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PORTAGE MOUNTAIN - BUTLER RIDGE

94 B/1E

Reconnaissance Mapping

Aug. & Sept. 1971

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LIC. NOS 2279 - 2321 INCL.

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ABSTRACT

The Portage Mountain-Butler Ridge area, composed of 43 claims, is underlain by terrestial sedimentary rocks of the Bullhead Group and marine sedimentary units of the Fort St. John Group. The Gething Formation, the coal bearing upper-half of the Bullhead, subcrops beneath extensive glacial overburden over a considerable portion of these claims. The Cadomin Formation, stratigraphically beneath the Gething Formation and forming the lower half of the Bullhead Group, underlies a somewhat larger fraction of the total claims area than the Gething, and is exposed where the Gething is eroded over three major structures: the Butler Ridge Anticline, the parallel and easterly Bullhead Mountain Anticline, and the intervening Bullhead Meuntain Syncline. The lowermost formation of the Fort St. John Group, the Buckinghorse Formation, is exposed in outcrop only once where it conformably overlies the Gething Formation.

The Buckinghorse underlies those portions of the claims along the eastern limit of the area which are not underlain by the Cadomin or Gething Formations.

Reconnaissance mapping was completed as far north through the area as Brenot Creek. Predictions can be made about the structure and stratigraphy of the units in the remaining claims to the north. Drilling possibilities have been evaluated; it is possible, with already established access, to penetrate the complete section of the Gething in one claim, #22.

No coal outcrops exceeding five feet in thickness were found. Those examined and sampled which approach five feet in thickness were man-made and slightly outside the area.

INTRODUCTION AND CONCLUSIONS

In the period Monday, 16 August/1971 -- Saturday, 18 September/1971 -- active field mapping was undertaken in the Portage Mountain-Butler Ridge area, which comprises 43 claims and somewhat less than forty square miles. In these four weeks 314 outcrops were examined, and approximately 60% of the total claims area was traversed. Reconnaissance was begun in the south, on Portage Mountain, and continued north as far as Brenot Creek. The next 20% of the area north of Brenot Creek is reasonably accurately predicted for structure and stratigraphy; the remaining 20% is predicted with slightly less assurance.

This report includes a base map, showing topographic features and nomenclature, all outcrops examined, the major structural features within the area, and the contacts of the various formations. Six sections are also included; these have been placed to emphasize structures and stratigraphic contacts. Drilling prospects are outlined in a separate section.

The traversing and outcrop examination were, due to the time available, performed in swift fashion. Traverses were chosen on the basis of structural conditions anticipated and expected exposure of outcrop, except on the East Slope of Butler Ridge where much sought Gething Formation outcrop proved virtually non-existent. Examination of individual outcrops was kept short in terms of time. As the major purpose of the reconnaissance was to identify the position and extent of the coal-bearing Gething Formation relatively short periods were expended on the well-exposed Cadomin Formation other than to determine its overall structure and contact with the Gething. Close attention was paid to strike and dip, measurements,

formational contacts of the Gething, and all structural features. Little time was spent on fine details of lithology and primary sedimentary structures.

The main crest of the Butler Ridge Anticlinorium, extending south from the region north of the area is structurally composed of the Butler Ridge Anticline. The axial plane trace of this anticline follows, generally, the high, west crest of the Ridge, and lies generally slightly to the west of the western line of the claims. The anticline is underlain by massive beds of the Cadomin Formation, which, historically, has not proven to be a major coal-bearing formation. Paralleling the anticline on the east, and running through the central portion of the north-south line of the claims, is the east crest of Butler Ridge, structurally composed of the Bullhead Mountain Anticline. This anticline is also underlain entirely by Cadomin Formation beds. Intervening between the two anticlines is the Bullhead Mountain Syncline. South of Brenot Creek this syncline does not contain Gething Formation beds; whereas north of the Creek it may. The plunge of this syncline, and also the Bullhead Mountain Anticline, is northerly; therefore Gething beds should be found where the Cadomin Formation strata become buried down-plunge.

The eastern half of the line of claims is topographically composed of the East Slope of Butler Ridge, covering that north-south-trending region between the heights of the Cadomin cliffs capping the Bullhead Mountain Anticline and the flatland of Beryl Prairie. It is here that the Gething Formation lies outcropping only once between Brenot Creek and Portage Mountain to the south. Portage Mountain structure and stratigraphy is a southward extension of the Butler Ridge Anticlinorium; the only major difference is that the west limb of the Bullhead Mountain

Anticline is thrusted over its east limb in the East Portage Thrust Fault. On this eastern slope of Portage Mountain good exposure of Gething Formation beds exists; this slope is the location of the old King Gething coal mine.

The Buckinghorse Formation, overlying the Gething, is exposed only once in outcrop, slightly to the south of the southern boundary of claim 1; its contact with the Gething is interpreted north under the East Slope. The Cadomin-Gething contact along the East Slope has been approximated, whereas the Gething-Buckinghorse contact remains mostly speculation. Should initial drilling be planned in the area south of Brenot Creek, the first hole should be placed to intersect the Cadomin-Gething contact at depth and determine the formational dip under the East Slope.

The six claims on Portage Mountain are not particularly inviting for initial drill exploration; either the small size and isolation of the claims or the structual conditions dictate any initial drilling should be to the north, under the East Slope. The line of claims south from Brenot Creek along the western edge of the area could be dropped; they are underlain completely by Cadomin Formation beds and are not of interest for coal. The East Slope claims, however, are most interesting; it may be that the best structural conditions for drilling exist north beyond Brenot Creek - the line of furthest reconnaissance this season - where the gently plunging Bullhead Mountain Anticline and Syncline have their Cadomin cores overlapped by Gething beds. Accessibility is non-existent without extensive road-building in this region; however, drilling could perhaps be better initiated under the East Slopeas outlined above, along the old Brenot Creek Well Road, in claim 22. Should worthwhile thicknesses of coal be penetrated here, drilling could be moved to this northerly

region to drill for the more favourable structure.

STRUCTURE

The property may be divided into four areas for the purpose of defining the occurrence and setting of the Gething Formation:

1. The Butler Ridge Anticline
2. The Bullhead Mountain Syncline
3. The Bullhead Mountain Anticline
4. Butler Ridge East Slope

These areas parallel each other, from west to east as listed. This nomenclature (the author's) is reproduced on the base map and in the sections.

The Butler Ridge Anticline, within the map area, is the southward extension of the main Butler Ridge Anticlinorium which stretches many miles to the north of the property. The anticline plunges south of the southern limits of the claims and disappears under Mount Johnson on the south side of the Peace River Canyon. The axial plane trace of the anticline crosses the peak of Portage Mountain (reader may refer to the base map) and follows, generally, the high "west crest" of Butler Ridge NNW past the western boundary of claim 46. Claims 47 and 48 are situated on the west limb of this anticline. The SW corner of claim 17 is situated on the trace; otherwise the crest of the anticline lies to the west of the western limit of the claims. Parts of the westernmost claims overlie the eastern limb of the anticline; dips are generally no greater than 20 degrees.

