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Barytes from Addiewell, West Calder, in Midlothian.

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THIS occurrence of barytes is somewhat remarkable and interesting from several aspects:—The peculiar conditions under which it seems to have been deposited, the limited quantity, and the perfection and richness of the crystallographic development.

It was found some two years ago in one of the shale pits of the Young's Paraffin Oil Company, and my friend Mr. J. S. Thomson, to whom I am indebted for two of the four or five existing specimens (of which one, I am happy to say, has been deposited in the Museum of Edinburgh), was so kind as to procure for me from the Mining Engineer of the Company a sketch of the Geological Strata of the neighbourhood, in which the position of the beds containing the crystals is indicated (Plate II.).

He writes as follows:—"The highest part of the section in that neighbourhood is the "Hurlet" or Main (carboniferous) limestone, and all depths are reckoned from this level. The crystals were found in a cavity in the sandstone at No. 15 shale pit at Addiewell; which cavity contained besides calcite, salt water, petroleum or liquid bitumen and solid bitumen or ozocèrite (?)."—"It may perhaps be of interest to you to know that the presence of salt water may possibly be accounted for by the cavity where the crystals were found occurring just at sea level."

On the larger of the two specimens which I have thus been enabled to study, the crystals of barytes, accompanied by a few isolated crystals of iron pyrites, are irregularly disposed upon the bedding surface and edges of an irregular slab of "waterworn" or eroded fine-grained grey sandstone, the other side being occupied by crystals of calcite.

The barytes seem to be of two generations, of which the older, in thick tabular dull crystals of the form (001), (110), (101), (012), and about three-fourths of an inch in length, are covered by the younger transparent ones, which range in size from half-an-inch in length downwards to quite minute dimensions. On the smaller specimen no sandstone remains, and the small brilliant crystals of barytes are carried mainly on an aggregate of saddle-shaped lustrous rhombohedrons of pearlspar, among which lie covered crystals of older barytes, and an occasional speck of pyrites; while the lower surface is again occupied by a few clear calcites of the form : $(20\bar{1})$ R^3, (110) $-\frac{1}{2}$ R. The barytes crystals of the second generation are all of the same somewhat uncommon type of development, viz. elongated in the direction of the brachydiagonal axis, and governed by the forms (101) (012) (001) (010), while the smaller, perfectly limpid, crystals of some 2 mm. long show a large number of subsidiary forms, which give them in general the habit of the beautiful crystals from Chirbury, Salop ; a relationship which is the more distinctly characterised by the fact that on both of them the rare and hitherto almost unknown form E (412) is hardly ever absent.

The lustre of the faces is exceedingly perfect, so that even the smallest of them give perceptible reflections, and the measured angles of inclination approach so closely to those deduced from calculation, that the conclusion seems justified, that the rate of growth of these crystals must have been unusually slow. The impeding cause may be looked for in the presence of the mineral oil, of which considerable quantities have been taken up by many of the crystals, and which appears, under the microscope, enclosed in irregular rounded cavities, of which many again are flattened out in a direction parallel with the plane (101). The oil thus disseminated is of a brownish yellow colour, transparent, and of an intensity varying with the thickness of the layer. Each cavity contains a large gas bubble. Cubes of NaCl or crystals of other salts could not be detected.

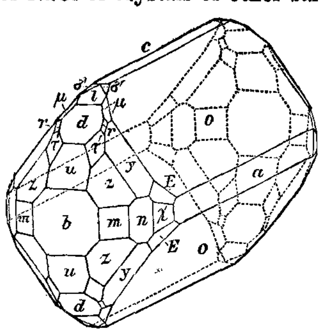

FIG. 1.

Eleven of the smallest crystals were subjected to examination, and on them a total number of 21 forms was observed, of which 6 seem to have hitherto been unknown. The distribution on each crystal is shown on Table I., the new forms being distinguished by an asterisk. Fig. 1 has been constructed as closely as possible after nature, and represents the general character of these crystals and the relative size of the principal planes.

TABLE I.

