Geology of the vicinity of Ogdensburg (Brier Hill Ogdensburg and Red Mills quadrangles)

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GEOLOGY OF THE VICINITY OF OGDENSBURG

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INTRODUCTION

The chief purpose in mind in undertaking the areal mapping of
the district here reported upon was to make a careful study of the
Beekmantown formation in the district of the upper St Lawrence,
in order to see how fully it was represented and how it compared
with the formation in the Champlain valley. Between Ogdensburg
and Morristown excellent sections of the formation are shown so
that, in so far as the lower portion of the formation is concerned,
the work was very successful. Down the river from Ogdensburg,
however, the glacial drift is very widespread and heavy, and rock
exposures are infrequent and scant; so much so that it is highly
questionable whether a satisfactory idea of the higher beds of
the formation can be obtained.

Prof. G. H. Chadwick was engaged in mapping the Paleozoic
rocks of the Canton quadrangle, at the same time that our work
was in progress, giving opportunity for us to keep in touch with
each other, and to make a definite comparison of results. This
has proved of especial help since, owing to heavy drift, the rocks
east of Ogdensburg on the Ogdensburg quadrangle are almost com-
pletely covered up, and a formation wedges in there and appears
strongly on the Canton quadrangle, where Professor Chadwick
recognized it, which would probably have entirely escaped our
notice on Ogdensburg.

In 1913 both Dr E. O. Ulrich and Dr R. Ruedemann spent two or
three days with me at Ogdensburg, looking over the section with
me and giving indispensable assistance. They have also spent
much time in determination of the fossils collected, hence a large
part of such merit as the report may have is owing to their aid.
LOCATION AND CHARACTER

The district here reported upon comprises the Brier Hill, Ogdensburg and Red Mills quadrangles of the topographic map sheets. The southwestern margin of the Brier Hill sheet overlaps by a trifle the northeastern corner of the Alexandria Bay sheet, so that the mapping is a continuation, down the river, of the work done in the Thousand Islands region.¹ In the latter territory the Paleozoic rocks found are chiefly those to the south of the Frontenac axis, as the belt of crystalline rocks which comes down to and crosses the river at the Thousand Islands is called. In the Ogdensburg district the Paleozoics are those to the north of this axis, and the contrast between the two will be subsequently shown.

The mapped area extends from longitude 75° 15' to 75° 45' W. and from latitude 44° 30' to the St Lawrence river. It is of triangular shape, since the river flows northeast. At the west edge of the Brier Hill sheet the river crosses the parallel of 44° 30'; at the east edge of the Red Mills sheet the south bank of the river is about at latitude 44° 52'. The area included is about 320 square miles.

The district lies entirely in the topographic province of the St Lawrence plain, though its southern margin might be said to belong to the northwest edge of the Adirondack highland. On the northwest there is not the sharp junction between these two topographic provinces that there is farther east, but a very gradual drop from the one to the other.

The district lies also on the boundary between two geologic provinces, which correspond in a general way with the topographic. The crystalline rocks of the Adirondack highland descend to low levels in this vicinity, and cross into Canada at the Thousand Islands in a narrow belt, furnishing an isthmianlike connection between the great area of these rocks in the Adirondacks, and the vastly greater area in Canada. Below the Thousand Islands the river flows through a country of low altitude whose rocks are flat-lying formations of early Paleozoic age, and crystalline rocks do not reappear along the river west of Quebec. The general breadth of this Paleozoic plain of the St Lawrence valley, which separates the Adirondack highland from the Canadian highland, is from 60 to 70 miles, but three-fourths of this breadth, and of the plain, lies on the Canadian side of the river.

¹ N. Y. State Mus. Bul. 145.
GENERAL TOPOGRAPHY

The mean level of Lake Ontario and of the St Lawrence through the Thousand Islands is 246 feet above tide. At Ogdensburg it is only 2 feet lower than this, but on the 12 miles of river across the Red Mills quadrangle there is a rapid drop at the Galop rapids, from 244 feet above the rapids to 228 feet at Rockaway point, 16 feet in 8 miles. The levels of the river are the lowest levels in the area mapped.

