

GRANULAR AGGREGATE MAPPING IN NTS MAP AREAS 1N/2, 1N/11, 11O/14 AND 11O/15

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ABSTRACT

The 2000 field season involved mapping of granular aggregate deposits in the Ferryland, Harbour Grace and Codroy Valley areas. The purpose of this ongoing mapping is to locate sources of suitable clean, sand and gravel. The need for these resources is especially critical on the Avalon Peninsula where current supplies are low and demand is extremely high.

In the Ferryland area, sampling of aggregate deposits was primarily conducted in man-made and natural exposures of glaciofluvial outwash deposits that are considered to have the best potential for good, clean aggregate. The largest deposits are located along the LaManche River and at Horse Chops Pond. Smaller deposits occur near Calvert, Birchy Pond and Lun-drigans Gullies. A clean, coarse aggregate having less than one percent silt-clay and variable sand concentrations is present in most deposits. Some deposits in the Horse Chops Pond area may contain significant quantities of suitable granular aggregate, although variable grain sizes and locally significant silt-clay contents, made it difficult to determine the overall quality of the aggregate. Mapping in the Harbour Grace area was unsuccessful in finding new sand and gravel deposits, although efforts to find glacial till having a low silt-clay content are continuing.

The Codroy Valley contains extensive deposits of aggregate. However, possible future aggregate-quarry developments in this area have the potential to conflict with existing residential developments, agricultural and silviculture projects. Thus, there is a need to accurately map the aggregate deposits, and to preserve areas that have the greatest potential for future aggregate use. In 2000, mapping was successful in identifying new aggregate deposits, extending boundaries of previously outlined deposits, and downgrading the potential for quarry developments in other areas.

INTRODUCTION

The objectives of the aggregate mapping program are to locate, map and sample sand, gravel and till materials, in support of construction activities within the survey area, and to make recommendations for the reservation of deposits for future developments. Mapping aggregate deposits will assist road construction, contractors and consultants to determine sources and quality of material available in a given area, and to evaluate the transportation costs of these materials to a specific job site, which greatly affects construction costs. There are numerous aggregate suppliers ranging from small local producers to major firms with an output of more than 100 000 tons annually. The aggregate industry is extremely competitive, especially where large multi-million dollar contracts are involved. It is 'a game of pennies' whereby an aggregate producer could win or lose an important contract on the basis of one cent or less per ton.

Definitions of aggregate are variable, depending on the producer, location and use of the material (Smith and Collis,

1993). It generally includes sand, gravel and crushed stone or a combination of these materials, and having a grain size that is greater than that of silt. Aggregates, as used in the context of this report, are defined as any hard, inert material such as gravel, sand, crushed stone or other material that is used in the construction industry (Carter, 1981; Rutka, 1976). Aggregates are used extensively in all types of construction activities related to domestic, industrial or other developments. Natural sand, gravel and crushed rock aggregates are fundamental to the man-made environment and represent a large proportion of the materials used in the construction industry. Road construction is a major use of aggregate material. Water and sewer systems, driveway construction and building foundations all require aggregate. Other major uses include backfill and topsoil for landscaping.

Aggregate materials can be: i) processed and used as Class A gravel, i.e., aggregate less than 19 mm diameter having a specified proportion of finer grain sizes and 3 to 6 percent silt-clay (Department of Transportation, 1999) or

Class B gravel, i.e., aggregate less than 102 mm diameter having a specified proportion of finer grain sizes and 3 to 6 percent silt–clay (Department of Transportation, 1999); ii) processed to mix with a cementing agent to form concrete, asphalt and mortar; and iii) used as unprocessed, out of pit material.

Not all quarry materials are suitable as aggregate. Vanderveer (1983) defined the quality of aggregate by its 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 (>2 percent) can interfere with the bonding process between the aggregate and the cementing agent. However, some high silt–clay aggregate (greater than 15 percent silt–clay) can be used for earth-filled dams, fill and subgrade road material. The presence of deleterious substances (e.g., silt–clay coating or iron-oxide staining on the surface of the aggregate), or of blade-shape fragments, commonly cause bonding problems with the cementing agent, or the breakdown of aggregate with time.

The demand for aggregate is directly associated with construction activity. Road construction and maintenance are by far the most important users of aggregates. Aggregates are characterized by their high bulk and low unit value so that the economic value of a deposit is a function of its proximity to a market area and its quality and size (Vanderveer, 1982). Thus, the location of resources relatively close to the users is important. The potential for extractive development is greatest in urban fringe areas where land-use competition is greatest. Comprehensive planning and resource management strategies are required to make the best use of available resources, especially in those areas experiencing rapid development. Such strategies must be based on a sound knowledge of the total aggregate resource base at both local, and regional levels.

PHYSIOGRAPHY OF THE STUDY AREAS

FERRYLAND

The Ferryland area is located on the east-central coast of the Avalon Peninsula (Figure 1) where the terrain is hilly with low to steep slopes. There are four main, east–west-trending valleys containing rivers that flow east into the Atlantic Ocean. These are the LaManche, Horse Chops, Cape Broyle and Aquaforte valleys. The LaManche and Horse Chops valleys are the widest, about 1 km. In the area between the LaManche and Horse Chops rivers elevations reach 822 m.

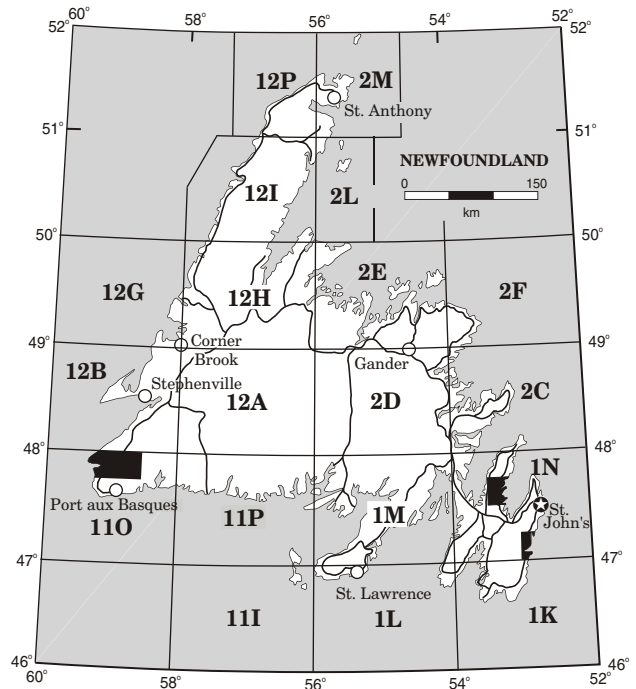


Figure 1. Study areas for the field program for 2000.

