



GEOLOGICAL  
SURVEY  
OF  
CANADA

DEPARTMENT OF MINES  
AND TECHNICAL SURVEYS

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PAPER 61-28

GEOLOGY OF TIGNISH MAP-AREA,  
PRINCE COUNTY, PRINCE EDWARD ISLAND

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(Report and Map ~~61-28~~)

V. K. Prest



CANADA

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By

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PS Map 38-1961. Tignish map-area, Prince County,  
P.E.I. ....In pocket



GEOLOGY OF TIGNISH MAP-AREA  
PRINCE COUNTY, PRINCE EDWARD ISLAND

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INTRODUCTION

Tignish map-area comprises the northern part of the western end of Prince Edward Island. The writer, ably assisted by W.H. MacLean, studied both bedrock and surficial deposits in this area during the 1953 field season. This was part of a Geological Survey mapping program that has continued to the present and has resulted in the publication of maps with marginal notes on the Souris, Mount Stewart, and Montague map-areas in eastern Prince Edward Island (Crawl, 1960a, 1960b; Frankel, 1960)<sup>1</sup>.

In 1948, Owen (1949) mapped the surficial deposits of O'Leary map-area to the south of the Tignish area. During the same year the Provincial Government undertook a geological survey primarily to ascertain what industrial minerals occurred on the island (Milligan, 1949). Prior to that time no extensive geological studies had been made for many decades, and knowledge of the bedrock in particular had increased but little since Ellis' (1884) report. Even today the structure of the surface rocks on the island has not been satisfactorily worked out, and is not likely to be worked out before completion of the geological study of the entire island.

The age of the 'red beds' that underlie the island is still in some doubt. Studies of plant microfossils from a bore-hole drilled by Imperial Oil, Limited in 1958 near Wellington, 10 miles west of Summerside, indicate a Stephanian age for the red beds at a depth of 1,730 feet, and similar studies on grey sandstone from Governor Island, south of Charlottetown, indicate a Middle or Upper Pictou (Westphalian) age. (These determinations were made by M.S. Barss, Geological Survey of Canada.) From these studies, it is evident that at least the lower parts of the 'red bed' sequence on the island are Pennsylvanian in age.

Plant remains and impressions from the south shore of Prince Edward Island between Summerside and Charlottetown, and on Gallas Point, St. Peters Island, and Governor Island in Hillsborough Bay, have been identified as the Permian genus Tylodendron (Holden, 1913). On the other hand, plant fossils collected by the writer in 1953 from these same areas, and studied by W.A. Bell and W.L. Fry of the Geological Survey, did not yield a diagnostic Permian flora, though Tylodendron sp. was recognized. Fry wrote that "the flora is almost certainly pre-Mesozoic and is probably best labelled as being

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<sup>1</sup>Dates, or names and dates in parentheses refer to publications listed in the References.

Permo-Carboniferous in age" (W.L. Fry, unpublished palaeontological report, on file, Geological Survey of Canada). Following a particularly detailed study of plant remains collected by the writer in 1954 Fry concluded that there was nothing in the assemblage to cause him to modify his earlier viewpoint. It should be emphasized, however, that none of the specimens studied by Fry showed the well-preserved cell-structures as illustrated by Holden (1913). Also the writer considers the identification of Tylodendron impressions in some of the above-mentioned localities as somewhat doubtful. Furthermore, some of the better specimens collected by Holden on the low tide flats may have been derived from the soil mantle rather than directly from the bedrock. Inland from Victoria Harbour pith casts of Tylodendron sp. are present in the stone piles along fence lines where they have been thrown aside as the fields were being cultivated. The soil here is derived from glacial till. The Permian age of Holden's plant remains from Governor Island is also somewhat questionable, for, as earlier mentioned, plant microfossils from that island now indicate an Upper Pictou (Pennsylvanian) age.

Vertebrate fossils collected from east of Malpeque Bay in 1960 and 1961 by W. Langston, Jr., for the National Museum of Canada, are strongly suggestive of Pennsylvanian and Permian genera. However, the aspect of the fauna as now known has a distinctly lower Permian character (W. Langston, Jr., personal communication). This interpretation supports the supposition of several vertebrate palaeontologists since the middle of the last century that a jaw-bone (Bathynathus borealis, Leidy) found near New London, and generally believed to indicate the presence of Triassic rocks, was that of a pelycosaur of Permian affinity.

