

REPORT
ON
THE DOLOMITE DEPOSITS OF SMITHTON AND ADJACENT
DISTRICTS.

NORTH WEST COAST

INTRODUCTION.

The systematic geological survey of the Smithton district during 1929 and 1930 resulted in the discovery of extensive areas of dolomite or dolomitic limestone. These were investigated within the districts being surveyed, and the bulletin describing these districts is in course of preparation. In order to supply general information concerning the dolomite (in response to a request for same) a preliminary report was prepared by Mr. K.J. Finucane in August 1931. At that time the deposits had not been systematically sampled, nor had reconnaissance trips been made to determine extensions etc., but since then such have been carried out and the results of same are contained in this report.

USES OF DOLOMITE

Dolomite is a mineral composed of carbonates of calcium and magnesium in equal molecular proportions, the formula being $\text{CaCO}_3 \cdot \text{MgCO}_3$ and the theoretical composition being CaCO_3 54.35% and MgCO_3 45.65%. Varieties occur in which the ratio of the carbonates differs from the 1 : 1 ratio.

It is used for a number of purposes mainly for its magnesium content and has in recent years largely replaced magnesite for such purposes. It is also used for its carbonate content.

The principal uses are:-

- (1) Manufacture of carbon dioxide.
- (2) Flux in the iron-smelting industry.
- (3) Refractory. It is used in the dead burned form for refractory purposes for which it is made into furnace linings and hearths, refractory brick, shapes, and crucibles.
- (4) In the sulphite process for the manufacture of paper.
- (5) Production of basic or technical carbonate. This product is a crude carbonate used for a filler for rubber, paint and paper, and mixed with asbestos for pipe and boiler coverings.
- (6) Magnesium Salts. These include precipitated carbonate, epsom salt, etc. They are used as chemical reagents and for medicinal and toilet preparations etc.
- (7) Manufacture of metallic magnesium. Dolomite has been used for this purpose but the present tendency appears to be to use other raw material.

GEOLOGY OF THE DOLOMITE

The dolomites of the N.W. districts occur as sedimentary beds interbedded with the Dundas series of Cambro-Orodivisian rocks. They were originally formed as beds of limestones which were later converted into dolomitic limestones or dolomites by replacement of part of the calcium by magnesium. The analyses given later prove that the conversion into dolomite was practically complete.

The analyses also prove that the limestone and the dolomite were nearly free of impurities, the percentages of silica, ferric oxide and alumina being very small.

The dolomite occurs in two main types viz.

- (1) Fine grained type. This type is light grey to dirty white in colour and very fine grained. It is usually thinly bedded with numerous joints at right angles to the bedding planes, which causes it to break in rectangular pieces.
- (2) Coarse grained type. This type is usually white in colour with sometimes a greyish tinge. It is more thickly bedded than the fine grained type. The crystals range up to one-sixteenth of an inch in size. This type has evidently been produced by recrystallisation and has probably been derived from the ^{fine} grained type.

The dolomite is in places traversed by narrow white veins of calcite and dolomite. When the veins are of calcite, and are included in samples they would tend to increase the calcium content and thus cause the sample to depart from the theoretical composition of dolomite.

At Nabageena, the dolomite contains irregular veins and patches of cherty quartz while at Irish Town quartz veins and impregnations are common in parts of the dolomite. The Duck River dolomite is free from silicification except an occasional large quartz vein.

DISTRICTS IN WHICH THE DOLOMITE OCCURS

The systematic survey established the existence of the dolomite in three localities in the Smithton district viz. along the Duck River and the plains to the west, at Irish Town and at Nabageena. The boundaries of the two latter were known, but the full extent of the Duck River belt was not known previous to the recent reconnaissance surveys. During these surveys the western boundary was determined, but it was not deemed necessary to trace it southwards and determine the boundary in that direction as the conditions of transportation would not be so favourable.

