PINE VALLEY MAPPING AND COMPILATION PROJECT (93O/9, 10; 93P/12)

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KEYWORDS: Coal geology, Pine Valley, Peace River coalfield, stratigraphy, structural geology, coal occurrences.

INTRODUCTION

This project is a continuation of the British Columbia Geological Survey Branch's 1:50 000-scale mapping program in the Peace River coalfield. The study area is adjacent to the Burnt River and Carbon Creek map-areas (Hunter and Cunningham, 1991; Cunningham and Sprecher, 1992, this volume). The objective is to produce Open File maps for NTS map sheet 93O/9, the northeast half of 93O/10 and the southwest half of 93P/12.

Computer methods were used extensively in data handling, compilation and map drafting. The geological maps will be in digital format for reproduction and distribution. Several in-house software modules were developed and, in conjunction with commercial packages, will be used to produce these maps.

LOCATION

The map area is located in northeastern British Columbia immediately west of the town of Chetwynd (Figure 4-6-1). It lies between latitudes 55°30' and 55°45' and is bordered on the west by the Front Ranges of the Rocky Mountains. The area is generally covered by thick vegetation except for the ridges in the west, and is divided by the east-flowing Pine River. Access to most of the area consists of a network of logging and drilling roads, cut-lines, seismic lines and transmission-line roads. Elevation ranges from about 600 to over 1900 metres.