The Bullhead Mountain Syncline separates the Butler Ridge Anticline and the Bullhead Mountain Anticline. The syncline, however, plunges to the north - a reversal

of the overall plunge of the Butler Ridge Anticlinorium. The syncline begins near the peak of Portage Mountain in the south, between claims 1 and 47 (the actual beginning is eroded), and appears again north across the buried channel of the old Peace River channel west of the peak of Bullhead Mountain. Here the syncline is sharply bottomed, with opposing limbs dipping approximately 18 degrees. Northwards, Portage Creek has deeply eroded the core of the syncline in claims 14 and 17. A topographic and stratigraphic high is reached in claim 21, where the sybcline has become flatter-bottomed, with horizontal beds lying across several hundred feet of the axial plane trace. Brenot Creek has also deeply eroded the syncline; it may then be followed on the air photos north through claims 25 and 29. The author has tentatively mapped the syncline as becoming buried, down-plunge, under generally flatter-lying topography near the northern border of claim 43.

The Bullhead Mountain anticline also plunges to the north. In the region of claims 1 and 3 the western limb of the anticline is thrust-faulted (the East Portage Thrust; author's nomenclature). The thrust, where measured on Irish Creek slightly to the west of claim 1's western boundary, dips at 49 degrees. Elsewhere near claim 1, however, the beds of the overriding sheet dip at an average 15 degrees. This is to be expected, as the outcrop uncovering the thrust is situated at a topographic low at creek level. At time of folding, stresses were sufficiently severe that the forming anticline was thrusted upwards and eastwards along the western limb. As shown on the base map, the axial plane trace meets and separates from the thrust in conformation with steep rises and declines in topography. The crest of the fold is sharp; near the crest the western limb has dips not greater than 20 degrees.

The eastern limb increases regularly in dip, except for minor "wrinkling" resulting in small monoclines dipping locally to 60 degrees to an average of 30 degrees.

Where the anticline appears again, forming Bullhead Mountain across the old Peace River channel underlying Rocky Mountain Portage, the eastern limb is no longer thrusted, but dips steeply, with its beds, in places, approaching vertical. The axial plane trace may be followed north along the east crest of Butler Ridge in claims 18, 21 and 22. Brenot Creek has eroded the anticline deeply; the crest may again be followed on the air photos north through claims 25, 26 and 29. It is assumed to plunge between the flatter topographic cover north of claim 43. In claim 26 the plunge is approximately 14 degrees NNW.

The anticline has a "box" shape, as shown on sections EF and GH. The eastern limb is steeper than the western limb; the box shape is not unusual in the lower Cretaceous of the foothills. The top of the box generally dips eastwards at dips no greater than 20 degrees.

The East Slope of Butler Ridge is underlain by the east limb of the Bullhead Mountain Anticline; topographically the slope forms the gradient upwards and to the west from flatlying Beryl Prairie. As shown on the sections, a complete section of the Gething Formation should be found here.

Several smaller, subsidiary folds are located in Cadomin Formation beds throughout the map area as far north as mapping progressed. None are of any import.

STRATIGRAPHY AND INTERPRETATION

In mapping the Portage Mountain-Butler Ridge area three formations were

encountered, all lower Cretaceous in age. Terminology and identification follows the nomenclature of Stott and Irish, of the Geological Survey of Canada, in their various papers on the foothills of the Rocky Mountain in NE British Columbia. These papers are mostly recent (of the last several years) and a last, concluding paper is yet forthcoming.

Stott defines the Bullhead Group, composed of the lower Cadomin Formation and the upper Gething Formation. These units are traceable, through time and facies equivalents, from southern Alberta northwestwards along the foothills as far as the Sikanni Chief River, approximately 125 miles north of Portage Mountain-Butler Ridge. The Gething Formation, the equivalent Luscar F. in west-central Alberta and the Blairmore of SE B.C. and SW Alberta has a long history of coking coal occurrence and is the formation of interest.

Overlying the Gething Formation is the Fort St. John Group, whose lowermost formation in the map area is the Buckinghorse Formation. The overall purpose in mapping, therefore, was to determine the Cadomin-Gething contacts and the Gething-Buckinghorse contacts throughout the area.

The Cadomin Formation

The Cadomin Formation, as measured in the Peace River area by Stott, was considered to be at least 600 feet thick. Stott measured one Cadomin section on Butler Ridge, west of the northernmost claims. The author has found, however, and has drawn the sections to show, that the Cadomin approaches instead 2,000 feet, unless the formation, within the map area, has been structurally tripled. No amount of

detailed mapping would likely prove or disprove either thickness interpretation. In any event, the result is not of great importance, as the formation is not the formation of interest.

Lithologically, the Cadomin is composed (within the map area) of conglomerates and sandstones, with extremely minor siltstones, shales, and coal. Common particle size begins as medium-grained, and is gradational through coarse, very coarse, and pebble sizes. In a few outcrops pebbles approaching cobble size were found; pebbly sandstones are also common.

The beds are flaggy to massive, excepting, of course, the shales and coal, and two beds were mapped exceeding 50 feet in thickness (these beds form the "cap" for the Butler Ridge east crest, structurally the Bullhead Mountain Anticline) in claim 14. The beds weather a medium-to-light grey, and fresh surfaces, even in the conglomerates, are normally light grey. Occasionally a brownish or pinkish tinge was encountered.

The Cadomin Formation is extremely hard and resistant; the conglomerates, when struck with a pick, break through the pebbles, rather than around them. The formation resists erosion to a much greater degree than the Gething or the Buckinghorse, and its beds form the heights of the Ridge and Portage Mountain. Gething and Buckinghorse beds are confined to the flanks of the Cadomin structures, as illustrated in the sections.

Cliff sof Cadomin, frequently to 40 feet in height, were encountered often on the Ridge. The more resistant beds of the formation could usually be followed as

slight ridges in the tree cover for hundreds of feet.

The Cadomin is composed of fluvial alluvial fan sediments; thick cross-bedding, cut-and-fill structures, and channel-fill structures are so common that very often extreme difficulty is encountered in attempting to determine true strike and dip. The author, since time was important, followed a practice of surveying each outcrop quickly, measuring several attitudes, and combining these attitudes with an overall visual impression. Greatest difficulty was encountered in attempting to determine attitude when the beds were almost flat-lying; cross-bed fore-slopes often vary as much as 40 degrees from the true dip. Imbrication of the sediments was generally treated as not of significant importance when considering the overall attitude within a large area.

Small slips and faults were often observed, evidenced by well-developed slickensides. Usually these faults were parallel to the bedding-planes, and probably represent strain in response to the fold stresses.

In the areas of almost-flat lying beds, the three-dimensional structure of the small alluvial fans, within the formation often further confused attitude measurement. The reader may note on the base map, on the east crest of Butler Ridge, in claims 18 and 21, attitudes indicating several reversal of plunges of the Bullhead Mountain Anticline. These reversals, which account for the "rolling" topography along the crest, may in reality be due to the shape of the erosion resistant fans. Again, as the Gething is the formation of interest, no great amount of time was passed on these primary structures.

The Gething Formation

The Gething Formation, as the Cadomin, is composed of terrestial sediments, with possibly minor incursions of marine shales. Sandstones predominate, but siltstones and shales are extremely common and form almost half of the section. Grain sizes are commonly fine and very fine, with uninterrupted gradations down to the silt size and intoshales. Only rarely were medium or coarse sizes seen; small-pebble conglomeratic beds a few inches thick were found several times.