Till is the dominant overburden type in this area, generally deposited as till veneers over bedrock. Numerous till ridges occur in the Brigus South area and minor till ridges occur near the northwest end of Horse Chops Pond. Bedrock outcrop is common, particularly in the northern map area. Large bog areas interspersed between outcrops are typical in the northwest, and in the south. Smaller bog units are found throughout most other parts of the map area. Glaciofluvial outwash deposits are more common along the LaManche and Horse Chops valleys. These outwash deposits occur as eskers and hummocks. Bedrock is principally siliceous sandstone and siltstone. Volcanic and plutonic rocks occur in lesser quantities.

Most of the vegetation in the area is coniferous forest. Exposed uplands and the summits of higher hills and ridges are generally stony barrens, underlain by bedrock or a thin layer of drift. The vegetation consists of stunted black spruce, bushes, grass, and moss.

Access to the Ferryland area is achieved via Route 10 that runs in a north–south direction, generally within 3 km of the Atlantic coastline; there are only two roads branching west from Route 10. These are the Cape Pond road north of the LaManche River, and the Horse Chops road on the northeast side of Horse Chops Pond.

HARBOUR GRACE

The Harbour Grace study area is located on the Avalon Peninsula between Trinity Bay and Conception Bay (Figure 1). It is characterized by generally rolling, stony, and barren surfaces and short ranges of hills rising to more than 250 m. Numerous lakes and ponds are connected by short, slow-flowing, boulder-filled streams.

The eastern coastline, along Conception Bay, has many bays, harbours and coves. The longest (6 to 9 km) are Bay de Grave, Bay Roberts, Spaniard's Bay and Harbour Grace. The coastline along these bays is steep to moderately sloping. Only where the lowland areas lie between the water and higher ground does the shore slope gently, sometimes extending inland to form valleys in a rolling, rugged plateau. From Conception Bay, the ground rises gradually south-westward to a barren, knobby upland, 150 to 250 m above sea level. The area southwest of Conception Bay is characterized by a series of southwest-oriented ridges, interspersed with numerous lakes and bog deposits.

The study area is covered by vehicle and foot traversing and much of the field area is accessible by road. An abandoned railway line crosses the study area, beginning in the south and goes as far north as Carbonear.

CODROY VALLEY

The Codroy Valley area is located in the southwest part of Newfoundland (Figure 1). It covers NTS map area 110/14 and the northwest corner of NTS map area 110/15. It is bounded on the southeast by the southern end of the Long Range Mountains and on the northwest by the Anguille Mountains. The valley occupies less than a quarter of the map area; it is a deep, triangular or funnel-shaped basin and has abrupt valley walls. The valley is a gently rolling lowland underlain by Carboniferous sandstone and siltstone (Knight, 1983). Local variations in lithology have produced corresponding variations in relief. The underlying bedrock topography has been partially modified by till and outwash deposits. Overburden consists of moderately fine- to moderately coarse-textured till and moderately coarse textured glaciofluvial materials. There is a small amount of alluvium, and poorly drained depressions that commonly contain bogs. Thin aeolian deposits can be found in a few areas near the coast, and are usually less than 0.5 m thick. The valley is drained by the Grand Codroy and Little Codroy rivers, both of which enter the Gulf of St. Lawrence in broad estuaries, partially blocked by sand spits. Elevations in the valley range from 15 to 130 m, whereas in the neighbouring Anguille and Long Range mountains elevations reach 500 to 600 m, respectively.

The area consists of well-wooded areas, cleared agricultural land, bog, outcrop areas, and barren mountain tops. In the mountain top areas, the forest consists mainly of scrubby black spruce. Shrubs and peat deposits are common and rock outcrop occur quite frequently.

The Trans-Canada Highway (TCH) runs along the valley and a good network of secondary roads connects the various communities to the highway. Forest access roads cover the wooded areas of the valley, valley slopes and mountainous areas – wherever wood can be harvested economically. Besides forestry, agriculture is an important industry for the region.

PREVIOUS WORK

Surficial geological maps of all areas exists at a scale of 1:50 000 (Vanderveer, 1988; Kirby, 1988; Catto, 1998a, b). The Codroy Valley area (Vanderveer, 1988) and Ferryland area (Kirby, 1988) maps show generalized deposits, and ice-flow features. Surficial interpretation by Catto (1998a, b) of the Avalon region, is more detailed, showing more polygons to outline deposit types. Liverman and Taylor (1989) compiled surficial data at 1:250 000 scale and later released this data in digital format (Liverman and Taylor, 1994).

An aggregate-resource study was conducted by the Department of Mines and Energy from 1978 to 1982 (Environmental Geology Section, 1983a, b; Kirby *et al.*, 1983) that covers a 6-km-wide corridor along all roads in Newfoundland and Labrador. This study outlined areas of potential aggregate within the corridor areas. In addition to these data, geotechnical bedrock maps were compiled at a scale of 1:250 000 (Bragg, 1985). Later, Bragg (1994a, b) released site location maps at 1:50 000 scale showing rock types and petrographic numbers. This was followed by a report (Bragg, 1995) with information on the petrographic quality of different rock types, to determine their potential as construction aggregate.

