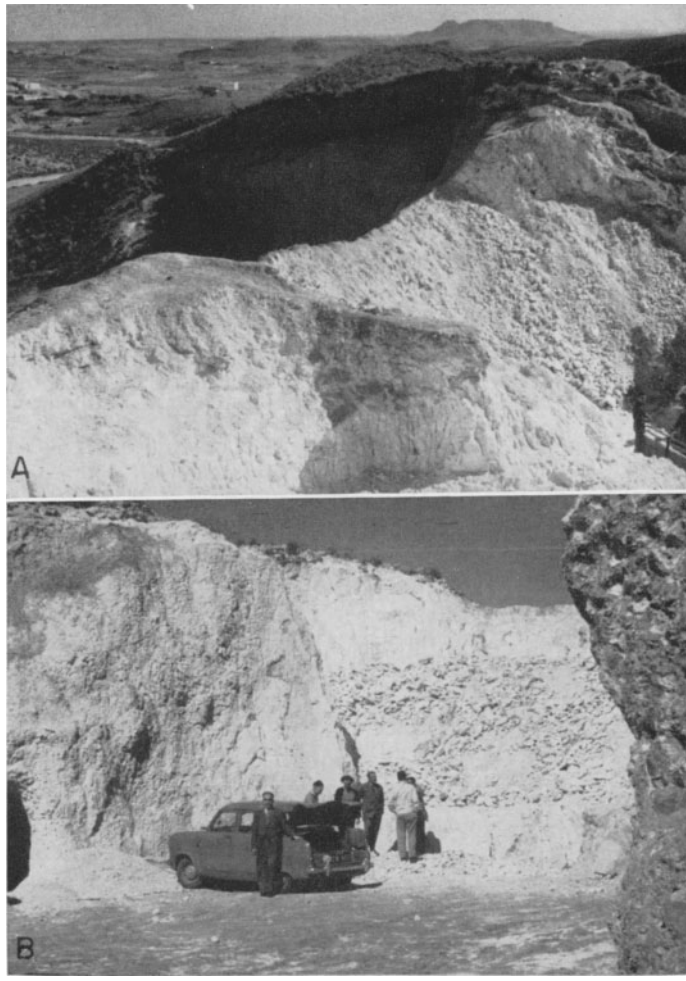

FIGURE 1.—Photographs of the deposit. A, general view, looking southeast along the range. B, one of the working faces, looking north.

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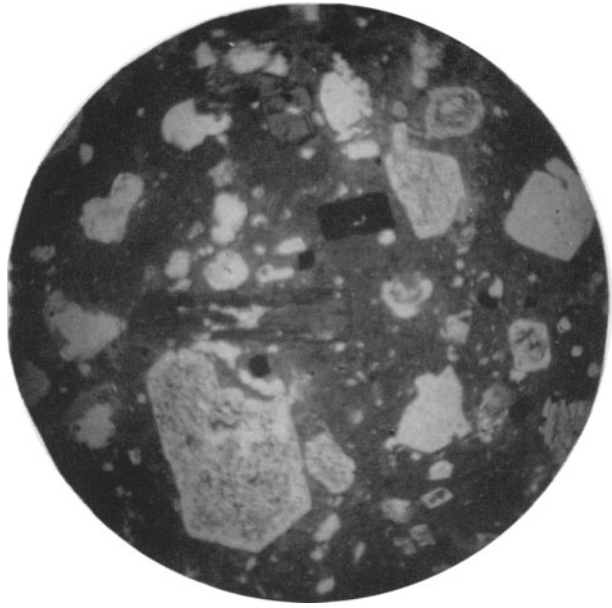

FIGURE 2. — Photomicrographs of thin section of least-altered sample. Polarized light.

fibrous mineral of the palygorskite-sepiolite group. This was confirmed by electron micrographs, which show fibers of about 0.1-micron diameter to be the most abundant material. These fibers are apparently flexible, very long, and difficult to disperse (since they appear in bundles).

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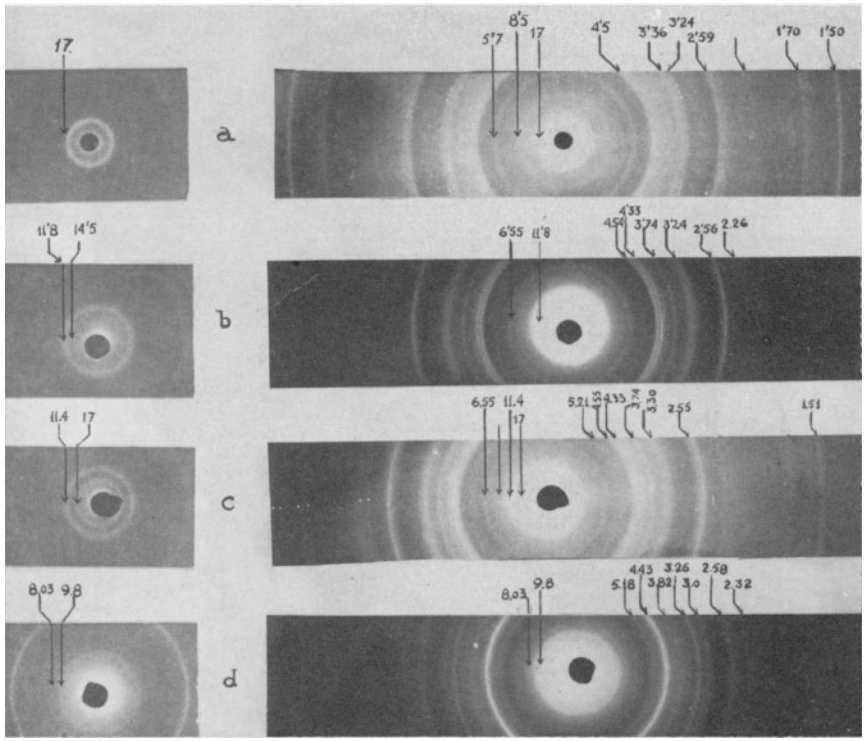

FIGURE 3. — Powder diagrams of clay minerals from Sierra de Gata. CuK*a* radiation. a. Montmorillonitic type, characteristic of most of the deposits; ethylene glycol-treated specimen. b. Specimen from vein; no treatment; palygorskite-sepiolite type and montmorillonite. c. Same as b, with ethylene glycol. d. Same as b, heated at 500° C for 7 hours. The prints on the left have been printed lightly, to bring out the central region.