BRITISH COLUMBIA AND POWER AUTHORITY

HAT CREEK PROJECT
PRELIMINARY EVALUATION

INTERIM REPORT
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HAT CREEK PROJECT

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A. INTRODUCTION

A preliminary review of information on Hat Creek has been completed. Particular emphasis in this evaluation is placed on the "Hat Creek (No. 1 openpit deposit) Summary Report".

Two specific references are made to minor errors in the report. Suggestions are made concerning geological correlation, field mapping, geological sections, and the need for downhole geophysical logs. The environment in which the sequence formed is interpreted from available information.

B. DISCUSSION OF REPORTS

1. General

The reports are well written; the format makes them easily read and used for reference. Costs appear to be somewhat lower than were expected although no detailed alternate estimate of costs has been made.

2. Individual Reports

Regarding the Hat Creek Summary Report dated January 1, 1975 the presence of a potential resource of 15 billion tons of coal in Hat Creek Valley is very speculative; the speculative nature of this figure should be emphasized further. A reader with little knowledge of geology may accept this value only to be forced to accept a significantly lower figure in the future.

Two errors of transcription were noted:

2. Individual Reports - (Cont'd)

(1) page 34 - "Total pit reserves - coal with selected waste removed" should read 478,624,000 tons rather than 388,613,000 tons; the later is the reserve figure from the 1957 - 1959 drilling.

(2) page 57 - The subtotal for supervision and plant overhead is $72,950 rather than $70,450 as written; succeeding calculations should be changed accordingly.

There is a problem in distinguishing between overburden and Coldwater sedimentary rocks in the diamond drill core. The two units are only partly consolidated. Although problems will not arise until later in pit development, it is probable that 45^{o} walls cannot be held with this type of material. The problems being encountered in drilling are an indication of future difficulties. There will probably be a water problem during spring runoff. The nature of the clay and silt interbeds will probably present problems to trucks and shovels. Significant money will have to be allowed for ballast on ramps from the pits. These problems are currently under study following recommendations made by R. Peck.

The nature and extent of the structural deformation is unresolved and to date one is forced to accept the interpretation that we are dealing with a single, unrepeated coal measure. This is the view held in the Dolmage Campbell reports.

3. Problems of Correlation

Geological correlations are difficult in the environment in which the Hat Creek coal deposits were formed.

Three methods of correlation are available:

(1) Possible marker horizons based on lithologic logs - interbedded tuffs, marls, or conglomerates would provide the best possibilities for marker horizons although the latter two are subject to abrupt facies changes. Such subtleties as proportions of different types of volcanic rocks, variation in type and degree of cementation, or the presence or absence of abrupt changes of dip may provide the characteristic feature for correlation.

(2) Possible marker horizons recognized from geophysical logs - difficulties in correlation have arisen because some logs have been taken in open holes, others in doubly cased holes, others in holes with single casing, others through casing and rods, and still other logs were taken through rods alone.

(3) A third method which could be tried is correlation based on spores and pollen. Biofacies differences are probably not as marked as lithofacies differences and it would be hoped that evolutionary changes up the geological section would be sufficiently diagnostic. Dr. Rouse, of U.B.C., has expressed an interest in studying Hat Creek in this regard should the situation arise.

The value in geological correlation lies in predicting the shape of the coal zone to determine pit outlines and in predicting where concentrated exploration is warranted.

4. Geological Sections

A set of geological sections should be compiled. Although the scale of the current drill sections (1":400') is excellent for presentation and perhaps for correlation, only the gross lithologic features can be plotted. For aiding in correlation it may be useful to plot field copies at 1":100' or less; the greater detail may suggest further correlations. These sections should be interpreted by the geologist who is logging the core. It must be pointed out that the geologist's time to date has been filled with problems concerning the land situation, relocating drill holes that proved inaccessible, report preparation and core logging; this is not to mention problems arising from being unable to readily refer to previous drill cores. Most of these problems are nearing solution, which should give the site geologist the opportunity to record his interpretations.

It is adviseable to construct a series of north-south geological sections to tie the geology together from one drill section to another and to adjust drill sections as necessary.

For presentation it is preferable that grid lines on vertical sections (geological and reserve) "line up". This type of format makes it easier to compare from one section to another.

Geological sections, although preliminary, should be submitted with the report. It commits one to an interpretation, indicates the basis for ore reserve estimations, and indicates areas where further drilling is necessary. The geological sections are very interpretive because of problems in correlation resulting from:

(1) abrupt and frequent facies changes,

(2) normal faulting,

(3) possible reverse faulting or folding due to lateral compression,

4. Geological Sections - (Cont'd)

(4) apparent folding which resulted from differential compaction or slumping soon after deposition,

(5) the wide spacing of drill holes and drill sections which in turn results in lack of control for confident interpretation.

A distinction should be made on the geological sections between coql seams 1 and 2.

C. RECOMMENDATIONS

1. Regional Mapping

One problem which must be considered in predicting future exploration sites on the basis of geology is the thickness of the Hat Creek coal zone. The Hat Creek deposits are of an order of magnitude thicker than most of the world's thicker coal deposits and is substantially thicker than any known deposit. Tectonically the area was supposedly stable since early Tertiary except for vertical movements; however the anticlinal structure mapped by T. Hoy in 1974 indicates moderate deformation involving lateral compression. Although outcrops are rare in the Hat Creek valley itself regional mapping should be extended into the valley from all sides. This mapping may uncover:

(1) early deformation of the Cache Creek formation,

(2) the nature of the surface on which the Coldwater sediments were deposited,

(3) further information on deformation of the Coldwater beds.

