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GRANULAR AGGREGATE-RESOURCE MAPPING OF THE GRAND FALLS (NTS 2D/13) AND MOUNT PEYTON (NTS 2D/14) MAP AREAS

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ABSTRACT

This report presents preliminary results of 1:50 000-scale granular aggregate-resource mapping in the Grand Falls (NTS 2D/13) and Mount Peyton (NTS 2D/14) map areas of central Newfoundland. The aim of the project is to complete a regional aggregate study to locate suitable deposits for economic extraction by the construction industry. Significant deposits have been located along the banks of the Exploits River, and at Sandy Brook, Stony Brook, West Stony Brook, the Northwest Gander River and near Red Cliff and Diversion Lake.

INTRODUCTION

The 1991 field season was the final year of a 3-year, 1:50 000-scale granular aggregate-resource mapping program in central and northeastern Newfoundland (Figure 1). The objectives of the program were to locate, map and sample sand, gravel and till materials and to evaluate their suitability for use as aggregate. Field sampling concentrated on glaciofluvial outwash deposits, which is one of the major sources of sand and gravel in Newfoundland. These deposits are excellent sources of low silt–clay aggregate, which is required for use in concrete and asphalt and as Class A and B road gravel. Till is generally regarded as poor-quality aggregate due to its high silt–clay content, and therefore, was given less attention during field investigations.

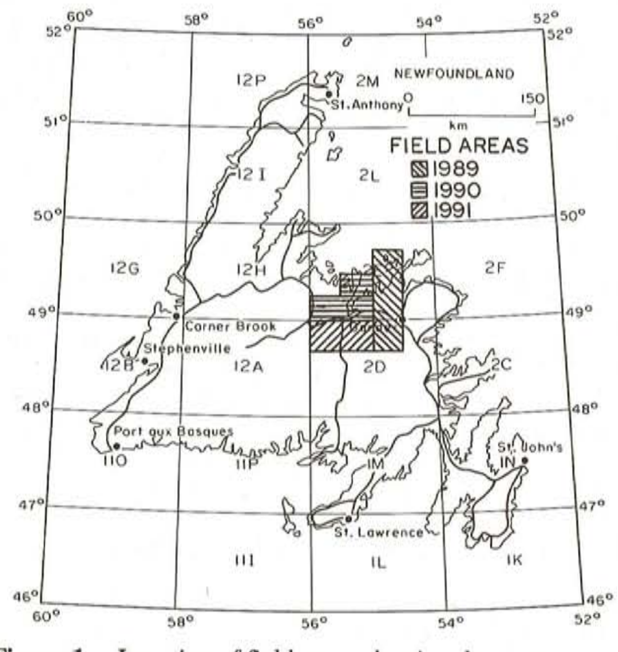

Figure 1. *Location of field area, showing the survey areas for 1989, 1990 and 1991.*

MINERAL AGGREGATE–A REVIEW

Mineral aggregates, as used in the context of this report, are defined as any hard, inert material such as gravel, sand, crushed stone or other mineral material that is used in the construction industry (Carter, 1981). Aggregates are used extensively in all types of construction activities related to domestic, industrial or other developments. Provincially, road construction is a major use of aggregate materials. Municipally, water and sewer systems, driveway construction and building foundations all require aggregate. Backfill is another major use, as is topsoil for landscaping. Aggregate materials can be, (a) used in an unprocessed form as pit and run, (b) processed and used as Class A gravel (i.e., generally aggregate consisting of 100 percent particle sizes less than 19 mm in diameter and 3 to 6 percent silt–clay content, plus a specified range of percentages for size fractions between these upper and lower limits; Department of Transportation, 1987) and Class B gravel (i.e., generally aggregate consisting of 100 percent particle sizes less than 101.6 mm in diameter and containing 3 to 6 percent silt–clay plus a specified range of percentages for size fraction between these upper and lower limits; Department of Transportation, 1987), and (c) mixed with a cementing agent to form concrete, asphalt and mortar.

Not all materials are suitable as aggregate. Vanderveer (1983) defined the quality of mineral 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. The presence of deleterious substances such as silt–clay coating or iron-oxide staining on the surface of the aggregate, or the presence of friable or blade-shape fragments often cause bonding problems with the cementing agent, or the breakdown of aggregate with time.

Aggregates are a high-volume, low-cost material. The cost of transport represents, on average, 30 percent of the delivered price (Vanderveer, 1982). Thus, the location of resources relatively close to the users is important in Newfoundland. The many users throughout the Island makes a regional mapping project of aggregate resources vital.

LOCATION AND ACCESS

Granular aggregate-resource mapping was conducted in the Grand Falls (NTS 2D/13) and Mount Peyton (NTS 2D/14) map areas of central Newfoundland.

Most of the field area is accessible by major road routes, numerous logging roads (in use and abandoned), which are usable by all-terrain vehicle, and water ways, which are navigable by canoe. Foot traversing was required in the south-central parts of both map areas where other means of ground movement was difficult to impossible.

PREVIOUS WORK

Surficial geological mapping at 1:50 000-scale (based mainly on 1978 reconnaissance aerial photographic interpretation) has been completed for NTS 2D/13 and the north and west part of NTS 2D/14 (Kirby *et al.*, 1989).

Reconnaissance aggregate-resource programs conducted by the Department of Mines and Energy (Environmental Geology Section, 1983; Kirby *et al.*, 1983) covered a 6-km-wide corridor along all major roads and a wider radius around towns in the area. Kirby (1991) conducted detailed sampling in granular aggregate deposits along the Exploits River and near Red Cliff. In addition, geotechnical bedrock maps have been compiled at a scale of 1:250 000 (Bragg, 1986). Bedrock aggregate mapping at a scale of 1:50 000 was conducted in central Newfoundland (Bragg, 1990) to locate suitable bedrock deposits as an alternative to granular aggregates.

MAPPING AND ANALYTICAL METHODS

Interpretation of 1:50 000-scale, black and white aerial photographs was used to locate potential deposits of sand and gravel. Following this, interpretation of 1:12 500-scale coloured aerial photographs was conducted in selected areas to delineate deposit boundaries. In these selected deposits where exposures were present, field sampling was carried out at 0.5 to 1.0 km intervals in outwash deposits and at 1.5 to 2.0 km intervals in till. Additional samples were taken in each deposit wherever changes of sediment type were observed, where quality differences were apparent, or wherever sediments of variable quality or texture could potentially be quarried separately.

