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BEDROCK-AGGREGATE ASSESSMENT, SOUTH–CENTRAL NEWFOUNDLAND

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ABSTRACT

The 1996 field season consisted of regional and detailed bedrock-aggregate assessments in southern and central Newfoundland to determine the quality and potential reserves of bedrock aggregate for use as construction aggregate. The assessments concentrated mainly in the Norris Arm area to identify potential high-quality bedrock-aggregate reserves for immediate use, due to current road construction programs on the Trans-Canada Highway in this area.

A total of 224 potential bedrock-aggregate sites were visited and 160 samples were collected in southern and central Newfoundland. One hundred and twenty-three sites showed potential for high-quality bedrock aggregate, 56 sites were considered of marginal quality and 45 sites were considered to be of poor quality for construction-aggregate use. Geotechnical properties, deleterious substances and petrographic analyses (number, rating) were carried out for each sample. Los Angeles Abrasion, Micro-Deval, freeze/thaw, stripping and alkali-aggregate reactivity tests will be done on selected samples.

INTRODUCTION

During the 1996 field season, an evaluation of the bedrock-aggregate potential was carried out in central and southern Newfoundland (Figure 1) because of the constant depletion of the few known high-qaulity reserves in the area. This assessment was conducted in order to determine the quantity and quality of bedrock for potential use as construction aggregates in road building, bridge repair or construction and other applications, and thus eliminate the use of poor-quality aggregate, such as weathered rock in asphalt and granular material, friable rock for rip-rap or armour stone and alkali-reactive rocks that react with the cement to cause premature deterioration of concrete.

FIELD WORK

The study area covers parts of eight map areas (Figure 1) that were not covered in the 1989 field program (Bragg, 1990). Field work for the bedrock-aggregate assessment consisted of road traverses along highways and side roads; samples were collected from most roads-cuts and all quarries in the field area. Field investigation for each site consisted of determining rock type, overburden thickness, degree of weathering, geological structures present and mineralization; veining and alteration zones were also noted.

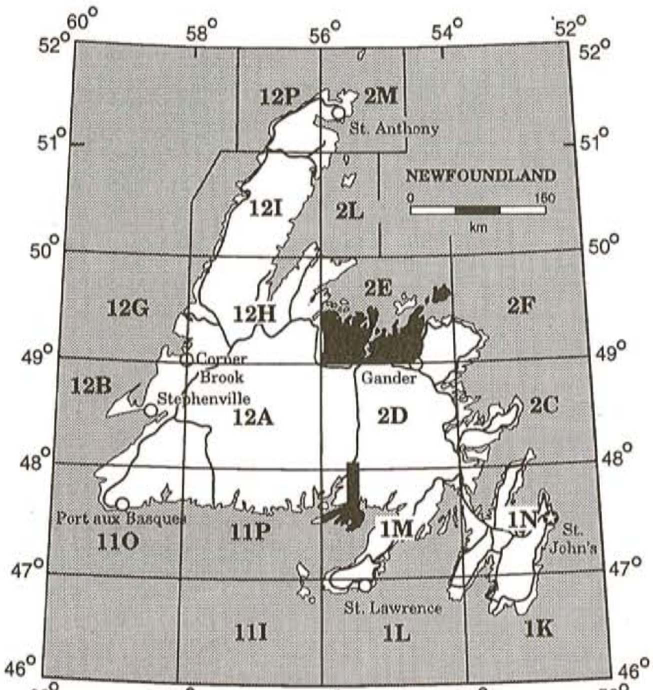

Figure 1. *Index map showing field survey area for the 1996 field season.*

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Once the site investigation has been completed, an initial quality reference (petrographic number) is given to each sample collected based on the durability of the rock. The durability of a rock is based on a number of factors (fractures, joints, cleavages, grain size, bedding, flow structures, mineral alignment, hardness and degree of weathering), which may be deleterious to the rock. Deleterious substances are materials that occur within, or on the rock surface, and are capable of producing adverse effects on the rock such as premature deterioration of the rock when used as a construction aggregate (road building, asphalt, concrete, rip-rap, and armour stone). Common deleterious substances include clay minerals, organic matter, mica, iron and manganese oxide staining and cherty or fine-grained siliceous material.

