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Geological Report on Hills 1, 2 and 3 of McGillivray Creek Coal and Coke Company's Property North of Coleman, Alberta

by

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Introduction

During July 1949 the outcrops of the Kootenay and associated formations along Hills 1, 2 and 3 in sec. 32, tp. 8, rge. 4 and sec. 5 and 8, tp. 9, rge. 4 were examined by the writer for the McGillivray Creek Coal and Coke Company upon instructions from Dr. G. Hanson, Chief Geologist, Geological Survey of Canada.

A plane table traverse on the scale of 1 mile to 20 inches or approximately 250 feet to 1 inch was employed to map and correlate the strata outcropping in this area and the coal seams as exposed in the various prospect pits, adits and bull dozer cuts made by the McGillivray Creek Coal and Coke Company. The accompanying map is a compilation of this data, which, with the cross-sections, show these correlations and the degree of accuracy on which they are based. The cross-sections have been compiled by projecting all data along the strike of the rocks into the plane of the paper. The various coal seams encountered may be traced either on the map or in the cross-sections.

Able assistance in the field was rendered by F.D. Anderson and R.E. Wetter. The Prospecting Report by Mr. A.E. Graham, engineer of McGillivray Creek Coal and Coke Co., proved of great value in the identification of the various prospects and considerable use is made herein of the geological data supplied by this report, especially where the workings can no longer be readily examined.

The core samples of diamond drill holes 5S1, 5S2, 5S3 and 5S4 were examined. Graphic lithologic logs of the latter two holes are submitted and all are shown projected into the appropriate cross-section with correlations of the strata encountered with that on the outcrop.

Subsequent work will involve the mapping of the northern part of the ridge to Vicary Creek and thence northward to Racehorse Creek. The results of this future investigation will be submitted in a separate report.

Structural Geology

Hills 1, 2 and 3 form a ridge, rising from an elevation of about 5,700 feet on the tributary to Nez Perce Creek at the south end of the area to a maximum of 7,675 feet at the crest of Hill 3 in the north. The ridge constitutes the northern continuation of the area at present mined by the McGillivray Creek Coal and Coke Company.

In general, the structure of the coal-bearing Kootenay formation is that of a west-dipping (35 to 40 degrees) nomocline, which in the vicinity of the falls in Nez Perce Creek is disturbed by a broad syncline with a tightly folded anticline lying on the ridge to the west (See cross-section 1). The Kootenay formation is underlain by the Coleman fault along which the coal-bearing beds have been thrust over Blairmore and Crowsnest strata, which in turn have been thrust over the Belly River formation along a lower fault.

The Coleman fault dips westward at an angle slightly greater than that of the strata above it (See cross-section 1). On the south slope of Hill 1 the fault dips west at about 38 degrees. Beneath Hills 2 and 3 the dip of the fault plane probably lies close to this figure. Further data should be forthcoming from diamond drill hole 5S4, if drilling is continued. Throughout its observed length, the fault plane follows close to or within coal seam No. 5 (so designated; see later discussion), but cuts into lower strata below an elevation of 6,450 feet on the south slope of Hill 1.

Little disturbance of the Kootenay strata above the Coleman fault is present on Hill 1 and the south slope of Hill 2, the strata dipping westward at about 38 degrees, conformably with the dip of part of the fault plane.

On the north slope of Hill 2, coal seam No. 5 is thickened considerably in the core of an anticlinal drag-fold above the Coleman fault. This condition probably does not persist at depth, and drill hole 5S4 should penetrate the true stratigraphic thickness of the seam.

Just north of the muskeg in the saddle between Hills 2 and 3, the strata above coal seam No. 5 are bent into an anticlinal fold which plunges north at a low angle. Higher strata farther north have been thrown into more complex folds which are suggested on the map, but which cannot be accurately interpreted owing to the poor outcrops. These structures terminate in the north against a tear fault which strikes

in an easterly direction and dips close to the vertical. The structures south of the tear fault may persist for about 300 feet below the surface elevation, but this figure may be in error owing to the lack of definite structural information as was mentioned previously.