A further possible complication affecting the interpretation of the stratigraphy and structure of Prince Edward Island is the reported occurrence of Cretaceous microflora from grey rock chips from near the surface and possibly also at a depth of 1,400 feet in the Imperial Oil bore-hole near Wellington. (Fossil determinations by D.C. McGregor, Geological Survey of Canada.) The possibility that these flora represent contamination of drilling equipment has not yet been ruled out.

Thus, for the present, the Prince Edward Island red beds are still most safely referred to as Permo-Carboniferous, as formerly designated by Ellis (1884).

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## BEDROCK GEOLOGY

Bedrock is prominently exposed along most of the west coast of Tignish map-area, locally as cliffs 50 to 60 feet high. Along the eastern coast of the area, shoreline exposures are less common and few are more than 25 feet high. Inland there are few natural exposures, but some road-cuts reveal the bedrock beneath a thin drift mantle. All exposures noted along the roads in 1953 are indicated on the accompanying map.

The bedrock includes sandstone, silt, shale, conglomerate, and shale breccia - mainly non-calcareous sediments. A very thin lenticular bed of buff-grey, red-mottled 'limestone' occurs on the coast at the shore end of the road around the north side of Little Miminegash Pond, but because of its location close to high-tide level, it is not likely to prove of economic importance.

Although the sandstone, siltstone, and shale are generally non-calcareous, in some places they contain enough calcium carbonate as the cementing medium to be termed calcareous. The sandstones generally weather a rusty-red; calcareous varieties, however, are a slightly reddish grey because of the smaller amount of ferric iron in the cementing medium. The shale is invariably brick-red, and is soft and clayey. All gradations occur between soft red structureless 'clay', derived by weathering of both shale and siltstone, and hard platy or massive sandstones. Also occurring are highly micaceous sandstones, which split into very thin leaf-like laminae and resemble a schist on weathering. Some of the soft red 'shales' appear to have been argillaceous limestones originally, with the calcium carbonate now removed by ground-water solution.



Conglomerate and breccia are less common than sandstone and shale. The conglomerate is locally calcareous, whereas the breccia is everywhere strongly calcareous. The conglomerate is a well-sized and well-sorted mixture of rounded pebbles of quartz, chert, porphyries, greywacke, etc. in a sandy matrix cemented by both iron oxide and carbonate. The pebbles form as much as 75 per cent of the rock. By decrease in pebble content the rock grades into conglomeratic sandstone. The colour of the conglomerate varies between greyish red and reddish grey.

The breccia is a variable, red-flecked to spotted greyish rock consisting of red-weathering shale fragments that are widely diverse in form and from pin-head to pebble-size and larger, in a calcareous and locally also arenaceous groundmass. In places the breccia contains a few rounded pebbles of foreign rocks, and, by increase in the proportion of pebbles, may grade into conglomerate.

The rocks are mostly terrestrial and estuarine in origin. The strikes and dips of the beds are greatly variable locally and all the beds are noticeably lenticular. Ripple-marked surfaces are uncommon. Fossil plant-remains are to be found in some of the shaly beds along the west coast, and rarely in siltstone and sandstone of the eastern part of the map-area.

Along the entire west coast of Tignish map-area, and south on the east coast from North Point to beyond Seacow Pond, the beds in general dip eastward at angles of 5 to 25 degrees. South of Seacow Pond as far as Cape Kildare, the rocks dip gently westward. This seems to indicate a gentle synclinal fold trending south from near Seacow Pond through the town of Tignish and south-southwest to the vicinity of Piusville—almost parallel to the main highway from Tignish to Bloomfield Corner. Five occurrences of conglomerate—on North Point, west of the main highway on the crossroad to St. Louis, on the highway 3 1/2 miles and 1/3 mile north of Elmsdale, and at Piusville—seem to bear out this structure, with the conglomerate occurring along the axis of the syncline. Conglomerate was also noted about a mile east of the highway near the head of Kildare River. The conglomerate and conglomeratic sandstone along the south bank of Mill River probably represent a different conglomerate horizon from that mentioned above. From Kildare southwest through Alberton and along Mill River, the rocks again dip mainly eastward, but this may be due to the initial dips of the beds rather than to fold structures.