	Miller. $\bar{a} : \mathring{b} : \overset{1}{c}$	Naumann. $\mathring{a} : \bar{b} : \overset{1}{c}$	Number of Crystal.										
			1	2	3	4	5	6	7	8	9	10	11
a	100	$\infty\breve{P}\infty$	—	—		—	—	—	—	—	—	—	—
b	010	$\infty\bar{P}\infty$	—	—	—	—	—	—	—	—	—		—
c	001	0P	—	—	—	—	—	—	—	—	—	—	—
m	110	∞P	—	—	—	—	—	—	—	—	—	—	—
n	210	$\infty\breve{P}2$	—	—	—	—	—	—	—	—	—	—	—
χ	310	$\infty\breve{P}3$	—	—	—	—	—	—		—	—	—	—
o	101	$\breve{P}\infty$	—	—	—	—	—	—	—	—	—	—	—
o^7*	701	$7\breve{P}\infty$	—										
l	014	$\frac{1}{4}\bar{P}\infty$	—	—	—	—	—	—	—	—	—	—	—
$d\frac{3}{8}$*	038	$\frac{3}{8}\bar{P}\infty$	—			—	—	—		—		—	—
d	012	$\frac{1}{2}\bar{P}\infty$	—	—	—	—	—	—	—	—	—	—	—
u	011	$\bar{P}\infty$	—	—	—	—	—	—	—	—	—	—	—
z	111	P	—	—	—	—	—	—	—	—	—	—	—
r	112	$\frac{1}{2}P$	—	—	—	—		—	—	—	—	—	—
y	212	$\breve{P}2$	—	—	—	—	—	—	—	—	—	—	—
μ	214	$\frac{1}{2}\breve{P}2$	—	—	—	—	—	—	—	—	—	—	—
P*	434	$\breve{P}\frac{4}{3}$			—								
E	412	$2\breve{P}4$	—	—	—	—	—	—		—	—	—	—
τ'*	234	$\frac{3}{4}\bar{P}\frac{3}{2}$	—	—		—	—	—		—		—	—
λ'*	123	$\frac{2}{3}\bar{P}2$							—				
σ'*	5.11.55	$\frac{1}{5}\bar{P}\frac{11}{5}$			—								

The new forms are established on the following measurements and zones, the calculated angles being deduced from the parameters determined by Helmhacker on the barytes of Svárov:—$\mathring{a} : \bar{b} : \overset{1}{c}$ = ·8152 : 1 : 1.3136 as harmonising best with my measurements.

o^7 = (701), $7\breve{P}\infty$ observed as an exceedingly narrow face on crystal No. 1.

	Measured.	Calculated.
o^7 : 001 =	83°55½′	83°47′36″

$d\frac{3}{8}$ = (038), $\frac{3}{8}\bar{P}\infty$ observed on seven crystals and measured on four, as a narrow, generally somewhat rounded truncation of the edge (012) : (014).

Measured (Mean).	Calculated.
$d\frac{3}{8}$: 010 = 58°54′	58°51′24″
maximum 60°32′ minimum 57°29′	

It is an ill-defined form, tending towards the known forms (025) and (013), for which the calculated angles are respectively 57°11′46″ and 61°45′32″.

P = (434), $\breve{P}\frac{4}{3}$ once as a very narrow face in the zones (111) : (212) and (112) : (210),

Measured (Approx.)	Calculated.
P : (014) = 48°8½′	47°37′4″
P : (210) = 30°31½′	31°6′58″

τ′ = (234), $\frac{4}{3}\bar{P}\frac{3}{2}$. A well characterised form with large and well developed faces in the zones (111) : (012) and (011) : (212),

Measured.	Calculated.
τ′ : 012 = 25°19′	25°20′30″
τ′ : 111 = 13°46½′	13°46′58½″
τ′ : 212 = 24°48′	24°46′29″

λ′ = (123), $\frac{2}{3}\bar{P}2$ once as a narrow face in the zones (101) : (011) and (012) : (111,)

Measured.	Calculated.
λ′ : 111 = 20°33′	20°39′16″
λ′ : 011 = 19°15½′	19°54′23″

σ′ = (5.11.55), $\frac{1}{5}\bar{P}\frac{11}{5}$ as a small face on crystal No. 3. The simpler indices (1.2.10), $\frac{1}{5}\bar{P}2$ suggested themselves, in which case the face would have been zonal with the faces ($\bar{2}10$) : ($\bar{1}12$) : (014). This was, however, not the case, the face σ′ lay slightly out of the zone,

