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GRANULAR AGGREGATE-RESOURCE MAPPING OF THE GANDER LAKE (NTS 2D/15), GANDER RIVER (NTS 2E/2) AND COMFORT COVE–NEWSTEAD (NTS 2E/7) MAP AREAS

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ABSTRACT

This report gives preliminary results of 1:50,000 scale granular aggregate-resource mapping in the Gander Lake, Gander River and Comfort Cove–Newstead map areas of northeastern Newfoundland. Field sampling concentrated on glaciofluvial outwash deposits, which are the major source of sand and gravel in the province. The largest known outwash deposits are located at Southwest Gander River, Careless Brook, Birchy Bay and Burnt Lake. These deposits have a low silt–clay content necessary for good quality aggregate. However, petrographic numbers are variable and usually too high for use in concrete or asphalt projects.

Most of the map area is covered by a blanket of till ranging in thickness from a few centimetres to 6 or 7 m. This type of deposit is the result of glacial deposition and generally has a higher silt–clay content than sand and gravel deposits and therefore may only be suitable for land-fill type projects. Large till deposits are located near Salmon River and Little Harbour.

INTRODUCTION

The 1989 field season marked the beginning of a regional granular aggregate-resource mapping program for the island of Newfoundland. The objectives of the program are to locate, map and sample all sand, gravel and sandy till deposits. These deposits are excellent sources of low silt–clay materials, which are necessary for use in concrete, asphalt and road-construction projects.

Mineral Aggregate–A Brief Description

Mineral aggregates as used in the context of this report, are defined as any hard, inert material such as gravel, sand, crushed stone, stone or other mineral material that is used in the construction industry (Carter, 1981). They are used extensively in all types of construction activities related to domestic, industrial or other developments. These materials can be, (a) used in an unprocessed form as pit run, (b) processesd and used as Class A and B gravels, and (c) mixed with a cementing agent to form concrete, asphalt, mortar, etc. Road construction is one of the largest consumers of aggregate materials. From a municipal viewpoint, street, water and sewer service, driveway construction and building foundations figure most prominently. Backfill is another major component, as are topsoil-type materials for landscaping.

Not all of the materials are suitable as aggregate. Vanderveer (1983) defines the quality of mineral aggregate by their composition. Aggregates containing too much or too little silt and clay when used in road construction can cause instability, such as flowage in the case of too much fine material, or the loss of compaction properties in the case of too little fine material. Too much fine material in concrete or asphalt can interfere with the bonding process between the aggregate and the cementing agent. The presence of deleterious substances such a silt–clay coating or iron-oxide staining on the surface of the aggregate, and the presence of certain friable or blade-shaped fragments, often cause bonding problems with the cementing agent, or the breakdown of particles with time.

Aggregates are high-volume, low-cost materials. The cost of transport represents, on average, 30 percent of the delivered cost, although long-distance transportation may drive the costs up to 60 percent of the delivered price (Vanderveer, 1982).

Location and Access

The field area is situated in the Gander Lake (NTS 2D/15), Gander River (NTS 2E/2), and the Comfort Cove–Newstead (NTS 2E/7) areas of northeastern Newfoundland (Figures 1 and 2).

Most of the southern part of map sheet 2D/15 is accessible by ATV's along the many abandoned logging roads and in early spring, by canoe along the Southwest Gander River. Gander Lake provides an excellent water route through the north-central part of the map sheet area. The northern section is accessible along Route 1 (Trans Canada Highway–TCH), a network of roads around the community of Gander and abandoned logging roads. Only parts of the south-central section of the map sheet have poor ground access.

