THE OCCURRENCE AND GEOCHEMICAL ORIGIN OF THE DOLOMITE MARBLE OF YELLANDU, SINGARENI

(WARANGAL DISTRICT, HYDERABAD, DECCAN)

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Introduction—The marble deposits of the Warangal District, especially those near Yellandu, have been previously reported upon by many investigators King[1] and Bruce Foote[2] while engaged in surveying and mapping this area carried out a more or less qualitative study of these marbles and more recently Syed Kazim and Mahadevan[3] published a paper dealing mostly with the economical aspect of the Yellandu deposit

Occurrence and distribution of the marble—The main occurrence of this marble is about four miles to the north of Yellandu village close to the village of Munditok (Map) Here mining is being done at present by a company and the marble is extracted, and cut into slabs and tiles

An impure form of this marble intercollated with quartzitic rocks occurs even at a distance of about two miles to the North of Yellandu village This deposit of impure marble continues towards the north and merges with the pure marble of the Munditok deposit This marble crops out only occasionally and is for most distances covered by the subsoil As for the quality of this marble nothing can be definitely said, because the exposed masses are found to be highly siliceous There is a possibility that at lower levels the marble might be of a purer type, because it has been found that in this region there is always a tendency for the high level marble to be more siliceous than the low level ones It has been ascertained in many cases that there is a definite reduction in the silica content of the marble at lower levels

It can be pointed out that the main occurrence, viz, the Munditok deposit, is rather continuous and the marble at certain positions is of a very superior type It is also interesting to note that the marble throughout this area is not either of uniform texture or of colour A large number of varieties of marble of various shades of colour and texture can therefore be obtained

As the various quarries, which are mere open pits are situated at regular intervals on the marble deposit, a survey of the occurrence of the marble could be readily made by observing the occurrence in these quarries

Quarry No. 1 (Map)—This quarry is situated between a nullah on the west and a gneissic hillock on the east It is now abandoned as the marble is found to be cracked and therefore unsuitable for purposes of slab-making. The marble which occurs at the southern end of the quarry is white in colour and is fine to medium grained (specimen No. 1). The usual inclusions in the marble are the white to pearl-white tremolite blades which vary in size from microscopic needles to fairly large blades The tremolite is abundant only at the top layers of the marble and it almost disappears at lower levels At the northern end of this quarry the colour of this marble shows a slight change towards grey owing to the increase in the amount of tremolite inclusions There are also found numerous tremolite veins which cut across the marble These veins vary in thickness from 0 5″ to nearly one foot and they are mainly composed of a greenish-grey tremolite and a micaceous talc which is an alteration product of the tremolite These tremolite and talc bands run almost in an east to west direction

In this quarry, the eastern margin, viz, the one bordering the gneissic hill has a higher tremolite content than the western margin Further, on the eastern margin one can notice big spherical lumps made up of radiating aggregates of tremolite blades in close association with marble on one side and quartzite on the other Here the marble is much crushed and plicated and even at low levels it shows the presence of tremolite.

On the western side of the nullah to the north-west of No 1 quarry marble is absent and the presence of quartzite becomes prominent.

Quarry No 2—The white fractured marble of quarry No 1 extends to the north for about 250 yards as a narrow patch between the nullah on the west and the hillock on the east and then it imperceptibly grades into a medium-grained yellow marble. Quarry No 2 is

situated N of the gneissic hillock and exactly on this yellow marble deposit The strike of the marble rock is not uniform but it runs more or less NNW and SSE and the dip is towards NEE The marble usually dips at very high angles Work has not yet begun in this quarry and only some preliminary digging is being carried out Compared to the white marble of quarry No 1 the tremolite content of this marble is rather low (specimen 2)

The colour of this marble is nonuniform and from the general occurrence of this marble, it can be gathered that it occurs only to a limited extent The colour changes gradually from dark yellow to a pale whitish-yellow There is a tendency for a weakening of colour with depth, showing perhaps that this marble disappears at depth giving place to the white variety

Another pit of yellow marble (quarry No 2*a*) which holds numerous inclusions of tremolite is situated to the NE of quarry No 2 This marble is considered to be of a lower quality than the one met with in quarry number 2, because it contains more of tremolite and the colour is not pleasing The marble is very coarse-grained and sometimes the individual crystals are half an inch thick (specimen No 3)

To the east of quarry No 2a occurs a small band of quartzitic rock, on either side of which marble occurs intercollated with quartzite

Quarry No 3—This quarry is situated on the north-eastern side of the gneissic hillock The marble occurring in this quarry is a coarse-grained grey variety mottled by dark lines which give it the characteristic greyish-white appearance (specimen No 4). This variety seems to occur in very large quantities Here also, as in quarry No 1, there are thick dark bands in the marble which hold large quantities of tremolite

Quarry No 4—The marble occurring at the northern end of this quarry is white with streaks of grey silky tremolite and a glittering yellow pyrite which give the fresh marble a beautiful appearance (specimen No 5) But on alteration, the pyrite spoils the marble by producing in it red spots of iron oxide. This marble is coarse-grained and rather compact.

