FIELD GUIDE

NEW YORK STATE GEOLOGICAL MEETING
MAY 12 AND 13, 1939

GENERAL

INTRODUCTION

The Adirondack Mountain Province includes that area in northern New York in which the bed rock is predominately Precambrian in age. As so defined, the area visited on this field trip lies in the northwestern part of the Adirondacks. To the northwest of the Adirondack Province is the St Lawrence Valley which is underlain by Paleozoic sediments of Cambrian and Ordovian age.

Parts of both the Adirondack and St Lawrence Valley provinces are included in St Lawrence County of which Canton is the County seat. The chief industries of this county are dairying, production of dairy products, and mining. Many farmers supplement their income from dairying by making maple sugar or syrup in the spring. Formerly, lumbering was important. The more important mineral industries at the present time are the mining of talc and zinc, quarrying of stone, and excavation of gravel. Graphite and feldspar have recently been mined and in the past, pyrite, marble, iron, and lead were the bases of important mining industries.

Water-power was an important factor in the location of villages and as late as 1890 there were eleven small manufacturing or processing plants which obtained their power from the Grass River within the village of Canton.

GEOLOGICAL HISTORY

The chief events in the geological history of the area are as follows:

Precambrian

1. Deposition of Grenville series consisting of limestone, sandstone, and shale now metamorphosed into marble, quartzite, various gneisses including garnet, rusty and pyritic gneisses, and possibly amphibolite.

2. Post-Grenville igneous intrusions consisting of gabbro, syenite, granite, and pegmatite dikes. Mineralization was a phase of granitic intrusion.

3. Metamorphism and folding. Buddington considers that igneous intrusion and folding accompanied each other, in many places forming phacoliths. Miller attributes all, or essentially all, of the folding to igneous activity, a conclusion from which many students of the Northwestern Adirondacks vigorously dissent.

4. Erosion, probably including peneplanation. But if the area was peneplained, it would appear that either the peneplanation was not

universal or was locally destroyed before the deposition of the Potsdam sandstone of late Cambrian age.

Paleozoic

1. Deposition of early Paleozoic sediments within or along the margins of the Adirondacks. The deposits included the Potsdam sandstone, a red stone used locally for building purposes and the Heuvelton sandstone from which the Men's Residence, Hepburn Hall and the Chapel on the University Canpus are built. The Potsdam sandstone of late Cambrian age is the only one of these formations which will be seen in the field. This sandstone is dominantly marine in origin but conditions of sedimentation undoubtedly varied and it has been suggested that the Potsdam sandstone is in part of eolian origin and in part formed by the consolidation of weathered material. For further discussion of this formation see Stop 7 of Saturday's trip.

2. Erosion, including removal of the Potsdam sandstone from the valleys where it was once widely distributed.

Mesozoic and Teriary

Chadwick, Reed, Cushing, and Newland suggest peneplaination during Mesozoic (possibly Cretaceous) and Tertiary times.

Quaternary

1. Advance of the glacier.

2. Probable depression of the land due to the weight of the glacier.

3. Glacial erosion.

4. Glacial deposition.

5. Retreat of the glacier and formation of lakes and bays. Some of the lakes were formed by direct damming by the ice, others by the damming effects of glacial deposits, while the bays were the result of the depression of the land. The most important ones were Lake Iroquois and Gilbert Gulf, an arm of the Champlain sea, but this certainly does not exhaust the list. Chadwick states (p. 50): "The blockade of the lower St Lawrence valley by the waning ice sheet produced a lowering succession of glacial lakes, whose beaches encircle our steeper hill slopes and blend with delta plains at the crossings of the stream valleys. These beaches are those of "Lake Iroquois," at 860 to 890 feet present altitude, and lower, "Lake Vermont" ranging downward from 600 to about 500 feet. At still lower levels, from about 460 feet downward, are the undoubtedly marine beaches of "Gilbert Gulf" (Woodworth's Hochelagan sea) representing a slow postglacial uplift of our region out of the ocean."

Other authors give slightly different elevations for these shorelines. The former great extent of these bodies is indicated by the fact that about one-third of St Lawrence County is underlain by lacustrine soils.

6. Disappearance of most of the lakes either by filling or by removal of the ice barrier.

7. Tilting and elevation of the area, causing retreat of the sea and tilting of shore lines.

TOPOGRAPHY

Drainage

The tortuous stream pattern of the area is the result of three influences:

1. Adjustment to the varying resistance of the underlying Precambrian rocks whereby the stream courses became located as much as possible in valleys of Grenville limestone (marble) in Precambrian time, developing at least locally, a trellis pattern of drainage.

2. Glacial deposition, damming the old courses, ponding the waters and thus leading to the inauguration of new courses, and of extensive deposition in certain areas.

3. Superimposition upon deltas formed in Lake Iroquois, Gilbert Gulf, and possibly other bodies of water.

The partial filling of the Precambrian valleys by Potsdam sandstone has apparently had little effect upon the drainage pattern for most of it has subsequently been removed, however post-glacial filling has developed locally broad valley flats well above the old rock surface.

Glaciation

The glacier has produced many interesting effects in this area which include not only derangement of drainage previously mentioned, and the developement of kames, eskers, proglacial deltas, outwash plains and roches moutonnees, some of which will be examined and which are described or mentioned elsewhere, but has developed a drumlinized plain and left several belts of recessional moraines. The drumlinized plain lies chiefly to the northwest of the area to be traversed, in the St Lawrence valley. However, the University Campus is located on one of these drumlins. There are several belts of indistinct recessional moraines, stretching across the area but these moraines were largely deposited under water where they were subjected to the modifying influences of these waters both at the time of their maximum extent and during their receding stages. They have consequently been greatly modified; the rounded surface of the moraines and the concentration of boulders in them, can undoubtedly be attributed to wave action smoothing the surface and washing away the finer materials in which the boulders were originally embedded. The fact that bed rock surfaces are exposed in places in the morainic belts may be attributed as much to the considerable pre-glacial relief as to the thinness of the glacial cover. The position of these moraines and former shore lines are indicated on the accompanying map.

Lake Features

In an area where nearly one-third of the soil is of lacustrine origin, one would expect to find many lake features. Such is the case. Referrent to Gilbert Gulf, Lake Iroquois, and other bodies of standing water, Cushing and Newland state (p. 8 and 9):"The chief effect of these waters was to wash the rock ridges fairly clean of loose rock material which was deposited as valley filling in the depressions between the ridges. The material so washed into the depressions consisted largely of fine clays, and the filling was comparatively even, so that the valley surfaces are now relatively flat, and the rock knobs and ridges rise sharply out of these flats, as though their lower slopes were drowned by the valley filling, and in fact, they are."

"The shore currents in these bodies of standing water often build bars and spits of sand and gravel, tailing out from the ends of the rock promontories of the shore line."

Solution

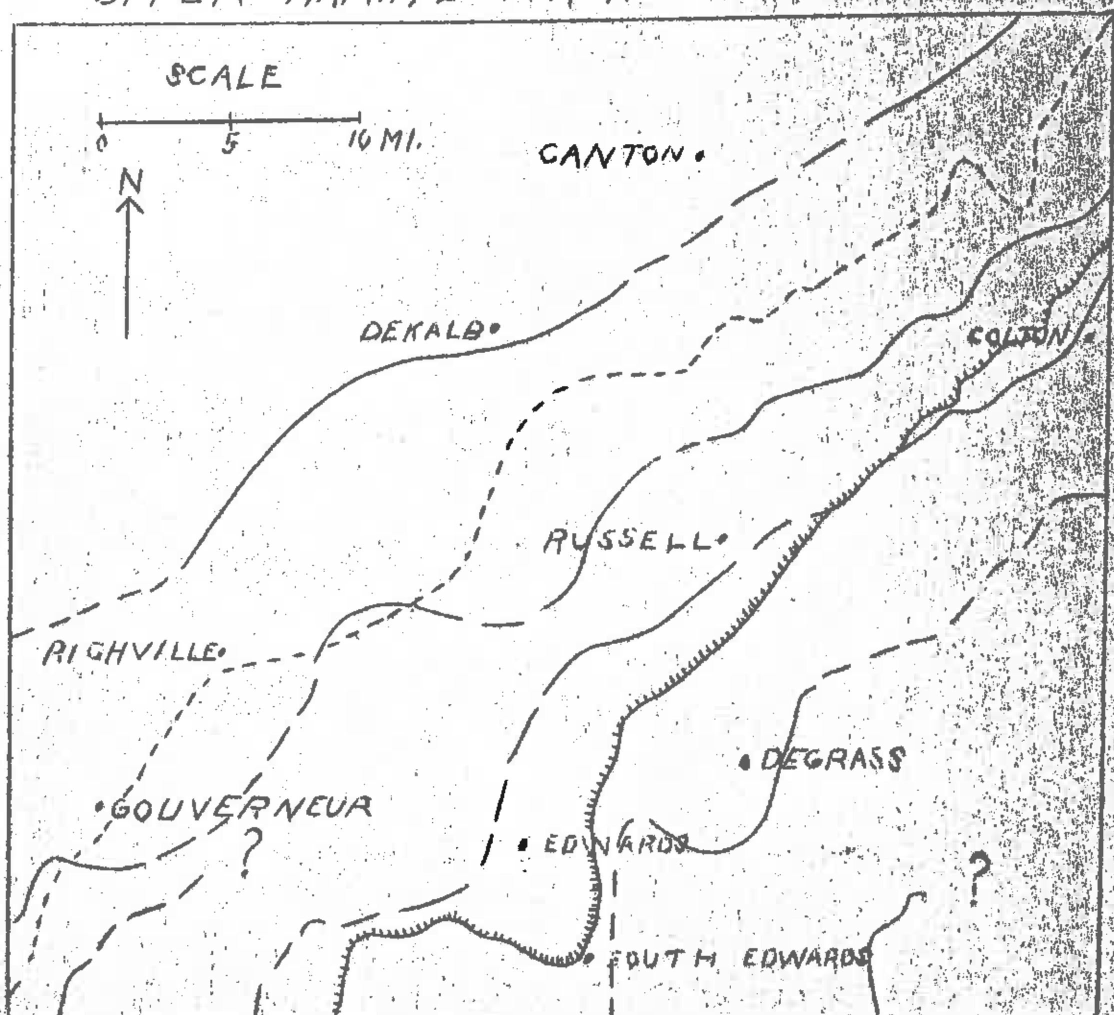
In limestone and marble areas one can expect to find evidences of solution and the area covered, lives up to this expectation. "Lost River"which is a good examole of the effect of solution will be visited and is described elsewhere. While sinks and solution channels may be observe in many localities, in other localities they probably exist below the glacial drift which hides them, some of which are being re-exhumed.

