High-order plates for the microscopic examination of mineral grains.

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FOR the examination of grains with high birefringence the usual types of wedge or plate often fail to give clear indications of optical sign. In such cases plates up to the 20th order on Newton's scale (relative retardation about 10 μ) may be employed.

Determination of sign of length of a crystal—A detrital crystal of zircon (length positive, i.e. slow) about 300–400 μ thick observed between crossed nicols in conjunction with a 15–20th-order plate will illustrate this test. When the length of the crystal is parallel to the fast direction of the plate (fig. 1 *A*) there is compensation, and colour bands are seen. Without the plate, or with the crystal rotated through 90° (fig. 1 *B*), only high-order whites are seen. A crystal of high birefringence with length negative (e.g. a bipyramid of anatase) will give colour bands in position *B*, and none in position *A*.

Determination of sign of an interference figure.—In the eccentric figure of a cleavage flake of calcite (uniaxial negative) the brushes are usually clear, but the rings, having very high-order colours, are indistinct. The insertion of a high-order plate causes the rings to become distinct in two opposite quadrants, where high-order whites have been reduced to low-order colours; whereas in the other two quadrants the rings are undetectable, having been raised to still higher orders (fig. 2). A positive uniaxial figure will give rings in position *B*, but none in position *A*.

Preparation of the plates.—The plates are most readily made from sheets of clear selenite. Orientation is found on a thinned edge and strips in the fast direction are cut with a sharp blade. Suitable thickness is obtained by cleaving or building up. The order of the plate is found by making one corner wedge-shaped and counting the reds, or, for thicker plates, by cleaving a portion of it and determining the order of each flake. Alternatively, if a spectroscope attachment is available, the spectrum of the light transmitted by the plates when viewed between crossed nicols indicates their thickness. A plate of about the 10th-order gives seven dark bands in the visible spectrum, one of about the

15th-order shows ten, and one of about the 20th-order shows thirteen. The strips are mounted with Canada balsam between glass slips (usually

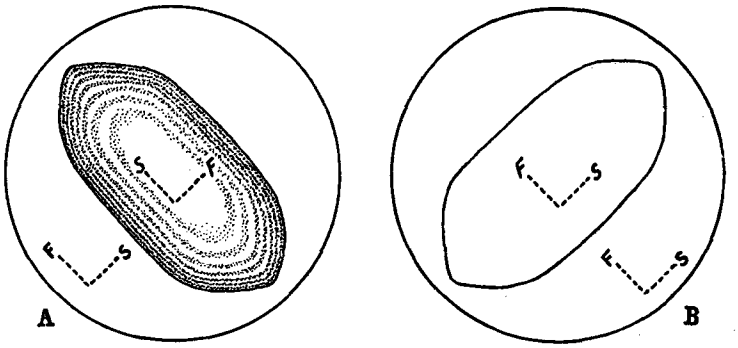

FIG. 1. Zircon between crossed nicols, using high-order plate.
F, S—fast and slow vibration-directions of the plate.
F, *S*—fast and slow vibration-directions of the zircon.

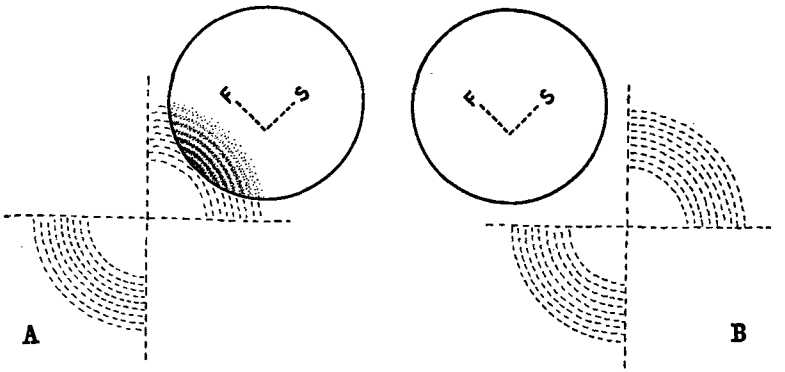

FIG. 2. Interference figure of calcite cleavage flake, using high-order plate.
F, S—fast and slow vibration-directions of the plate.

12×75 mm.) to fit into the slot of the microscope. The baking must be gentle, since excessive heat damages the selenite.

High-order plates have also been prepared from rock-crystal by cutting slices parallel to the *c*-axis and grinding disks of appropriate thickness, which, enclosed between small cover-slips, are oriented in metal holders such as are supplied with the Leitz microscope.

It is convenient to prepare a set of three or four plates of different thicknesses, and when applying the test to try them in sequence until a clear result is obtained.