GEOLOGY OF THE WHITEHORSE COAL DEPOSIT

Trevor Bremner
Exploration and Geological Services Division
Indian and Northern Affairs Canada
Whitehorse, Yukon

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ABSTRACT

Anthracite in floodplain deposits of the Cretaceous Tantalus Formation is preserved in a west-trending graben on the south side of Mt. Granger, 24 km southwest of Whitehorse. The graben extends from Fish Lake to Double Mountain, a distance of 20 km. Two main seams are exposed by bulldozer trenches across the central part of the Mt Granger property. The upper seam is about 1.8 m thick at surface and has been traced almost continuously over a strike length of 2 km. The lower seam is at least 3.3 m thick at surface and can be traced for more than 1 km. The seams dip at about 30°-50° to the north. Rotary drilling in 1985 on the central showing penetrated up to 22.25 m of coal. The best continuous coal intersection was 13.1 m in WC-85-6. Open pittable reserves were calculated at 180,033 tonnes over a 335 m strike length.

Six days of mapping in 1987 confirmed the continuity of the two main coal seams which are deformed by open north-plunging folds. A north-trending fault along Fisher Creek cuts off massive conglomerate channel deposits interbedded with the coal in the main showing area against recessive floodplain deposits to the west, where up to five coal-bearing horizons occur in a thick shale sequence. Additional reserves may lie beneath the low-lying overburden-covered area west of the Fisher Creek fault.

RÉSUMÉ

L'anthracite présent dans des dépôts de plaine inondable dans la formation crétacée de Tantalus est conservé dans un graben d'orientation générale ouest sur le versant sud du mont Granger, à 24 km au sud-ouest de Whitehorse. Le graben s'étend du lac Fish au mont Double, c'est-à-dire sur une distance de 20 km. Deux grands filons sont exposés dans des tranchées creusées au bulldozer, à travers la partie centrale de la propriété de Mt Granger. Le filon supérieur a environ 1,8 m d'épaisseur en surface, et a été suivi de façon presque continue sur une longueur de 2 km en direction. Le filon inférieur a au moins 3,3 m d'épaisseur en surface, et a pu être suivi sur plus de 1 km. Les filons ont un pendage d'environ 30-50° vers le nord. En 1985, un forage rotatif effectué dans la venue centrale a traversé jusqu'à 22,25 m de charbon. La meilleure intersection avec un filon continu de charbon se trouvait à 13,1 m dans WC-85-6. On a calculé que les réserves exploitables à ciel ouvert s'élevaient à 180 033 tonnes sur une longueur de 335 m en direction.

En 1987, en six jours de travaux cartographiques, on a pu confirmer la continuité des deux principaux filons houillers qui sont déformés par des plis légers de plongement nord. Une faille d'orientation générale nord qui borne le ruisseau Fisher (Fisher Creek) recoupe des gîtes linéaires, en forme de traînées, de conglomérat massif interstratifié avec le charbon dans la principale zone de venues, en bordure de dépôts récessifs de plaine inondable à l'ouest, où jusqu'à cinq horizons carbonifères sont présents dans une succession d'argile litée. Il est possible qu'il existe des réserves supplémentaires au-dessous de la région basse, recouverte de morts-terrains, à l'ouest de la faille de Fisher Creek.

HISTORY

Coal was first discovered on Mt. Granger in 1899 and reported by McConnell in 1901. By 1906 coal occurrences had been traced over a 20 km strike length and between 1906 and 1908 several trenches and an 18 metre adit were excavated into the uppermost of three coal seams exposed in Fisher Creek on the southwest side of Mt. Granger. In 1908, Cairnes reported the results of four analyses, one from the face of the adit and three from outcrop. The results indicated semi-anthracite coal with an average 36% ash content.

In 1942, the U.S. Army Corps of Engineers briefly examined the coal deposit and shipped a small tonnage for use in Whitehorse that winter.

Luscar Ltd acquired three coal exploration licences in the area in 1969. Consultants R.S. Taylor and Associates Ltd. undertook reconnaissance geological mapping, hand trenching and sampling on Luscar's behalf. One to three seams up to 1.83 m thick were described within a coal-bearing section which was traceable over a strike length of 10 km. More than 2,386,125 tonnes of recoverable coal were estimated to lie above the level of the valley floor.