MAPPING AND ANALYTICAL METHODS

The assessment of granular aggregates can be complex because of the great variety of materials occurring in a single deposit, and because the available information is insufficient to determine quality of material in localized areas for pit and quarry operations. Much interpretation is involved and the potential for errors in tonnage estimates is high. Interpretation of aerial photographs (1:50 000-scale black-and-white and 1:12 500 colour) is the first stage in locating potential deposits. Interpretation is used to produce preliminary landform classification maps showing distribution and

nature of the various deposits found within an area. They have the potential to indicate a variety of tills, and sand and gravel deposits. Till is a sediment deposited by a glacier, commonly with a wide variety of grain sizes. Sand and gravel are commonly formed by fluvial action, either by glacial meltwater or present day lakes or streams or by marine processes. The landform classification is used to identify potential granular deposits that may be used in the construction industry. Granular aggregate maps are a derivative of landform classification maps. They subdivide potential aggregate deposits into high, moderate, or low potential for aggregate production. Generally, the size of the deposit can be determined if its areal extent and average thickness are known or can be estimated. Thickness values are approximations, based on the face heights of pits developed in the deposit, roadside exposure or features of the general landscape such as the height of ridges and terraces above the surrounding terrain. From all the available data, individual deposits may be assigned to one of four zones, with Zone 1 being the area of greatest potential (Kirby *et al.*, 1983).

In addition to the data collected from aerial photographs, information on the various sediment types was obtained in the field by examining natural exposures (e.g., such as stream-cuts, shorelines, and gullies) or man-made exposures (e.g., road-cuts, and pit and quarry excavations). Where exposures were not available, samples were collected from 1-m-deep hand-dug pits. In some places hand-dug pitting was not practicable because of boulders or a thick, cemented B soil-horizon, making it impossible to see the undisturbed parent material. Lack of exposures meant that deposit thickness was difficult to assess. The scarcity of vertical sections, combined with the presence of a concealing surface mat of organic material in many places, made positive interpretation of the nature and extent of the glacial sediments heavily dependent upon evaluation of the geomorphology. Thus, in most instances, surface form was an important aspect in recognition of the unit mapped. Obvious landform boundaries were the basis of many delineations.

Other features recorded were sediment thickness, stoniness, presence of compact layers and the presence of vegetation. Sampling provided material for petrographic and grain-size analyzes. Approximately 15 to 20 kg of material was collected for field sieving. Field sieving and petrographic analysis were performed on most samples containing >8 mm size material. A split (70 to 140 g) of the sand-silt-clay fraction (<8 mm) was retained for laboratory sieve analysis, which 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 procedures outlined by Ricketts (1987).

In addition to landform classification maps, information on the bedrock geology was reviewed. The suitability of

aggregate depends on physical properties and the capability of the rock to withstand stresses when it is used as a construction material. Bedrock geology information was used to help determine the petrographic characteristics (e.g., Bragg, 1995; Ontario Ministry of Transportation, 1994; Canadian Standards Association, 1973) of the pebble fraction (16 to 32 mm) as a subjective method to provide evaluations of aggregate quality for construction purposes. The petrographic number can range from 100 to 1000, and is derived by taking the sum of the percentage of each rock type present in the pebble fraction (in a sample of approximately 100 pebbles) multiplied by a petrographic factor (based on soundness and durability) assigned to that rock type (Ricketts and Vatcher, 1996). The petrographic factor is determined by the type and grain size of the rock in a given sample, and also by the presence of silt-clay coatings, weathering, staining, degree of sphericity, rounding and fracturing. The lower the petrographic number, the better the quality of aggregate material. For example, a clean, hard, fresh granite would normally have a petrographic number of 100, whereas a friable, shale would have a petrographic number of 1000. Most deposits contain a combination of different rock types having different petrographic factors. The proportion of each of these components determines the petrographic number. For most purposes, aggregate material used in concrete requires a petrographic number of 135 or less, whereas in road asphalt and Class A and B gravels a petrographic number up to 150 is acceptable (Department of Transportation, 1999). The rounding of pebbles, the number of fracture faces and their sphericity are important considerations in using an aggregate for concrete. These factors affect the bonding capabilities of concrete and the amount of water necessary to make a concrete; this has a direct relation on the strength of a concrete.

AGGREGATE POTENTIAL

FERRYLAND (NTS MAP AREA 1N/2)

The search for suitable aggregate sources in the Ferryland area was undertaken to meet the needs in the St. John's – Avalon Peninsula region. Aggregate deposits at the LaManche River, Horse Chops Pond, Birchy Pond, Calvert, Gunners Pond and Lundrigans Gullies areas were sampled (Figure 2). Samples were collected from 1- to 1.5-m-deep hand-dug pits. In most deposits, sample analyzes indicate a clean, coarse aggregate showing less than one percent silt-clay and variable sand-gravel concentrations. Estimated aggregate quantities vary from 3000 m³ to 500 000 m³ in these deposits (Table 1). Analyses of 81 samples collected during several projects in the Ferryland map area indicate 44 samples having less than 5 percent silt-clay, 26 sites having 5 to 15 percent silt-clay and 11 sites having greater than 15 percent silt-clay (Ricketts, 2001a).

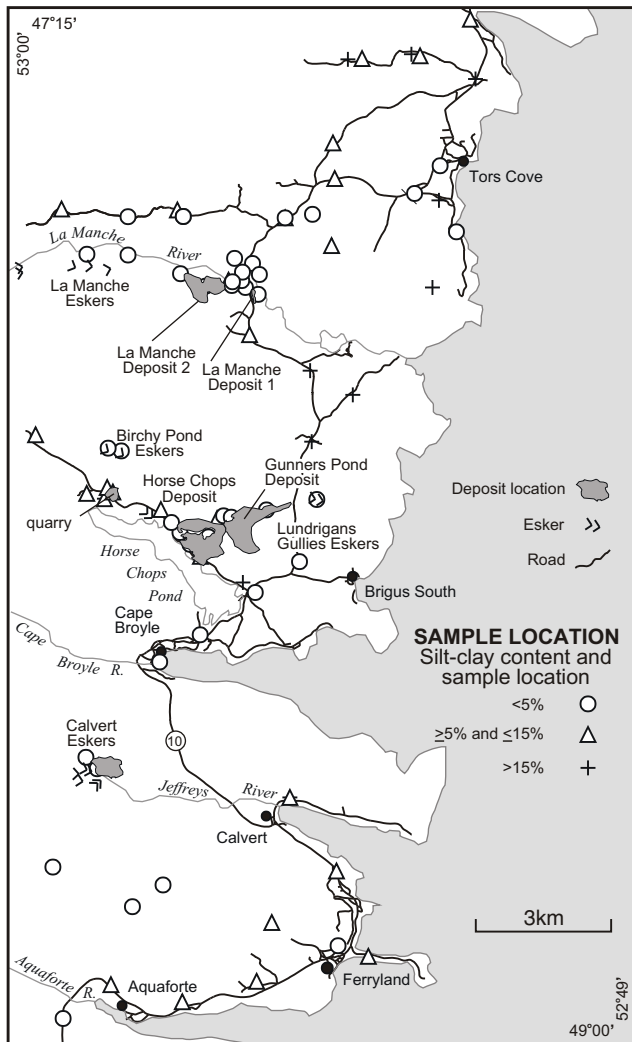


Figure 2. Granular aggregate deposit locations in the Ferryland map area (NTS map area 1N/2).

