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DEPARTMENT OF MINES

GEOLOGY OF HENWOOD TOWNSHIP

DISTRICT OF TIMISKAMING

by

ROBERT THOMSON

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Abstract

The report describes the geological features of Henwood township. In the township only the Huronian Cobalt Group sediments and the Keweenawan intrusives,the Nipissing diabase sill and the Keweenawan diabase dikes,are exposed. The upper part of the Cobalt Group stratigraphic succession in the township, in particular the Lorrain and Firstbrook formations, were shown by a drillhole to have a vertical thickness greater than 2,980 feet. In Henwood township the Nipissing sill is a basin-shaped sheet which has a known thickness of 770 feet, in lot 4, concession III.

The natural resources of the township include large deposits of sand, gravel and ballast in addition to agricultural land.

GEOLOGY OF HENWOOD TOWNSHIP

District of Timiskaming

by

Robert Thomson[1]

INTRODUCTION

Henwood township lies about fifteen miles northwest of the town of New Liskeard, which is situated at the north end of Lake Timiskaming. The centre of the township is 20 miles N.40°W from the town of Cobalt.

This report was written because important information on the stratigraphy of part of the Cobalt Group sediments (of Huronian age) was afforded by a long (4,050 feet) diamond drillhole (the Stone-Eplett No.3) which was put down in lot 4, concession IV in 1954, 1955, and 1958. The hole penetrated much of the Lorrain and Firstbrook formations as well as the complete thickness of the Nipissing diabase sill. It seemed desirable to round out this information by a brief geological survey of the township.

No metallic mineral occurrence of economic significance is known in the township. The writer includes in the report notes on copper and also uranium-bearing veins, closely adjacent to Henwood, in Hudson township. During the period 1954 to 1958, while the Stone-Eplett No.3 diamond drill hole was being drilled, the writer

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[1] Resident Geologist, Ontario Dept. Mines, Cobalt.

logged the core.

Reconnaissance geological mapping was done in 1960, and for about a week in 1962. The geological information was compiled on a base map (scale one inch equals one quarter mile) made up of parts of Forest Resources Inventory Dept. Lands and Forests sheets 475794, 476794, 475801 and 476801.

In 1962 an uncoloured preliminary geological map of Henwood township (Ontario Department of Mines No.P.160, scale, one inch to one quarter mile) by the writer was issued; in that year a summary of the geology was given in the "Summary of Field Work, 1962,"by the Geological Branch, Ontario Department of Mines. A coloured geological map (2126) accompanies this report.

ACKNOWLEDGMENTS

The writer is indebted to A.T. Stone (deceased) and S.D. Eplett of New Liskeard for permission to examine the core of the deep drillhole (the Stone-Eplett No.3).

C.A. Giovanella, senior geological assistant, and Vincent Kennedy, junior assistant, spent about one week during the field season of 1962 in geological work in the township; their assistance is gratefully acknowledged. Drafting of Ontario Department of Mines preliminary map P.160 was done by V. Kennedy.

Means of Access

Highway No.65, between New Liskeard and Elk Lake traverses the township along the line between concession IV and V. From the Highway, gravel roads, made to serve the farms, extend so that access can be obtained to nearly any part of the township.

The branch of the Ontario Northland Railway, between Earlton and Elk Lake passes through the northern part of the township.

Previous Geological Work

Parks (1904) examined in reconnaissance fashion a few parts of Henwood township.

The township was mapped and described by Burrows and Hopkins (1922) as part of the Blanche River Area which comprises twenty five townships; a few outcrops not visited by the present writer are copied directly from O.D.M. Map No.31b.

Topography and Drainage

Nearly level clay-covered plains are the most apparent topographic features. The elevation of the plain in the northeastern part of the township is somewhat lower than that of the one over much of the rest of the township. Thus at McCool station in lot 1, concession VI the elevation is approximately 839 feet; at Kenabeek station in lot 11, concession V the elevation is about 926 feet. Transition from the lower to the upper plain in concessions III and IV takes place fairly abruptly along a highly irregular line a little southwest of the southeasterly course of Wabi creek; in concessions V and VI the transition is much more gradual.

In lot 12, concession III, prominent rock hills rise above the upper plain to an elevation of at least 1,100 feet (possibly up to 1,150 feet). This is the highest elevation in the township.

At the transitinn from the lower to the upper plain along Highway No.65, in lot 5 between concessions IV and V, there is an easterly-facing hill of sand, gravel and cobbles.

In the northwestern part of the township are occasional minor hills and ridges of sand, gravel, and cobbles; one such ridge extends northeasterly through lots 10, 9 and 8 in concession V.

In the northern and northeastern parts of the township outcrops appear to be absent. Over the rest of the township outcrops occur rather commonly.

Except for the prominent rock hills mentioned above (in lots 11 and 12, concession III) most of the outcrops rise only a few feet above the clay plain.

The drainage of all but a small part in the northwest part of the township is by Wabi Creek into Lake Timiskaming at New Liskeard; Evanturel Creek drains this northwesterly part into Blanche River. The clay plain is traversed by ravines and creeks which have cut down to a considerable depth below the plain; Moffatt Creek where it crosses the north line of lot 2, concession I, is 65 feet below the plain along its sides.

Certain rectilinear topographic features (lineaments), particularly depressions occupied by creeks, are present in the township. Among these may be listed the courses of the following creeks at the locations given (a) Wabi Creek, southeasterly course through concessions IV to II, lots 4 to 1. (b) Wabi Creek, northeasterly course through concessions I to IV, lots 9 to 5. (c) Lepha Creek, east of northerly course through concessions I to III, lots 12 to 10. (d) Leacock Creek, northerly course through lots 4, in concessions I, II and III, (e) Evanturel Creek, north of easterly course in concessions V and VI, lots 12 to 8.

Natural Resources

Natural resources in the township include the extensive areas of land suitable for agriculture and extensive sand and gravel deposits. Henwood is one of a large number of townships covered by a soil survey report issued by Hoffman, Wicklund and Richards (1955) to assist agriculture. Lumbering was an important industry in the past. Workable metallic mineral deposits have not been discovered to the present.

GENERAL GEOLOGY

Rocks exposed at surface or intersected by drilling in Henwood township represent two major geological time units — a Precambrian era and the Cenozoic era. Of the Precambrian only Proterozic rocks, Huronian sediments of the Cobalt Group and Keweenawan diabase intrusions into them, are known (Table 1).

Cobalt Group

The rocks of the Cobalt Group have a thickness greater than 2,980 feet as shown by the Stone-Eplett No.3 drillhole (see Fig. 1) in lot 4, concession III. The hole is included in a vertical geological section across the township shown at the bottom of Map 2126. The base of the Cobalt Group lies at a depth greater than 3,750 feet below the hole collar.

The nomenclature used in this report for the formations of the Cobalt Group is that proposed by the writer (1957); the three-fold division of the group is shown in Table 2.

A division of the Cobalt Group in the vicinity of Cobalt into three subdivisions or formations was made by Barlow (1899, p.45 and pp.90 to 104); in the following quotation from Barlow the present writer inserts the modern nomenclature. "Throughout the area, the Huronian (Cobalt Group), where fully represented, is separable into three distinct subdivisions which are, in ascending order, as follows: - (1) Breccia or breccia-conglomerate (Coleman Formation), (2) Greywacke, shale or slate (Firstbrook

Table 1 | TABLE OF FORMATIONS

Cenozoic

Recent	Peat, alluvium.
Pleistocene:	Silt, sand, cobbles;
	Glacial lake deposits (Lake Barlow-Ojibway) varved clay
	Silt, sand, cobbles;
	Boulder clay.
	Unconformity

Precambrian

Proterozoic

Keweenawan Diabase (dikes)

Intrusive contact

Quartz diabase (Nipissing diabase sill)

Intrusive contact

Huronian - Cobalt Group

Lorrain Formation: arkose

Firstbrook Formation: argillite

Coleman Formation (not exposed in township or intersected in drill holes)

Note - The Firstbrook and Coleman constitute what was termed the Gowganda Formation in older publications