The recent surveys further verified the occurrence of dolomite at the Montagu River, 16 miles by road west of Smithton which had been previously noted by Mr. F. Blake, Field Geologist. They also proved the existence of dolomite at the Black River, 12 miles by road east of Smithton, which represents another new locality for the rock.

GEOLOGICAL RELATIONS BETWEEN THE DOLOMITE IN THE
DIFFERENT DISTRICTS

The dolomite in the Smithton or Duck River district represents a very thick series of beds with a westerly dip of 40°. The width across the outcrop is 220 chains and the thickness is therefore 140 chains or 9,000 feet.

The Irish Town dolomite represents another bed some 5,000 feet lower stratigraphically than the Duck River beds.

The Nabageena dolomite consists of thin beds only and may possibly represent the southerly continuation of the Irish Town with a thinning out in the direction of Nabageena.

The Montagu River dolomite occurs in flat sandy country and very little information could be obtained about it during a reconnaissance survey. However, in view of the knowledge of the geology of the country between Smithton and the Montagu River it would appear that the two dolomites are parts of the one series of beds being in fact on opposite limbs of a synclinal fold (the Smithton dolomite being on the eastern limb which dips to the west and that at Montagu being on the western limb which probably dips to the east).

The Black River dolomite occurs under similar conditions to the Montagu River rock and little is known of its geological relationships. However, it is similar to the rock at Smithton and Montagu River and may be part of the same bed being exposed on perhaps the opposite limb of an anticlinal fold to that at Smithton or more likely as a result of faulting. It is also possible that it is a different bed situated much lower stratigraphically than the other beds.

RELATIVE IMPORTANCE OF THE DISTRICTS

The relative importance of the dolomite in the different districts from the view point of its commercial exploitation depends upon a number of factors including size of deposit, quality, proximity to transport facilities, suitability for easy and cheap means of extraction, etc.

Size of Deposit

As far as is known the Smithton deposit occupies the largest area, while the Montagu River and Black River deposits might prove to be of similar dimensions if detailed surveys were made of them. The Irishtown deposit is smaller than the Smithton, but sufficiently large to be exploited. The Nabageena one is too small to be considered of importance.

Quality

This is a factor to be determined in the favourable deposits after the other factors have eliminated the unfavourable deposits. It will, therefore, be considered later in the case of the more favourable deposits.

Transport Facilities.

The railways (Smithton, Irishtown and Irishtown-Trowutta) traverse or are in close proximity to the Smithton deposits while numerous roads also serve the

district. The Irish Town-Wiltshire line traverses the Irish Town deposit.

The Montagu River deposit is connected by road (16 miles in length) with Smithton, which is the nearest railway station.

The Wiltshire-Burnie railway and the main road to Burnie traverse the Black River deposit.

Of the above, it will be realised that the Montagu River deposit is the least favourably situated as regards transport facilities. The remainder are well served by rail and road.

Working Facilities.

The deposits at Duck River, Montagu River and Black River occur under similar conditions viz. in plain-like tracts of country forming parts of the valleys of the respective streams after which they are named. This similarity is not accidental, but is the result of geological processes in that these streams have formed their valleys in the dolomite which is more easily coroded than the adjacent rocks (slates, breccias, etc.) The similarity extends further in that the plains are for the most part covered by small thicknesses of sands (representing sand deposited by the sea during recent flooding of the valleys).

The outcrops of dolomite are not numerous, and it is exceptional to find it occurring in low hills rising above the level of the plains.

In the Irish Town deposits the conditions are somewhat different and the dolomite does form low hills and there is alluvium instead of sand on the plains. Thus the conditions for quarrying are generally not very suitable and sub-surface quarries would have to be opened up.

Development

In the Montagu River and Black River districts, the dolomite is represented by outcrops only. This applies also to the Irish Town deposit except that rail and road cuttings have further exposed it.

In the Duck River deposit, rail and road cuttings have exposed it, but it has also opened up in numerous quarries for road metal. These afforded opportunities for sampling the dolomite and also represent suitable places for opening up sub-surface quarries. (The locations are shown in the attached plan).