## PLEISTOCENE GEOLOGY

### Direction of Ice-movement

The history of glaciation on Prince Edward Island is still obscure. It has long been assumed that the glaciers came from New Brunswick, scattering 'foreign' rocks over the western end of the island; many of the stones in the glacial till and the glacio-fluvial deposits are rock types that occur in New Brunswick. Many of the 'foreign' stones found in Tignish map-area may well be rock types that occur in Labrador, but their presence does not invalidate the concept

of eastward-moving glaciers over the western end of Prince Edward Island. Glacial striae were noted in only two places in the map-area—one on the west coast at Black Pond, the other on Hill River on the eastern side of the island. At Black Pond the striae trend N5°E on a south-sloping rock surface and swing to N20°E on flat surfaces about 100 feet farther south. The ice probably was deflected from a north-northeasterly direction to a more northerly direction by the point of rock north of Black Pond, as it rode up the local south-facing dip slope of these rocks. Northerly moving ice in the Black Pond area may be explained as the deflection of the northern side of a New Brunswick glacier lobe upon encountering the Cape Wolfe shore of O'Leary map-area. The striae on the shore of Hill River trend N95°E, and probably indicate that the main part of the glacier moved eastward across the island toward Cascumpeque Bay and the Gulf of St. Lawrence.

### Glacial Deposits

Most of the map-area is covered by a relatively thin mantle of glacial debris or till in the form of ground moraine. This till, which ranges from very sandy to very clayey, was deposited by the last great glacier that occupied the area late in the Pleistocene or glacial epoch. The clayey till is often referred to on the island as 'brick clay', but its pebble content makes it unsuitable for the manufacture of brick. The proportions of clay and sand in the till vary from place to place according to the type of rock over which the glacier passed or moved. Hence with the rocks trending more or less north and south, clayey till is characteristic of the western side of the map-area, where shales are more prevalent, and sandy till is characteristic of the eastern side. The boundary between these two till types, as shown on the accompanying map, is an arbitrary one, for the two tills grade into each other. Analyses of two series of till samples taken across the north-central part of the map-area indicate that the boundary, as mapped, lies where the clay-silt content approaches 40 per cent, and where the clay fraction alone is 15 per cent or more.

The 'clay phase' of the sandy tills in Montague map-area (Frankel, 1960), probably corresponds to the till of the transition zone in Tignish map-area. The till of most of the western part of Tignish map-area is less sandy than the till in central and eastern Prince Edward Island; in fact some of the till along the west coast of the map-area is so clayey that it is difficult to distinguish it from the weathered shale or 'keel'.

### Glacio-fluvial Deposits

During the waning stages of glaciation, meltwater streams deposited gravel in tunnels beneath the ice, in holes in the ice, and as aprons in front of the ice. These deposits—known as eskers, kames, and outwash respectively (and collectively as glacio-fluvial deposits)—are represented in Tignish map-area by certain

elongate deposits of silt, sand, and gravel, and by other deposits believed to have a fan-like distribution. The gravels are in places very bouldery. These glacio-fluvial deposits may prove valuable sources of gravel for road-surfacing and heavy fill, especially the deposits in which the stones are hard calcareous types of local rocks.

The northernmost deposit of glacio-fluvial gravel in the map-area, about 3 miles south of the town of Tignish, consists of an elongate northeast-trending ridge of sand and gravel, which appears to be a kame. The gravel appears to be largely pebble-size, judging from the surface of the deposit and from a small borrow pit on the east side of the road at the eastern end of the ridge. Much of the gravel is composed of soft non-calcareous local stones; the remainder includes both 'foreign' stones brought in by the glacier, and hard calcareous local stones.

At the forks in Little Tignish River, 3 1/4 miles south-southeast of Tignish, gravel is exposed in a borrow pit. The gravel—believed to be outwash gravel—is about 6 feet thick, rests on bedrock, and is overlain by 2 to 3 feet of sandy till. Half a mile due south, gravel is exposed in the fields but no pits have been put down to explore it. It may be either outwash or kame gravel. Here too, an appreciable amount of soft rock is included with the harder stones in this gravel.

A mile or so farther southeast, at the head of Kildare River, is an elongate ridge, only 1/2 mile long, that may be either a kame or a short esker. This ridge is more or less in line with the aforementioned gravel deposits and is probably related to them in time of origin. A pit approximately 300 feet long and 100 feet wide had been opened in this ridge prior to 1953 on the southside of the crossroad, and had exposed a 15- to 20-foot section of gravel. The gravel is irregularly sorted and stratified and is clearly glacio-fluvial in origin. The glacial stream depositing the gravel moved northward; this is evidenced by the tilt of the beds, which is commonly about 8 degrees but in a few places is as much as 20 degrees. Some beds consist of well-sorted pebble gravels with but scant sand matrix; others are poorly-sorted boulder gravels mixed with much sand, pebbles, and cobbles. Large slabs of calcareous breccia and calcareous sandstone, several feet across and a foot or more thick, are not uncommon. The content of soft rocks of local origin is relatively low. The gravel is as much as 35 feet thick, and is overlain by a mantle of till 2 to 5 feet thick that is probably the product of a minor advance of glacial ice over the gravel there and northward to the forks in Little Tignish River.