The highest land on the Ogdensburg quadrangle is around Dekalb Junction in the extreme southeast corner where an elevation of 470 feet is reached. This gives for the quadrangle an extreme of relief of only 225 feet, a very small amount; and the bulk of the quadrangle lies between 300 and 400 feet altitude. On the Brier Hill quadrangle it is even less, since 400 feet is exceeded in only two places, and 440 feet is the highest point, only 200 feet above the river.

The minor relief on the Brier Hill sheet is considerable, much of the surface consisting of slopes; there are many rock exposures, and hence very little guess work is necessary in working out the geology. But the entire northern half of the Ogdensburg quadrangle consists of a plain with little relief, and so covered with glacial drift that rock exposures are very infrequent, and the mapping of formation boundaries is a very uncertain matter.

Drainage. The mapped area drains entirely into the St Lawrence, the chief stream being the Oswegatchie river, which is one of the five good-sized streams which drain out from the Adiron- dacks to the northwest, the others being the Black, Grass, Raquette and St Regis. Five miles south of Ogdensburg, Black lake, which is nothing but an expansion of the waters of the Indian river into a lake, empties into the Oswegatchie. The Indian river is a considerable stream, but not comparable to the others in size.

The general slope of the district is to the northwest, toward the St Lawrence. This is, however, at right angles to the geologic grain of the country which trends northeast. Most of the preglacial valleys of the district have this northeast trend. Black lake lies in a preglacial valley; and the adjacent valleys of Fish creek and Beaver creek have the same trend and are small preglacial valleys. South of Rensselaer Falls the Oswegatschie is now occupying the preglacial valley of a small stream; but below that point its course seems entirely postglacial, and it has no valley worthy of the name,
but flows in a shallow trench cut chiefly in glacial deposits, with rock seldom showing, and with rapids in the stream wherever it is on bedrock.

The St Lawrence, in its course across the Brier Hill sheet, seems to be occupying an old valley; at least there is a well-defined valley rock wall on the New York side. But below Ogdensburg it has the same characteristics as the lower Oswegatchie, no well-defined valley, low banks of drift with no rock showing, and rapids in the river whenever it discovers rock ledges in its bed, as at the Galop rapids.

GLACIAL DEPOSITS

All the surface of the district is below the levels of the bodies of standing water which existed in the region during the closing stages of the Glacial Period, and practically all of it is beneath the level of the marine waters which invaded the St Lawrence valley when the final melting away of the ice sheet cleared a way for their passage. On the Brier Hill sheet the wave action of these water bodies swept away most of the glacial deposits from the higher rock surfaces and into the old depressions, which are deeply filled with them. The low grounds which comprise all the north half of the Ogdensburg are so drift-covered that rock outcrops are exceedingly scarce, but the drift has comparatively little surface relief, was probably all laid down under standing water, and has since all been wave-washed.

A well-defined morainic belt extends across the Ogdensburg and Red Mills sheets, parallel to the river. It has a breadth of several miles and seems to be broadening eastward, with the widening of the Paleozoic plain. But the moraine has a very subdued relief, the knobs being low and of gentle slope, with seldom a relief of as much as 40 feet above the low grounds. Nor does the material appear to be particularly thick; we doubt if it would average 40 feet thick.

This moraine does not extend far west on to the Brier Hill sheet, on which rock exposures abound and drift is heavy only in the pre-glacial valleys. On the south half of the Ogdensburg sheet, also, there is no widely spread drift cover. The rock relief is greater there than to the north and the drift is solely in the depressions. The depressions are often marshy.

The morainic belt is, to a considerable extent, drowned beneath the clay plain formed by deposit in the standing waters, so that the
general surface is a clay flat, above which the higher knobs of the moraine project.