Topographic Age

The good state of preservation in which many of the conspicious glacial and lake features such as eskers, kames, drumlins, and deltas are now found even when favorably exposed to the work of streams, indicates that the topography is youthful although the pre-glacial topography apparently was at least locally well advanced into maturity.

GLACIAL MORAINES
AND
MARINE BEACHES

PREPARED BY MARSHALL M. COOK
FROM MAP BY FRANK B. TAYLOR
KEY - MORAINES —— - IROQUOIS BEACH
UPPER MARINE BEACH - - - - -



FIELD GUIDE

New York State Geological Association
Friday May 12, 1939

Gouverneur to Canton

Park cars facing Highway No. 11 on Clinton, Austin, and Trinity Streets in the vicinity of the Municipal Building at Gouverneur.

STOP 1: GOUVERNEUR MARBLE QUARRY

Quarrying of marble was a very important industry at Gouverneur about 1900, but has declined greatly. The opening of the Gouverneur Marble Company affords good exposures of fairly pure Grenville limestone. The rather flat bandings (15° to 30°) probably approximate true bedding. At the southwest end of the quarry are a number of dark inclusions, probably broken and altered fragments of a Precambrian sill or dike of gabbroic affinities. Aureoles of mica and brown tourmaline crystals may be found around some of these inclusions.

In an abandoned quarry one-fourth mile south-east is a good exposure of a vertical, fine-grained diabase dike of probably Ordovician age, but time will not permit its examination.

In the marble mill, if it is operating, the cutting and polishing of marble can be seen.

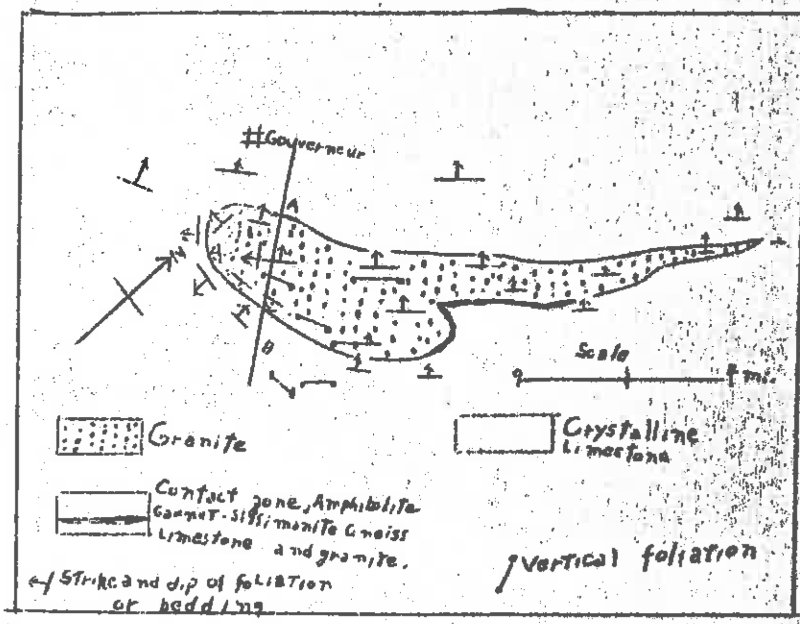
STOP 2: RESERVOIR HILL PHACOLITH

The term Phacolith, proposed by Harker in 1909, is defined by Arthur Holmes as follows:

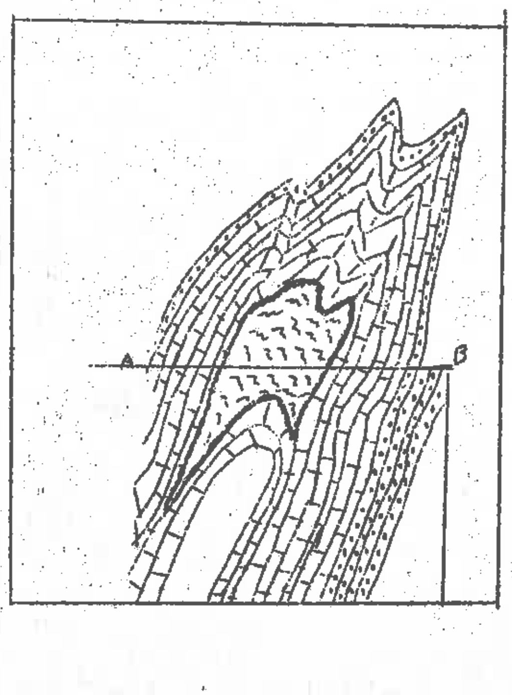
"A concordant minor intrusion occupying the crest or trough of a fold. Unlike a laccolith, its form is a consequence of folding, not the cause."

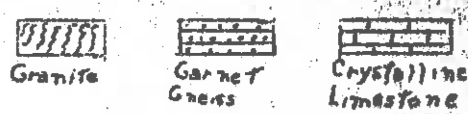
Buddington (p52) states that the numerous phacoliths in the northwest Adirondacks have resulted "from the intrusion of magma in the crests of anti-clinal folds and subsequent intense deformation by continued folding before the magma's complete consolidation."

In the northwestern part of the Adirondacks, there are two well-defined lithologic types of granite. One is porphoritic and coarse grained and is referred to as the Hermon type by Buddington. The other is fine-grained and non-porphoritic and is referred to by Buddington as the Alexandrian type.