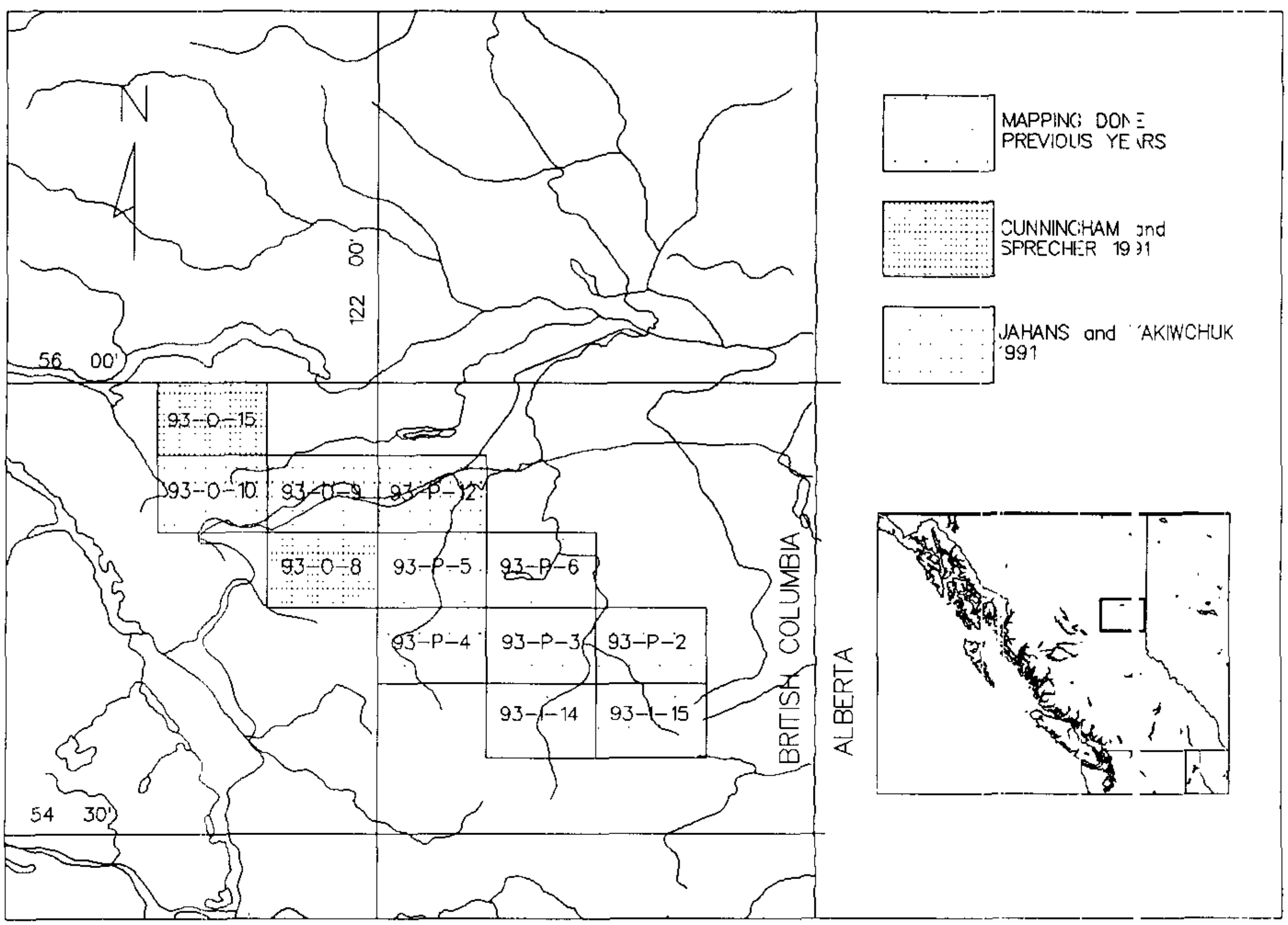
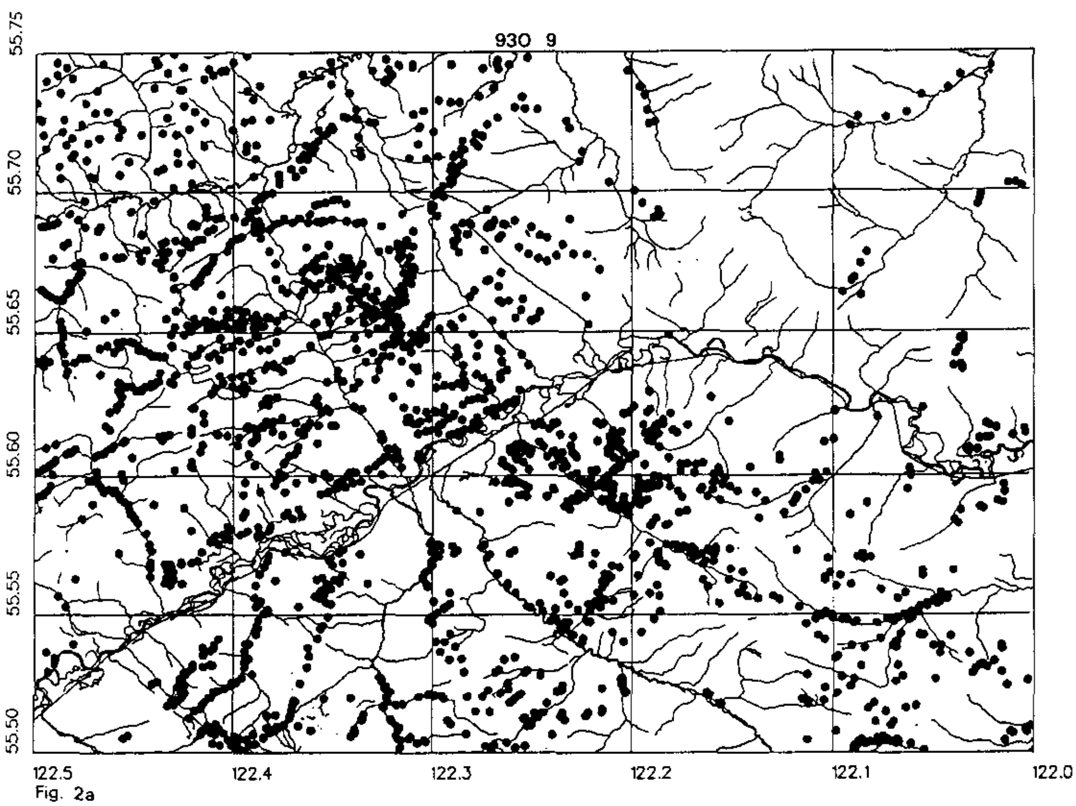


Figure 4-6-1. Location map showing the project areas of the 1991 field season and of previous years.



