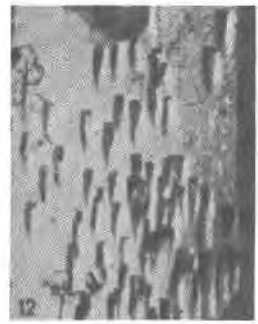
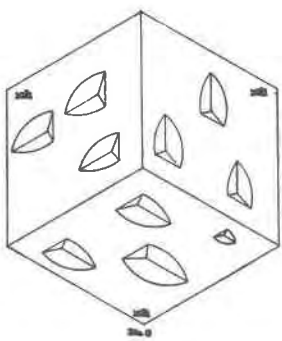
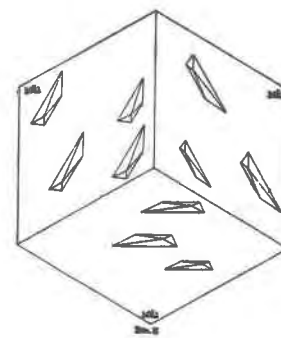


Photographs by Arthur P. Honess.





ETCHING FIGURES ON DOLOMITE AND PHENACITE

For explanation see pages 71-74

Fig. 11 is x850; 12, x120; and 13 and 14, x300

PLATE II

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A STUDY OF THE ETCHING FIGURES OF THE HEXAGONAL-ALTERNATING TYPE OF CRYSTALS

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(*Continued from page 61*)

PHENACITE

The phenacite crystals used are from the Crystal Peak locality, Florissant, and Mt. Antero, Chaffee Co., Colorado. Those from the former locality are flat rhombohedrons, with the prism zone almost completely lacking; the latter locality yields crystals of the elongated type, with the prism $11\bar{2}0$ the dominant form. The prism was first investigated.

Prism

Phenacite, being quite insoluble, was not etched after repeated attempts with the more common acids, consequently the fused alkalies were used. At first the crystal was immersed for only three seconds in fused NaOH, but even this was sufficient to produce distinct etchings, which appeared as very minute elongated depressions extending parallel to the prism edges; other than this no definite form could be assigned to them. Repeated immersions for several seconds each gradually developed more distinct figures possessing three sides, but still very narrow and elongated in form, the two longer sides terminating in a single point, the third side extending in an oblique direction across the prism face. This, then, being the most primitive stage of development indicates a more rapid solution in the direction of the *c* axis. Immersion to the extent of twenty seconds in the fused NaOH was sufficient to produce well-defined figures as seen in Photo 12 (see frontispiece). They have a definite orientation, with their longer axes extending parallel to the intersections of the prism faces. The two longer sides are curved outward, and are intersected by two short, straight oblique lines which form the upper and lower terminations of the figures. The upper boundary is definite, but the lower one is very dim and uncertain. The figures do not conform to any possible planes of symmetry, but their position on adjacent faces indicates the presence of an alternating axis *c*.

The etch figures of another small crystal from the same locality were investigated by means of fused KOH. As before, the crystal was immersed for only two or three seconds at a time, and examined after each immersion, in order to note the development of the figures, and if possible to compare the figures resulting from the action of the two different solvents. At first no etching was visible on the prism, but very minute grooves or striae cut the face of the rhombohedron diagonally, indicating the more soluble nature of this form. Only after immersion of several minutes did solution begin, and even then the etchings were visible only as the smallest pits, slightly elongated, very similar to those previously described as produced by NaOH. Five minutes immersion produced as the ultimate form a quadrilateral figure, well defined and distinct. (See Photo 13.) The figures are bounded by four straight lines, all differing in length, the two longer being nearly parallel and extending parallel to the prism edges. Unlike the NaOH figures, there are no curved lines, and the terminations instead of appearing as indefinite broken margins are definite lines; the one at the narrower end of the figure is about perpendicular to the longer axis, while the other intersects it obliquely. The figures may or may not have a face parallel to the prism; in the absence of this plane the deeper part of the figures lies well to one end. Like the NaOH figures, those produced by KOH bring out the symmetry of the type.

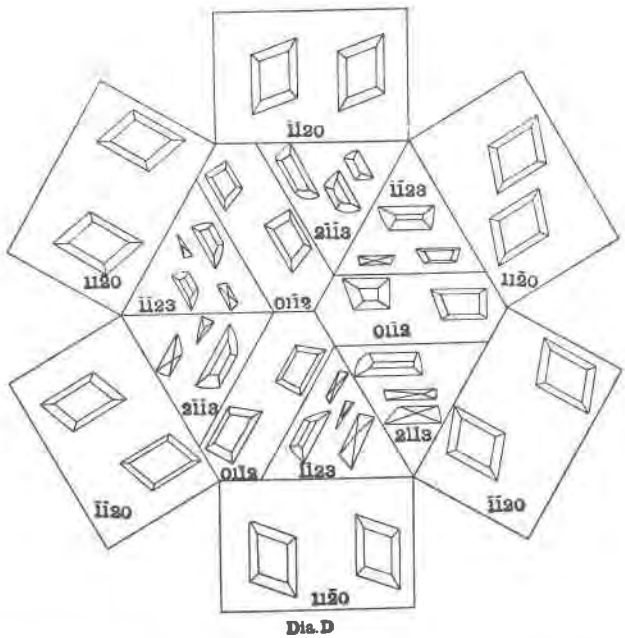
Etch figures were also obtained by fused borax, but the action of this solvent was so violent that the tendency was to corrode the face rather than to etch it. The first indication of etching was the appearance of many minute depressions, elongated diagonally across the prism; these upon continued immersion became intergrown to such an extent that individual forms were completely obliterated. Fused KF, likewise, acted with such vigor that individual figures were difficult to obtain. Photo 14 represents the crystal face after five seconds immersion. The darker portions represent the small basal faces of the etchings. The etch figures are very irregular, and reveal no planes of symmetry.