The only considerable drift hill in the whole mapped district is the rather boldly projecting ridge known as Mount Lona, about 2 miles south of Heuvelton, midway of the Ogdensburg sheet. Its north front is at the river edge, at the sides it rises rather abruptly from low, flat country, it trends southwest, parallel with the general direction of ice motion, has a length of about a mile and one-half, and a breadth of one-half of a mile. Its summit has an elevation of 466 feet, the highest point on the map with the exception of one or two of the granite knobs near Dekalb Junction, which are a few feet higher. It towers 160 feet above the country on the north and east, and 100 feet above that on the southwest.

The ridge is entirely composed of bouldery drift, probably morainic. It stands on a sandstone plain, with rock near the surface, and occasionally outcropping around the margins of the knob. A low moraine stretches from it toward the southwest, but a moraine of no particular bulk or prominence. The hill somewhat suggests a drumlin, though somewhat more abrupt, more prominent and more elongated than the usual drumlin. The lack of other hills of the same type in the district tends to throw doubt on such a classification also. We were unable to devote any particular attention to the drift deposits of the region, and simply chronicle this hill as an interesting point for study. Because of its prominence it was thought that perhaps shore line features would be shown upon it, but we could detect none, and apparently the marine waters must have overtopped it somewhat.

A much smaller and less conspicuous hill of similar type is that at Lost village, 5 miles south of Ogdensburg, on the west side of the Oswegatchie at the point where Black lake outlet empties into it; this is also a purely morainic hill, resting on bedrock, and with no particular connection with a morainic belt.

Though the general surface of the Ogdensburg quadrangle consists of a clay plain, above which low, morainic summits rise, locally considerable sand rests upon the surface. Much of the sand is in the lee of the moraine knobs, in the fashion of sand spits, similar to the many occurrences of the same sort on the Theresa and Alexandria Bay quadrangles. But there is also much sand as knolls mingled with the moraine knobs, which seem to be of the kame type, and the chief moraine is probably a kame moraine, its features masked because of its subaqueous formation.
GENERAL GEOLOGY

The rocks of these three quadrangles consist of (a) crystalline rocks of Precambrian age and (b) early Paleozoic rocks of the St. Lawrence trough which lie upon the Precambrian rocks. The Precambrian rocks are the characteristic rocks of the Adirondack region, are as old as any rocks of which we have knowledge, consist in part of sediments and in part of igneous rocks, and have but small extent on the sheets here reported upon, occupying about one-fourth of the area of the Ogdensburg sheet, and occurring in the southeast corner of the Brier Hill sheet. On the Hammond and Gouverneur sheets, next south, however, they occupy most of the territory. The overlying Paleozoic rocks extend solidly along the St. Lawrence in a strip a few miles in breadth, and the lowermost member, the Potsdam sandstone, is also found in outlying patches within the area of the crystalline rocks. The crystalline rocks are much older than the Paleozoics, venerable as the latter are, and in the time interval between the two sets of rocks the region existed as a land area for a very long period, during which time much rock material was slowly worn away from its surface. It is upon this worn and somewhat irregular surface of the crystalline rocks that the Paleozoic rocks rest. They have remained comparatively undisturbed since their deposition, and still lie nearly flat and unbroken, as laid down, presenting the strongest kind of a contrast to the greatly deformed Precambrian rocks.

DESCRIPTIVE GEOLOGY

PRECAMBRIAN ROCKS

The Precambrian rocks of northern New York comprise an old series of sedimentary rocks, known as the Grenville series, which are the oldest known rocks of the region, and various masses of igneous rocks, all of which cut the Grenville rocks intrusively and are therefore younger than they are. The older set of these intrusives consists chiefly of granite, while a younger set consists of granites, syenites, gabbros and anorthosites. Where both sets are present and in contact with one another, as is the case in the Thousand Islands region, it is possible to class them in their appropriate groups, on the evidence of their structural relations to one another. But where such contacts can not be found, such classification is a difficult and hazardous matter. To the older set of
these intrusives the name of Laurentian is applied; for the younger set certain of the Canadian geologists have recently suggested the name "Algoman." It is not certain to which of these groups the granites in Dekalb and in Macomb belong. But both granites and syenites are well represented in the small Precambrian area which the maps contain.

