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GEOLOGY AND COAL RESOURCES OF THE NANAIMO GROUP IN THE ALBERNI, ASH RIVER, COWIE CREEK AND PARKSVILLE AREAS, VANCOUVER ISLAND (92F/2, 6, 7, 8)

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INTRODUCTION

This report is part of an ongoing study, begun in 1987, to establish the distribution and resource stratigraphy of the Vancouver Island coalfields. Knowledge of the extent of potentially underground-mineable coal resources will assist in the development of land-use guidelines for eastern Vancouver Island.

In this year's field program, we have investigated the extent and coal resource potential of the Comox Formation between Cowie Creek, Port Alberni and Parksville, in east-central Vancouver Island. We have also continued stratigraphic studies of the marine sediments of the middle Nanaimo Group, overlying the Comox Formation, in order to better ascertain the depth to the Comox in undrilled areas.

LOCATION AND ACCESS

The study area covers the central part of the eastern coastal plain of Vancouver Island and extends westward into the Alberni and Cameron River valleys (Figure 5-3-1). A dense network of public and private roads provides good access to most parts of the area, with the exception of the central peaks of the Beaufort Range, where rugged topography and low-grade timber resources have deterred road building. Elevations range from sea level to 1600 metres. Fairly gentle slopes on the coastal plain and in the large valleys are bounded by the steep slopes of the Beaufort Range, which forms a prominent mountain wall along the northeastern side of the Alberni Valley. Most of the region is covered by scrub forest, with small patches of merchantable timber along the higher slopes of the Beaufort Range.

Port Alberni is the major population centre in the study area; Qualicum and Parksville are the largest of several