It is hoped that I will be able to aid in this mapping once the snow is gone.

2. Geophysical Logging

As more data is available an assessment will be made of the value of geophysical logging. Tentatively it does not appear to be of great value with the availability of diamond drill core and approximately 95% recovery. It appears that we have a direct geological approach to correlation and we do not need an indirect geophysical approach. As has been pointed out logging must be done through 2 casings, 1 casing, casing plus rods, rods, and in the open hole. This situation reduces the value of the logs significantly. Similarly the abrupt facies changes makes tracing of particular units difficult. In core logging the interpreter can allow for these facies changes to some extent.

The advantages to geophysical logs are that they provide information on sections where core is lost and they are more objective than a person visually logging core. However it appears, from the core logs that the geologists of Dolmage Campbell are logging in sufficient detail; although objectivity is always a problem they are doing good work.

3. Geophysical Surveys

During Stage 1 airborne heat sensing and infrared surveys and ground resistivity, gravity, electro-magnetic, and magnetic surveys were completed. A report should be written including the instrumentation, technique, and results of each survey. Maps and/or sections of the results should be included in the report. There may be geological information available from these surveys other than that for which the surveys were proposed. For future reference it is adviseable to have a record of the reason these procedures succeeded or failed.

D. ENVIRONMENT OF THE HAT CREEK DEPOSITS - (Cont'd)

believed that there were no seas in the region during the Tertiary Period. Sediments are believed to be continental and from a nearby source. The central area of the Cordillera was undergoing discontinuous uplift associated with orogenic activity to the east and west. Between these periods of spasmodic uplift and once equilibrium had been established, that is, the uplifted hills had been eroded sufficiently to reduce sedimentation into the basin, peat was formed. As is expected fine clastic sedimentary rocks (shales and claystones) are most abundant in and adjacent to the coal sequences. Changes in the course of the associated river channel account for interlayered siltstone and less commonly sandstone. Major drainage systems in the Tertiary in British Columbia are believed to be not unlike they are today, so north-south primary river systems are expected, with tributaries feeding into these rivers from the east and west. The small lateral extent of the coal measures at Hat Creek support this description of the environment of the deposits. The thickness of the deposits remains unexplained by any mechanism or environment. At this stage the structural setting also appears contradictory.

E. CONCLUSIONS

The reports are well written and few changes are necessary. It is recommended that:

(1) a concerted effort be made to find marker horizons,

(2) geological sections be compiled on scales of 1":100' (field copy) and 1":400' (report copy),

4. Magnetometer Survey

A magnetometer survey is proposed in an effort to acquire information on:

(1) depth of the basin,

(2) other areas overlain by Kamloops group volcanic rocks.

A more detailed survey than that already completed, with significantly shorter spacing between readings (e.g. 50 feet) and closer line spacing (e.g. 1,000 feet), could provide this information. It must be assumed that all positive responses are due to magnetite in the underlying basement. This conclusion presents problems in that:

(1) unoxidized magnetite in pebbles in the conglomerate will also respond,

(2) remanent magnetism in the volcanic rocks is not considered.

The former effect could be important because the conglomerates, being significantly closer to the instrument, exhibit a more pronounced effect. It is hoped much of the magnetite in these fragments has been oxidized. Remanence is probably not important in overall effect in that any remanent magnetism is probably of similar magnitude throughout the underlying volcanic rock.

D. ENVIRONMENT OF THE HAT CREEK DEPOSITS

From late Cretaceous to the present there have been two periods of orogeny and prolonged periods of vertical uplift in the Cordillera. In general these have left the interior of the province relatively unaffected. As a result of this stability coal seams could form in isolated basins where similar conditions prevailed. It is currently

D. ENVIRONMENT OF THE HAT CREEK DEPOSITS - (Cont'd)

believed that there were no seas in the region during the Tertiary Period. Sediments are believed to be continental and from a nearby source. The central area of the Cordillera was undergoing discontinuous uplift associated with orogenic activity to the east and west. Between these periods of spasmodic uplift and once equilibrium had been established, that is, the uplifted hills had been eroded sufficiently to reduce sedimentation into the basin, peat was formed. As is expected fine clastic sedimentary rocks (shales and claystones) are most abundant in and adjacent to the coal sequences. Changes in the course of the associated river channel account for interlayered siltstone and less commonly sandstone. Major drainage systems in the Tertiary in British Columbia are believed to be not unlike they are today, so north-south primary river systems are expected, with tributaries feeding into these rivers from the east and west. The small lateral extent of the coal measures at Hat Creek support this description of the environment of the deposits. The thickness of the deposits remains unexplained by any mechanism or environment. At this stage the structural setting also appears contradictory.

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E. CONCLUSIONS - (Cont'd)

(3) north-south geological sections be prepared on a scale of 1":100',

(4) regional mapping be done around Hat Creek Valley and extended into the valley,

(5) geophysical logging be re-evaluated in the near future,

(6) a report be written and maps and/or sections prepared covering the earlier airborne and ground geophysical surveys,

(7) a more detailed magnetometer survey be undertaken over the Hat Creek Valley.

It is hoped that information gained in following these recommendations would delimit more areas for exploration in Hat Creek Valley and permit a better interpretation of the geology of other Tertiary deposits in south-central British Columbia.

TMcC:sm

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