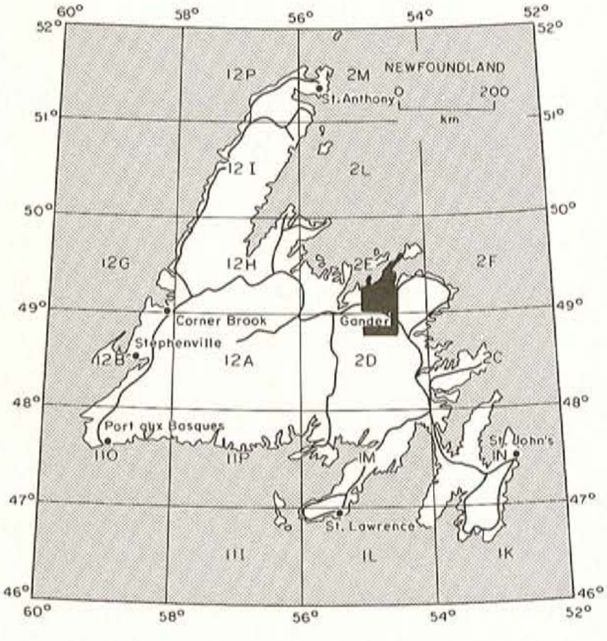

Figure 1. *Location of study area.*

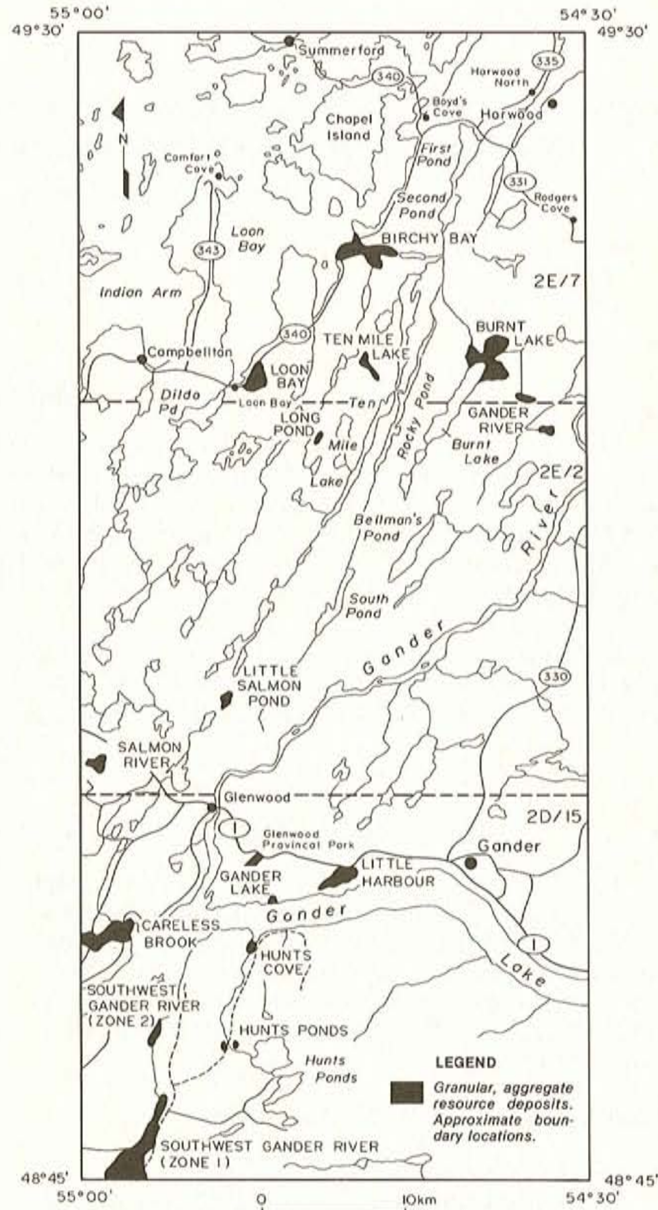

Figure 2. *Potential aggregate-resource deposits in the Gander Lake (2D/15), Gander River (2E/2) and Comfort Cove–Newstead (2E/7) map areas.*

The eastern section of map sheet 2E/2 is accessible by the Gander Bay road (Route 330). The TCH allows access to the southwest and to an extensive network of logging roads expanding throughout the central, southern, northern and northeastern areas. There are logging roads into the northwestern part but most of this area, and parts of the south-central section of map sheet 2E/2, are inaccessible by road.

Map sheet 2E/7 is easily accessible along Routes 331, 335, 340 and 343 and the many logging roads in the area. Many ponds, lakes and coastal shores are accessible by boat.

Previous Glacial Work

Surficial geology mapping at 1:50,000 scale (based largely on reconnaissance aerial photographic interpretation in 1978) has been completed in most of the study area (Kirby *et al.*, 1989). Map sheet 2E/2 was revised by Vanderveer and Taylor (1988) who used detailed aerial photographic interpretation and field observations.

An aggregate resource program was conducted by the Department of Mines and Energy from 1978 to 1982 (Environmental Geology Section, 1983a,b; Kirby *et al.*, 1983) covering a 6-km-wide corridor along all major roads and a wider radius around towns and cities in Newfoundland and Labrador. In addition to this data, geotechnical bedrock maps were compiled at a 1:250,000 scale (Bragg, 1986). Bedrock aggregate mapping is being conducted in central Newfoundland (Bragg, *this volume*) to locate suitable bedrock deposits where granular aggregates are scarce and/or poor in quality. Kirby (1983) conducted detailed sampling by backhoe testpitting in selected areas around Gander.

A geological report and map (1:253,400 scale) by Jenness (1963) of the Gander (NTS 2D/15) map area included a chapter on glacial geology with discussions on glacial deposits such as ground and end moraines, and outwash deposits including eskers, kame terraces and deltas.

Physiography

Most of the map area lies within the Notre Dame Bay Basin, which extends from the south end of Red Indian Lake to Notre Dame Bay (Twenhofel and MacClintock, 1940). Coastal areas have a high relief and low elevations, whereas inland areas have relatively low relief with relatively higher

