AN ELEMENTARY INTRODUCTION TO CRYSTALLOGRAPHY

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IT IS impossible to think of a person being interested in mineralogy without being interested also in crystallography. The beauty of color is at once acknowledged but the beauty of form is not much behind it, and is generally of much more importance in the determination of a mineral or a chemical compound. Yet a great many collectors of minerals will acknowledge that the subject is to them a sealed book. There seems to be a lion in the way,—one that scares a great many people in other matters as well: mathematics.

The way the subject has been presented may be to blame. In a series of articles of which this is the first I am going to try to make the matter plain to any one who will apply himself to the subject. I will confine myself mostly to four figures, 0, 1, 2 and 3, and avoid complicated mathematics entirely.

The student may want to go further than this series of essays will take him, which can be done all the more readily if he has taken pains to master these easy lessons. I have tried them with entirely satisfactory results on a number of people without the slightest previous knowledge of the subject. A young chemical student read 38 pages of my notes with evident satisfaction and was able to correct an involved clerical error in one of my symbols.[1]

The study of crystallography involves certain facts, certain conventions and certain symbols.

The facts cannot be easily described without the conventions and symbols. A little attention given to these will enable any one to get a clear idea of the matter. The symbols I am going to make use of differ somewhat from those adopted by the foremost English writers on mineralogy, the Danas and H. A. Miers. The first great fact is that crystals are bounded by flat surfaces or planes. Our endeavor is to describe these planes and the forms they build up so clearly that any one can easily imagine or realize the forms or faces referred to.

[1] If any further errors should be detected, or the meaning is not reasonably plain at any point, I would be very much obliged to receive information about it.

If we hold a map up in front of us there is a line running north and south—up and down thru the center—which we call a meridian. This direction in a crystal we call *c*, or the *c* axis. There is also in general a straight line running east and west, from right to left, that might be the equator. In a crystal this would be *b*, or the *b* axis. Since crystals are not planes like the map, but solids, we require a third direction in space, or axis, to fully describe them. This may be represented by a long needle put through the map where the north-south line or axis crosses the east-west line or axis. This is *a* or the *a* axis.

The authors named use *a*, *b* and *c* in this way, but they also use them to indicate faces, which is confusing. Faces or planes should always be indicated by three numbers, as for instance 110 (read one, one, naught); 1 and 0 being used more frequently than all the other numbers put together. The figure 1 in the first place refers to the *a* axis and means that the plane or face passes thru the end of it nearest to the observer. The 1 in the second place means that the plane passes thru the right or east end of the b axis. We will take up the third figure, 0, later.

(*To be continued*)

In a note in *Science* (**44,** 161, Feb. 16, 1917) Professor John E. Wolff of Harvard University has given a brief account of the Hancock collection, which was referred to in our January number (**2,** 4, Jan. 1917). The late Mr. Hancock was a landscape artist and wood carver, and with an artist's eye and skilled manipulation with fine tools, developed the hidden beauties of crystals by removing the matrix.

"The collection contains about 1,600 specimens of generally the first quality, usually matrix specimens showing good crystals. The standard European and other non-American localities are fairly represented with excellent and well-chosen material but the greater interest is in the superb crystals from American localities such as Franklin Furnace, Tilly Foster mine, Amelia Court House, Va., and others where Mr. Hancock collected on the spot and then worked out his material with incredible skill and patience."