In 1975, B. Savage acquired two coal exploration licences and prospected the area. J. Hughes reviewed available data.

P. Poggenburg et al. staked a coal mining lease in 1981 and acquired a coal exploration licence on an area to the southeast. Two additional mining leases were added in 1982 and Whitehorse Coal Corporation was formed. Construction began on an access road from Wolf Creek. Three trenches were excavated in the Fisher Creek and West Hill areas and a geological reconnaissance was made by R. Hill. Combustion tests on three samples taken by Mr. Hill indicated the samples were meta-anthracites with an average 3.5% moisture, 38.2% ash and 19,765 kj/kg heating value.

A further six trenches were excavated in 1983, the access road was completed and J. Perry undertook three days of geological reconnaissance. Perry estimated in situ coal reserves of 85 million tonnes assuming a thickness of 3.05 metres, a strike length of 10 km and a downdip extent of 500 metres.

In 1985 two short bulldozer trenches were excavated and six vertical rotary holes totalling 275 m were drilled along the slope above the main showing along a 335 m strike length. Gamma-neutron, density, resistivity and caliper logs were run. The logs showed good correlation between five of the six drillholes. Drill cuttings were logged by L. Carlyle. Coal intersections up to 13.1 m were encountered. In WC-85-4 a total of 22.25 m coal was penetrated in 8 layers interbedded with conglomerated and shale. The best single intersection in this drillhole was 8.5 m. Some of the cleaner coal bands contained as little as 15% ash. Carlyle calculated drill-indicated reserves of 180,033 tonnes within the drilled area.

