

## REVIEWS

REVIEW OF A RECENT ARTICLE ON THE SYMMETRY OF THE ETCH  
FIGURES OF ALKALI HALIDES

Pointing out that the study of alkali halides by X-rays indicates their structure to be holosymmetric, while the etch-figures of some of them are recorded to be gyroïdal or plagihedral, A. Hettich, a student under Fajans and Herzfeld at Munich, has recently published the results of a somewhat elaborate investigation on the influence of various substances on the symmetry of these etch-figures.<sup>1</sup> Most of his observations were made on pure potassium chloride, fused to destroy organic matter, and then cleaved into small blocks or plates. When these blocks were etched with nearly saturated solutions of KCl, for periods of a few minutes or hours, series of tiny pyramids appeared on the surfaces, and their symmetry could be readily recognized with a low power microscope. Upon taking special precautions to exclude organic matter, such as doubly distilling the water over permanganate, cleaning all vessels with bichromate-sulfuric acid mixture, heating the forceps used to handle the crystals in a flame, and excluding dust as far as practicable, the etch-figures were found to be entirely symmetrical. However, when dust was admitted, when the crystals were handled, or when the water was stirred with animal charcoal, filter paper, etc., the etch-figures always showed a certain amount of rotation with respect to the crystal axes, corresponding to plagihedral (gyroïdal) symmetry. The sense of this rotation is always clockwise. When minute amounts of optically active organic compounds were added to the etching solution, the same rotation was produced in some cases, although most of the substances tried showed no effect. Of the substances, both optical isomers of which could be used, only lactic acid had a consistent asymmetric effect, but both right and left forms produced the same etch-figures. The author concludes that the merosymmetry (he uses the less apt term hemihedrism) shown by the etch figures of potassium chloride, potassium bromide, (which was also tried to some extent), and presumably the rest of the alkali halides, is due to a trace of optically active organic matter contaminating the etching solution and being differentially adsorbed on the surface of the crystal.

The question of the cause of this apparent merosymmetry of the alkali halides, or indeed, of the whole problem of amphisymmetry, is a very interesting one, but the reviewer can not feel that it has been adequately handled by this author. For one thing, he does not seem very familiar with crystallographic literature, for he innocently asks "whether perhaps further cases of such pseudoplagihedrism may not be found outside of the alkali halide group?" Several years ago, in a paper on amphisymmetric crystals, which Hettich has overlooked, the reviewer pointed out that the literature contained over a hundred instances of this relation, all of the crystal systems being represented.<sup>2</sup> Then, his deductions from the observational data do not seem very sound.

In the first place, the obtaining of symmetrical etch figures in the uncontaminated experiments would not demonstrate that the substance is holosymmetric unless it were shown that the general form (hkl) was actually present as a bounding

<sup>1</sup> *Z. Krist.*, 64, 265-295 (1926). Abstracts of the same work have been also published elsewhere.

<sup>2</sup> *Am. J. Sci.*, 4, 237-244 (1922). An amphisymmetric crystal is defined as one which shows different symmetry when examined by different methods.

face on those figures, and this was not done. In the second place it has not been proved that the merosymmetry observed, when contamination occurred, was actually due to an optically active constituent in the dust or other contaminating agent. Such experiments as were tried with optically active compounds were admittedly inconclusive, and the fact that the revolution of the etch-figures was clockwise in all cases, even when two optical isomers of a given compound were used, seems to the reviewer to indicate quite clearly that the production of gyroidally arranged etch-figures is a property characteristic of the crystal itself. All that Hettich does appear to have demonstrated is that a trace of organic matter in the etching solution leads to the development on the etch figures of an (hkl) form, which, for some reason as yet undetermined, has a clockwise gyroidal face-arrangement.

This review is written in the hope that someone may be encouraged to carry on further work on the alkali halides, and clear up the points still in question. Perhaps instead of etching crystal surfaces it would be more informing to grow crystals under conditions leading to the development of (hkl) faces, along lines such as those so well worked out by Walcott in this journal recently.<sup>3</sup> The lack of rotation of the plane of polarized light showed long ago that the alkali halides are structurally holosymmetric, and the reviewer quite agrees with the author's criticism of the theory of Johnsen and of Thirring, that the ions in the crystal are nevertheless themselves plagihedral. Etch figures bring out only surface, not internal, relationships. However, as has been stated elsewhere<sup>4</sup> the phenomena of amphisympmetry do make it appear that even though the ions in a crystal may be arranged with a high degree of symmetry, under certain conditions at the instant of solution or deposition a diminished symmetry, perhaps characterizing the atoms rather than the ions, can assert itself. Possibly Hettich's contaminating organic matter merely represses ionization at some critical moment in the change from liquid to solid phase (or the reverse); or, it may slow up, differentially, the rate of change of the two opposing ions. However, theoretical speculation is of little value until the necessary experimental data are available. A crystallographic problem of considerable interest and probable importance awaits further investigation.

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## NEW MINERAL NAMES

### Heterobrochantite

H. BUTTGENBACH: L'Hétérobrochantite, variété d'antlerite (Stelznérite). *Bull. Ann. Soc. Geol. Belg.*, 49, pp. 3-11 (1926).

NAME: Named in allusion to its *heteropolar* (*hemimorphic*) development and its resemblance to *brochantite*.

CHEMICAL PROPERTIES: A basic sulfate of copper. Formula: Like that of antlerite,  $3\text{CuO} \cdot \text{SO}_3 \cdot \text{H}_2\text{O}$ . Analysis: CuO 68.03,  $\text{SO}_3$  22.33,  $\text{H}_2\text{O}$  10.53, Insol. 0.01; Sum 100.93.

CRYSTALLOGRAPHIC PROPERTIES: Orthorhombic. Habit flat plates. Cleavage (100) good, also (010). Under the microscope the crystals appear to be hemimorphic, one set of faces making an angle of  $45^\circ$  with the vertical, the opposite set  $54^\circ$ .

<sup>3</sup> *Am. Mineral.*, 11, 221-239, 259-278 (1926).

<sup>4</sup> *Am. J. Sci.*, 4, 241-242 (1922); also *Am. Mineral.*, 9, 53-54 (1924).