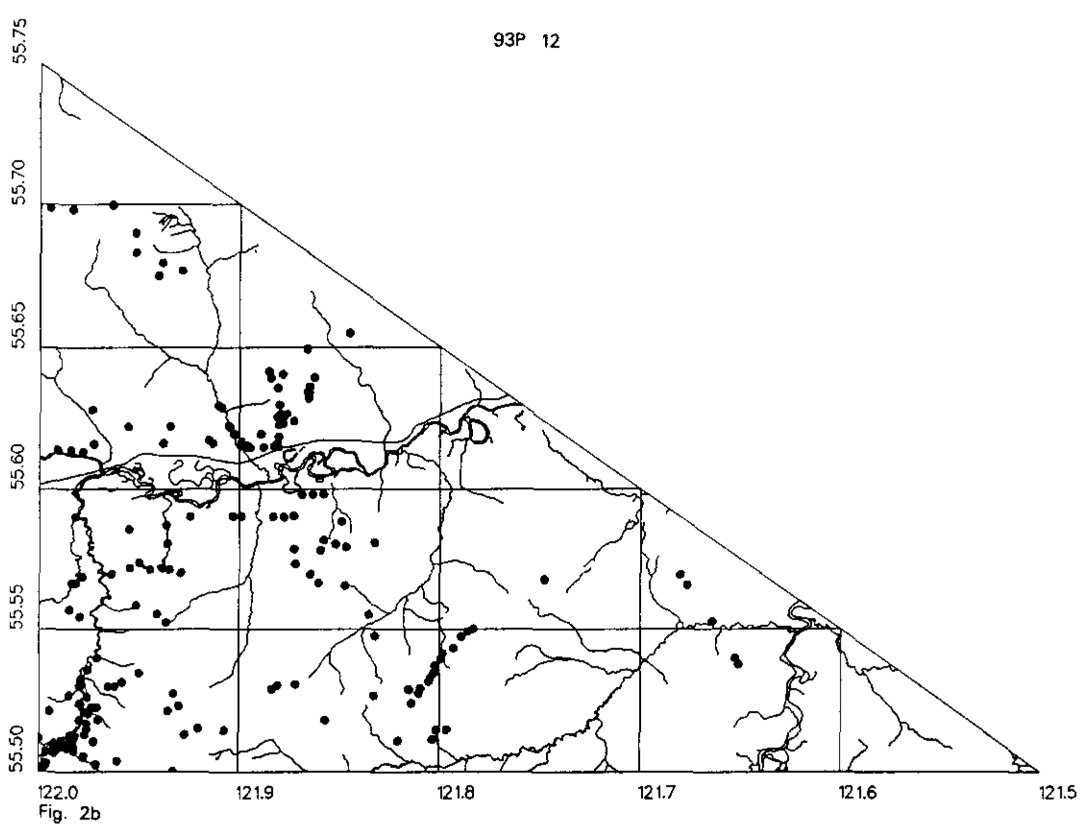


Figure 4-6-2. Outcrop distribution in the map sheets (a) 93O/9 and (b) 93P/12. Outcrops represented here are a compilation from previous work and the 1991 field season.

PREVIOUS WORK

Parts of the map area have been studied in detail by several coal and petroleum exploration companies as well as by researchers from the provincial (McKechnie, 1955; Hughes, 1964, 1967) and federal governments (Stott, 1967, 1968, 1973, 1982). This project is a compilation of the past summer's fieldwork and recent detailed mapping by coal company geologists.

1991 FIELD ACTIVITIES

Mapping during the 1991 field season focused on areas with little or no coverage on existing maps. Coverage is generally good near the Pine River and in most of the western parts of the 93P/12 and 93O/9 map sheets. Transport was by four-wheel-drive vehicle, mountain bicycle, helicopter and hiking on foot (Figure 4-6-2). Aerial photographs were used for navigation and in geological interpretation.

DATA

The integration of outcrop data collected during this field season with the extensive information obtained from provincial government coal and petroleum files and from various industry sources was accomplished using computer techniques. Base maps with contour, cadastral, drainage and cultural information were obtained as digital TRIM files.

During the field season, outcrop data were recorded in the traditional way and then entered into computer files at the field office in Chetwynd. Maps showing topographic contours, roads, cut-lines and drainage were plotted at various scales for use in the field in conjunction with aerial photographs. If time permitted, preliminary geological interpretations of each day's fieldwork were added to the database. Extensive use of CAD-based graphical mapping software facilitated the efficient presentation of data and drawing of geological maps.