Beds are commonly platey to medium-flaggy; only rarely were massive beds encountered. The shales are not usually fissile or particularly well-bedded; the designation "shale" refers mostly to the grain size. Weathered colour is usually a medium-to-dark brown, with various hues of gray and lighter brown common. Fresh surfaces vary widely in colour; the majority center about medium-dark brown-grays. Rusty hues, dark gray, and dark brown are common. The shales are generally medium to dark, with a few black beds occurring. The colours vary widely and rapidly through the section, changing with each variation in grain size. The rock generally appears "dirty" matrixed when compared to the Cadomin, which is clean, light, often almost salt-and-pepper.

Rippling is common in the Gething; in the Cadomin it is less so. Cross-bedding, in the order of inches is also common; the Cadomin's cross-bedding is massive and is usually the major control over bedding. The Gething is much less resistant to erosion than the Cadomin and has been completely eroded from the steeper upper slopes of the Ridge proper. Gething beds are soft to the pick; no prominant thick units which have stood up to erosion were encountered. This uniformity of

erodibility accounts for the scarcity of Gething outcrop on the East Slope.

In conclusion, there is no difficulty in distinguishing Gething Beds from Cadomin Beds; the Cadomin is so distinctive that throughout the foothills of Alberta and British Columbia it has long been used as a marker Formation.

The Buckinghorse Formation

The Buckinghorse was encountered in only one outcrop, which is described below. The formation is composed of marine shales, with minor siltstone interbeds. The shales are usually well-bedded, often fissile, and a dark gray to black. They represent a marine incursion concurrent with the lower Cretaceous sinking of the Gething and Cadomin source lands to the west.

The Buckinghorse is even more erodable - and consequently more recessive - than the Gething. It may be assumed to underlie, along with its Fort St. John fellow-formations, Beryl Prairie, which stretches eastwards from the foot of the East Slope.

The Cadomin-Gething Contact

The Cadomin-Gething contact usually presented some difficulties in definition. The contact is conformable, but is also gradational. The author, on those three sections where outcrop was sufficient to allow close examination, followed a method of judging the contact to lie where relatively massive, light-coloured, hard-to-break Cadomin-typical beds equalled in thickness relatively "dirty", darker-coloured, platey and flaggy, soft, Gething-typical beds.

There is an important "catch", however. Stott defines the Cadomin-Gething contact as being generally facies-gradational (i.e. laterally gradational) throughout the foothills as well as being vertically gradational. In the Peace Canyon, at the Gething type area, only one to two miles distant, Stott (1970) define the Gething as being 1,800 feet thick. He states also that northwards (which is in the direction of the claims) the upper portions of the Cadomin grade laterally into the Gething, and both formations decrease considerably in thickness. Therefore there is no assurance that at the northern end of the property the Gething is actually 1800 feet in thickness. Outcrop exposure was not good enough to make any more accurate predictions.

The Gething-Buckinghorse Contact

The Gething-Buckinghorse contact is also vertically gradational. In addition, as only one outcrop of Buckinghorse was discovered, the drawing of the contact is tentative. On the base map and in the sections, therefore, the contact has been drawn assuming a thickness of 1800 feet for the Gething.

Claims 1, 2, 3 and 4.

These claims are situated on the lower, east slope of Portage Mountain, which may be considered to be the topographic and structural southward extension of the East Slope Butler Ridge. Good outcrop exposure on King and Irish Creeks allow the Cadomin-Gething contact to be accurately and precisely defined; the contact is the East Portage Thrust Fault, which has brought Cadomin beds to override the Gething, here forming the southward extension of the Bullhead Mountain Anticline. The fault dips 49 degrees west on Irish Creek; generally, however, the Cadomin is lying at

an average dip of fifteen degrees west on the higher slopes above the Creek. This is to be expected, as erosion has progressed to the point where only this small remnant of the beginning of the steeper up-cut of the fault sole is left.

The position of the fault, its dip, the Cadomin-Gething contact, and the position of the axial plane trace of the anticline, as shown on section AB, may be regarded as accurate. The dip of the axial plane, however, is not known with any accuracy.

Eastwards from the fault and the anticlinal crest the slope is underlain by Gething beds, dipping at an average of thirty degrees. The dormant King Gething Mine, described below, is located in these beds. Outcrop exposure on King Creek ceased before the foot of the slope (where the slope shallows and becomes Beryl Prairie) was reached. On Irish Creek outcrop exposure ceased long before the foot of the slope; it is assumed that the data from King Creek may be transferred north to this creek-line.

No further outcrop was uncovered throughout the remainder of these four claims. A short section of Gething, representing uppermost Gething beds, was found south of the southern border of claim 1, as shown on the base map. The stratigraphic uppermost outcrop of this group is Buckinghorse Formation; therefore the contact is established at this point, and has been extended north through claims 1 and 3 as shown on the base map and in section AB.

All of claims 2 and 4, all of claim 3 except for the SW corner, and the eastern half of claim 1 are topographically part of Beryl Prairie; the land surface, as the name "Prairie" implies, is almost flat, with only a very slight upward gradient to the

west. This gradient is mostly imperceptible on the ground.

The section AB, in the light of the above inforrna tion, has been drawn to show, therefore, approximately 600 feet of uppermost Gething bevelled and underlying the east slope of the mountain. The lower Cadomin-Gething contact has been drawn on the basis of an 1800-foot thickness for the Gething. The lessening in formational dip eastwards beneath Beryl Prairie is assumed only; several miles east the Fort St. John Group is essentially flat-lying.

Claims 47 and 48

These two claims are situated on the west slope of Portage Mountain, overlying what is structurally the west slope of the Butler Ridge Anticline. Outcrop exposure on the two branches of Parker Creek in the southern half of claim 48 allow close delineation of the Cadomin-Gething contact; the contact drawn on the base map and in the section AB may be regarded as accurate. The section shows that the steep upper slopes of the mountain are underlain by Cadomin beds, for a part dipping steeply, about the contact, at 54 degrees. Nearer the peak the beds flatten somewhat, and dip only 10 to 20 degrees. The lower, gentler topographic slope, extending SW to the canyon, is underlain by beds averaging 16 degrees in dip. The section shows that approximately 1700 feet of Gething beds underlie the SW corner of Claim 48; this figure should be accepted as accurate.

Continuous (almost) exposure was found NNW through claim 47, along the crest of a high spur extending from the peak in this direction. The base map shows that, along this crest, massive Cadomin beds dip regularly to the west. Only a few outcrops

were found down the west slope, on Gunn Creek and above its headwaters. The Cadomin-Gething contact is drawn on the base map, and in the section CD, to reflect these few outcrops. It may be noted that almost all of claim 47 is underlain by Cadomin Formation.

The Area between Claims 1 and 3, and Claims 47 and 48

This area, as may be viewed on the base map, is topographically the uppermost part of Portage Mountain. These highlands are underlain by Cadomin beds, often cliff-like, resistant, and easily discernible on the air photos. Much is bare of vegetation, in contrast to the thickly-wooded slopes of the claims to the east and west. In section AB the author has interpreted one or more subsidiary back-limb thrust faults (i.e. subsidiary to the main East Portage Thrust) to account for the thick section of Cadomin present. Subsidiary faults should be expected under existing foothills thrust theory, and the air photos support this interpretation. The relatively steep (about 54 degrees) dips about the Cadomin-Gething contact in claim 48 (also shown on the section AB) are attributable to rotation about the thrust axis.

