

Ilmenite from the dolomite at Binn, Switzerland.

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AS is well known, the dolomite of the Lengenbach quarry is rich in pyrites and has some rutile; the crystals of the latter being very small and somewhat infrequent. It seems therefore strange that the presence of hematite or ilmenite has not hitherto been recorded. This last summer I obtained a specimen which showed a minute black crystal with numerous faces, which I began examining under the impression that it was a sulpharsenite. After numerous zones were measured, it became fairly clear that a triad axis was present; and a comparison of the angles with those given in Miller's edition of Phillips's 'Mineralogy' (1852) led me to the conclusion that the crystal was one of hematite or ilmenite. Careful examination has confirmed this conclusion; and as, unfortunately, the crystal was broken in trying to clear away matrix for further readings, I was able to get the streak, which was dark brown to black and not red. It follows therefore that the substance is to be regarded as ilmenite.

The numerous zones measured have not proved redundant; for I became aware of a remarkable relation: (*a*) between the zone [*ae*] = [100] of rutile and two zones of ilmenite, to which the symbols [111] and [101] can be given; and (*b*) between the zones [100] and [121] of ilmenite with one another and with the zone [110] of rutile. So that measurement of two zones may still leave the nature of the substance uncertain if they happen to belong to these two sets. The relations are shown in the following tables, in which Miller's letters, symbols, and angles are given:—

Ilmenite (Miller).				Observed.	Rutile (Miller).	
[<i>ae</i> = 011 : 101	57° 41'	[<i>or</i> = 111 : 100	57° 33'	57° 30'	[<i>ae</i> = 100 : 101	57° 18'
[<i>oa</i> = 101 : 211	32 19	[<i>rb</i> = 100 : 211	32 30	32 24	[<i>ec</i> = 101 : 001	32 47
[<i>ar</i> = 011 : 001	43 5	[<i>oa</i> = 111 : 012	42 11	42 58	[<i>cs</i> = 001 : 111	42 20
[<i>ra</i> = 001 : 011	46 55	[<i>ra</i> = 012 : 101	47 49	47 2	[<i>sm</i> = 111 : 110	47 40

This table makes it clear that a crystal may be wrongly interpreted unless more than these two zones are measured. In ilmenite the angles $57\frac{1}{2}^\circ$ and $42^\circ-43^\circ$ are measured from the same face; in one case the common plane is the base, in the other it is a face of the hexagonal prism {10I}. Rutile is at once excluded, for the angle $57\frac{1}{2}^\circ$ is measured from the prism face (100), whilst that of $42^\circ 20'$ is measured from the base (001). But when rutile has been thus excluded, we have the possibility of error in taking the face from which the angles in ilmenite are $57\frac{1}{2}^\circ$ and $42^\circ-43^\circ$ either as base or prism face. A third zone, fixing the angle between these two zones, becomes necessary. If the angles are measured from the base, the zones are inclined to one another at angles of 80° or 90° ; if they are measured from a prism face (10I), the zones are inclined to one another at an angle of $38^\circ 7'$. In the ilmenite from Lengenbach this angle was found to be $38^\circ 18'$.

In habit the crystal is much like one of the prismatic (orthorhombic) system; and the faces of a form have very unequal size. To show the accordance with ilmenite I give the following table of angles:—

Ilmenite.

Forms.	Computed.	Observed means.	No. of distinct observations.
$\left[\begin{array}{l} ae, = 10\bar{1} : 110 \\ e'u = 110 : 121 \\ ul = 121 : 275 \\ le = 275 : 011 \end{array} \right.$	57° 36'	57° 33'	1
	*	32 24	4
	15 11	14 48	1
	17 13	17 35	1
$\left[\begin{array}{l} ar = 10\bar{1} : 100 \\ rs' = 100 : 101 \end{array} \right.$	43 1	42 58	1
	46 59	47 2	1
$\left[\begin{array}{l} e'o = 101 : 111 \\ ou = 111 : 121 \\ ur' = 121 : 010 \\ or' = 111 : 010 \\ e'u = 101 : 121 \end{array} \right.$	38 13	38 12	1
	21 29	21 31	1
	36 6	36 4	1
	57 35	57 28	1
	59 42	59 44	2
$au = 10\bar{1} : 211$	71 30 $\frac{1}{2}$	71 33	1