COAL ASSESSMENT IN THE DEER LAKE CARBONIFEROUS BASIN

by

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An assessment of coal occurrences in the Deer Lake Carboniferous Basin was begun in the 1981 field season. The area examined lies within a narrow (approximately 1.2 km wide) sedimentary belt along the northeast shore of Grand lake. The belt extends from Hinds Brook in the southwest to Kelvin Brook in the northeast, a distance of about 11 km, and comprises a series of sedimentary units known as the Howley Beds. Hacquebard *et al.* (1960) determined the Howley Beds, from spore dating, to be Westphalaian A age, thus correlating the coal-bearing strata in terms of age, with the late Cansoan or early Riversdalian strata of the Maritime Provinces.

The existence of coal in the Howley area was first noted by Newfoundland's first government geologist, J.B. Jukes, in 1839-40. He reported a 15 cm coal seam on Coal Brook (Snelgrove, 1953). Additional coal occurrences on Coal, Alder and Kelvin Brooks and in the Goose Brook area, were reported by Howley (1893, 1913), who made a prodigous but unsuccessful effort to locate a coal field. A coal seam on Coal Brook was exploited on a small scale by the Reid Newfoundland Development Company in 1914, and later further explored underground by the Anglo-Newfoundland Development Company (1947). Hayes' (1949) survey of Newfoundland coal occurrences concentrated mainly on coal occurrences in the St. George Carboniferous basin with apparently minimal field work in the Howley area. For a more comprehensive treatment of the history of coal exploration in the Howley area, readers are referred to an unpublished report by Hyde (1978).

Analytical data listed by Hayes (1949) for 10 samples of Howley coal and vitrinite reflectance values obtained by Hacquebard and Donaldson (1970) from four samples indicate that it has a high volatile B rank.

The 1981 field project consisted of detailed mapping along 5 streams (Kelvin, Coal, Alder and two small unnamed streams). Except for certain sections of Coal and Alder Brooks, bedrock exposure is generally poor and greatly restricts geological interpretation.

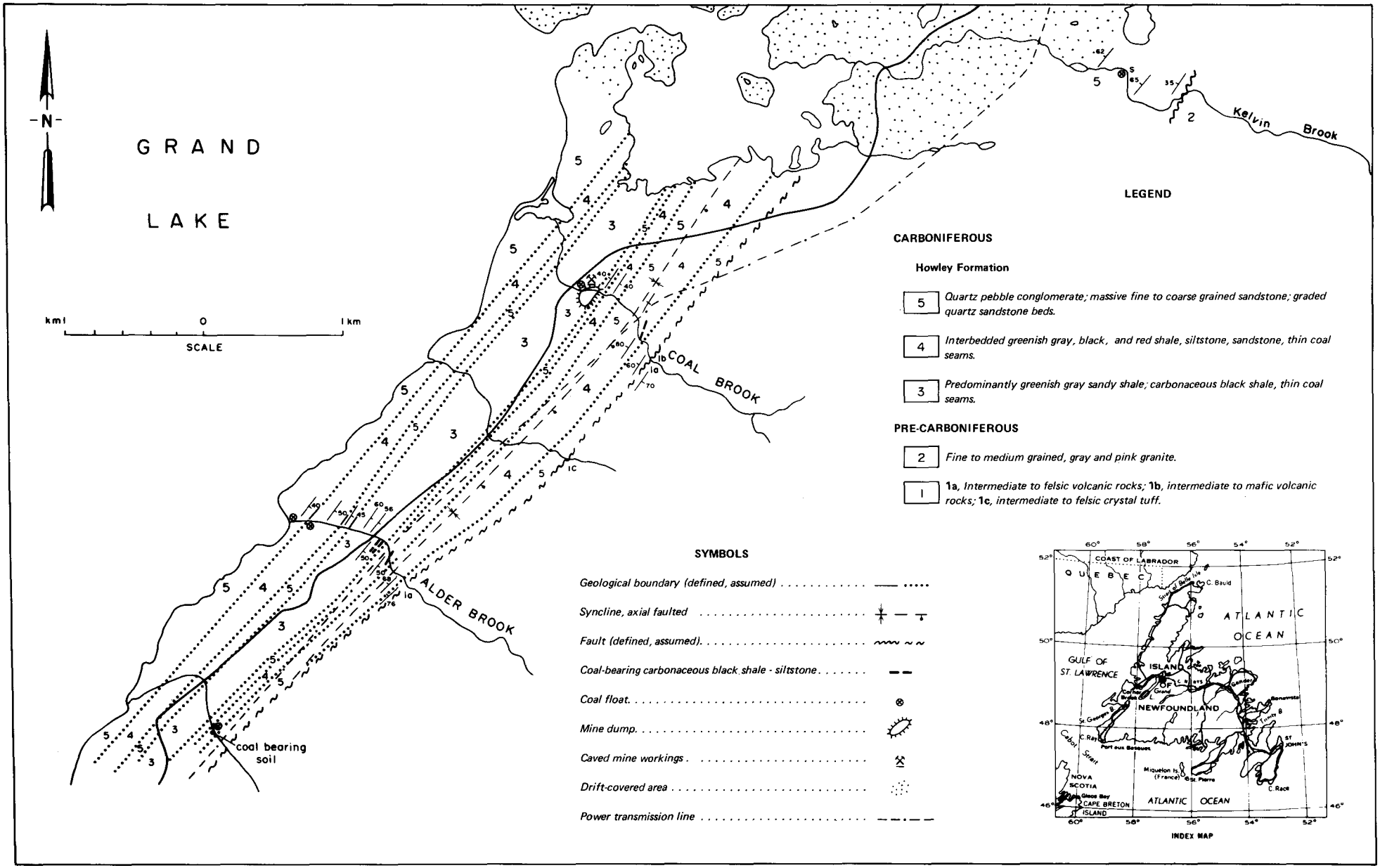
Some geophysical surveys (ground VLF-EM and magnetic) were also carried out.