North of the tear fault, tight folds occur in the strata associated with coal seam No. 5 as shown on cut F. These conditions probably continue along the strike to about survey station No. 175 where the Coleman fault lies close below the massive sandstone above coal seam No. 5.

The greater part of the strata of the south slope of Hill 3 north of the tear fault dip west at about 32 degrees, but the uppermost Kootenay beds and the basal conglomerate of the Blairmore group dip steeply close to the western end of the tear fault. This steepening of dip is local and was not observed farther north.

The crest of Hill 3 is capped by the basal Blairmore conglomerate. The Kootenay strata beneath it dips westward at dips varying between 20 and 45 degrees.

On Hill 4, which lies about a half mile north of Hill 3, and forms the most northerly peak of the ridge, the Coleman fault appears to have cut into stratigraphic levels above coal seam No. 5, but has not been studied to date.

Stratigraphy

Within the area studied, the Kootenay formation is composed of massive-bedded, crossbedded, coarse-grained, dark grey to black sandstones; Thin-bedded, fine to medium-grained, finely crossbedded and laminated, brown or grey sandstones; grey and silty grey, thinly bedded shales; black carbonaceous shale and coal seams. A maximum thickness of 300 feet is present above the Coleman fault on the south slope of Hill 1. The massive-bedded coarse-grained sandstones and the coal seams are the more persistent lithologics and are shown on the accompanying map. The other lithologics were not differentiated for mapping purposes.

The various types of sandstone, shale and coal grade laterally into one another. Some of these variations may be seen on examination of the map. For instance, the massive-bedded sandstones between the basal Blairmore conglomerate and coal seam No. 4 thicken and thin, split and diverge as they pass laterally into the finer

grained sandstones and shale. These variations may be, in part, one result of unconformities within the stratigraphic succession. Another instance is the variation in the sandstones above coal seam No. 5. On Hill 1, at survey station 11 above adit No. 12, the coal is overlain by 32 feet of massive-bedded, coarse-grained sandstone, which thins northward and grades into fine-grained, laminated sandstone at cut B on Hill 2. A third instance may be cited. At cut N at the extreme northern end of the area, 4 coal seams lie interbedded with about 110 feet of grey shales and thin-bedded sandstones overlain and underlain by massive-bedded, coarse-grained sandstones. These massive sandstones converge southward to where, on Hill 2, they are separated by only 20 feet of strata (between the sandstones at survey stations 87 and 88). In diamond drill hole No. 5S4, this interval lies between depths of 208 and 222 feet where it is composed of medium-grained, laminated sandstones with shaly and coaly breaks at 215 to 220 feet depth.

The coal seams, likewise show lateral variations, although not as rapid as those mentioned above. Coal seams, of varying thickness and quality, were observed to lie at 6 different stratigraphic horizons within the Kootenay formation. Not all seams extend the length of the area. They are discussed in the following paragraphs under the headings of coal seams No. 2, No. 4 and No. 5.

Coal Seam No. 2

Except at prospect pits L and M on Hill 3 coal seam No. 2 is not present within the area mapped. In the southern part of the McGillivray Creek Coal and Coke Company's property at present being mined or recently mined, coal seam No. 2 lies close below or in contact with the basal Blairmore conglomerate. As the seam is traced northward, massive-bedded coarse-grained sandstones separate it from the conglomerate. At prospect pit No. 8 about 10 feet of thinly bedded, fine-grained sandstones lie between coal seam No. 2 and the conglomerate, whereas at prospect pit No. 24 about 30 feet of coarse-grained sandstone lie below the conglomerate, with coal seam No. 2, if present, lying still farther below. The coarse-grained sandstone may also be seen on cut F 4S on the east side of the road leading up to the F level open cut. There coal seam No. 2 is overlain by about 25 feet of thinly bedded sandstones and shales and 10 feet of coarse-grained sandstones, in turn overlain by the basal Blairmore conglomerate.

