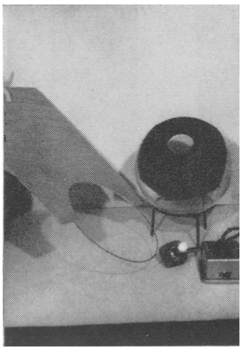
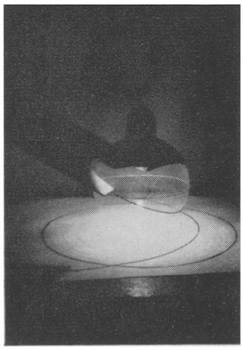
MINERALOGICAL MAGAZINE, DECEMBER 1969, VOL. 37, NO. 288

The stereographic projectionarium

THIS simple apparatus was built by the author some years ago to demonstrate the principles of the stereographic projection; it has proved a successful teaching accessory. Zussman (1967) described a useful model that projects points on the sphere on to an equatorial plane. The present model projects both points (face-normals), great circles (planes), and small circles on to a plane outside the sphere. The same arrangement was used by Barrett (1952) in describing the derivation of the stereographic projection.





FIGS. 1 and 2: Fig. 1 (left). The equipment dismantled: (*a*) a glass flask in the neck of which a small electric bulb can be emplaced; the bulb is held by a sponge bung, (*b*) a plywood board with attached wire ring, used to demonstrate inclined planes cutting the sphere. Fig. 2 (right). The projectionarium in use. An inclined plane cuts the sphere in a great circle, which great circle is being projected stereographically on to the paper below. The photograph was taken 'live' and has not been retouched.

The apparatus consists of a large glass flask (see photograph) from which most of the original neck was removed. A small electrical bulb is emplaced within the flask opening, pointing downwards, in such a position that the bulb filament lies within the flask circumference. The area immediately around the bulb has been blackened in order to prevent superfluous light falling during the demonstration.

The flask represents the sphere of the spherical projection on which all points and planes to be projected stereographically are first marked. A useful accessory is a plywood board from which a semicircular cut has been made; a wire circle of diameter slightly larger than the sphere is so attached to the board that the cut-out and wire comfortably encompass the sphere. If the board is suitably held, then the great-circular trace of any plane is demonstrable. The horizontal plane is represented on the sphere by its equator (relative to the bulb as pole). The size of the bulb filament greatly affects the success of the projection. The apparatus illustrated here uses a Zeiss 6-V microscope lamp and bulb the filament of which is so small that it effectively serves as a point-source.

The projectionarium is demonstrated in a darkened room. The plane on which the spherical projection is projected stereographically may conveniently be the table top on which a sheet of drawing paper is spread. The lamp at the sphere's north pole then serves as the pole of projection. If desired, however, this arrangement could be reversed, or alternatively projection may be made on a wall.

The equatorial plane of the sphere will appear projected as the stereographic primitive circle. The diameter of the primitive will be twice that of the sphere if the sphere rests directly on the table; if the sphere be raised, the diameter of the primitive increases but the resulting projection is still a valid stereographic one.

In use a plane may be selected using the board; this plane is then depicted simultaneously by two projections: as a great circle on the sphere, outlined by the wire attached to the board; and as a great circle on the paper—the stereographic projection of the circle on the sphere. Illustration of the change in form of the stereographic arc with changing inclination of the plywood plane is both convincing and dramatic. Further applications will be self-evident.

Acknowledgement. The author's son, D. V. Oppenheim, kindly took the photographs.

Department of Geology, Hebrew University
Jerusalem, Israel
M. J. OPPENHEIM

REFERENCES

BARRETT (C. S.), 1952. *Structure of Metals*, 2nd edn, p. 28. New York (McGraw-Hill).
ZUSSMAN (J.), 1967. *Min. Mag.* **36**, 137–8.

[*Manuscript received 1 January 1969; revised 8 April 1969*]

MINERALOGICAL MAGAZINE, DECEMBER 1969, VOL. 37, NO. 288

Effect of concentration of etchant on the shape of etch pits on cleavage faces of calcite

SEVERAL workers have reported the study of etch phenomena on calcite cleavages (e.g. Honess, 1918; Pfefferkorn, 1952; Bengus *et al.*, 1960; Keith and Gilman, 1960; Pandya and Pandya, 1961). The present communication reports some typical observations on the effect of concentration of etchant on the shape of etch pits on calcite cleavages.

Freshly cleaved rhombohedra of calcite were immersed in a still, dilute solution of A.R. quality hydrochloric acid in distilled water. The etching time was varied from 1 sec to about 5 min to get sharp, well-defined etch pits. The etched surface was thoroughly washed in distilled water and dried. For microtopographical studies of surfaces, thin silver films were deposited on them by thermal evaporation.

It was observed that the shape and symmetrical nature of the etch pits with respect to the vertex of the conical pits were functions of concentration of hydrochloric acid, time of etching, and temperature. Fig. 1 is a photomicrograph of a rhombohedral cleavage etched by 0·6 % HCl solution for 10 sec. It shows five-sided etch pits, the faces of which meet at a point at the deepest part of the pit. The faces of the pits are