Table 2	Cobalt Group: Subdivision into Formations
Thomson 1957	Collins 1917
LORRIAN FORMATION Arkose, quartzite.	LORRAIN FORMATION
FIRSTBROOK FORMATION Argillite.	GOWGANDA FORMATION
COLEMAN FORMATION Conglomerate, bedded greywacke, quartzite	

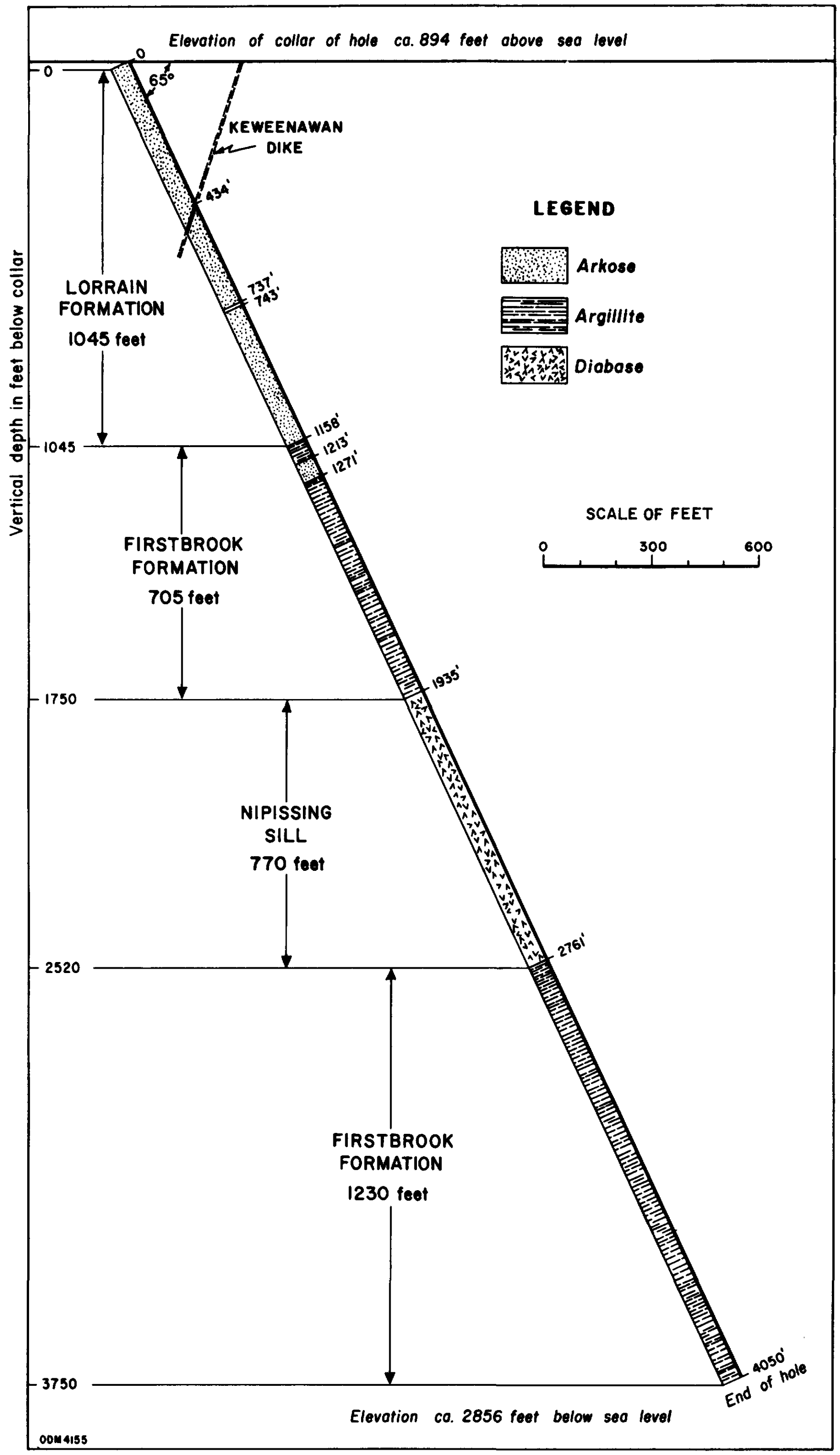


Figure I.—Vertical Geological Section, Stone-Eplett No.3 Drill Hole.

Formation), (3) Feldspathic sandstone or quartzite (Lorrain Formation)". The mapping of three subdivisions of the Cobalt Group in the vicinity of Cobalt was continued by Miller (1910), Todd (1925) and the present writer (O.D.M. map 2050, published in 1964). Because the nomenclature used by Barlow, Miller and Todd for the two lowermost formations seemed inadequate the present writer suggested the nomenclature shown in Table 2.

Collins (1917) in writing of the Onaping Map-Area, whose eastern limit is about 20 miles west of Henwood township, used the term "Gowganda Formation" for the Cobalt Group sediments below the Lorrain Formation. The characteristics he (Collins, 1917, p.65) ascribed to the Gowganda Formation "conglomerate greywacke, laminated greywacke, and limestone ...too intricately and variably associated to be resolved by the field methods which served to differentiate the other formations in the Cobalt series." are not applicable to all of the pre-Lorrain part of the Cobalt Group sediments in the vicinity of Cobalt or in Henwood township.

Sediments of the Firstbrook and Lorrain formations are exposed at surface and were intersected in great thickness (Firstbrook - 1,935 feet; Lorrain 1,045 feet) by the Stone-Eplett No.3 drillhole. This hole was stopped before reaching the Coleman Formation whose nature and thickness are unknown in the township as is also the nature of underlying pre-Huronian rocks.

Firstbrook Formation

The Firstbrook Formation outcrops only in the southeast corner of the township. The strike in that part is northerly and the dip from 10 to 15°W. The most important evidence on the thickness and nature of the formation is furnished by the Stone-Eplett No.3 drillhole. That part of the hole which the writer includes in the Firstbrook Formation is from 1,158 to 1,935 feet and also from 2,761 to 4,050 feet (see Fig. 1) a vertical thickness of 1,935 feet. Between 1,935 and 2,761 feet is the Nipissing diabase sill, which merely separates the two parts of the formation.

The total thickness of the Firstbrook Formation in the vicinity of the drillhole is unknown: no indication of the depth of the bottom contact below the end of the hole was afforded by the nature of the Firstbrook sediments intersected by the hole near its end.

The thickness of 1,935 feet is the greatest known for the Firstbrook Formation.

The Firstbrook Formation shows variation over its considerable thickness but in the writer's opinion all the varieties may be included under the name argillite. Considered as individual beds, or somewhat larger units, parts of the formation might be named greywacke, arkose, siltstone or argillite.

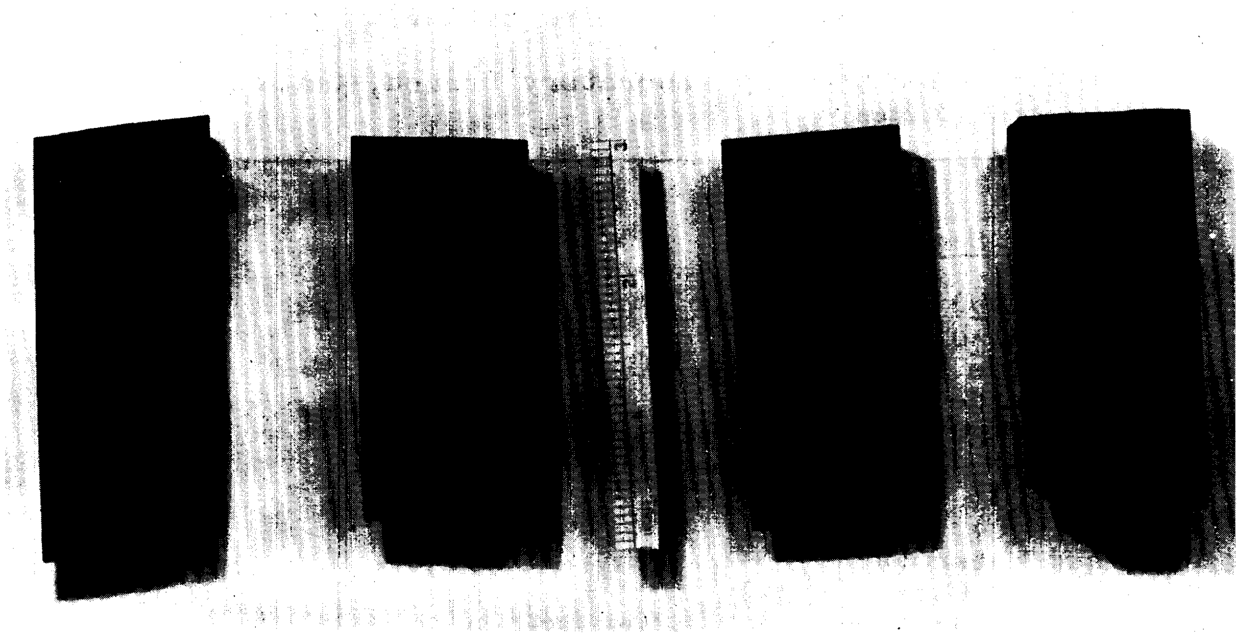
A salient characteristic of the Firstbrook Formation is its conspicuously bedded nature (Photo 1) which contrasts with that of the overlying Lorrain formation. For the most part the bedding ranges in thickness from 0.1 mm. to 5 mm.

