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COAL-BEARING FACIES IN THE NORTHERN BOWSER BASIN (104A, H)

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INTRODUCTION

Strata exposed in the drainage of the Klappan and Nass rivers were examined during the 1990 field season as part of an ongoing sedimentological study of the Groundhog coalfield and the surrounding area in the northern Bowser basin (Figure 5-8-1). The field program consisted of measurement, sampling and detailed description of outcrops chosen from airphotos and airborne reconnaissance based on their continuity and location relative to sections measured during prior field seasons. Sections examined are now being integrated with earlier sections to delineate the geographic limits of coal-bearing stratigraphic units across a wide area of the northern Bowser basin and to better understand the depositional history of the rocks. Coal-bearing strata studied during the 1990 field season belong to the Currier and McEvoy formations as originally described and defined in the Groundhog coalfield (Bustin and Moffat, 1983; Cookenboo and Bustin, 1989). Based on their gross lithology and facies characteristics, rocks examined south of Maitland Creek, near the headwaters of Konigus Creek, and south of Currier Creek are assigned to the Jurassic Currier Formation and strata at the southern end of Konigus Creek and west of the Nass River are assigned to the Cretaceous McEvoy Formation.

STRATIGRAPHY

Four lithostratigraphic units outcrop in the vicinity of the Groundhog coalfield (from oldest to youngest): Ashman, Currier, McEvoy and Devils Claw formations.