In 1986 the main pit was surveyed and enlarged, with a head-

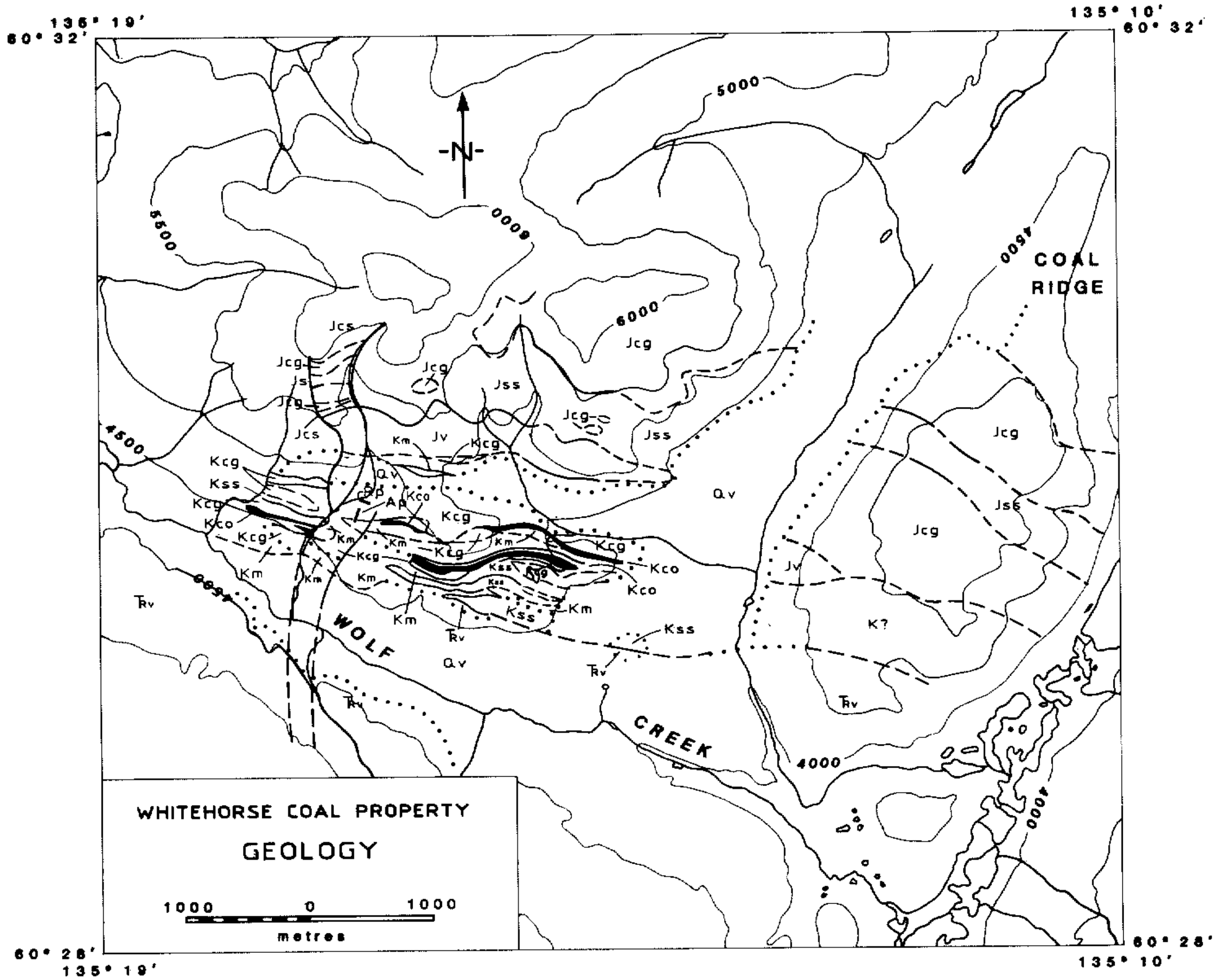

Figure 1 Geological map of the Whitehorse Coal property.

wall slope of 60°. The volume of the main pit was estimated at 15,297 cubic metres.

STRATIGRAPHY

The Whitehorse coal deposits lie within non-marine strata of the Early Cretaceous Tantalus Formation which occupy a graben 1.7 km long extending from Double Mountain which lies 10 km east of Mt Granger to Fish Lake 10 km northwest of Mt Granger. Figure 1 shows the central part of the graben which is bounded on the north side by coarse submarine fan conglomerates and deep basinal shale and greywacke of the Jurassic Laberge Group (J. Dickie, personal communication), and on the south side by pyroclastic rocks and siltstone of the Triassic Lewes River Group.

LEGEND

QUATERNARY

QV alluvium, glacial deposits.

EOCENE?

Rp rhyolite-porphyry dykes.

EARLY CRETACEOUS

Tantalus Formation (non-marine floodplain deposits).

Kcg conglomerate: generally clast-supported. Well-rounded chert pebbles in sandstone matrix.

Kss sandstone, commonly coarse-grained, pebbly to gritty, displays trough cross bedding.

Km mudstone, commonly carbonaceous grading to coal. Associated fine dark silty sandstone and siltstone.

Kco coal, with variable shale partings and thin mudstone bands.

JURASSIC

Laberge Group (submarine fan and basinal deposits).

Jcg conglomerate, massive, weathers pinkish: matix-supported with well rounded cobbles 15-20 cm dia. of augite porphyry, green and white speckled crystal tuff and lesser granodiorite in a dark muddy matrix.

Jss sandstone, feldspathic, weathers pinkish. Grades to greenish crystal tuff.

Js argillite: dark grey with minor very fine silt and sand laminations.

Jcs chert, banded, and siliceous hornfels.

TRIASSIC

Lewes River Group (island arc volcanics).

Trv tuff, green and white speckled lithic tuff with feldspar crystals.

Tra argillite, dark grey, weathers brown.

The Tantalus Formation in the Mt. Granger area is approximately 670 m thick and consists of braided river or alluvial fan conglomerate and sandstone interlayered with fine-grained siltstone, mudstone and coal. More than nine major channels can be mapped near the Mt. Granger area. Individual channels up to 2 km wide are flat-bottomed and lenticular in cross-section and appear to have a width to depth ratio of more than 16:1. Paleocurrent indicators show the main flow was from a northwest to northeast direction. Floodplain deposits are laterally extensive and well preserved due to the lack of downcutting by the aggrading channels above.