A second characteristic of the Firstbrook Formation is its fine grain size. The writer in examining some 2,066 feet of drill core of the Firstbrook saw one place only where the grain size was larger than that of sand (2 mm.); at the one place two granules (between 2 and 4 mm.) were seen. The grain sizes of the Firstbrook sediments are sand, silt, and clay (sand- 2 to 0.062 mm.; silt-0.062 to 0.005 mm., clay-less than 0.006 mm.); considering the 2,066 feet of core length as a whole the silt and clay sizes predominate.

The beds of the Firstbrook Formation characteristically alternate in colour; pairs of beds form couplets. Red-brown or grey-brown beds alternate with grey, grey-green, or greenish ones; the former are, for the most part thicker and of coarser grain size than the latter. The Firstbrook Formation in the vicinity of its contacts with the Nipissing diabase sill is grey-green; presumably the loss of the red-brown or grey-brown colour is due to the sill. A small part of the formation below the sill is grey in various shades without noticeable reddish tinges; in this part the grey colour appears to be the original colour.

Chemical analyses of the argillite of the Firstbrook Formation are given in Table 3. The samples were selected to be representative of the formation.

Photo 1



Firstbrook formation - bedding shown in sawn drill core from Stone-Eplett No.3 drillhole. Specimens from left to right at footages 3517, 2992, 1489, and 4043.

Table 3

Chemical Analyses of Argillite of Firstbrook Formation

(1) Stone-Eplett No.3 Drillhole at footage 3,223 (2,950 feet vertically below collar).

(2) Same hole at footage 1,645 (1,485 feet vertically below collar).

Analyses by Laboratory Branch, Ontario Dept. of Mines.

Sample No.		(1) percent	(2) percent
Silica (SiO_2)	-	52.77	58.85
Alumina (Al_2O_3)	-	21.7	18.3
Ferric Oxide (Fe_2O_3)	-	1.69	3.25
Ferrous Oxide (FeO)	-	9.14	4.56
Magnesia (MgO)	-	3.28	3.05
Lime (CaO)	-	1.30	0.87
Soda (Na_2O)	-	1.41	2.74
Potash (K_2O)	-	2.63	3.05
Combined Water (H_2O+)	-	4.59	3.26
Superficial Water (H_2O-)	-	0.24	0.06
Carbon Dioxide (CO_2)	-	0.50	0.20
Titania (TiO_2)	-	0.84	0.69
Phosphorus Pentoxide (P_2O_5)	-	0.29	0.25
Sulphur (S)	-	0.15	0.26
Manganese Oxide (MnO)	-	0.28	0.03
	Total	100.8	99.4

Lorrain-Firstbrook Contact

The writer places the Lorrain - Firstbrook contact at footage 1,158. The Lorrain Formation above this is almost entirely arkose: the Firstbrook Formation below is almost entirely argillite. In only one place in the Lorrain (between footages 737 and 743) was argillite, indistinquishable from that in the Firstbrook, intersected: in only one place in the Firstbrook (from footages 1,213 to 1,271) was a noticeable thickness of arkose, indistinquishable from that in the Lorrain, intersected. The position of the Lorrain-Firstbrook contact over an interval of about 10 feet (between footages 1,148 and 1,158) was set arbitrarily; the rock in this interval is red and argillitic.

The arkose of the Lorrain Formation immediately above the Lorrain-Firstbrook contact (footage 1,158 and the arkose in the minor arkose member (footage 1,213 to 1,271); of the Firstbrook are much finer grained than most of the arkose of the Lorrain formation.

Mode of Origin

The Firstbrook Formation might be reworked Coleman Formation or derived from Keewatin and Timiskaming rocks; presumably the Lorrain granite which contributed so largely to the Lorrain Formation contributed very little to the Firstbrook.

That the Firstbrook Formation was deposited in a body of water of considerable size is inferred from its wide distribution.

The nature of the bedding in the Firstbrook suggests seasonal deposition and indeed deposition under glacial conditions.

Parts of the underlying Coleman Formation (in Collin's (1917) nomenclature the lower part of the Gowganda Formation) are commonly regarded as being of glacial origin.

If the argillite of the Firstbrook Formation is a post-glacial sediment of the Huronian glaciation in a manner analogous to the Lake Barlow-Ojibway varved clays,being a post-glacial phase of the Pleistocene glaciation,the thickness of the argillite is indeed remarkable. Antevs (1925,p.4) has commented on the much greater thicknesses of older varved slates believed to be glacial in origin and ranging in age back to the Proterozoic compared to late-Pleistocene clays.

Lorrain Formation

The Lorrain Formation makes up most of the outcrops of Cobalt Group sediments in Henwood township but the most important information on its thickness and nature was afforded by the Stone-Eplett No.3 drillhole (see Fig. 1). That part of the Lorrain which has escaped erosion has a vertical thickness of 1,045 feet. The 1,045 feet vertical thickness is of arkose except that red argillite occurs between footages 737 and743 and also in a 10-foot band at the bottom contact. The arkose shows a considerable variation in colour and grain size but the only distinctive horizons were the red argillite bands.

Feldspar and quartz are estimated to make up between 90 and 95 percent of the arkose with the feldspar more abundant than the quartz. Magnetite and mica can also be identified in hand specimen. The colour of the arkose ranges from reddish brown to pale green grey. The grain size is for the most part from $\frac{1}{2}$ mm. to $1\frac{1}{4}$ mm.; in a few places grains to 5 mm. are present. The coarsest particles are between footages 720 and 737; pebbles 1 cm. or larger made up an estimated 5 percent of the rock; one pebble 6 cm. in size is present.

Bedding is in general poorly developed but is in places distinct. Some surface exposures show cross bedding. Hematite spots in the arkose were noted in a few surface exposures.

The parental rock of the Lorrain Formation could have been presumably only coarse-grained granite. Presumably during the deposition of the Firstbrook the covering rocks of the coarse-grained granite were being removed. Possibly the conditions most conductive for deposition of arkose, as given by Pettijohn (1949) ".....strong faulting-upfaulting of the source area and downfaulting of the area of accumulation," prevailed during Lorrain time but proof of this must await further investigation.

Keweenawan

The diabasic intrusions, younger than the Huronian rocks, are classified as Keweenawan. The intrusions are further classified on the basis of the shape of the bodies, and also on the time of intrusion as (1) Nipissing diabase which forms sheet or sill-like bodies with generally low dips, and (2) Keweenawan diabase dikes which where they cut Nipissing diabase have chilled contacts against it.

Nipissing Diabase

Distribution and Thickness

The total outcrop area of Nipissing diabase in Henwood township is about one fifth of a square mile but the township, except for the northwest part, is underlain by the diabase sill at varying depths below surface. The only extensive area of outcrop is in lots 11 and 12, concession III; small outcrops occur in lot 1, concession I; lot 11, concession V; lot 9 concession V; and lot 8 concession VI. Important information on the position and nature of the sill in lot 4, concession III was disclosed by the Stone-Eplett No.3 drillhole (see Fig. 1) which traversed the sill and showed it to have a vertical thickness of 770 feet. The position of the top contact of the sill in Henwood township is shown on Map 2126.