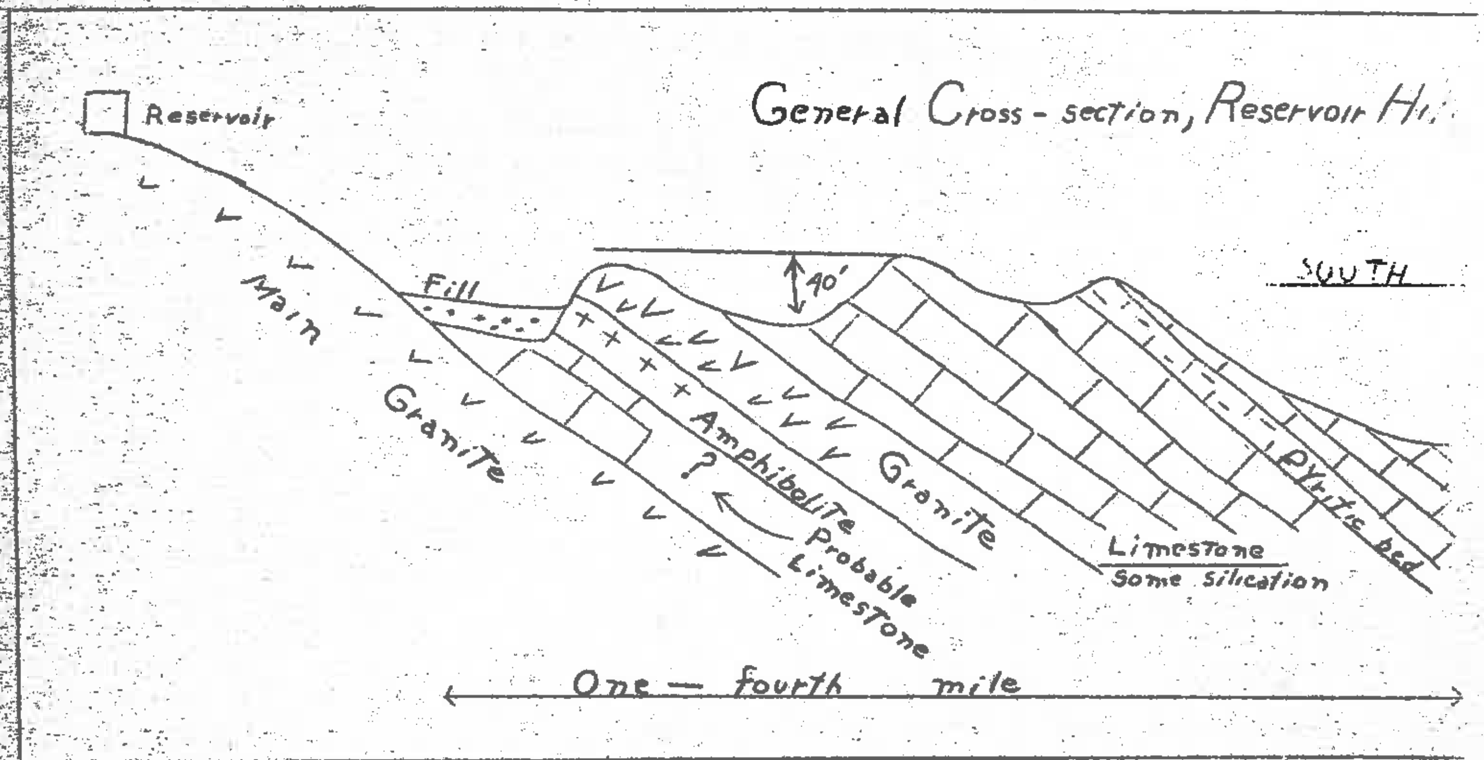


Map of Reservoir Hill phacolith, Gouver. quad.





Inferred structure section across Reservoir Hill phacolith along line A-B.
Copied from Figs. 34 and 35 of Buddingtons report by Marshall M. Cook.



Copied from sketch of J.S. Brown
by Marshall M. Cook

The Reservoir Hill phacolith, although mapped in the Gouverneur quadrangle bulletin as porphyritic granite (and called a sill), is considered by Buddington to belong to the fine-grained Alexandria granite (p59), which is thought (J. S. Brown) to be the younger of the two granites.

Reservoir Hill rises above the surrounding low-lands of Grenville limestone because of the more resistant qualities of its granite core. The approach, from the south, is over beds of Grenville limestone which are considerably silicated and pyritized due to general metamorphism, and the proximity of the granite. These beds drop southward down the plunging axis of the anticlinal nose with a prominent development of dip and scarp slopes. A sill-like sheet of granite (not shown on State map) occurs in front of the main mass. Beneath this is a small exposure of dark amphibolite, either an altered, more basic, intrusive or possible altered limestone. Most of the space be tween the sill and the main granite is covered by glacial till, the topography strongly suggesting a limestone band beneath this small valley.

Continued erosion of the central core of the phacolith should expose underlying or inter-layered Grenville rocks at the center. (See diagrams).

Buddington states, the evidence in favor of phacoliths in the Northwestern Adirondancks (52p) "is based upon the restriction of the granite bodies to anticlinal folds; upon the general conformity between the borders of the granite mass and the bedding of the country rock, both on the limbs and on the plunging noses of folds; upon the actual exposure of the base of a major phacolith and upon contemporaneity of folding and intrusion, and indicated by phenomena connected with the foliation and texture of crystalization."

He also states (p53): "The foliation and bedding in the Grenville formations are uniformly parallel. This is interpreted as resulting from deformation of a system partly solid (Grenville) and partly liquid (magma and magmatic solutions), and is not necessarily the result of load or static metamorphism, as so commonly inferred." In other words, the foliation in the granite was produced during folding, but he also considers that some of the foliation was produced while the magma was still liquid as inclusions of foliated amphibolite are found in the granite (p58).

EN ROUTE TO "LOST RIVER"

In proceeding to "Lost River", the road approximately one-fourth of a mile southeast of the New York Central Railway will be traversed. Several points should be noted in route.

The eastern portion of Gouverneur is located on a plain which can be traced beyond Richville along Highway No. 11 (which lies north-west of the New York Central Railroad). In places, this plain has been dissected by streams and in places rocky knobs and hills rise above it. This plain can also be traced into the valley now occupied by the headwaters of White Creek and Boland Creek and will be more or less followed to and beyond "Lost River". In many places the elevation of the plain lies at an approximate elevation of 460-480 feet, which corresponds to the elevation of Gilbert Gulf in this area and in which the relatively fine sediments underlying the plain were probably deposited. The fact that the plain does not rise everywhere to the same elevation may be attributed either to deposition in a somewhat later stage of Gilbert Gulf or to subsequent compaction.

Excellent examples of longitudinal hills following the strike of the more resistant members of the Grenville formation (including shists, siliceous limestone and more resistant portions of the relatively pure limestone) can be seen in route to "Lost River". These hills parallel the road and are more prominent near "Lost River" than near Gouverneur. The corresponding longitudinal valleys were sediments once much deeper than at present for they have been filled with sediments from Gilbert Gulf. To the south-east of the road, the Reservoir Hill phacolith forms one side of a longitudinal valley and can be seen for a distance of three or four miles out from Gouverneur.

At Cole, about five miles east of Gouverneur, an abandoned Pyrite mine may be seen to the northwest, to the southeast is a hill having some characteristics of an esker.

STOP 3: "LOST RIVER"

The term "Lost River" is applied to that portion of Boland Creek where underground drainage is important. Originally the site of "Lost River" was occupied by a stream flowing entirely on the surface. It has twice been excavated, once in pre-glacial time by a short tributary of the Oswegatchie River which did not receive any water from the longitudinal valley southeast of the road, and again, after having been filled by glacial and estugrine deposits, in post-glacial time by the present drainage.

Pre-Glacial History

A pre-glacial divide exists near the road in the vicinity of "Lost River". At present the highest observable rock surface in the bed of Boland Creek in the vicinity of "Lost River" is immediately to the southeast of the bridge and is readily observable from the road. The pre-glacial divide was probably a short distance northwest at this point. Prior to glaciation, a stream occupied the longitudinal valley stretching to Gouverneur while a tributary of the Oswegatchie River occupied the present site of "Lost River". It was this tributary that first excavated "Lost River". That this excavation had made considerable progress in pre-glacial time is indicated by the distribution of glacial drift in the valley of "Lost River" well below the surrounding rock surface. Furthermore, the amount of rock removed is too great to have been accomplished in post-glacial time. Water first found entrance underground at the present lower entrance (marked A on the contour map), and subsequently midway back (B on the contour map) to the present upper entrance (C on the contour map) which was the last entrance for the water to enter. (See also diagramatic cross-section). Evidence for this order is indicated by the fact that any other order would necessitate water, (not under hydrostatic pressure* flowing up-hill, an obvious impossibility. Furthermore, during the spring, water now flows at the surface as far as the lower entry to underground channels (A on the contour map). It must not be imagined that the underground channels are simple. In times of low water only one channel may be used for exit or entrance, but during high water many additional openings are used to connect the surface with the underground drainage. Mr. Adin Deming who has examined the caverns states: that there not only are multiple channels when considered in horizontal plane, but that two distinct levels could be observed in places which were separated by as much as four feet of rock. In other places there was only one observable level and a room eight feet high was noted, due in all probability to the collapse of the roof of the lower level as the floor was strewed with boulders. He also states that stalactites an inch in diameter were found in the upper level.

Possible causes for the multiple openings are lowering of the ground water table, which would accompany the history of the drainage, and also clogging of openings by glacial or estuarine material when removed from "Lost River" in the second period of excavation.

Glacial History

During the period of glaciation and of the occupance of the area by the waters of Gilbert Gulf deposition occurred in "Lost River" and surrounding area which filled the old channel and longitudinal valley to the southeast up to an elevation indicated by the 460 or 480 foot contour. When the bottom of the longitudinal valley was so raised then the waters of this valley could flow into the Oswegatchie River by way of "Lost River", initiating the present drainage pattern as indicated by the accompanying sketch map.

Post-Glacial History

The post-glacial history of "Lost River" consists of re-excavation of the old channels and essentially, a duplication of the detailed history whereby the surface stream went underground. This re-exhumation of former underground drainage following glaciation is not unusual in this area, and examples may be found near Balmat, Harrisville, and at the Dixon mine near Antwerp.

Points of Geolcgical Interest:

Other points of interest are indicated on the contour map as follows:

1. Abandoned underground entrance at B.
2. Potholes at P.
3. Superficial fault or rock slide at F.
4. Huge blocks probably representing the fall of part of a cave at A.

