TELKWA COALFIELD, WEST-CENTRAL BRITISH COLUMBIA (93L)

By J. Koo

INTRODUCTION

The Telkwa Coalfield is situated a few kilometres southwest of Telkwa and 18 kilometres south of Smithers in west-central British Columbia. The Canadian National Railway line and Highway 16 run through the town of Telkwa to the port of Prince Rupert, 370 kilometres west of the Telkwa Coalfield.

After the initial discovery of coal about 1900 until the 1950's, exploration had been concentrated on the coal seams exposed along the valleys of the Telkwa River and Goathorn Creek (Dowling, 1915; Black, 1951) (Fig. 34). Telkwa coal measures crop out only in a few valleys that have cut deeply through the thick overburden. Volcanic or intrusive rocks underlie most of the higher ridges around the Telkwa Coalfield. The Telkwa basin lies near the southern boundary of Bowser successor basin north of Skeena Arch within the Intermontane Belt of the Canadian Cordillera (Tipper and Richards, 1976; Carter, 1981), and the Telkwa coal measures comprise part of a Mesozoic volcanic and sedimentary sequence cut by granitic intrusions of Late Cretaceous and Early Tertiary age.

In 1969, Canex Placer Ltd. conducted a drill program to explore the northern part of the coalfield. Since 1979, Crows Nest Resources Limited has conducted an extensive exploration program to delineate economic coal seams of the Telkwa Coalfield. Mining to date has consisted of relatively small scale underground and open pit operations in the valleys of the Telkwa River and Goathorn Creek. Growth in mining has been hampered by the limited geological understanding of the coal measures and their coal resource potential.

The present project was initiated in early August of 1982 with the following terms of reference: description of the stratigraphy, structural development, depositional environments, and geologic age of the Telkwa basin; the correlation of coal seams and their quality; definition of the areal extent of the coal measures, and their relationships to surrounding rocks. This report presents preliminary results of the fieldwork conducted between August and September of 1982. Geological mapping, conducted at scale 1:10 000, was based on investigation of outcrops and examination of drill cores. Fieldwork for the project will be completed during the summer of 1983.

STRATIGRAPHY OF THE TELKWA COAL MEASURES

The Telkwa coal measures can be subdivided into the Lower, Middle, and Upper units (Figs. 34, 35, and 36).