Shape and Attitude of Sill

The top contact of the Nipissing diabase sill at bedrock surface in Henwood and contiguous townships(see O.D.M. Map 2046) is an incomplete and somewhat irregular ellipse, whose long axis has a direction about N30°E. At the Cane mine (in the southeast part of Cane township) the top contact dips about 30°E as shown O.D.M. Map 31b. At the Triangle mine (in the northeast part of Auld township) the southerly extension of this contact is reported by Ogden (1961) to dip about 54°E. Along the extension of this contact through Lundy, Henwood (the southeast corner), Kerns, Beauchamp and the northwest part of Henwood township no dips, have been determined. The two dips and the intersection of the diabase in the Stone-Eplett No.3 drillhole show that the top contact of the Nipissing intrusion in and near Henwood township has a basin-like shape (see vertical geological section on Map 2126) which presumably defines the shape of the intrusion. For convenience in description the writer uses the term "Henwood diabase basin" in reference to this basin-shaped Nipissing intrusion.

Although the intrusion as a whole has a somewhat regular attitude there are locally very considerable irregularities; thus in lots 11 and 12, concession III are marked divergencies in strike, in lot 11, concession V the dip appears to be steep (Burrows and Hopkins 1922, p.9) reported it to be nearly vertical), and at the south end of lot 1, concession I, is what appears to be a large inclusion of Cobalt sedimentary rock in the diabase.

Positional Relationship of Sill to Enclosing Rocks

The Nipissing sill in Henwood township appears to be everywhere overlain and underlain by Cobalt Group sediments. As shown on vertical longitudinal section along A-B-C on O.D.M. Map 2126 the diabase on the west side of the Henwood diabase basin, that is on the west side of Henwood township, is overlain and underlain by Lorrain Formation. At the Stone-Eplett No.3 drillhole the diabase is overlain and underlain by rocks of the Firstbrook Formation. Thus in the central part of the basin the intrusion transgresses the bedding surfaces of the Firstbrook Formation and the Firstbrook-Lorrain formational contact. Although the Nipissing intrusion is customarily referred to as a sill it has in nearly every place in the Timiskaming area transgressive contacts. Clearly bedding surfaces or formational contacts played no part in controlling the shape of the body.

Petrography

The Nipissing diabase in the Timiskaming area is not of uniform composition. At any place there is a variation laterally from place to place. These variations in the diabase near Cobalt have been described by Hriskevich (1952).

Use of the term "Nipissing diabase" as a general name to include all the varieties of diabase present in the sill is convenient.

The Nipissing diabase is in general massive and relatively unaltered. The colour is characteristically grey in distinction to the greenish colour (due to plentiful amphibole and chlorite) commonly shown by the older Archean basic intrusions. In hand specimen sharply defined euhedral plagioclase crystals are plainly visible. Distinction in hand specimens of Nipissing diabase from the diabase of the Keweenawan dikes is usually not possible; the presence of large plagioclase phenocrysts occurring in some of the Keweenawan dikes allows those dike rocks to be distinguished from Nipissing diabase. Olivine-bearing varieties of the Keweenawan diabase dikes do not, in the writer's experience, contain hypersthene; olivine-bearing varieties of Nipissing diabase always contain hypersthene. The thickness and varieties of Nipissing diabase in Stone-Eplett No.3 drillhole are shown in Table 4

The fine- to medium-grained quartz diabase at the top of the sill is a dark grey rock in which (apart for about six inches at the contact) pyroxene and plagioclase can be seen in hand specimen. Grain size becomes progressively coarser with distance from the contact; in the Stone-Eplett drillhole No.3 at 32 feet from the contact the plagioclase crystals are up to 2 mm. long. What is termed varied-texture diabase is characterized by areas of coarse-grained minerals, largely plagioclase and pyroxene, intermixed with areas of the same minerals in smaller grain size.

Table 4 | Nipissing Diabase; Thickness of Varieties Intersected by Stone-Eplett No.3 Drill Hole.

Cumulative thickness from top contact	Thickness of variety intersected	Percentage of sill thickness	Rock Types
feet	feet		
0			Top contact of sill
	32	4	Fine- to medium-grained quartz diabase.
32			
	153	20	Varied texture quartz diabase.
185			
	514	67	Hypersthene diabase.
699			
	71	9	Quartz diabase becoming progressively finer grained.
770			Bottom contact of sill.

In hand specimens of the hypersthene diabase, the hypersthene usually shows plainly as a light-brownish mineral with cleavage, in grains up to 4 mm. In a careful inspection of the core from the Stone-Eplett No.3 drillhole supplemented by the study of a few thin sections no olivine was seen.

Contact Effects

Contact effects of the Nipissing diabase sill at its bottom contact against Firstbrook argillite, as shown by the Stone-Eplett No.3 drillhole, are slight. In hand specimen the bedding within a foot or so of the contact is somewhat indistinct and irregular; leucoxene flecks are abundant. In thin section biotite, in irregular flakes from 0.1 to 0.15 mm. forms 7 percent of the rock, and is seen to have a random orientation. Recrystallization of feldspar and quartz grains has occurred to some extent. The usual chlorite of the argillite is present in enlarged areas; and epidote-zoisite areas with numerous inclusions occur rarely.

Unusual Type of Alteration in Diabase

An unusual type of alteration in Nipissing diabase is shown by a few isolated outcrops along a belt at least a mile and a half long extending from lot 11, concession V to lot 8, concession VI. Features of the alteration include the development of prehnite[1], pumpellyite[1], calcite, and the albitization of the original plagioclase.

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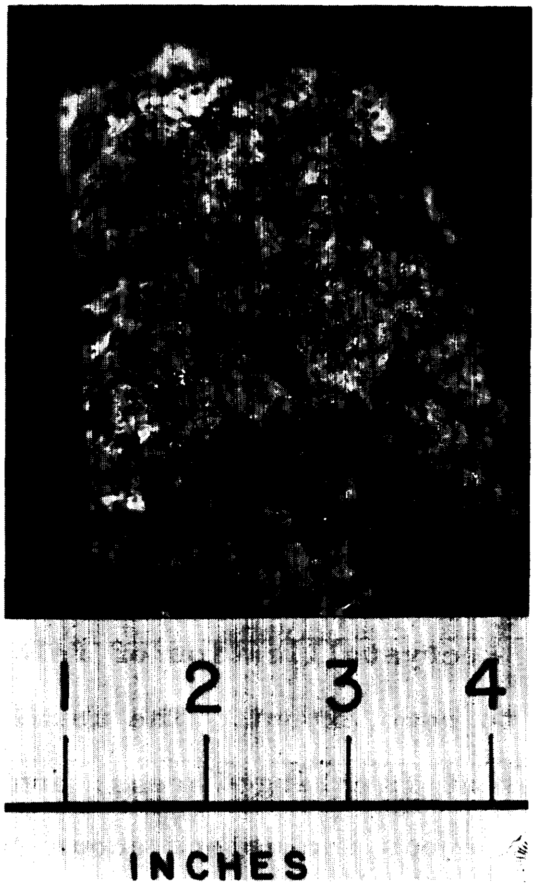
[1]The author is indebted to L.D. Ayres (Ontario Dept. of Mines) and B.E. MacKean (formerly with the Ontario Dept. of Mines) for pointing out the presence of prehnite and pumpellyite.

Photo 2



Prehnitized Nipissing diabase, lot 11, concession V, Henwood township. The white areas are largely prehnite, the dark albite and chlorite.

The most easily accessible outcrop in the belt is situated about 1,300 feet north and 250 feet west of the southeast corner of lot 11, concession V. The outcrop, rising 10 feet above the clay, is separated from Lorrain arkose (to the NW) by a 4-foot wide strip of clay believed to be along the bottom sill contact; the contact, from the attitude of the jointing in the diabase, is thought to be nearly vertical.

The outcrop has a width of about 250 feet at right angles to the contact. Near the contact the usual fine-grained quartz diabase is exposed with the grain size becoming progressively coarser away from the contact. Away from the contact the nature of the rock changes to the unusual type mentioned. At about 200 feet from the contact this unusual type weathers to a rough pitted surface with irregular rounded depressions up to about one half inch across and a quarter inch deep. The depressions have developed by the weathering of prehnite, which in the unweathered rock is dull white and forms about a third of the rock. Plagioclase, about albite in composition, makes up much of the rest of the rock; in hand specimen it has a grey-green colour due to the plentiful development of chlorite. The appearance in hand specimen of this rock is shown in Photo 2.