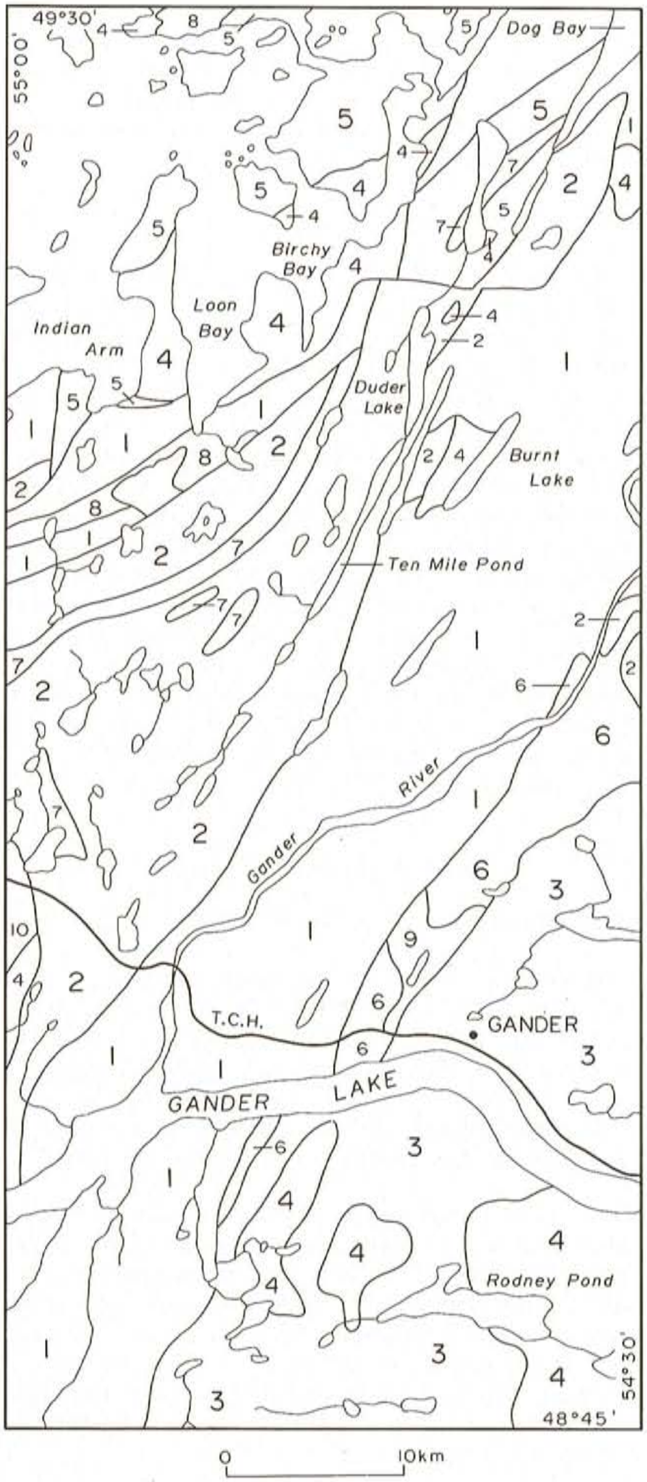

Figure 3. *Generalized geology in the Gander Lake, Gander River and Comfort Cove–Newstead map areas (after Hibbard, 1983; Blackwood, 1982 and Dean, 1977).*

LEGEND

10 *Diabase, gabbro, diorite and amphibolite*

9 *Mafic volcanic and volcaniclastic rocks, marble, chert, shale, keratophyre and conglomerate; includes ophiolitic lavas and undivided volcanic cover sequences*

8 *Pillow lava, pillow breccia, and associated volcaniclastic rocks, minor epiclastic rocks, diabase and gabbro and rare felsic volcaniclastic rocks*

7 *Agglomerate, tuff and amygdaloidal lava*

6 *Gabbro, peridotite, pyroxenite, troctolite, minor dunite, granite, trondhjemite and keratophyre*

5 *Argillite, greywacke, mudstone, bedded clastic rocks, agglomerate, gabbro, dunite, granodiorite, minor limestone and granite and large volcanic masses*

4 *Granite, quartz monzonite, granodiorite, minor tonalite and diorite*

3 *Psammite and semipelite, minor mafic tuff, conglomerate, quartzite and amphibolite*

2 *Sandstone, siltstone, conglomerate, minor calcareous rocks, greywacke and olistostromes*

1 *Slate, shale, argillite, siltstone, sandstone and minor conglomerate, chert and greywacke*

elevations. The Gander River valley carves into this area, locally producing relief between 100 and 200 m above sea level (m a.s.l.). Elevations north of Grand Lake are less than 100 m a.s.l., but south of the lake they increase abruptly to 200 m a.s.l. Glacial action is responsible for the rounded appearance of much of the land surface.

Coastline areas are usually exposed bedrock and are almost devoid of vegetation. Surficial deposits become more evident inland where most of the area is covered by a till veneer, and a few thicker deposits of up to 7 m. Outwash deposits occur in valley areas. On many slopes and even on hills having moderately flat and undulately crowns, peat has formed over imperfectly or poorly drained soils (Wells and Heringa, 1972).

Drainage is orientated principally toward the Gander River drainage basin, which runs in a northeastward direction through the map areas, largely as a result of the coincidence of the northeasterly slope of the terrain and the northeast structural trend of the underlying rocks (Jenness, 1963).

Geological Setting

Granular deposits in the map area are dominantly derived from four (Units 1-4) of the ten geological units summarized in Figure 3. The remaining rock units from these areas generally show up in small proportions (< 5 percent) and have little impact on petrographic characteristics of granular materials.

Unit 1 forms a linear zone extending from the southwest corner of the map area to the northeast corner, south of Dog Bay. Rock types in this unit include slate, shale, argillite, siltstone, sandstone, minor conglomerate, chert and greywacke. Similar rock types are also found in the vicinity of Indian Arm, Loon Bay and Birchy Bay (Blackwood, 1982; Dean, 1977).

Unit 2 extends from the northwest end of Gander Lake, northeast past Ten Mile Pond and in segmented units around Dog Bay. Rock types included in this unit are sandstone, siltstone, conglomerate, minor calcareous rocks, greywacke and olistostromes (Blackwood, 1982; Dean, 1977).

Unit 3 is located in the southeast part of the map area around the town of Gander and south of Gander Lake, principally west of Rodney Pond. Psammite, semipelite, minor mafic tuff, conglomerate, quartzite and amphibolite are rock types included in this area (Blackwood, 1982, 1989).

Unit 4 consits of isolated zones of plutonic rocks located in the southwest, west and northern parts of the map area. Granites, granodiorite, quartz monzonite, minor tonalite and diorite are rock types included in these areas (Hibbard, 1988; Kean, 1989).