Measured.	Calculated. for (5.11.55)	(1.2.10)
σ′ : 101 = 48°27′	48°29′39″	47°52′16″
σ′ : 014 = 7°36½′	7°39′21″	8°12′22″
σ′ : 012 = 21°35½′	21°55′48″	22° 7′10″

As the number of forms recognised on this mineral has much increased since the publication of Helmhacker's monograph and the remarkable "Atlas" of Schrauf, I have ventured, with the literature at my disposal, to give in the following table a list of 94 forms, of which those which have been observed on barytes found in Britain are indicated by the letters in the first column. These consist of 24 forms given in Greg and Lettsom's Manual, and of 15 new forms characterised by an asterisk, of which 7 were observed on the barytes from Chirbury and 8 on that of Addiewell, or a total of 39 British forms.

TABLE II.

British Forms.	Miller. $\bar{a}:\breve{b}:c$	Naumann. $\breve{a}:\bar{b}:c$	Helmhacker, 1871.	Schrauf, Atlas, 1872-73.	New Forms.	Locality.	Observer.
a	100	$\infty\breve{P}\infty$	1	*b*			
b	010	$\infty\bar{P}\infty$	12	*c*			
c	001	0P	22	*a*			
m	110	∞P	6	*m*			
	320	$\infty\breve{P}\frac{3}{2}$	5	*N*			
*n**	210	$\infty\breve{P}2$	4	*n*		Addiewell	
χ*	310	$\infty\breve{P}3$	3	χ		Addiewell	
	410	$\infty\breve{P}4$	2	*L*			
	450	$\infty\bar{P}\frac{5}{4}$			*h*	Telekes	Schmidt.
η	230	$\infty\bar{P}\frac{3}{2}$	7	η			
	350	$\infty\bar{P}\frac{5}{3}$	8				
λ	120	$\infty\bar{P}2$	9	λ			
	130	$\infty\bar{P}3$	10	β			
	140	$\infty\bar{P}4$	11	τ			
	108	$\frac{1}{8}\breve{P}\infty$	23	α			
	103	$\frac{1}{3}\breve{P}\infty$			*i*		Miers
φ	102	$\frac{1}{2}\breve{P}\infty$	24	φ			
	506	$\frac{5}{6}\breve{P}\infty$	25				
	809	$\frac{8}{9}\breve{P}\infty$		ε			
o	101	$\breve{P}\infty$	26	*M*			
	201	$2\breve{P}\infty$	27	*i*			
	401	$4\breve{P}\infty$			*x*	Binnenthal	Grünling
o^7*	701	$7\breve{P}\infty$			o^7	Addiewell	
	10 0 1	$10\breve{P}\infty$			*x*	Telekes	Schmidt
	018	$\frac{1}{8}\bar{P}\infty$	21	*W*			
w	016	$\frac{1}{6}\bar{P}\infty$	20	*w*			
	015	$\frac{1}{5}\bar{P}\infty$	19	σ			
l	014	$\frac{1}{4}\bar{P}\infty$	18	*l*			
g	013	$\frac{1}{3}\bar{P}\infty$	17	*g*			
$d\frac{3}{8}$*	038	$\frac{3}{8}\bar{P}\infty$			$d\frac{3}{8}$	Addiewell	
i	025	$\frac{2}{5}\bar{P}\infty$		κ			
d	012	$\frac{1}{2}\bar{P}\infty$	16	*d*			