Channel-fill deposits range from clast-supported pebble conglomerate to matirx-suported conglomerate, coarse grit and pebbly sand. The coarser channel fill (Figure 2) consists of rounded 1-4 cm pebbles of dark grey chert and minor white quartz in a matrix of fine well-sorted scoured sand. Lag deposits may contain pebbles up to 8 cm. The channels show scoured bases, with flute casts commonly preserved on the underside (Figure 3). The finer channel deposits are commonly cross-stratified with beds 5-30 cm thick. Both coarsening and fining-upward trends are seen and some depositional units show reversals.

Floodplain deposits consist of crossbedded silty sandstone, siltstone, mudstone, carbonaceous shale and coal (Figure 4). Mudstone bands up to 15 cm thick and shale partings in the coal seams caused by frequent overbank flooding are reflected in the high ash contents of some samples.

Two main coal seams have been reported in the area (Figures 5 and 6). The lower seam, exposed in trenches at the base of West and East Hills ("Coal Zone B" of Perry, 1984) is a minimum of 3.3 m thick and is overlain by up to 6 metres of siltstone, mudstone and fine-grained crevasse-splay sands. Mapping strongly suggests the lower seam is continuous over a strike length of at least 1 km with no decrease in thickness. In the main pit at the base of West Hill a 15 cm thick rhyolite sill intrudes the coal seam. For 8 cm either side of the dyke the coal has been baked to a porous coke-like material showing columnar jointing (Figure 7). Coal sampled in the main pit may be of higher rank than coal elsewhere on the property due to the local heating.

The upper seam (Perry's "Coal Zone A") is 1.8 m thick and is exposed almost continuously in trenches and pits between Fisher Creek and East Hill, a strike length of 2 km. The coal layer is overlain directly by massive channel-fill conglomerate, or separated from it by less than 1 metre of mudstone. Coal seams of similar thickness and stratigraphic position are reported to outcrop on Coal Ridge and Double Mountain, up to 8.4 km along strike to the east.

The upper coal seam is also exposed on the west side of Fisher Creek where it was penetrated by an adit prior to 1906. However, it appears to have been displaced across a north-trending fault which follows the lower part of the creek. On the west bank of the creek the fine-grained floodplain deposits underlying the upper coal seam are at least 69 metres thick and contain at least four other coal seams including the middle and lower seams reported by Caimes (1906), Taylor (1969) and Hill (1982). A greater thickness of recessive floodplain sediments on the west side would explain the lack of outcrop west of the fault.

STRUCTURE

Figure 8 shows discordant bedding attitudes across the bounding faults of the graben. Within the graben the Tantalus Formation is deformed by large open upright folds which plunge northward. Pervasive north-south cleavage is probably axial planar to these folds (Figure 9).

Figure 10 shows channel-fill conglomerate at the east end of the main pit on West Hill folded into an open anticline. The coal intersected in drillholes above the main pit appears to be thickened in the axis of this anticline. Several small faults with about 2 metres displacment have offset the underlying coal and mudstone layers only, suggesting soft-sediment deformation.

Fisher Creek appears to follow the trace of a sinuous strike-slip fault. Slickensides along the creek plunge consistently northward at low angles. Approximately 100 metres of sinistral movement would account for the displacement of Coal Zone across the creek.

Figure 2 Channel-filled deposit: massive chert-pebble conglomerate.

Figure 3 Flute casts at the base of the channel which overlies the lower coat seam.