LaManche Deposit 1

A small hummocky sandy gravel deposit is located 100 m west of Route 10, on the south side of the LaManche River (NTS map area 1N/2; Figure 2). It is approximately 200 by 50 m and between 2 and 6 m high. It is a well drained, poorly compacted material consisting of 45 percent gravel, 53 percent sand and 2 percent silt-clay, based on weights determined from the analysis of one sample (Table 1) taken from a 1.4-m-deep hand-dug pit. The pebble fraction of this sample is subrounded to subangular and has a very thin coating of fine sand that washes off easily. Pebble types collected were siltstone (53%), volcanics (24%), granite (10%), sandstone (11%) and undefined (2%). The sample has a petrographic number of 108. Proximity to the highway and environmental concerns resulting from proposed quarry activity near the LaManche River may prevent this deposit from being developed.

LaManche Deposit 2

A large hummocky gravel deposit was sampled between 1 and 2 km west of Route 10 on the south side of the LaManche River (Figure 2). It is approximately 1000 by 600 m and between 2 and 6 m high. It is a well drained, massive, poorly compacted deposit. Grainsize analyses of two samples gave average values of 76 percent gravel, 23 percent sand and 1 percent silt-clay (Table 1). The pebble fraction is subangular to rounded and has a thin coating of fine sand and silt-clay that washes off easily. Pebbles types are siltstone (63%), sandstone (13%), granite (12%), volcanics (9%), undefined (2%) and quartz (1%). Petrographic numbers for the two samples are 102 and 131. However, proximity to the LaManche River may prevent removal from the northern part of this deposit.

LaManche Eskers

The LaManche eskers are located on the south side of the LaManche River between 3 and 6 km west of Route 10 (Figure 2). Access to the eskers was achieved by a 3- to 4-km foot traverse from Route 10. There are seven eskers occurring over a 3 km distance, orientated in an east-west direction. These eskers are between 100 and 900 m long, 4 to 10 m high, and have a combined length of 2600 m. They contain an estimated 50 000 m³ of aggregate. Analyses of three samples taken from 1 to 1.1 m exposures in hand-dug pits gave results of 71 percent gravel, 28 percent sand and 1 percent silt-clay (Table 1). Pebbles have a fine sand and silt coating that washes off very easily. Pebbles are siliceous siltstone (49%), siliceous sandstone (35%), granite (12%), undefined (2%), quartz (1%) and shale (1%). Petrographic numbers from the three samples are 112, 129 and 135. Bog is located in several areas adjacent to the esker ridges, and outcrop was located at three sites along the LaManche River. Potential for sand and gravel also exists in the valley area between the eskers.

Gunners Pond

The Gunners Pond deposit is located 1 km north from the intersection of Route 10 and Horse Chops Pond road (Figure 2). This deposit consists of many ridges ranging from 50 to 400 m long and 2 to 12 m high, containing an estimated 100 000 m³ of material. Samples having variable textures were collected from these ridges, which may be derived from crevasse filling, or a combination of crevasse filling and till moraines.

One sample was taken from a 1-m-deep hand-dug pit at the top of a 8-m-high ridge and consists of well drained, poorly compacted gravel. A second sample, taken from a 1.3-m-deep hand-dug pit at the top of a 10-m-high ridge,

Table 1. Summary results of sand and gravel deposits in LaManche (NTS map area 01N02)

Deposit	Estimated m ³	Samples Analyzed	Grainsize Analyses			Petrographic Analyses (PN)			Comments
			% Grv +5 mm	% Sand .078-.5 mm	% Silt-Clay -.078 mm	samples analyzed	PN Range	PN Average	
LaManche Deposit 1	30 000	1	45	53	2	1	108		hand-dug pit in hummocky gravel
LaManche Deposit 2	500 000	2	76	23	1	2	116	102-131	hand-dug pits in hummocky gravel
LaManche Eskers	50 000	2	71	28	1	2	120	112-135	hand-dug pits in esker
Gunnars P	100 000	4	70	27	3	2	120	117-124	hand-dug pits in ridge deposits
Horse Chops	400 000	4	67	32	1	1	128		road-side exposure in gravel ridge
Birchy Pond	18 000	2	62	37	1	2	122	117-128	hand-dug pit in dissected esker
Lundrigans Gullies	8 000	1	69	30	1	1	130		hand-dug pits in esker
Calvert	112 000	2	70	29	1	2	121	104-138	hand-dug pits in esker complex

Note: Estimated quantities in table are based on airphoto interpretation and observations at field sample locations. Grainsize percentages are based on a compilation of sample data for each deposit.

consists of well drained, moderately compacted, massive sandy till. Sieve analysis of the samples indicate an average of 70 percent gravel, 27 percent sand and 3 percent silt-clay (Table 1). The silt-clay content varies from 0.2 to 6.7 percent. Pebbles collected from the two sample locations are subangular to subrounded and have a silt and fine sand coating that washes off easily. The pebbles consisted of siltstone (62%), sandstone (30%), volcanics (4.5%) and undefined pebbles (3.5%). Petrographic numbers are 117 and 124.

More extensive sampling is needed in this area, and a 1- to 1.5-km-long road will have to be constructed to access this deposit.