GEOLOGY

Rocks of the area were divided into 5 main units. Volcanic rocks (Unit 1) and granite (Unit 2) constitute the Pre-Carboniferous eastern boundary of the Howley Beds. Predominantly greenish gray, sandy shale, carbonaceous black shale with thin coal seams (Unit 3), interbedded greenish gray, black, red shale, siltstone, sandstone and thin coal seams (Unit 4), and quartz pebble conglomerate, massive fine to coarse grained sandstone, and graded quartz sandstone beds (Unit 5) comprise the Howely Beds. The sedimentary rocks form a long northeast striking synclinal structure. A high-angle fault is postulated to lie along the fold's axis. This could explain the contrasting rock types which lie adjacent to the proposed axis.

UNIT 1

Volcanic rocks define the eastern boundary of the Howley Beds with which they are in fault contact. No attempt was made to divide these rocks beyond the immediate contact area, however, intermediate to felsic rocks were


N
GRAND
LAKE
km 1 0 1 km
SCALE
Kelvin Brook
COAL BROOK
ALDER BROOK
coal bearing soil
LEGEND
CARBONIFEROUS
Howley Formation
5 Quartz pebble conglomerate; massive fine to coarse grained sandstone; graded quartz sandstone beds.
4 Interbedded greenish gray, black, and red shale, siltstone, sandstone, thin coal seams.
3 Predominantly greenish gray sandy shale; carbonaceous black shale, thin coal seams.
PRE-CARBONIFEROUS
2 Fine to medium grained, gray and pink granite.
1 1a, Intermediate to felsic volcanic rocks; 1b, intermediate to mafic volcanic rocks; 1c, intermediate to felsic crystal tuff.
SYMBOLS
Geological boundary (defined, assumed)
Syncline, axial faulted
Fault (defined, assumed)
Coal-bearing carbonaceous black shale - siltstone
Coal float
Mine dump
Caved mine workings
Drift-covered area
Power transmission line
COAST OF LABRADOR
QUEBEC
ATLANTIC OCEAN
GULF OF ST. LAWRENCE
NEWFOUNDLAND
NOVA SCOTIA
CAPE BRETON ISLAND
ATLANTIC OCEAN
INDEX MAP

observed on Coal Brook and Alder Brook, intermediate to mafic rocks on Coal Brook and intermediate-felsic crystal tuff on the innamed brook that flows roughly midway between and parallel to Coal and Alder Brooks.