STRATIGRAPHY

The map area is underlain by rocks ranging in age from Triassic and Jurassic in the southwest to Cretaceous in the northeast. Marine clastic rocks make up the Jurassic Fernie Formation and Lower Cretaceous Minnes Group. Alternating marine to nonmarine clastics and marine shales dominate the rest of the Cretaceous. Formation names and general thicknesses with brief lithological descriptions are given in Table 4-6-1.

MINNES GROUP

The Minnes Group, divisible into the Monteith, Beattie Peaks, Monach and Bickford formations, consists mainly of interbedded sandstones, siltstones and shales. The Beattie Peaks and the Bickford are the more argillaceous of these formations with minor coal seams present in the Bickford. Towards the west, the sand content of the Beattie Peaks Formation increases to the point where it becomes increasingly difficult to distinguish between it and the underlying Monteith and overlying Monach formations.

The ridge-forming Monteith and Monach formations are dominated by arenaceous strata. Very light grey to white quartzitic sandstones occur in both units. Two such beds, usually 2 to 6 metres thick, provide useful marker horizons near the top of the Monach Formation.

The Bickford Formation consists of interbedded fine-grained sandstones, siltstones, dark grey mudstones and silty shales. Thin coal seams, generally less than 1 metre thick, are present in this unit.

BULLHEAD GROUP

The Bullhead Group includes the Cadomin and Gething formations. The ridge-forming Cadomin Formation consists of well-rounded, poorly sorted chert pebbles and very coarse grained sandstones and grits. Its thickness varies and the proportion of conglomerate tends to decrease to the northwest.

The Gething Formation is generally a recessive unit and exposures are rare. Similar in composition to the Bickford Formation, it consists of interbedded sandstones, siltstones, mudstones and silty shales. The Gething Formation, however, contains more shale and thick coal seams, has better developed cyclothems, and is finer grained. Coal seams are generally from 1 to 3 metres thick but are up to 4 metres thick in places. Abundant plant imprints and the occasional fossilized tree stump are observed in outcrop.

FORT ST. JOHN GROUP

The Fort St. John Group is divided into the Moosebar, Gates, Hulcross, Boulder Creek, Hasler, Goodrich and Cruiser formations. At two locations in the Crassier Creek area, a bed of conglomerate and sandstone, 2 to 4 metres thick, separates the Moosebar from the Gething and is believed to represent, or be stratigraphically equivalent to, the Bluesky Formation. The Moosebar Formation is a very recessive and poorly exposed unit. It is distinguished by its dark grey to black shale content and interbedded sideritic siltstones and concretions.

The remaining formations are easily distinguishable in the field. Prominent ridges formed by Gates, Boulder Creek and Goodrich sandstones and conglomerates together with the topographic lows formed by the recessive marine shales of the Hulcross and Hasler formations, combine to form a distinctive profile easily recognized in the east-central portion of map sheet 93O/9.

Unlike the area to the south, the Gates Formation is thin and lacks significant coal seams. There is an abrupt change from the sandy sediments of the Gates to the dark marine shales of the Hulcross Formation. The Hulcross is similar to the Moosebar Formation and its contact with the basal sandstones of the Boulder Creek Formation is gradational. The Boulder Creek sandstones and conglomerates separate the Hulcross from the Hasler, another dark grey marine shale which is often difficult to distinguish from other shale units.

TABLE 4-6-1
TABLE OF FORMATIONS FOR THE PINE RIVER VALLEY AREA. ADAPTED FROM STOTT (1982)