A petrographic number (P.N.) is calculated for each sample site. This is a preliminary screening test to measure the quality of a material for aggregate use. The petrographic number may be calculated by multiplying the percentage of a particular rock type at a site or in a sample by its appropriate petrographic factor (P.F.); then, the products are summed giving a petrographic number. The P.N. is the sum of the factors for the percentage of each rock type and can range from 100 to 1000. The lower the P.N., the higher the rock quality (e.g., a clean, fresh, hard, fine-grained durable granite would normally have a P.F. of 1 and a P.N. of 100; whereas a friable, soft shale would normally have a P.F. of 10 and a P.N. of 1000).

Along with the field investigation, a laboratory investigation consisting of petrographic analysis, petrographic numbering, and petrographic rating (Bragg, 1995) with hand and thin-section samples is undertaken for each sample. Additional laboratory testing is carried out on selected samples including Los Angeles Abrasion, Micro-Deval, stripping, freeze/thaw, and Alkali-Åggregate reactivity tests.

GENERAL GEOLOGY

The general geology of the field area (Figure 2) consists of Silurian, Ordovician and Cambrian sedimentary, metamorphic and igneous rocks in various degrees of alteration and weathering.

Volcanic and sedimentary rocks of the Silurian Botwood Group (Williams, 1962) consist of sandstone, siltstone, mudstone, conglomerate, mafic and felsic flows and pyroclastic rocks; the Goldson Group (McKerrow and Cocks, 1978) contains sandstone, siltstone, argillite and conglomerate; the Fogo batholith (Williams, 1957) includes diorite and granodiorite; the Gaultois Granite (Colman-Sadd, 1974) consists of biotite granite; the Loon Bay Batholith (Elliott *et al.*, 1991) consists of diorite, granodiorite, and the Mount Peyton intrusive suite (Blackwood, 1981) includes gabbro, diorite, granodiorite and syenite.

Sedimentary, metamorphic and igneous rocks of the Ordovician Davidsville Group (Kennedy and McGonigal, 1972) contains sandstone, siltstone, conglomerate, shale, slate and minor limestone; the Gander Group (McGonigal, 1973) consists mainly of psammite, pelite, semipelite and minor mafic tuff; the Baie D'Espoir Group (Jewell, 1939) consists of shale, slate, sandstone, siltstone, mafic and felsic tuffs; the Sansom Formation (Heyl, 1936) consists mainly of greywacke interbedded with argillite and shale; and the Dunnage Melange (Hibbard and Williams, 1979) consists mainly of blocks of basalts, gabbro, greywacke, limestone, sandstone and granite in a matrix of shale, argillite and mudstone.

Igneous rocks of the Cambrian Twillingate granite (Baird, 1953) consist of granite and granodiorite.

RESULTS

During the 1996 field season, a total of 224 sites were visited and 160 samples collected. Table 1 shows the initial quality of the different rock units investigated during the 1996 field season based on field observstions and petrographic number. Of the 224 sites visited, 123 show potential for high-quality construction aggregate, 56 sites show potential for marginal-quality construction aggregate and 45 sites were considered to be of poor quality for construction-aggregate use.

The Botwood Group, Fogo batholith, Loon Bay granodiorite, Mount Peyton intrusive suite, Sansom Formation, Twillingate granite and the Gaultois Granite are all considered to be of potentially high quality for construction-aggregate use. A total of 125 sites were examined from these units, of which 95 sites were considered to be of high quality (P.N. 110 to 145), 18 sites are considered to be of marginal quality (P.N. 155 to 225), 12 sites were considered to be of poor quality (P.N. 250 to 350).

The Gander Group, Goldson Group, Loon Harbour volcanics and the Wigwam Formation are all considered to be of marginal quality for construction-aggregate use. A total of 55 sites were examined from these units. Of these, 38 sites were considered to be of marginal quality, 7 sites were considered to be of poor quality and 10 sites were considered to be of high quality.

The Davidsville Group, Dunnage Melange and Baie D'Espoir Group are all considered to be of poor quality for construction-aggregate use. A total of 44 sites were examined from these units, of which 27 sites were considered to be of poor quality for road construction use, 14 sites were considered to be of marginal quality, and only 3 sites were considered to be of high quality for construction-aggregate use.