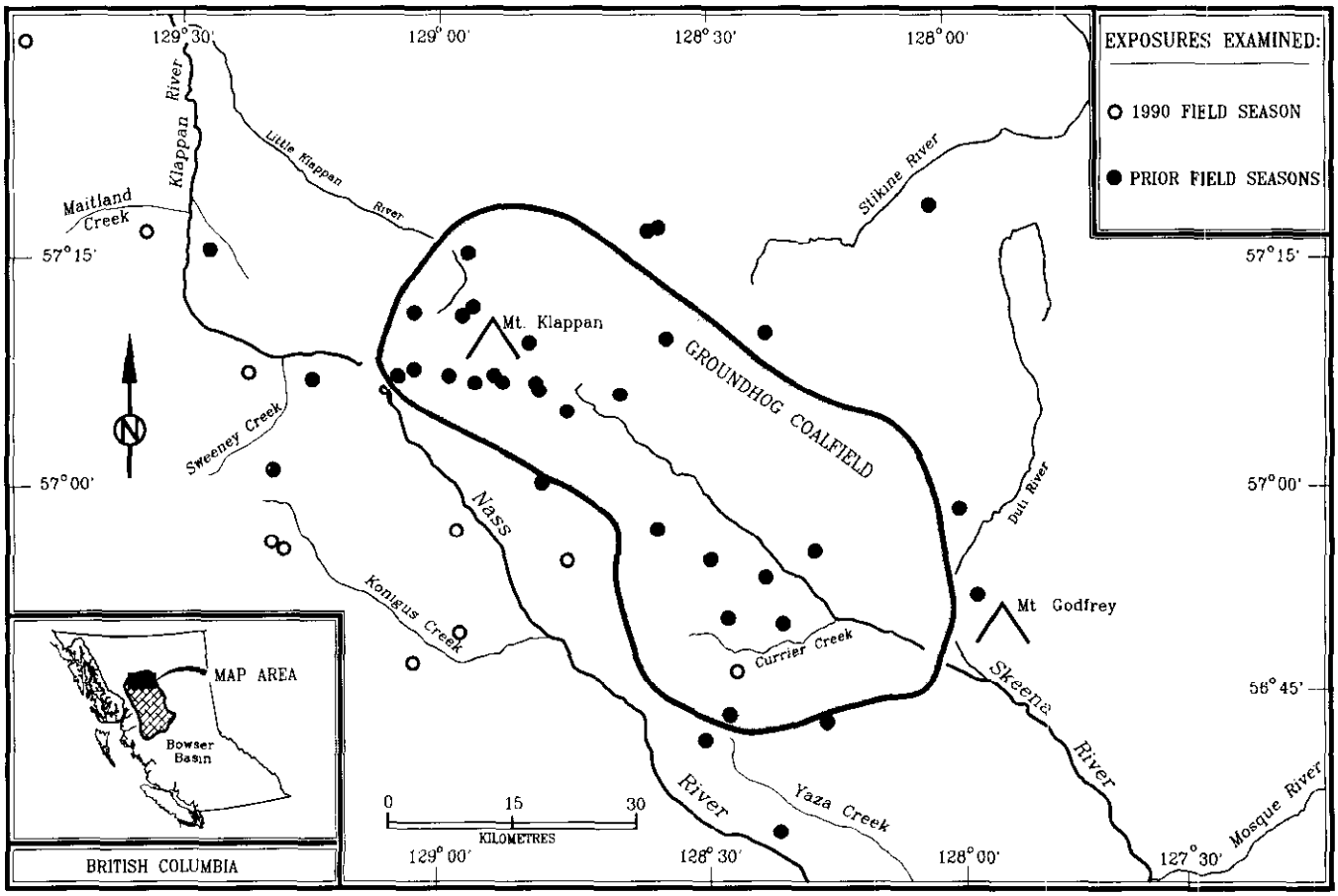

Figure 5-8-1. Map of the study area showing outcrops examined as part of this study and the Groundhog coalfield.