The alteration described above is thought to be autometamorphic, due to fluids emanating from one place in the sill, attacking another part of the sill which had largely solidified.

Keweenawan Diabase

Three diabase dikes intersecting Cobalt Group sediments are shown on Map 2126: their relationship to the Nipissing sill was not established by observation but that they intersect the sill is inferred.

The attitudes and widths of the dikes are as follows: (1) Concession III, lot 4, at the Stone-Eplett pit (see Photo 5); width 8 feet, strike N80°W; dip 85°S to a depth of 400 feet. Alteration of this dike in the vicinity of the pit is extensive; it appears to be a quartz diabase. (2) Concession II, lot 1, at SE corner; width greater than 20 feet, strike NW; dip vertical. Nearly unaltered augite and labradorite make up more than 90 percent of this rock; quartz and quartz-feldspar intergrowths make up about 2 percent. (3) Concession I, lots 9, 10 and 11; width greater than 200 feet, strike irregularly N of E; dip nearly vertical. The outcrop of this dike on the lot 10-lot 11 line is not the typical quartz diabase of the Keweenawan dikes; a thin section shows it to contain about 15 percent of quartz and quartz-feldspar intergrowths and to have a variation in grain size similar to that shown by varied-texture Nipissing diabase.

Another dike, not precisely located, is situated in concession II, lot 5; it has an E strike and a nearly vertical dip.

Pleistocene and Recent

In the last glaciation the Wisconsin of Pleistocene time continental glaciers covered the map-area. The direction of glacier movement as indicated by striae was between S10°E and S20°E. During and after the recession of the ice front most of the surface was submerged below a very large post-glacial lake called Lake Barlow-Ojibway. Drainage of this lake may be taken as the end of the Pleistocene and the beginning of the Recent. Although boulder clay was no doubt deposited widely on bedrock surface during the retreat of the glacier little is presently visible due to the bedded clays deposited in Lake Barlow-Ojibway.

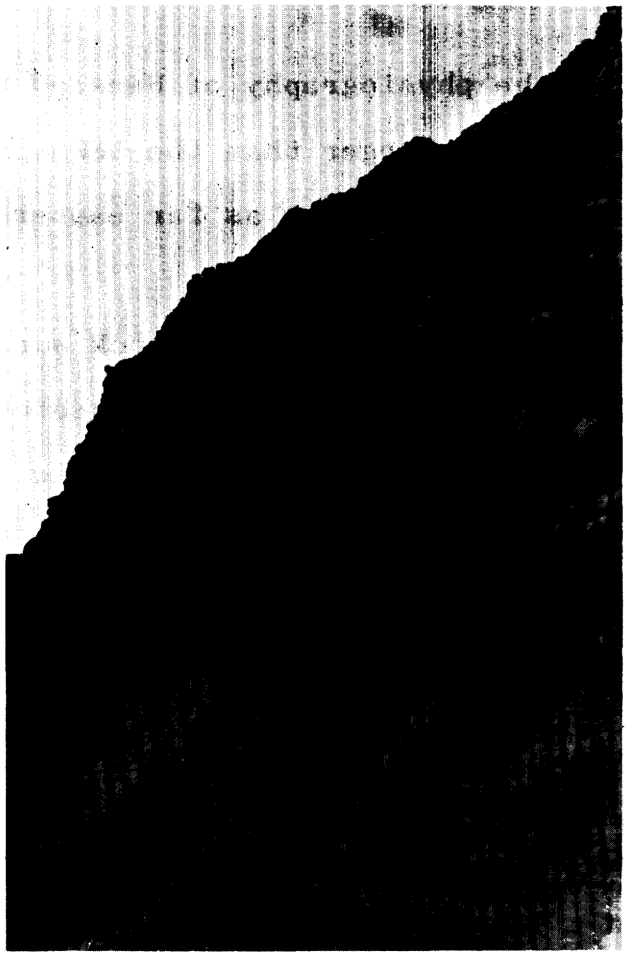
During the northerly recession of the ice front across the map-area the land surface was at a lower elevation than at present; in Lake Barlow-Ojibway, ponded in front of the ice sheet, were deposited sediments of two kinds (a) varved clays and (b) glaciofluvial deposits. The widespread varved clay shows its characteristic and prominent bedding; darker coloured, finer grained beds (winter deposited) alternate with lighter coloured, coarser grained (summer deposited) beds. A beach deposit on the south side of the rock hill in the northwestern part of lot 12, concession II is thought to mark the highest shore line of Lake Barlow-Ojibway in the township; the approximate elevation of this beach, as determined by aneroid is 990 feet above sea level.

A large area of varved clay without outcrops is present in the northeastern part of the township; presumably the clay has a considerable thickness. Over most of the rest of the township south of Highway No.65 varved clay occurs between the rather numerous outcrops. Evidence of the thickness of the clay is afforded by the depths of the creek valleys; thus at Moffatt Creek in the north end of lot 2, concession I the clay is more than 80 feet thick.

The glaciofluvial deposits, as shown on Map 2126, are widespread in the northern part of the township. In close association with the retreat of the ice front extensive sand, gravel, cobble, and boulder deposits were left by a a greater glacial river which flowed in a southeasterly direction. The course of this river is marked by sand plains, and hills of sand, gravel, cobbles and boulders in Hudson, Firstbrook, Coleman and Gillies Limit townships to the southeast of Henwood. The varied nature of the glaciofluvial deposits is shown in Photos 3 and 7. Landforms typical of such glaciofluvial deposits include kettle basins and a lake in lots 5 and 6, concession VI; esker-like ridges as the one in lot 4, concession IV extending S40°E for over a quarter of a mile.

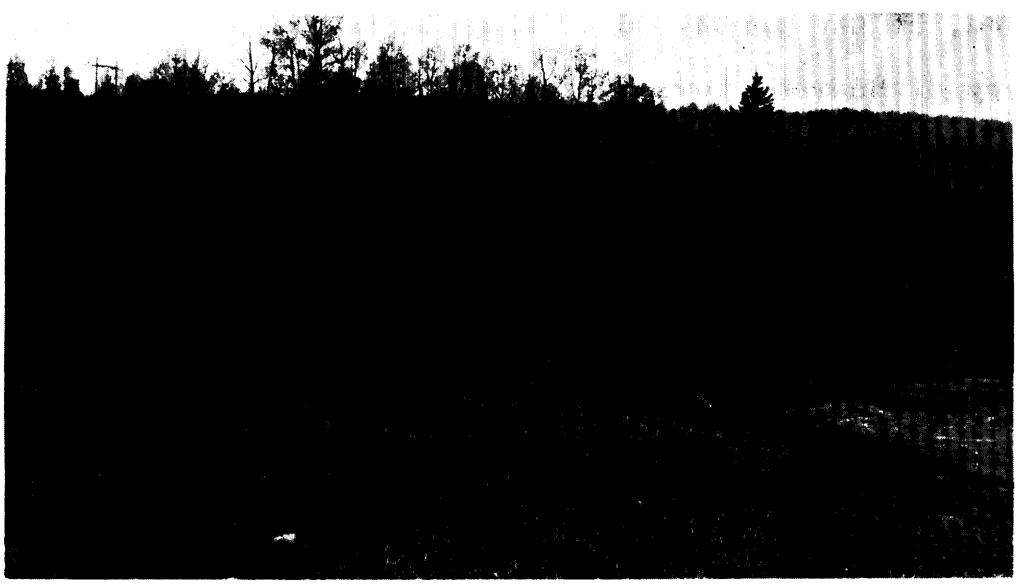
The most marked feature of the Recent is stream development which has been rapid since the disappearance of Lake Barlow-Ojibway. The clay plains have been and are being dissected by deep ravines. Slumping is an important feature in the development of the ravines; this is illustrated by Photo 4 which shows slumping along the banks of Wabi Creek in nearby Dymond township, lot 4, concession III.

