

# SOME UNUSUAL MINERALS FROM NAXOS, CYCLADES, GREECE \*

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*Abstract.* During fieldwork in the Cyclades Islands by a team of geochemists and students of the department of Geochemistry of the Vening Meinesz Laboratory of the Utrecht University a number of minerals have been found which had not been described before. The following is a short account of these minerals accompanied by a map showing the mineral localities.

## Introduction.

Several geologists, notably PAPAVALASSIOU (1909) and PAPA-STAMATIOU (1951) have carried out studies on the geology and petrology of Naxos. They were chiefly interested in the emeries and metamorphosed bauxite deposits which occur in the marbles of the metamorphic series. Even so it can be seen from their descriptions that on Naxos a large number of minerals can be found. During our geochemical investigations starting 1963, we have discovered an additional number of minerals, of which a short account will be given here. The localities of these minerals are shown on the accompanying map, which gives also the outline of the three main units, viz. a granodiorite intrusion, a zone of structural weakness, and the metamorphic complex (see also the paper by SCHUILING & OOSTEROM, 1967). In the extreme East a small outcrop of Upper Permian unmetamorphosed limestone has been found (MARKS & SCHUILING, 1965).

It should be noted here, that none of the minerals seems to present an economical interest; the occurrences are so small, or the mineral content so low, that they are of mineralogical interest only.

## Minerals.

In many of the pegmatites of Naxos which are found in and around the central migmatite complex, small amounts of *beryl* have been found. The beryl crystals measure, at most, a few centimeters in length and 1 cm. in diameter, and are greenish-yellow, pale bluish-green or almost colorless. The localities where beryl has been found are shown on the accompanying map by the number 1.

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Large amounts of *topaz* as well as some small grains of *tantalite* were discovered in one of the pegmatites containing beryl. This is locality 2.

Large radiating clusters of brown vesuvianite were found in a marble just inside the migmatite complex attaining several cm in length and a few mm across. The vesuvianite occurs in association with grossularite, diopside and hornblende. This is locality 3.

In locality 4, in the immediate contact of a metamorphosed metagabbro with large augitic clinopyroxenes, another occurrence of vesuvianite was found in a dolomitic marble. This vesuvianite is sugary grained and has a yellow-green color. In the vesuvianite bands a dark bluish-green platy mineral occurs, which turns out to be xanthophyllite. In table 1 the observed d-values and intensities of this mineral are compared with published d-values for a xanthophyllite from Crestmore, California (FORMAN, 1951).

T A B L E 1.

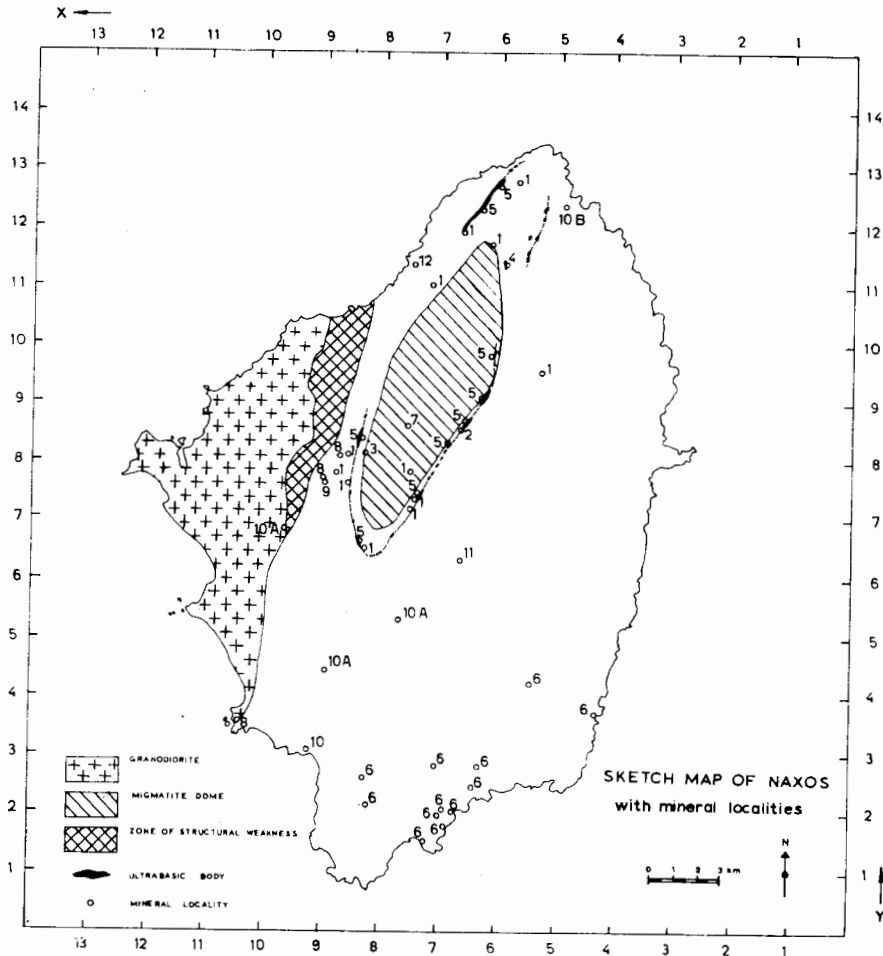
**Comparison of d-values of xanthophyllite from Naxos with published d-values for a xanthophyllite from Crestmore.**