By reviewing Figure 3 we can see the dominant rock types are derived from sedimentary deposits such as shale and sandstone with smaller zones of plutonic, volcanic, gabbroic and ultramafic rock types present.

References for numerous smaller units in the map area not discussed in this report include Blackwood (1982, 1989); Kean (1989); Hibbard (1988) and Dean (1977).

Analytical Methods

Field work was undertaken in a similar manner to that oulined by Kirby *et al.* (1983). Interpretation of 1:50,000 scale, black and white aerial photographs was used as a guide to locate potential resource areas. Following this, interpretation of coloured aerial photographs at 1:12,500 scale was conducted in selected areas based on deposit type, to delineate deposit boundaries accurately. Field sampling was carried out at 0.5- to 1.0-km intervals in outwash deposits, and at 1.5- to 2-km intervals in till. Till is generally regarded as poor quality aggregate due to its large silt–clay fraction. Additional samples of granular materials were taken wherever sediment-type changes were observed, where quality differences were apparent, or wherever sediments of variable quality or texture occurred together that could be mined separately.

Field work was carried out with the aid of a 4-wheel drive vehicle, ATV's, canoe and by foot traversing. Where possible, samples were taken from natural exposures such as stream cuts, shorelines and gullied areas or from man-made exposures such as road cuts, pit and quarry excavations. Where these types of exposures were not available, samples were collected from hand-dug pits, slightly greater than 1 m in depth.

Sampling provided material for petrographic and grain-size analyses, and Los Angeles abrasion and soundness test. Field sieve and petrographic analyses were done on all samples containing >8mm size material. A split of the sand–silt–clay fraction (<8 mm) was retained for laboratory sieve analyses. The laboratory sieve analyses involved drying and splitting the sample to a manageable size (70 to 140 g) and wet and/or dry sieving of each sample following the procedure outlined by Ricketts (1987).

Clast Lithology Analysis

Pebble types were examined to help determine the petrographic characteristics of the pebble fraction (16 to 32 mm) of aggregate. A petrographic number was calculated for each sample following CSA standard A23.2.30 (Canadian Standard Association, 1973) procedures. The petrographic number, ranging between 100 and 1000 is derived by taking the sum of the percentages of each rock type present in the pebble fraction multiplied by a factor (based on soundness and durability) assigned to that rock type (Bragg, *this volume*). The factor is determined by the silt–clay costing, weathering, staining, sphericity, roundness, fractures, mineralogy and texture of various rock types present in a given pebble sample. The lower the number, the better the quality of the aggregate material. For example, a clean, hard, unweathered granite would normally have a petrographic number of 100, whereas for a friable, soft shale it would be 1000. Aggregate material used in asphalt or concrete, in Newfoundland, requires a petrographic number of 135 or less (Specifications Book, 1987).

DATA PRESENTATION

Office Program

Particle-size analyses were conducted on 169 samples and lithological analyses on 135 samples. The results of particle-size analyses were used to plot cumulative graphs for each sample similar to those of Kirby *et al.* (1983) These graphs show percentages of gravel, sand and silt–clay and petrographic numbers for each sample. Individual sieve percentages can also be calculated from these graphs.

A review of landform classification data and particle-size analyses will be made and results drafted on 1:50,000 scale maps. These maps will show aggregate zones determined by quantity and type of material, sample numbers and type of sample collected (sand, gravel, silt and till). Boundaries around designated aggregate zones will be determined principally from air-photo investigations and may not represent the true extent of any deposit that can be used as a source of aggregate.

AGGREGATE-RESOURCE AREAS

The following are brief descriptions of some of the potential granular aggregate-resource deposits in the study area (Figure 2; Table 1). The descriptions include deposit location and estimated reserves (in cubic metres); exposure types where samples were collected; cumulative thickness of topsoil and iron oxide layers; average percentage of gravel, sand and silt–clay and range of petrographic numbers for each deposit.

Table 1. Summary and comparisons of aggregate zones sampled in the Gander Lake (2D/15), Gander River (2E/2), and Comfort Cove–Newstead (2E/7) map areas

		Petrographic Analyses			Grain-Size Analyses				
Deposit	Estimated m³	# of samples analyzed	Range	Average	# of samples analyzed	% Gravel (+5mm)	% Sand (78 μm) to +5 mm)	% Silt–clay 78 mm	Comments
Southwest Gander River									
(Zone 1)	>1,000,000	15	254-840	610	18	57.1	42.1	0.8	Glaciofluvial terrace with localized silt–clay pockets
(Zone 2)	<100,000	1		519	1	79.8	19.9	0.3	Shallow (<2m) outwash deposit along river bank; pebble sized material dominant; boulder free
Gander Lake	<5,000	1		957	1	79.3	20.6	0.1	Poorly sorted cobble-pebble gravel in outwash deposit
Little Harbour	>1,000,000	3	369-537	430	3	65.6	30.5	3.9	Unsorted till
Careless Brook	500,000 to 1,000,000	5	125-297	233	5	57.5	41.7	0.7	Shallow to hummocky gravel with intermittent rock outcrops and localized sand–silt zones
Hunts Cove	<500,000	2	814-999	906	2	39.0	60.8	0.2	Poorly sorted, variable sized material in glaciofluvial terrace; generally boulder free
Salmon River	500,000 to 1,000,000	3	101-119	110	3	42.6	46.5	10.9	Unsorted sandy till overlain by 2 m of bouldery till
Gander River	<500,000	2	547-610	578	2	44.9	52.7	2.4	Moderately sorted kame terraces with little boulder content
Little Salmon Pond	<500,000	1		301	2	28.6	60.5	10.9	Sandy till with moderate sorting; localized sand–silt pockets
Birchy Bay	500,000 to 1,000,000	5	401-641	496	9	33.5	65.9	0.6	Moderately to well sorted sand and gravel deltaic deposit
Ten Mile Lake	<500,000	2	532-558	545	2	43.3	54.7	2.0	Poor to well sorted sand and gravel in kame terrace
Burnt Lake	500,000 to 1,000,000	5	514-902	643	10	36.4	62.4	1.2	Poor to moderately sorted sand and gravel with sporadic sand–silt layers.

