Note on the determination of the orientation of section planes of meteoritic irons.

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RECENTLY Dr. M. H. Hey published in this journal[1] a method to construct graphically a projection showing the relation of two etched surfaces *M* and *N* to the crystallographic axes of a mass of the Gibeon meteoritic shower. Upon those faces could be distinguished the traces of four octahedron planes o_1, o_2, o_3, o_4 which are inclined at the following angles, measured clockwise from the intersection [*MN*] of the etched surfaces: on surface *M* 22°, 62°, 98°, and 135°, and for the same octahedron planes on surface *N* 106°, 38°, 150°, and 86° respectively.

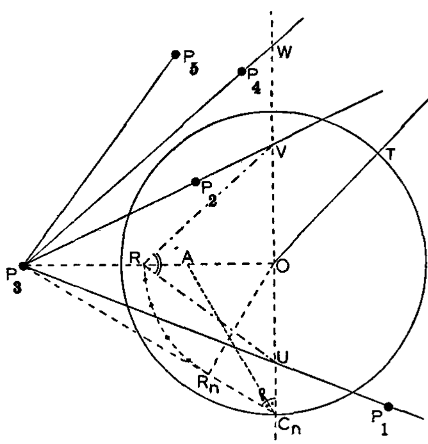

FIG. 1.

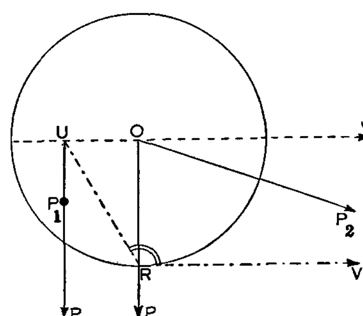

FIG. 2.

The two faces *M* and *N* are at an angle of 84° one to the other. Hey's solution of the problem is based on a reversal of the Goldschmidt construction for drawing crystals from the gnomonic projection. This method uses the 'angle-points' (Winkelpunkte) of the linear projections of the planes *M* and *N*. The construction is elegant, but it is rather cumbersome in consequence of the many lines that have to be drawn (in Hey's fig. 2 the greater part of the auxiliary lines has been omitted).

We found a simpler construction by taking into account, instead of the angle-point *A*, another point which I have called[2] the 'radiant point' *R*. In the same manner as the angle-point of a gnomonic zone-line shows the angles between the

[1] M. H. Hey, Min. Mag., 1942, vol. 26, pp. 141–166.
[2] P. Terpstra, Kristallometrie. Groningen, 1946, p. 17.

planes of that zone, so the radiant point R of a gnomonic pole indicates the angles between the traces wherein the plane, figured by that gnomonic pole, is intersected by other planes. In fig. 1 the origin C of the gnomon is below the plane of the drawing vertically under the point O at a distance equal to the radius of the circle. The angle between the 'zone-planes' P_3P_1C and P_3P_2C equals the angle between the traces of the planes P_1 and P_2 on the plane P_3. This angle can therefore be found by bringing a plane through the point O which is normal to the line P_3C (the intersection of P_3P_1C and P_3P_2C) in a point R'. Hinging that plane on UV to the plane of projection, the point R' is brought to R and URV

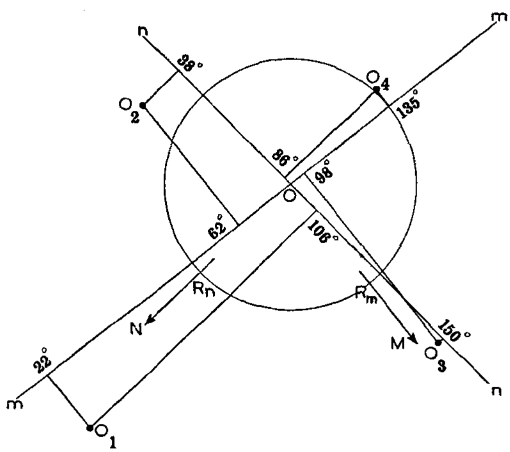

FIG. 3.

is the angle between the traces of the planes p_1 and p_2 on the plane p_3; likewise URW is the angle between the traces of p_1 and p_4 on p_3, &c. Taking into account the above-mentioned construction of the radiant point, it will at once be clear that O is its own radiant point, whereas the radiant point of a pole π at infinity is the point T upon the gnomonic circle.

Calling in fig. 1 $OC_n = r$ and angle $OC_nP_3 = \rho$, one finds $OR = OR_n = r.\sin\rho$. Moreover, the point A is the angle-point of the zone-line whose pole is in P_3, if angle $OC_nA = \frac{1}{2}\rho$, and therefore $OA = r.\tan\frac{1}{2}\rho$. In the case of a pole π at infinity $\rho = 90°$ and hence $r.\sin\rho = r.\tan\frac{1}{2}\rho = r$, so that in this special case the radiant point and the angle-point coincide in the point T.

Turning now to fig. 2, one recognizes the construction by the radiant point method of the angle between the traces wherein the vertical plane p_3 is intersected by the plane p_1 and by a second vertical plane p_2. The zone-line $[p_1\,p_3]$ is now parallel to OP_3, whereas the zone-line $[P_2\,P_3]$, being the line at infinity, intersects the line UO in the point V at infinite distance.

Hey's problem is dealt with in fig. 3. The faces M and N have been put in vertical positions and their radiant points are R_m and R_n respectively. In R_m the line corresponding with the intersection of the faces M and N is the tangent to the gnomonic circle. Measuring clockwise, lines should be drawn through the point R_m that are inclined at the angles 22°, 62°, 98°, and 135° to that tangent, and further, the intersections of those lines with the line mm should be determined.

A rapid method to find those intersections is the application of a gnomonic protractor, which gives the required points directly without any construction of lines. These points have to be connected with the gnomonic pole of the face M, i.e. lines have to be drawn normal to mm. The same procedure has been applied to N and nn. Thereafter the poles of the planes o_1, o_2, o_3, o_4 are found directly as is indicated in the figure.

It is worth while to observe that this construction does not necessarily depend on the radiant-point method, since the points R_m and R_n are also the angle-points of M and N, and mm and nn respectively are the corresponding guide-lines. Hence the reversed Goldschmidt construction that was applied by Hey and the radiant point method are identical for this special case.

The writer is indebted to Dr. M. H. Hey for his valuable criticisms.

Summary.—A simple graphical construction is described for the orientation of two etched faces M and N of a meteoritic iron from the Widmanstetter figures.