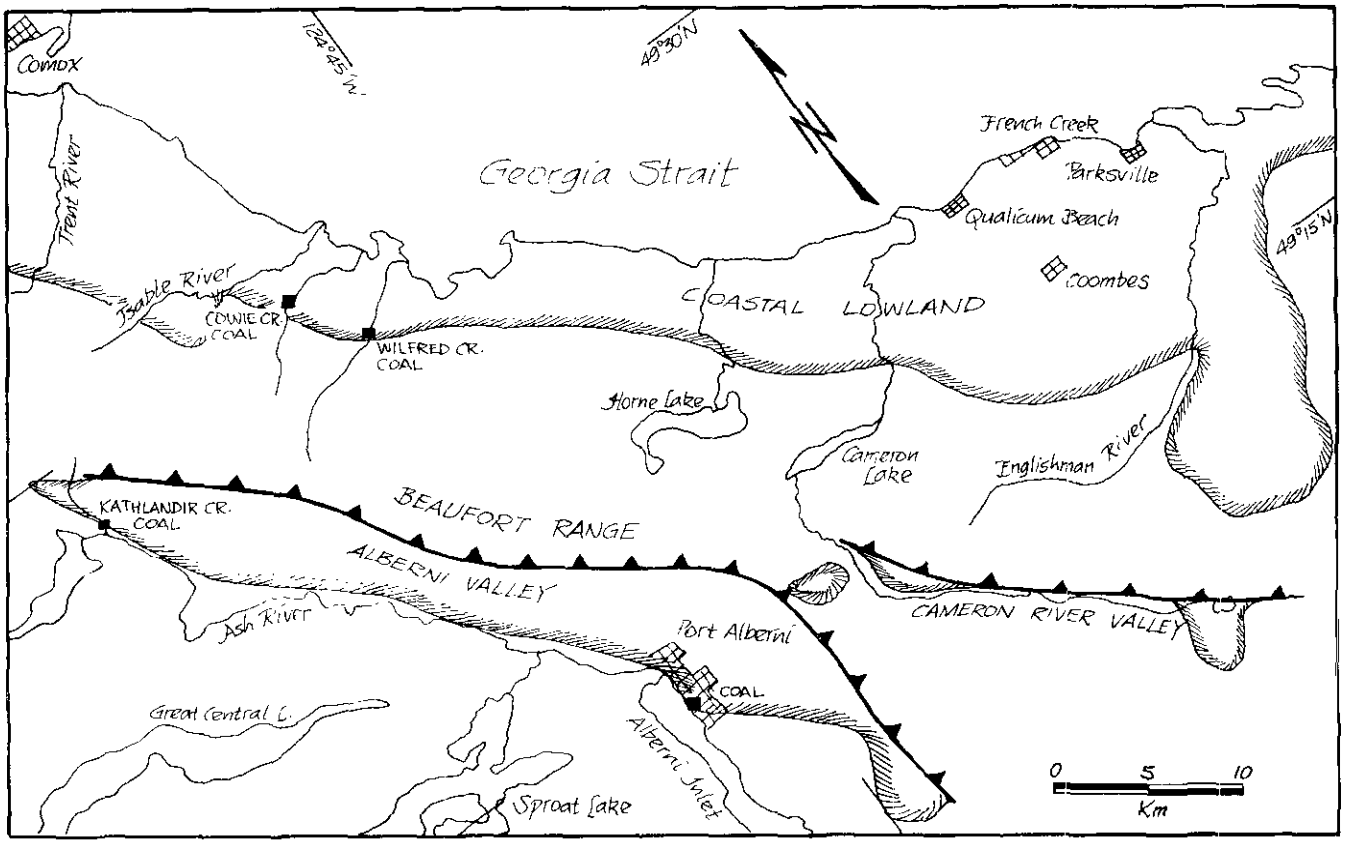

Figure 5-3-1. Location map.

resort communities along the eastern coast. Logging and pulp production are the major resource industries in the area, with tourism and real-estate development becoming increasingly important as the forest resources decline in volume and quality.

FIELDWORK

As in past years, geological mapping was done on aerial photographs and the observations transferred to base maps at 1:20 000 scale. Forest maps at the same scale, obtained from MacMillan Bloedel Ltd. and the Ministry of Forests, were used for orientation purposes in recently logged areas.

Samples of coal and carbonaceous mudstone were collected for petrographic study, and sandstones were collected for thin sectioning. Specimens were also collected, where appropriate, for paleontological and paleobotanical studies which should assist in refining the biostratigraphy of the lower Nanaimo Group.

GEOLOGICAL SETTING

The study area comprises the southerly half of the Comox sub-basin of the Late Cretaceous Georgia basin. The coal measures occur in the Cumberland and Dunsmuir members of the Comox Formation (Bickford and Kenyon, 1988). The Comox Formation outcrops on the eastern slopes of the Beaufort Range, and dips gently to moderately eastward beneath younger Cretaceous rocks and thick unconsolidated Pleistocene sediments. Dikes and sills of probable Tertiary age frequently cut the Cretaceous rocks in the southeastern part of the area, at the headwaters of the Englishman River.

Large outliers of the Comox Formation and younger Cretaceous rocks occur in the Cameron River and Alberni valleys, west of the Beaufort Range. These rocks dip moderately to the east and northeast, and are locally warped into asymmetric, southwest-verging folds. Overthrusts form the eastern margins of both the Alberni and Cameron River outliers; pre-Cretacous basement rocks have been thrust over the Cretaceous rocks and the resultant fault scarp forms the steep southwestern face of the Beaufort Range.