DISCUSSION

Fine-grained floodplain sediments in the Mt Granger area tend to be recesive-weathering while the channel deposits outcrop as resistant ridges. The association of the coal with the floodplain facies suggests that these low-lying areas should be the focus of further exploration

WEST EAST

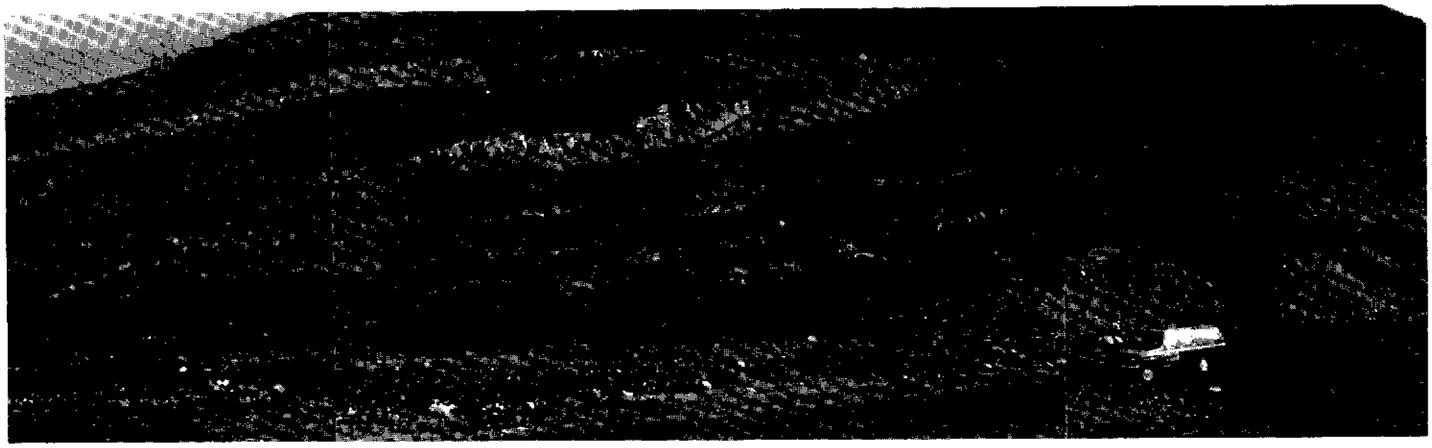

Figure 4 Conglomerate channel scoured into silty and fine sandy floodplain deposits exposed in main pit. A 3.4 m coal seam (coal zone 'B') is exposed at the base of the section.

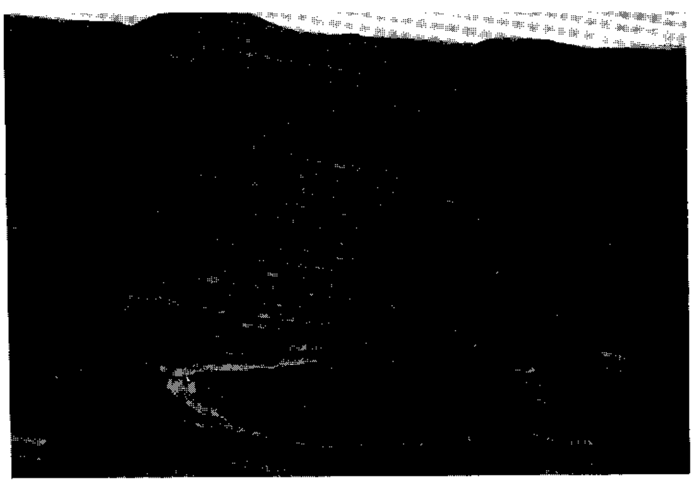

Figure 5 East Hill from the summit of West Hill. Upper and lower coal seams dip 30-50 degrees N between layers of channel-filled conglomerate.

The Tantalus Formation sediments observed in the Mt Granger area are friable and unmetamorphosed. Even the conglomerate can be broken by a bulldozer blade (P. Poggenburg, personal communication). Consequently, coal seams exposed at the surface should be readlily mineable along strike by open-pit methods, but coal-bearing strata generally dip at a 30-50° angle, and substantial reserves would only be accessible by underground mining. Variations in the thickness of the seams may be found due to the open north-plunging folds.

Variations in coal rank may be expected due to local thermal alteration by intrusive rocks which intrude the coal-bearing sediments. A rhyolite and an andesite dyke outcrop on the ridge east of Fisher Creek, and rhyolite sills intrude coal at the West Hill showing. The extent of these volcanic rocks is still unknown.

