A NOTE ON THE INTERPRETATION OF ETCH FIGURES

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One of the first principles learned by the student of crystallography is that the 32 crystal classes differ primarily in their general form (*hkl*) or (*hkīl*), and except in the triclinic system and a few special cases in other systems, the remaining six forms are morphologically identical through two or more classes. In several recent publications on etch figures this principle has, however, been overlooked, leading to some misunderstandings which deserve an attempt at clearing up.

In an interesting paper by Honess and Jones[1] it is shown that the etch figures on several forms of calcite produced by certain solvents exhibit a lower degree of symmetry than that usually ascribed to this mineral, yet the basal pinacoid (0001) in their experiments yielded only figures possessing the full crystallographic symmetry. These authors consider this as in some way connected with the arrangement of atoms in the structure, and recommend more extended study. Their diagram on page 684 shows, however, that the figures in question are not bounded by a general form, but by a rhombohedron (0*hh̄l*), a form which occurs in several classes and accordingly is incapable of revealing merosymmetry at all. Further study of the matter is indeed desirable, but it may well be of practical character, consisting of trying additional etch media until one is found which produces on the base figures bounded by the general form (*hkīl*). Only in this way can it be ascertained whether or not the basal pinacoid of calcite is in fact anomalous with respect to the other forms.

Two suggestions may be made as to the lines along which search for such etch media might be profitable. It has been observed that the symmetry of etch figures may become lessened when the etching liquid is made more concentrated. (According to the principle above discussed, this merely means that the more dilute solutions yield figures bounded by some of the 6 forms other than the general one.) No doubt the critical concentration for the appearance of (*hkl*) or (*hkīl*) bounding faces on the figure varies from one form to another, and is higher for the base than for any other form. Its maximum value may conceivably be attained by the use of more soluble etching compounds.

On the other hand, the appearance of modifying faces on crystals is often stimulated by the presence of impurities, both crystalloids and colloids, in the solutions. Perhaps small amounts of accessory substances might lead to the development of complex, and ultimately general, bounding faces on etch figures as well.

[1] *Bull. Geol. Soc. Amer.*, vol. **48**, p. 667, 1937.

The contradictory results which have been obtained by workers on the etch figures of sylvite and other halides may well be connected with the principle here under discussion. One worker may have used an etching medium which yields only (111) pits, and since this form is geometrically the same in all five classes of the cubic system, he reports holosymmetry. Another may have chanced upon a medium capable of producing (*hkl*) pits, and finds them asymmetric. I have sought in vain in the controversial papers on the etching phenomena of halides of the past 20 years for a recognition of this elemental principle. Perhaps our textbooks are to blame, in that they do not emphasize the point, and the diagrams of etch figures they give are often misleading in this very respect.

BROMYRITE FROM TOMBSTONE, ARIZONA*

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Bromyrite at Tombstone, Arizona, here described, is believed by the writer to represent the first authenticated occurrence from the United States, though others have mentioned it without publishing a chemical analysis. Search for this mineral has been made, especially in the silver districts of Nevada.

In the study of the mineralogy of the Tombstone district, several specimens of unusually well crystallized dark green "horn silver" had not changed its color since they were first collected by the writer in April 1935. Specimens collected before that date by others had, also, not changed color. Therefore, a carefully separated sample of about 3 grams submitted to the chemistry department of the University of Arizona was analyzed by Mr. R. Carrillo under the supervision of Dr. R. L. Nugent and gave the following composition:

	Per cent	Ratios	
Cl	0.6	.017	
Br	38.9	.487	.524
I	2.6	.020	
Ag	56.7	.526	.526
	98.8		

The analysis shows the mineral to be bromyrite, probably containing, isomorphously, small proportions of iodyrite and cerargyrite.

The silver haloid, mined from the surface to the lowest depths of oxidation, both in the early days and at present, has been called cerargyrite without any mention that bromine was a constituent. In unpublished

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