Series	Group	Formation/Thickness	Description
Upper Cretaceous	Smoky	Dunvegan 107-300 m	Fine- to coarse-grained carbonaceous sandstone and shale; minor coal.
Upper Cretaceous / Lower Cretaceous	Fort St. John	Cruiser 107-244 m	Dark grey marine shale with sideritic concretions and interbedded siltstones and sandstones.
Lower Cretaceous	Fort St. John	Goodrich 15-411 m	Fine- to medium grained crossbedded sandstone; interbedded shale, mudst.
Lower Cretaceous	Fort St. John	Hasler 152-459 m	Dark grey marine shale with sideritic concretions; siltier in lower half.
Lower Cretaceous	Fort St. John	Boulder Creek 73-171 m	Fine-grained, well sorted sandstone; massive conglomerate; non-marine sandstone and mudstone.
Lower Cretaceous	Fort St. John	Hulcross 0-131 m	Dark grey marine shale with sideritic concretions and interbedded siltstones.
Lower Cretaceous	Fort St. John	Gates 67-274 m	Fine-grained, marine and non-marine sandstones; conglomerate, sh. & mudst.
Lower Cretaceous	Fort St. John	Moosebar 30-304 m	Dark grey marine shale with sideritic concretions; sandst. and congl. at base.
Lower Cretaceous	Bullhead	Gething 22-549 m	Fine grained, carbonaceous sandst.; coal, carbonaceous shale; some conglomerate.
Lower Cretaceous	Bullhead	Cadomin 14-213 m	Massive chert & quartzite pebble conglomerate, and med. to coarse gr. sandst.
Lower Cretaceous	Minnes	Bickford 0-427? m	Interbedded fine-grained sandst.; silty sh.; coal.
Lower Cretaceous	Minnes	Monach 0-304 m	Fine- to coarse grained, argill. to q'tzose sandst.
Lower Cretaceous	Minnes	Beattie Peaks 0-396 m	Interbedded silty shales and fine-grained sandst.
Lower Cretaceous / Jurassic	Minnes	Monteith 0-610 m	Fine- to coarse grained, quartzose sandstone.
Jurassic		Fernie 0-579 m	Calcareous and phosphatic shales; thinly interbedded sandst, siltst, & shale.

A persistent argillaceous sandstone with interbedded dark grey shales, which has been called the Walton Member of the Boulder Creek Formation, separates the Boulder Creek from the Hasler. The Walton Member is distinguished by the presence of abundant rootlets and other plant remains. Although it is known to contain coal (Hughes, 1967; Stott, 1982), no coal seams were found during this field season.

Next in succession are the recessive dark grey shales of the Hasler Formation. The lower half of this unit has a distinctly siltier composition and is more resistant. Gradationally overlying the Hasler are the fine-grained, well-sorted sandstones of the Goodrich Formation. Reddish brown weathering, and abundant large-scale crossbedding are its characteristic features. Fossiliferous marker horizons are present.

The dark grey shales and interbedded siltstones of the Cruiser Formation overly the Goodrich gradationally. This unit is very similar to the Hasler Formation. To the east, where the Goodrich pinches out in the subsurface, the Hasler and Cruiser are together assigned to the Shaftesbury Formation. In the eastern half of the map area, the Cruiser Formation underlies most of the upper slopes.

Smoky Group

The Dunvegan Formation is the youngest mapped formation, conformably overlying the Cruiser Formation and forming many of the easternmost cliffs in the map area. It is made up of interbedded carbonaceous sandstones, siltstones and shales. The sandstones are often micaceous and plant debris is abundant. Minor coal measures, generally less than 1 metre thick, are found in some locations. *Unio* and *Inoceramus* are common and distinguishing fossils.

STRUCTURE

The map area lies in the Rocky Mountain Foothills. This region is characterized, as is most of the Rocky Mountain fold and thrust belt, by northwesterly trending folds and southwest-dipping thrust faults (McMechan, 1985; McMechan and Thompson, 1989). The Foothills are subdivided into inner and outer belts. The outer Foothills are characterized by low amplitude, long-wavelength, easily mapped folds involving Fort St. John and Dunvegan strata (Figure 4-6-3).

Deformation in the inner Foothills is characterized by tighter, higher amplitude folds involving Gething and older strata. The boundary between the outer and inner Foothills in the map area runs through Crassier Creek. Folds in the Gething Formation are difficult to analyze because of their complexity and small scale, and because of the poor exposure. The alternation of resistant and recessive units of the Minnes Group and the prominence of the Cadomin Formation provide good structural markers in the western parts of the inner Foothills belt.

Although numerous small faults are visible in outcrop in the outer Foothills, there is little evidence for large thrust faults. The inner Foothills, in contrast, contain many small- and large-scale faults. The linearity of their surface traces in areas with considerable topographic relief indicates relatively steep dips. There is some evidence for minor east-dipping thrust faults in the map area, especially the outer Foothills, though no major fault traces were found. The east-dipping contact between the Moosebar and the Gates on Dokie Ridge appears disconformable towards the northwest, and nearly pinches out the Gates Formation (Plate 4-6-1). Exposures are very poor and access is limited, so it is unconfirmed whether this feature represents local thinning of the Gates or the presence of an east dipping thrust fault.