There is an extremely small possibility of Gething beds occurring in the core of the beginning of the Bullhead Mountain Syncline in this area, but this possibility is so remote that a traverse was not made across the area. The heights of the mountain are too distant from the nearest roads and too difficult to climb in one day's traverse.

The area between Portage Mountain and Bullhead Mountain

This area, about 1 1/2 miles wide (refer to the base map) is heavily drift covered and is the site of the pre-glacial Peace River channel. Claims 3, 9, and the western half of 12 are covered by the Portage End Moraine (author's nomenclature),

deposited during a time of glacial stand-still. At the SW corner of claim 12 this moraine may be as much as 700 feet thick, and, in general, must be at least 200 feet thick. Its outline is clearly shown on the base map by the contours. Most of claim 3 is covered by the Bennett Dam gravel borrow pit - excavated into the morainal sediments. Much of claims 10, 12 and 13 show, on the ground, eskers and medium-sized kettle holes. These claims, and claims 2 and 4, may be underlain by much greater thickness of outwash sediments occupying the old river channel; it is not known exactly where the buried channel is positioned. The author interprets Beryl Prairie, in its entirety, paralleling the east slope Butler Ridge, as being underlain by outwash sediments of unknown thickness.

Butler Ridge, North to Brenot Creek

Butler Ridge, from Bullhead Mountain north to Brenot Creek, is topographically composed of two separate ridges; the western ridge is formed by the Butler Ridge Anticline, while the eastern ridge is formed, in the main, by the Bullhead Mountain Anticline. Portage Creek has deeply eroded the intervening Bullhead Mountain Syncline. Sections EF and GH show accurately the conformation of these three folds. The Bullhead Mountain Anticline has a "box" shape, which is easily mapped on the ground and clearly discernible on the air photos. In claim 14 the eastern limb of this box approaches a vertical dip (as shown on the base map and in section EF). In claim 26 (as shown on section GH) this limb has decreased to 48 degrees in dip. The steeper dips of the limb in the southern region of the anticline reflect increasing stress at time of folding, with maximum stress in the area of claims 1 and 3 causing a total break - the East Portage Thrust). The Flexures, or "creases" in this box

are remarkably well exposed in outcrop. The sections illustrate accurately, therefore, the conformation and position of the anticline.

Careful attention was paid in the field to the eastern limb of this box, as here the Cadomin-Gething contact is to be found. Many traverses were made, criss-crossing this limb and the east slope Butler Ridge to the east, extending down to the Beryl Prairie flats. Only one outcrop of Gething was found - in a small man-made borrow pit along the old Brenot Creek Well Road. This small outcrop dips 65 degrees easterly; somewhat greater than that anticipated for the Gething under the East Slope. 1200 feet west of this outcrop, in east-central claim 26, a Cadomin outcrop occurs which shows a 48 degree dip to the east. Therefore the use of the 65 degree dip for the Gething formational dip is moot. Under the East Slope in claim 1 small wrinkle-monoclines were mapped which dipped to 60 degrees. But it would appear to be unlikely that the Gething generally dips this steeply under the whole of the east slope.

This problem is an important one. A sufficient number of traverses have been made over the east slope (refer to the traverse map) through these regions where any outcrop is likely to be found that no more data could reasonably be expected to be uncovered, short of digging by back-hoe. The choice of drilling equipment, and surface area underlain by bevelled Gething beds to be used in planning drill sites, is at stake. On the sections EF and GH the author has shown the Gething Formation to dip under claims 12, 15, 18, 19, 22, 26 and 27 at a dip approaching 65 degrees. It is important to note, however, that this interpretation will lead to a very conservative figure in calculating the amount of land in these claims having Gething

Formation beds subcropping beneath the overburden. The lower the average formational dip used, the higher the areal extent becomes, and the Gething-Buckinghorse contact is moved easterly accordingly.

This contact has been drawn on the Base Map and in the sections using a thickness for the Gething of 1800 feet. Its position should be regarded as tentative. The Cadomin-Gething contact, however, may be relatively closely approximated under the East Slope. The author has drawn it between the two above-described outcrops in claim 26, and extended it southwards accordingly to the known structure and thickness of the Cadomin beds forming the crests of the Ridge. In claim 22, at the intersection of the Brenot Creek Well Road and the south branch of "Claim #22" Stream, two outcrops were found which are structurally further down the East Slope than any others, save the above-mentioned outcrops in claim 26. These outcrops have been mapped as Cadomin, but the author feels they are close to the Cadomin-Gething contact. The contact has accordingly been drawn slightly to the east of these two outcrops, and continued south to the East Slope on Bullhead Mountain. When traversing in the field across the East Slope the worker can always observe a sudden increase in the gradient when progressing upwards to the west; this increase can probably be correlated closely to the contact. This assumption is based on a certain amount of "field sense" developed during the work.

In conclusion, therefore, the structure of the three major folds shown on sections EF and GH may be regarded as accurate, as also the positions of their axial plane traces, the dip of their limbs, and their extension as far north as Brenot Creek.

Considerable traverse time was passed in the area of the Bullhead Syncline. On the federal 1" : 4 mile geological maps this syncline is shown to contain Gething beds in its core, overlying uppermost Cadomin beds forming the cap rock of the parallel anticlines. From many traverses through claims 14, 17 and 21 the author can definitely state that no Gething is contained in this Syncline. Portage Creek has eroded what little Gething may have left after folding; indeed, the Creek probably owes its course to the easily-erodable Gething once contained in the core. What is now the topographic and stratigraphic uneroded highest point in the syncline (south of Brenot Creek) is found in central claim 21, at the head of Portage Creek. Several unmistakably-Cadomin outcrops were found on the Creek banks here, completely nullifying any possibility of the presence of the coal-bearing Gething.

The Area between Brenot Creek and Claim 46

Due to the late start of the field reconnaissance active traversing was not performed north of Brenot Creek. Much of the structure and conclusions immediately south of the Creek can be carried north, however.

The three major folds can be seen, from the air photos and from vantage points on the ground, to continue north through claims 25, 26, 29 and 30. Small cliffs in the Cadomin strata stand out particularly well and are simple to follow. The Bullhead Mountain Anticline can be seen, by means of these cliffs, to plunge north at a dip of 14 degrees. The topographic high in the NE corner of claim 25 and in claim 29 can likewise be seen to be capped by Cadomin beds. It is therefore assumed that this anticline continues to plunge northwards and becomes buried under claim 43 after passing through claim 39.

The Bullhead Mountain Syncline can be seen on the air photos to parallel the Bullhead Mountain Anticline. There is a possibility, however, that Gething beds are contained in the core of the syncline north of Brenot Creek. Indeed, this must be the case sooner or later, as, where the Cadomin syncline of the core plunges out, lowermost Gething strata becomes the core. The question to determine in future mapping is how far south these Gething beds extend before erosion bevels them completely. The author has shown, on sections IJ and KL, an optimistic interpretation. The largely uneroded core of the syncline, on the height of the Ridge in claims 25 and 29, is topographically and stratigraphically several hundred feet higher than the eroded surface of the synclinal core in claim 21 tothe south. It may be that the lowermost Gething beds will be found in these claims.

The base map and the sections IJ and KL show tentative only structure and stratigraphy for the region north of Brenot Creek. They should be a fairly reliable guide, however, for future mapping.