Photo 3



Glaciofluvial deposits, sand and gravel with cobbles and boulders; Caswell Pit, concession V, Henwood township. Largest boulder is about one foot long.

Photo 4



Slumping banks of Lake Barlow-Ojibway varved clay along Wabi Creek, lot 4, concession III, Dymond township.

PHYSIOGRAPHY

In discussing the physiography of Henwood township, consideration of an area larger than the township is helpful; in what follows an area extending as far easterly as Lake Timiskaming is considered.

The development of the present bedrock surface is the result of erosion extending far back into geological time presumably into the early part of the Cenozoic era. Presumably there was then a river ancestral to the present Ottawa river and which extended along the position presently occupied by Lake Timiskaming.

The position and nature of the present bedrock surface appears to have been determined largely by erosion related to this ancestral river although it was effected to some extent by the later Pleistocene glaciation.

Certain features of the topography visible to a traveller going westerly along Highway No.65 from New Liskeard, at the north end of Lake Timiskaming to the west boundary of Henwood township furnish insight into the physiography; a diagrammatic section of this route (Fig. 2) is referred to in the following. Certain surfaces are designated on the basis of their approximate elevations above sea level as e.g. the "639-589 elev. surface."

Highway No.65 for about three miles northwesterly of New Liskeard passes near the south side of a nearly level plain described by Hume (1925), which extends far to the north.

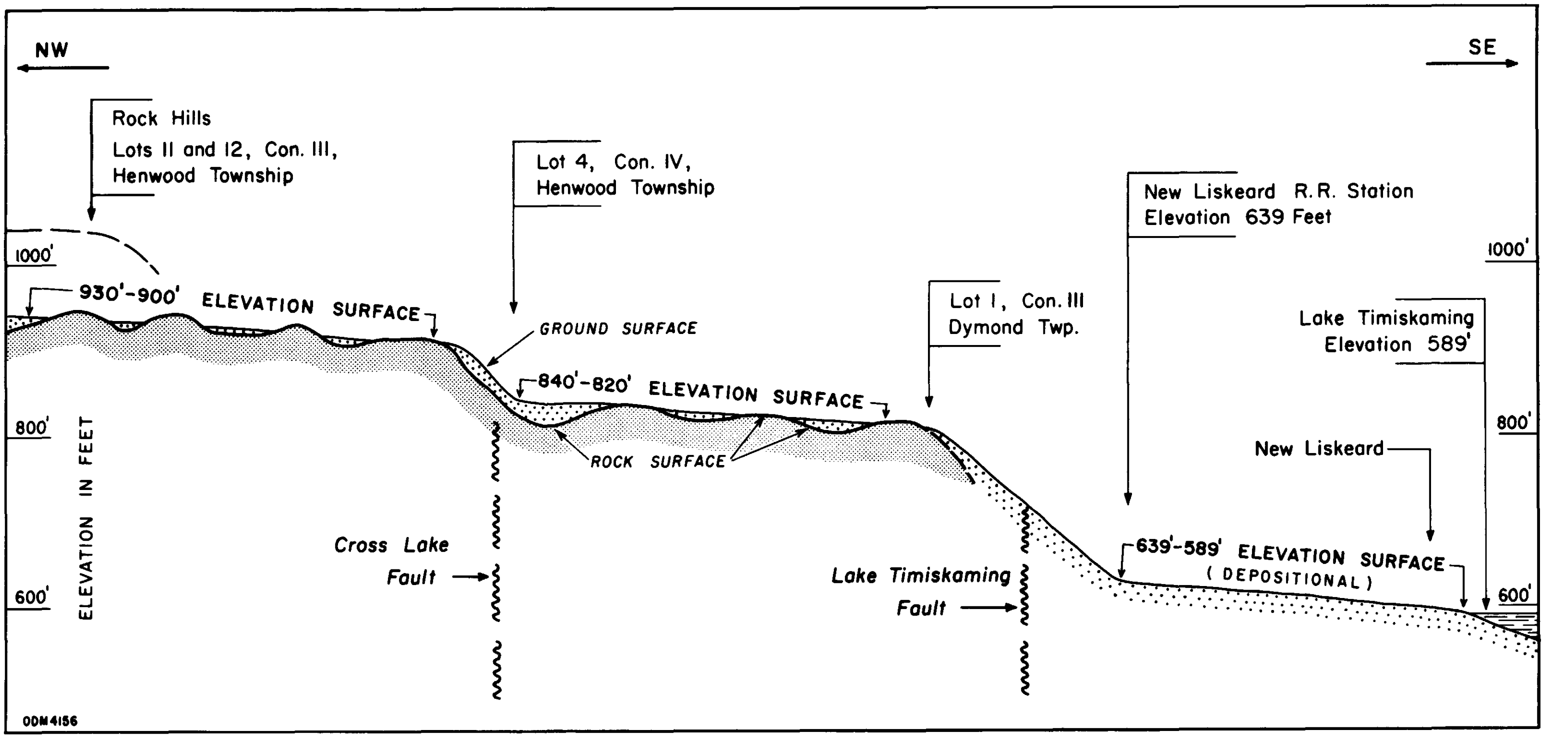


Figure 2 — Diagrammatic Vertical Section to Illustrate Physiography.

The elevation, near the highway, of the plain ranges from 589 feet (the elevation of Lake Timiskaming) to about 639 feet (the elevation of New Liskeard railway station). The plain, a depositional surface, was the bottom of post-glacial Lake Barlow-Ojibway to the final stage when the lake was drained. The depth of clay and other unconsolidated material beneath the plain is considerable; in places it is over 200 feet but detailed information on the elevation of bedrock surface below the "639-589 elev. surface" is not available.

From about 3 to 4 miles northwesterly of New Liskeard Highway No.65 goes up an easterly-facing hill whose top (in lot 1, concession III, Dymond township) has an elevation of about 820 feet. From this the highway passes over a somewhat level surface which rises to an elevation of about 840 feet near lot 4, concession IV, Henwood township. The "840-820 elevation surface" consists of a clay plain through which numerous outcrops rise short distances (in general only a few feet). The writer interprets the "840-820 elev. surface" to be a somewhat uneven erosion surface developed in bedrock, with the lower parts covered by varved clay deposited in Lake Barlow-Ojibway.

Near lot 4, concession IV, Henwood township, Highway No.65 climbs an easterly-facing hill, whose top has an elevation of about 900 feet; from this the highway passes over a somewhat level surface which rises to an elevation of about 930 feet near the west boundary of Henwood township.

The "930-900 elev. surface" consists of a clay (in places sand) plain through which numerous outcrops rise short distances (in general only a few feet). The writer interprets the "930-900 elev. surface" to be a somewhat uneven erosion surface developed in bedrock with the lower parts covered by clay and sand.

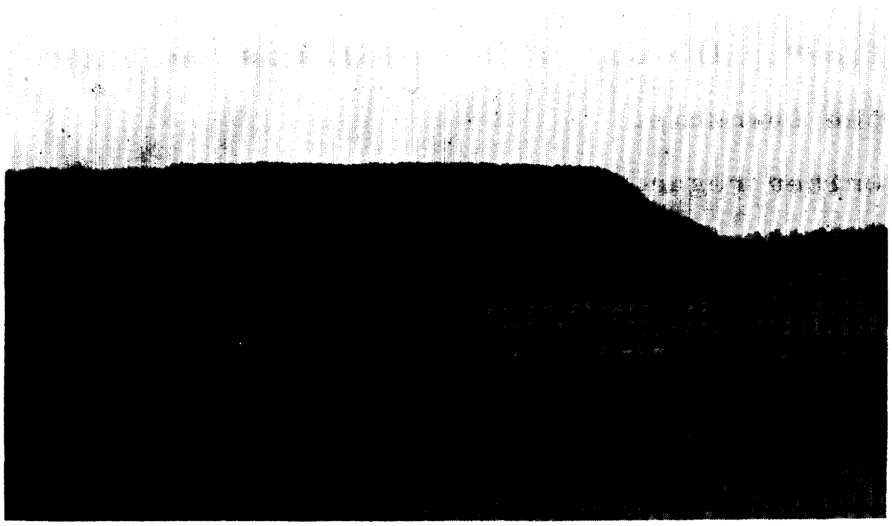
In lots 11 and 12, concession III, Henwood township rock hills rise to more than 200 feet above the "930-900 elev. surface". The top of these hills is the highest point in the township.