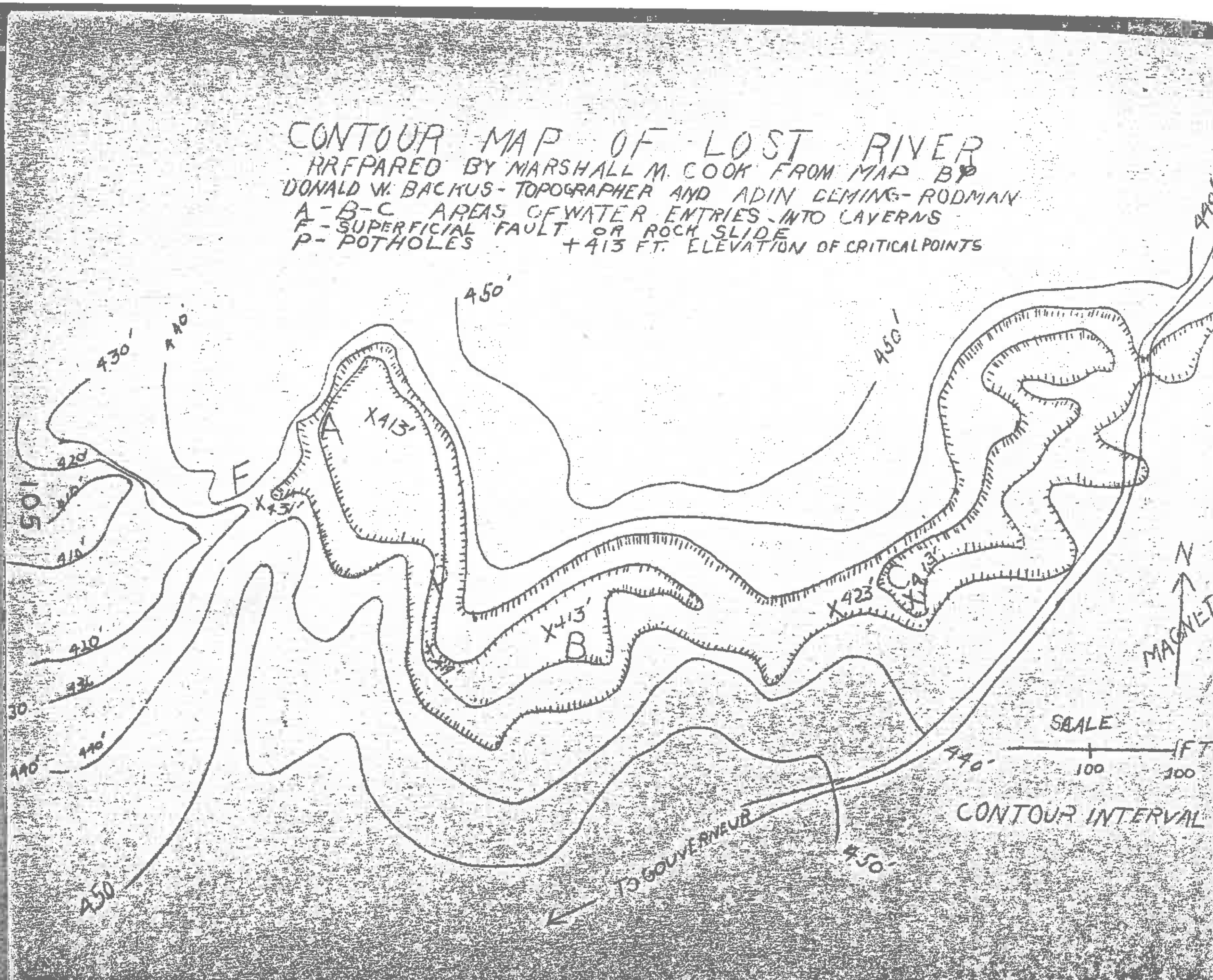
Above "Lost River", Boland Creek appears to be an old stream largely because it has not yet dissected the underlying sediments. It has inherited its characteristics which cause it to resemble an old stream from the past history of the area and derives these particular characteristics from Gilbert Gulf. Should such a stream be said to have inherited its "old age" and be classified as one of "inherited old age"?

En route to Canton:

About five miles from "Lost River" just before taking a sharp turn to the left, there is a feldspar mine, which has been operated within the last few years.

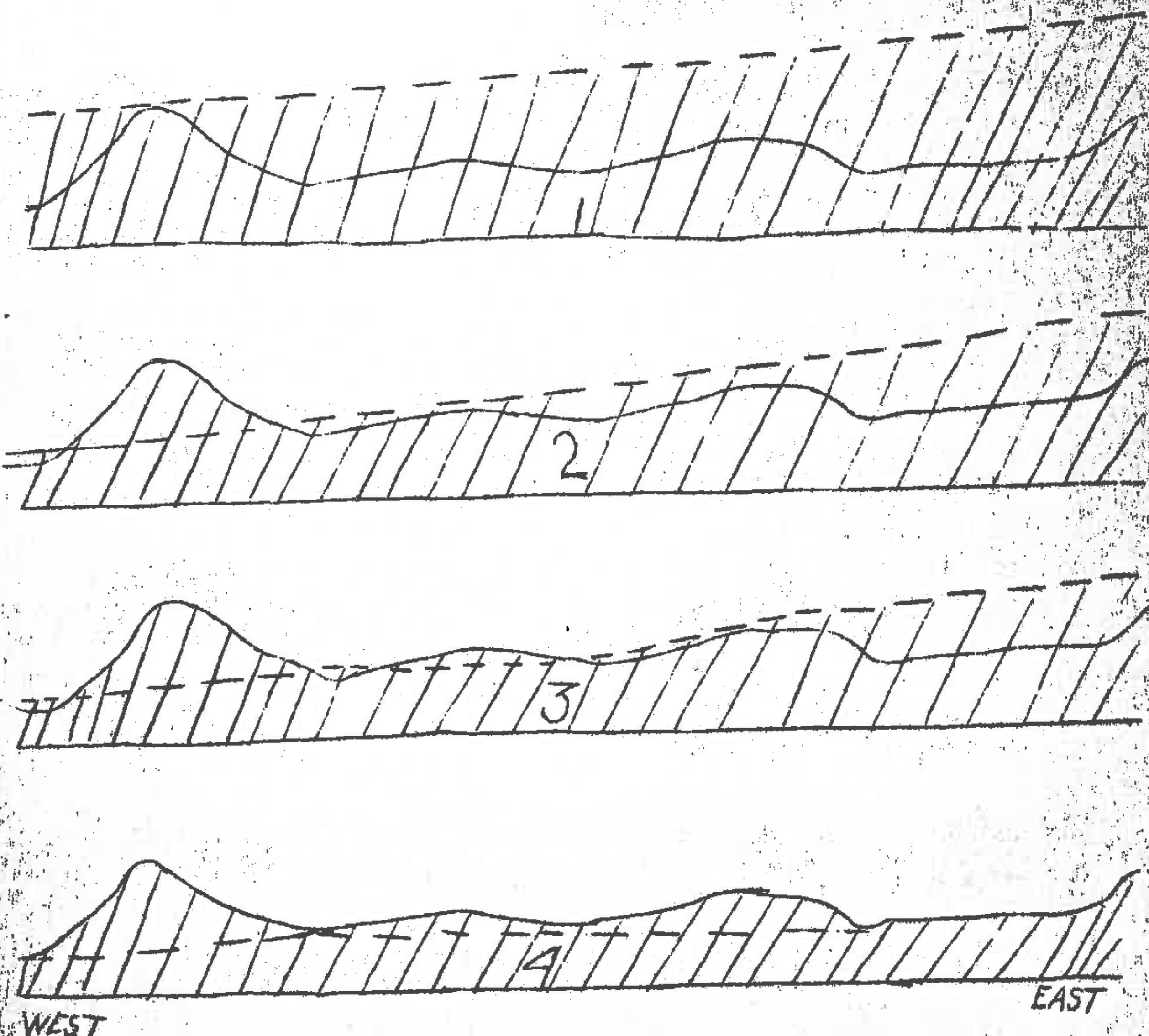
About two miles after returning to Highway No. 11, one crosses a broad flat valley. On the farther side is an indistinct terminal moraine, which, however, possesses fairly well defined characteristics away from the road.

