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The Hemimorphism of Stephanite: the crystalline form of Kaolinite.

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(*a*). *The Hemimorphism of Stephanite.*

STEPHANITE has been the subject of two important memoirs. Schröder[1] examined minutely the crystals from Andreasberg; Vrba[2] has described fully the character of the stephanite from Przibram and other localities, and has given at the same time a summary of the observations of previous mineralogists, so that his memoir constitutes a monograph of the mineral.

By neither of these observers, however, nor elsewhere, has it been stated that stephanite is hemimorphic, although it has been suspected of being possibly hemihedral.

It is the object of the present paper to establish the hemimorphism of

[1] *Pogg. Ann.* 95 (1855), p. 257.

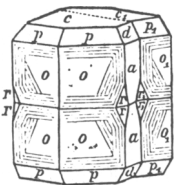
[2] *Ber. Böhm. Ges.* (1886), p. 119.

stephanite upon evidence similar to that which has been employed in the case of pyrargyrite.

With regard to the latter mineral it has been shown by M. Schuster[1] and myself[2] that certain striæ upon the prism faces are unsymmetrical since they point to one end of the crystal alone; and further, that when they occur at both ends they are accompanied by certain indications of twinning which show the crystal to be in reality a combination of two hemimorphic prisms attached to each other by their similar ends. This twinning tends to disguise the hemimorphic character of the crystals.

A similar striation and the same mode of twinning may now be shown to exist in stephanite.

The accompanying figure represents a combination of the forms :—



$c = 001 = oP$
$a = 100 = \infty \breve{P}\infty$
$o = 110 = \infty P$
$d = 201 = 2\breve{P}\infty$
$P = 111 = P$

twinned upon the face $\bar{1}10$: the two individuals are combined parallel to the twin-plane which is indicated by the dotted line upon *c*.

The faces *c* *P* and *d* are generally smooth and bright, except when traversed by twin laminæ parallel to faces of the forms $110 = \infty P$ and $310 = \infty \breve{P}3$; the brachypinakoid *a* is striated horizontally and vertically.

The prism *o* is sometimes smooth and sometimes striated horizontally and vertically; but on the crystals which are the subject of the present note, it is characterised by an oblique striation of special significance inclined at an angle of 23° 21½′ to the prism edge.

If now the attention be confined to the upper half of the figure, it will be seen that these striæ are exhibited upon each face of the prism *o*, and that they run in one direction parallel to its intersections with the form $\Gamma = 731 = 7\breve{P}\frac{7}{3}$.

The lines are only parallel to those faces of Γ which are situated at the lower end of the prism, and are therefore sufficient in themselves to indicate a want of complete symmetry; but the hemimorphic character is more clearly displayed when the form Γ is developed and presents small bright planes which are then to be found at one end of the crystal alone.

The figure further illustrates another feature which is characteristic of

[1] *Zeits. f. Krystallographie* 12 (1887), p. 117.

[2] *Min. Mag.* vii. pp. 71, 79, and *Zeits. f. Kryst.* 15 (1889), pp. 160, 168.

most, though not of all, of the hemimorphic crystals. The middle of the prism is traversed by a line of junction parallel to the basal plane *c*, dividing the crystal into two symmetrical halves. The upper half has oblique striations parallel to the faces of Γ situated at its lower end; the lower has the striations parallel to Γ at its upper end; so that these faces when present give rise to small re-entrant angles at the junction of the two individuals.

Such crystals must be regarded as twins precisely similar to those of the hemimorphic zinc-silicate, two crystals being united so as to be symmetrical to the basal plane.

If described as a hemitropy the twins must be geometrically defined as due to twinning about either the macropinakoid 010 or the brachypinakoid 100 with composition parallel to the basal plane; they are analogous to the twins of *pyrargyrite* described in vol. viii. p. 79 as due to twinning about the prism $10\bar{1} = \infty P2$ with composition parallel to the basal plane.

The two individuals are usually united by their Γ ends (ends at which the form Γ occurs), but sometimes the Γ faces are at the ends opposite to those by which the prisms are united; in this respect also they are analogous to pyrargyrite.

It is another peculiar feature of the crystals that, as is shown in the figure, this mode of twinning is generally combined with the almost universal twin-structure of stephanite which results from hemitropy about the planes $o = 110$.

A prism may, therefore, in addition to the hemimorphic twinning, consist of two or more individuals twinned about faces of the form 110, or may be traversed by twin laminæ parallel to those faces.

Upon some crystals, which appear at first sight holosymmetrical, the prism faces show striations at both ends without any signs of twinning; but on closer examination they prove to be totally distinct; those at one end are the striæ described above, which are inclined to the prism edge at the angle 23° 21½′, are formed by the faces $\Gamma = 731 = 7\breve{P}\frac{7}{3}$, and belong to the zone [$\bar{1}14$] containing the form $e = 401 = 4\breve{P}\infty$; while those at the other end are inclined to the prism edge at the angle 40° 46′, are formed by the faces $\rho = 421 = 4\breve{P}2$, and belong to the zone [$\bar{1}12$] containing the form $d = 201 = 2\breve{P}\infty$.

The latter striation is mentioned by Vrba as common on stephanite from Andreasberg.

When a twin crystal has Γ at its outer ends, the striæ and the re-entrant angles which indicate the line of junction are formed, not by Γ, but by the faces ρ, *d*, and belong to the latter series.

The two ends of a stephanite prism are therefore to be distinguished; one is characterised by Γ and by striations belonging to the zone $[\bar{1}14]$, the other by ρ and by striations belonging to the zone $[\bar{1}12]$; the direction of these striations, when they are visible, will always show to which end any part of a crystal is to be referred.

My attention was first attracted by the above peculiarities in crystals from Wheal Boys, Endellion, but I have subsequently observed the same indications of hemimorphism in Stephanite from Freiberg, Andreasberg, Gersdorf, Guanaxuato, and Chañarcillo.

(b). The Crystalline form of Kaolinite.

The length of the vertical axis of this mineral given in vol. viii. p. 25 is not correct.

If deduced from the measurements (p. 24) of the crystal represented in Fig. 34, Plate iii., the crystallographic elements are—

$$\beta = 83° 11'$$
$$a : b : c = 0{\cdot}5748 : 1 : 1{\cdot}5997,$$

the angles being

	Measured.	Calculated.
$b\ m$	60° 17′	
$c\ m$	84° 5′	
$c\ n$	78° 8′	
$b\ n$	60° 44′	60° 8½′.