Where possible, samples were taken from natural exposures such as stream cuts, shorelines, and gullies or from man-made exposures such as road cuts, and pit and quarry excavations. Where these types of exposures were not available, samples were collected from hand-dug pits, 1 m in depth.

Sampling provided material for petrographic and grain-size analyses, and Los Angeles Abrasion (ASTM Standards C 88-83, 1990) and Soundness Tests (ASTM Standard C 131-89, 1990). Field sieving and petrographic analysis were performed on all samples containing >8mm-size material. Approximately 15 kg of material was collected for field sieving. A split of the finer than 8-mm diameter material was retained for laboratory sieve analyses following procedures outlined in Ricketts (1987). Los Angeles Abrasion and Soundness Test results are currently unavailable.

PETROGRAPHIC ANALYSES

Aggregate samples were examined to determine the petrography of the pebble fraction (16 to 32 mm) as a preliminary means of determining aggregate quality for construction purposes. A petrographic number was calculated using procedures similar to those outlined in CSA standard A23.2.30 (Canadian Standards Association, 1973). The petrographic number, which can range from 100 to 1000, is derived by taking the sum of the percentage of each rock type present in the pebble fraction (50 pebbles) multiplied by a petrographic factor (based on soundness and durability) assigned to that rock type (Bragg, 1990). The petrographic factor is determined by the rock type and their grain size in a given pebble sample, and also by the presence of silt−clay coatings, weathering, staining, degree of sphericity, rounding and fractures. 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, soft shale would be 1000. Most deposits contain a combination of different rock types with different petrographic factors. The proportion of each of these components determines the petrographic number (see Table 1 for example). For most purposes, in Newfoundland, aggregate material used in concrete requires a petrographic number of 135 or less, and in road asphalt and for Class A and B gravels, a petrographic number of 150 or less is acceptable (Department of Transportation, 1987).

Table 1. Example for calculating a petrographic number for a granular aggregate sample having more than one rock type

Rock type	# of pebbles	%		Petrographic factor	Petrographic number
shale	12	22	x	10	= 220
granite	27	50	x	1	= 50
sandstone	10	19	x	3	= 57
schist	5	9	x	6	= 54
Petrographic number for sample analyzed					= 381

RESULTS

A total of 232 sites were examined and 201 samples collected in the NTS 2D/13 map area. They consisted of 92 gravel, 67 till, 38 sand and 2 silt and 2 clay samples. In the

NTS 2D/14 map area, 98 sites were examined and 67 samples collected. Samples consisted of 42 tills, 18 gravels, 6 sands and 1 silt. A computer graph program (available at the Department of Mines and Energy) is used to plot results as cumulative curves (Kirby *et al.*, 1983) and to calculate percentages of gravel, sand, and silt–clay or individual sieve percentages for each sample. Till samples will not be discussed further because of high silt–clay content (>6 percent) and their low economic importance in most industrial projects.

Data, including aggregate-resource maps and grain-size analyses, will become available through open-file release.

POTENTIAL DEPOSITS

The following are brief descriptions of the main granular aggregate deposits in the study area (Figure 2; Table 2). The descriptions include deposit location, dimensions, average percentage of gravel, sand, and silt–clay, and the range of petrographic numbers for each deposit. Results of particle size and petrographic analyses are based on a compilation of sample data collected during the 1991 field season and previous sampling programs by the Department of Mines and Energy.

MAP AREA NTS 2D/13

1. NORTHWEST EXPLOITS RIVER

The northwest Exploits River deposit is located in the west of map area NTS 2D/13 on the north bank of the Exploits River (Figure 2). It is approximately 3 km long and has an average width of 0.3 km. Kirby (1991) subdivided this deposit into two zones based on terrain type; zone A is a glaciofluvial terrace and is estimated to be approximately 6 to 8 m thick; zone B is an eroded terrace consisting of several gravel ridges and abandoned dry river channels cut by higher levels of the Exploits River during glacial meltwater run off. These ridges are estimated to be 10 to 15 m thick.

Grain-size analyses of sampled material indicate both zones are moderately sorted and contain high gravel content, moderate amounts of sand and low percentages of fines (Table 2). Two samples in zone A contain silt–clay in the 9 and 10 percent range (Figure 3) but this is a minor problem considering the overall size of the deposit. Most samples collected from this deposit were from backhoe-dug pits and supplemented by hand-dug pits and river-bank exposures. Petrographic numbers of the 16- to 32-mm pebble fraction generally have high values. Kirby (1991) attributes the poor petrographic quality to moderately weathered conglomerate pebbles and to a lesser extent, weathered acidic volcanic pebbles.

Based on grain-size distributions and volume this deposit has a high potential for quarry development. However, petrographic characteristics indicate this material is unsuitable as a high-quality aggregate source.

2. ASPEN BROOK–LEECH BROOK

The Aspen Brook–Leech Brook deposit is located along the north bank of the Exploits River between Aspen Brook and Leech Brook in the western part of map area NTS 2D/13 (Figure 2). The deposit is 8 km long, has a width between 0.2 km and 0.8 km, and a thickness of 2 to 9 m increasing eastward toward Leech Brook. The Leech Brook area has been the site of a large quarry operation in the past (Plate 1). It is a coarse-grained, moderately sorted deposit (Table 2). Three samples collected with silt–clay contents of 10.7, 12.7 and 12.8 percent (Figure 4), are not typical of material in the area and were not included in average analyses. Petrographic numbers range from good to poor in this deposit based on the analyses of 14 samples. Samples with poor petrographic quality are the result of weathered siltstone and sandstone. There were also a number of highly weathered undefined pebbles, which contributed significantly to poor petrographic quality in some samples.

Due to the past removal and a thin gravel unit in parts of this deposit, remaining quarry potential is considered low to moderate.