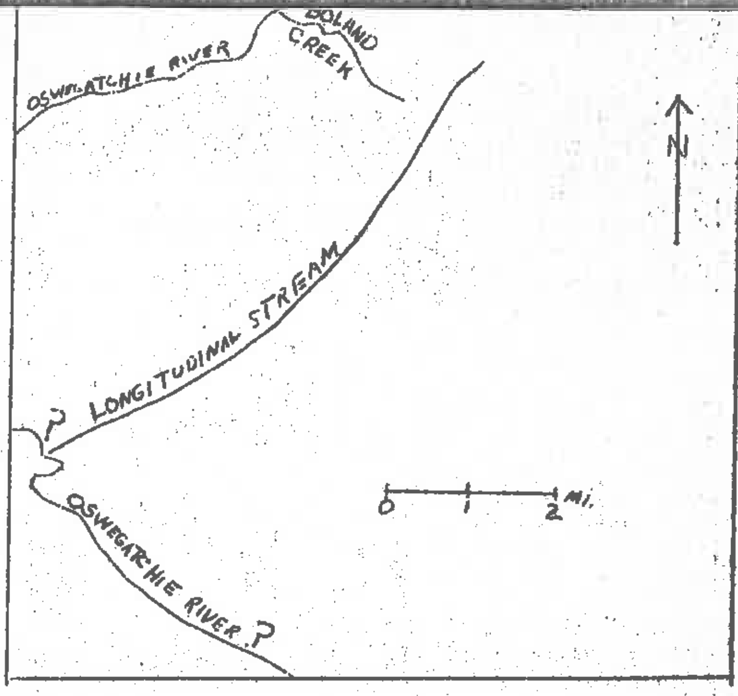
At the underpass, just before entering Canton, there is a mixture of granite and amphibolite readily observed on the right hand side of the road and which according to Buddington, is a contact mixed zome of another phacolith.


CONTOUR MAP OF LOST RIVER
RRFPARED BY MARSHALL M. COOK FROM MAP BY
DONALD W. BACKUS - TOPOGRAPHER AND ADIN DEMING - RODMAN
A-B-C AREAS OF WATER ENTRIES INTO CAVERNS
F - SUPERFICIAL FAULT OR ROCK SLIDE
P - POTHOLES
+413 FT. ELEVATION OF CRITICAL POINTS
450'
450'
440'
430'
440'
420
410'
410'
430
440'
440'
450'
450'
440'
A
X413'
F
X431'
B
X413'
X423'
C
X413'
TO GOUVERNEUR
N
MAGNET
SCALE
100
100
FT
CONTOUR INTERVAL

PROFILES OF LOST RIVER

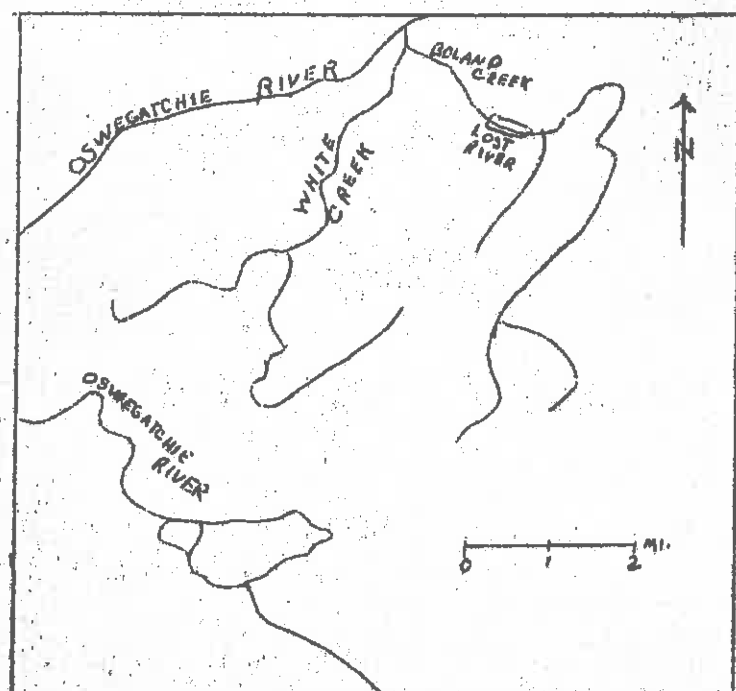
PREPARED BY MARSHALL M. COOK BASED ON
WORK OF DONALD BACKUS AND EDWILL HULL
SHOWING SUCCESSIVE STAGES (DASHED LINES)
IN THE DEVELOPMENT OF UNDERGROUND DRAINAGE
SOLID LINES — PRESENT PROFILE
HATCHED AREA — ROCK PRESENT IN BOTTOM OF
VALLEY AT EACH STAGE.
SCALE - VERTICAL ⊢⊣ 10 FT. HORIZONTAL ⊢⊣ 80 FT.





MAP I

DIAGRAMMATIC SKETCH MAP OF PAST (MAP I) AND PRESENT (MAP II) DRAINAGE OF BOLAND CREEK PREPARED BY MARSHALL COOK



MAP II

for its bearing on the fifteenth meeting of the
New York State Geological Association

Areal Geology

Cushing, H. P.? Geology of the Gouverneur quadrangle. New York State Museum Bulletin 259, 1925

Martin, James C., The Precambrian rocks of the Canton quadrangle. New York State Museum Bulletin 185, 1916

Chadwick, G. H., The Paleozoic rocks of the Canton quadrangle. New York State Museum Bulletin 217-18, 1919

Dale, N. C., Preliminary Report on the Russel quadrangle. New York State Museum Bulletin

Precambrian and Economic Geology

Buddington, A. F., Granite Phacoliths and their Contact Zones in the Northwest Adirondacks, New York State Museum Bulletin 281, 1929 (Especially figs. 34 and 35 and pp 59-60)

Brown, J. S., Structure and Primary Mineralization of the Zinc Mine at Balmat, New York. Economic Geography, Vol. XXXI No. 3 May 1936, pp 233-258 (For additional bibliography see p 235)

Brown, J. S., Supergene Sphalerite, Galena and Willemite at Balmat, New York. Economic Geology, Vol. XXXI No. 4 June-July 1936 pp 331-354 A description of unusual aspects of oxidation and secondary enrichment, the results of which, unfortunately, can not be observed on this trip.

Pleistocene Geology

Chadwick, G. H., Adirondack Eskers, Geol. Soc. Am. Bulletin Vol. 39 pp 923-930, 1928

Fairchild, H. L., Pleistocene Marine Submergence of the Hudson, Champlain, and St. Lawrence Valleys. New York State Museum Bulletin 209, 210, 1919. (Especially maps of Lake Iroquois and Gilbert Gulf, and accompanying delta deposits, in pocket and pp 59-60)

Fairchild, H. L., The Glacial Waters in the Black and Mohawk Valleys. New York State Museum Bulletin 160, 1912 (Especially maps in pocket, which however, are chiefly of supplementary rather than direct value.)

Taylor, F. B., Moraines of the St. Lawrence Valley. Journal of Geology, Vol. XXXII No. 8, 1924, pp 641-667

NEW YORK STATE GEOLOGICAL MEETING
S[illegible] 13, 1939

CANTON TO FOWLER

Park cars facing north on University Driveway between the Chapel and the Men's Residence.