Drilling has indicated the presence of blind thrusts in the region, and regional structural sections have shown the likelihood of major detachment zones in Upper Jurassic to Lower Cretaceous strata as well as at the base of Middle Devonian shales (McMechan, 1985). A triangle zone appears to be present.

COAL OCCURRENCES AND ECONOMIC GEOLOGY

Coal seams up to 3 metres thick are found in the Gething Formation and others up to 1 metre thick are present in the Bickford Formation. Minor coal occurrences are visible as thin seams less than a metre thick, in the Dunvegan, Goodrich and Cadomin formations. No significant coal was seen in the Gates Formation in the map area, although there are economic deposits in the Gates to the south at Bullmoose and Quintette mines.

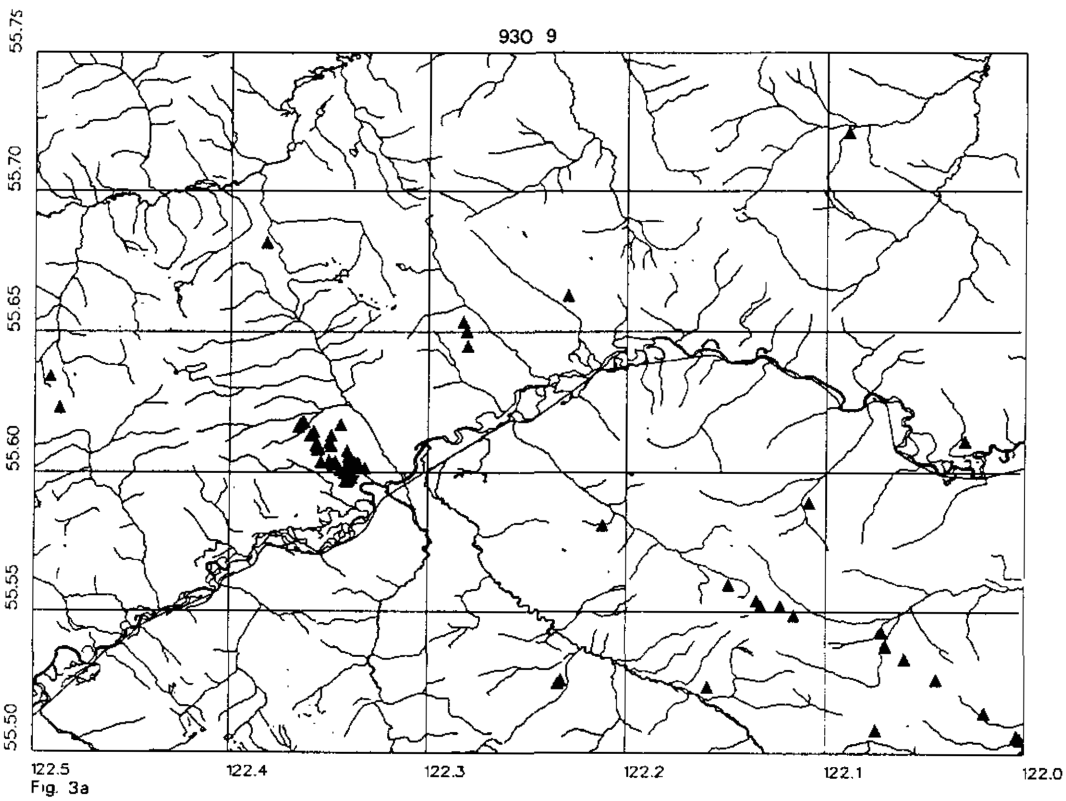
There is no exploration for coal currently underway in the study area. Previous exploration was carried out by numerous coal and petroleum companies which mainly targeted the Gething Formation, although some interest was taken in the thinner seams of the Bickford Formation (referred to as the Brenot Formation by Hughes, 1964 and 1967, and many coal companies), and in the reported coal measures of the Walton Member (Hughes 1967; Stott, 1982). Vitrinite reflectances from coal samples suggest this area would be of potential interest for coalbed methane exploration (Hunter and Cunningham, 1991; Cunningham and Sprecher, 1992, this volume).

