XCVI.—*A Composite Sodium Chlorate Crystal in which the Twin Law is not Followed.*

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COMPOSITE crystals are either twins, in which rotation of the one crystalline individual about a common twin axis suffices to bring both into identical orientation, or else the crystalline individuals have intergrown in some chance position in which no symmetrical relation holds between the orientations of the individuals constituting the growth. The following case is of interest, as being apparently anomalous as regards the manner in which composition has occurred.

During the recent work of Kipping and Pope on enantiomorphism (Trans., 1898, 606), several thousand sodium chlorate crystals were examined microscopically, and one crop of crystals, deposited from a pure aqueous solution, contained three presenting the appearance shown in the figure (next page); one of these three composite crystals was

removed from the solution in a fit state for measurement and was found not to have been formed in accordance with the ordinary twin law referred to above, but, nevertheless, the two individuals were orientated in a peculiarly symmetrical manner one to the other.

Each of the two crystals exhibit all the faces of the form $\{100\}$. The crystal forming the base of the combination is about a centimetre square and a millimetre thick, whilst the crystal standing upon the centimetre square base is almost a cube of 5—7 mm. edge. The measurements given below show that one four-fold axis of symmetry of the lower crystal coincides in direction with one three-fold axis of symmetry of the upper crystal. In the table, the capital letters refer to the faces on the cube-shaped crystal, the indices of which are enclosed in brackets; the calculations are made on the assumption that

Angle.	Measured values.	Calculated values.
$AB = (100) : (010)$	$89^{\circ}56'$	$90^{\circ} 0'$
$BC = (010) : (001)$	$90 1$	$90 0$
$AC = (100) : (001)$	$90 5$	$90 0$
$bB = 010 : (010)$	$44 59$	$45 0$
$\bar{b}C = 0\bar{1}0 : (001)$	$45 3$	$45 0$
$aA = 100 : (100)$	$35 18$	$35 16$
$\bar{a}B = \bar{1}00 : (010)$	$65 51$	$65 54$
$\bar{a}C = \bar{1}00 : (001)$	$65 52$	$65 54$

the three-fold axis of symmetry of the one crystal coincides in direction with the four-fold symmetry axis of the other, and that the faces $bBC\bar{b}$ are in a zone.

The close agreement between the observed and calculated angles on the composite crystal leads to the conclusion that the planes (111) and (011) on the cube-shaped crystal are respectively parallel to the planes (001) and (010) on the tabular crystal.

Both individuals are dextrorotatory and were firmly attached; on breaking them apart, an uneven surface was left at the plane of contact.

It would be interesting to know whether such cases of regularly orientated juxtaposition, in which the twin law is not followed, are common.

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