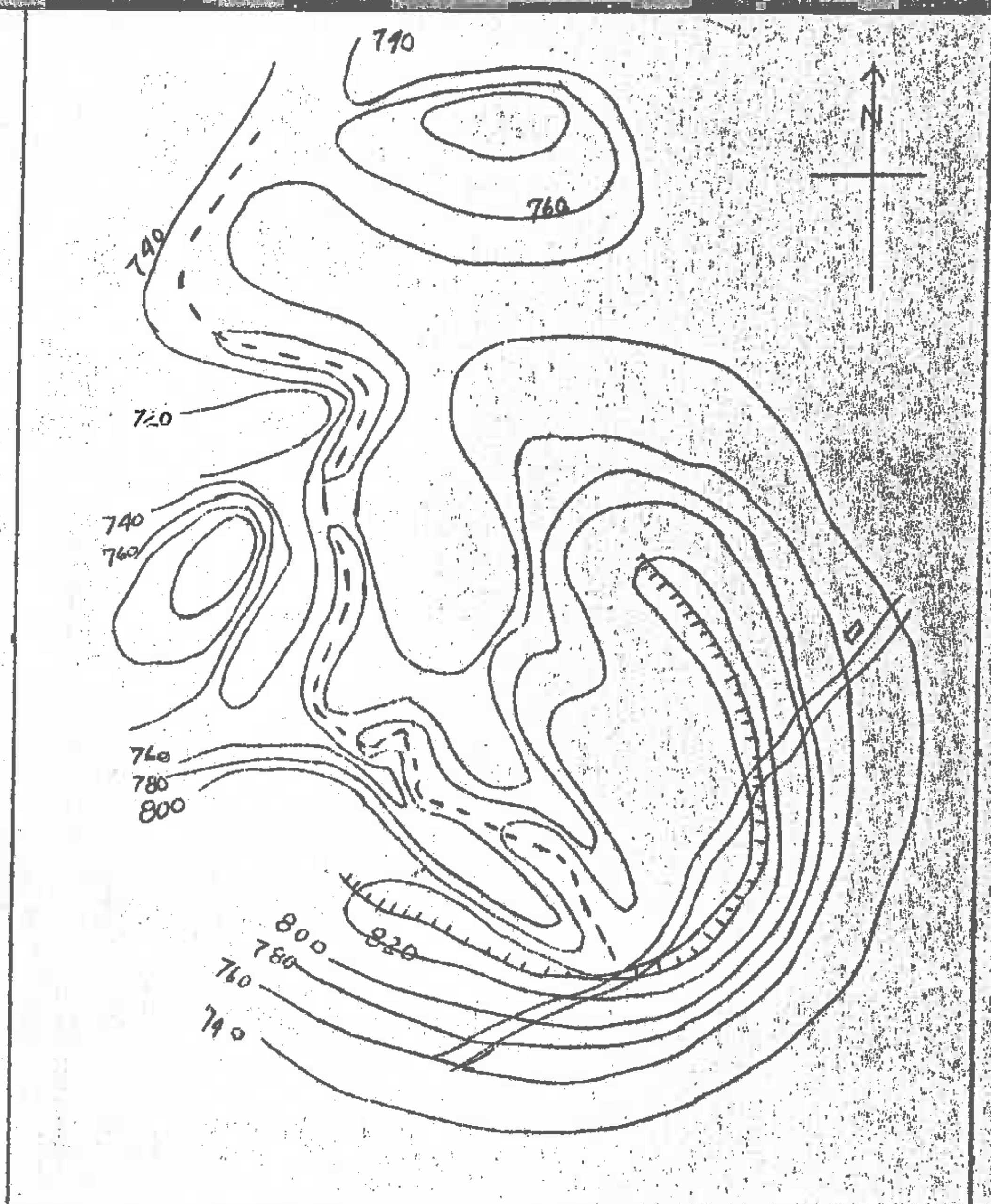
STOP 1. BEACH PLAINS ESKER

Beach Plains Esker has furnished sand and gravel for road building purposes and during the period of active excavation, well developed stratification could be observed. At present, one can observe the coarseness of the material which consists of coarse gravel at the north and sand at the southern end as would be expected from a southward flowing stream. It is interesting to note that the southern end is about 60 feet higher than the northern one, indicating that the water flowed uphill, which is possible only where there is hydrostatic pressure. This conclusion is interesting in view of the recent proposal of Thomas C. Brown (Journal of Geology, vol. XLI, pp. 150-151) that eskers are developed along longitudinal crevasses. Such a proposal does not appear to meet the condition required of Beach Plains Esker regardless of its merits for the area in which proposed.

An excellent opportunity will be given to observe the esker as we travel along or on top of it, for nearly three quarters of a mile. The youthful character of the present topography is well indicated by the slight amount of dissection which it has suffered in spite of its proximity to streams.

STOP 2. BEACH PLAINS

Some of the Natives state that beech trees once grew extensively on Beach Plains and that this fact was responsible for its name. If so, the spelling of the name has since been changed. But the plain also resembles a beach and Professor G. H. Chadwick (p. 51) considered Beach Plains to be a proglacial delta in Lake Iroquois. The evidence in favor of the plain being a delta includes the abrupt and steep slope at its southern margin and the fact that its elevation corresponds with that of shore lines of Lake Iroquois in this area. The evidence that the material was derived from a glacier is perhaps more convincing. The only area higher than Beach Plains in this vicinity is Benway Hill to the east but this hill could not have furnished the material because the material of the plain becomes finer, not coarser, in this direction. Furthermore, such an extensive deposit as Beach Plains covering a few hundred acres, necessitates an equal amount of erosion which must have occured in glacial or post-glacial time. Evidence for such erosion should be conspicuous on Benway Hill if it were the source of the material, but such evidence is lacking. Furthermore, the plain merges with a terminal moraine at the northeast, there is an esker to the north and the large boulders of the plain can most readily be explained on the basis of being carried there by ice-bergs broken off the front of the glacier.



WEST PIERREPONT ESKER

---- ESKER CONTOUR INTERVAL 20FT.

PROBABLE ICE LOBE FRONT SCALE 0 500 1000 FT

STORE AT WEST PIERREPONT

MAPPED BY MARSHALL M. COOK

RODMAN — HARWOOD BOGARDUS.

Beyond the church small sand dunes are visible and ripple marks may frequently be seen. Several methods of anchoring the dunes may be seen, including:

1. Natural pebble pavement-- the accumulation of pebbles on the top surface-- the sand containing the pebbles having been blown away.

2. Grass.

3. Moss.

4. Trees planted for the purpose of anchoring the sand. The reforestation projects in St Lawrence County are based on the need for anchoring sand and most of the reforestation projects are located in the deltas of former lakes or in former lake beds.

Beech plains are also interesting as being the collecting ground for Canton's water supply. After percolating through the sand, the water issues in springs at the base of the delta.

About two miles beyond Beech Plains Church, and to the right can be seen kames, marking the position of a terminal moraine which crosses the road at this point.

STOP ...WEST PIERREPONT ESKER AND OUTWASH PLAIN

Note esker on the north side of the road and glacio-fluviatile fan or outwash plain on the south side. Note that this fan can be traced on either side of the esker and suggests that the glacier occupied a small lobe, less than a quarter of a mile wide. In spite of the narrow width of the lobe, it would appear that hydrostatic pressure was developed under the glacier, yet it would seem to be that there would be great opportunity for leakage. However, in spite of this difficulty, the best explanation that can be offered is that while an esker was being formed under a narrow lobe of ice, on the margins and front of this lobe, the present horse-shoe shaped outwash plain or pro-glacial delta was being contemporaneously formed. See contour sketch map.

EN ROUTE TO LAKE STALBIRD

After turning right on Highway 87 and about a mile south of Hermon Roches Moutonnees can be seen on the right.

CAUTION -- About half a mile beyond the Roches Moutonnees, there are a number of very sharp turns in the road.

Notice the water falls, narrows, youthful character of Elm Creek and the fact that it is flowing over the rock surface.

LAKE STALBIRD

Lake Stalbird begins about a mile beyond the narrows. The road runs along the west side of the extinct Lake Stalbird for several miles and then crosses the lake and follows along the east side.

The following indicates the history of Lake Stalbird that seems most reasonable.

1. River running to the south.

Evidence:

a. Linear form.

b. Slight projections along what may well have been tributary valleys.

c. Flowing over rock surface at narrows with presumably greater depth to bed rock at the south. In the Oswegatchie River which is only a few miles from the south end of Lake Stålbird, the rock surface is at an elevation of only 350 feet.

There islittle doubt but what the valley occupied by extenct Lake Stalbird was formed by a river having a course different from the present drainage and while the slope of the rock surface in this immediate area suggests drainage to the south, difficulties are encontered as soon as one tries to trace the complete drainage pattern for no adequate outlet in any direction has been discovered so far

2. Glaciation - which formed a dam at the south end in the vicinity of Stop 4.

3. Presence of a lake caused by the glacial dam, the flat topography of the valley and its fine soil are the chief evidences. The filling may well have occured shortly after the retreat of the glacier, possibly in the Gilbert Gulf stage.

4. Present drainage - in which the lake is now dissected.

At Stalbird, a terminal moraine crosses the lake bed and is indicated by kames which rise above the valley.

Another terminal moraine may be noticed along the west side of the valley at the point where the road crosses to this side and extending south and east to Stop 4. The moraine lies to the left of the road and, at various points, kames may be seen which have been used for gravel.

STOP 4. LAKE DEPOSITS AND MORAINE

Note the level crest, ridge-like cross section, and laminated clays in the spur of land in which a road cut is made. Concretions may be found in the clays. It has been suggested that this spur represents a spit and also that it represents a hill left by stream erosion working on both sides. Evidence in favor of the latter conception is that all of the observed lamination is horizondal, none having been observed parallel to the sloping sides of the spur. Evidence in favor of a spit is based upon its topographic form and the form of the valleys on either side, especially the one to the east.

Note also how the top of the spur is parallel to the top of a terrace along the hill to the south back of which is a recessional moraine. An interesting example of land use is also indicated. The moraine with its boulders is used as pasture land, while the lake deposits in part, are cultivated. The fence between the two roughly follows the old shore line of a body of water higher than Lake Stalbird but lower than Lake Iroquois.

The elevation of this spur is approximately 660 feet at which elevation lake flats are found north of Lake Stalbird and also in the Edwards area suggesting that the body of water in which the deposits were formed was a bay of a rather extensive body of water, which may be referred to as "Edwards Bay".