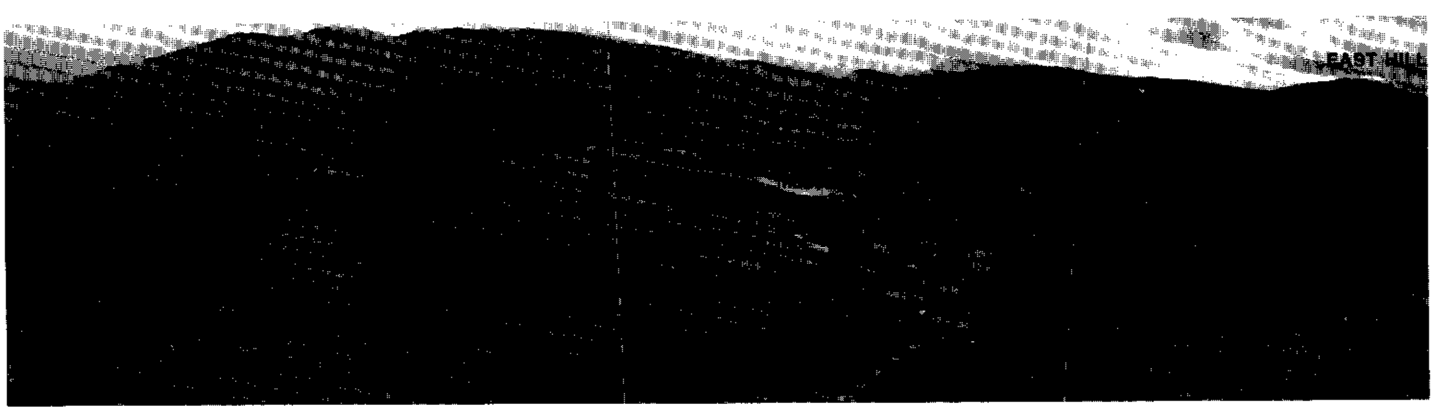

Figure 6 Whitehorse Coal Property looking south, showing location of upper and lower coal seams.

Figure 7 Baked margins of lower coal seam which has been cut by a thin rhyolite sill. Coal shows columnar jointing for about 8 cm on either side of the sill.