STRATIGRAPHY

Lithostratigraphic units of the lower Nanaimo Group are shown in Table 5-3-1 and illustrated in Figure 5-3-2. Formations and members have been traced into the study area, by mapping, from both the Cumberland (Bickford *et al.*, 1990) and Nanaimo (Bickford and Kenyon, 1988) coalfields

Contrary to the position presented by England (1989), the lower units of the Nanaimo Group may be readily traced from the Comox to the Nanaimo sub-basins of Georgia basin. The traceability of Cretaceous rock units between the two sub-basins suggests that the onshore portion of the Nanoose uplift (Muller and Jeletzky, 1970; Yorath and Sutherland Brown, 1984), at least during the Santonian and early Campanian stages, did not form a substantial barrier

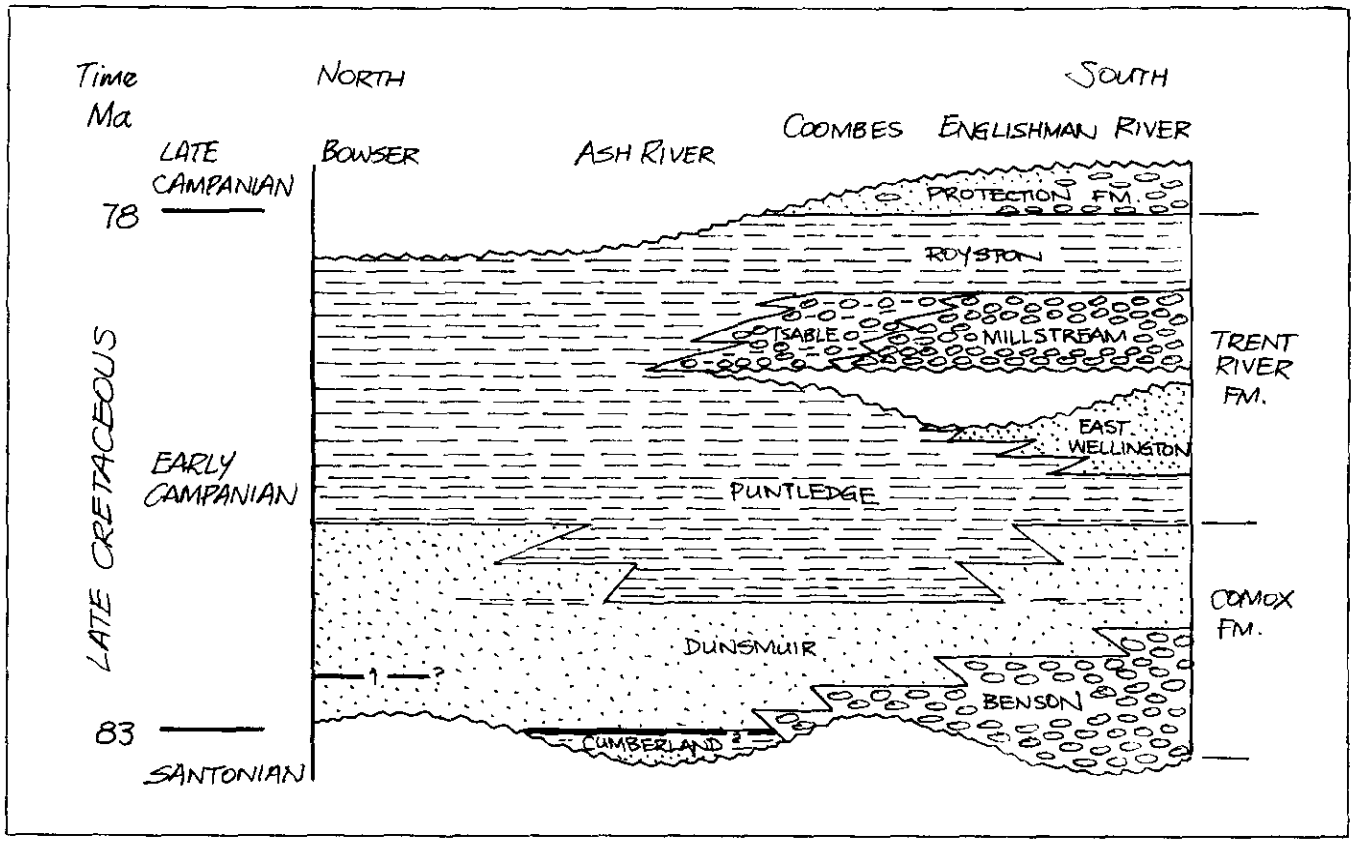

Figure 5-3-2. Chronostratigraphic diagram of lower Nanaimo Group, southern Comox sub-basin.