Horse Chops

The Horse Chops deposit is on the northeast side of Horse Chops Pond, along the Horse Chops Pond road, about 1.5 km from Route 10 (Figure 2). It consists of several gravel ridges ranging from 200 to 500 m long. Gravel was also sampled in the low areas between the ridges. Samples were taken from roadcuts, quarry and hand-dug pit exposures, up to 9 m high. The deposit contains approximately 400 000 m³ of moderately to well drained, massive to moderately sorted, poorly compacted material. Analyzes of four samples gave a summary result of 67 percent gravel, 32 percent sand and 1 percent silt-clay (Table 1). Pebbles collected at one sample location were subangular to subrounded and had a thin coating of fine sand and silt-clay that washed off easily. Pebbles include siltstone (50%), sandstone (44%), shale (3%), tuff (2%) and gneiss (1%). A petrographic number of 128 was determined from sampled material. The area contains a large number of cabins, which has restricted quarry development and transportation of quarried materials.

Birchy Pond Esker

The Birchy Pond esker is located about 1.5 km north of the Horse Chops Pond road, 4 km northwest of the intersection at Route 10 (Figure 2). This dissected esker is 400 m long and 2 to 4.5 m high, containing an estimated 18 000 m³ of material. Two samples collected from hand-dug pits at 0.9 and 1.1 m deep indicate a well drained, massive, poorly compacted material. Grain-size analyzes show 62 percent gravel, 37 percent sand and 1 percent silt-clay (Table 1). Pebbles are subangular to subrounded and have a moderate coating of silt to fine sand that washes off with little difficulty. Pebbles consist of siltstone (47%), sandstone (47%), shale (3%), granite (1%), gabbro (1%) and quartz (1%). Petrographic numbers are 117 and 128.

Lundrigans Gullies Esker

The Lundrigans Gullies esker is located approximately 250 m east of Route 10, 2 km north from the exit to Brigus

South (Figure 2). It is 2 to 6 m high and approximately 300 m long. The esker contains an estimated 8000 m³ of material. It is a well drained, very poorly compacted deposit containing 69 percent gravel, 30 percent sand and 1 percent silt–clay (Table 1), based on analysis of one sample taken from a 0.9-m hand-dug pit at the top of the esker ridge. Oxide from the topsoil layer may have affected quality of material from this site. Pebbles collected from one sample location were subangular and had a fine sand and silt–clay coating that washed off easily. Pebbles consisted of siliceous siltstone (70%), siliceous sandstone (27%), shale (2%) and quartz (1%). The sample has a petrographic number of 130. Small size and proximity to a water body may make this deposit unattractive for quarry development.

Calvert

The Calvert deposit is located along a 5- to 5.5-km-long ATV trail northwest from Calvert. It consists of an esker ridge complex where the ridges range from 100 to 300 m long and 2 to 4 m high (Figure 2). The deposit contains an estimated 40 000 m³ of material. Samples collected from two hand-dug pits indicate these ridges contain massive well drained, very poorly compacted material, consisting of 70 percent gravel, 29 percent sand, and 1 percent silt–clay, based on samples taken from two hand-dug pits with 1 and 1.1 m exposures (Table 1). Pebbles are subrounded to subangular and have a coating of fine sand and silt–clay that washed off with little difficulty to fairly easily. The pebbles consisted of sandstone (38%), siltstone (31%), tuff (13.5%), undefined (8%), quartz pebbles (3%), granite (3%), arkose (2%) and volcanics (1.5%). Petrographic numbers are 104 and 138.

HARBOUR GRACE (NTS MAP AREA 1N/11)

Analyzes of 292 samples collected in the Harbour Grace area (NTS map area 1N/11), show 127 samples having less than 5 percent silt–clay, 131 samples having 5 to 15 percent silt–clay, and 34 samples having greater than 15 percent silt–clay (Ricketts, 2000b). Many of these samples were collected during earlier mapping programs in the South and North Brook map area. Mapping in the Harbour Grace area failed to find any new sand and gravel deposits. Large quantities of material are present but these are restricted from quarry development because of residential expansion, farming and private land ownership. Gravel and sand quarries in the North and South Brook areas are expected to be depleted within the next ten years. Efforts to find alternate sources of aggregate such as low silt–clay tills are ongoing. If this is unsuccessful, aggregate will have to be transported into the area or bedrock will have to be blasted and crushed.

CODROY VALLEY (NTS MAP AREAS 11O/14 AND 11O/15)

Sand and gravel deposits resulting from glaciofluvial processes cover a large part of the Codroy Valley (Figures 3 and 4). Some of these deposits contain millions of cubic metres (Table 2) of material and may support quarry operations for decades; others may have economic potential but field investigation techniques could not determine deposit thicknesses or estimate deposit. Some deposits outlined on earlier aggregate-resource maps were determined to have low potential and hence probably will be deleted from updated maps. This may help to mitigate potential conflicts with other land-use activities such as agriculture and forestry.

Grain-size data has been compiled from 257 samples collected in the Codroy Valley area. There are 143 samples having less than 5 percent silt–clay, 42 containing 5 to 15 percent silt–clay and 72 containing more than 15 percent silt–clay (Ricketts, 2001c, d). Most of the low silt–clay samples were taken from glaciofluvial deposits. Potential sources of aggregate having suitable grain-size characteristics that can be considered for exploitation are listed below. Several other areas where individual samples of low-silt content (<5 %) were collected are shown in Figure 3. However, there is insufficient data to determine the aggregate potential at many sites.

The largest potential sources of aggregate are located along the Little Codroy River, Brooms Brook, near the community of O'Regan's, and near Mollichignick Brook. Smaller deposits are located along Ryans Brook, Coal Brook and North Brook.