Much later in Precambrian time came renewed igneous intrusion, and black, heavy lavas, so-called trap rocks, rose toward the surface. Such traps are well represented in the Thousand Islands, but in the district here mapped but two small dikes of this rock have been seen.

The Grenville rocks in considerable diversity are found in the southern part of the Ogdensburg quadrangle. They are cut by granitic, syenitic and gabbroic eruptives, and by trap dikes.

The Precambrian rocks exposed within the mapped area cover such a trifling amount of territory, being the mere northern fringe of the great and well-exposed areas of these rocks on the Gouverneur and Hammond sheets next south, that it seems unwise to attempt any elaborate investigation of them until these sheets have also been studied. Since it is our present plan to commence study of the Gouverneur area, the detailed report upon the Ogdensburg Precambrian will be left until that work is completed.

**Grenville series.** The Grenville series in the Adirondacks exhibits an enormous but unknown thickness of limestones, quartzites and various sorts of schists and gneisses. These are water deposited rocks and were unquestionably deposited in great thickness over the entire region. Not long after their deposit, however, they were invaded from beneath by huge masses of molten granite; and at a subsequent time by even greater masses of a variety of igneous rocks. This action broke up the old series into a group of disconnected blocks and patches, separated by masses of the intrusives, so heated and compressed the sediments as to cause complete recrystallization of their constituent parts, and vastly changed their appearance. The pure limestones were changed into white marbles, with scales of yellow mica and of graphite always present. The less pure limestones are full of other silicates in addition, chiefly pyroxenes and scapolite. The sandstones were changed into quartzites and quartz schists. The shales were altered to schists of various sorts. Contact rocks were produced at the contacts of many of the igneous rocks, and these also have been recrystallized to schists and gneisses. Often there is great difficulty
in determining just what the nature of the original rock may have been.

**Limestone.** An unusually large proportion of the exposed Grenville on the Ogdensburg sheet consists of limestone. A great belt of limestone comes on to the sheet at its southwest corner and the rock is magnificently exposed along the east side of Mud Lake, and runs northeast from there in a prominent belt more than a mile in width, its western portion overlapped and covered by Potsdam sandstone. The Grenville limestone is a weak rock in its resistance to erosion, tends to form low grounds and to be heavily covered with soil, so that outcrops are scarcer than in most of the Grenville rock belts, that is, belts of other rock. To the east of this belt are two narrower belts, one east and one west of the Oswegatchie, but in these the limestone is less pure and alternates with thin bands of quartzite and of schists. The areal distribution of the limestone suggests a series of folds pitching to the northeast.

Frequent knobs of granite are found cutting through the limestone, especially in the belt which borders the Oswegatchie on the east. These are more resistant to erosion than the limestone and form the more prominent outcrops in the limestone belts; in fact the great majority of the limestone outcrops are found on their borders. These granite knobs in every case consist of _white_ granite, though the granite masses elsewhere are red. It seems to be the same sort of bleaching of the granite at limestone contacts as has been described in the Thousand Island region.

**Quartzite.** There is no considerable belt of quartzite in the Grenville series of the Ogdensburg quadrangle, though there are narrow belts of it involved with impure limestone in alternating layers, too narrow to map on this scale as separate from the limestone. There is still more of it in narrow bands interbedded with amphibolite and rusty gneiss, all too narrow to map separately and hence mapped simply as Grenville schist. The quartzite is thin bedded, is really quartz schist, and exhibits everywhere minute folding and puckering, showing these features much better than any other rock in the district (plates 1 and 2).

**Schists.** The larger portion of the area which is mapped as Grenville schists is occupied by the dark-colored rock conveniently known as amphibolite, and made up chiefly of feldspar and hornblende, often with some pyroxene as well and commonly with black mica in addition. When the mica becomes prominent the rock cleaves readily and becomes rather weak. From these thinly