The writer regards the "930-900 elev. surface" and the "840-820 elev. surface" as representing erosion surfaces developed in pre-Pleistocene (probably early Cenozoic) time; it is possible that the tops of the rock hills in lots 11 and 12, concession III, Henwood township represent another and still older erosion surface.

The easterly-facing hill between the "930-900 elev. surface" and the "840-820 elev. surface" lies on a north-westerly lineament which marks approximately the position of the Cross Lake fault. The hill is a fault-line scarp; a view of this scarp about four miles southwest of Henwood township is shown in Photo 5. The scarp originally formed by pre-Pleistocene erosion was presumably modified by Pleistocene glaciation, ie. the face was steepened and the bedrock surface eroded to a greater than usual depth on the east side of the scarp.

The easterly-facing hill on the east side of the "840-

Photo 5



Cross Lake fault-line scarp in lot 7, concession IV, looking west from Highway No.65 at scarp. Level clay flats in foreground. Hill, about 300 feet high, is of Nipissing diabase.

820 elev. surface" lies on a northwesterly lineament marking the position of the Lake Timiskaming fault.

FAULTING

Although a number of rectilinear topographic features (five such lineaments are listed in the "Introduction" of this report) suggestive of faulting occur in Henwood township for only one is supporting evidence available.

The northeasterly-facing scarp paralleled by Wabi Creek in its southeasterly course from lot 4, concession IV to lot 1, concession II is thought to indicate approximately the position of the Cross Lake fault. The scarp may be traced southeasterly to Coleman township at which place it coincides with the Cross Lake fault. Photo 3 gives a view of this scarp in Hudson township (adjoining and southeast of Henwood). In the northern part of Henwood township the topographic expression of the fault is obscured by glaciofluvial deposits. Information on the dip, or displacement of the fault is not available in Henwood township; in the vicinity of Cross Lake in Coleman township the writer (1961, p.5) suggested that the displacement is less than 100 feet. The fault is believed to be post-Silurian in age. As shown in Figure 2, the Cross Lake fault is approximately at the boundary between two erosion surfaces.

In lots 11 and 12, concession III, a fault striking N 75°E has displaced horizontally the Nipissing sill contacts about 1,700 feet.

ECONOMIC GEOLOGY

In Henwood township important deposits of industrial minerals sand, gravel and ballast occur but no metalliferous ore deposits are known.

Metalliferous Deposits

Henwood township is within the Timiskaming Silver-Cobalt area and these metals and copper are thought to be the ones most likely to occur in deposits of economic importance in the township.

Following the discovery and development of the Cobalt Camp the search for silver-cobalt deposits was extended away from the camp. The presence of Keweenawan diabase regardless of whether this occurred in the sill-like form of the Nipissing diabase or the dike form of the Keweenawan diabase dikes was considered to indicate "favourable prospecting ground." The diabase exposures in Henwood township were found and prospected probably about the period 1909-1911. The prospecting did not discover ore but in places sulphide occurrences were found as for instance chalcopyrite mineralization on what became later the Stone-Eplett property.

One important factor to be considered in prospecting for silver-cobalt deposits in Henwood township is the accessibility to investigation of the most favourable horizon; the position of this most favourable horizon is controlled to an important extent by the position of the Nipissing diabase sill. That some kind of association exists between Nipissing diabase and silver-cobalt deposition in the Timiskaming Silver-Cobalt Area has been advocated by most investigators since the early discoveries at Cobalt. In many places silver-cobalt deposition is preferentially associated or even restricted to the vicinity of three contacts as follows: (a) the top contact of the Nipissing diabase sill,(b) the bottom contact of the sill,(c) the contact of Cobalt Group sediments over Keewatin volcanics below the sill. This spatial relationship furnishes a guide in a vertical sense for prospecting but the occurrence of vast areas of Nipissing sill devoid of silver-cobalt deposition should be kept in mind. A vertical range of 300 feet above and below the contacts mentioned above would include most of the profitable silver-cobalt deposition in Timiskaming Silver-Cobalt Area although there are a few important exceptions to this. In Henwood township these favourable contacts are in general so far below surface as to be inaccessible to the careful prospecting required to discover deposits of this type. Presently available prospecting techniques are inadequate to determine either the presence or absence of silver-cobalt deposits over much of Henwood township.

No silver or cobalt occurrences have been found in Henwood township to-date. In lots 1 and 2, concession II of Cane township (contiguous and west of Henwood) silver-cobalt deposits, with associated uranium, (for location see O.D.M. Map 2046) have been worked.

Two metallic mineral occurrences in lot 12, concession VI, Hudson (cornering on the southeast corner of Henwood) are in such close proximity to Henwood (they are shown on Map 2126) that the writer describes them briefly.

Description of Properties

Spencer Copper Occurrence, Hudson Township

This chalcopyrite occurrence was explored by W.A. Spencer at intervals during the period 1950-1960. A fractured zone trending southeast in Nipissing diabase was explored by an open cut about 80 feet long and with depths up to 12 feet. The fractured zone is up to 7 feet wide but for the most part is about half of this; along the irregular fractures are carbonate veinlets (to three quarters of an inch wide but for the most part much less) with minor amounts of quartz. Chalcopyrite with smaller amounts of pyrite is present in the veinlets and to some extent in the wallrock. Where exposed at the time of the writer's visit the tenor was below ore grade.

Spencer Uranium Occurrence, Hudson Township

This uranium occurrence is the only one of its kind known by the author to occur in the Timiskaming Silver-Coabalt Area: in the area uranium mineralization occurs in several places at least (e.g. in Cane township, contiguous and west of Henwood) with calcite veins in Keweenawan diabase;

at the Spencer property the uranium mineralization is in Firstbrook argillite which appears to underlie the adjacent Nipissing sill. The radioactive minerals are in bands of breccia, which consist of angular fragments up to two by six inches of argillite, reddened and somwhat hardened in a dark green chloritic matrix. The breccia contains in places small areas of carbonate (to one inch) and in places is mineralized with chalcopyrite. The breccia bands are up to one foot wide and occupy clear-cut fractures, with knife-edge contacts, intersecting the bedded argillite. Bands of breccia have been found within a zone about 250 feet long. Lang (1952, pp.150, 151) reports "A sample taken by R. Thomson showed 0.14 R (percent U_3O_8 equivalent, determined by radiometric test). Seventeen samples sent to the Ontario Department of Mines showed radioactivity ranging from nil to 0.18 R, and the results of twenty-three samples sent to the Geological Survey range from 0.01 R to 0.21 R. The radioactive mineral has not been isolated." Murray Watts, mining engineer, who first brought the occurrence to the writer's attention in 1949 reported (personal communication) that one sample gave a return of 0.10 percent U_3O_8 determined by chemical analysis. The deposit was explored first by a few small trenches and later by diamond drilling, the results of which are not available to the writer.

Stone-Eplett Property, Lot 4, Concession III

Henwood Township

Unusual circumstances led to the extensive drilling that was done on this property. The type of deposits a fractured, veined, and mineralized (with chalcopyrite) dike of post-Huronian age is not of common occurrence in the Timiskaming Silver-Cobalt Area nor does the writer know of any mine having been developed on a similar occurrence.

Little information would seem to be available as to the most favourable horizon at which deposits of this type should be explored; for the most part reliance must be had on random drilling.

That part of the Stone-Eplett property on which prospecting was carried out during the period 1952-1958 consists of the NW quarter and the SW quarter of the north half of lot 4, concession III, Henwood township.