TABLE 5-3-1
LITHOSTRATIGRAPHIC UNITS OF THE LOWER NANAIMO GROUP, SOUTHERN HALF OF COMOX SUB-BASIN

Formation:	Member:	Lithology:
Protection		Conglomerate and sandstone
		Abrupt Contact
Trent River	Royston	Mudstone and siltstone
		Intertonguing Contact
	Tsable	Mud-matrix conglomerate and pebbly siltstone
		Intertonguing Contact
	Millstream	Conglomerate and gritstone
		Erosional Contact
	East Wellington	Sandstone
		Intertonguing Contact
	Puntledge	Mudstone; siltstone at top; minor glauconitic sandstone at base.
		Intertonguing Contact
Comox	Dunsmuir	Sandstone; minor siltstone and coal
		Abrupt Contact
	Cumberland	Siltstone; minor sandstone, shale and coal.
		Intertonguing Contact
	Benson	Conglomerate; minor red siltstone at top.
		Erosional Contact
Pre-Cretaceous volcanic, plutonic and metasedimentary basement.		

between the two sub-basins. There is no evidence to suggest that the Comox and Nanaimo sub-basins were ever separate depositional areas, and their existence as geographically separate entities can be wholly explained by post-Cretaceous erosion along the Nanoose uplift.

Conglomerates Near Parksville

Ridge-forming conglomerates near Parksville were assigned to the Parksville member of the Trent River Formation by England (1989). In the course of this year's mapping, we have been able to distinguish three different types of conglomeratic units near Parksville. Two of these units we have assigned to the Millstream and Tsable members of the Trent River Formation, while the third we assign to the Protection Formation.

MILLSTREAM MEMBER

The Millstream member at Parksville consists of at least 90 metres of quartz, chert and basalt-pebble conglomerate and pebbly gritstone. It is well exposed along the Alberni Bypass Highway near Craig's Crossing and forms Little Mountain, a prominent hill south of the outskirts of Parksville. Distinguishing features of the Millstream conglomerates are absence of bioturbation, other than rare rooting at bed tops, excellent framework sorting and well-developed medium to very thick planar stratification and low-angle trough cross-stratification. We interpret the Millstream member near Parksville to be a delta-front deposit, sourced by streams carrying large amounts of gravel and grit as bed load.

The Millstream member was previously assigned to the Extension Formation of the Nanaimo coalfield (Bickford and Kenyon, 1988). Although we can confidently map this conglomeratic unit across the erosional gap of the Nanoose arch into the Parksville area, we cannot trace it across the remainder of the type Extension Formation and we therefore consider the Millstream member at Parksville to be a member of the Trent River Formation.

TSABLE MEMBER

The Tsable member at Parksville consists of mud-matrix, chert-pebble conglomerates with abundant interbeds of pebbly siltstone. It is well exposed in the canyon of French Creek above the Alberni Highway bridge at Coombes village where it is 20 to 30 metres thick. Distinguishing features of the Tsable conglomerates and pebbly siltstones are moderate bioturbation of bed tops (chiefly irregular grazing trails), good framework sorting with disorganized sedimentary fabric, and the sparse presence of broken pelecypod and ammonoid shells. We interpret the Tsable member at French Creek to be a submarine-canyon fill, sourced by the northwestward collapse of the Millstream delta-front.

PROTECTION FORMATION

The Protection Formation at Parksville consists of at least 30 metres of quartz-chert-basalt gritstone and sandy pebble conglomerate with abundant whole and broken pelecypod shells. It is well exposed along the coastline east of the mouth of French Creek and also forms low, north-dipping cuesta ridges at the east and west ends of the town of Parksville. Distinguishing features of the Protection conglomerates include their greenish or greenish grey coloration and their abundant content of shell debris. We interpret the Protection conglomerates at Parksville to be delta-front or barrier-bar deposits.