DRILLSITE PLANNING

Should drilling of the Gething Formation be undertaken, a few comments here on siting may be helpful.

The Bullhead Mountain Syncline may be negated for drilling exploration, as, south of Brenot Creek, all Gething strata have been eroded, leaving only Cadomin beds in the core. North of Brenot Creek access is non-existant, and what Gething beds which may be mapped there in the future will be lower Gething only; a complete Gething section is not likely to be found. The Butler Ridge Anticline and the Bullhead

Mountain Anticline are composed entirely of Cadomin strata. They too may be negated.

Claim 47 contains, at most, several hundred feet of lowermost Gething beds only. It may be negated. Claim 48, in its western half, contains almost a complete section of Gething, lacking only the upper several hundred feet (estimate based on a Gething thickness of 1600 feet). This claim, however, is not surrounded by any others, and half of a square mile is not justification for drilling expenditures.

Claims 1, 2, 3 and 4 are underlain by the complete Gething section; however, only the upper 600 feet subcrop beneath the overburden. At least one deep hole would be necessary to reach the Cadomin beneath. Also, glacial sediments of at least 200 thickness are known to underlie part of the total area here. Finally, the approximate two square miles of surface covered by the claims are not area enough to justify expensive drilling methods.

This leaves the East Slope Butler Ridge. The Brenot Creek Well Road crosses the slope completely, and allows reasonable access. Forestry officials and conservationists would be satisfied in approving drilling along an already existing road. Drilling should first locate the Cadomin-Gething contact, shown, as on the base map and in the sections, to extend NnW through claims 9, 12, 15, 18, 22 and 26. Drilling could then be extended eastwards towards Beryl Prairie to locate the Gething-Buckinghorse contact. Formational dip, which has not been successfully mapped in reconnaissance, could be approximated from the first hole locating the Gething-Cadomin contact.

Perhaps the most favourable drilling area, however, will be found on the East Slope where the Bullhead Mountain Anticline (that part of it created by Cadomin beds) plunges beneath claims 32, 33, 36, 39 and 43. The complete section of the Gething should be drillable there, along the axial plane trace of the anticline. Where Cadomin beds are buried the dip i.e. the plunge, is a mere 14 degrees, allowing the low cost vertical rotary drilling methods. This region should also prove to be that part of the property which contains the greatest areal extent of Gething sub-cropping beneath the overburden. Should the drilling prove the Gething to contain sufficiently thick beds of coal, this area probably constitutes the most favourable stripping region.

COAL OUTCROPS

1. Outcrop BPO71-1 (Bell Portage Mountain Outcrop #1): the site of the "NE Mine", located on the base map, south of Claim 1. This is an old adit site; the seam is correlated with the King Gething mine on King Creek to the north. The opening is caved; samples were taken from the wall at the entrance. Dip is 29 degrees east; field notes pp. 15. From the top:

Covered	
3' 0"	Sandstone; fine-grained; brown and grey; platey to flaggy; soft, stem and plant remains.
3"	Shale; medium-grey; small-platey to blocky.
1' 5"	COAL; Sample BPS71-1; several streaks of clay partings.
10"	Shale; medium-grey; small-platey to blocky.
3' 0"	COAL; Samples BPS71-2 & 3, each 18"; much vari-coloured shale in beds less than 1".

Footwall

Siltstone-Mudstone; soft.

Samples were channel samples, 2" wide, 1" deep. All material taken, including partings. This will be sampling method for samples listed below.

2. Outcrop BPO71-2: The site of the "SW Mine", located on the base map south of claim 1. This is an old mine; the seam is correlated to the King Mine on King Creek to the north. Entrance remains open; samples taken from wall at mouth. Dip is 20 degrees east; field notes pp. 17. From the top:

Covered	
1' 6"	Sandstone; slightly conglomeratic; almost salt-and-pepper; bedding irregular; fine-grained; plants, stumps, and roots visible.
2"	Shale; almost fissile, grey.
11"	COAL; bright.
1' 8"	COAL; dull; a few light sandstone stringers.
3' 0"	COAL; bright, clean.

5 samples taken of this 5' 7" total, each 13", last 15". BPS71-4 to 8; numbering beginning at top of coal. The base of the coal was not uncovered; probably very little thickness remains.

3. Outcrop BPO71-6: On King Creek above the old, closed, and covered King Gething Mine. Dip 30 degrees east. 1' small-blocky, friable-weathering coal; base not uncovered. Probably correlates to the buried coal in the mine, a few feet downstream. Field Notes pp. 22.

4. Outcrop BPO71-30. On the lower portion of King Creek, south of claim 1. This is Irish's "Gully Seam". Occurrence is stratigraphically less than 100 feet beneath the Gething-Buckinghorse Contact. Field Notes, pp. 41; dip 34

degrees east. From the top:

Sandstone and Siltstone; sandstone very fine-grained; platey to flaggy; ripple-marked; medium-dark gray-brown, abundant dark gray laminations.

3' 0" COAL; alternately hard and soft; blocky and coarse-friable.

3" Shale.

9" COAL; as above.

Sandstone, as above.

5. Outcrop BPO71-149. At the Bennett Dam, in parking-lot cut. Field Notes pp. 148, dip 6 degrees west.

2' 9" COAL; clean; bright; chippy-friable; extremely hard; tends to break out in large chunks. Sample BPS71-9.

Section above and below composed of interbedded sandstone, siltstone, and shale; Gething-typical appearance and composition.

6. Twelve other coal beds were found exposed in outcrop; none over 1' in thickness. They may be referred to in the field notes by the word "coal" heavily underlined in the margins.

7. Several occurrences of coal "bloom" were noted. In each case hand shovel work failed to uncover the source. They may be referred to by the words "coal bloom" heavily underlined in the margins of the field notes.

Stott (1968) lists 30 coal beds in the Gething Formation in the Peace River Canyon, no more than a mile distant from the southern end of Portage Mountain. None of these are over 5', the thickness of the King Seam, shown on the sections. The coal is the least resistant of the beds within the Gething, and cannot be expected to outcrop to any great degree naturally. All of the nine samples taken were excavated

from man-made cuts.

BIBLIOGRAPHY

The following list is not complete, but covers all work done by the Geological Survey of Canada in the Peace River area of use in coal exploration. The Provincial British Columbia Department of Mines has nothing published which adds to the G.S.C. work.

1. E.J.W. Irish — Halfway River Map Area, British Columbia; G.S.C. Paper 69 - 11.
2. ---------- — Some Coal Deposits of the Peace River Foothills, British Columbia; G.S.C. Paper 44 - 11.
3. D.F. Stott — The Gething Formation at Peace River Canyon, British Columbia; G.S.C. Paper 68 - 28.
4. ---------- — Lower Cretaceous Bullhead and Fort St. John Groups, between Smoky and Peace Rivers, Rocky Mountain Foothills, Alberta and British Columbia; G.S.C. Bulletin 152, 1968.
5. ---------- — Jurassic and Cretaceous Stratigraphy Between Peace and Tetsa Rivers, Northeastern British Columbia; G.S.C. Paper 66 - 7.
6. ---------- — Stratigraphy of the Lower Cretaceous Fort St. John Group and Gething and Cadomin Formations, Foothills of Northern Alberta and British Columbia; G.S.C. Paper 62 - 39.
7. ---------- — Cretaceous Rocks between Smoky and Pine Rivers, Rocky Mountain Foothills, Alberta and British Columbia; G.S.C. Paper 60 - 16.

