association becomes unstable and is converted to a new association of minerals ("b" type, fig. 1). Development of "b" accessory minerals begins on the side of the hot zones, when their temperature reaches 1350°C. Figure 1 (2) gives a sketch of a thin section in which the temperature of the cold zones was 1290°C. An "a" association (kyanite + K-analcime) was retained in these zones. On the hot-zone side (temperature about 1540°), the kyanite + K-analcime association was replaced by a "b" neogenic association. The boundary between these associations in the thin section corresponds approximately to an isotherm of 1350°C.

In transmitted light, in thin sections the neogenic "b" material has a bright yellowish color. It consists of a fine flaky mass, in which we clearly observe individual acicular crystals of size 0.008 x 0.12 mm. The needles are transparent and sometimes display sharp transverse fissures (fig. 2). In addition to needles, the fine flaky material contains fairly large (up to 0.015 mm) crystals (round, rhombic, rectangular), optically identical with these needles. In polarized light the fine flaky mass clearly consists largely of a mixture of two minerals (of size not more than 0.02 x 0.005), one of which (the minor) is characterized by gray interference colors, the other mineral being yellow-brown. Table 6 shows the refractive indices and densities of the "b" neogenic material.

Table 7 gives the interplanar spacings calculated from the powder patterns of the acicular mineral (col. a) and the fine flaky material adjoining the needles (col. c).[2]

The X-ray data for the acicular mineral agree closely with those for corundum (table 7, col. b), and the X-ray data for the adjoining material largely agree with those for hydrosanidine $K\,AlSi_3O_8 \cdot H_2O$[3] (table 7, col. d). However, like the optical data, several strong lines on the powder pattern of the mixture, absent in the group of lines of hydrosanidine, indicate the presence of a third mineral in the "b" association, but it cannot be identified from the available data.

The refractive indices and the density of the acicular mineral agree closely with those of corundum, but the refractive indices and densities of the double-refracting mineral agree satisfactorily with those of hydrosanidine (table 6). Although the "b" association contains a small amount of the third mineral, we assume that during conversion this mineral is not in equilibrium, and a second conversion takes place as follows:

$$\underset{\text{(kyanite)}}{2Al_2O_3 \cdot SiO_2} + \underset{\text{(K-analcime)}}{K_2O \cdot Al_2O_3 \cdot 4SiO_2 \cdot xH_2O} +$$

$$+ (2-x)H_2O \rightarrow \underset{\text{(corundum)}}{2Al_2O_3} + \underset{\text{(hydrosanidine)}}{K_2O \cdot Al_2O_3 \cdot 6SiO_2 \cdot H_2O} + H_2O$$

A corundum + hydrosanidine association is observed in the specimens up to 1800°C. Sectors of the thin section above 1800°C contained a fine flaky micaceous mass ("c" type neogenesis). Figure 1 (3) shows a sketch of a thin section of a specimen whose cold zone had a temperature of 1660°C, and whose hot zone

[2] Specimens for the X-ray photographs were selected from the thin section itself.

[3] An artificial mineral synthesized at high pressures (Seki and Kennedy, 1964).

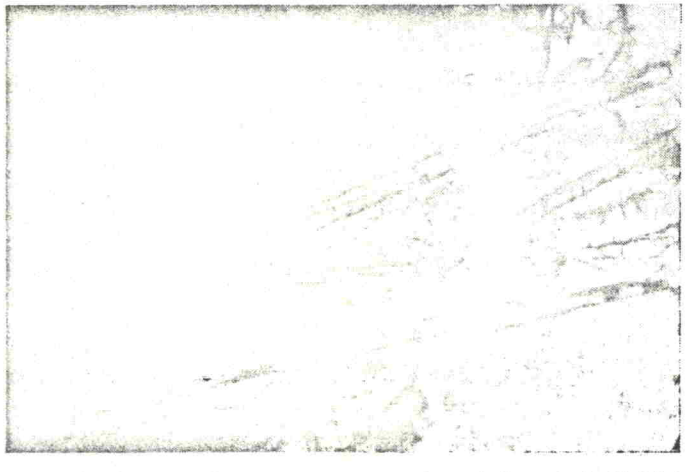

FIGURE 2. Replacement of an "a" accessory mineral (the dark field in the figure) by a "b" accessory mineral (light field - elongated corundum crystals clearly visible).

Transmitted light; x 20