A small exposure of gravel occurs on the west side of Kildare River about 1/2 mile south of its head. It too is covered by a 5-foot mantle of till. The gravel appears to be about 10 feet thick, and extends vertically downward to sea-level.

From the east side of Kildare River, a short distance north of the mouth of Huntley River, an esker-kame system is traceable as a ridge up Huntley River as far as the railway and thence southwesterly to near the head of Hill River. A large gravel pit has been opened in the highest part of this ridge on the east side of the

railway and the south side of Huntley River. For the most part the gravel is well stratified and sorted, and appears flat-lying, but where it reaches its maximum elevation of about 85 feet it is humped over a knoll of clay till, which rises 10 to 12 feet from the floor of the pit. In general the gravel beds dip to the southwest as if the general flow was in that direction. The deposit exposed in the pit appears to be a kame intimately associated with the esker-like ridge. Stream flow may have been both eastward toward Kildare River and southward toward Hill River. A couple of old borrow pits occur on the north side of the railway and highway west of Alberton, but slumping prevented any reliable determination of bedding. As seen in the main pit on Huntley River, about 15 per cent of the pebbles, cobbles, and boulders are hard 'foreign' rock types; these include those brought to the island by the glacier and pebbles derived from the island's conglomerate beds. The rest of the pebbles, cobbles and boulders are sandstones (some calcareous) and calcareous shale breccia; the breccia is twice as abundant as the sandstones. These calcareous rocks are hard and durable, and the deposit provides a good-quality gravel.

Another esker forms a ridge trending north from just northwest of Piusville to about 1 1/3 miles south-southeast of the hamlet of St. Lawrence, where it borders the west side of Miminegash River. Toward the northern end of this ridge, one small borrow pit—from which a farmer obtained sandy gravels for fill around his house—was the only 'opening' in the ridge in 1953 except for those near Piusville. This small pit did not reveal any evidence of the direction of river flow but did reveal anticlinal structure across the ridge. The gravels there are largely cobble size and include a large proportion of igneous rocks. The locally derived rocks, however, are non-calcareous sandstones that are rather soft or friable.

Near Piusville the ridge is indefinitely defined, except at its extreme southwestern end. At this locality a small pit reveals the deposit to be largely sand, with thin pebble-gravel horizons to a depth of about 10 feet. Northwest of Piusville, where the ridge bends sharply from its southerly course to a westerly course, a large irregular-shaped pit has been opened up and most of the esker has been removed. Conglomerate, which has weathered to a gravel, occurs at this site at a depth of 10 to 15 feet. Exploration for this conglomerate 'gravel', including stripping of 4 to 6 feet of till, has made it impossible to trace the original course of the esker. It was probably during exploitation of the esker gravel that the underlying conglomerate gravel was found. Pebbles from the conglomerate gravel occur along the course of the esker for a short distance southwest of the pit, but none was noted northeast of the pit. This suggests a southward- and southwestward-moving glacial stream. However, a large area of silt at the north end of the Piusville - Miminegash River esker may be outwash from northward-coursing waters of the esker system; and further, the slope of the ground is northward over the length of the esker. More borrow pits will have to be opened before the true course of the glacial waters and the character of the gravels will be revealed.

### Glacio-marine and Marine Deposits

The irregular and sporadic distribution of sand and gravel in the map-area—from near sea-level to 75 or 80 feet above it—and the absence of either wave-cut or wave-built terraces, are best explained by the occurrence of stagnant blocks of ice during the marine invasion that immediately followed the waning glaciers. This sporadic occurrence of sand and gravel up to the level of maximum marine overlap bears no relation to topography; even in protected areas where sands should have accumulated, the nearby marine deposits may end sharply as if an ice-block were present, which on melting exposed the underlying till. In other words the maximum marine overlap in Tignish map-area was at about 75 feet—the same level as in O'Leary map-area to the south (Owen, 1949)—but there was so much ice in the region that the sea left only scant and scattered evidence of its presence at this early stage of deglaciation. Furthermore, the map-area contains no well-developed terraces or raised beaches between an elevation of 75 feet and present sea-level. Toward the southwest corner of the area there is better continuity of marine deposits more or less paralleling the contours of the land, but wave-cut terraces and raised beaches only attain prominence much farther south, in O'Leary map-area.