ECONOMIC GEOLOGY

Only four significant coal showings were identified during the 1990 field season. The lack of coal showings is partly due to poor exposure, but also to the general lack of suitable depositional conditions in the southern part of the Comox sub-basin. Three of the four showings are along the northern edge of the study area and represent extensions of prospective areas identified in previous studies. Details of

TABLE 5-3-2
SIGNIFICANT OCCURRENCES OF COAL AT OUTCROP IN THE SOUTHERN PORTION OF THE COMOX SUB-BASIN

Locality	UTM Coordinates	Coal Bed	Thicknesses Gross	Thicknesses Net	Per Cent Coal by Thickness
Cowie Creek	363510 E 5484425 N	No.3	2.92 m	2.21 m	76
Wilfred Creek	366315 E 5481140 N	No. 2	1.99 m	1.27 m	64
Kathlandir Creek	348860 E 5480700 N	No. 2?	2.15 m	1.20 m	56
Port Alberni	368210 E 5454740 N	No. 3?	0.91 m	0.56 m	70

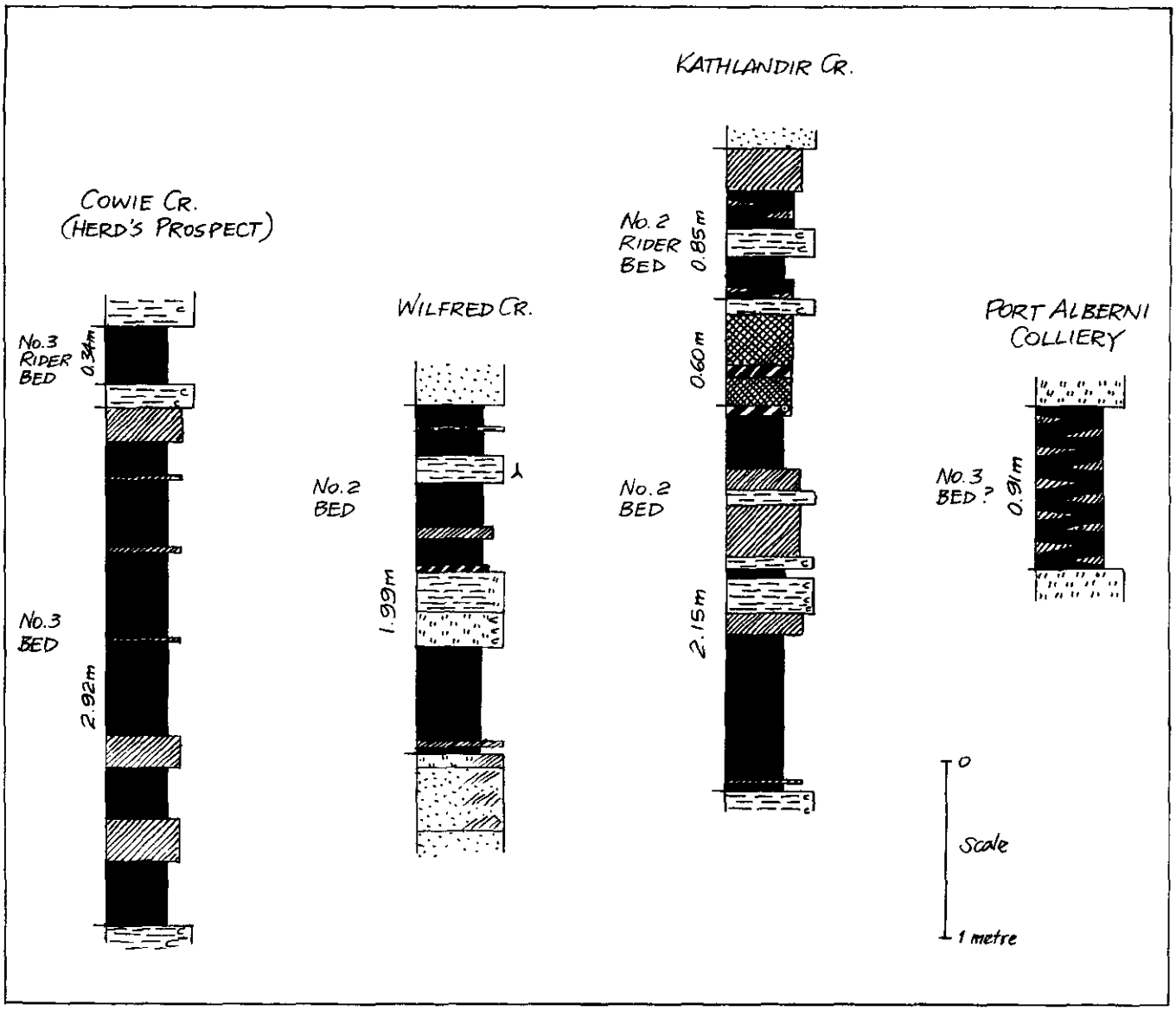

Figure 5-3-3. Measured sections of significant coal outcrops, southern Comox sub-basin.

the four coal showings are presented in Table 5-3-2, while graphic sections are shown as Figure 5-3-3.

The best showing is on Cowie Creek where an adit has been driven into the south bank of the creek, exposing a relatively clean bed of coking coal. This coal, which we correlate with the No. 3 bed of the type Comox section, is locally known as the Lower Seam and the adit is known as Herd's Prospect. Tests conducted on a bulk sample taken from the adit yielded a coke button which was described as "very hard, expanded, with metallic lustre (good coking)" (U.S. Steel Co., 1949). Although the U.S. Steel tests indicate that this coal is of good quality, its roof, which has caved near the portal of the adit, consists of a sheared carbonaceous mudstone with a thin rider coal band. Such a roof could be expected to cause problems in underground mining (Stan Lawrence, retired colliery manager, personal communication, 1990).