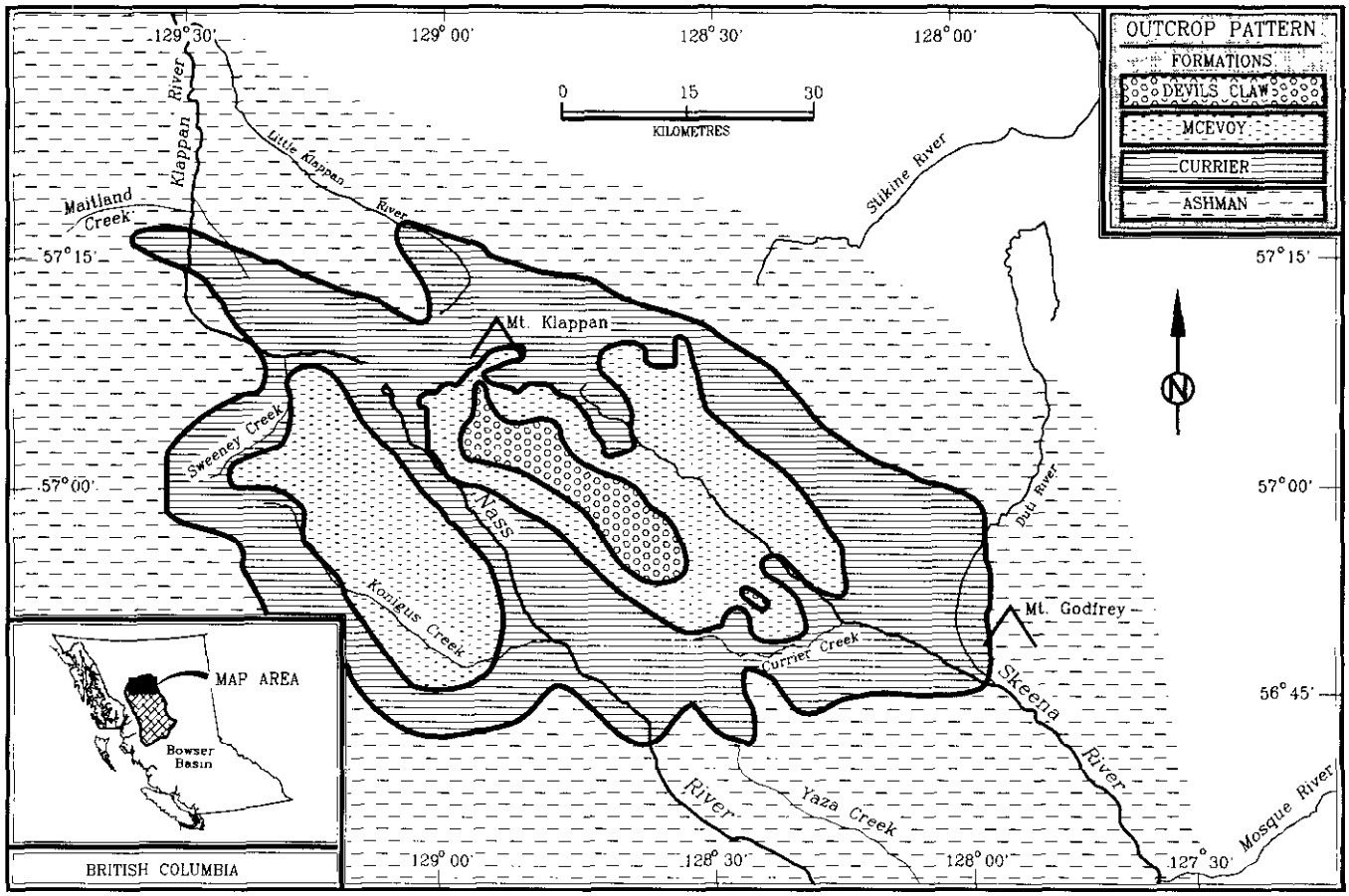

Figure 5-8-2. Outcrop patterns based on sections measured in this study.

The lowermost unit is correlated with the Jurassic Ashman Formation as described in the southern Bowser basin (Tipper and Richards, 1976). The Ashman Formation is exposed around the margins of the coalfield. It is a fully marine, clastic unit composed mostly of dark bluish grey to black shale that coarsens upwards repetitively to shallow-marine sandy mudstone and sandstone. The name Ashman Formation, as it is used here, may include coarser grained strata in its upper portions than are included elsewhere in the formation.

The Currier and McEvoy formations are coal-bearing deltaic and fluviodeltaic units. The thickest coals are restricted to the lower part of the Currier Formation. The Cretaceous Devils Claw Formation is a dominantly conglomeratic unit more than 600 metres thick that caps the succession exposed in the Groundhog coalfield.

OUTCROP EXTENTS

Exposures examined during the 1990 field season were chosen, in part, to establish the southwestern and western limits of coal-bearing strata in the Groundhog coalfield as well as to document variations in the depositional facies. The transition from coal-bearing rocks of the Currier Formation to underlying fully marine strata of the Ashman Formation was established in the western part of the coalfield, but the southwestern limit of the Currier Formation was not determined. The most southwestern sections examined are assigned to the McEvoy Formation, suggesting that either more coal-bearing rocks of the Currier Formation, or its marine equivalents, may outcrop farther to the southwest. The geographic limits of the Currier, McEvoy and Devils Claw formations, based on sections measured last season and prior fieldwork, are shown in Figure 5-8-2.

COAL-BEARING STRATA

Currier Formation

The Currier Formation was originally defined for coal-bearing strata exposed between the Skeena and Nass rivers, from Mount Klappan in the north to Currier Creek in the south (Cookenboo and Bustin, 1989). Study during the 1989 and 1990 field seasons has extended the range of known Currier Formation occurrence north to the Klappan River watershed, southeast to Mount Godfrey (east of the Duti River), and west to the headwaters of Konigus Creek (Figure 5-8-2).

The formation consists of up to 1000 metres of alternating beds of shale and sandstone, with lesser amounts of siltstone, conglomerate and coal. Strata are arranged in generally coarsening-upward units ranging from 30 to 60 metres thick in the lower part of the formation. The coarsening-upward units thin to 6 to 10 metres toward the top of the section. Thick (1 to 4 m) seams of anthracite coal are notable in the lower part of the formation, although coal is only a minor component (comprising less than 3%) of the total stratigraphic thickness. Marine trace fossils (including *Teichichnus*, *Zoophycus* and *Helminthopsis*), a diverse suite of dinoflagellate cysts and marine macrofauna are common in the lower Currier Formation. Higher in the formation, plant fossils are common, trace fossils are rare and marine macrofauna are absent. The diversity of dinocysts and an oyster bed identified at the headwaters of Konigus Creek suggest that marine and brackish water conditions persisted during Currier deposition. Criteria used to recognize the formation are dominance of shale in the fine-grained deposits, local occurrence of thick coals, and increasing plant fossils and decreasing marine shells and trace fossils up stratigraphy.

The contact of the Currier Formation with the underlying marine rocks of the Ashman Formation is gradational and placed at the first occurrence of coals or abundant fossil leaves. The contact with the overlying McEvoy Formation is recognized by a change from Currier Formation facies to a dominance of siltstone in the fine-grained deposits, lack of thick coals, and an increase in conglomerates.