The deposits of the glacio-marine and marine stage of the Pleistocene period are mostly sandy, but in places there are appreciable accumulations of gravel. Marine shells are rare, apparently because they have been leached away by lime-poor surface waters that percolated through the deposits. Some marine shells were observed in a gravel deposit northeast of Tignish. At an elevation of about 30 feet, shell fragments were observed from near the surface to a depth of about 15 feet, and are reported to have been seen in a test pit another 10 feet below. Shells were also noted in sandy gravels on the west coast, south of Miminegash, at an elevation of about 30 feet.

Marine clay was noted at a few places on the west coast, particularly south of Miminegash. It is commonly less than a foot thick, but south of Miminegash it is up to 4 feet thick. The clay is commonly interbedded with sand and fine gravel. South of Miminegash there is a gradation from good, stone-free and well-stratified clay and silt, downward through a stratified clay-stone mixture, into the typical non-stratified clayey till with an abundant stone content. At the outlet of Little Miminegash Pond a variable deposit of sand and gravel up to 4 feet thick passes downward through 1 foot to 2 feet of a clay-gravel mixture into marine clays varying from 6 to 8 feet in thickness. Below this is a 1/2- to 1 1/2-foot-thick clay-stone layer overlying clay-sand till. The surfaces between all these materials are very irregular. The marine clay does not extend south along the shore, but appears to have been limited to an area covering the site of the pond. All evidence points to glacio-marine conditions.

Over much of the southeastern part of the area, where sand might be expected at elevations up to 50 feet or more, the sea has not left any deposits but rather has removed material so that sandy

till or bedrock occurs at the surface. In many places the sandy till shows evidence of having been rapidly worked over by water with some of the 'fines' being removed, but this water action was not of sufficient strength or duration to give rise to stratified deposits. The water-worked sandy till is therefore not mapped as a marine deposit. The washed surfaces and 'washed-till' deposits are only mentioned here to complete the record of the glacio-marine stage.

### Recent Beach Deposits

As it is not possible to easily separate the glacio-marine deposits from the marine deposits, only the present-day or recent beaches are discussed here. Most of them are too small to be shown on the geological map. In places, gravel beaches are well-developed in coves along rugged shores, and broad sand beaches are present especially along the eastern shore as bay-mouth bars and spits. The present-day beach and bar deposits appear to have been mainly derived from glacio-fluvial deposits rather than from the winnowing of the island's sandy tills.

### Aeolian Deposits

Wind-blown deposits of sand are intimately associated with the well-developed present-day sand beaches. These may occur as thin 'blankets' overlying bedrock, till, or water-laid materials, but in many places they are in the form of dunes. The dunes are partly stabilized by grass, cranberry, or scrub spruce, but every storm causes some changes, and blow-outs are frequent. Salt marsh is a common associate of the dune areas at or near sea-level.

### Swamp Deposits

Two main types of non-marine swampy areas are present in Tignish map-area—the muskeg type, as seen near North Point and northeast of Miminegash, and the older, partly humified swampy type, trending irregularly southward from the North Point muskeg. The North Point muskeg was formed after the retreat of the sea below the present 50-foot contour level by the development of barrier beaches and bars at the north end of the island; these beaches and bars trapped fresh waters as the sea-level dropped to lower elevations. A thin layer of black muck generally lies beneath the present muskeg surface of huckleberry, Labrador tea, and sphagnum moss; the moss is believed to be less than 5 feet thick. The muck in turn rests on glacial till or weathered bedrock. Along the west coast, however—and now exposed by the ingress of the sea into the sea-cliffs—is a bed of peat up to 2 1/2 feet thick beneath the more recent and diverse vegetal accumulations; this peat rests directly on till. The Miminegash muskeg is a smaller, wet and flat area of sphagnum moss.

The irregular-shaped older swamps are floored by a 4-inch-to-2-foot layer of black muck. This readily identifiable material is a mixture of variously decayed vegetal matter and minor fine mineral matter.

Marine and estuarine swamps (salt marshes) are associated with the recent shoreline and dune deposits. These are not extensive in the map-area and have not been mapped separately. The vegetal layer is probably not more than 2 feet thick.

## ECONOMIC GEOLOGY

### Shale

Some of the shales of Tignish map-area are low enough in carbonate to be suitable for the manufacture of brick and tile; most of the rocks, however, are too calcareous. In addition, the non-calcareous shales in this area are too far from a ready market; the same rocks occur closer to the major communities on the island. In the past, some suitable brick was made from clayey till in the area, but this practice is now obsolete.