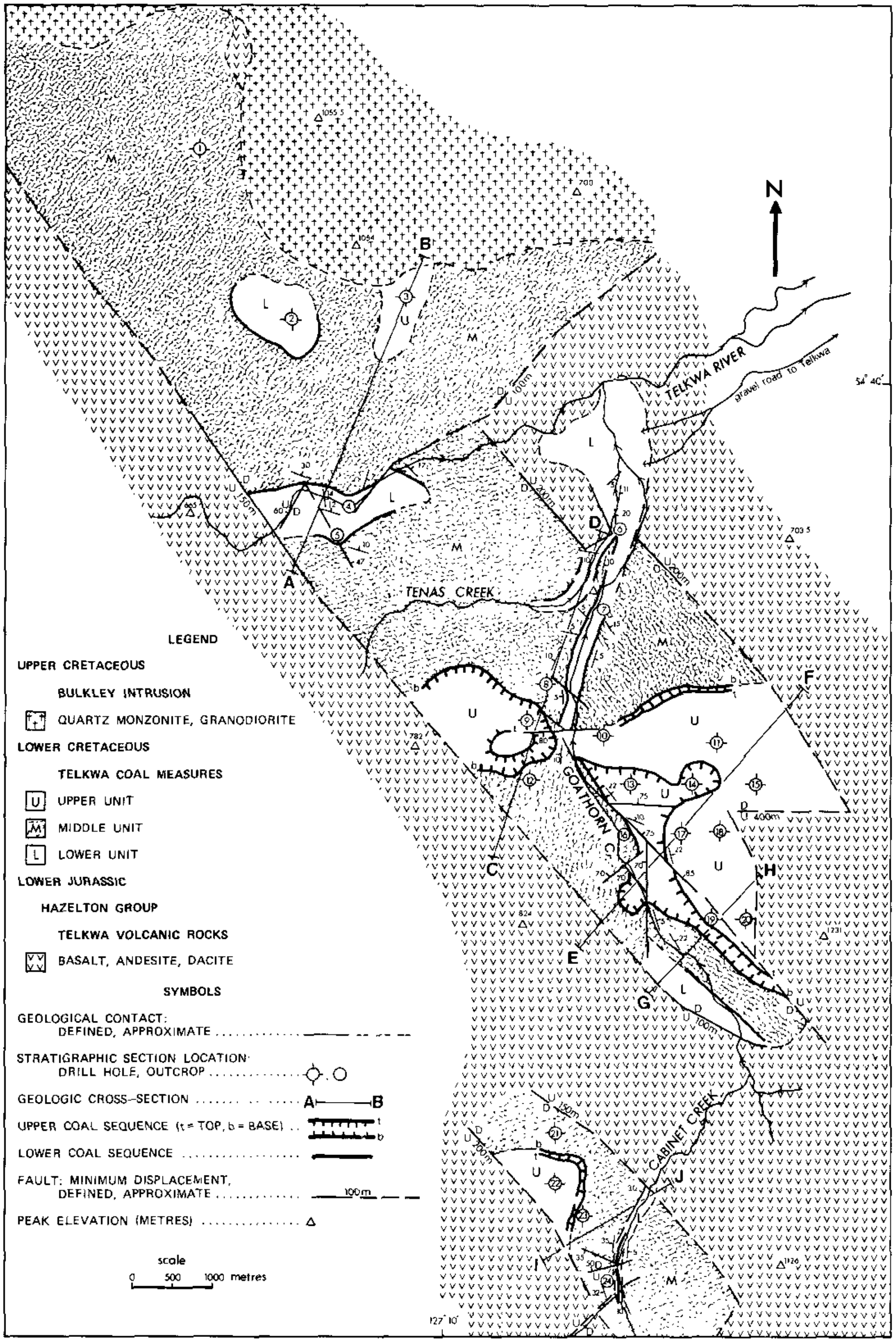

Figure 34. Simplified geology of the Telkwa Coalfield.

