THE NORMAL TRICLINIC SETTING: CORRECTION

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In a recent paper on the crystallography of axinite (1937 A) a unique setting was proposed for triclinic crystals and named the *normal setting*, since it was founded on principles and conventions which are now widely accepted. The normal setting was defined as the setting in which the geometrical elements refer to the cell given by the three shortest non-coplanar identity periods of the structural lattice, in the one orientation in which the axis *c*[001] is the axis of the main zone, the plane *c*(001) slopes to the front-right, and the axis *b*[010] is greater than the axis *a*[100].

The condition that the base shall slope to the front-right is most directly expressed by stating that the pole of (001) must lie in the first quadrant where its azimuth angle ϕ is between 0° and +90°. Alternatively, it seemed, the same condition was defined by stating that the direct axial angles α and β shall both be obtuse; and in several recent papers, by the writer and others who consulted him, these two modes of defining the normal attitude of the base were used indiscriminately in the belief that they were equivalent. The following tabulation gives the relevant angles for five triclinic species which have recently been described in the normal setting; in each case it will be seen that both the apparently equivalent rules are obeyed: ϕ_{001} positive, acute; α and β both obtuse.

	ϕ_{001}	$\nu(\phi_{100})$	α	β	
Axinite	89°23′	102°38′	91°51½′	98°04′	PEACOCK (1937 A)
Rosenbuschite	60 33	67 30	91 21	99 38½	PEACOCK (1937 B)
Gordonite	54 19½	102 49	109 27	110 57½	POUGH (1937)
Babingtonite	56 39½	75 49½	91 31	93 51	RICHMOND (1937)
Römerite	87 24½	94 19½	91 17	100 30	WOLFE (1937)

While working on the crystallography of tarbuttite Mr. W. E. Richmond, Jr., found that the axial angle α is less than 90° when (001) lies in the first quadrant. This led to a reexamination of the geometrical relations involved, which clearly showed that under certain uncommon conditions α may be acute when the base slopes to the front-right. There are two cases, best seen in the stereographic projections (Figs. 1, 2), which give the poles of the axial planes, *a*(100), *b*(010), *c*(001), of a triclinic parallelepiped, the direct axial angles $\alpha\beta\gamma$, the polar axial angles $\lambda\mu\nu$, and the azimuth of the base ϕ_{001}; in both cases *c*(001) slopes to the front-right. In Fig. 1 $\nu(\phi_{100})$ is greater than ϕ_{001}; the zone-circle *ac* passes to the right of the centre and α is obtuse, as in the five examples given. In Fig. 2, however, $\nu(\phi_{100})$ is less than ϕ_{001}; the zone-circle *ac* passes to the left of the centre, and α is acute. Evidently there is also a special intermediate case, precisely realized in wollastonite (1935), in which $\phi_{100}=\phi_{001}$ and $\alpha=90°00'$. It is clear, therefore, that α is obtuse only when the azimuth of (100) is greater than that of (001), and that therefore the rule "α and β both obtuse" is not strictly equivalent to the rule "ϕ_{001} between 0° and +90°."

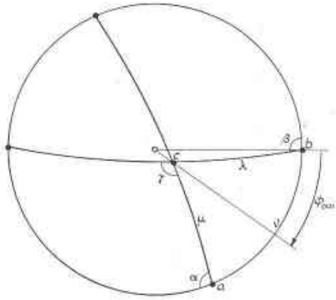

FIG. 1

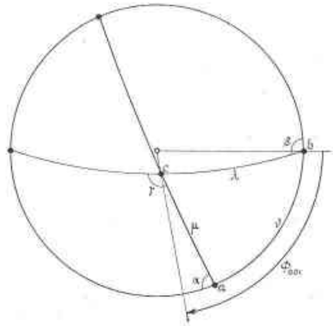

FIG. 2

In seeking a unique setting for triclinic crystals for determinative purposes Barker (1930, p. 13) gave the following rules to place the base in the conventional attitude: "(3) The zone-angle *abc* is taken less than 90°. (4) The great circle *ac* must traverse the projection to the right of the centre." These rules are exactly equivalent to "α and β both obtuse," as in our Fig. 1; they are not obeyed in Fig. 2 in which *c*(001) still lies in the first quadrant. If the normal setting and that of Barker rested on a common foundation it would be desirable to retain uniformity in the matter of the rule regarding the attitude of the basal plane. But such is not the case. Barker's method takes no account of the structural lattice, as determined by *x*-rays or by a comprehending consideration of the external geometry; it will therefore never be adopted as a general system of morphology, although it may yet serve its important purpose of providing a ready means of classifying and identifying chemical compounds from the angular relations of their crystal planes.

We propose, therefore, to retain the rule regarding the base in the form "ϕ_{001} lies between 0° and +90°," or its strict equivalent: "the angles $abc(180°-\beta)$ and $bc(\lambda)$ are both acute," and discard the rule: "α and β are both obtuse," which is frequently but not always equivalent to the first and second expressions.

The above correction in no way affects the singleness or propriety of the normal setting or its application in any of the published cases; it bears only on the wording of the rule which ensures the conventional attitude of the basal plane.

References

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