### Limestone

The only occurrence of limestone per se in the map-area is that at the shore end of the road north of Little Miminegash Pond, where a thin bed occurs on the coast at high-tide level. The bed dips inland at about 5 degrees, so that the establishment of a moderate-scale quarry at a sufficient distance inland would be economically unfeasible because of the thickness of overlying material. In any case the limestone is only 2 or 3 feet thick at the most, and appears to be lenticular. It runs about 80 per cent 'lime' or calcium carbonate, 2 per cent magnesium carbonate, and about 18 per cent insoluble material (probably silica). This limestone is a non-marine deposit and contains the ostracod Carbonita inflata (Jones and Kirkby)<sup>1</sup>.

Rocks locally referred to as 'limestone' on Prince Edward Island are in fact calcareous sandstone and calcareous shale-breccia. The latter has locally been used on the island for lime kiln operations, but judging by the abandoned kilns it did not prove satisfactory or economical. This calcareous rock constitutes only a minor member of the generally shaly formations of the western part of Tignish map-area; it is more important in the more-sandy eastern part. It is generally associated with conglomeratic horizons. The best exposures are along Mill and Kildare Rivers and around North Point. This calcareous breccia is the most variable rock on the island as regards both its distribution and its 'lime' content. The breccia occurs as lenticular beds. Where calcium carbonate constitutes the entire cement between scattered shale fragments, the lime content may run as high as 70 per cent, but where the shale fragments are more closely packed or where sand also occurs between them, a corresponding marked decrease in 'lime' is to be expected.

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<sup>1</sup>Identification by M. J. Copeland, Geological Survey of Canada.



No exposures of the better-grade limy shale breccia were noted in the map-area, but the occurrence of such boulders in the glacio-fluvial deposits north of Alberton and at the head of Mill River suggests the presence of such rock beneath the drift mantle at these localities.

### Ground Water

Tignish map-area, like all parts of Prince Edward Island, relies entirely on ground water for its domestic and industrial supplies. There is no shortage of available ground water in the area, though seasonal shortages have been experienced locally. Such shortages occur especially where the bedrock is mainly shale or siltstone. Most of the shale, however, contains intercalated porous sandstone or is fractured, and adequate water supplies can be obtained. When shortages do occur, sufficient water can generally be obtained by digging or drilling deeper, or by the proper construction of a larger-sized bored or drilled well. Locally, where surficial deposits of sand and gravel are thick enough (15 feet or more), 'sand points' may be employed to obtain domestic supplies.

### Sand

Sand deposits along the north shore of central Prince Edward Island are an important tourist attraction; they provide excellent beaches, sheltered harbours for boats and game birds, and scenic vistas. In Tignish map-area, however, such sand deposits are relatively unimportant, except east of Alberton where a sand spit and a bay-mouth bar separate the Kildare and Mill River estuaries from the Gulf of St. Lawrence. These deposits are also a potential source of sand for certain fill or for construction purposes. Should the need arise, sand east of Alberton might be used in the manufacture of sand-lime brick, as is now being done at Bothwell in eastern Prince Edward Island. The sand near Alberton is not pure enough to be used as glass-sand or for silica brick.

### Gravel

The gravels are the only deposits in Tignish map-area that are of foreseeable direct economic use. These are needed primarily for road dressing, but are used also for heavy fill. The Pleistocene and Recent gravel deposits are of glacio-fluvial, glacio-marine, and marine origin. For heavy fill, the best grades are the gravels deposited by the glacial streams where the turbulent action of the water concentrated the harder stones; the best gravels for road dressing however, are those resulting from the weathering of the conglomerate bedrock.

### Conglomerate Gravel

The conglomerate is a mixture of quartz, chert, jasper, greywacke and porphyry pebbles in a sandy matrix with a calcareous

cement; in a few places it contains a minor amount of red iron oxide or black manganese oxide. Under certain conditions of weathering the carbonate bond has been loosened, and the rock has broken down to form a gravel. As the conglomerate tends to be lenticular and, except where it outcrops on the seashore, is almost invariably covered by a mantle of till, the beds are not readily traceable; hence the possible continuity of these highly desirable 'gravel' deposits is never clear.

Some weathered conglomerate or 'gravel' probably existed prior to the last glacial period, for pebbles from the conglomerate are locally abundant in the till. A large part of these 'gravels', however, may have developed in the period since the ice retreated from the area.