3. SOUTHWEST EXPLOITS RIVER

The southwest Exploits River deposit is a partly dissected glaciofluvial terrace located at the west end of map area NTS 2D/13 on the south bank of the Exploits River (Figure 2). It is one of the largest deposits in the study area, beginning 3 km west of Tom Joe Brook and extending for 14 km eastward along the Exploits River to Sandy Brook. It has an average width of approximately 0.7 km, and thicknesses of between 3 and 10 m. Grain-size data of 94 samples indicate this deposit is variably sorted and contains equal amounts of sand and gravel, and generally has less than 1 percent silt–clay (Table 2). Eleven other samples had silt–clay contents between 10 and 52 percent (Figure 5). Some of these samples having high silt–clay concentrations were taken from thin units within gravel beds or from sites away from the larger gravel sources within the deposit. Due to the extensive area covered by this deposit, silt–clay concentrations should not be a major concern if quarrying occurs. Petrographic numbers are generally high throughout the deposit. Poor petrographic quality is due to 25 percent, slightly weathered pebbles consisting of siltstone, sandstone and some volcanic rocks.

Based on grain-size analyses and volume, the southwest Exploits River deposit is considered to have high potential for quarry development. However, high petrographic numbers reduce its potential for a high-quality aggregate source.

4. RED CLIFF

The Red Cliff deposit is situated on the north side of the Exploits River, 1.5 km west of Rushy Pond (Figure 2). It is composed of a glaciofluvial terrace and esker complex. The Red Cliff deposit can be divided into 3 zones, based on the grain-size distribution (Table 2; Figure 6) of 22 samples collected in quarry and road-cut exposures.

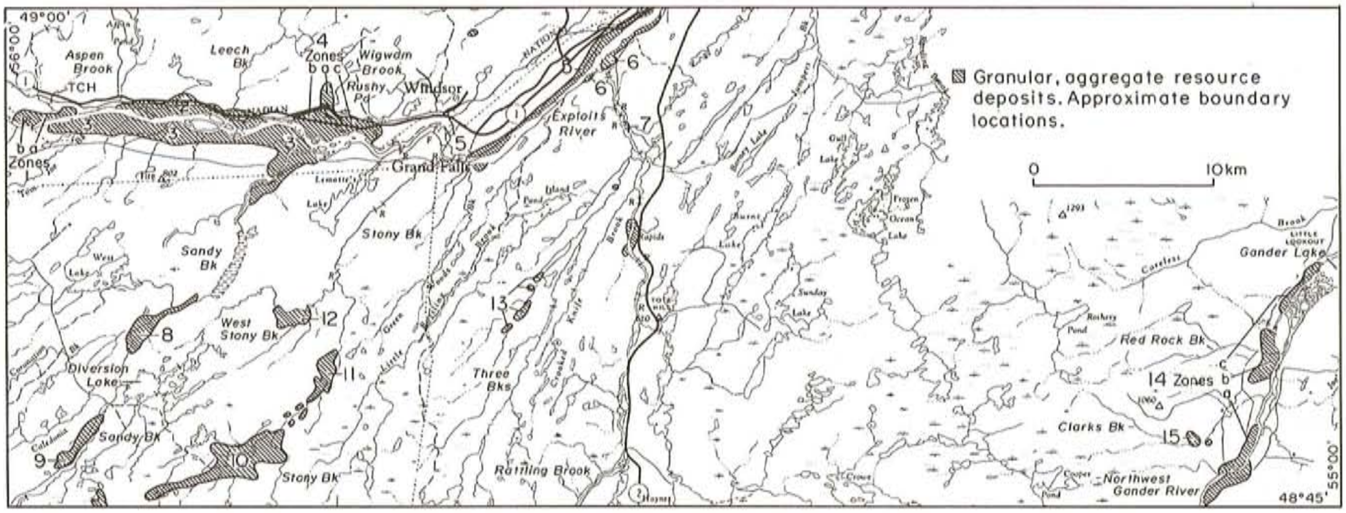

Figure 2. *Potential aggregate-resource deposits in the Grand Falls (NTS 2D/13) and Mount Peyton (NTS 2D/14) map area.*

Table 2. Summary and comparisons of aggregate deposits in the NTS 2D/13, 14 map areas of central Newfoundland

Deposit	Estimated m3 x 6	Grain-size Analyses: # of samples analyzed	% Grv. (+5mm)	% Sd. (+78um to 5mm)	% Slt-Cly (-78um)	Petrographic Analyses: # of samples analyzed	Range	Average
1. Northwest Exploits River								
Zone A	>10	15	69.0	30.5	0.5	15	154-253	212
Zone B	>10	27	69.7	28.7	1.5	27	128-262	193
2. Aspec Brook—Leech Brook	1.0-5.0	14	74.5	25.3	0.3	14	100-266	175
3. Southwest Exploits River	>10	94	49.9	49.3	0.7	50	116-653	282
4. Red Cliff								
Zone A	1.0-5.0	14	41.1	56.1	2.9	6	100-235	149
Zone B	1.0-5.0	3	52.6	47.2	0.3	1	148-148	148
Zone C	1.0-5.0	5	0.7	90.8	8.5	0	–	–
5. Northwest Bank of Exploits River	1.0-5.0	14	46.3	52.8	0.9	9	212-315	267
6. Rattling Brook—Exploits River	1.0-5.0	9	58.7	41.1	0.2	8	230-919	448
7. Rattling Brook	<1.0	6	31.0	66.0	3.0	2	314-380	348
8. Sandy Brook	>10	6	73.1	26.7	0.2	6	201-414	294
9. Diversion Lake	>10	7	46.6	50.4	3.1	4	246-334	289
10. Stony Brook South	>10	6	51.0	47.6	1.4	4	176-408	242
11. Stony Brook North	1.0-5.0	5	61.1	37.2	1.8	4	209-286	260
12. West Stony Brook	1.0-5.0	4	23.6	75.7	0.7	1	260	260
13. Three Brooks	<1.0	13	51.5	48.3	0.2	11	224-506	315
14. Northwest Gander River								
Zone A	5.0-10	12	40.2	59.3	0.6	8	130-352	237
Zone B	1.0-5.0	3	78.5	21.3	0.2	2	128-158	143
Zone C	1.0-5.0	4	59.7	39.8	0.5	3	130-350	215
15. Charles Brook	<1.0	2	72.7	27.1	0.2	2	112-150	131

Note: Estimated quantities in Table 2 are based on air-photo analysis and field investigation of road cuts, shallow hand-dug pits and natural exposures. Detailed sampling methods such as drilling were not conducted. Grain-size analyses are based on sample data averages for each deposit and do not take into account extent and thickness of units at any one location.