A short distance to the south, another old adit has been driven into the Comox No. 2 coal bed (locally known as the Upper Seam) on the south bank of Wilfred Creek. Despite an earlier report (Atchison, 1968) of thick and clean coal, this coal bed contains numerous partings of mudstone and on the whole is sheared and dirty. It has a strong sandstone roof which has stood, essentially unsupported, with only minor spalling, since the adit was driven in 1908. The net coal content of this bed, at 64 per cent, is marginal for underground mining, but should be an encouragement to further exploration in the area.

Approximately 18 kilometres to the east of the Wilfred Creek showing, a thick zone (>3.6 metres) of coal and shale is exposed on Kathlandir Creek, a south-flowing tributary to Ash River. This coal, discovered at the turn of the century, is locally known as the Ash River Seam; it is tentatively correlated with the Comox No. 2 and 2 Rider coal beds.

Only the lower, (No. 2) portion of this thick, dirty zone contains sufficient coal to have been considered as worthy of further investigation. Drilling in 1985 by Canadian Occidental Petroleum was aimed at establishing the continuity of the coal bed; results were not encouraging as the drilling showed the coal to be pockety and of local extent only.

On the eastern shore of Alberni Inlet, in Port Alberni city proper, a coal bed (possibly the Comox No. 3 bed) has been extensively prospected by trenching and underground development, and was unsuccessfully worked by the Port Alberni Colliery in 1911 and 1912 (Wilkinson, 1922; MacKenzie, 1923). Although the adit is now caved, the material dumped at the portal was sampled. The dump material consists of platy to blocky, bright coal with 30 per cent thin interbeds of black, coaly mudstone. Much of the coal shows woody surface markings, and it appears to be of allochthonous origin.

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