The Currier Formation is interpreted to be deltaic in origin, recording a change to alternating marine and non-marine deposition from fully marine deposition in the underlying Ashman Formation. The coarsening-upward units that comprise the Currier indicate repeated aggradation and progradation of deposition, and are interpreted as delta or subdelta (crevasse splay) lobes. In the lower Currier, the thickness of coarsening-upward units and widespread marine influence suggests that each individual unit represents a prograding delta lobe. Higher in the formation, marine influence is less clear, although saline to brackish conditions are suggested by the dinoflagellate assemblages, and the thinner coarsening-upward units probably represent splay or subdelta lobes. Pervasive marine influence suggests most of the deposits accumulated in the subaqueous delta and lower delta plain.

COAL-BEARING FACIES OF THE CURRIER FORMATION

Coals of the Currier Formation occur within a black shale facies and commonly directly overlie sandstones that form the top of the underlying delta lobes. The black shales are in part carbonaceous and homogeneous, and in part laminated with lighter brown silty layers. The black shale facies is commonly rich in plant fossils and some beds are intensely burrowed by *Helminthopsis*. Although the shales commonly overly delta sandstones, the peats that were the direct precursors of Currier Formation coals may have accumulated at considerable distance from active deltaic deposition, as suggested by depositional models proposed by McCabe (1986).

McEvoy Formation

The McEvoy Formation was originally defined for rocks exposed in the Groundhog coalfield. Fieldwork during the last two seasons has expanded its extent westward to include rocks in the Konigus Creek watershed (Figure 5-8-2). The formation consists of between 600 and 1000 metres of siltstone, shale, sandstone, conglomerate and minor thin coal of subanthracite to anthracite rank. Coarsening-upward silty mudstones are the dominant facies. The mudstones occur in stacked units, typically 3 to 5 metres thick, which grade upward from black or dark grey and often carbonaceous claystone at the base, to dark grey to brown siltstone with increasing sand content. The units may or may not be topped by trough-crossbedded, very fine grained sandstone. The top and bottom contacts are sharp, with the top surface commonly rooted. Thick black shale beds (up to 20 m thick) occur interspersed within the coarsening-upward siltstone. These shales are variously silty to carbonaceous and are rich in plant remains.

Coarse-grained deposits form resistant layers in the McEvoy Formation and include fine-grained sandstones and chert-pebble conglomerates which become thicker and more common higher in the formation. Erosive based and lens-shaped sandstone and conglomerate beds, and consistent southwesterly directed current indicators (measured from cross laminae) are common, indicating McEvoy deposition is dominantly fluvial.

The lower contact of the formation is recognized by a marked upward increase in the occurrence of silt in the mudstones relative to the Currier Formation, a dearth of thick coals, and an increase in the proportion of conglomerate above the contact. The upper contact with the overlying Devils Claw Formation is gradational, and recognized by a further increase in conglomerate to the extent that the Devils Claw Formation is dominantly conglomerate.

Plant remains including plant debris, wood, and well-preserved leaves are common in the McEvoy Formation; no marine macrofossils are known. A broad suite of dinoflagellate cysts recovered from throughout the fine-grained deposits suggests a brackish to marine depositional environment.

McEvoy strata are interpreted as paralic marine or brackish water deposits of a fluvially dominated delta system. The repeated vertical stacking of coarsening-upward mudstones are analogous to overbank or crevasse splay deposits of the Mississippi River and other fluvially dominated delta systems (Coleman, 1982). Lack of marine fauna suggests a fluvially dominated upper delta plain, above the reach of open-marine conditions. A similar depositional environment was recently suggested by Macleod and Hills (1990).

COAL-BEARING FACIES OF THE McEVOY FORMATION

Coals occur within two facies of the McEvoy Formation. The thickest coals are in the thick shale facies interbedded with carbonaceous shales, and are associated with a wide

variety of well-preserved fossil leaves and wood. The best developed coals in this facies are exposed southeast of Sweeney Creek, where six seams in excess of 1 metre thick crop out. The thick shale facies is interpreted as fine-grained bay or lacustrine-fill deposits in an upper delta plain environment.

The second coal-bearing facies is a sequence of coarsening-upward siltstones. Coals in this facies are generally less than 20 centimetres thick and argillaceous. These thin coals may have accumulated following emergence of overbank splay deposits more closely associated with the active depositional system than the somewhat thicker coals of the thick shale facies.

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