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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

PLASTER ROCK AREA NEW BRUNSWICK

BY

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Introduction

A block of rock salt reported to have come from a bedrock outcrop in Tobique valley near Plaster Rock was obtained by Dr. W.J. Wright, Provincial Geologist of New Brunswick, in 1934. In general the bedrock in this vicinity is similar in character and age to the rock salt and gypsum-bearing rocks at other places in the Maritime Provinces, so it was considered to be not unlikely that a rock salt deposit of value might occur. The finder, however, refused to disclose the locality to interested parties who were instrumental in getting the Provincial Government to reserve a large area for staking, and in 1935 the writer was sent by the Geological Survey, Canada, to investigate the possibilities of rock salt occurrence in the area. The results indicate that discovery of rock salt in commercial quantity in the vicinity is improbable. More details of the possibility of rock salt in the area are given at the end of the report.

A possible explanation for the finding of salt in this locality is that the block had been placed in the open for cattle, and was mistaken by the finder for salt in place. Salt of similar coarse crystallization and colour banding was used by one farmer in the valley, and he reports having missed a block several days after putting it out, much too short a time for it to have dissolved or to have been eaten by animals.

Location, Scope of Work, and Acknowledgments. Plaster Rock is located in Tobique River valley which joins St. John River valley near Perth and is 27½ miles by rail northeast of Perth.

Tobique river flows for about 30 miles through an elongated basin of sedimentary rocks of Carboniferous age, from near Riley Brook in the north to Red Rapids, 11 miles southwest of Plaster Rock. The southern and wider part of the basin has a maximum width of 14 miles at Plaster Rock. It is in this part, particularly towards the centre where the highest strata occur, that the chances of finding rock salt seemed most likely. The borders of this part of the basin were mapped and the strata measured and correlated. The lack of outcrops and the variable character of the strata made exactness impossible.

GENERAL GEOLOGY

The consolidated rocks of Plaster Rock area are of Palaeozoic age. Two groups occur, one of Carboniferous age and an older or pre-Carboniferous group. This subdivision is not based on fossil evidence but on lithological similarities of the strata to those in other parts of the Maritimes where more definite age determinations have been made, and on the lithological and structural differences of the two groups in the area. In addition a third group includes the unconsolidated surface deposits made up of glacial debris, stratified gravels, sands, and clays, and the more recent stream gravels and modified glacial drift.

Pre-Carboniferous Group

This consists of a much deformed complex of lavas, pyroclastics, bedded tuffs, and clastic sediments in which shale predominates, but in which siltstone and conglomerate also occur. Many of these rocks show a well-developed cleavage. The group underlies and borders the basin and in places, particularly along the edges, hills of these rocks protrude through the Carboniferous sediments. The rocks had been deformed and eroded to a hilly

topography before Carboniferous time and on them in a depression the flat-lying, Carboniferous sediments of the Plaster Rock basin were deposited nonconformably. Further description of this group is not included as its subdivision into formations and the age determinations await further investigation.

Carboniferous Group

This group is made up of semi-consolidated to well-consolidated sediments consisting of coarse conglomerates, sandstones, thin-bedded shales, sandy shales, limestone, shaly and gypsum-bearing strata, and a conglomerate horizon at the top. This upper conglomerate, which caps the top of a flat ridge at the structural centre of the basin on the east side of Tobique river, extending northeastward from Plaster Rock Forestry tower, probably marks the base of another series of rocks which except for these beds has been removed by erosion. An outstanding character of the whole series is its colour, which varies from maroon to bright red, and although there are some greys and greens in the sandstones and limestones the whole succession is aptly termed red beds. It is in the upper part of the series, above the limestones and particularly in the gypsum beds and overlying red shales, that the search for salt was made.

This series of red beds is tentatively assigned to the Windsor series of Upper Mississippian age. This correlation is wholly based on their lithological similarities to rocks of the Windsor series at other places, notably their red colour and the fact that they are gypsum-bearing. No fossils were found in them. Their lower part may possibly be correlated with the Horton series of Lower Mississippian age, but no unconformity was noted in the succession. The upper conglomerate as suggested above may be the basal member of a higher series. If so it may

be of Pennsylvanian age. Mississippian rocks are overlain conformably by the Millstone grit of Pennsylvanian age at other places in the province.

Structurally the rocks occur as a typical basin deposit, flat-lying in the centre, but with dips in places up to 10 degrees and 15 degrees towards the edges of the basin where the bedding of the lower members conforms to the slopes of the pre-Carboniferous surface. For the most part dips are 5 degrees or less, but these vary from place to place, particularly in the coarser, somewhat crossbedded sandstones. In a few places dips of 25 degrees to 30 degrees were noted; these either also conform to slopes of the underlying surface or else were caused by slumping.