STOP 5. EDWARDS

Physiographic and Glacial

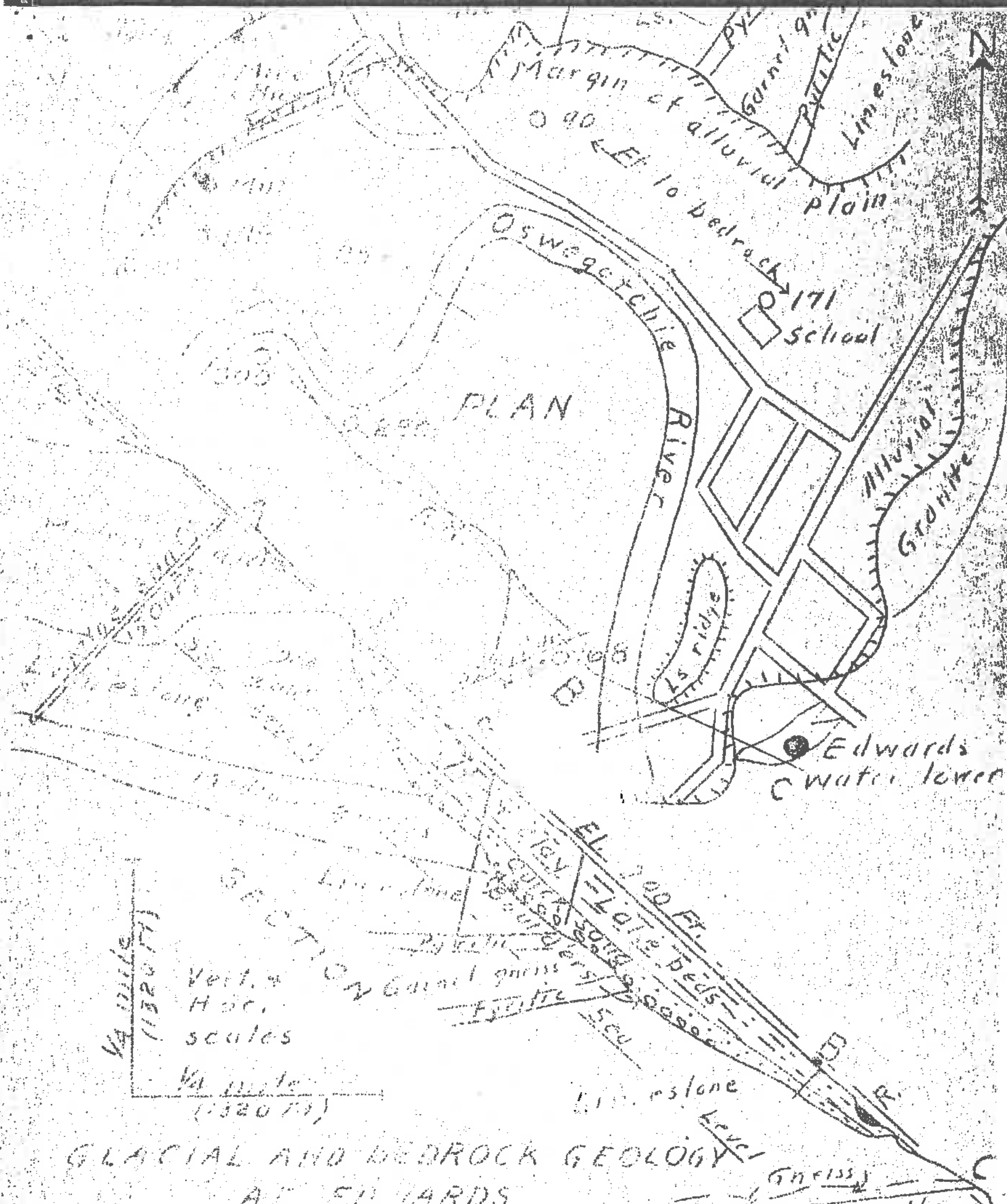
The amphitheatre-like plain (elevation about 660) almost a mile wide extending from Edwards villiage to the Edwards zinc mine is the central portion of a temporary lake basin similar to that of "Lake Stalbird" which was formed when the glacial waters retreated from the Iroquois level (800 ft.) to that of Gilbert Gulf (500ft.). Its formation probably was partly due to the kame and delta barrier already noted in the gravel pits four miles northeast, and partly to other glacial obstructions. The temporary lake was completely filled by stratified outwash forming the plain at Edwards which is known from several drill holes to be underlain by a thick deposit of silt and clay, lake beds, Beneath this at some places is a layer of sand or coarse gravel. The depth to bedrock is commonly 100 to 200 feet, in one instance 300 feet, so that the pre-glacial relief was much greater than at present. This strong dissection, moreover, was merely a restoration of pre-Cambrian topography, as indicated by abundant small remnants of Potsdam sandstone in the valleys near Edwards. The ancient valley was carved on a broad belt of Grenville limestone, and walled by ridges of gneiss and granite. A sketch of its relations is appended. "Edwards Bay", now traversed by the Oswegatchie river, was drained and dissection of its filling initiated by the cutting of a gorge near Talcville, two miles southwest.

Edwards Mine

The following description is abstracted from an article prepared for a symposium on the relations of structure to ore deposition being prepared under the auspices of the National Research Council.

"Two mines rank New York seventh or eighth among zinc producers of the United States, closely following Utah, Idaho, and possibly Tennessee. The Edwards mine has operated since 1915, Balmat since 1930, present operating depths being respectively 1900 and 900 feet.

"The significant rocks are metamorphosed Grenville sedimentary beds and later intrusions, all pre-Cambrian. The mineralization



GLACIAL AND BEDROCK GEOLOGY AT EDWARDS

definitely is pre-Cambrian. The chief igneous rocks from oldest down include stocks of syenite, stocks and sheared sills of gabbro amphibolite, and abudant granite of two types in sill-like and lit-par-lit injection and as oblate areas which have been interpreted as phacoliths. One of the granites, probably the younger, is the source of mineralization.

"Ore occurs only in the thick metamorphic magnesian limestone of the Grenville. Some limestone bands are siliceous and many others are variously silicated with mica, diopside, tremolite, talc and serpentine.

"The ore consists of brown, iron-rich sphalerite, with much pyrite, minor galena and some barite, replacing limestone, preferentially in phases of intermediate impurity.

"Structural interpretation is illustrated by Figs. 1, 2, 3, of the description in Economic Geology. Each mine is situated in a broad area of intensely folded limestone, with minor bands of gneiss. These folds are believed to represent opposite axes of a very large, overturned drag-fold, on the side of a major overturned anticline. The drag-fold has been distorted by pressure and flowage until the axial plunge averages about 90°, shifting in either direction, and corresponding closely to the regional dip, which is about 40° to the northwest. This relationship makes the interpretation of the folds difficult, and previously they were called synclinal. The writer believes an anticlinal interpretation is demanded by the large regional relationships. In any case the steep axial plunge is established, and the deposits are intimately related to it. In a sense they may be likened to saddle reefs set on end.

"Mineralization is closely related in detail to the apparent bedding of the limestone, most of which is really flow banding. During flowage the more brittle, silicated bands were shredded to produce breccia zones of all degrees of clarity or vagueness, the anhydrous silicates probably being developed early in this process. Such breccia zones appear in nearly all cases to govern the localization of ore shoots.

"The Edwards mine, comprises four principal ore shoots, nearly all exploited continuously from the surface to the 1700-foot level (vertical).

"The cross section of the ore shoots on any level averages 100 to 200 feet in length and up to 25 in width, averaging perhaps 10 feet. Mineralization, even in traces, is seldom continuous between the major shoots."

The zinc ore as mined at Edwards contains 10 to 12% Zn. (about 20% sphalerite or ZnS), about half as much pyrite, and mere traces of lead. Only the sphalerite is saved. All the ore is finely ground, treated in flotation mill which extracts the sphalerite, and rejects the ground rock including pyrite, etc., which is discarded and forms the conspicuous deposits of gray sandy waste near the mine. Zinc concentrates are shipped to smelters near Pittsburgh, Pa, to produce either metallic zinc, for galvanizing, etc., or zinc oxide for the rubber and paint trades.

The nearby Balmat mine contains more lead (galena) and pyrite than the Edwards mine and both are recovered, the pyrite being sold to make sulphuric acid, also near Pittsburgh.

Unusual Features

Development of the Edwards mine has brought to light a number of noteworthy geological features. Natural gas (chiefly methane - CH_4) has been encountered frequently, in small quantities, on the 1500- to 1900-foot levels. It seems to exist in the pore spaces of silicated limestone masses and is believed to be an original organic constituent.

Gypsum with some anhydrite was encountered in a substantial body interbedded in the Grenville limestone in diamond drill holes a mile from the mine, apparently an original sedimentary constituent.

Veinlets of gypsum and even halite (NaCL) are found occasionally cutting the zinc ore, and may have been derived from bedded deposits at greater depth.

Most unique is the recent discovery, on the 1900-foot level of a body of granite pegmatite intrusive in the limestone, which is bordered on one side by a band of mixed zinc ore and beautiful pink or lavender anhydrite, with some halite. The sphalerite and anhydrite are slightly later than the pegmatite, but obviously related to its cooling stages. This is significant because it dates the ore as pre-Cambrian, for all the granite is pre-Cambrian; and interesting because anhydrite is an unusual mineral in igneous associations and rather uncommon in ore deposits. It may conceivably have been derived from the bedded deposits, however. A display of pegmatite and anhydrite specimens will be exhibited at the mine office.