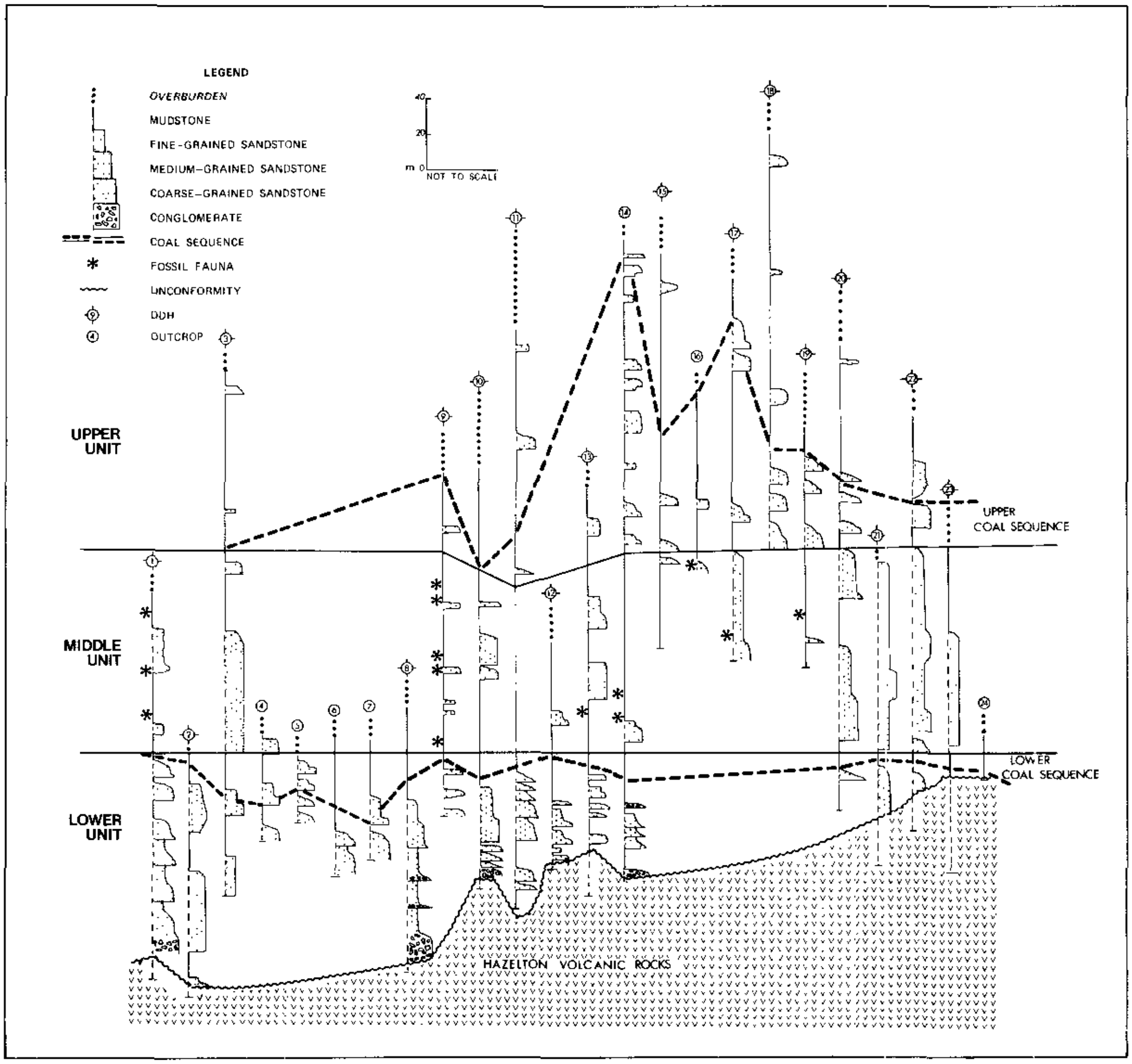

Figure 35. Geological cross-sections, Telkwa Coalfield.

The Lower unit consists of conglomerate, coarse to fine-grained sandstone, mudstone, and coal seams. This unit comprises the lower part of the Telkwa coal measures. Its thickness varies from 15 to 120 metres. Up to seven fining-upward rhythmites characterize vertical sections of this unit. Each rhythmite shows a gradual lithological variation up section from conglomerates or coarse-grained sandstone through medium-grained sandstone to fine-grained sandstone or mudstone. The individual rhythmites vary in thickness from 4 to 40 metres.