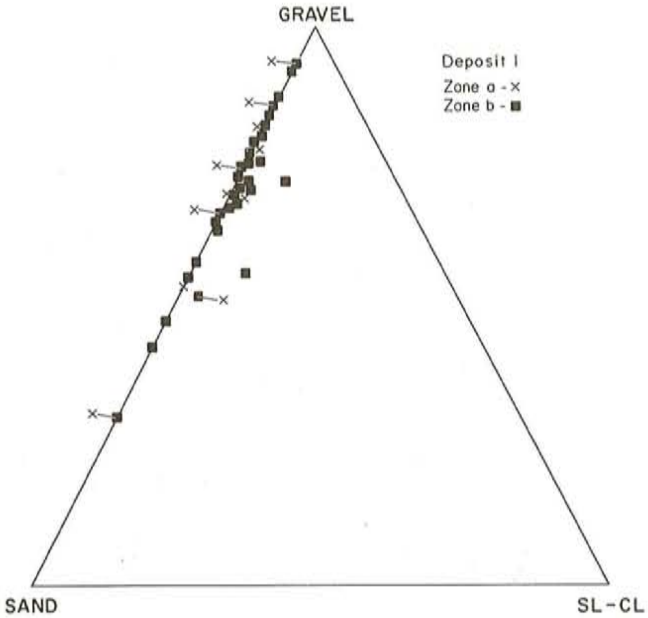

Figure 3. *Ternary diagram showing granular distribution of samples collected in the northwest Exploits River deposit.*

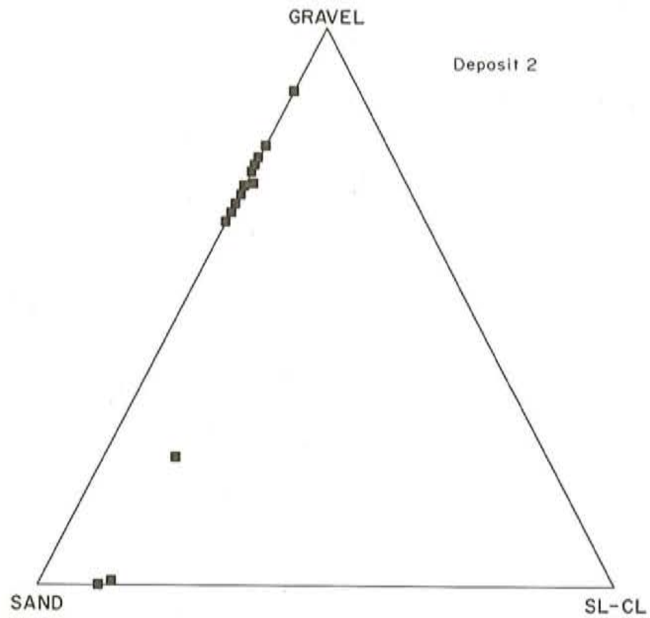

Figure 4. *Ternary diagram showing granular distribution of samples collected in Aspen Brook–Leech Brook deposit.*

Plate 1. *Inactive quarry in the Aspen Brook–Leech Brook deposit.*

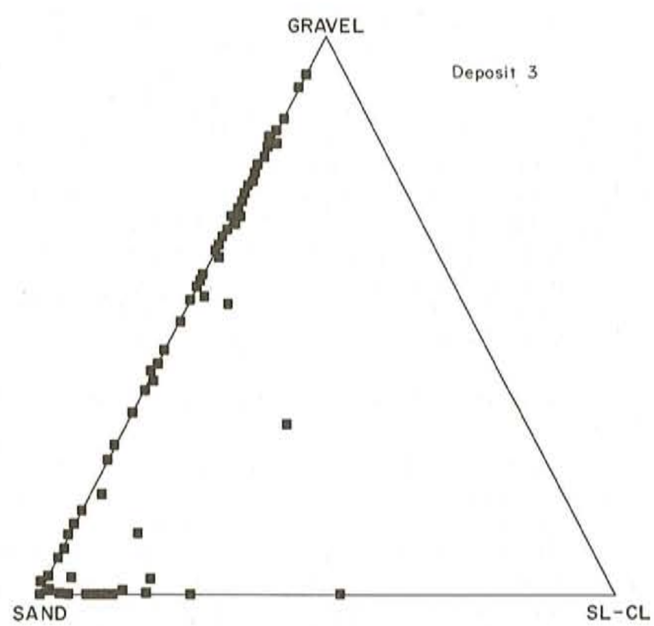

Figure 5. *Ternary diagram showing granular distribution of samples collected in the southwest Exploits River deposit.*

Zone A consists of an esker complex located north of the Trans Canada Highway on the west side of Wigwam Brook, and is the largest of the three zones. Grain-size analyses of samples indicate that this area is composed of a sandy-gravel, which has a low silt–clay content. Stratified units in quarry exposures show poorly sorted gravel and moderately to well-sorted sand. Petrographic analyses of sampled material range from very good to poor. High petrographic numbers are the result of weathered sandstone and siltstone. This zone has been extensively quarried in the past, but has a considerable amount of material remaining for future quarry activity. However, consideration should be given to poor petrographic quality, when considering this material for concrete and road-paving projects.

Zone B is located along the north side of the Exploits River, south of zone A. It is a thin outwash deposit (generally < 3 m thick) consisting of poorly sorted sandy gravel generally greater than 0.125 mm in diameter (97.5 percent). A petrographic number of 148 was determined from the petrographic analyses of one sample. Petrographic quality of this zone is reduced by the presence of moderately weathered to weathered siltstone. Past quarry activity in this area has nearly depleted the resource. It has a low potential for future quarry development.

