ART. IX.—*On some remarkably developed Calcite Crystals;*
by LOUIS V. PIRSSON.

BEAUTIFUL specimens of calcite are procured at Guanajuato in Mexico, and through the dealers have found their way into collections. On these specimens, not only are simple scalenohedrons of the ordinary form, $1^3(21\bar{3}1)$, common, often of great beauty in the perfection of their crystal form, but also twins, which are often developed in a most remarkable manner. As these, so far as can be learned, have never been described, it has been thought that an account of them with some figures, would not be without interest.

The twins consist in general of the ordinary 1^3 scalenohedron, twinned always upon $01\bar{1}2$, $-\frac{1}{2}$. By a development of two faces of the scalenohedron and the corresponding ones in twin position, the crystals are lengthened out into four sided prisms, with a re-entrant angle at one end and a salient angle at the other. They are usually attached to the rock at the salient angle with the prism projecting and at first sight present no appearance of hexagonal symmetry. They appear rather like twinned monoclinic crystals, consisting of a prism and pyramids, the latter forming the re-entrant angle at the end.

In fig. 1 the simplest and most common of these forms is shown; $v=1^s$ ($21\bar{3}1$). In this figure the crystal is drawn in the usual position of the plus scalenohedron; in fig. 1a the same crystal is shown after a revolution of 60° into the position of a minus scalenohedron in order to better present the great development of four of the scalenohedron faces into a prism. This is the usual development of the greater number of specimens examined. The prism like form varies greatly in length with different crystals. These twins and simple individuals occur intimately associated together on the same specimen. Some twins are very large, up to eight or ten inches long. The larger crystals are however of the simple twinned form described, while the smaller ones are in general more highly modified. One of these is shown in fig. 2 in its normal position and in fig. 2a revolved, as in the previous example, 60° to show its prismatic development. On this crystal the forms v , 1^s , ($21\bar{3}1$); Ψ , $\frac{1}{3}\frac{1}{3}$, ($7 \pm 1\bar{1} 15$); and f , -2 ($02\bar{2}1$) were observed.

The most common habit of the smaller crystals is shown, however, in fig. 3, where of the scalenohedron, $\frac{1}{3}\frac{1}{3}$ one pair of faces is represented, largely developed in front, cutting off the main form 1^s above the re-entrant angle, while the other two pairs are either wholly wanting or are developed in so small a degree as to practically be so. It will be observed in the study of these crystals that all scalenohedral faces which appear as bevelments of the acute prism-like edge, must lie in the zone $10\bar{1}1 \wedge 01\bar{1}2$ and this affords an important aid in their identification. The crystal faces do not generally reflect light well but sufficiently so for fair measurements on the reflecting goniometer and the determination of the forms.

Fig. 4 represents a very remarkable calcite from the collection of Mr. Norman Spang, who very generously presented it to Professor Penfield and the latter has kindly allowed me to study and figure it in connection with these Mexican crystals. Mr. Spang obtained it in the southwest, but the exact locality could not be discovered. From its general similarity to the described forms, it will be suspected of having come from the Mexican locality. It differs from all of them which have been examined in being much more highly modified and especially by the presence of minus forms. The forms observed on this crystal were r , 1,

($10\bar{1}1$); v , 1^s , ($21\bar{3}1$); F , 2^s , ($24\bar{6}1$); J , $-\frac{4}{3}\frac{7}{3}$, ($8 \ 20 \ 2\bar{8} \ 9$); P , $-\frac{4}{3}$, ($4 \ 8 \ 1\bar{2} \ 5$); x , -2^s , ($13\bar{4}1$); N , $-4\frac{5}{3}$, ($4 \ 16 \ 2\bar{0} \ 3$), and λ , 1^s , ($31\bar{4}2$).

While the planes of the plus forms were generally smooth and gave fair reflections of the signal, the minus forms were always striated, resulting from an oscillation of them with the main face $-4\frac{7}{3}$. These striations were not however, as is often the case, mere lines blending the signals into an unbroken band of light, but were distinct facets, often of some size. As a result, each form gave a distinct reflection of the signal, by which it was possible to recognize and measure it with a fair degree of accuracy. The form $-4\frac{3}{5}$ occurred as a distinct pair of faces at the top of the striations and by covering the latter with wax, the former could easily be measured with exactness. The striations of these minus forms were also all in one zone and this when determined aided greatly in their identification. Along the zone, the signal of each face stood out sharply in a dim band of light connecting them and pretty exact measurements could be made. The forms -2^3 and $-4\frac{5}{3}$ occurred most largely at the bottom and they are so represented in ideal symmetry in the figure. At the re-entrant angle, the main plus form v , 1^3 , and the main minus form $4\frac{7}{3}$, occurring in about equal development, the crystal presents at this end the appearance of the di-hexagonal pyramid.

The following table of measured and calculated angles is appended to show the identification of the forms.

Angles of Scalenedrons.

	Long edge.		Short edge.		Middle edge.	
$1^3 (21\bar{3}1)$	calc.	$35^\circ 35\frac{1}{2}'$	calc.	$75^\circ 22\frac{1}{2}'$	calc.	$132^\circ 58'$
	meas.	35 49	meas.	75 24	meas.	133 05
$1^2 (31\bar{4}2)$		36 10		75 07		133 07
	calc.	24 10			calc.	113 45
	meas.	24 13			meas.	113 26
$\frac{1}{5}^{\frac{1}{3}} (7 4 \bar{1}\bar{1} 15)$						113 56
	calc.	22 01	calc.	39 41		
	meas.	22 04	meas.	40 40		
$2^3 (24\bar{6}1)$		22 30				
	calc.	37 30				
	meas.	37 00				
$-\frac{3}{5}^3 (4 8 \bar{1}\bar{2} 5)$	calc.	$34 20\frac{1}{2}$	calc.	72 22		
	meas.	34 20	meas.	72 23		
		34 10				
$-\frac{7}{3}^{\frac{7}{3}} (8 20 \bar{2}\bar{8} 9)$	calc.	$30 11\frac{1}{2}$	calc.	$81 16\frac{1}{2}$	calc.	131 30
	meas.	30 01	meas.	81 02	meas.	131 29
		30 15		81 12		131 56
		30 11				
		30 18				
$-4\frac{4}{3} (4 16 \bar{2}\bar{0} 3)$	calc.	$21 29\frac{1}{2}$				
	meas.	21 40				

And also the following angles:

		Calc.	Meas.		
$r \wedge v$	$10\bar{1}1 \wedge 12\bar{3}1$	29 01½	29° 01'	29°	29° 04'
$r \wedge r$	$10\bar{1}1 \wedge 0\bar{1}11$	74 55	74 58	75	75 03
$r \wedge \lambda$	$10\bar{1}1 \wedge 31\bar{4}2$	9° 25'	9 30	9 31'	9 35
$P \wedge x$	$(4\ 8\ \bar{1}\bar{2}\ 5 \wedge 13\bar{4}1)$	11 01½	10 50	11	11 19
$v \wedge P$	$(21\bar{3}1 \wedge 4\ 8\ \bar{1}\bar{2}\ 5)$	20 29	20 28	20 29	20 15
$v \wedge F$	$(21\bar{3}1 \wedge 24\bar{6}1)$	8 57	8 54		

In conclusion the author desires to express his thanks to Professor G. J. Brush, who kindly afforded the use of material from his collection and to Professor S. L. Penfield for valuable assistance and advice.

Mineralogical Laboratory.
Sheffield Scientific School, June, 1890.