UNIT 2

Highly sheared and altered fine to medium grained gray and pink granite was noted on Kelvin Brook where it forms the eastern boundary of the Howley Beds at that point.

UNIT 3

Greenish-gray sandy shale with minor carbonaceous shale form a belt of northeast striking southeasterly dipping rocks noted mainly on Alder and Coal Brooks. Rusty weathered sandy shale with up to 5% fine grained muscovite and chloritic sandy shale occur in the stream bed on Coal Brook near the old coal mine dump. Several thin beds of carbonaceous shale containing very thin coal seams were identified in this unit on Alder Brook, and although no *in situ* coal was found in the equivalent rocks on Coal Brook, the old mine dump contains numerous fragments of coal, which are strong evidence that such seams exist, but are probably obscured by overburden and dump material.

UNIT 4

Unit 4 consists of interbedded greenish-gray, black and red shale and siltstone, quartz sandstone and minor thin coal seams. The best exposed section of this unit occurs in the bed of Coal Brook about 800 m upstream from the hydro road bridge. There, a 50 m cross-section of steeply westward dipping strata is exposed. Twelve beds were identified in this section and are described below in ascending order:

0-3.0 m Sandstone, grades from fine to coarse grained (fining upwards). Five percent quartz feldspar pebbles, which average 2 mm in diameter in a gray, coarse sandy matrix grades upwards into fine grained gray sandstone.

3.0-5.5 m Quartz sandstone, light gray, medium grained, micaceous. Contains plant debris (stems, twigs, etc.)

5.5-9.5 m Shale, rusty weathered surface, greenish-gray fresh surface, micaceous, moderately fissile.

9.5-16.0 m Siltstone, rusty weathered surface, dark gray to black fresh surface, fine to very fine grained, massive, 2-3% sericite, ripple laminated.

16.0-18.5 m Shale, rusty weathered surface, black fresh surface, fine grained, contains abundant iron nodules concentrated in a 0.5 m wide basal zone.

18.5-19.0 m Sandstone, light brown to buff weathered surface, light gray fresh surface, fine grained, joints perpendicular to bedding filled with quartz carbonate.

19.0-19.7 m Shale, rusty weathered surface, dark gray fresh surface, fine grained, 10-15% sericite, ironstones up to 8 cm in diameter present.

19.7-20.0 m Shale, red, fine grained.

20.0-24.5 m Shale, dark gray to black, mottled, fine grained, contains numerous, randomly distributed, conical to cylindrically shaped ironstone nodules up to 6 cm (long axis), 3 cm (short axis).

24.5-25.3 m Coal, highly weathered, mixed with carbonaceous shale.

25.3-33.0 m Shale, sandy, rusty weathering, fine grained, light gray, micaceous in part, crossbedded.

33.0-49.0 m Sandstone, light gray to buff, medium to coarse grained, abundant subrounded to angular quartz pebbles averaging 1 mm in diameter near top of bed.

The distinctive association of thin coal seams and ironstone bearing, mottled shales was also noted in equivalent rocks exposed along strike, a short distance upstream from the hydro access road bridge on Alder Brook. Also at this location, a 1 m wide bed of coalbearing shale occurs, underlain by massive fine grained, dark gray, micaceous sandstone containing carbonaceous films and rootlets.

Mottling, ferruginous nodules, carbon films and rootlets are all diagnostic features of ancient soils (Collinson, 1978). The mottled appearance is attributed to migration in solution of iron and manganese ions leading to the patchy accumulation of their oxides and hydroxides as grain coatings. The nodules are interpreted as being due to precipitation from groundwater. Ferruginous nodules are commonly associated with rootlet bearing gray beds below coal seams and in the Carboniferous coal measures these rootlets are usually preserved as carbon films. The coals are thought to be the product of *in situ* plant growth and decay with the seat earth (paleosol) being the soil for the earliest plants, the decomposition of which would provide a soil for later plants.