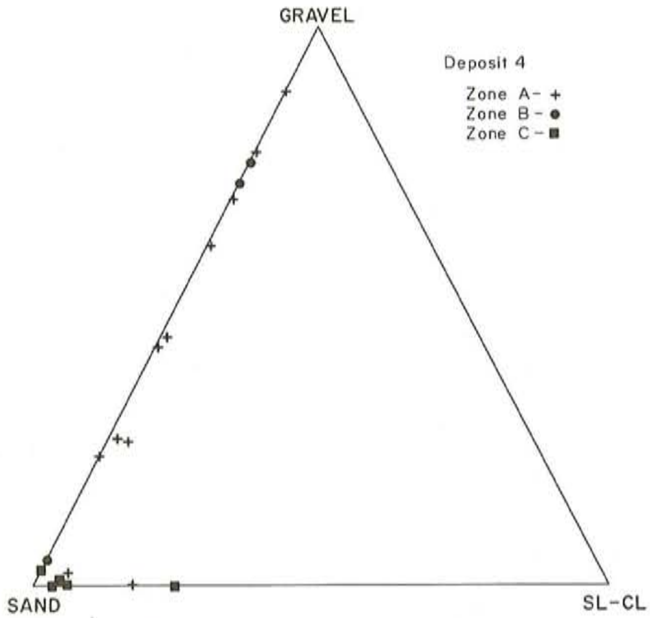

Figure 6. *Ternary diagram showing granular distribution of samples collected in the Red Cliff deposit.*

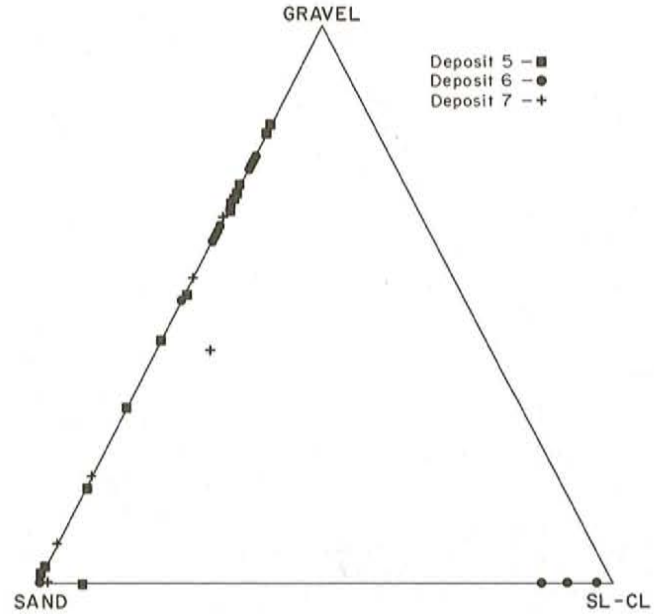

Figure 7. *Ternary diagram of granular distribution of samples collected in deposits 5, 6 and 7 along the northeast bank of the Exploits River, confluence of Rattling Brook and Exploits River and along the east bank of Rattling Brook, respectively.*

Zone C is a moderately to well-sorted sand deposit located between zones A and B, extending east between Rushy Pond and the Exploits River. This zone is estimated to be between 3 and 5 m thick but may locally reach thicknesses of 8 m. It contains in excess of 90 percent sand (grain-size diameter is generally less than 0.5 mm) with the silt–clay content ranging from 0.5 to 24.4 percent in 5 samples analyzed. Due to the fine texture of this deposit there were no pebbles to conduct petrographic analyses. Based on volume alone, the potential for a sand quarry in this area is high, however, the high silt–clay content and fine sand texture may reduce its usefulness for most construction purposes.

5. NORTHEAST BANK OF EXPLOITS RIVER

The northeast bank of the Exploits River in the northeast corner of map area NTS 2D/13 consists of a glaciofluvial terrace deposit over 12 km long and 0.1 km to 0.7 km wide (Figure 2). It is generally 6 to 8 m thick, becoming thinner (approximately 2 to 3 m) in the northeast, past the confluence with Rattling Brook. Grain-size analyses of 14 samples indicate that this deposit is a poorly sorted gravelly sand, having low silt–clay content (Table 2; Figure 7). Silt–clay samples (not included in average analyses) were collected at the base of two exposures of this deposit. Petrographic numbers of 9 samples analyzed were high. Poor petrographic quality is principally due to moderate to highly weathered micaceous sandstone and weathered siltstone.

This deposit has moderate to low potential for quarry development. Silt–clay units may pose problems in some areas and the proximity of a large section of the deposit to the Exploits River will restrict exploitation. High petrographic numbers will reduce its potential as a high-quality aggregate for most construction purposes.

6. RATTLING BROOK–EXPLOITS RIVER

The Rattling Brook–Exploits River deposit is a glaciofluvial terrace located in the northeast part of map area NTS 2D/13 at the confluence with Rattling Brook and the Exploits River (Figure 2). This deposit is over 6 km long and 0.1 to 0.6 km wide. Thickness varies from 1 m in the northeast to 8 m in the southwest. This deposit is well stratified and contains units of gravel, sandy gravel and silt–clay (Table 2). Fine-grain units of silt–clay were sampled in 3 exposures below gravel beds. These fine-grain sediments (Figure 7) are located below the gravel units and were not included in the average analyses. Poor petrographic quality in this deposit results principally from moderate to highly weathered sandstone and siltstone.

The Rattling Brook–Exploits River deposit has a moderate to low potential for quarry development. Thin gravel beds, zones of silt–clay, past removal, private land ownership and poor petrographic quality will have a negative influence on quarry development in this area.

7. RATTLING BROOK

The Rattling Brook deposit is a small glaciofluvial terrace situated on the east bank of Rattling Brook, 3.5 km up stream from its confluence with the Exploits River (Figure 2). This deposit has an average length of 1 km and and average width of 0.7 km. River-bank exposures (Plate 2) show an average thickness of 3 m. It consists of stratified, poorly sorted gravels and moderately sorted sand with generally low silt–clay contents (Table 2). Five of the 6 samples have a range from 0.4 to 1.1 percent silt–clay and the sixth sample has 16 percent silt–clay (Figure 7). Petrographic quality in this deposit is poor because of shale content and moderate to highly weathered sandstone.

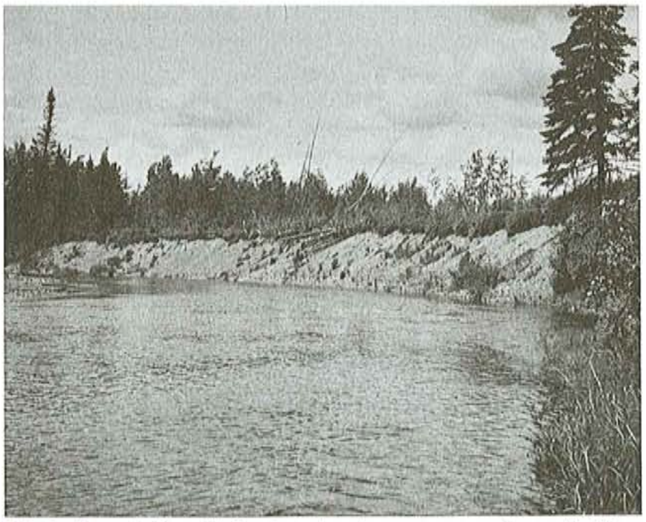

Plate 2. *A 3-m-high river-bank exposure along Rattling Brook.*

The Rattling Brook deposit has a poor potential for quarry development. Shallow thickness, private land ownership and poor petrographic quality will negatively affect development in this area.