Conclusions.

From the above considerations of size, transport and working facilities, and development, it is evident that the Duck River deposit is the most suitable deposit, while the Irish Town deposit though smaller is also worthy of being considered. These deposits were sampled and their quality and other factors will be discussed below.

SAMPLING AND RESULTS THEREOF

The Duck River dolomite has been opened up in numerous small quarries from which the rock was taken for road-making. These are restricted chiefly to the

vicinity of the Duck River where the denudation of the sand has exposed the underlying dolomite. The one exception is at Edith Creek where the dolomite forms a low hill and has been opened up by a quarry and railway cuttings. The quarries offer good facilities for sampling except where filled with water or overgrown with vegetation.

Representative samples were taken at Blackwood bridge (Nos. 1 - 5), near junction of Duck River and Mowbray Creek (Nos. 11 and 12), $\frac{1}{2}$ mile south of latter (No. 13 sample), and near Edith Creek (Quarry Nos. 9 and 10 and railway cutting Nos. 6 - 8). One grab sample (No. 15) was taken from the quarry at Watson's Bend.

In the Irish Town district, the only place suitable for sampling was the railway cutting from which No. 14 sample was taken.

The representative samples will give the composition of the dolomite as closely as it can be obtained. It must be remembered, however, that as all quarries and cuttings are shallow and so samples are taken near the surface. Under such conditions the joints in the rocks contain more soil which has moved downwards from the surface and more oxides of iron than would be the case at greater depths. In most samples the joints were therefore avoided as far as possible and in such cases the analyses will reveal a rock slightly better in quality than will be obtained by actual quarrying. On the other hand when jointed material has been included, the analyses will more truly represent the quality at shallow depths but will indicate a rock slightly more impure than will be obtained at greater depths. The actual conditions will be indicated in the following list.

- No. 1. Across 20 feet of the N.W. face in Western quarry, West of Blackwood Bridge. Sample of clean dolomite only. Crystalline type.
- No. 2. Across 30 feet over total width of 60 feet. N. face of Northern quarry, west of Blackwood Bridge. Sample of clean dolomite only. Crystalline type, partly weathered in places.
- No. 3. Picked from 10' x 10' x 3' heap of dolomite obtained from shallow pits, west of Blackwood Bridge. Clean material only. Crystalline type (some soft due to weathering).
- No. 4. Picked from 10' x 25' x 3' heap of dolomite obtained from shallow pits, west of Blackwood Bridge. Clean material only. (Some soft due to weathering). Crystalline type.
- No. 5. Picked from 10' x 25' x 3' heap of dolomite obtained from shallow pits, west of Blackwood Bridge. Clean material only. Crystalline type (some soft due to weathering).

- No. 6. Railway cutting north of Edith Creek, 10 feet vertical sample. Iron stains on joint planes. Fine grained type.
- No. 7. Three chains north of No. 6. Across 10-12 feet. Iron stains on joint planes. Fine grained type.
- No. 8. Half a chain north of No. 7. Across 6 feet. Iron stains on joint planes. Fine grained type.
- No. 9. Quarry at intersection of road and railway, north of Edith Creek, Across 12 feet at west side. Jointed, weathered and stained material. Fine grained type.
- No. 10. Quarry at intersection of road and railway, north of Edith Creek. Across 8 feet at east side. Jointed, weathered and stained material. Fine grained type.
- No. 11. Quarry near Junction of Duck River and Mowbray Creek. Across 12 feet on east side. Fine grained type with oolitic band. Clean material.
- No. 12. Quarry near Junction of Duck River and Mowbray Creek. Across 10 feet on west side. Fine grained type with oolitic band. Clean material.
- No. 13. Quarry 30 chains south-west of Nos. 11 and 12. Across 10 ft. Fine grained. Fairly clean material.
- No. 14. Cutting Wiltshire-Irish Town railway, 20 chains east of Smithton-Irishtown road. Across 200 feet. Chiefly fine grained type. Jointed and stained.
- No. 15. Grab sample. Watson's Bend. Crystalline type.