UNIT 5

Unit 5 consists of quartz-pebble conglomerate, massive, fine to coarse grained sandstone and graded quartz sandstone beds. Three isolated but spectacular outcrops of cobble-boulder conglomerate that occur on Kelvin Brook near the granite contact, have been included in Unit 5.

The quartz pebble conglomerate occurs in fairly massive to massive outcrops; pebbles of quartz are prominent on the brown weathered surface. The fresh surface is light gray-brown. Rounded - subrounded - angular quartz pebbles up to 5 cm in diameter constitute 5-20% of the rock in a coarse grained sandy matrix usually containing about 5% medium grained muscovite. Although quartz pebbles dominate, feldspar clasts were also observed. The unit also contains light gray to buff, fine to coarse grained sandstone and graded quartz sandstone occurring in fining upward sequences. One particularly well exposed outcrop on Alder Brook consists of 8-10 graded beds averaging 1.7 m thick underlain by a basal quartz pebble conglomerate.

Three outcrops of cobble-boulder conglomerate were observed on Kelvin Brook near the contact with pre-Carboniferous rocks (granite). Two outcrops separated by a 2 m band of red mudstone occurs about 350 m downstream from the granite contact. The rock consists of 40% poorly sorted pebbles, cobbles and boulders comprising a wide variety of sizes, shapes and lithologies set in 60% matrix of greenish coarse grained sandstone. The pebbles and cobbles appear to be orientated parallel to the bedding and there is some suggestion of a coarsening upwards graded bedding. About 230 m upstream at least ten graded conglomeratic beds were identified each up to 50 cm thick and consisting of poorly sorted pebbles and cobbles in a red silty matrix.

COAL OCCURRENCES

Five coal-bearing carbonaceous shale units were identified, four of which occur in close proximity with each other along the west bank of Alder Brook. The thickest unit is about one metre wide and contains 30-40% thin (up to 2 cm) coal seams. Other such units may exist along the same slope, but mud, gravel and an almost impenetratable tangle of deadfalls cover the bedrock. Coal float, the largest of which measures 15 cm by 25 cm, is common in the stream bed in this area and is

probably derived from a thicker unexposed coal seam upstream.

The fifth coal bearing unit, a 0.8 m wide carbonaceous shale unit located about 800 m upstream from the hydro road along coal Brook, contains <10% thin coal seams. The association of these coal-bearing horizons with underlying shales and sandy shales containing features characteristic of ancient soils has already been noted.

A coal-bearing soil occurs on an unnamed stream located about 1.8 km southwest of Alder Brook and is described with the soil profile below.

0 - 10 cm	organic layer
10 - 120 cm	rusty cobbly till
120 - 145 cm	grayish brown clayey silt
145 - 153 cm	dark gray silty clay
153 - 162 cm	black carbonaceous clayey silt with abundant minute coal chips (pinches out downstream)
162 - ?	brownish gray clayey silt

Coal chips from the soil have been sampled for analysis.

A one metre wide zone of dark carbonaceous soil containing coal chips was also discovered on Kelvin Brook about 2 km upstream from the hydro road. Due to the lack of outcrop and the weathered nature of the material, it is difficult to determine whether this represents a weathered shale-coal zone, or an unconsolidated soil containing coal chips.

Mine dumps, collapsed workings and trenched areas were identified over the abandoned mine on Coal Brook. No *in situ* coal seams were found and are perhaps masked by the heavy vegetation dump material which straddles the stream. Fragments of coal from the site were collected for analysis.

GEOPHYSICS

Ground VLF-EM and magnetic surveys (using a Geonics EM16 and Scintrex Fluxgate magnetometer) were conducted over the coal-bearing shale units that were identified. The surveys were also conducted over the old mine site on Coal Brook utilizing a grid consisting of a cut baseline and flagged crosslines (20 m spacing). The objective was to test the effectiveness of those types of surveys in delineating the geology. Both types of surveys proved to be ineffective. The particularly flat EM profiles recorded may be due to the thick multi-layered nature of the area's overburden which includes a ubiquitous layer of clay.

Scintillometer readings were recorded over most of the outcrop exposures. Carbonaceous rocks and soils characteristically yielded higher counts, 2-3 times background. The highest counts were recorded over coal-bearing shales (1400 cps).

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