8. SANDY BROOK

The Sandy Brook deposit is located along Sandy Brook in the west part of map area NTS 2D/13 (Figure 2). This deposit is over 5 km long and 0.1 to 1 km wide. It is composed of a glaciofluvial terrace and two eskers. The terrace covers most of the deposit area but has a thickness of only 2 to 4 m. The eskers are 0.7 km and 1 km long, respectively, and are estimated to be 12 to 15 m thick. No natural exposures were found in this deposit and therefore grain-size analyses is based on samples taken from hand-dug pits. Both esker and terrace deposits contain a large amount of gravel, lower amounts of sand and have a low silt–clay content (Table 2; Figure 8). Petrographic quality is poor, resulting from weathered sandstone and shale pebbles.

The Sandy Brook deposit has a moderate to high potential for quarry development based on granular content and potential reserves of material, although poor petrographic quality reduce its potential as a high-quality aggregate for use in most construction projects.

9. DIVERSION LAKE

The Diversion Lake deposit is situated 1 km southwest of Diversion Lake in the southwest part of map area NTS 2D/13 (Figure 2). It is a hummocky glaciofluvial outwash deposit 4 km long and averaging 0.8 km wide. Thickness varies between 4 and 7 m. It is a sand–gravel deposit having low silt–clay content (Table 2). Two of seven samples collected in this deposit had silt–clay contents of 6.8 and 11.5 percent, respectively (Figure 8). Five other samples had less than 1.0 percent silt–clay. Petrographic quality in this deposit is poor, resulting from weathered sandstone, tuff, basalt and gabbro pebbles.

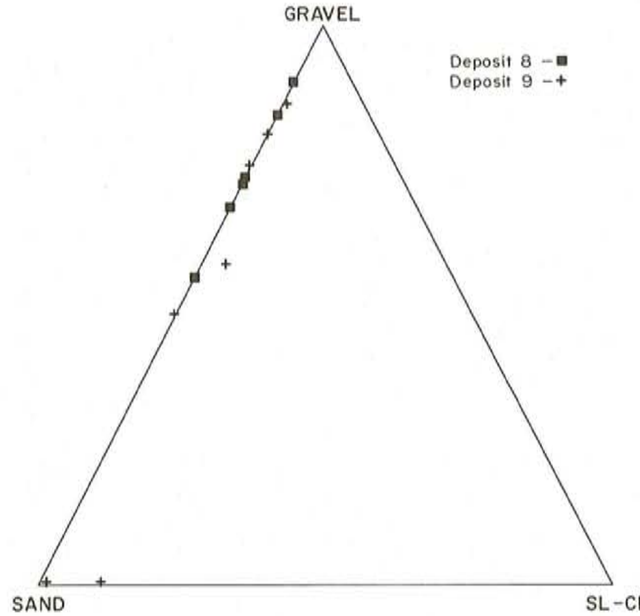

Figure 8. *Ternary diagram of granular distribution of samples collected in the Sandy Brook and Diversion Lake; deposits 8 and 9, respectively.*

Sediment in the Diversion Lake deposit was used in the past for construction of forest access roads. This deposit has a high potential for future quarry development based on volume and grain-size distribution. However, poor petrographic quality reduces its potential for concrete and most road-construction projects.

10. STONY BROOK SOUTH

The Stony Brook south deposit, located along Stony Brook in map area NTS 2D/13 (Figure 2), consists of a large glaciofluvial terrace over 8 km long having an average width of 1 km. River-bank exposures (Plate 3) observed during field investigations indicate that thicknesses of 6 m to 12 m is common. It is a poorly sorted gravel and sand deposit having low silt–clay content (Table 2; Figure 9). Petrographic quality is poor and variable, resulting from weathered sandstone, siltstone and a few weathered, granite pebbles.

This is the largest deposit in the study area and has a high potential for quarry development based on potential reserves and grain size. However, variable petrographic quality indicates a need for more extensive sampling and analyses to determine use for this material as a high-quality aggregate.

Plate 3. *A 6-m-high river-bank exposure in the Stony Brook south deposit.*

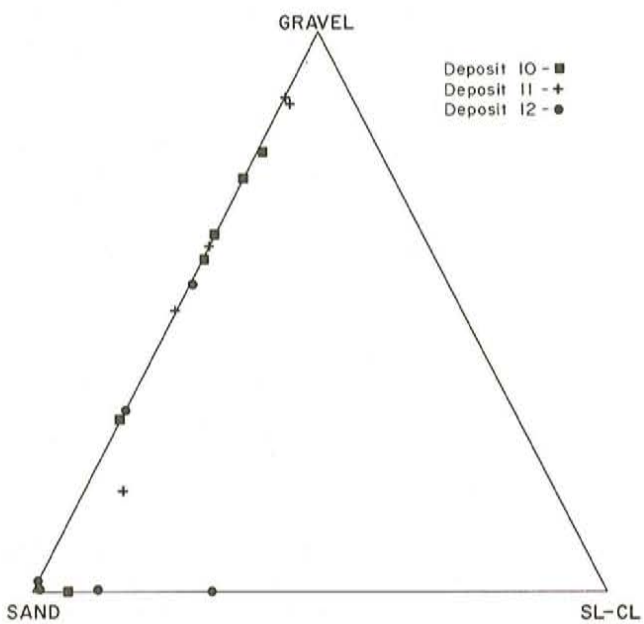

Figure 9. *Ternary diagram of granular distribution of samples collected in deposits along Stony Brook south and north and West Stony Brook; deposits 10, 11 and 12, respectively.*

The Stony Brook North deposit has a moderate to low potential for development because of small aggregate volumes and poor petrographic quality.