TABLE II.—*Continued.*

British Forms.	Miller. $\bar{a} : \breve{b} : c$	Naumann. $\breve{a} : \bar{b} : c$	Helmhacker, 1871.	Schrauf, Atlas, 1872-73.	New Forms.	Locality.	Observer.
	058	$\frac{5}{8}\bar{P}\infty$				Pésey	Fényes
	023	$\frac{2}{3}\bar{P}\infty$	15				
Z*	034	$\frac{3}{4}\bar{P}\infty$			Z	Chirbury	Miers
	0 23 24	$\frac{23}{24}\bar{P}\infty$	14				
u	011	$\bar{P}\infty$	13	u			
	032	$\frac{3}{2}\bar{P}\infty$		D			
	021	$2\bar{P}\infty$		U			
	1 1 20	$\frac{1}{20}P$			e	Telekes	Schmidt
	119	$\frac{1}{9}P$	28	H			
k	118	$\frac{1}{8}P$	29	k			
	116	$\frac{1}{6}P$	30	F			
v	115	$\frac{1}{5}P$	31	v			
q	114	$\frac{1}{4}P$	32	q			
f	113	$\frac{1}{3}P$	33	f			
r	112	$\frac{1}{2}P$	34	r			
	223	$\frac{2}{3}P$	35	R			
z	111	P	36	z			
	441	$4P$			p	Telekes	Schmidt
P*	434	$\breve{P}\frac{4}{3}$			P	Addiewell	
y	212	$\breve{P}2$	37	y			
	313	$\breve{P}3$	38	I			
	414	$\breve{P}4$	39	ρ			
	515	$\breve{P}5$	40				
	616	$\breve{P}6$		ψ			
Q*	15 1 15	$\breve{P}15$			Q	Chirbury	Miers
	211	$2\breve{P}2$	41	Σ			
	311	$3\breve{P}3$	42	Φ			
	411	$4\breve{P}4$	43	T			
	511	$5\breve{P}5$	44	Ξ			
ω*	432	$2\breve{P}\frac{4}{3}$			ω	Chirbury	Miers
μ	214	$\frac{1}{2}\breve{P}2$	50	μ			
	634	$\frac{3}{2}\breve{P}2$	54				

TABLE II.—*Continued.*

British Forms.	Miller. $\bar{a} : \breve{b} : \grave{c}$	Naumann. $\breve{a} : \bar{b} : \grave{c}$	Helmhacker, 1871.	Schrauf, Atlas, 1872-73.	New Forms.	Locality.	Observer.
	632	$3\breve{P}2$	53				
	316	$\frac{1}{2}\breve{P}3$	51				
s	312	$\frac{3}{2}\breve{P}3$	55	s			
	726	$\frac{7}{6}\breve{P}\frac{7}{2}$		$\aleph$			
	416	$\frac{2}{3}\breve{P}4$			F		Miers
E*	412	$2\breve{P}4$	56		E	Chirbury, Addiewell	
	514	$\frac{5}{4}\breve{P}5$		ζ			
	513	$\frac{5}{3}\breve{P}5$			G		Miers
	716	$\frac{7}{6}\breve{P}7$		θ			
	8 1 12	$\frac{2}{3}\breve{P}8$	52	Γ			
Y*	19 1 18	$\frac{19}{18}\breve{P}19$			Y	Chirbury	Miers
Λ*	25 1 27	$\frac{25}{27}\breve{P}25$			Λ	Chirbury	Miers
	122	$\bar{P}2$	45	ν			
	133	$\bar{P}3$	46	∇			
	144	$\bar{P}4$	47	δ			
ξ*	232	$\frac{3}{2}\bar{P}\frac{3}{2}$			ξ	Chirbury	Miers
τ'*	234	$\frac{3}{4}\bar{P}\frac{3}{2}$			τ'	Addiewell	
λ'*	123	$\frac{2}{3}\bar{P}2$			λ'	Addiewell	
σ'*	5 11 55	$\frac{1}{5}\bar{P}\frac{11}{5}$			σ'	Addiewell	
	254	$\frac{5}{4}\bar{P}\frac{5}{2}$		Δ			
γ	132	$\frac{3}{2}\bar{P}3$	48	γ			
	3 11 6	$\frac{11}{6}\bar{P}\frac{11}{3}$		t			
	7 28 24	$\frac{7}{6}\bar{P}4$	58				
	3 15 10	$\frac{3}{2}\bar{P}5$	49	X		Probably with the	identical following
	11 55 30	$\frac{11}{6}\bar{P}5$			Π	Mittelagger	Busz
	178	$\frac{7}{8}\bar{P}7$	59				
	2 14 9	$\frac{14}{9}\bar{P}7$	57			Doubtless with the	identical following
	8 56 35	$\frac{8}{5}\bar{P}7$			$\Pi_{,}$	Mittelagger	Busz
	196	$\frac{3}{2}\bar{P}9$		π			
	1 10 7	$\frac{10}{7}\bar{P}10$			$\Pi_{,,}$	Mittelagger	Busz