BASE MAP NOTES

The base map is drawn on a scale 1" : 2,000 feet.

Claim Boundaries: Claim boundaries were drawn from measurements taken from a 1" : 2 mile office-copy drawing. Due to the facts that the boundary lines on this drawing are 25 feet wide and the line orientations are often not north-south nor east-west the claim positions should not be regarded as strictly accurate. Also, the inherent distortions in producing a topographic sheet from air photos i.e. the base map, invalidate accurate drafting. The claim outlines drawn, therefore, are accurate only to within several hundred feet.

Trails, powerlines, etc. Trails, powerlines, the pipeline, new roads, borrow pit outlines, etc. used in transferring field measurements to the base map were taken from the newest series of 1" : 1 mile air photos, photographed several years ago. All such features are identified on the map. Their positions are also accurate to several hundred feet only, as the distortion, increasing towards the edges of the photos, often confused accurate plotting. These features are included so that any worker returning to the field in the future can locate outcrops described in the notebooks.

Outcrop Strike and Dip Symbols: Outcrop locations were measured in the field by pace-and-compass; a small fraction were located by odometer or directly on the air photos. When plotting a pace-and-compass traverse, the usual method of adjusting paced distances between two air photo-located points was followed. Where the strike line of a particular symbol touches a stream course or trail on the base map, the outcrop occurs at the intersection. Where the symbol does not intersect a stream course or trail, the outcrop occurs at the intersection of the strike line and the dip line.

Faults: The East Portage Thrust, in claims 1 and 3, was located accurately in the field. Other thrust fault positions are approximate only. Minor faults are not shown on the base map, as no faults of significance were noted in the project's quick field reconnaissance.

Anticlinal and Synclinal Axial Plane Surface Traces: These, as drawn on the base map, can be regarded as accurate as far north as Brenot Creek. Beyond this creek-line they are tentative only, based on examination of the air photos and "field-sense" developed during mapping.

Formational Contacts: The Cadomin-Gething contacts in claims 1, 3, 47 and 48 may be regarded as accurate. Northwards the Cadomin-Gething contact is approximate; only one Gething outcrop was located north to Brenot Creek, in the east-central portion of claim 26. Beyond Brenot Creek all contacts are tentative only. The Gething-Buckinghorse contact drawn through claims 1 and 3 is likewise approximate, except on King Creek south of claim 1, where one outcrop of Buckinghorse was found. It is important to note that the Cadomin-Gething contact is geologically conformable, except where thrust faulted, and is also gradational, both vertically and horizontally. Therefore, a large amount of interpretation, intuition, and topographic "field-sense" was used in drawing Cadomin-Gething contacts.

Drill Holes: Three drill holes (rotary, truck-mounted) were drilled by McAulay Drilling of Edmonton for Brameda Resources in the winter of 1970-71 in the area of Claim 1. These are located on the map.

SECTION NOTES

The sections are drawn to a scale 1" : 1,000 feet, both vertically and horizontally. All sections are drawn on a sectional topographic azimuth of 075 degrees (WSW - ENE), which is approximately perpendicular to the average outcrop strike. All sections are viewed to the NNW. Six sections are included; the first four (AB, CD, EF and GH) are based on field mapping; the final two (IJ and KL) are located north of Brenot Creek, the northernmost point of mapping during this season. These two sections are tentative only, and again are based on study of the air photos combined with geologic and topographic "field sense" developed during the mapping. They are included as an aid to future mapping.

Claim Boundaries: The claim boundaries drawn on the sections are approximate only; they are included to provide a certain perspective in evaluating the Gething Formation within the claims.

Topographic Profile: The topographic profile was taken from the contours of the base map. Note that it is customary for the contours on such a sheet to be approximate only; they cannot be used for accurate measurement of slopes. The prominant Cadomin Formation cliffs occuring throughout the area are not shown.

Creeks and Streams: All stream courses intersected by the sections are shown on the sections; nomenclature for those prominant enough to have been named in the notebooks is reproduced.

Contacts: The Cadomin-Gething and Gething-Buckinghorse contacts are identified in each section. Position of contacts at depth is postulated only. Contacts north of

Brenot Creek are tentative only.

Structural Features: Anticlines and Synclines are named where important; nomenclature is reproduced from the field notbooks. The thrust fault forming the Cadomin-Gething contact in claims 1 and 3 is herein named the East Portage Mtn. Thrust. Excepting this fault's position and dip at the surface, all fault representation is interpretational only.

TRAVERSE MAP NOTES

As the author of this report has performed the field mapping as a temporary employee only a "traverse map", on the same scale and topographic sheet as the base map, is included. The nomenclature of the topographic features identified in the traverse route outlined in the notebooks is reproduced. Note that traversing was not done north of Brenot Creek.

NOTEBOOKS

Three notebooks (totalling 328 pages) labelled "D. F. Bell, Nickel-Alrae #'s 1, 2 and 3" are included with the maps and sections. As the author is a temporary employee only, the following notes are made:

1. Starting date: 8 August, 1971; finishing date about 15 September, 1971; included are diary-type notations about travelling time, report writing time, etc.

2. Each notebook contains a table of contents on the inside cover, giving page numbers, date, appropriate claim numbers, and general area designation.

3. Each traverse is outlined for the appropriate day in somewhat greater detail than would be the case if the author was a permanent employee. This information, combined with the also-included Traverse Map, should enable any future worker to easily locate a particular outcrop.

4. 314 outcrops are described, each outcrop number prefaced with the figures "BPO71-" meaning "Bell Portage Mountain Outcrop Number -".

5. The attitude (strike and dip) of each outcrop is given, together with notes on variations, averaging used, or other difficulties encountered.

6. Each outcrop's description contains a section labelled "Lith." defining lithologic characteristics, formational identification if applicable, and any pertinent stratigraphic or structural notes. Sundry other details may be included.

7. Stratigraphic measurements, where given, were gauged in inches.

8. Occurrences of coal may be easily located in the notes by the word "coal" heavily underlined in the margin.

9. The determination of a formational contact is marked in the margin for easy reference.

10. Beginnings and endings of paces, and conversion factors used in plotting, are included as part of each traverse's notes.

11. Sketched diagrams are included throughout illustrating structural

interpretations and traverses which contained many direction changes.

12. The end of each day's traverse is finished by a section labelled "Conclusions", outlining conclusions concerning stratigraphy, structure, and occurrence of outcrop.

13. Free and continual use is made of the claim numbers, to enable a future worker to easily locate traverses and outcrops.

14. Topographic and structural terminology employed in the notebooks is carried to the base map and the sections.

Rae E Gray
for D. Bell.

is now curator of our coal report files.

Rogers, Major & Company

Barristers & Solicitors
205 - 846 West Hastings Street
Vancouver 1, British Columbia
687 - 6661

MAY 23 '72 PM

May 17th, 1972.

C.M.
C.G.C. ✓
C.C.
C.G.G.C.
ACCTS.
C.M.E.
C.L.
C.A.
R. T.
C.P.E.
ARC ✓
MR JAMES ✓

Department of Mines & Petroleum Resources,
Parliament Buildings,
Victoria, B.C.