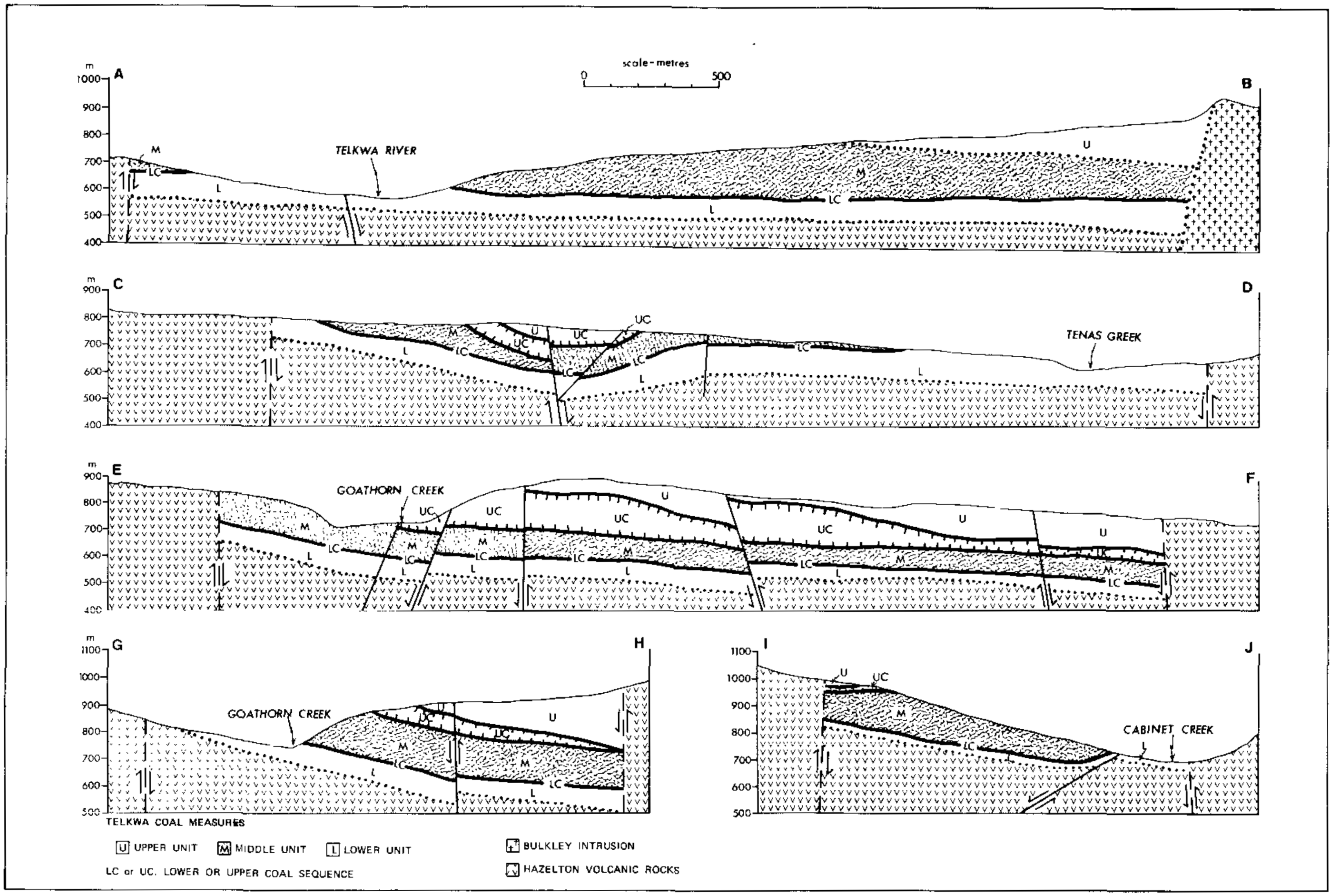

Figure 36. Stratigraphic cross-sections, Telkwa Coalfield.

Conglomerates occur in some of the fining-upward rhythmites, but only near the base of the Lower unit. Most conglomeratic layers consist of subangular to subrounded, relatively well-sorted clasts that decrease in size up section from cobbles through pebbles to granules. The conglomeratic layers vary in thickness from 50 centimetres to 15 metres. Most of the clasts originate from red, green, or grey volcanic flows, agglomerates and tuffs of basaltic, andesitic, or dacitic composition.

The coarse-grained sandstones are mainly maroon, purple, or grey. They are up to 10 metres thick and similar in composition to the conglomerates. The medium to fine-grained sandstones are purple, grey, or dark grey, and range up to 40 metres in thickness. The mudstones are grey, black, or brown and range from 2 to 25 metres in thickness. In the upper part of the Lower unit, mudstone layers at the tops of the fining-upward rhythmites are relatively thick. These mudstone layers are closely associated with coal seams. Coalified plant debris up to 15 centimetres long, 5 centimetres wide, and 2 centimetres thick are randomly scattered within the conglomerates and coarse to medium-grained sandstones.

The Lower unit typifies a fluvial clastic sequence. The conglomerate and commonly crossbedded, coarse to medium-grained sandstone layers are lenticular in shape with limited lateral extension, and represent relatively high-energy channel deposits. The fine-grained sandstones and mudstones form laterally extensive layers and represent relatively low-energy flood plain deposits.