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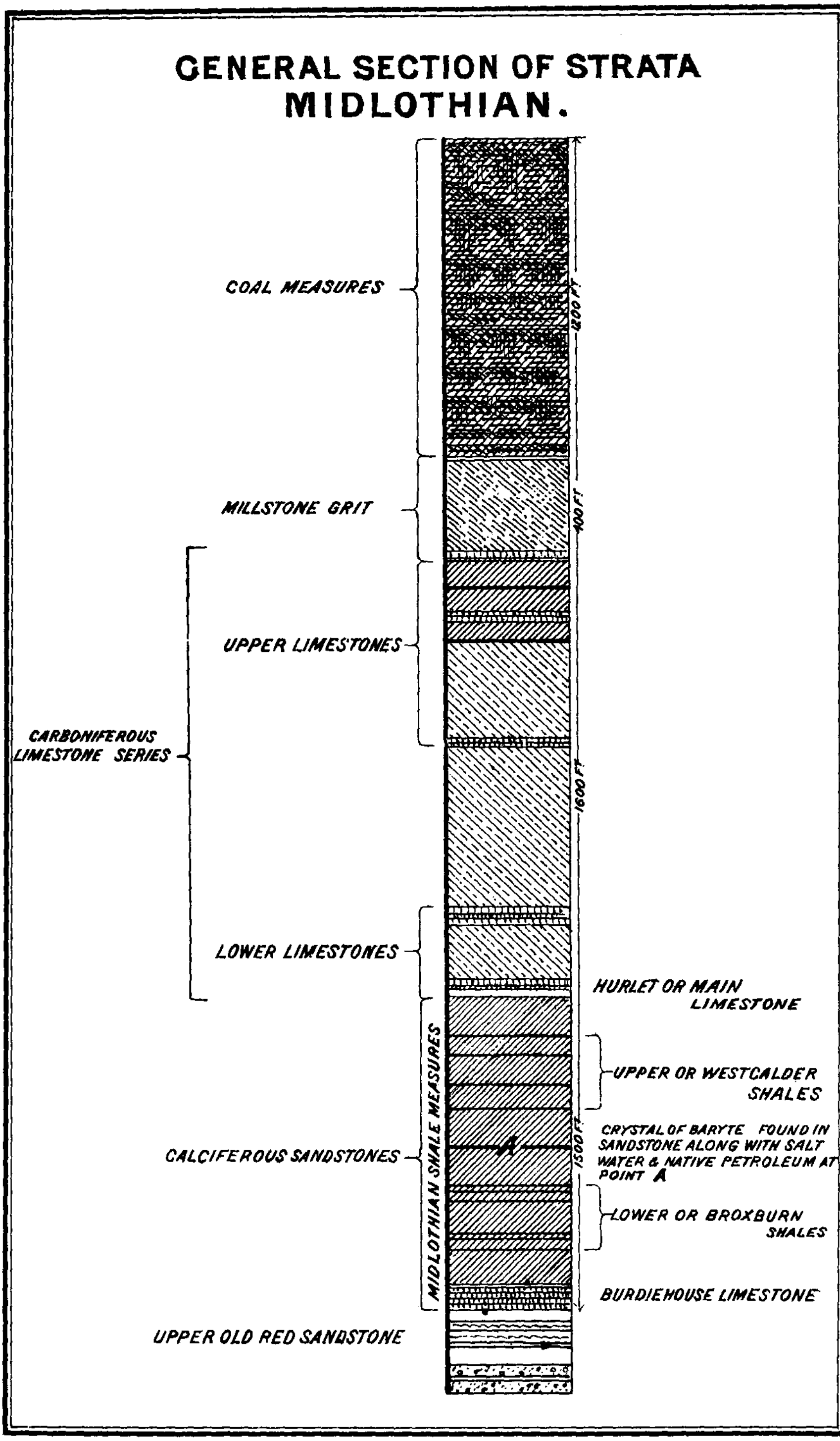
GENERAL SECTION OF STRATA MIDLOTHIAN.



To illustrate Dr. Trechmann's Paper.