d	I	d	I
Naxos		Crestmore	
9.59	18	—	
—		4.53	20
3.55	2	3.58	30
3.51	3	—	
3.28	3	—	
3.215	100	3.24	80
2.822	3	2.85	10
2.555	33	2.57	100
2.440	8	2.44	10
2.366	4	2.36	10
2.199	6	2.20	10
2.109	17	2.11	50
1.928	18	1.94	30
1.847	3	1.85	5
—		1.78	5
1.688	3	1.69	5
—		1.66	5
1.608	7	1.61	30
1.500	10	1.50	70
1.485	12	1.48	70

It should be noted that the d-value of 9.59, not recorded by FORMAN, is also present in the xanthophyllite from Statoust, Ural, Mtns.

The interesting and rare mineral, xanthophyllite, will form the subject of a special study by one of us (R.D.S.).

As can be seen from the map, there are two series of outcrops of metamorphosed ultrabasic rocks around the migmatite dome.



Σχ. 1.

The southern half consists mostly of dunites and peridotites, the northern half mainly of orthopyroxenites. Several of the larger bodies in this string of ultrabasic rocks were already known to PAPA VASSILIOU. Towards the gneissic country rock these bodies

develop reaction zones which are partly monomineralic. Talc, chlorite, biotite, anthophyllite and actinolite zones are developed this way, and may almost occur as monomineralic bands of, sometimes over a meter thick. Some of the more extensive anthophyllite occurrences have been indicated with the number 5 on the map.

The discovery of glaucophane is of special interest to metamorphic petrologists (Nos. 6 on the map). We have now a complete metamorphic sequence grading from glaucophanitic greenschists, in the south-eastern part of the island, to anatectic granites and migmatites in the central part. Associated with some of the glaucophane schists, paragonite has been found.

At locality 7 a small schist inclusion occurs in a highly metamorphic dolomitic marble. Around this inclusion large masses of tremolite developed, for which the silica was clearly derived from the schist inclusion. Due to this desilicification spinel and corundum developed in this schist. The cell-constant of this spinel is 8.11, indicating that it is probably close to  $MgAl_2O_4$  in composition.

Both in the contact zone of the granodiorite and in the regionally metamorphic complex, some andalusite has been found (localities no 8).

The other two polymorphs of  $Al_2SiO_5$ , kyanite and sillimanite occur very extensively and are known already by PAPA VASSILIOU.

An unusual occurrence of molybdenite in small flakes (at most a few tenths of a mm across) was found in a marble (no 9), associated with magnetite and pyrite. One of us (J.B.H.J.) hopes to give a further discussion of this molybdenite in a later paper.

Near the bay of Agiassou (No 10), an oxidation zone occurs over what is presumably a small sulphide mineralization. In this oxidized zone, next to azurite, malachite, hydrocerussite and cerussite, we have discovered rather large amounts of the rare mineral beudantite -  $PbFe_3(AsO_4)(SO_4)(OH)_6$  - as well as a very small amount of duftite -  $PbCu(AsO_4)(OH)$ .

The duftite occurs as a dark green earthy crust on some rock fragments, the beudantite is widely dispersed as a greenish yellow coating on loose rock fragments. In the heavy fraction of the soil in this locality cerussite and beudantite are often the main constituents.

At the localities 10A small amounts of malachite and azurite were found, and at locality 10B a small amount of amorphous clayey material, of green and blue color with a high copper-content, was found.

In the emery deposit near Philót (locality 11) we have,  
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found a few small pods of turquoise and in small cavities in the emery at the same locality some small blades of carphosiderite -  $\text{H}_2\text{OFe}_3(\text{OH})_5\text{H}_2\text{O}(\text{SO}_4)_2$ , have been found. Both minerals are clearly of secondary origin and have formed, presumably through the weathering of copper-bearing sulphides; further evidence for this is found in the fact that a small amount of malachite as well as pyrite concentrations have been found at the same locality. Also at this locality a small amount of a green spinel was found with the unusually small cell-constant of 8.04.

In a road cut of the new road along the north-west coast of Naxos (locality 12) some veinlets parallel to the schistosity carry laumontite in small needles. Its formation is probably due to retrograde metamorphism.

### Acknowledgments.

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