11. STONY BROOK NORTH

The Stony Brook north deposit is located on the northwest bank of Stony Brook in the south-central part of map area NTS 2D/13 (Figure 2) and consists of an esker ridge complex (Plate 4). Glaciofluvial outwash sediment is found in adjoining areas and in thin layers between the esker ridges. The esker complex is 1.4 km long and 0.6 km wide and is generally less than 5 m thick. Grain-size analyses of samples collected from this (poorly sorted) deposit show it is composed of a sandy gravel with low silt–clay content (Table 2). Four of five samples have $<$ 1 percent silt–clay and the other sample has 7.5 percent silt–clay (Figure 9). Petrographic analyses indicate poor-quality material, resulting from weathered siltstone and sandstone. Some weathered basalt and tuff clasts are also present.

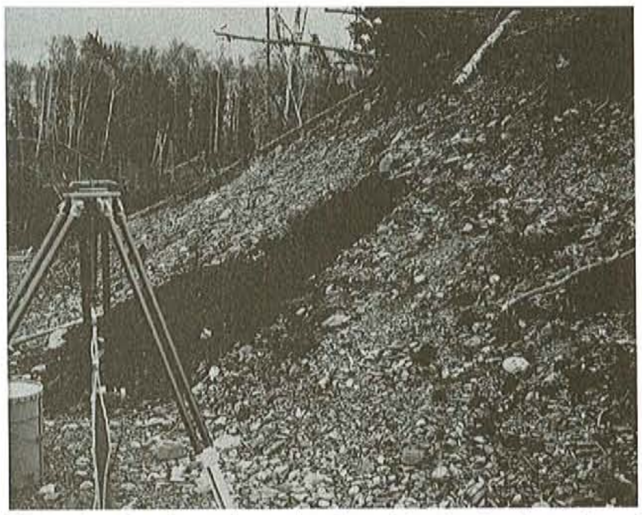

Plate 4. *Road-cut through esker ridge in the Stony Brook north deposit.*

12. WEST STONY BROOK

The West Stony Brook deposit is situated along the south side of West Stony Brook in the central part of map area NTS 2D/13 (Figure 2). This is a glaciofluvial terrace deposit, approximately 1.7 km long, having an average width of 0.7 km. Grain-size analyses of four samples collected from quarry exposures (Plate 5) and road cuts indicate this deposit is a moderately to poorly sorted sand with low amounts of gravel and silt–clay (Table 2). Two other samples with silt–clay contents of 11.8 and 31.2 percent (Figure 9) were not included in average analyses. These sites appeared to be localized and should not affect quarry operations in other parts of the deposit. Petrographic analysis was conducted on only one sample due to the fine texture in most of the deposit. It produced a petrographic number of 260, the poor petrographic quality being principally the result of weathered volcanic rocks.

The West Stony Brook deposit has a high potential for a sand quarry operation, although further sampling should be done to provide a broader range of petrographic data.

Plate 5. *Abandoned quarry in the West Stony Brook deposit.*

13. THREE BROOKS

The Three Brooks deposit is situated on the east side of map area NTS 2D/13. It consists of four small glaciofluvial terraces, accessible along a 4 km section of forest access road. The largest terrace is approximately 1 km long, 10 m wide and 4 to 6 m thick. The other three terraces are approximately 400 m long, 300 m wide and 2 to 4 m thick. Samples collected from backhoe-dug pits, stream cuts (Plate 6) and road cuts indicate that all four areas consist of poorly sorted sandy gravel and low silt–clay concentrations (Table 2; Figure 10). Petrographic quality is poor resulting from weathered sandstone, siltstone and shale. Weathered volcanic rocks, granite, gabbro and conglomerate also contribute to the poor quality.

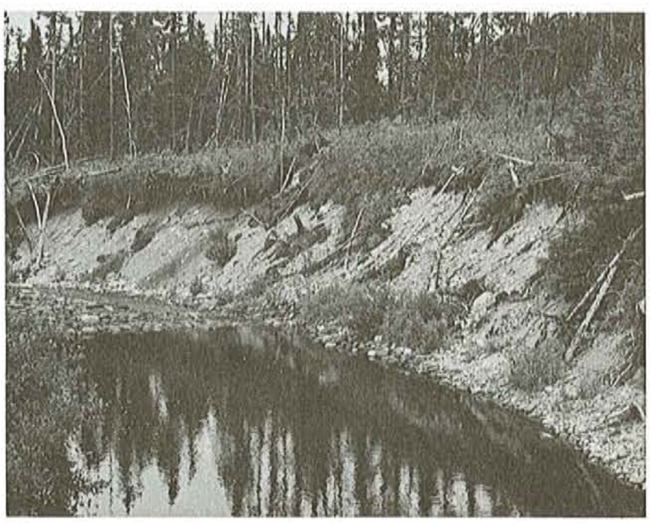

Plate 6. *A 3-m-high river-bank exposure in the Three Brooks deposit.*

Potential quarry development in this area is considered moderate in the largest of 4 terraces, and low in the remaining 3 areas where gravel beds are thin. However, poor

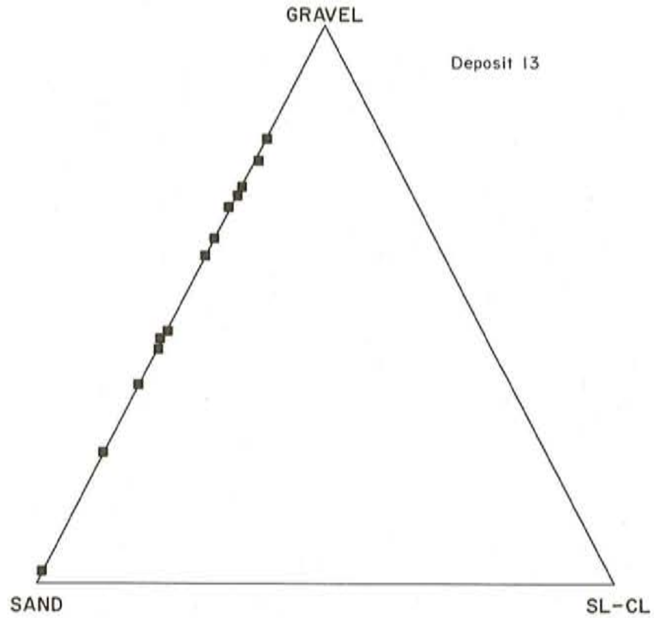

Figure 10. *Ternary diagram of granular distribution of samples collected in the Three Brooks deposit.*

petrographic quality reduces its potential as a high-quality aggregate.

