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A NEW METHOD OF CRYSTAL DRAWING[1]

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The following method of crystal drawing, unlike all other methods, is not based upon geometrical constructions. In place of geometrical construction lines we have substituted the more general equations of analytical geometry and obtained two simple formulas which are applicable to all forms. These formulas give coördinates which, when plotted on the axial cross (of any system), give at once the direction of the line of intersection. The first part of this article will be devoted to the technical procedure of drawing crystals; the second part to the theory of the method.

PART I. METHOD

The method may be best illustrated by taking a practical example and working it thru. First the axial cross, the construction of which is described in all standard texts, must be drawn. We then have the two formulas

$$b = \frac{hr - lp}{kr - lq}; \qquad c = -\frac{hq - kp}{kr - lq}$$

which give the coördinates of the direction point of the line of intersection between any two faces whose Miller indices are hkl and pqr. For example take the forms 223 and 021, we have

$$b = \frac{2 - 0}{2 - 6}; \qquad c = -\frac{4 - 0}{2 - 6};$$

from which $b = -1/2$ and $c = 1$, which are the coördinates of the direction point.

[1] Read at the meeting of the Mineralogical Society of America, December 29, 1920.

In Fig. 1A, which represents orthorhombic axes, we plot the point d(− 1/2, 1) by going to the left of the origin a distance equal to 1/2b and then vertically a distance equal to c. This point connected with the control point, the positive end of the *a* axis, gives the direction of the line of intersection between the two forms, 223 and 021. Figs. 1B and C show the application of the same coördinates to the triclinic and the hexagonal systems. In all calculations in the hexagonal system we drop out the third number of the Miller indices because three axes determine the position of a face.

Under certain conditions the denominator in the formulas becomes zero, and coördinate values can not be obtained. In this case the origin becomes our control point and the coördinates of the direction point are the numerators of the fractions. The coördinates are then plotted as before, but to obtain the direction of the line of intersection we connect that point with the origin.

Knowing the direction lines between all faces, we construct the crystal drawing by the same method that is followed when using the intersection or the Stöber method. For lines in the rear, one may use the same direction point as used for the corresponding faces in front, but connect that point with the negative end of the *a* axis.