In contrast to coal, exploration for natural gas is very active. This season, several new wells were drilled and seismic lines cut in and around the study area. Main targets were the deep Triassic carbonates, which crop out in the west and form part of the Front Ranges.

SUMMARY

The importance of the Gates Formation as a coal-bearing unit is diminished in this map area compared to southern regions, while the Gething Formation, and to lesser extent, the Bickford Formation and Walton Member have been targets for coal exploration. Although there is potential for coalbed methane, current exploration activities are limited to conventional gas plays. Known coal deposits are not economic at this time.

Evidence for blind thrusts and east-dipping faults indicates the possible existence of a triangle zone. Regional geological mapping is essential in the construction of accurate, balanced cross-sections for resource exploration in the Rocky Mountain Foothills.



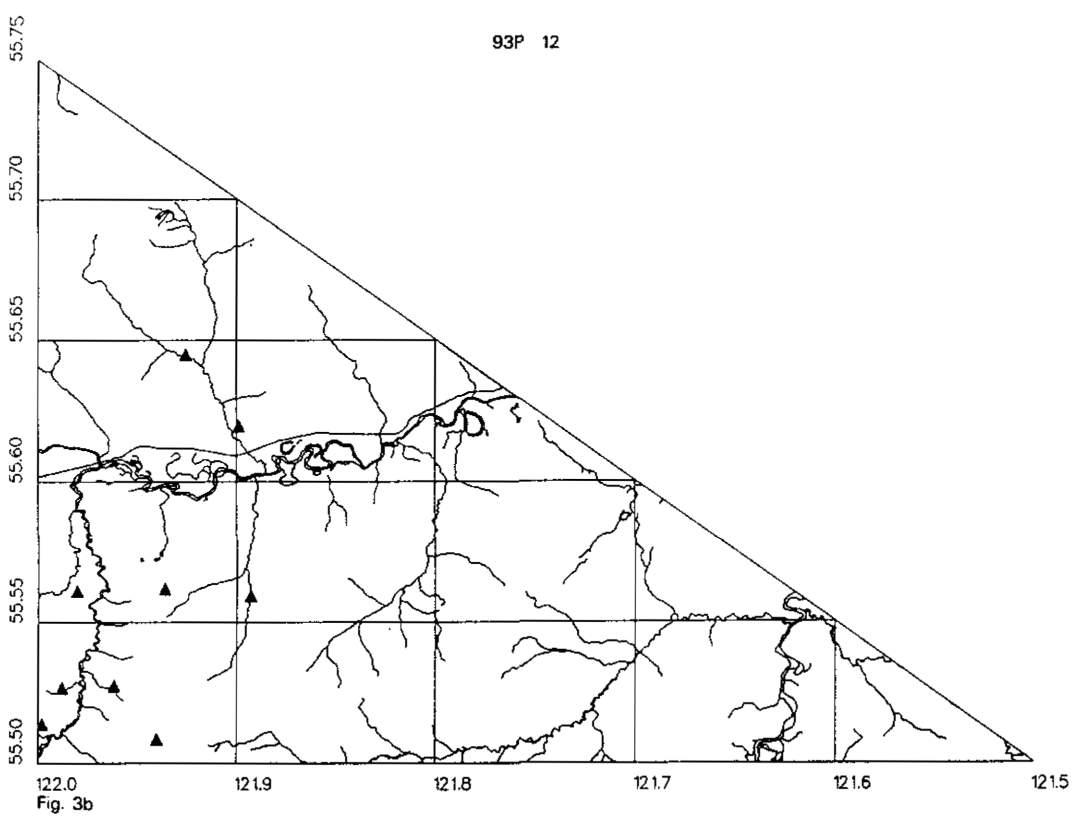


Figure 4-6-3. Drillhole locations in maps sheets (a) 93O/9 and (b) 93P/12.

This project is a continuation of the Peace River Coalfield Digital Mapping Project. Computer methods have enabled efficient data compilation and interpretation, in both the office and the field. Geological maps at a 1:50 000 scale will be available as Open Files in early 1992.

