

## *Thaumasite from Co. Down, Northern Ireland.<sup>1</sup>*

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With X-ray data by B. R. YOUNG, B.Sc.

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*Summary.* Thaumasite has been found in a dolerite sill at Ballyalton, Co. Down, Northern Ireland. Indexed powder data for the mineral are given.

**T**HAUMASITE, a complex sulphate salt ( $\text{CaSiO}_3 \cdot \text{CaCO}_3 \cdot \text{CaSO}_4 \cdot 14.5\text{H}_2\text{O}$ ) has been recorded from only four countries but has been the subject of numerous papers. It was first noted by Gurnaelius (1874) from the sulphide Bjelke Mine at Åreskutan, Sweden, but it was not until 1878 that it was described and named by Nordenskjöld, the name being derived from the Greek *θαυμάζω*, 'to be surprised'. Other occurrences in Sweden, in association with sulphide ore deposits, were later noted by Widman (1890), Backström (1897), and Flink (1917). The paragenesis was discussed by Aminoff (1918, 1931) and Magnusson (1924).

In 1896 Penfield and Pratt described thaumasite and other zeolites from cavities in basic lavas from Paterson and Great Notch in the Watchung Mountains area, New Jersey, U.S.A. A similar occurrence was described by Mauritz (1931) from near Plattensee, Hungary. A further occurrence at the Old Hickory Mine, Beaver Co., Utah, was described by Butler and Schaller (1911), and Schaller (1912). The thaumasite from Utah, Sweden, and Sulitelma, Norway (Vogt, 1938), is similar in its mode of occurrence as it is found in fissures in sulphide ore deposits. It is presumed by Butler and Schaller (1911), Aminoff (1918, 1931), and Vogt (1938) to have formed at a very late stage of mineralization. A different paragenesis was recorded from Crestmore, California, by Foshag (1920), Larsen and Foshag (1921), Larsen and Dunham (1933), and Dunham (1933) who described veinlets of thaumasite where limestone had been invaded by granodiorite and quartz-monzonite. Other publications that have discussed the structure

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composition, and properties of thaumasite from the known localities include papers by Allen (1915), Holden (1922), and Welin (1956).

The Irish thaumasite, which appears to be the first recorded occurrence in the British Isles, has been found in a Tertiary dolerite sill encountered in a borehole sunk 2100 yards south-west of Flush Hall, Ballyalton, Newtownards, Co. Down (1-inch Geological Sheet 37). Patches of soft white material up to 3 mm. across that coated a fracture surface were observed by Mr. A. Fowler from specimens collected at 262 feet 8 inches (G.S.M. No. N.I. 1120). Later examination showed that these patches and others from a specimen at 413 feet (N.I. 1157) consisted of thaumasite. The dolerite sill from which the specimens were obtained is intruded into Triassic sediments, which consist mainly of conglomerates and breccias.

Under the microscope the thaumasite is acicular, colourless, and uniaxial negative with  $\omega = 1.504$ ,  $\epsilon = 1.470$ ,  $\omega - \epsilon = 0.034$  for sodium light. With one exception (Penfield and Pratt, 1896), the refractive indices agree with those determined for thaumasite from other localities (Nordenskiöld, 1878; Lévy and Lacroix, 1888; Backström, 1897; Butler and Schaller, 1911; Vogt, 1938).

The occurrence is comparable with that from Paterson, New Jersey, and Plattensee, Hungary, where thaumasite is found as a late stage mineral associated with zeolites in basic rocks. Wherry (1922) has suggested that solutions which would normally deposit calcite and zeolites may react with anhydrite to form thaumasite. Both calcite and zeolites (including analcime and natrolite) are present in amygdaloids and cracks in the Ballyalton dolerite, and anhydrite, gypsum, and calcite occur in the adjacent Triassic sediments as a cement and in veins. The thaumasite may therefore owe its origin to the agencies suggested by Wherry.

*X-ray data.* X-ray powder data were obtained using Co-*K* $\alpha$  radiation and a Philips camera of 11.483 cm. diameter. The *d*-spacings (table I) are identical with those obtained from films of thaumasite from Burger's Quarry, West Paterson, New Jersey (G.S.M. No. M.I. 21089), but differ considerably from the figures in the X-ray Powder Data File (card 2-0061). All the diffraction lines can be satisfactorily indexed on a hexagonal cell with *a* 11.03 Å. and *c* 10.40 Å., giving an axial ratio of *c/a* 0.943. These cell dimensions are slightly larger than those given by Aminoff (1933) (*a* 10.90 Å., *c* 10.29 Å., *c/a* 0.944) and by Welin (1956) (*a* 10.95 Å., *c* 10.30 Å., *c/a* 0.941). The line intensities were measured with a microphotometer.

TABLE I. X-ray powder data for thaumasite from Ballyalton Borehole No. 3, Co. Down (G.S.M. No. M.I. 30218).  $\lambda = 1.7889 \text{ \AA}$ .

<i>hkl</i> *	<i>d</i> , $\text{\AA}$ .	<i>I</i> .	<i>hkl</i> *	<i>d</i> , $\text{\AA}$ .	<i>I</i> .	<i>hkl</i> *	<i>d</i> , $\text{\AA}$ .	<i>I</i> .
100	9.56	100	113	2.935	< 1	411	2.045	< 1
101	7.04	2	220	2.755	2	322	2.019	3
110	5.51	40	302	2.713	14	412	1.934	3
111	4.88	5	310	2.649	4	500	1.911	10
200	4.76	5	004	2.599	< 1	331	1.809	6
102	4.56	6	311	2.565	10	421	1.778	3
201	4.34	4	213	2.499	10	332	1.733	3
						006		
112	3.78	16	312	2.357	4	511	1.692	2
210	3.61	1	204	2.282	< 1	414	1.626	4
202	3.51	6	320	2.191	6	600	1.592	4
211	3.41	20	402	2.155	13 vb			
300	3.18	16	223			430	1.570	< 1
301	3.04	< 1	321					
			313	2.106	5	431	1.551	1
			410	2.086	2	513	1.538	1
						226	1.467	1
						107		

\* Hexagonal indices *hkl* with third index omitted.

#### References.

The following references are additional to the bibliography of thaumasite given by T. VOGT, Norsk. Geol. Tidsskr., 1938, vol. 18, p. 291.

HOLDEN (E. F.), 1922. Amer. Min., vol. 7, p. 12.

WELIN (E.), 1956. Arkiv Min. Geol., vol. 2, no. 5, p. 137.

WHERRY (E. T.), 1918. Proc. U.S. Nat. Mus., vol. 54, p. 373.

*Note:* There is a specimen of thaumasite (B.M. 1958, 88) from Embleton quarry, nr. Cockermouth, Cumberland, in the mineral collection of the British Museum (Natural History). Several pieces, about 2–3 cm. across and consisting of a mixture of thaumasite and gypsum, were found by Mr. A. W. G. Kingsbury in 1956 in a quartz-carbonate vein cutting a quartz-dolerite sill and presented to the Museum. Associated minerals in the vein are dickite, alunite, and zunyite; this appears to be the first British occurrence of alunite and zunyite. P. G. E.