MAP AREA NTS 2D/14

14. NORTHWEST GANDER RIVER

The banks of the Northwest Gander River located in the southeast corner of map area NTS 2D/14 (Figure 2) consist of glaciofluvial terrace sediment that can be divided into three different zones based on grain size (Table 2; Figure 11).

Zone A is the most southerly and the largest of the three areas. It is approximately 4 km long and 0.3 km wide, and varies in thickness from 2 to 8 m. This area consists of poorly sorted sandy gravel and moderately sorted sand, both with low silt–clay content (Figure 11). Petrographic quality is generally poor, resulting from moderately weathered sandstone and siltstone and highly weathered undefined pebbles.

Zone A along the Northwest Gander River has been used for construction of forest access roads, but has sufficient reserves to be considered as a high-potential site for future quarry development. However, variable petrographic quality indicates a need for more sampling and analyses in this area.

Zone B is located on the west side of the Northwest Gander River, south of Red Rock Brook. It is approximately 1 km long and 1 km wide. Road-cut exposures (Plate 7) indicate it is approximately 3 m thick but may locally reach a thickness of 7 m. Zone B is a poorly to moderately sorted gravel with low sand and silt–clay contents (Figure 11). Petrographic numbers of 128 and 158 were calculated from

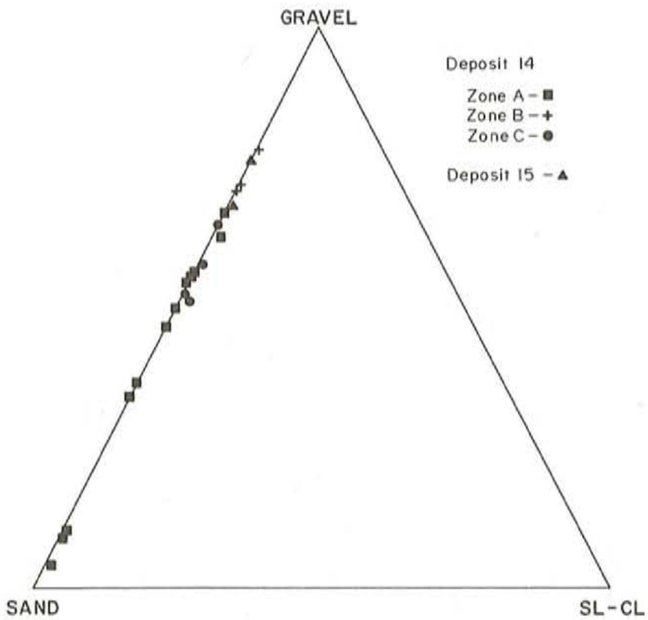

Figure 11. *Ternary diagram of granular distribution of samples collected in the Northwest Gander River and Clarks Brook; deposits 14 and 15 respectively.*

Plate 7. *A 3 m road-cut in zone B along the Northwest Gander River.*

the analyses of two samples. Pebbles consist mainly of fresh granite.

Although the site area is widespread, it is generally thin and quarry operations in this zone will require a large working area. A large amount of topsoil, trees and root debris will have to be removed thereby increasing cost of quarry operation. As a result, this deposit is considered to have a moderate potential for quarry development.

Zone C is located at the outlet of the Northwest Gander River into Gander Lake. It is 3.5 km long and varies from 50 to 350 m wide. Thicknesses range from 3 to 8 m. This is a poorly sorted sandy gravel deposit with low silt—clay content (Figure 11). Petrographic quality ranges from good to poor based on analyses of three samples. The quality of the deposit is reduced by the presence of weathered sandstone and some highly weathered undefined pebbles.

This last zone in deposit 14 has a moderate to low potential for quarry development. Areas of thin sediment and private land ownership will have a negative influence on quarry development in this area, and the variable petrographic quality indicates a need for more sampling and analyses.

15. CLARKS BROOK

The Clarks Brook deposit is an esker complex situated in the southeast corner of map area NTS 2D/14 (Figure 2). It is approximately 500 m long, 200 m wide and 3 to 8 m thick. Grain-size analyses of 2 samples collected from a hand-dug pit and a stream cut indicate this deposit contains poorly sorted gravel with low silt—clay content (Table 2; Figure 11). Petrographic analyses of two samples are 112 and 150, indicating a good-quality aggregate.

Based on potential reserves and grain-size data, the Clarks Brook deposit may have a high potential for quarry development.

OTHER DEPOSITS

Resource areas not numbered in Figure 2 also contain sand and gravel. However, these deposits are small, with depleted or low reserves, restricting continued quarry operations or new quarry development.

SUMMARY

Granular deposits were sampled within the study area to determine their potential for use in the aggregate industry. Several deposits are thin (around 2 to 3 m) and would require extensive topsoil, vegetation and root-debris removal to mine small amounts of material, thereby increasing excavating cost. Deposits of this type are located along Stony Brook, Rattling Brook, near Three Brooks, zones A and B along the Northwest Gander River, zone B at Red Cliff, and parts of deposits along the Exploits River.

Many of the deposits sampled have sufficient quantities of material to support large quarrying operations (exceeding a 10-year production period). These include the northwest and southwest Exploits River deposits, zone A at Red Cliff, the Sandy Brook, Diversion Lake, West Stony Brook deposits, and zone A along the Northwest Gander River.

Low silt—clay content is necessary for aggregates used in concrete projects and asphalt. Most deposits sampled have a silt—clay content of less than 1 percent. Other deposits may have zones of sand—silt or silt—clay, which can be avoided during mining. This reduces the need for washing the material, thereby reducing overall cost. In some areas, screening or crushing may be necessary to remove the coarse aggregate fraction.

Results of petrographic analyses indicate generally poor petrographic quality throughout the study area. Samples from four deposits show petrographic numbers low enough to indicate suitable aggregate material for use in concrete or asphalt type projects. These deposits are located along the northwest Exploits River, the Aspen Brook–Leech Brook deposit, zone A at Red Cliff, along the Northwest Gander River and at Clarks Brook. Within some of these deposits, samples with higher petrographic numbers were also collected. To determine the suitability of aggregates for most concrete projects more extensive testing is needed other than petrographic analyses, as outlined by the CSA Standards for concrete materials. If granular materials are found to be unsuitable, alternative aggregate sources from outside the area or suitable bedrock sources closer to the construction site should be used.

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