Coal seam No. 2 was not located on Hills 1 and 2, nor in the valley of Nez Perce Creek in the vicinity of the falls. In these locations a considerable thickness of coarse-grained sandstones lies between the

basal Blairmore conglomerates, broken by a few thin, shaly intervals, and the top of coal seam No. 4. These sandstones were encountered in diamond drill hole No. 5S1 from 0-106 feet depth (total depth), in No. 5S3 from 197.5 feet (base of Blairmore conglomerate) to 423 feet depth (total depth) and in No. 5S4 from 61 feet (base of Blairmore conglomerate) to 305 feet depth. Thin grey shales and thin-bedded, fine-grained, laminated sandstones separate these beds. Only very thin coaly streaks were observed in the drill core samples. (See cross-sections 1 and 2).

Coal seam No. 2, accordingly, must be assumed to have thinned or graded laterally into shale and sandstone. This change takes place north of prospect No. 8 and south of Hill 1, possibly south of prospect adit No. 24.

On Hill 3, at prospect pits L and M the basal Blairmore conglomerate is underlain by 6 feet of coarse-grained sandstone. Thin coal seams and carbonaceous shale underlies this sandstone and represent what may be the stratigraphic equivalent of coal seam No. 2. About 30 feet below, above prospect pit H is a coarse-grained sandstone, which when traced northward merges with the sandstone beneath the conglomerate, the interval between them thinning to about 2-0 feet of silty shale.

The sandstone above prospect pit H was traced northward to where it overlies the coal seams at cut N. The coal at prospect pit H is believed equivalent to that at NA; the coal at prospect pit F 2 is equivalent to that at prospect pits K and NC. Coal Seams NB and ND were not observed elsewhere. These coal seams grade laterally southward into shale and lie within the stratigraphic interval between the sandstones at survey stations 87 and 88 on Hill 2 as mentioned previously. It is possible that one or more of these coal seams may be equivalent to coal seam No. 2 but since they do not join with it, at least along the outcrop, it is more probable that they are separate seams and may or may not have the same properties as coal seam No. 2.

Coal Seam No. 4

At the south end of Hill 1 where a tributary to Nez Perce Creek enters from the east, two coal seams have been opened up by adits and trenches. The westernmost seam in which prospects Nos. 10, 11 and 12 have been made lies about 180 feet stratigraphically below the basal Blairmore conglomerate. At F level open cut to the south, coal seam No. 4 lies 155 feet stratigraphically below the conglomerate. In view of the increase in number of coarse-grained sandstones below the conglomerate this variation in thickness is not excessive and prospects Nos. 10, 11

and 12 may be assumed to have exposed coal seam No. 4.

Coal seam No. 4 is reported by Mr. Graham (Prospecting Report) to be 3.5, 2.0 and 2.0 feet thick in prospects Nos. 10, 11 and 12 respectively. It is overlain by a massive-bedded, coarse grained sandstone varying in thickness from 10 to 25 feet. This sandstone has been traced up Hill 1 where prospect pits No. 14 and 16 lies below it, presumably within No. 4 seam. The former pit shows 2.4 feet of interbedded shales and coal, while the latter exposed 0.8 feet of coal (Prospecting Report). On the north slope of Hill 1, prospect pit No. 18 (survey station 56A) has been developed on seam No. 4 with 2.0 feet of coal reported (Prospecting Report). The sandstone above coal seam No. 4 with 2.0 feet of coal reported (Prospecting Report). The sandstone above coal seam No. 4 was traced into that lying at the west end of bulldozer cuts A, B and C on the north slope of Hill 2. In these cuts the sandstone is underlain by carbonaceous shale. Farther north on the west end of cut F on Hill 3, the same horizon consists of carbonaceous shale which passes up slope into 2.0 feet of silty shale lying between two coarse grained sandstones at survey stations 139 and 140.

Coal seam No. 4 was not encountered in diamond drill holes 5S1, 5S2 and 5S3. In 5S4, the sandstones between depths of 282.5 and 311 is believed to be equivalent to the sandstones lying above coal seam No. 4 in cut B (See cross-section 2). It is underlain to 317 feet depth 6.0 feet of fine-grained, laminated, sandstone and fissile carbonaceous shale. No coal is present at this horizon. Below lies grey shale and fine-grained sandstone. The hole is, at present, being deepened to test lower horizons.

