BARKER'S DETERMINATIVE ANGLES FOR CASTANITE

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The mineral castanite provides an interesting example in the search for its classification angles according to the Barker method.[1]

Castanite, the validity of which as a definite mineral was established by A. F. Rogers[2] in 1930, crystallizes in small triclinic crystals. Six forms were observed by Rogers, who assigned to them the following symbols: *b*(010), *M*(1$\bar{1}$0), *m*(110), *c*(001), *e*(011), and *s*(112). This crystal does not possess a four-plane zone, but exhibits four three-plane zones. The zone *msc* offers the greatest angle of all ($cm'=90°50'$), it is therefore completed harmonically by inserting a fourth pole I between *c* and *m'*. The stereographic projection is now rotated so that the newly created four-plane zone comes into vertical position. Note that the completion of this zone does *not* simultaneously create another four-plane zone; neither does it prevent the application of the principle of simplest indices. We are now dealing with a case of "three terminal planes" in triangular arrangement. Zones passed through terminals taken two at a time meet the primitive circle in observed faces with simplest indices. Of these three zones, the zone *ceb* offers the largest angle ($b'c=89°36'$); it is harmonically completed by the insertion of a pole II between *b* and *c'*. The problem is now one of "four terminals in the *T*-formation." Note that the completion of the zone *ceb* does not lead to complex indices.

The two four-plane zones now available intersect in *c*. The zone *bmM*, meeting the primitive circle in *m*, the pole next but one to *c*, is completed harmonically by the addition of a pole III inserted in the largest angle ($M'm'=71°37'$). No ambiguity exists at this stage. The central quadrilateral is built up from the five terminals so as to comply with the principle of simplest indices. The planes *M*, *m*, and *c* are given pinacoidal symbols, they are to be the so-called "cubic" faces. The "dodecahedral" faces will be *s* and I on the primitive circle, *b* and III on the central quadrilateral. The planes *e* and II are taken for the "octahedral" planes. All the ob-

[1] Barker, T. V., *Systematic Crystallography*, London, **1930.**

[2] Rogers, A. F., Castanite, a basic ferric sulfate from Knoxville, California, *Am. Mineral.*, vol. **16,** pp. 396–404, 1931. Attention is called to two misprints in the paper: on p. 397, in the explanation of the figures, read *M*{1$\bar{1}$0} instead of *m*{1$\bar{1}$0}; same page, second interfacial angle listed, read (010)$\wedge$($\bar{1}$10) instead of (010)$\wedge$(110).

served forms are thus given simplest notation. The axial and parametral planes are unambiguously determined. In other words, the unit-cell of the lattice adopted for determinative purposes is determined in shape. What remains to be done is the naming of the axes of reference and orienting them.

By applying the hypomonoclinic principle, the plane *c* must be chosen as the side pinacoid[3] **b**{010}. The condition that **cr**(001:101) must be less than **ra**(101:100) determines the notation of the forms *M* and *m*, which become **c**{001} and **a**{100}, respectively. Now the face **c**(001) must slope forward and to the right, hence the faces *m*(110), *c*(001), and *M*($1\bar{1}0$) become **a**(100), **b**(010), and **c**(001), respectively.

The Barker classification angles must now be computed from the values given by Rogers in the original description. The calculations are somewhat delicate on account of certain angles being very close to 90°. The results are embodied in the "filing card" of castanite according to the Barker scheme.

CASTANITE, $Fe_2O_3 \cdot 2SO_3 \cdot 8H_2O$ (Rogers, A. F., *Am. Mineral.*, vol. **16**, p. 396, 1931).

ELEMENTS: $a:b:c = 0.726:1:0.895$.

$\alpha = 89°50'$, $\beta = 91°10'$, $\gamma = 78°46'$.

TRANSFORMATION: $110/001/1\bar{1}0$.

FORMS						
Old:	$b(010)$,	$M(1\bar{1}0)$,	$m(110)$,	$c(001)$,	$e(011)$, and	$s(112)$.
New:	$10\bar{1}$,	001,	100,	010,	$11\bar{1}$,	110.

ANGLES: cr = 31°57′, ra = 39°40′, **am = 54°36′**,
mb = 34°34′, bq = 39°28′, qc = 49°24′.

The reader who desires to reproduce the above derivation by means of a stereographic net will obtain sufficiently accurate values of the classification angles (by reading them on the projection) to check the correctness of his adopted setting. The coördinate angles for the forms of castanite have been computed by Rogers from his interfacial angles and can be found on page 401 of his paper. The interfacial angles measured by Rogers are as follows: $bm = 61°34'$, $bM' = 46°49'$, $ce = 42°32'$, $eb = 47°52'$, and $cm = 89°10'$.

[3] The letters referring to the new setting (Barker) are printed in bold face.