Note: Estimated quantities given in Table 1 are based on air-photo analysis and field investigation where road cuts, shallow hand-dug pits and natural exposures permitted. Detailed sampling methods such as drilling were not conducted. Particle-size percentages are based on a compilation of samples for each deposit and do not take into account extent and depth of units at any one location.

Southwest Gander River

The Southwest Gander River is situated in an area of dense forest growth in the southwest corner of map area 2D/15. Large volumes of glaciofluvial outwash material are located along the banks of this river forming terraces several kilometres long and up to 14-m high. Two zones of granular aggregate deposits were mapped along the Southwest Gander River.

Zone 1 is located on both sides of the river in the southeast corner of the study area and extends beyond this area in a southerly direction along the river channel (Figure 2). This zone is over 7-km long, up to 2-km wide and has variable thickness up to 14 m (Plates 1 and 2). It forms the largest deposit (>1,000,000 m³) of low silt–clay aggregate. River, quarry and road exposures indicate cumulative topsoil and iron-oxide layers are generally less than 1-m thick. This deposit is composed of variable size material and localized silt–clay pockets. Particle-size analyses of 18 samples gave an average of 57.1 percent gravel, 42.1 percent sand and 0.8 percent silt–clay.

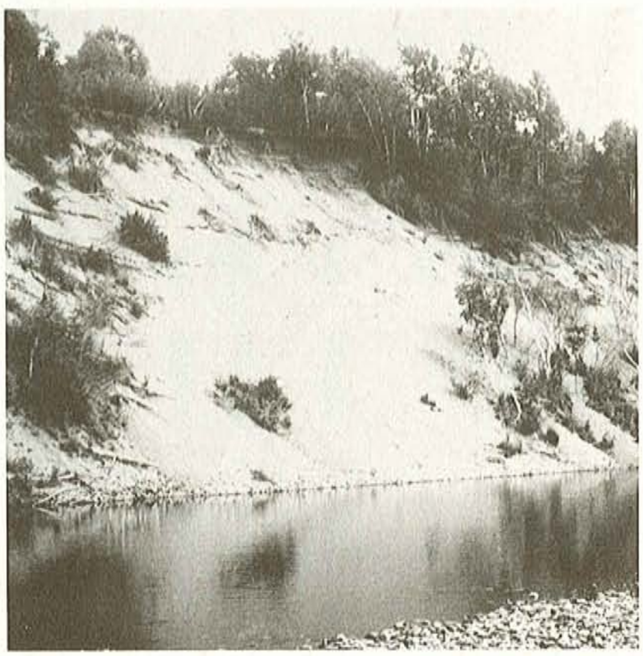

Plate 1. *Glaciofluvial terrace containing a 4-m-thick unit of moderately sorted gravel, overlying 10 m of stratified sand at Southwest Gander River.*

Petrographic numbers of 15 samples range from 254 to 840 with an average of 610. The quality of this deposit is greatly reduced by the high content (approximately 60 percent) of pelitic schist, micaceous sandstone and weathered pebbles, resulting in high petrographic numbers. Other rock types include shale, siltstone, granite, quartz pebbles and conglomerate.

Zone 2 is located on the west bank of the Southwest Gander River, approximately 2 km south of Gander Lake

Plate 2. *Cobbly pebble gravel in 8-m-high quarry exposure at Southwest Gander River.*

(Figure 2), and is about 2-m thick. Field observations at one river exposure showed a cumulative topsoil and iron-oxide thickness of 0.5 m. Material in this deposit is dominantly composed of pebbly gravel of low boulder content. Particle-size analysis of one sample shows 79.8 percent gravel, 19.9 percent sand and 0.3 percent silt–clay.

A high petrographic number of 519, determined from pebble-type analysis of one sample was due principally to the 43 percent sandstone, 26 percent pelitic schist and 10 percent highly weathered (undefined) pebbles. Other rock types included were siltstone, gabbro, granites and quartz pebbles.

Gander Lake

The Gander Lake deposit is a small glaciofluvial gravel–sand deposit bordering the north side of Gander Lake, 3.5 km south of Glendwood Provincial park on map sheet 2D/15 (Figure 2). The deposit is overlain by dense tree growth and situated near the base of a steep slope. This deposit is approximately 30-m long, 20-m wide and 6-m high. One shoreline exposure showed a cumulative topsoil and iron-oxide thickness of 0.3 m. Material in this deposit is composed of poorly sorted, variable grain sizes. Particle-size analyses of one sample show 79.3 percent gravel, 20.6 percent sand and 0.1 percent silt–clay. A high petrographic number of 957 determined from pebble analysis of one sample resulted principally from a 93 percent pelitic schist content in the pebble fraction, which makes this a poor aggregate. Other rock types present are fine sandstone and granites.