The Middle unit consists of 90 to 140 metres of medium to fine-grained sandstones and mudstones. This unit comprises the middle strata of the Telkwa coal measures. The rocks are green, grey, or black. They form relatively thick and laterally extensive layers. Some of the layers are up to 100 metres thick and over 1 kilometre long in lateral extent. Locally, the Middle unit contains several 2 to 20-metre-thick fining-upward rhythmites. Each rhythmite begins with medium-grained sandstone and ends with fine-grained sandstone to mudstone. Although these rhythmic sequences represent fluvial deposits, local shallow marine incursions in the Middle unit are also signalled by the molluscan faunas that include brachiopods.

The Upper unit consists of more than 330 metres of sandstones, mudstones, and coal seams. This unit comprises the upper strata of the Telkwa coal measures. The lower part of this unit consists of up to 180 metres of medium to fine-grained sandstones, mudstones, and coal seams. This succession consists of up to eight fining-upward rhythmites that change from medium-grained sandstone through fine-grained sandstone to mudstone and coal seams. Individual rhythmites are 10 to 30 metres thick. Coalified plant debris up to 5 centimetres across are commonly scattered within the sandstones. The upper part of this unit is more than 150 metres in thickness, consisting of mudstone with subordinate amounts of fine-grained sandstone and marl. The rocks are greenish grey or dark grey.

The Upper unit is a fluvial clastic sequence consisting of much finer grained sedimentary rocks than those of the Lower unit. This unit represents relatively low-energy, recessive fluvial deposits.

Plant fossils are relatively abundant, and occur mainly in the Lower and Upper units. Hacquebard, *et al.* (1967) identified these fossil plants and determined them to be of Lower Cretaceous age. Concretions up to a few metres across are common in iron and carbonate-rich mudstones and sandstones of the Telkwa coal measures. Clay rip-ups, loading, slumping, flasers, convolution, thin laminations, scour filling, and bioturbation are also common in most mudstones and sandstones of the coal measures.

Erosion stripped off much of the Upper and Middle units in places from the Telkwa Coalfield (Figs. 35 and 36). Overburden ranges in thickness from a few metres to more than 100 metres outside major valleys in the coalfield.

HAZELTON VOLCANIC ROCKS

The Telkwa coal measures unconformably overlie a volcanic sequence composed of red, purple, green, or grey flow and pyroclastic rocks (Figs. 34, 35, and 36). These volcanic rocks are of dacitic, andesitic, or basaltic composition. The contact is clearly an unconformity that is marked by basal conglomerates or coarse-grained sandstones of the Telkwa coal measures that lie on the uneven, erosional surface of the volcanic sequence. Similar volcanic rocks occur outside the Telkwa Coalfield. They are of Lower Jurassic age (Sinemurian to earliest Pliensbachian) and comprise part of the Howson subaerial facies of the Telkwa Formation, a lower stratigraphic unit of the Hazelton Group (Tipper and Richards, 1976).

BULKLEY INTRUSIONS

A major intrusion of porphyritic granodiorite and quartz monzonite cuts the coal measures at the north end of the Telkwa Coalfield (Figs. 34 and 35). This stock is one of the Upper Cretaceous (70 to 84 Ma) Bulkley intrusions (Carter, 1981). Elsewhere, the coal measures are also cut by up to 10-metre-thick quartz porphyry dykes which are similar in composition to the major intrusion, and by up to 2-metre-thick mafic dykes of unknown age.

STRUCTURAL FRAMEWORK

The Telkwa coal measures dip mostly 5 to 15 degrees to the northeast or east (Figs. 34 and 35). However, faulting causes local variations due to drag folding or block tilting. These faults dip mostly at high angles ranging from 70 to 90 degrees and strike northwest, east-west, north-south, or northeast. Some created intensely brecciated and sheared zones up to 5 metres wide that commonly contain brecciated and sheared coal seam blocks. The high-angle faults show reverse or normal displacements of up to 30 metres (Figs. 34 and 35). Mafic dykes intruded along some of the northwesterly faults, and all mafic and felsic intrusions are at least partly fault controlled. The mafic dykes are intensely sheared and, locally, are altered to talc schist.

The coal measures appear to be bounded by a number of northwesterly trending high-angle faults that are parallel to faults within the coal-field. The net displacements on these boundary faults appear to be mainly vertical and range from 50 to 300 metres. The Telkwa coal basin has a horst and graben configuration that consists of two parallel, major grabens that contain coal measures separated by a central horst made up of Hazelton volcanic rocks.