It appears that coal seam No. 4 thins in a northerly direction and grades laterally into carbonaceous and silty shale prior to grading into sandstone. From data at prospect pits Nos. 10, 11 and 12, the seam does not exceed 3.5 feet in thickness and probably cannot be economically mined farther north than the south end of Hill 1.

Coal Seam No. 5

Along the tributary to Nez Perce Creek at the south end of Hill 1 prospects Nos. 10A, 10B and 13 are located on a coal seam that lies 55 feet stratigraphically below coal seam No. 4. For convenience this seam may be designated coal seam No. 5, but need not necessarily be that seam designated No. 5 in Dr. B.R. McKay's report on the Coleman area (Geological Survey of Canada, Summary Report, 1932B, page 45). Dr. McKay's stratigraphic section was taken on York Creek south of Crowsnest River where the stratigraphic interval between the top of coal seam No. 4 to the top

of coal seam No. 5 is given at 325 feet. The coal seam on Hill 1 is, in all probability, a different seam which is not present on York Creek. Coal seam No. 5 (so designated) on Hill 1 lies about 60 feet stratigraphically above the Coleman fault.

At prospects 10A, 10B and 13 coal seam No. 5 is 1.5, 1.5 to 8.0 (contorted), and 1.0 feet thick respectively (Prospecting Report). The seam is overlain by massive-bedded coarse-grained sandstones, 32 feet thick at prospect 13. This sandstone has been traced up the south slope of Hill 1 to prospect 14a. Farther north the sandstone thins and at survey station 41 is cut off by the Coleman fault. The sandstone reappears about 5 feet thick on the crest of Hill 1.

On the south slope of Hill 2 coal seam No. 5 is exposed on the numerous bulldozer cuts lying in contact with the Coleman fault. The coarse-grained sandstone above it is present locally close to the crest of Hill 2 but grades laterally into fine grained laminated sandstone on Cut B at the crest of Hill 2. There coal seam No. 5 is 8.0 feet thick, underlain by a small fault, subsidiary to the Coleman fault beneath which lie shales and sandstones with 2.0 feet of coal seam No. 5 reappearing immediately above the Coleman fault (See cross-section 2). To the north coal seam No. 5 thickens greatly in cuts A and C. This is believed due to the formation of an anticlinal structure produced by drag on the Coleman fault as shown in cross-section 3.

On the south slope of Hill 3, north of the tear fault, coal seam No. 5 is exposed in cut F in the core of an anticlinal fold and the east limb of the syncline adjacent to a small subsidiary fault above the Coleman fault (see cross-section 3). The strata are highly contorted here and to the north end of the bulldozer cut on the east side of Hill 3. These conditions are due to the proximity of the seam to the Coleman fault and are not expected to persist at depth where the Coleman fault cuts into the strata beneath the seam.

North of the bulldozer cut on Hill 3 the Coleman fault lies close below the massive sandstones above coal seam No. 5 and probably lies within it. Still farther north on Hill 4 the Coleman fault appears to have cut above the sandstone above coal seam No. 5.

Coal seam No. 5 appears to be thickening in a northerly direction from about 1.5 feet in prospects 10A and 13 at the south end of Hill 1 to 8.0 feet at Cut B on Hill 2. The thickness of the seam at the outcrop on Cut B may not be its true thickness. Diamond drill hole No. 5S4, as was previously mentioned, is at time of writing being deepened. It now lies a short distance above coal seam No. 5 and should give a reliable thickness for the seam.

It may be advisable to continue drilling at 5S4 until the Coleman fault is encountered. The dip of the Coleman fault plane, its stratigraphic separation from coal seam No. 5 and the structural condition of the seam would thereby be learned and may have an important bearing on the estimate of recoverable coal. Lower coal seams, if present, would also be detected, as strata lower than coal seam No. 5 are not exposed in the area mapped.