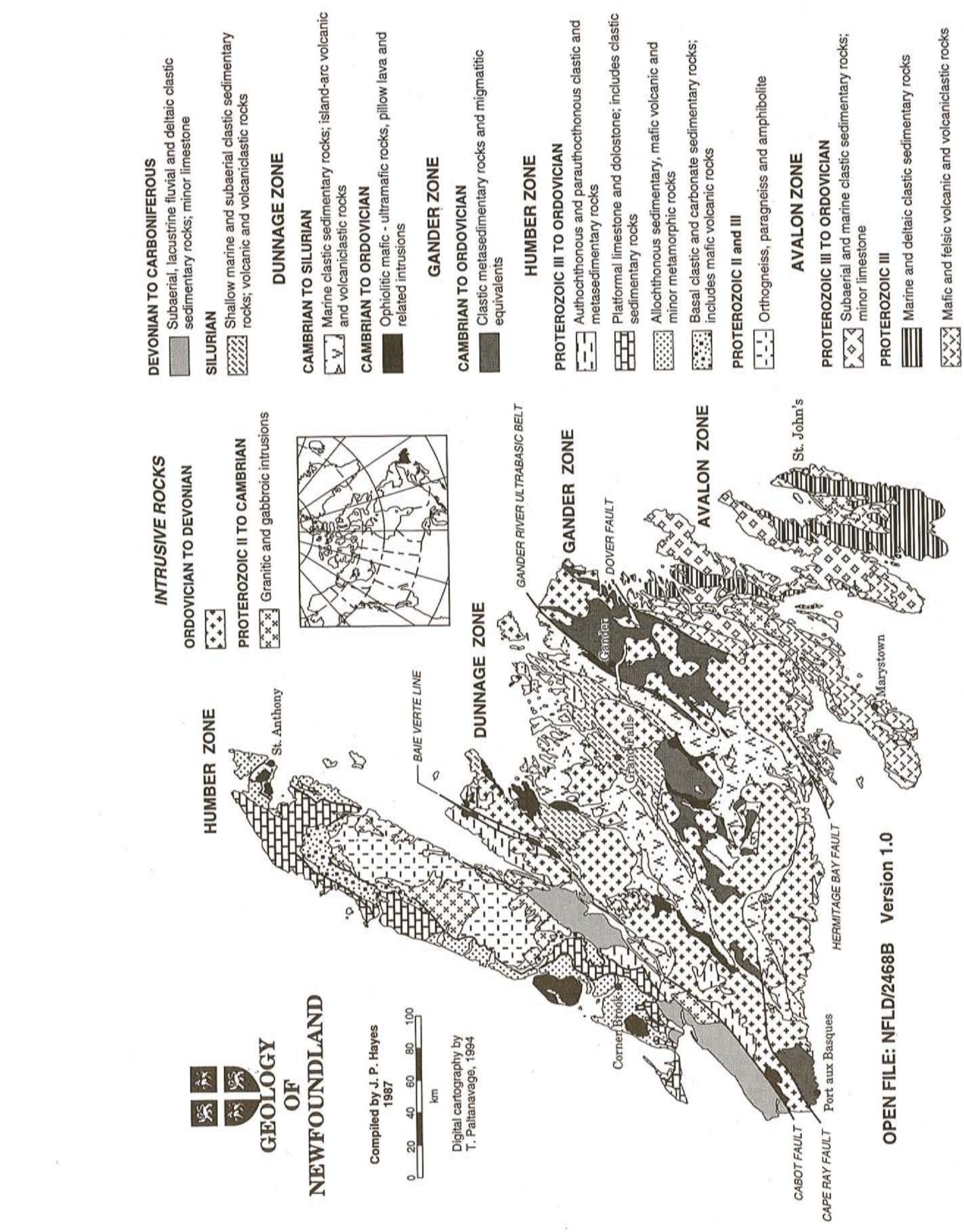

Figure 2. *Geology of the Island of Newfoundland (Hayes, 1987).*

Table 1. Petrographic number ranges of different rock units sampled in the 1996 field season

Group/Formation	Number of sites	Petrographic number range	Sites with petrographic number < 150	Sites with petrographic number > 150	Average petrographic number
Botwood Group	21	125-300	9	12	165
Davidsville Group	12	250-500	0	12	350
Dunnage Melange	8	135-350	2	6	250
Fogo batholith	19	110-145	19	0	120
Gander Group	18	120-250	6	12	175
Goldson Group	13	125-200	6	7	165
Loon Bay granodiorite	15	115-150	15	0	127
Loon Harbour volcanics	11	145-250	4	7	165
Mount Peyton intrusive suite	18	110-250	15	3	130
Sansom Formation	25	110-350	18	7	160
Twillingate granite	17	110-350	12	5	145
Wigwam Formation	13	120-1000	5	8	250
Baie D'Espoir Group	24	150-500	5	19	225
Gaultois Granite	10	115-250	7	3	130

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