COAL SEAMS

The coal in the Telkwa basin occurs in the Lower and Upper units (Figs. 34, 35, and 36). Coal seams, therefore, are classified as lower and upper sequences.

The lower sequence consists of up to four coal seams, 1 to 15 metres apart, that occur near the stratigraphic top of the Lower unit. Individual coal seams range from 1 to 6 metres and aggregate zones from 2 to 12 metres in thickness. The lower coal sequence extends continuously throughout the Telkwa Coalfield and varies from 2 to 40 metres in thickness.

Following infilling of the uneven, eroded surface of the older Hazelton terrane by fluvial deposits of the Lower unit of the Telkwa coal measures, an extensive flood plain developed and bogs persisted long enough for potentially economic coal seams to form. Periodic flooding and deposition of river muds occurred. The coal swamp and flood plain environment was altered and ended by marine incursions. Sediments deposited during a few short-term transgressions and regressions mark the end of the lower coal sequence.

The upper coal sequence consists of up to 13 coal seams. It lies in the lower part of the Upper unit. Potentially economic coal seams are closely associated with black mudstone layers at the tops of fining-upward rhythmites of fluvial clastic rocks. Intervals between individual coal seams range from 2 to 20 metres, almost the thickness of individual fining-upward rhythmites. Coal seams range in individual thickness from 1 to 5 metres and in aggregate thickness up to 26 metres.

The upper coal sequence occupies a stratigraphic interval of 20 to 170 metres. Evidently, eutropic coal swamps and flood plains developed again in a recessive, low-lying fluvial environment, following deposition of the Middle unit.

Both sapropelic and humic coals comprise the lower and upper coal seams. The sapropelic coal consists of black, dull canneloid type with vitrain stringers less than 1 millimetre thick and up to a few per cent of disseminated pyrite. This coal represents limnic gyttja deposits. The humic coal consists of alternating clarain and durain with occasionally abundant vitrain and fusain. This coal represents limno-telmatic reed moor deposits. The lower and upper coal seams have vitrinite reflectances ($\bar{R}_o$ max.) of 0.6 to 0.9 per cent. Although the Telkwa coal represents largely limnic to telmatic deposits, it may also contain paralic coal locally due to the marine incursions near the top of the lower coal sequence and near the base of the upper coal sequence.

Natural burning occurred in limited parts of some coal seams that crop out in the steep cliffs along Goathorn Creek. These burnt seams occur in zones that lie within 10 metres of the base of the overburden. The sedimentary sections with burnt coal seams show local collapse or crackle structures, red oxidation zones, melted rock fragments, and residual ash layers.

CONCLUSIONS

The Telkwa coal measures can be subdivided into three stratigraphically significant map units with respect to the potentially economic coal seams: the Lower unit, the Middle unit, and the Upper unit.

Maximum thickness of the coal measures succession reaches 400 metres. Stratigraphic columns show typical, vertically and laterally accreting, fluvial clastic sequences with periodic marine incursions. The fluvial sequences appear to comprise channel lag, point bar, braided bar, levee, crevasse-splay, and flood plain deposits.

Coal seams occur at the upper part of the Lower unit and at the lower part of the Upper unit. In each unit they occur near the tops of most fining-upward fluvial clastic rhythmites. The lower coal seams can be traced continuously throughout the Telkwa Coalfield within a relatively narrow stratigraphic interval. The upper coal seams are relatively thick and are best developed in the southern half of the coalfield.

The coal measures are probably of Lower Cretaceous age. They unconformably overlie Hazelton volcanic rocks, and Bulkley intrusions intrude them. The Telkwa Coalfield exists because the coal measures lie in two grabens and were protected from erosion.

ACKNOWLEDGMENTS

Thanks are extended to: F. Martonhegyi, D. Handy, S. Cameron, and K. Lendell of Crows Nest Resources Limited and L. Gething of Bulkley Valley Collieries for their willing cooperation, and I. Webster for his able assistance. The author thanks his colleagues in the Geological Branch for their helpful support in various aspects of this project.