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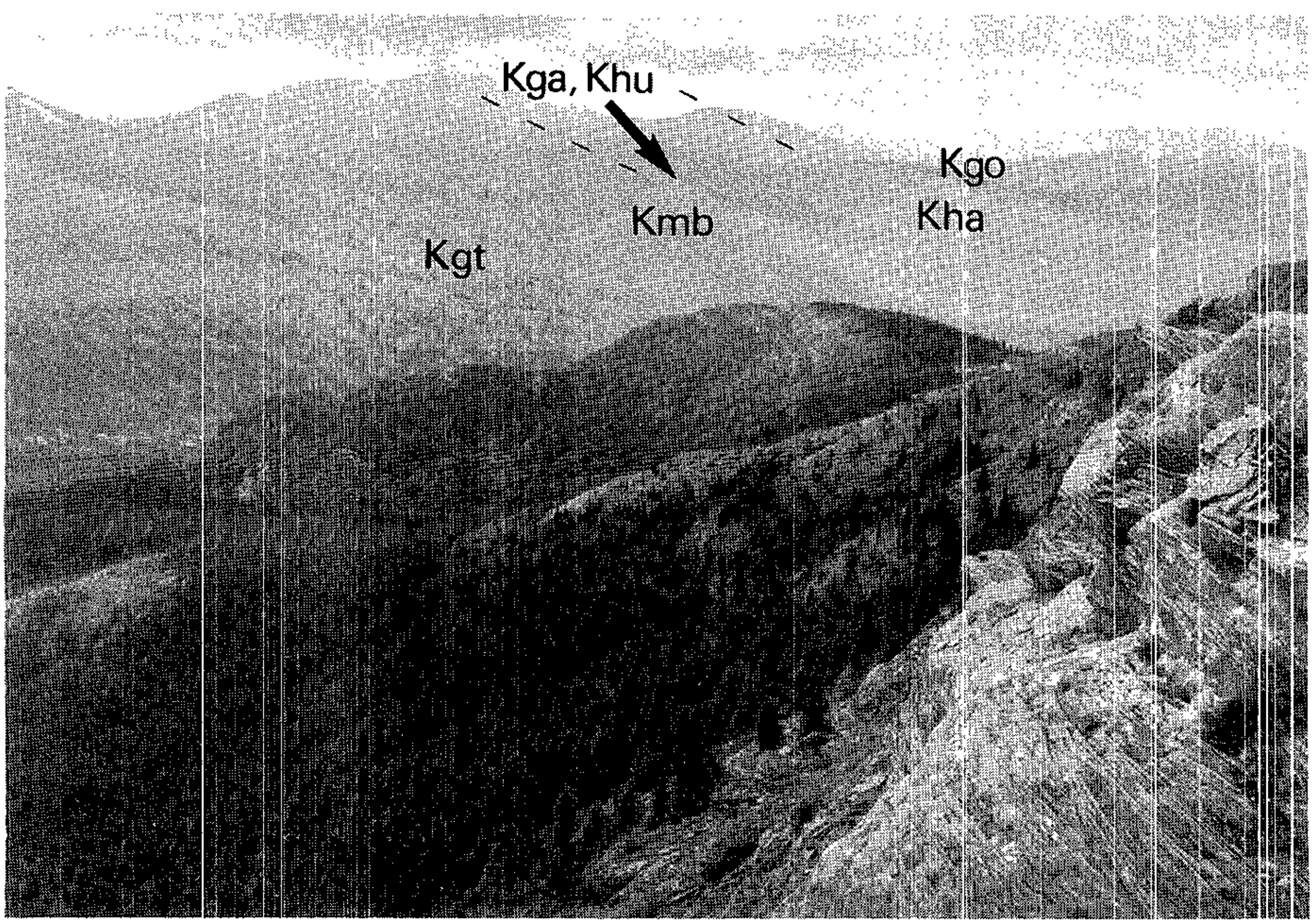

Plate 4-6-1. Photograph looking northwest showing east-dipping strata of the outer Foothills (foreground and right) overlying tightly folded strata in the Crassier Creek valley (background-left). Crossbedded sandstones of the Goodrich Formation (foreground) overly shales of the Hasler Formation. An apparently disconformable contact between the Moosebar and Gates formations indicates the possible existence of an east-dipping thrust fault (*see* text).

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