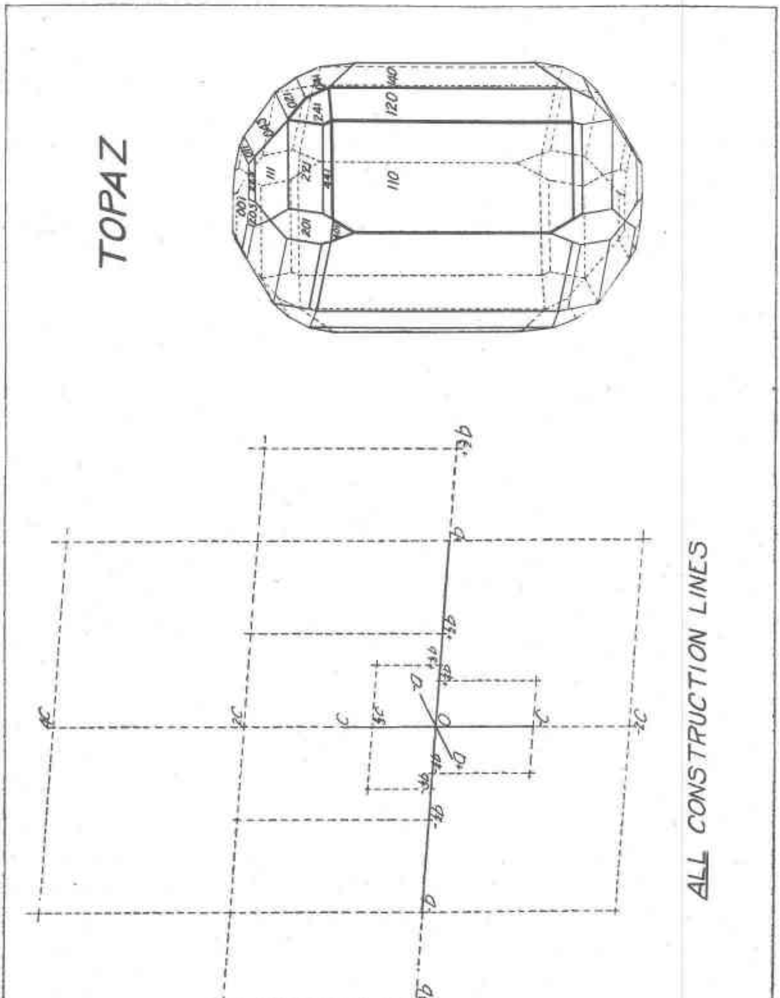
Part II. Principles of the Method

This method of determining the direction of the intersection lines is a mathematical solution of the well-known intersection method under special conditions. Every face is moved parallel to itself until it cuts the *a* axis at unity. Then the positive end of the *a* axis becomes a point on all intersection lines. We then determine by analytical geometry the coördinates of the point at which a line of intersection pierces the plane of the *b* and the *c* axes. This is done as follows:

Let hkl and pqr be any two faces of a crystal. Let the *a*, *b*, and *c* axes represent the coördinate axes x, y, and z. Then write the equations of the two planes parallel to those two faces and passing thru the point x = 1, on the *x* axis, which gives:

$$hx + ky + lz = h; \qquad px + qy + rz = p.$$

The equation of the plane of the *b* and the *c* axes is x = 0, so if we solve this equation simultaneously with the two equations above we will have the coördinates of the piercing point. The solution gives: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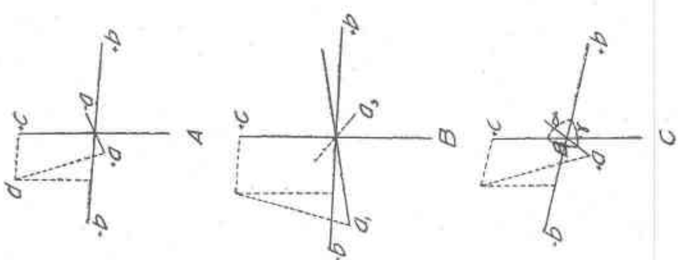
A
B
C

$$y = \frac{hr - lp}{kr - lq}; \qquad z = -\frac{hq - kp}{kr - lq},$$

our two general formulas.

In the special case where the denominator becomes zero the line of intersection is parallel to the plane of the *b* and *c* axes and will not pierce it. If we then move the two planes parallel to themselves until they pass thru the origin we will have the trace of the line of intersection on the plane of the *b* and *c* axes and it will pass thru the origin. The numerators of our two formulas will represent coördinate values, which will give the correct slope.

THE MINERALS OF ST. LAWRENCE, JEFFERSON AND LEWIS COUNTIES, NEW YORK

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Muskalonge Lake. *Hammond*-7-3-southwest edge.

This lake was formerly noted for the large-sized fluorite crystals and crystal aggregates which it furnished. At present pale green to nearly colorless cleavage pieces with occasional crystals are to be found along the northeastern shore, but the cracks out of which they have weathered were not found by the writer.

Region North of Somerville. *Hammond*-9-4-east edge, north of center.

The minerals are here developed in a nodular limestone. To reach this locality start at Somerville on the state road and go northeast towards Gouverneur, take the left turn at the first road junction and follow this dirt road (along the township line on the map) across a creek where it turns sharp right and passes a farm. Leave the road one hundred meters before it takes this turn and go southeast into the fields along the south edge of the woods. The limestone is cut by a few masses of granite and pegmatite but the minerals are developed in nodules away from the igneous contacts. In these nodules the following minerals may be found: phlogopite, light green serpentine holding pale purplish spinels (these cannot generally be seen except on the freshly broken under surface of the nodule), grayish white and brown silky scapolite, granular disseminated brown tourmaline, occasional small, light green pyroxenes, and, near the eastern border of the nodular zone, a little chondrodite with rare spinels.