A long time ago, possibly about 1910, a prospector found the post-Huronian diabase dike in the southwest quarter, north half, lot 4, saw the brecciation, calcite veins, and chalcopyrite mineralization along the dike, and investigated it by a 5-foot pit. To the unknown prospector presumably the occurrence did not warrant further effort. When the present writer examined the pit in 1952 he noted that no ore was exposed. In the writer's opinion most geologists examining the occurrence would not have recommended the extensive work that was done later. About 1952 A.T. Stone[1] (deceased) by what may be described as "extrasensory perception" or "revelation" came to the conclusion that

1.A.T. Stone, personal communication, 1952.

important ore deposits existed at a depth of 500 feet below the pit. In 1953, Mr. Stone in association with E.D. Eplett carried out a diamond drilling campaign; at least three drill holes were put down (the deepest for a length of 980 feet) to test directly below the pit at a depth of 500 feet. The pit was deepened to a total depth of 20 feet. In 1954, drilling was again undertaken; four holes were drilled during the year; of these the No.3 (referred to in this report as the Stone-Eplett No.3) was put down for a length of 1,645 feet. In 1955 the Stone-Eplett No.3 was continued to 1,965 feet and in 1958 to 4,050 feet. In the later stages of this hole the intention (not realized) was to drill to the Huronian-Archean contact.

The collar of the Stone-Eplett No.3 (see Map 2126)is 350 feet distant at S11°W from the pit; core was of one and a quarter inch diameter; inclination of the hole at the collar was 65°. In a hole of this length deviation in direction as well as dip may be considerable; no significant variation of the angles between bedding planes and core axis throughout the length of the hole was made out. This was the last work done on the property.

The pit is on the nearly level top of a hill which faces easterly over clay flats; abundant outcrops of Lorrain arkose are exposed on the hill top. The pit is 8 feet wide, 15 feet long and 20 feet deep; it occupies the entire width of the Keweenawan diabase dike which strikes N80°W and has a vertical dip. Both the north and south walls of the dike are smooth slip surfaces and there are numerous steep irregular fractures in it (see Photo 6). Calcite and also quartz veinlets occur in the fractures; in places the veinlets were sufficiently abundant to make a calcite breccia. In and associated with the veinlets are chalcopyrite and pyrite mineralization; the material contained chalcopyrite too sparsely to be copper ore.

The first hole drilled in 1953 was collared at roughly 145 feet N70°E from the pit; it was drilled 523 feet S25°W at 65°; the dike where intersected between footages 505 and 520 was fractured, but contained negligible amounts of carbonate veining or mineralization. The second hole drilled in 1953 was collared at about 100 feet N25°E from the pit and was drilled towards the pit at -55°; at footage 196 the dike was intersected; it was markedly fractured and contained carbonate and chalcopyrite. The third hole drilled in 1953 was collared at about 250 feet N18°E from the pit; it was drilled for a length of 980 feet S3°E at - 68°; the dike was not intersected. Of the four holes drilled in 1954 one was collared near the bottom of the easterly-facing hill on which the pit is situated; abundant water at a considerable pressure flowed from the hole.

The writer examined the core of the Stone-Eplett No.3 drillhole and saw nothing of economic interest in it.

Industrial Minerals

Sand, gravel, and ballast have been supplied in large amounts from the glaciofluvial deposits in the northern

Photo 6

View down Stone-Eplett pit, lot 4, concession 111, Henwood township, showing full width (8 feet) of post-Huronian diabase dike, slips along dike walls, fracturing in dike and veinlets.

part of the township and reserves in larger quantity than will be required probably are available for the future. The material was used in the construction of the Earlton-Elk Lake branch of the Ontario Northland Railway. The most important use at present is in the construction of roads and highways. The size of the various pits as of 1962 is indicated on Map 2126 and by Photos 7 and 8.

The Caswell pits in lot 5, concession V are the largest in the township. The varied nature of the material is shown by Photos 4, 7, and 8; the portable plant used to treat the material is shown in the photographs.

Other pits in the township include the Batty pits in lot 5, concession IV and the Elk pit in lot 5, concession VI; at the latter the bank is about 40 feet high.

Photo 7

Caswell gravel pit in glaciofluvial deposits, lot 5, concession V, Henwood township. Shovel and hopper leading to crushing and screening plant.

Photo 8

Caswell gravel pit, lot 5, concession V, Henwood township: portable crushing and screening plant.

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Maps

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Map 31b. Blanche River area. Scale 1 inch to 1 mile. (Accompanies O.D.M. Vol.XXXI, pt.3) Geology by Burrows, A.G. and Hopkins, P.E. Published 1922.

Map P.160 Henwood Township, District of Timiskaming. Scale one inch to one quarter mile. (N.T.S. sheets 41P and 31M). Geology by Robert Thomson; Published 1962.

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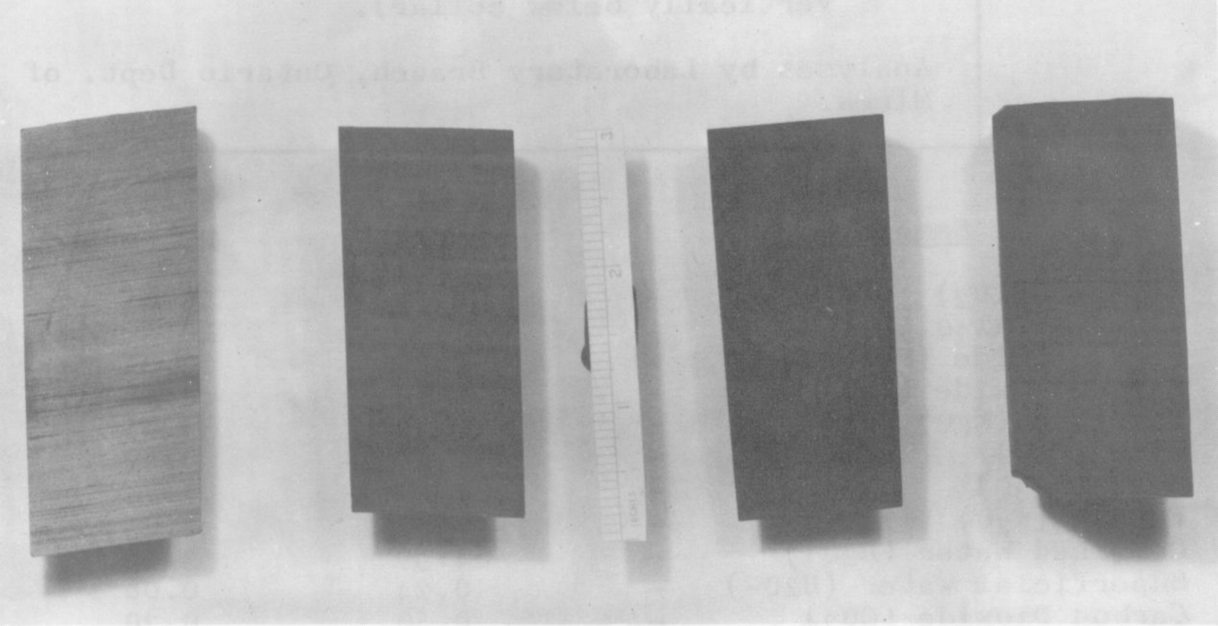

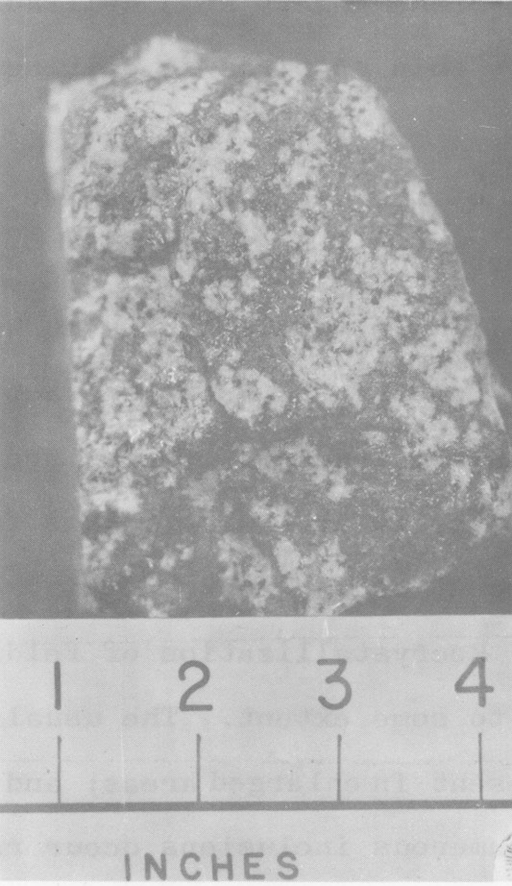
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