The general structure, the isolation of outcrops, and the variable and lensing characters of the beds at different outcrops made it impossible to correlate and work out any detailed succession that would apply to the whole basin or to estimate the total thickness with any assurance of accuracy. Generally, the limestone members underlie the gypsum beds and separate a lower, more sandy succession from an upper, more shaly part.

The total thickness of the series is probably about 2,000 feet and the following table summarizes the general succession.

	Feet
Upper conglomerate	25±
Shale, red, friable, with some sandy lenses	800±
Gypsum - mostly dull red due to a coating of iron oxides about individual grains or crystals, giving the effect of a red sandstone; in places beds of 1 to 2 feet in thickness are quite white; in places a mixture of white gypsum crystals of $\frac{1}{4}$- to $\frac{1}{2}$-inch length are mixed with red and green shale and red and grey-green shale lenses occur throughout the total thickness.	100±

Thin layers of mottled red and green limestone from 1 inch to 1 foot in thickness interbedded with red shale and many limy nodules; some gypsum. 30±

A zone of red and grey-green, mottled shales and limestones characterized by thick beds of limestone, three of which are in places 10 to 20 feet thick but not correlatable between outcrops; commonly several thinner layers of limestone of from 1 to 5 feet thickness. 100±

Reddish sandstone, shale, and conglomerate becoming more sandy and conglomeratic and also more massive and solid towards the base. In places, as at the south end of the basin along Tobique river, coarse sandstone and conglomerate predominate throughout the lower half of the section. In other places, as along the Canadian National Railways east of Wapske, friable, platy sandstones predominate towards the base. This variable character of the basal members was doubtless brought about by a gradual filling of the basin, the basal members, particularly on the higher slopes, having been deposited much later than those in the lower parts of the basin, and for the same reason the thickness of this lower, sandy part varies from place to place within the basin. 500 to 1,000±

A very marked exception to the orderly basin structure occurs within the basin itself, near Three Brooks about 4 miles southwest of Plaster Rock, where two isolated outcrops of mottled red and grey limestone associated with chocolate-coloured shale and thinly bedded, red, sandy shale are highly deformed. At one outcrop the dip is approximately vertical. Limestone would not occur at this locality within the basin without faulting or folding of some considerable magnitude. It seemed too solidly in place to be accounted for by slumping and the neighbouring outcrops both to the east and west along the brook are of fairly flat-lying, shaly sandstone such as would be expected in this part of the basin if no deformation had occurred. No similar, deformed structures were noted at other places in the basin and they are inexplicable here except that they show post-Mississippian deformation of some magnitude, the evidence for which seems, however, to be confined to this locality. However, it may be that some of the steeper dips in

other parts of the basin, in places as much as 30 degrees, should be regarded as the result of deformation rather than as depositional dips.

ECONOMIC GEOLOGY

The surface gravels and soils, and the gypsum, are the only rock products of value occurring in the Plaster Rock basin. The presence of rock salt in the area has not been confirmed.

Gravels

The tops of the higher ridges and slopes are mantled with residual soil. This would appear to indicate that the area was not over-ridden by a continental glacier. Indeed some of this residual soil appears to be pre-Carboniferous, for in places the bedrock is well decomposed to depths of 2 and 3 feet where the Carboniferous rocks have been eroded from the pre-Carboniferous surface. Glacial gravels, sands, and clays, both sorted and unsorted, along with some Recent terraced stream gravels, however, mantle the valley bottoms and lower slopes. These deposits are evidently the result of local valley glaciers which originated at the headwaters of Tobique river, occupied the valleys, and on retreat left their morainal deposits only in the lower areas.

The valley glacier that occupied the main Tobique valley probably never reached farther south than about to Odell river, for beyond this the only surface deposits are sorted gravels, whereas for 5 miles north of Odell there are many hills, some of them rising abruptly to 200 and 300 feet in height, composed of unsorted morainal material with many large boulders. These drumlin hills dot the main valley bottom and extend over the lower areas to the east and west and most of them are elongate transverse to the valley. They are evidently moraines deposited

near the front of a retreating glacier. Recent stream action of Tobique river has in places cut abruptly into some of these drumlin hills. At an excavation along the Canadian Pacific Railway, north of Odell, the moraine has been cemented to a firm conglomerate, evidently by deposition from a former underground water channel.