Little Harbour

The Little Harbour till deposit is situated approximately 8 km west of Gander between the TCH and Gander Lake, on map sheet 2D/15 (Figure 2). This is a substantial hummocky till deposit covering approximately 2 km² having an average thickness of 7 m and the material is used as fill in the Gander area. It is poorly sorted and contains variable sized clasts. Particle-size analyses of three samples show 65.6 percent gravel, 30.5 percent sand and 3.9 percent silt–clay.

Petrographic numbers for three samples are 369, 384 and 537. The poor petrographic quality is due to the 24 percent siltstone, 17 percent highly weathered pebbles, 10 percent metasediments and 10 percent amphibolite pebbles that are found in the samples. Other rock types present are slate, sandstone, granite, quartz, gabbro, ultramafic rocks, pelitic schists, diorite and peridotite.

Careless Brook

The Careless Brook deposit is situated near the northwest end of Gander Lake on map sheet 2D/15 and extends from Careless Cove westward beyond the map area (Figure 2). This is an outwash deposit, consisting of gravel veneers (<2m) (Plate 3) and hummocky gravel, with intermittent rock outcrops. Road- and river-cut exposure showed a cumulative topsoil and iron-oxide thickness of 0.4 m. Material in this deposit is generally poorly sorted with textures varying from boulders to fine sand. Particle-size analysis of 5 samples gave an average of 57.5 percent gravel, 41.7 percent sand and 0.7 percent silt–clay. A localized silt, sand hummock within this area showed 84.6 percent sand and 15.4 percent silt–clay.

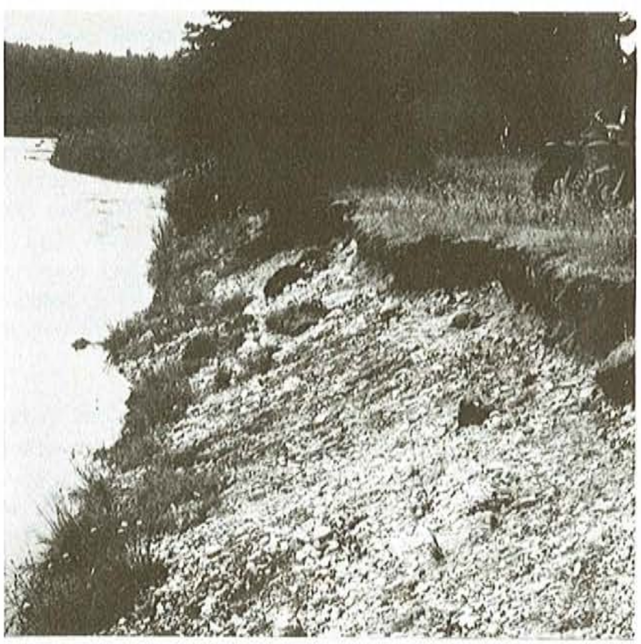

Plate 3. *2-m-high gravel exposure in outwash deposit along bank of Careless Brook.*

Petrographic numbers of 5 samples in the Careless Cove deposit range from 125 to 297 with an average of 233. The major rock type is granite, with minor amounts of undefined, highly weathered pebbles and gabbro. The granites are medium to coarse grained and fracture easily, resulting in low quality aggregate.

Hunts Cove

Hunts Cove is located near the central part of the southern shoreline of Gander Lake (Figure 2). The sand and gravel deposit forms a small glaciofluvial terrace that extends southward along Hunts Brook to the east side of Hunts Cove (Plate 4). This deposit is approximately 700-m long, 200-m wide and up to 5-m thick. Measurements at one shoreline exposure and one hand-dug test pit showed a cumulative topsoil and iron-oxide layer thickness of 0.5 m. Material in this deposit is poorly sorted. It is generally boulder free and has a gravelly sand texture. Particle-size analyses of two samples gave an average of 39.0 percent gravel, 60.8 percent sand and 0.2 percent silt–clay.

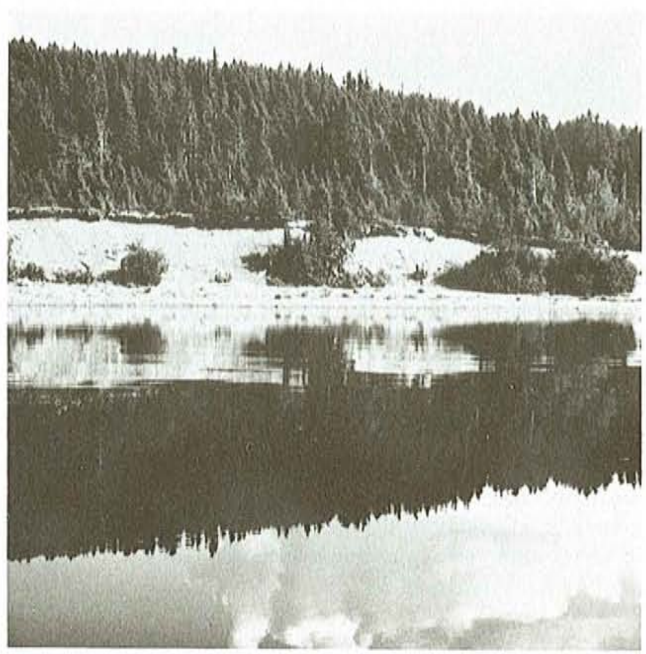

Plate 4. *4-m-high outwash deposit showing gravel terrace at Hunts Cove, Gander Lake.*

Petrographic numbers determined from analyses of two samples are 814 and 999. These high numbers are primarily the results of the 80 percent pelitic schist, pebble content, which makes this deposit a poor aggregate. Other rock types present are weathered (undefined) pebbles, sandstone, quartz and granite.