DEPT. OF M
AND PETROLEUM

Attention:- E.J. Bowles, Esq.,

Dear Sirs,

5590

Re: Nickel Hill Mines Ltd. (N.P.L.) - Coal Licences Nos.2279-2321 inclusive.

Please find enclosed the following documents:

1. A Reconnaissance Geological Report on the captioned Coal Licences, dated September 1971 and prepared by D. Bell of Alrae Engineering Ltd.

2. A report to tne Company dated May 15th, 1972 by R.G. Jury, P.Eng.

In light of the report of R.G. Jury, the Board of Directors of Nickel Hill Mines Ltd. (N.P.L.) has instructed us to advise you that the Company does not wish to renew the captioned Coal Licences.

As well, we have been instructed to approach you concerning the $50,000 performance bond posted by the Company in connection with the acquisition of the captioned Coal Licences. Although the Company has not spent $75,000 on the properties contained within these Licences, and intends to spend no further monies thereon in light of the aforementioned report, we would ask in that the Company has complied with all its undertakings to date and would continue to do so if preliminary reports had not proven unfavourable, that you consider the return of a portion of the performance bond pro rata to the monies expended by the Company on the captioned Coal Licences.

We look forward to receiving your advice on the above matter.

Yours very truly,
ROGERS, MAJOR & COMPANY

R. JOHN ROGERS

C.C. Nickel Hill Mines Ltd. (NPL)

ALRAE ENGINEERING LTD.
844 WEST HASTINGS STREET, VANCOUVER, B.C.
TELEPHONE 681-9381
TELEX 04-54688

May 15th, 1972

Nickel Hill Mines Ltd.,
848 West Hastings St.,
Vancouver 1, B.C.

Dear Sirs,

re: Portage Mountain - Coal Licences

Total expenditures on this project since its conception last year now total $47,181.29 as per the company's ledger. This includes licence location as well as geological field work and legal and accounting charges etc.

Field work has indicated that coal should be present on many of the licences, but will be steeply dipping on most and hence uneconomic at present. An area of some five sections may be underlain by shallow dipping coal deposits, but is relatively inaccessible. Drilling has not been undertaken in this area to confirm thickness and quality of coal, but the best seam anticipated would only be seven feet maximum thickness. Even if this seam is present in the favourable area the indicated reserve of coal is too small to warrant possible production. Preparation of access and drill testing would, in itself, be an expensive project.

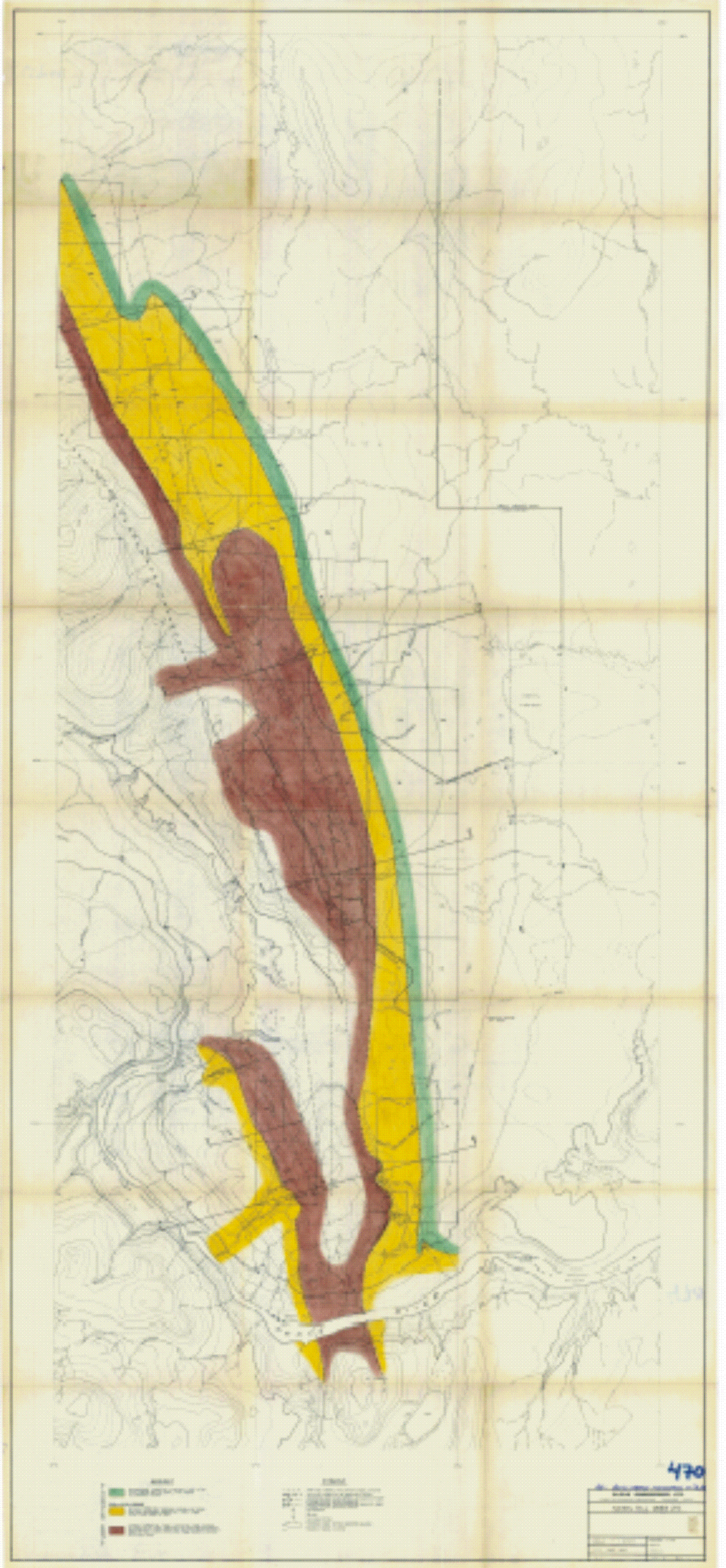
Considering the indicated limited economic potential of the property it is recommended that field work not be continued, and that the project be abandoned by the company.

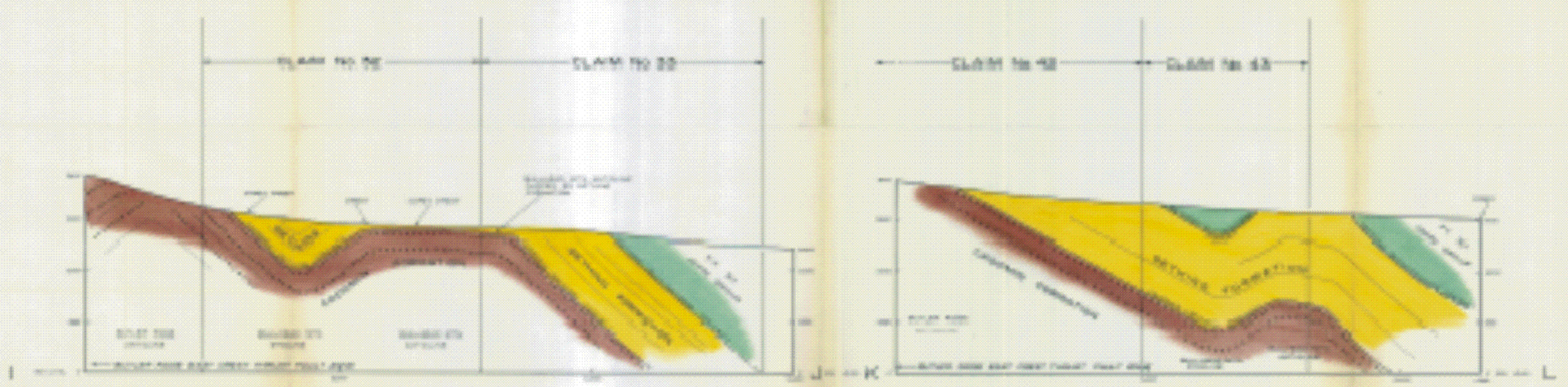
Yours very truly,
ALRAE ENGINEERING LTD.

