A new occurence of thaumasite near Bodrum, SW Turkey

A NEW OCCURENCE OF THAUMASITE NEAR BODRUM, SW TURKEY

BY

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ABSTRACT

An occurence of the rare mineral thaumasite in Turkey is described for the first time. It is found at Girelbelen- Bodrum in veins within xenoliths of carbonate rock in dioritic intrusions. It occurs in a sulfide mineral assemblage similar to those of its other occurences. Its optical and X-ray properties agree well with published data. It is believed to have formed at low temperature ($< 300^{o}C$) from sulfide-rich solutions.

RÉSUMÉ

La thaumasite a été observée pour la première fois en Turquie, dans la région de Girelbelen-Bodrum, dans des fissures de roches d'origine carbonatée, et métamorphisées par des intrusions dioritiques. La paragenèse minérale de caractère sulfuré de la roche mère ressemble à celle qui a été décrite pour les rares affleurements de ce minéral. Les données optiques, roentgénographiques et chimiques du minéral sont présentées et les conditions de formation discutées.

INTRODUCTION

Although rarely found thaumasite (chemical composition $CaSO_4.CaCO_3.CaSiO_3\ 14H_2O$) has been the subject of many studies. It was first reported in 1874 by Gumaelius in sulfide mineralizations at Bjelke, Sweden. It was later observed in similar conditions in Utah, Sweden and Norway. It is also known to occur with zeolites (Dana 1932) in vesicules in basic lavas (New Jersey) and as veinlets in metamorphosed limestones intruded by granodiorites and monzonites (California).

We have observed thaumasite for the first time in Turkey near the village of Girelbelen (Turgutreis-Bodrum-Mugla). It is found in veins in mineralized rocks of carbonate origin occuring as xenoliths in dioritic rocks. In these veins, which range from several millimeters to a few centimeters in thickness, thaumasite forms radial aggregates, losing its transparency, because of exposure to the atmosphere, and

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becoming white. The rock containing the thaumasite veins is mineralogically rather complex: monticellite/glaucochroite + idocrase + calcite + scapolite + opaque sulfide minerals.

OPTICAL AND X-RAY DATA

Under the microscope thaumasite is hexagonal, prismatic to acicular in habit, colorless and shows three good cleavages (1000, 0100, 0010). It has parallel extinction, elongation negative and is optically negative. Its indices of refraction are W = 1.507 − 1.509 ($\pm$0.002) E = 1.4678 − 1.4688 ($\pm$0.002) and its birefringance W-E = 0.040.

An X-ray powder diffraction study was made using a Gandolfi 57.5 mm diameter and a Guinier-Hägg 100 mm diameter camera (Cu Kα, radiation = 1.540 Å, Ni filter). The thaumasite gave 49 reflexions, the principal ones of which are given in Table 1. The parameters calculated from these values are a = 11.06 Å, c = 10.34 Å, c/a = 0.934.

There is good agreement between these values and those in the literature, given below

a = 10.992 Å, c = 10.311 Å, c/a = 0.938 ASTM
a = 11.03 Å, c = 10.40 Å, c/a = 0.943 Wherry (1922)
a = 10.90 Å, c = 10.29 Å, c/a = 0.944 Aminoff (1933)
a = 10.95 Å, c = 10.30 Å, c/a = 0.941 Welin (1956)
a = 10.90 Å, c = 10.29 Å, c/a = 0.944 Font-Altaba (1960)

CONCLUSION

Certain authors have assumed that thaumasite forms in the last stages of mineralization. Others thought that thaumasite, accompanying zeolites in vesicules in basic lavas, would be the product of the reaction of fluids with anhydrite, precipitating calcite and zeolites. Knill (1960) in studying the mineral proposed a structural scheme which was improved by Font-Altaba (1960). A differential thermal analysis of the mineral by the latter showed a loss of weight of 41.9% at 250° C and 50.8% at 330° C and the total loss of H_2O and CO_2 at 300° C. Thereafter, there was no loss of weight between 330° C and 1 000° C; at 950° C the phases anhydrite and larnite were formed.

At Girelbelen, the thaumasite is found in veins in thermally metasomatized carbonate rocks which are composed of monticellite/glaucochroite, scapolite and idocrase. The presence of these minerals in addition to galena-pyrite-chalcopyrite indicates that the metasomatic fluid was essentially rich in silicates and sulfides. However, the absence of the sulfide minerals in the thaumasite veins suggests that

this mineral was the product of low temperature sulfide-rich fluids which did not contain any metallic elements. In view of the above and considering the stability fields of the zeolites, it is suggested that the thaumasite at Girelbelen was almost certainly formed below 300° C and probably even below 200° C, there being no notable pressure effects.

TABLE 1

X-ray powder diffraction data for thaumasite from Girelbelen

I/I_1 d Å Mesured		I/I_o d Å ASTM		I/I_1 d Å Mesured		I/I_o d Å ASTM	
100	9.668	100	9.56			2	2.086
12	7.081	2	7.04	18	2.028	4	2.045
44	5.559	40	5.51			3	2.019
18	4.895	5	4.88	9	1.978		
65	4.593	6	4.56	3	1.955		
10	4.362	4	4.34	10	1.944	3	1.934
75	3.802	16	3.78	7	1.919	10	1.911
4	3.652	1	3.61	6	1.866	3	1.809
31	3.537	6	3.51	10	1.787	3	1.778
36	3.437	20	3.41	8	1.765		
20	3.274			4	1.755		
15	3.201	16	3.18			3	1.733
10	2.952	1	2.93	45	1.713		
3	2.778	2	2.755	20	1.692	2	1.692
37	2.730	14	2.713	11	1.640	4	1.626
6	2.667	4	2.649	8	1.635		
39	2.615	1	2.599				
18	2.581	10	2.565				
66	2.513						
	2.502	10	2.499				
11	2.374	4	2.357				
10	2.293	1	2.282				
8	2.201	6	2.191				
41	2.169	13*b*	2.155				
18	2.158						
22	2.114	5	2.106				

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