Salmon River

The Salmon River deposit is located approximately 3 km west of Salmon River on the south side of the TCH on map sheet 2E/2 (Figure 2). It is situated in an area of hummocky till that covers approximately 1.5 km². Samples were collected from one quarry exposure and from 2 road cuts. Cumulative topsoil and iron-oxide layers averaged 0.5 m in thickness. Beneath the oxide layer is a 2-m-thick bouldery-cobble unit (Plate 5) overlying variable size, poorly sorted, silty–sandy till. Sieve analysis of three till samples gave an average content of 42.6 percent gravel, 46.5 percent sand and 10.9 percent silt–clay.

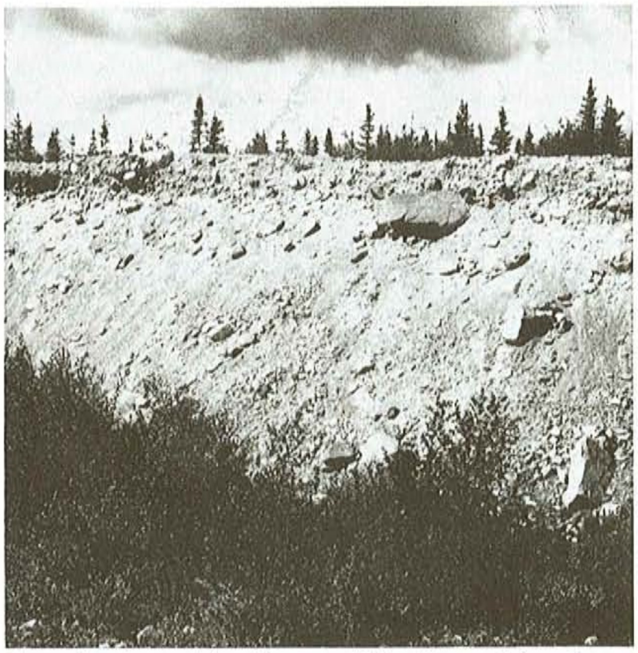

Plate 5. *2 m of bouldery–cobbly till overlying 6 m of sandy–silty till along 8-m-high quarry exposure near Salmon River.*

Petrographic numbers determined from analyses of three samples in this deposit are 100, 111 and 119, and up to 173 in nearby areas. The low petrographic numbers are due to the high content of granite and gabbro pebbles, which usually gives a good quality aggregate. Higher petrographic numbers in surrounding areas are due principally to the presence of highly weathered pebbles.

Petrographic characteristics of this deposit indicate it is the most suitable aggregate deposit within the study area. However, the 2-m-thick boulder–cobble layer near the surface will lead to higher excavation cost due to the need for screening or crushing. Added to this, is the high silt–clay content, which will have to be screened or washed out for this material to produce a good quality aggregate for concrete or asphalt purposes.

Gander River

The Gander River sand and gravel deposit is situated 4 km southwest of Clarks Head in Gander Bay and 2 km west of the Gander River in the northeast corner of map sheet 2E/2 (Figure 2). This deposit is a 5-m-high kame terrace of undetermined aerial extent. Measurements at two, 2-m-high road-cut exposures indicate cumulative topsoil and iron-oxide layers, having an average 0.5-m thickness. Observations at these exposures also indicate a moderately sorted sediment and low boulder content within this deposit. Particle-size analyses of two samples gave an average 44.9 percent gravel, 52.7 percent sand and 2.4 percent silt–clay.

Petrographic numbers determined from analyses of two samples were 547 and 610. These high numbers are due principally to the 31 percent of highly weathered pebbles and 22 percent shale content in the pebble fraction. Other rock types included in this sample are siltstone, medium grained sandstone and quartz pebble.

Little Salmon Pond

The Little Salmon Pond till deposit is located 3 km northwest of Gander River and 4 km northeast of the TCH on map sheet 2E/2, at the northeastern end of Little Salmon Pond (Figure 2). It comprises an area of lineated till approximately 0.5-km long, 0.3-km wide and up to 4-m thick. Field observations at one road-cut exposure indicate a cumulative topsoil and iron-oxide layer thickness of 0.5 m. The deposit is a poorly sorted silty–sandy till, with irregular spaced silt–clay pockets. Particle-size analyses of two samples gave an average of 28.6 percent gravel, 60.5 percent sand and 10.9 percent silt–clay.

Petrographic analysis of one sample gave a petrographic number of 301. Rock types consist of sandstone, siltstone, granite, gabbro, quartz pebbles, weathered pebbles and shale. Shale, sandstone and weathered pebbles are the major deleterious rock types forming poor quality aggregate material in this deposit.

Birchy Bay

The Birchy Bay sand and gravel deposit extends eastward from the east side of Birchy Bay to approximately 3 km along Jumper Brook (Figure 2). The deposit consists of a large raised deltaic deposit up to 15-m thick (Plate 6). Cumulative topsoil and iron-oxide layers observed in several quarry exposures showed an average thickness of 0.5 m. Material in this deposit ranges from poor to well sorted sand and gravel. Textures vary throughout the deposit, from sand to sandy gravel, and irregularly spaced silt–clay pockets. Particle-size analyses of nine samples gave an average content of 33.5 percent gravel, 65.9 percent sand and 0.6 percent silt–clay.

