OCCURRENCE OF A COARSELY CRYSTALLINE KAOLIN MINERAL IN SOME SOUTH AFRICAN FIRE-CLAYS

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Thin sections of fire-clays almost invariably show shreds and plates of colorless minerals, which although difficult to identify exactly, are almost certainly either dickite or members of the kaolinite-anauxite series. During a visit to a deposit of fire-clay at Boksburg, about 10 miles from Johannesburg, Dr. A. L. du Toit drew my attention to a buff colored clay, which contained "nodules" of an opaline looking material. These "nodules" range up to 1 cm. in length and are sometimes fairly well rounded although more usually somewhat elliptical. The material is flesh colored and easily scratched by a knife.

From one of the larger nodules enough material was removed almost completely free from the surrounding groundmass, for a semi-micro-analysis with the following results.

SiO_2	46.00
Al_2O_3	36.84
Fe_2O_3	0.01
TiO_2	trace
MnO	nil
CaO	not deter.
MgO	not deter.
Loss on Ignition	12.58
H_2O-	5.09
	100.52

Analyst V. L. B.

The powder was examined microscopically and found to consist of colorless plates with a low birefringence. The optical properties determined in sodium light are as follows:

$$\left.\begin{array}{l}\alpha=1.560\\ \beta=1.564\end{array}\right\}\pm 0.004$$

Biaxial, negative.
Perfect basal cleavage.

The mineral readily adsorbed a deep blue aqueous solution of malachite green, becoming greenish to dark blue in color. The pleochroism was distinct but not very marked. The formula calculated from the chemical analysis corresponds very well to $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$ and while the indices are somewhat low it is suggested that the mineral is kaolinite.[1] The immersion oils used were a mixture of a paraffin and alpha-chloronaphthalene.

Thin sections were prepared of this specimen and other non-plastic clays and even more interesting features were noted. Under crossed nicols and *not using conoscopic conditions* an "acute bisectrix figure" is observed. In large elongated grains a series of these figures, sometimes only as single bars, are seen (Fig. 1). These have been described by chemists working on fatty acids as "crosses of polarization," but as far as could be traced have not been previously recorded by petrographers. In Fig. 2 the phenomenon in a single shred of kaolinite is depicted diagrammatically. Actually in position 3 the figure is fairly diffuse although fairly sharp in positions 1, 2, and 4. The angle of rotation is about 60°. These dark bars (they are too distinct to be called shadows) are almost certainly due to strain during desiccation of the clay. The clays are hard and compact and do not slake easily on wetting. In thin sections of other fire-

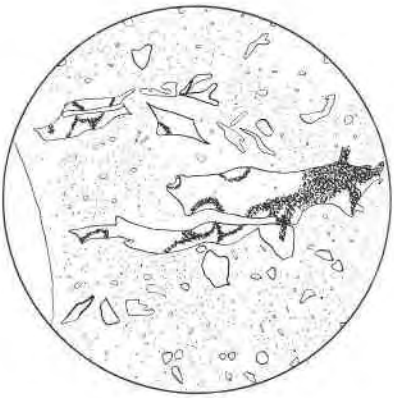

FIG. 1. Non-plastic clay from Boksburg, Transvaal; showing "Extinction Bars." Crossed nicols. Magnification 12 diameters.

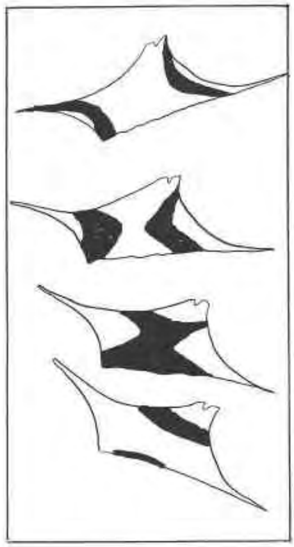

FIG. 2. "Cross of Polarisation" in a shred of kaolinite. Non-plastic fireclay. Magnification 27 diameters. Rotated clockwise.

[1] Small amounts of halloysite were unavoidably included in the sample. This mineral was easily distinguished from the kaolinite.

clays this optical effect was also noticed but as the grains are very much smaller, in general being 20–30μ mean diameter, the phenomenon is not so distinct.

Somers described a spherulite of kaolinite in a white clay which exhibited a similar effect (1). In the present case, however, the strain bars are definitely related to the grain shape. In some slides these kaolinite shreds appeared to have adsorbed some iron, as they are stained fairly uniformly a light brown. In these grains the "strain bars" were observed to be less distinct and cannot be readily distinguished from the undulatory extinction of quartz. It may be noted that none of the rounded detrital quartz grains in these rocks exhibit strain shadows.

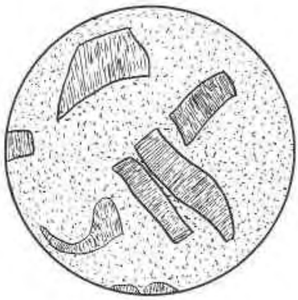

FIG. 3. Kaolinite crystals, showing perfect cleavage. Magnification 175 diameters.

Another structure observed in these sections is a "wormlike" lath-shaped particle. In Fig. 3 extinction proceeds from one end to the other but at high magnifications is difficult to photograph. These "worms" are fairly common in the non-plastic fire-clays.

The replacement of quartz grains by kaolinite is common. However, this may take place in two ways. In one case the replacement is normal as described by Ross and Kerr, and in others the quartz is recrystallized to a very fine grained "cherty texture" (3) intermixed with kaolinite and an anauxite groundmass.

ACKNOWLEDGMENTS

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