Brooms Brook

The Brooms Brook deposit is located about 4 km upstream from the Grand Codroy River and is accessible by vehicle along a 4-km-long forest access road leading from the community of O'Regan's (Figure 3). It is a delta deposit consisting of well to imperfectly drained, poor to moderately compacted, coarse-textured gravel. It is roughly 900 m long and 700 m wide. Estimated thickness of the deposit at the sample sites range from 3 to 8 m suggesting this deposit may contain several million cubic metres of material. Sieve analyses of the samples show average values of 68 percent gravel, 27 percent sand and 5 percent silt–clay (Table 2). The pebbles are subrounded and have a silt–clay and fine sand coating that washes off with little difficulty. These pebbles include sandstone (58%), undefined (12%), granite (9%), gneiss (7%), gabbro (7%) diorite (2%), siltstone (3%) and quartz (2%). The three samples have relatively high pet-

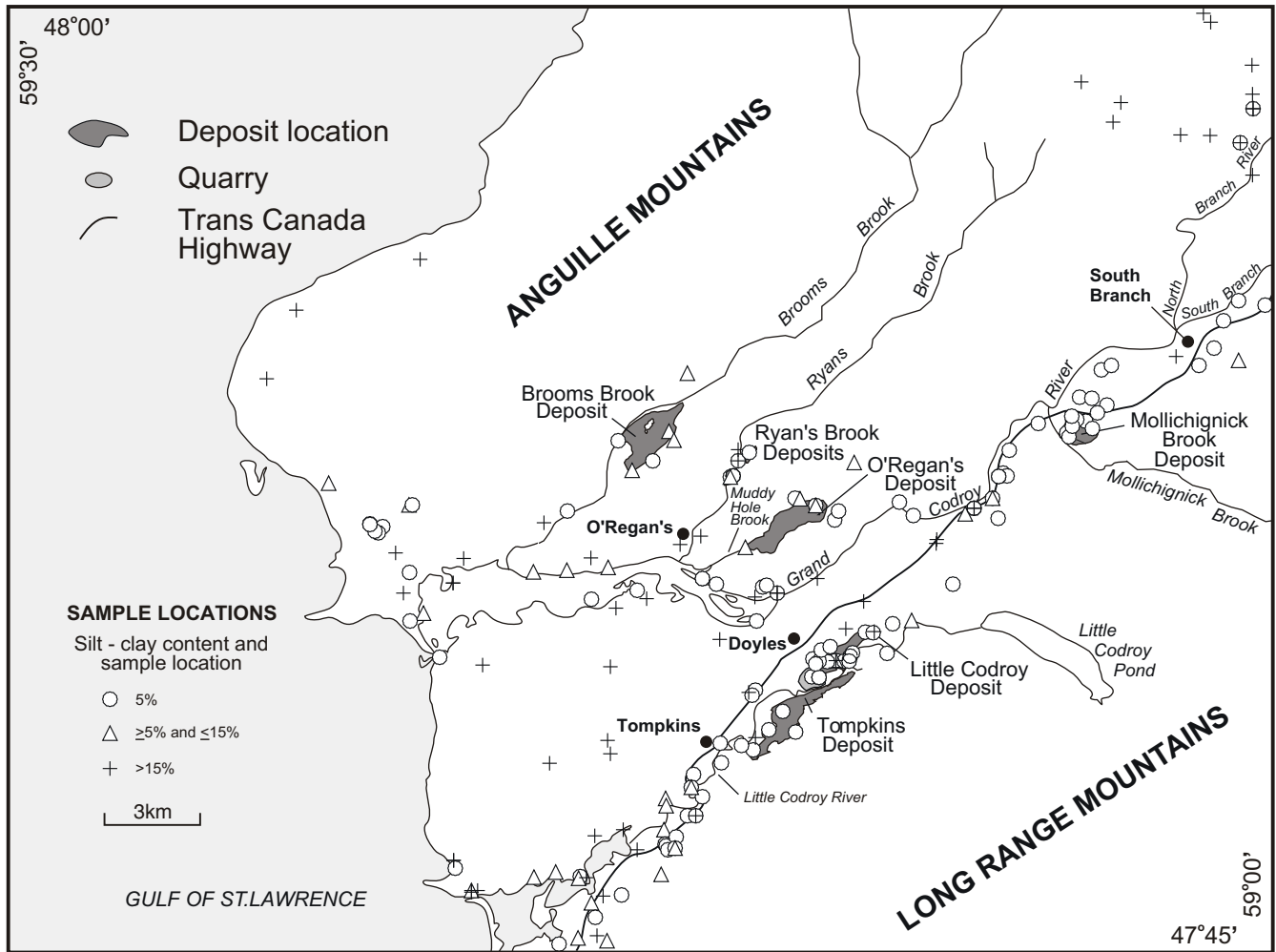
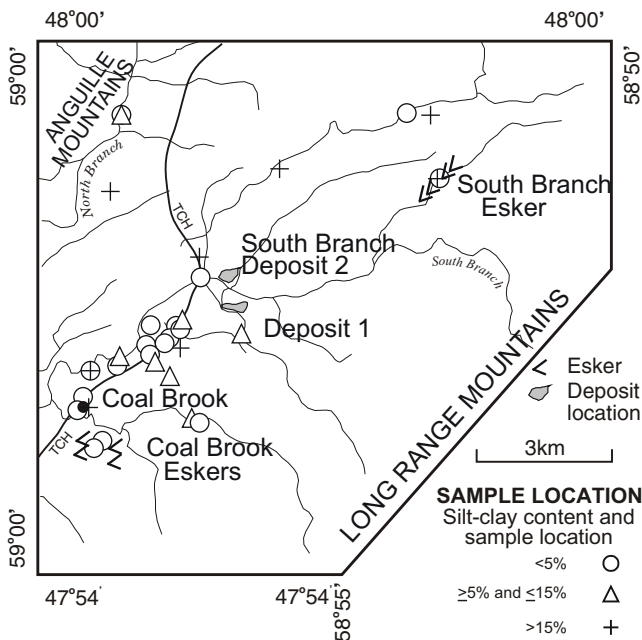


Figure 3. Granular aggregate deposit locations in the Codroy map area (NTS map area 110/14).



rographic numbers of 172, 185 and 195 because the samples contain significant amounts of soft, micaceous sandstone and siltstone pebbles.

O'Regan's

The O'Regan's deposit is located along Muddy Hole Brook near the community of O'Regan's (Figure 3). It is a glaciofluvial terrace consisting of well drained, very poor to moderately compacted gravel (4 m) over sand (4 m). The terrace is eroded and has ridges and meltwater channels remaining in most of the deposit area. The terrace is 8 to 10 m high, and the ridges vary from 5 to 8 m high. The O'Re-

Figure 4. Granular aggregate deposit locations in the northwest corner of the Grandys Lake map area (NTS map area 110/15).