Conglomerate 'gravel' is known at only two places in Tignish map-area—at Piusville and on Mill River at Fortune Cove. In both places the gravel grades downward into hard conglomerate. The Piusville occurrence is by far the more important; the gravel there has a better lateral continuity and a depth of about 4 to 6 feet. It has been opened by a pit north of the Piusville school on the south side of the railway, and one to the northwest of Piusville station. The till mantle ranges in thickness from practically zero to about 6 or 8 feet. Where the till is more than 3 1/2 feet thick it is at present impracticable to remove the gravel. The areas both north and south of the present pits merit exploration for further occurrences, as the conglomerate beds are believed to trend in these directions. The 'gravel' at Fortune Cove has been less extensively worked. The till mantle is only about 2 feet thick, but the pebble horizons are lenticular and bedded with much sandstone.

Conglomerate with a very thin gravel capping was noted near an old sawmill on the east side of Kildare River opposite the mouth of Huntley River. The till in this area contains many pebbles, which implies that glaciation removed much gravel from this region and little has formed since. Hard, unweathered conglomerate is exposed in many places on the shores around North Point, but 'gravels' are not likely to be found inland from this locality as the sea has scoured the bedrock and left it bare or with but a thin sand cover. Weathering since deglaciation does not appear to have been extensive here, and no 'loose' conglomerate beds were observed. Some sandstone however has weathered to a soft friable product to a depth of 4 feet.

#### Glacio-fluvial Gravel

Glacio-fluvial gravel is of considerable importance in Tignish map-area as a source of road materials and heavy fill for dams, weirs, docks, etc. The esker-kame ridges contain well-sorted and well-sized materials from which stones of specific sizes can be removed as desired. The gravels are generally screened however, and the fine material is removed for road dressing, whereas the coarse material is used for heavy fill. With the aid of a crushing unit, the large boulders (commonly more plentiful than necessary to meet the demand) can also be broken down for road dressing. The materials of

the kame-esker ridges and of outwash aprons may vary considerably in different parts of the map-area because of variations in the local strata from which the glaciers plucked their load of rocks, later to be fed into the glacial streams. Hence the Piusville - St. Lawrence esker is quite unlike the Kildare River - Huntley River gravel ridges.

Test-pitting of the short gravel ridge northeast of Greenmount should reveal further supplies of fine gravel. West of Greenmount, stripping and test-pitting would probably reveal appreciable fine gravel, both at the surface and beneath a thin capping of till. Much good gravel remains in the ridge at the head of Kildare River, but large-scale operation has been limited by a crossroad and farm buildings. A crushing and screening plant at this locality would help remove some of the undesirable soft sandstone and at the same time produce excellent road material from the large boulders of hard, durable, calcareous sandstone and breccia.

The well-located Huntley River gravel deposit has been extensively worked, and large quantities of crushed materials have been stockpiled to meet demands. By 1957 the operation had extended from near the highway west to near the railway. Exploitation to the east is prevented by the location of the highway and a few houses, but some gravels could be removed from the eastern part of the peninsula butting into the wide part of Huntley River, and from along the north bank where a narrow fringe of gravel extends as far as Kildare River. The maximum thickness of gravel there, however, is 25 feet, with most of it only 10 to 15 feet above the river and tide-level. Toward Kildare River, bedrock rises above river level and further limits the depth of gravel. The proximity of the railway at the western end of the gravel pit will necessitate suspending gravel removal in this direction; fortunately the deposit bends southwesterly so that gravel can be removed from alongside the railway southwestward to a crossroad and another bend in the railway. At the open end of the 'V' made by the railway leading in and out of the town of Alberton, the esker is traceable through the woodland and no doubt holds appreciable quantities of excellent road gravel there. Though the ridge is narrower than at Huntley River it has a length of more than a mile across the mouth of the 'V' in the railway, with another half mile of ridge occurring south of the railway and highway along the head of Hill River.

The Piusville - Miminegash River esker may not yield as good a grade of gravel as that in the Huntley River - Kildare River area, but suitable gravel for general road-construction purposes may be found when the ridge is opened up. As the direction of stream flow in this ridge may have been to the north, concentrations of the Piusville conglomerate gravel may be found here. The ridge might be opened up along Miminegash River southeast of St. Lawrence to provide sandy gravels if required. Glacial boulders, including granitic, volcanic, and diabasic types found along the length of Miminegash River, have been derived from this esker. A single pit in the northern part of the ridge southeast of St. Lawrence where Miminegash River splits into several branches, reveals the typical anticlinal structure expected of an esker but gives no indication of the

direction of stream flow. The material there is a rather loose sandy gravel largely composed of cobble-size stones, many from igneous rocks. Unfortunately, the locally derived stones are mostly rather soft, non-calcareous sandstones. This type of gravel would be excellent as heavy road-fill for swampy and clayey areas. Further exploration in this area will probably reveal some better-grade gravel for road dressing.