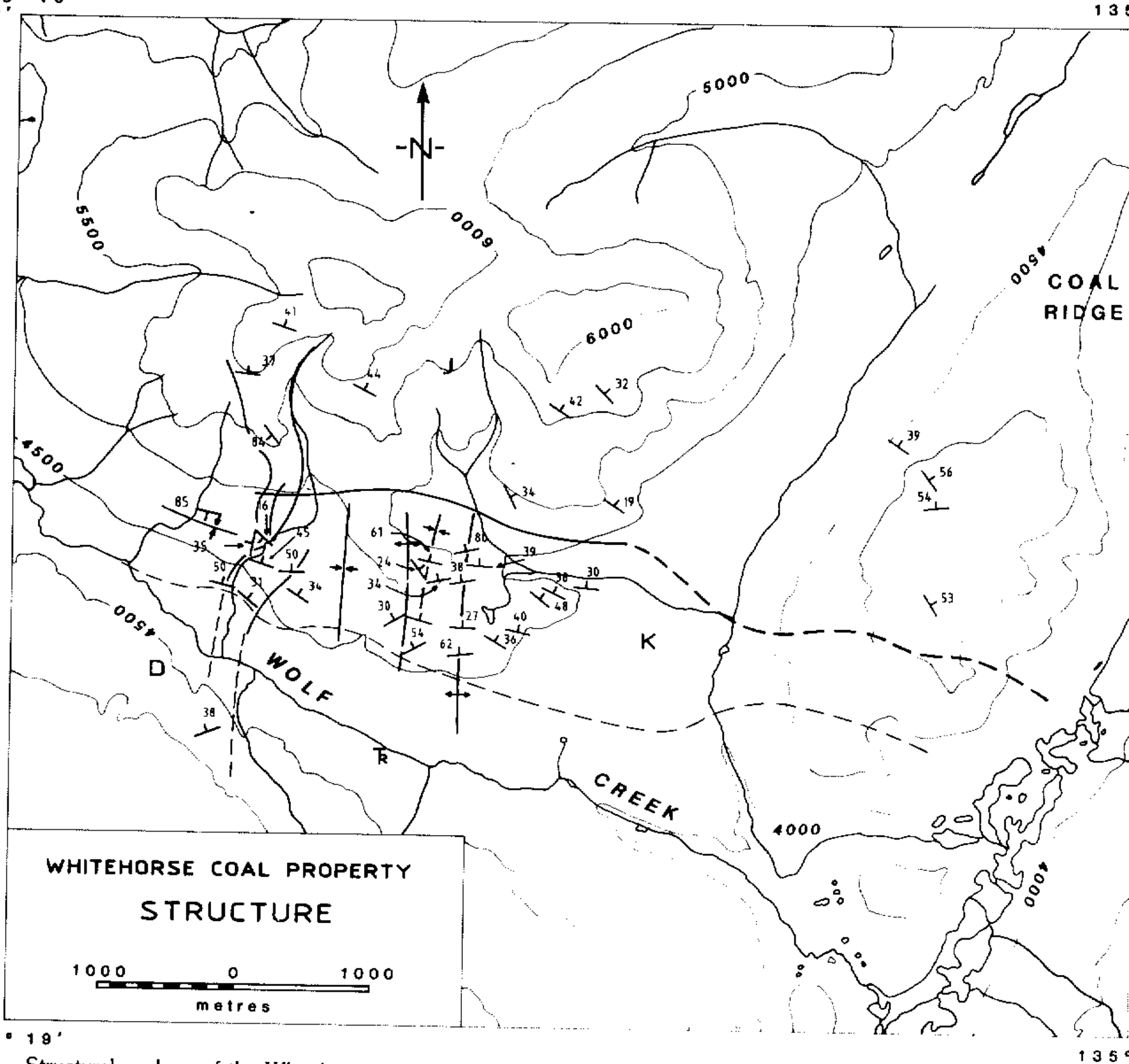

Figure 8 Structural geology of the Whitehorse Coal Property.