Rhombohedron

Crystals from the Crystal Peak locality were selected for the purpose of etching the rhombohedron. The $10\bar{1}1$ face is quite soluble if submerged in fused NaOH, so that a little caution is necessary to avoid intergrowth. The less perfect portions of the face very quickly assume a dull corroded appearance, but occasional distinct figures may be seen which are dagger-like, and composed of three faces, one plane and two curved surfaces (See dia. C). The broad end of the figure occupies a position parallel to *d–r*. The primitive forms are shorter and broader. Like all of the phenacite figures previously described, these forms possess no planes of symmetry and accord with the type.

Natural Etch Figures on Phenacite

Among the phenacite crystals in the Princeton University collection are several gem crystals from San Miguel de Peracicora, Brazil, possessing a variety of forms, and most beautifully naturally-etched, as illustrated in Dia. D. The + and - rhombohedrons of the second order are the best developed faces and occur in groups of two, one + and one - form; the pairs are separated by the faces of the *-r* form, which truncates the alternate intersections of $\bar{1}\bar{1}23$ and $2\bar{1}\bar{1}3$. The natural etchings of $\bar{1}\bar{1}23$ and



Dia. D

$2\bar{1}\bar{1}3$ are almost identical in outline, but are differently oriented on the two forms. In general, the figures which represent the final stage of development are slightly elongated forms, the longer margins of which are straight parallel lines, intersected by two shorter curved lines, which bound the ends of the figures. One of the lateral margins being shorter than the other gives the figures an asymmetrical appearance. The more rounded terminations are turned poleward with the shorter lateral boundaries adjacent to the edge $01\bar{1}2$–$2\bar{1}\bar{1}3$ Various stages of development are represented but all are asymmetrical. The plus and minus forms do not become congruent if revolved about a vertical axis, indicating the difference of molecular configuration of the faces.

The form $01\bar{1}2$ is marked by elongated quadrilateral figures, one end of which is rectangular, the other oblique. These etchings are similar in position and form to those just described, but they differ in the absence of curved margins. They are elongated parallel to the intersections $01\bar{1}2$–$2\bar{1}\bar{1}3$ and $01\bar{1}2$–$\bar{1}\bar{1}23$, with the shorter lateral boundary adjacent to $2\bar{1}\bar{1}3$. As in the figures of $\bar{1}\bar{1}23$ and $2\bar{1}\bar{1}3$, those of $01\bar{1}2$ may or may not possess a face at the bottom of the pit. The etchings by their form and position indicate an absence of symmetry planes and verify the presence of the alternating axis c.

The prism $11\bar{2}0$ is the best developed form of this zone, and is marked by definite rhombic figures, slightly elongated parallel to the intersections of the prism zone. They are composed of five planes, two of which are asymmetrically placed, and by their positions on adjacent faces indicate the vertical axis c to be hexagonal-alternating. The mineral as a whole is therefore hexagonal-alternating in symmetry.

Dolomite

In the investigation of the etchings of dolomite white rhombohedral crystals from Canton Wallis, Switzerland, were used. Several large crystals and cleavage plates were carefully etched by two solvents, sulfuric and hydrochloric acids. In each case the same form $10\bar{1}1$ was etched and the time thru which solution continued was approximately twenty seconds. The figures produced by the dilute sulfuric are quadrilateral and composed of four faces of unequal size; the deeper portion of the figure lies without the center, producing an asymmetrical form elongated parallel to the long diagonal of the face. (See Dia. E.) The figures produced by boiling 15% HCl are illustrated in Photo 11. Here the asymmetrical character of the figures is very apparent; the four bounding faces of the etching meet in a common point near one end of the pit, indicating a difference in size and shape of the two faces at the ends. The lateral bounding faces are also dissimilar; intersections of these faces with the crystal face are very different, the one straight, the other decidedly curved. The figures are therefore, not symmetrical to planes and indicate the hexagonal-alternating symmetry of dolomite, which by some writers has been assigned incorrectly to the calcite type.

Cleaning Ferberite Specimens.—The ferberite crystals from Boulder County, Colorado, are often dull on the surface owing to the presence of a film of silica. This coating can be removed by immersion in dilute hydrofluoric acid, which dissolves silica but does not attack the ferberite, so that the crystals of the latter come out clean and brilliant. Inferior specimens can often be considerably improved by this treatment. The work must of course be done in hard rubber, lead or platinum vessels, and the hands carefully protected from contact with the acid.

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