Table 2. Summary results of sand and gravel deposits in the Codroy Valley (NTS map areas 110/14 and 110/15)

Deposit	Estimated m ³	Grainsize Analyses				Petrographic Analyses (PN)				Comments
		Samples Analyzed	% Grv +5 mm	% Sand .078-5 mm	% Silt-Clay -078 mm	samples analyzed	PN Range	PN Average		
Broom's Brook	5 000 000	3	68	27	5	3	184	172-195	1-m roadside exposure in delta	
O'Regan's	3 000 000	4	43	53	4	2	250	152-348	quarry and road cut exposures in eroded glaciofluvial terrace	
Ryans Brook	50 000	5	48	50	2	3	241	143-344	River, quarry and hand-dug pit exposures in delta	
Little Codroy	10 000 000	11	66	33	1	11	129	120-139	Quarry, river & hand-dug pit exposures in glaciofluvial terrace	
Tompkins	8 000 000	4	54	44	2	4	185	130-301	Bulldozed cuts in glaciofluvial terrace	
Mollichignick Brook	1 000 000	8	68	31	1	2	138	108-169	Quarry and hand-dug pit exposures in glaciofluvial terrace	
Coal Brook	10 000	2	71	28	1	2	164	152-176	Bulldozed cuts in esker	
South Br. 1	100 000	4	74	24	2	4	141	135-152	River exposures in glaciofluvial terrace	
South Br. 2	30 000	1	61	38	1	1	148		River exposures in glaciofluvial terrace	
South Br. Esk	5 000	1	70	29	1	1	133		hand-dug pit	

Note: Estimated quantities in table are based on airphoto interpretation and observations at field sample locations. Grainsize percentages are based on a compilation of sample data for each deposit.

gan's deposit contains approximately 3 million m³ of aggregate, consisting of 43 percent gravel, 53 percent sand and 4 percent silt-clay (Table 2). This data is based on the analyses of 4 samples collected from the sand and gravel layers along the road side and quarry exposures ranging from 1 to 8 m high. The underlying sand unit has a silt-clay content varying from 1 to 10 percent.

The pebbles are subrounded and have a silt and fine sand coating that washes off very easily. These pebbles are derived primarily from micaceous sandstone (40%) and granite (22%). Other lithology types include micaceous siltstone (10%), diorite (9%), gabbro (9%), gneiss (8%) and quartz pebbles (2%). Soft micaceous sandstone and siltstone are the major influencing factor contributing to poor petrographic quality. The petrographic numbers of the two samples are 152 and 348.

Ryans Brook

The Ryans Brook deposits is located 2 km north of O'Regan's, and is accessible along a forest access road from the north end of O'Regan's (Figure 3). It consists of two, small glaciofluvial deposits composed of well drained, very poorly compacted, stratified graded, medium to fine sand and pebbles over pebble gravel, and a massive 4-m-thick gravel unit overlying bedrock. These two deposits contain an estimated 50 000 m³ of aggregate, consisting of 48 percent gravel, 50 percent sand and 2 percent silt-clay based on the grain-size analyses of five samples collected from quarry, stream-cut and hand-dug pit exposures, ranging from 1 to 6 m high (Table 2). Pebbles are subrounded and had a medium to thick silt-clay coating that washed off easily. The pebbles consist of sandstone (45%), dolomite (17%), siltstone (16%), gabbro (8%), undefined (7%), granite (2%), gneiss (2%), diorite (2%), and quartz (1%). The abundance of micaceous sandstone is the major influencing factor contributing to poor petrographic quality. Petrographic numbers of 143 and 344 were determined from the two samples analyzed.

Little Codroy

The Little Codroy deposit is located between the Little Codroy River and the TCH, near the community of Doyles (Figure 3). The existing quarry has been in operation since the 1960's and is currently a major source of aggregate material. This delta deposit consists of variable sand and gravel textures. Parts of the quarry have been abandoned because of significant amounts of silt and fine sand units. Generally, the deposit consists of moderately sorted, well drained sand and gravel. Sand content varies from 26.9 to 78 percent in the thirteen samples analyzed. Silt-clay content is 1 percent or lower except for two samples that contain 20 and 45 percent; the sieving results from these two samples were not included in the average analyzes. The deposit has approximately 10 million m³ of material remaining, consisting of 66 percent gravel, 33 percent sand and 1 percent silt-clay based on analysis of 11 samples collected from quarry, river and hand-dug pit exposures (Table 2). Pebbles are subrounded to subangular and had a medium to thin silt-clay coating of fine sand and silt that washed off with little difficulty to easily. Pebbles include granite (56%), gabbro (17%), diorite (11%), undefined (8%), gneiss (4%), quartz (2%), sandstone (1%) and siltstone (1%). Petrographic numbers range between 120 and 139.

Tompkins

The Tompkins deposit is located east of Tompkins on the southeast side of the Little Codroy River (Figure 3). It consist of massive, very poorly compacted, well drained coarse to moderately textured gravel and sand. This large deposit extends over 4 km and is from 100 to 1000 m wide, containing an estimated 8 million m³ of aggregate, consisting of 54 percent gravel, 44 percent sand and 2 percent silt-clay (Table 2); the results were based on the analyses of four samples. Pebbles are subrounded and have a fine sand and silt-clay coating that washed off fairly easily. Pebbles consisted off gabbro (49%), granite (15%), undefined (12%), gneiss (11%), diorite (5%), sandstone (5%), siltstone (2%) and quartz pebbles (1%). The petrographic numbers range from 130 to 301.