Petrographic numbers of five sample analyzed, range from 401 to 641, with an average of 496. Poor petrographic qualities are principally due to high proportions of poor quality sandstone (61 percent) and weathered pebbles (18 percent). Other rock types include shale, granite, gabbro, pelitic schist and siltstone.

A large proportion of this deposit has been excavated. Other parts appear inaccessable due to a residential area, cemetery, sawmill and agricultural area. Less than 50 percent of the deposit appears available for future aggregate use.

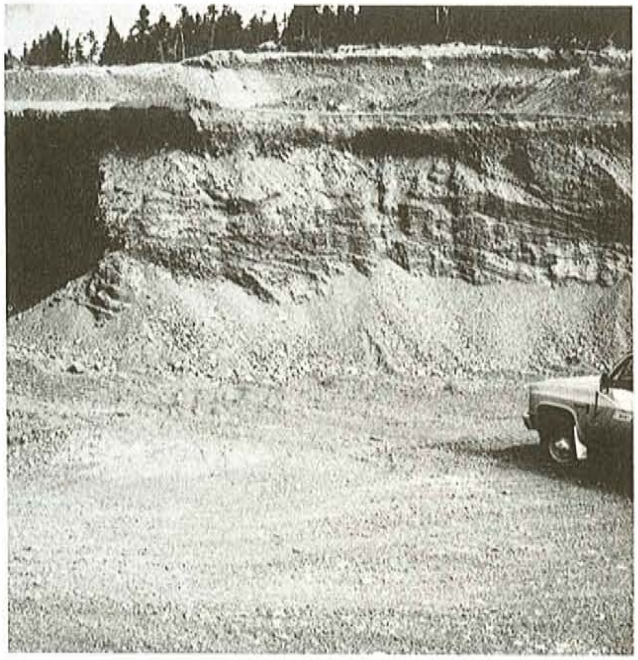

Plate 6. *Stratified sand and gravel in 12-m-high qurry exposure in deltaic deposit at Birchy Bay.*

Ten Mile Lake

The Ten Mile lake gravel and sand deposit is located at the northwest end of Ten Mile lake on map sheet 2E/7 (Figure 2). It consists of a kame terrace, up to 3-km long, 0.2-km wide and up to 5-m high. Measurements in one quarry exposure and in one hand-dug pit showed a cumulative topsoil and iron-oxide layer thickness of 0.4 m. The material consists of poor to well sorted sand and gravel. Particle-size analyses of two samples gave an average content of 43.3 percent gravel, 54.7 percent sand and 2.0 percent silt–clay. Silt–clay varied from 0.56 to 3.48 in these two samples.

Petrographic numbers determined from pebble analyses of two samples were 558 and 532. These high numbers are principally due to the 44 percent poor quality sandstone and 25 percent shale content. Weathered pebbles, siltstone, quartz pebbles and granite compose the remainder of rock types in this deposit.

Burnt Lake

Burnt Lake is located 6 km west of Clarke's Head on Gander Bay on map sheet 2E/7 (Figure 2). An outwash gravel and sand deposit borders the north and northeast side of the lake covering approximately 2 km^2 in area. Samples in this area were collected from bulldozer-dug pits, road cuts and quarry exposures. The cumulative thickness of the topsoil and oxide layers measured at these sites averaged 0.4 m. This deposit varies from poor to moderately sorted sand and gravel, although sporadic sand–silt layers were also sampled. Sieve analyses of 10 samples gave an average content of 36.4 percent gravel, 62.4 percent sand and 1.2 percent silt–clay.

Petrographic numbers, determined from analyses of five samples, ranged from 514 to 904 with an average of 643. High numbers in this deposit are principally the result of 45 percent pelitic schist content in the pebble fraction. Other rock types include sandstone, siltstone, quartz pebbles, weathered pebbles (undefined), gabbro, granite, diorite and basalt.

Other Resource Areas

Besides the resource areas outlined above, samples were also collected from a number of other locations. These sites were not extensive or were poor in both petrographic and granular quality. These areas are near Long Pond, south of Rodney Pond and at Loon Bay (Figure 2).

SUMMARY

Granular aggregate deposits were sampled at several locations within the study area to determine their potential for use in the aggregate industry. Data reveals major differences between deposits, such as estimated reserves and gravel, sand and silt–clay percentages and petrograhic numbers (Table 1).

Most deposits are large enough to support a quarry operation. Deposits vary in size but may require more work to accurately determine reserves of material in each. The largest deposit determined from field observations and air-photo interpretation is at Southwest Gander River, exceeding 1,000,000 m^3. Other large deposits are at Birchy Bay and Burnt Lake. These are believed to be in excess of 500,000 m^3 and may exceed 1,000,000 m^3.

Several deposits have silt–clay percentages of less than 1 percent, which improves the quality of material by reducing the need for washing, thereby reducing overall cost. In some areas, screening or crushing will be necessary to remove the coarse fraction.

Petrographic results were generally poor throughout the study area, with the exception of the deposit near Salmon River where petrographic numbers ranged between 101 and 119. In other areas, petrographic numbers are generally greater than 200 indicating poor aggregate quality for use in concrete and asphalt projects.

FUTURE WORK

The extent and depth of most deposits sampled during the 1989 field season could not be accurately determined from the few samples collected and from the small exposures visible in hand-dug pits and road cuts. For these reasons, further sampling is necessary to determine the extent of deposits. This will be achieved partially during the 1990 field season when backhoe-test pitting will be used in selected deposits. It is anticipated that work will continue northward from the 1989 study area to map sheet 2E/10 and westward to map sheets 2D/14 and 2E/3, 4, 6 and 11.

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