The positions and lengths of samples, the nature of the dolomite (crystallised or fine grained), and the nature of the sample (clean, iron stained etc.), are given. It will be noted that Nos. 1 - 5 and No. 15 are of crystalline dolomite and the remainder fine grained dolomite.

Total analyses were carried out on the samples and the results are given in the table at the end of this report. In addition each sample was calcined, the percentage of calcine being determined and a partial analysis made of same.

It will be noted that the best samples i.e. those which give the highest contents of lime and magnesia and the lowest content of impurities such as silica, alumina and oxides of iron, are Nos. 1 to 5 and No. 15. These are all of the crystalline type, which, therefore, apparently forms the purest material. Further Nos. 1 to 5 are all from the quarries west of Blackwood Bridge.

The lime ranges from 28.00 to 31.60% and the magnesia (excepting No. 11) from 19.20 to 22.22%. The silica ranges up to 6.64%, the ferric oxide up to 0.76%, the ferrous oxide up to 1.26% and the alumina (excepting No. 11 the content of which is 8.24) from 0.36 Phosphate (P_2O_5) ranges from a trace up to 0.10% and is soluble in hydrochloric acid. Carbon i.e. carbon apart from that in the carbonate, ranges up to 0.65%. In the samples determined, the sulphate was present to the extent of a trace only.

CONCLUSIONS

The geological surveys and reconnaissance trips have shown the existence of dolomite in several districts on the far North West Coasts. From a consideration of extent, transport facilities, development of the deposits etc., it is recommended that the deposits of Duck River Plain and of Irish Town at present offer the best opportunities for exploitation of same. These deposits were sampled in order to determine the quality of the dolomite in them. The main result of the sampling is that the crystalline type of dolomite is the purest material in that it contains less impurities. It is the impurities that really determine the quality as all the samples (except No. 11) contain the lime and magnesia in the approximately correct proportions for dolomite, and the material, therefore, consists of dolomite with more or less impurities.

The area of crystalline dolomite sampled was that including the small quarries west of the Blackwood Bridge, over the Duck River on the Broadmeadows road. There are no other areas of crystalline dolomite as well opened up as this one, nor are there any in the Smithton district with better transport facilities. This area is adjacent to the Broadmeadows road and is 1 1/2 miles from the Smithton railway station, or 2 miles from the township. The dolomite outcrops over approximately 7 acres and beyond this it is covered with several feet of sand. Sub-surface quarrying would have to be resorted to.

Of the other areas, the sampling indicates that the Irish Town deposit is of fairly good grade with magnesia content of 21.56% and silica 3.28%. The sampling was carried out in the railway cutting and no outcrops occur in the immediate vicinity, the dolomite being covered by soil, alluvium etc. Sub-surface quarrying would have to be carried out.

The Edith Creek area has a magnesia content of 19.20 to 20.36 per cent, while the silica ranges from 3.30 to 5.08 per cent, and the alumina from 3.06 to 3.86 per cent. The conditions here are suitable for quarrying and approximately 15 acres would be the maximum that could be so quarried.

The poor quality of No. 11 samples is against the exploitation of the Lower Scotch Town road area, though better grade material exists as is evident from sample No. 12. Sample No. 13 is high in silica but also comparatively high in magnesia. The transport facilities are not so good as in the other areas.

Generally, therefore, it would appear that the Blackwood Bridge area is the one which should be investigated first with a view to exploitation. The dolomite is of good quality, the extent is sufficient for all purposes; it is within two miles of a railway station with which it is connected by a good motor road; it is close to the Duck River from which a supply of water is obtainable (it would, however have to be treated if being used in preparation of chemicals etc.); it is close to a settlement (Smithton) where labour is available; and it is within two miles of the electric power connected to Smithton.

Sgd. F.E. Nye
GOVERNMENT GEOLOGIST

HOBART 25/1/32