A test and borrow pit near the southwestern end of the esker revealed well-bedded sand with minor pea-gravel. At the sharp bend in the esker north of Piusville, some 10 feet of esker gravel was removed before the weathered conglomerate 'gravel' was encountered. The gravel appears to have consisted of conglomerate pebbles mixed with pebbles and cobbles of igneous rocks and a rather high proportion of sand, but because of slumping and operations in connection with removal of the conglomerate gravel, little can be learned of the true nature or attitude of the material.

The gravel deposits east of Glengarry in the southwest corner of the map-area appear to be of kame and, possibly, crevasse-filling origin. They are mostly thin cappings and fringes on and around till knobs. One narrow ridge along the east side of the north-south road east of Glengarry is traceable for about 3/4 mile. Test-pitting would probably reveal some pebble-cobble gravel, but the supply would not be great as the deposit is likely shallow. Southwest of Glengarry on the Tignish-O'Leary map-boundary, a small kame, which is believed to be gravelly in nature, trends southward into O'Leary map-area.

#### Glacio-marine and Raised Marine Gravel

These deposits are mainly sandy, but in places they are gravelly and of commercial interest. They comprise beaches and bars lying between sea-level and an elevation of 75 feet.

Northeast of Tignish, gravel has been obtained from a pit on the east side of North Point road; here it occurs at a maximum elevation of about 30 feet and is reported to extend to a depth of at least 25 feet. The uppermost beds dip westward at 5 degrees and are composed chiefly of sand-, gravel-, and minor cobble-sized materials; the beds at depths of 8 to 16 feet dip westward at 25 degrees and consist of coarser materials including some boulders. The stones comprise rounded pebbles (derived from the conglomerate), rounded but flat sandstone pebbles and cobbles, variously rounded igneous pebbles and cobbles of glacial derivation, and a few cobbles of conglomerate. About 60 per cent of the pebbles and cobbles are red sandstone, most of which are soft non-calcareous types; the other 40 per cent are hard, more durable rocks. The gravel in this pit underlies an appreciable area west of the North Point road; it extends southeastward to the shore north of Tignish Shore and thence southward beneath the sand dunes for at least half a mile. The road along this duned area was built from gravel removed from a 7-foot-deep pit at its northern end where it connects with a crossroad. The

material is a pebble gravel with a sparse scattering of sandstone pebbles and harder 'foreign' pebbles. Similar gravel is also present on the north side of Bain Creek and extends inland to the west of the North Point road where it is covered by thick deposits of sand. Both outwash and glacio-marine gravel are probably represented here.

Thin, small deposits of mostly poor-grade gravel occur northwest of Kildare, along the road southeast of Montrose, and in and around Alberton, with a larger deposit on Savage Island.

Gravel deposits are fairly common on the west coast of the map-area. Along the west side of North Point, 4 to 8 feet of gravel is present along the cliff-top, but its proximity to the sea cliff and the fact that it is bordered on the east by muskeg, makes it difficult to obtain; some, however, could be removed for local use. About 10 feet of gravel is exposed in the road-cut west of Nail Pond corner where it occurs at an elevation of about 50 feet, representing a beach deposit in a small cove when the sea stood at that elevation. Gravel also occurs both on the south side and 1 mile east of Black Pond. A medium-sized borrow pit in the latter deposit revealed east-dipping beds. No shell fragments could be found, but the deposits probably formed when a large ice-block still occupied the Black Pond area, during the glacio-marine stage.

From Black Pond south to Miminegash, gravels that represent beach deposits are encountered in many places, especially near the upper limit of the marine-overlap area. They are generally sandy and commonly contain too much soft sandstone to make good road materials. Some of the gravels are useful, however, as an addition to the road base, which in this area is composed of clay till.

Gravels are of widespread occurrence from near Little Miminegash Pond southward to Campbellton, Burton, and the southwest corner of the map-area. They have been removed for local roadwork from a pit at the shore of Little Miminegash Pond and from small borrow pits at several places along the road to the southwest.

#### Recent Beach Gravel

In coves along rugged parts of the shore, especially where conglomerate or calcareous shale breccia is present, gravels are continually being thrown up on the beach by the waves. Where some of these coves are accessible by road or trail they have provided a source of gravel from time to time in the past. The largest boulders of durable calcareous breccia and sandstone have also been gathered and hauled away for anchoring docks and breakwaters. Considerable gravel and boulders has been removed from the west-coast beaches between the North Point muskeg and Nail Pond, and lesser amounts have been removed from many other places on both shores of the map-area.





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