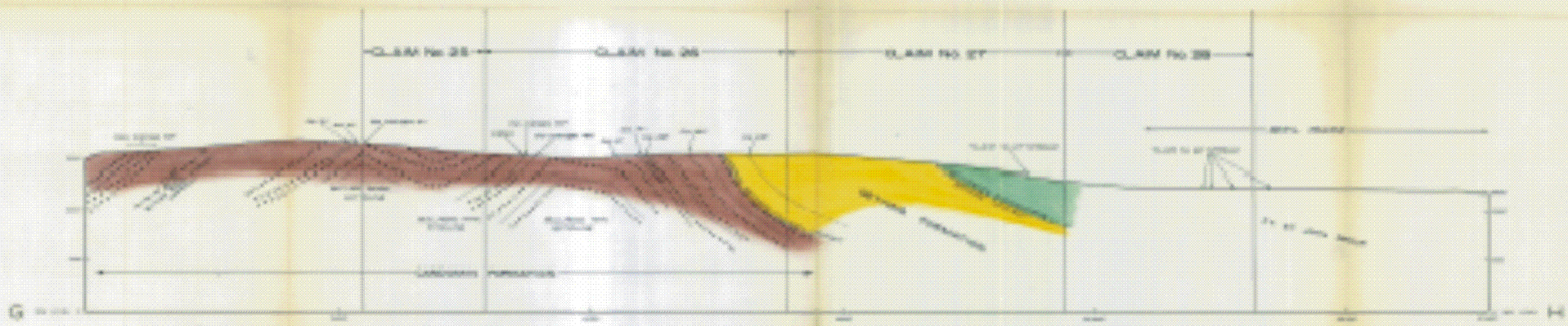
per: R.G. Jury

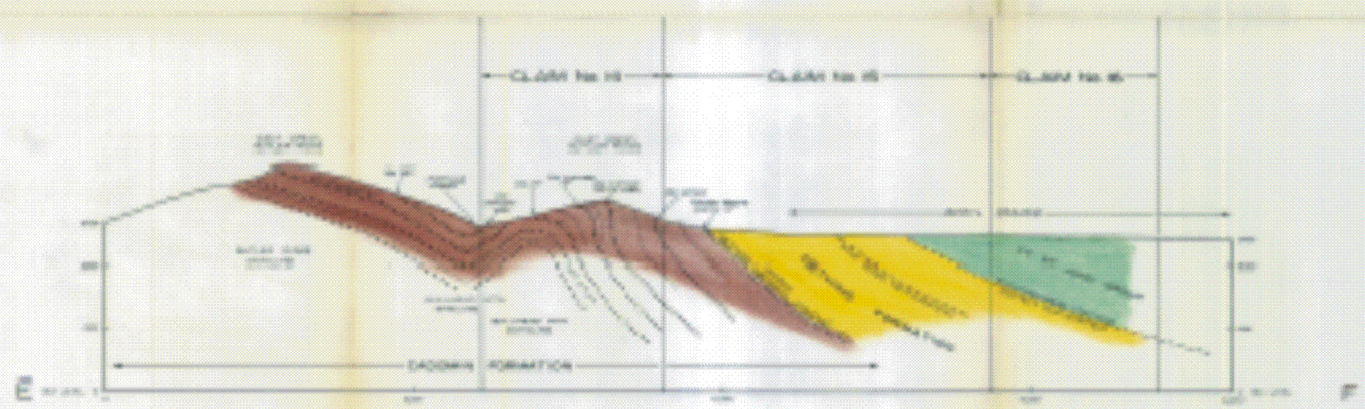
R.G. Jury, P.Eng.

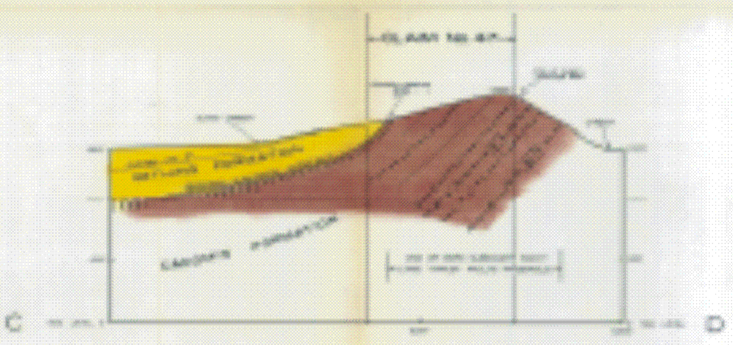
RGJ:k

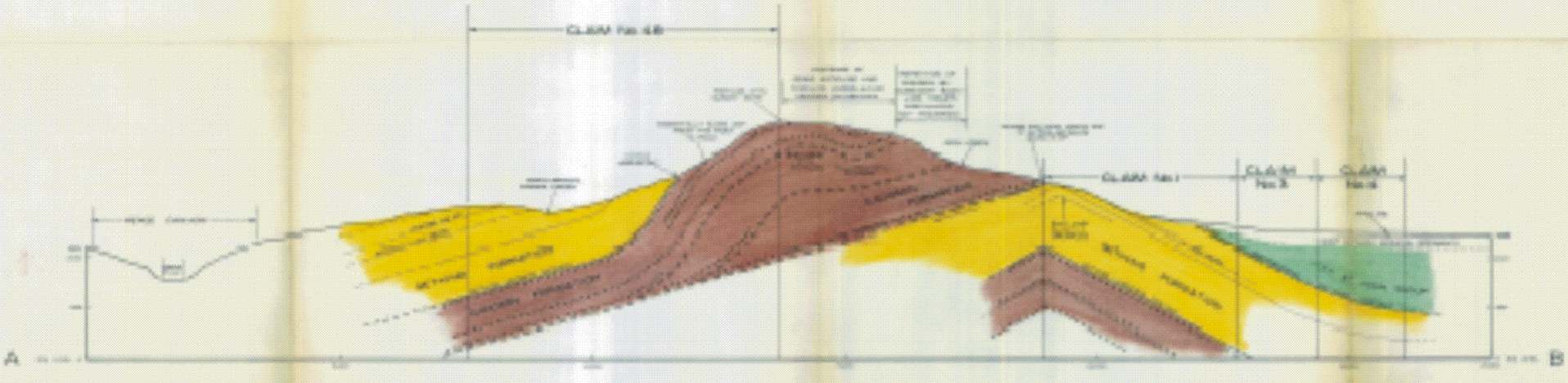












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PORTAGE MTN. BUTLER RIDGE

SECTIONS AB, CD, EF, GH, IJ, KL
(IJ & KL TENTATIVE ONLY)