The marble which occurs at the southern extremity of the quarry is grey coloured (specimen No 6) There medium grained and holds inclusions of tremolite of a dark variety

Chemical analysis of these marbles, specimens 1 to 6, was carried out after removing from them the included tremolite blade

Method of analysis—The marble was at first roughly crushed and the included tremolite was initially separated visually by hand picking and then by picking under a low power microscope After the more or less complete removal of tremolite the specimens were finely powdered A weighed portion of this finely powdered material was dissolved in hot dilute hydrochloric acid, filtered and the insoluble residue was washed well, ignited and weighed From the filtrate iron, calcium and magnesium were determined as usual Carbon dioxide was determined in a separate portion by treating a weighed quantity of the finely powdered material with dilute hydrochloric acid, collecting the gas evolved and measuring its volume The total loss on igniting the specimen was also determined and thus the amount of moisture was obtained by difference

TABLE I

Chemical composition of the specimens per cent

Specimens	1	2	3	4	5	6
Fe_2O_3 ..	0 79	0 93	0 91	0 61	0 88	0 73
MgO .	21 16	19 56	10 13	2 86	1 52	3 38
CaO	30 50	32 07	42 95	51 62	49 91	51 11
CO_2 ..	47 39	46 75	45 22	43.60	44 19	43 93
H O ..	0 09	0 17	0.13	0 14	0 14	0 11
Insoluble matter	0 35	0 28	0 39	0 42	0 46	0 57
TOTAL ..	100 28	99 76	100 03	99 29	100 11	99 86

SPECIMENS NO 1—White marble from quarry No 1
2—Yellow marble from quarry No. 2
3—Yellow marble from quarry No 2a
4—Greyish-white marble from quarry No 3
5—White marble from quarry No 4
6—Grey marble from quarry No 4

The chemical composition of these marble specimens (table I) was then recalculated in terms of mineral composition and the results are shown in table II

TABLE II

Mineral composition per cent

Specimens	1	2	3	4	5	6
Dolomite . .	97 33	89 96	46 97	13 61	20 79	15 56
Calcite . .	1 60	8 35	50 63	84 67	77 83	82 85
EXCESS						
CO_2 ...	0 13	0 07	0 01	−0 26	−0 17	−0 06
Fe_2O_3 ...	0 79	0 93	0 75	0 64	0 88	0 73
Insoluble matter	0 35	0 28	0 39	0 42	0 46	0 57
H_2O ..	0 09	0 17	0 13	0 15	0 15	0 11
Total	100 29	99 76	98 88	99 23	99 94	99 76

Discussion —Tables I and II show that specimens 1 and 2, viz, the white marble of quarry No 1 and the yellow marble of quarry No 2 have a more or less similar composition and both of them are almost pure dolomites Specimens 4, 5 and 6, on the other hand, are

highly calcite and their magnesium content is low. Specimen 5 has an almost intermediate composition between those of the above two types of marbles. The correctness of the mineral composition derived thus from recalculating the chemical composition was to be tested by microscopic examination and it was established that they agree closely. Microscopic examination of the different specimens from the various quarries also reveals a gradual change in the dolomite content of these marbles. According to this investigation the composition varies from almost pure dolomite to a highly calcite marble holding a small percentage of magnesium. Therefore, it can be said that the marbles occurring on the western and north-western sides of the central ore-rich hillock are highly dolomitic, while those occurring on the north-eastern and eastern sides are highly calcite. Thus the western part of this marble deposit is highly charged with magnesium, while the eastern part is very low in magnesium content and the transition from the highly magnesian marble on the west to the marble with a poor magnesium content on the east seems to be gradual.

It was pointed out already that these marbles have an almost north to south strike and dip at very high angles towards the east. This shows that the marbles found at the western extremity of the deposit are definitely older than those present at the eastern extremity. Further it follows from the above statements that the marbles found on the west must have originally occupied the lower zones of the deposit and must have been overlain by the younger eastern portion. The fact that the lower portion of the marble deposit is highly dolomitic and shows a tendency to become progressively less dolomitic upwards, should be taken in support to indicate that progressive dolomitization has played a great part in changing the composition of the marbles of this deposit.

Summary - 1. A detailed list of the localities in which the marble occurs and also the characteristics of the specimens found in the various quarries are given.

2. Chemical analyses and mineral compositions calculated therefrom of six different samples of marble are given in two tables.

3 The chemical composition and microscopic study reveal that these marbles vary in composition from almost pure dolomitic to highly calcitic marbles

4. It is found that this variation in composition is regional and closely connected with the dolomitization of the original limestone.

5 As the older beds were found to be highly dolomitic and the younger ones were found to have a progressively reduced amounts of magnesium, it is concluded that the original limestone has suffered *progressive dolomitization*

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REFERENCES

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A ROUGH SKETCH MAP OF MUNDITOK MARBLE AREA

Scale – 1" = 250 ft