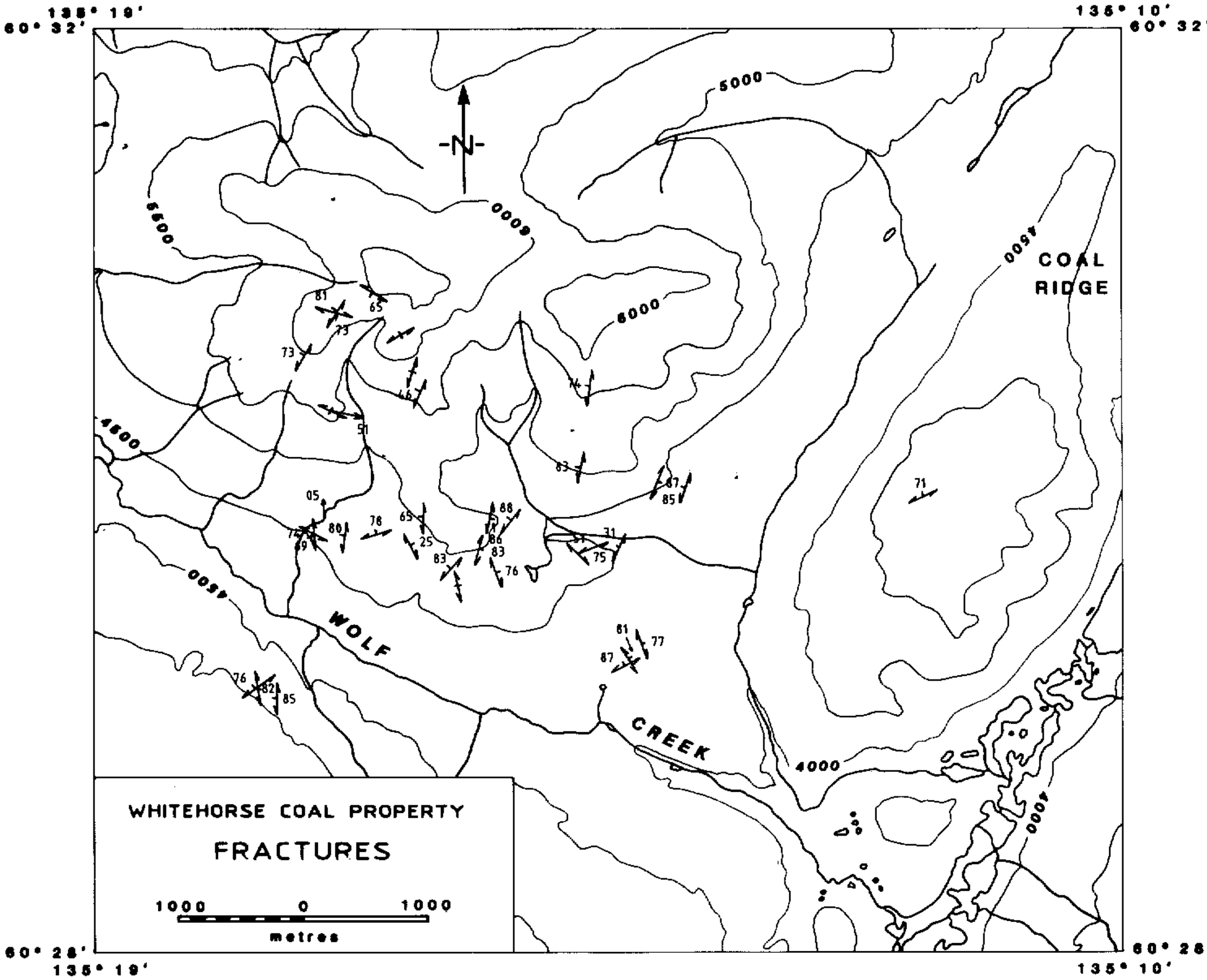

Figure 9 Fractures on the Whitehorse Coal Property.

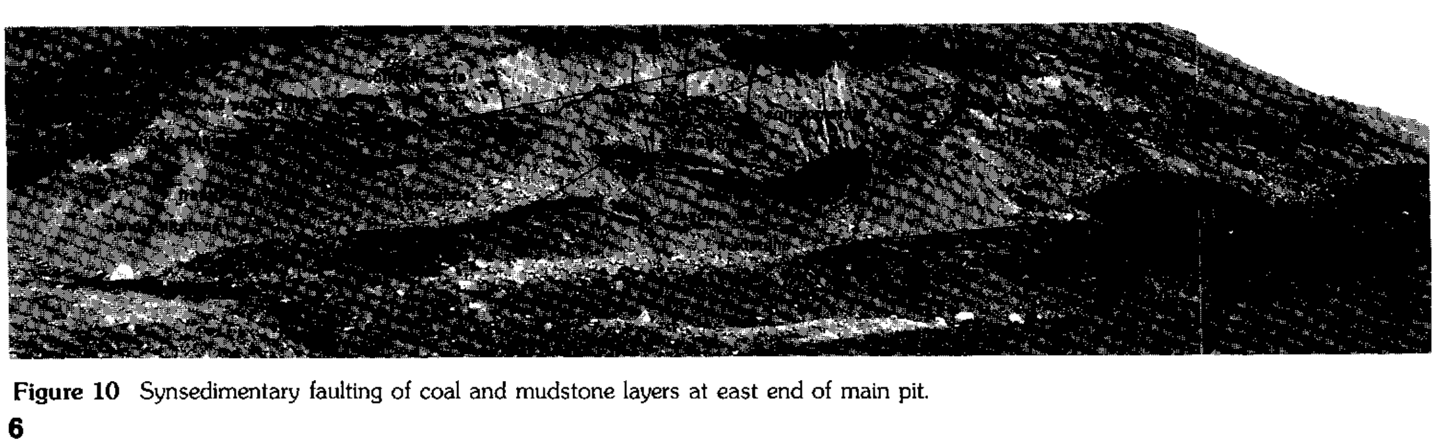

Figure 10 Synsedimentary faulting of coal and mudstone layers at east end of main pit.

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