The Balmat zinc mine, some 12 miles southwest of Edwards also has some unique mineralogic features in the presence of oxidized ore masses containing magnetite, hematite, secondary sphalerite, and willemite which are described in Economic Geology and attributed to supergene oxidation - a conclusion not easily accepted by many geologists, particularly those who have not seen the evidence on the ground. This unusual occurrence of oxidized zinc ore is not duplicated at Edwards, but some specimens from Balmat will displayed. The unusual minerals at Balmat (willemite, etc.) are not economically very important; the ore as mined is substantially similar to that at Edwards, except for a larger pyrite content and appreciable lead.

EN ROUTE TO FOWLER

En route to Fowler in the vicinity of the West Branch of the Oswegatchie River, wind blow sand may be observed along the road. This sand was derived from the delta formed by the foregoing stream in Lake Iroquois and blown to lower levels. To the south sand in the form of the original delta or dunes covers an extensive area.

En route to Fowler, talc prospects are visible from the road.

STOP 6 TALC MINES

New York easily leads the United States in the production of commercial talc, all of it coming from a small area lying between the Edwards and Balmat zinc mines. The principal talc mining centers are at Talcville, 2 miles southwest of Edwards, and near the villages of Fowler and Balmat. The Grenville limestone in this locality contains a narrow but virtually continuous band, probably originally a sandy dolomitic limestone, which was first altered into white tremolite schist during the regional metamorphism of the Grenville. Much of this tremolite schist was then further altered to the approximate composition of talc, supposedly mainly by the action of solutions emanating from granite intrusions. Most of this talc retains the fibrous bladed character of tremolite, and is known as "fibrous talc". This has properties of special value in paint, ceramics paper and rubber manufacture, which are the chief uses. The fibrous character and the presence of some unaltered tremoolite, on the other hand, preclude its use in cosmetics.

The deposits contain minor amounts of true flaky talc, locally known as "foliated talc" or "scale".

Tremolite is an essentially anhydrous silicate of magnesium with some calcium; talc a hydrous silicate of magnesium. Formation of talc therefore involves elimination of calcium from a magnesian limestone or substitution of magnesia in a calcareous rock. Opinion is divided as to whether the magnesia was original or introduced; likewise as to whether silica was present as sand or otherwise, or came from granite solutions. J. S. Brown believes that in this district the silica and magnesia are mainly original, and calcium was eliminated. A prior step in the formation of tremolite is believed to have been formation of a banded diopside - quartz rock, which by intense shearing was converted into tremolite. Granite solutions then undoubtedly completed the final elimination of calcium, and hydration to talc.

Material to be collected on the dump will consist principally of white "fibrous talc" or tremolite schist; occasional flaky or "scale talc" usually greenish-white; and rarely a piece of the beautiful pink tremolite to which the misnomer "hexagonite" has been applied.

The mine to be visited is the No. 1, or Arnold Mine, of the W. H. Loomis Talc Co.. The talc comes from a band 10 to 30 feet thick which dips about 50 degrees northwest parallel to the bedding of the enclosing Grenville limestone. The mine is some 900 feet vertical with lateral workings several hundred feet in length. The talc is taken by truck to a grinding plant 3 miles away on the road to Gouverneur, easily visible from the highway.

A kame from which gravel has been extracted is on the opposite side of the road from the mine. This kame is apparently a part of a recessional moraine which extends across the southeastern corner of the Gouverneur Quadrangle from the southern margin of Sylivia Lake along or south of the Edwards-Gouverneur highway to a point about a mile south of Edwards. In this gravel pit, one can also observe glaciated rock surfaces.

STOP 7. POTSDAM SANDSTONE

If time permits, following the visit to the Talc mine, a stop will be made near by to examine some interesting exposures of Potsdam sandstone and basal conglomerate, for which a sketch is included herewith.

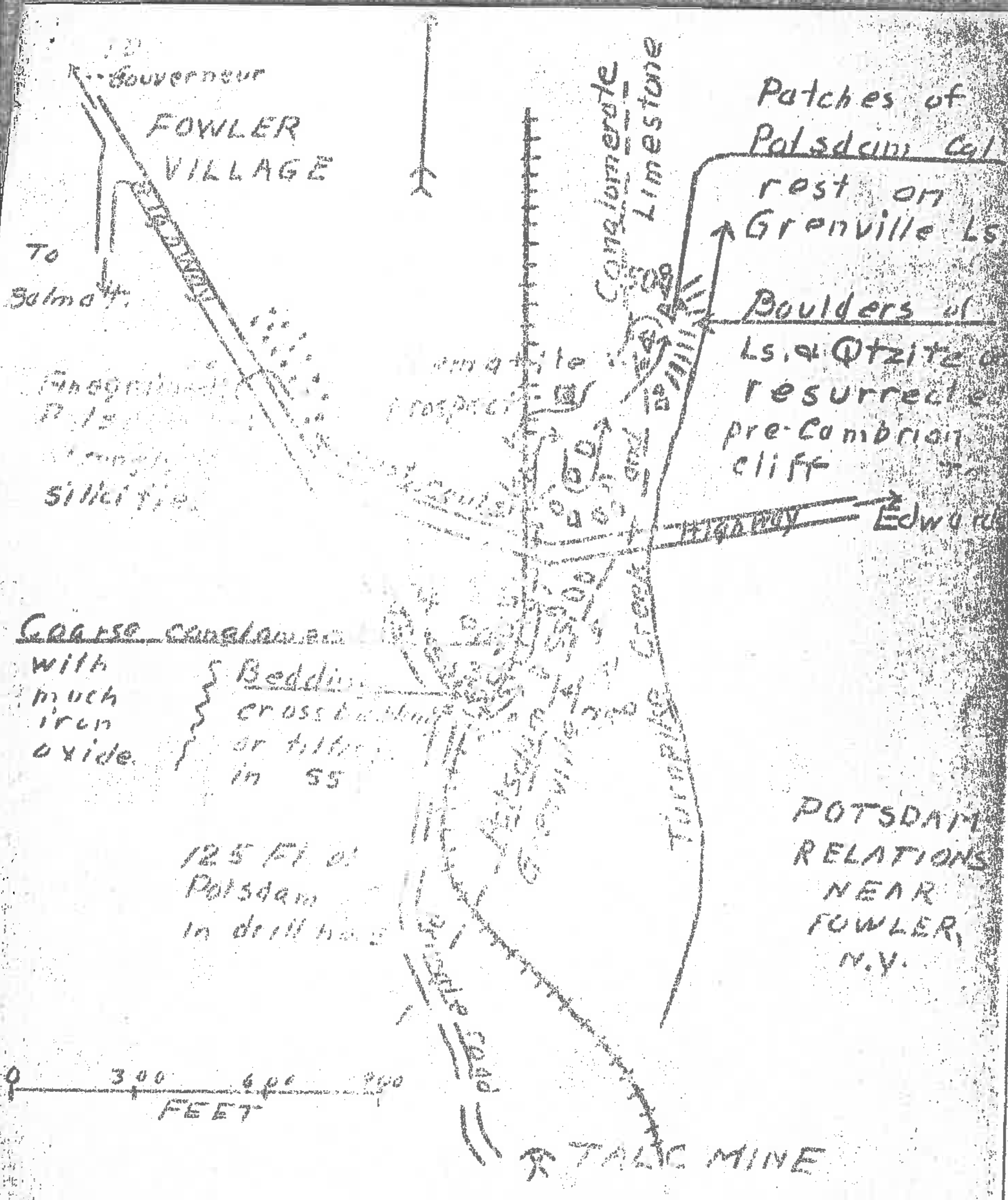
The small remnants of Potsdam are all that is left of the Paleozoic fromations which once covered the whole region. They are undoubtedly only the more resistant portions of the Potsdam, highly cemented by silica and iron oxide, the iron in many places being so abundant that it hed to much prospecting for iron ore. An unsettled problem is that of the pre-Potsdam or post-Potsdam age of the hematite. Was it incorporated in the sediments as deposited, or was it introduced at a later date with the secondary silica?

The Potsdam remnants are found almost wholly on Grenville limestone, where the pre-Cambrian floor was lower than on the adjacent granite and gneiss. Surprising thicknesses of Potsdam are encountered, several drill holes near Fowler showing 100 to 200 feet.

The beddeng of the finer phases of Potsdam presents a problem in origin. Strong dips of 30° to 45° are common, and vary greatly in strick in short distances. They have been attributed to eolian beddine, initial dip, slumpage from solution of underlying limestone, and deformation, without any final agreement.

Any who preefer may omit this stop and proceed homeward.

For this report, J. S. Brown prepared the description of the Precambrian geology and R. W. Brown the description of the general and Pleistocene geology.


Gouverneur
FOWLER
VILLAGE
To
Conglomerate
Limestone
Patches of
rest on
Grenville Ls
Boulders
pre-Cambrian
cliff
Highway
Creek
Turnpike
with
much
iron
oxide.
125 Ft. of
Potsdam
POTSDAM
RELATIONS
NEAR
FOWLER,
N.Y.
0
300
FEET
TALC MINE