Mollichignick Brook

The Mollichignick Brook deposit is located on the southeast side of the TCH, 4 km southwest of the community of South Branch (Figure 3). It is a well drained, very coarse to moderately coarse-textured deltaic deposit; this site was the location of past quarry activity. Till was noted in part of the quarry nearest to the TCH. However, a large reserve of material about 100 m southeast of the quarry and not previously sampled, is estimated to contain approximately 1 million m³ of material, consisting of 68 percent

gravel, 31 percent sand and 1 percent silt-clay (Table 1) based on the analyses of eight samples. Pebbles are subrounded to rounded and had a fine sand and silt-clay coating that washed off with little difficulty to fairly easily. Pebbles consist of gabbro (42%), granite (23%), gneiss (10%), undefined (9%), diorite (8%), micaceous sandstone (3.5%), dolomite (2.5%), micaceous siltstone (1%) and quartz (1%). Petrographic numbers are 108 and 169, determined from the analyses of two samples, indicating a higher quality aggregate than at the present quarry site where an average petrographic number of 196 and a range of 191 to 235 was determined. The new deposit is at a higher elevation and probably the result of deposition from a different source area.

Coal Brook

Two small eskers are located 900 m southeast of Coal Brook (Figure 3). They have a total length of about 220 m and range from 3 to 5 m thick, containing an estimated 10 000 m³ of aggregate. They consist of moderately to poorly compacted, well drained, massive aggregate consisting 71 percent gravel, 28 percent sand and 1 percent silt-clay (Table 2) based on analyzes of two samples. Pebbles are subangular to subrounded and have a fine sand and silt coating that washed off fairly easily. Pebbles consist of gabbro (47%), granite (22%), undefined (17%), gneiss (7%), diorite (7%) and quartz (1%). Petrographic numbers determined from analyses of these two samples are 152 and 176.

South Branch Deposit 1

A glaciofluvial terrace deposit approximately 250 by 100 m and 4 to 7 m high is located on the south side of the South Branch River, 1 km east of the TCH (Figure 4). It consists of coarse, moderately to poorly compacted, massive, well drained material having 74 percent gravel, 24 percent sand and 2 percent silt-clay (Table 2) based on analyses of four samples. Pebbles are subrounded and have a silt and fine sand coating that washes off with little difficulty to easily. Pebbles consist of gabbro (44%), granite (32%), undefined (9%), gneiss (8%) and diorite (7%). Petrographic numbers determined from analysis of four samples are 135, 138, 142 and 152. A few weathered gabbro and undefined pebbles account for one slightly high number.

South Branch Deposit 2

A glaciofluvial deposit on the north side of the South Branch River, 700 m east of the TCH (Figure 4), is approximately 200 by 50 m in area and 3 to 5 m thick. It is composed of coarse to moderate-textured, very poorly compacted, massive, well drained aggregate. Grain-size analysis determined from one sample consisted of 61 percent gravel, 38 percent sand and 1 percent silt-clay (Table 2). Pebbles

are subangular and have a fine sand and silt coating that washes off fairly easily. Pebbles consist of gabbro (31%), granite (29%), gneiss (12%), undefined (16%), diorite (8%), quartz (3%) and conglomerate (1%). A petrographic number of 148 was determined. There were a few pebbles of weathered gabbro and highly weathered undefined pebbles in the sample.

South Branch Esker

The North Branch esker is located north of the South Branch River, 6 km east of the TCH (Figure 4). It is 200 m long and 2 to 4 m high, containing an estimated 5 000 m³ of poorly compacted, massive, well drained sand and gravel. Analysis of one sample indicates the deposit contains 70 percent gravel, 29 percent sand and 1 percent silt–clay (Table 2). A petrographic number of 134 was determined from analyzes of sampled material consisting of granite (60%), gabbro (19%), diorite (6%), gneiss (4%), quartz pebbles (4%), and weathered undefined pebbles (7%). Pebbles were subangular to subrounded and had fine sand and silt–clay coating that washed off fairly easily.

SUMMARY

Knowledge of the nature and distribution of the surficial aggregate deposits (sand, gravel and other low silt–clay materials) assists in estimating cost of construction projects requiring mineral aggregate. When it is necessary to site new pits for production of large quantities of construction material, close attention to the type of aggregate and that of the bedrock lithology in the surrounding area should aid in making a choice. In large-scale operations it might be more economical to transport aggregate materials long distances rather than use inferior material nearer at hand; processing costs could be lower and the quality of the product higher.

Work in the Ferryland map area has revealed several new potential deposits. The area of greatest potential is located on the south side of the LaManche River, near Route 10. These deposits have low silt–clay content and excellent petrographic qualities. Environmental concerns such as proximity to the LaManche River and visibility to motorists may pose potential problems in developing parts of these deposits. The Horse Chops deposit is another large deposit that has low silt–clay content and excellent petrographic qualities. Cabin development in this area has prevented new quarry sites in the past and will most likely pose problems in the future. The Gunners Pond deposit appears to be an area of large reserves but insufficient data on this deposit makes it difficult to judge its potential. This is an area where further investigations may be conducted in the future. Potential to develop other sites in the Ferryland area are low.

Although other deposits generally have low silt–clay content and good petrographic characteristics, access and/or their small sizes make them unattractive to quarry development.

Due to lack of accessible glaciofluvial outwash deposits in the Harbour Grace area, glacial tills may be considered as a local aggregate source. Quarrying in outwash deposits is restricted because these areas are used extensively for other land-use activities. The aggregate potential of the till is low because of their variable silt–clay content. The tills can be washed and screened to remove the fines, but this increases cost of production. At several locations, tills have less than 5 percent silt–clay content. These are regarded as ‘clean’ aggregate in the construction industry and require little processing other than crushing and sieving to secure commercially acceptable sand and gravel. A review of data derived from sampling of tills is being conducted to determine potential quarry sites.

In the Codroy Valley, large outwash deposits are scattered throughout the valley area, particularly along the Little Codroy River. Also, there are several smaller deposits where more detailed investigations are needed to determine aggregate potential. In some areas, potential aggregate is not accessible due to farming and residential development. More detailed investigations are needed in the Brooms Brook deposit where both grain-size and petrographic data are variable. Deposits along the Little Codroy River, and along Mollichignick Brook are the areas of greatest potential. These deposits have large reserves for future exploitation and will meet aggregate demand in the area for several decades. Petrographic characteristics were good to favourable, grain size is good (low silt–clay content) and the proximity to the TCH adds significant value to these deposits.

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