Sand-plains and clay flats east of Tobique valley, in the area drained by Gulquac and Wapskehegan rivers, are another marked feature of the glacial deposits. Several hundreds of square miles of flat swamp and open evergreen forest areas are here underlain by stratified sands and clays which were probably deposited in glacial lakes, the lakes having formed behind the ice dams of the glacier that blocked the channel of the main Tobique valley to the west. These extend roughly from the first low ridges near Tobique valley eastward to about the border of the area underlain by Carboniferous rocks, beyond which hills of pre-Carboniferous rocks rise above the level of the plains.

On the west side of Tobique valley the lower areas, particularly along Three Brooks, are mantled with low hills of unsorted, and sorted, glacial gravels. These also extend roughly to the edge of the Carboniferous basin beyond which are the higher hills of pre-Carboniferous rocks.

All these surface deposits make good farm lands, except where morainal gravels contain too many large boulders, or where the slopes are too steep for cultivation or the residual soil is too thin. The gravels are used for road surfacing.

The glacial deposits, like the underlying Carboniferous rocks, are markedly reddish in colour, chiefly because they were derived largely from this underlying rock. The residual soil on the pre-Carboniferous ridges is mostly grey in colour.

Gypsum. The gypsum deposits of Plaster Rock area, as outlined in the table of rock succession, outcrop along cliffs and bluffs on the east side of Tobique river at intervals for about one mile both north and south of Plaster Rock and doubtless extend farther, although no outcrops were seen at any other points in the basin. Here they dip gently to the east beneath a cover of red shale, and sink-holes in the fields to the east for about $\frac{1}{2}$ mile indicate their presence. How far they extend to the north and south and whether they occupy the whole centre of the basin and recur on its east side is problematical. A report that they occur 4 miles up Wapskehegan river can hardly be correct as the rocks at that point underlie the limestones which at Plaster Rock are beneath the gypsum. If they occupy the whole centre of the basin then they underlie an area of from 30 to 40 square miles as indicated on the accompanying sketch map.

Although in the table of rock succession 100 feet thickness is assigned to the gypsum beds, this is by no means all gypsum but includes gypsum mixed with, and interbedded with, shales. The workable layers are rarely 25 feet, and in most places are less than 20 feet, thick.

The gypsum has been quarried and used as land plaster or fertilizer at intervals since the days of early settlement and some of it has been used in cements. At present none is being quarried, probably because this gypsum cannot meet the competition of better quality, and more cheaply obtained, gypsum from other localities. Its red colour prohibits its use for many purposes, but this is not a detriment in fertilizer and there is here a great quantity that is well suited for this purpose. A test on samples from representative parts of the deposits shows a sulphur trioxide content of 39.54 per cent.[1]

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[1]Mines branch, Department of Mines, Canada, Report No. 714, p.92. The Gypsum Industry of Canada, by L. Heber Cole.

The presence of the gypsum beds in this series of non-fossiliferous red beds suggests that the whole series was deposited in a recurrently freshened but evaporating basin of salt water. In such circumstances it is probable that the gypsum would have accumulated at favourable spots along the border of the basin rather than covering the whole basin. These conditions of deposition must also be taken into account when considering the possibilities of rock salt in the basin.

Rock Salt. Rock salt, sodium chloride, is commonly associated with other salts and in particular in many places it is interbedded with or rests on top of gypsum. In the evaporation of brines the saturation point for gypsum, hydrous calcium sulphate, is reached much sooner than is that of sodium chloride. As a result gypsum may be deposited, but if the brine does not reach the saturation point for sodium chloride, the salt is not deposited or rock salt may be deposited on top of gypsum and redissolved with recurrent freshening, or rock salt may be deposited and with a further ingress of brines and evaporation may be covered with gypsum.

It appears, then, that in the Plaster Rock basin the conditions were those that led to the accumulation of considerable thickness of gypsum, but that probably the evaporating brines were so repeatedly freshened that the deposition of rock salt to any extent did not take place. That there is some chloride in the gypsum beds and overlying shales, however, is well shown by the fact that nearly all the waters draining from the centre of the Plaster Rock basin give decided tests for chlorides. Nevertheless, the rock salt may be disseminated throughout the gypsum-shale succession with no sufficient concentration at any one place to make a workable salt deposit.

If there is a rock salt deposit of any size it is so thoroughly concealed by overlying rocks and overburden that no clue to its location is apparent and any drilling that might be attempted would be purely guess work. The writer is inclined to think that no rock salt deposit of workable size exists, but that the chloride is disseminated throughout the beds.

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