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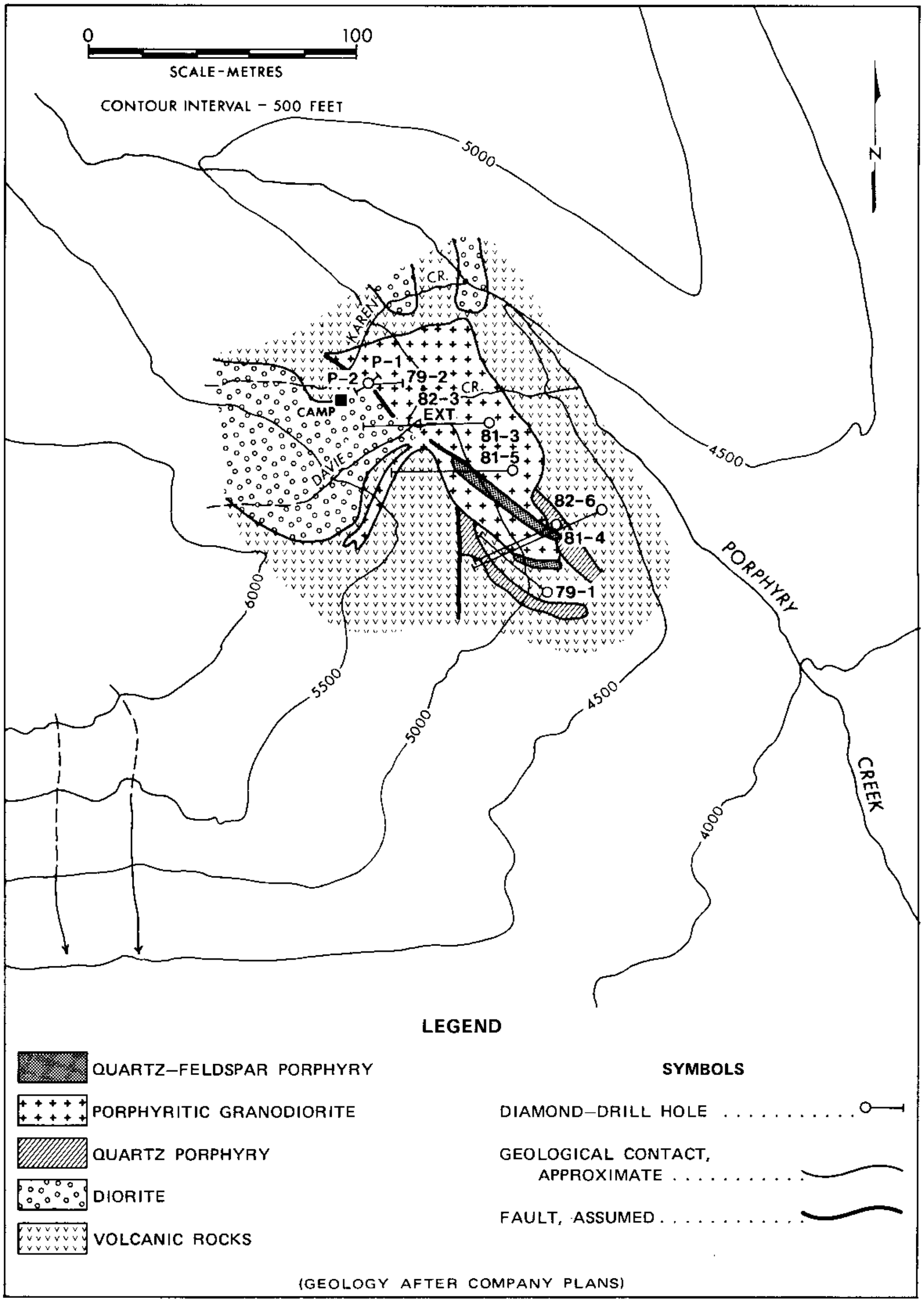

Figure 37. Geology of Porphyry Creek prospect.