Coleman fault encountered at ~350' in hole

Conclusions

A brief summary of some of the conclusions reached by this study of Hills 1, 2 and 3 follows:

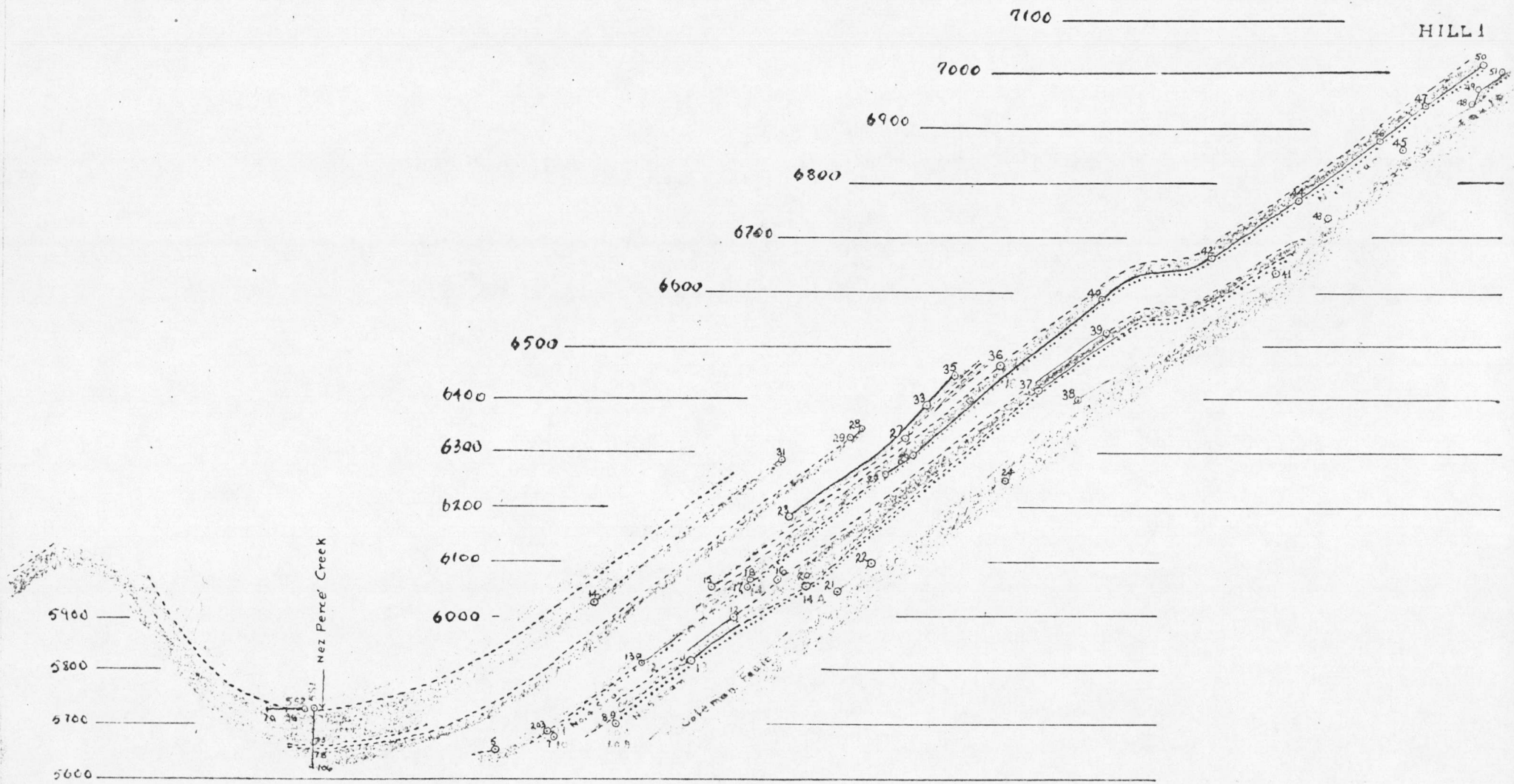
1. Coal seam No. 2 is absent. Other coal seams lying at about the same stratigraphic position or below coal seam No. 2 are present on Hill 3.

2. Coal seam No. 4 thins and grades laterally northward into shale and sandstone. It is not economiccaly mineable within the area mapped.

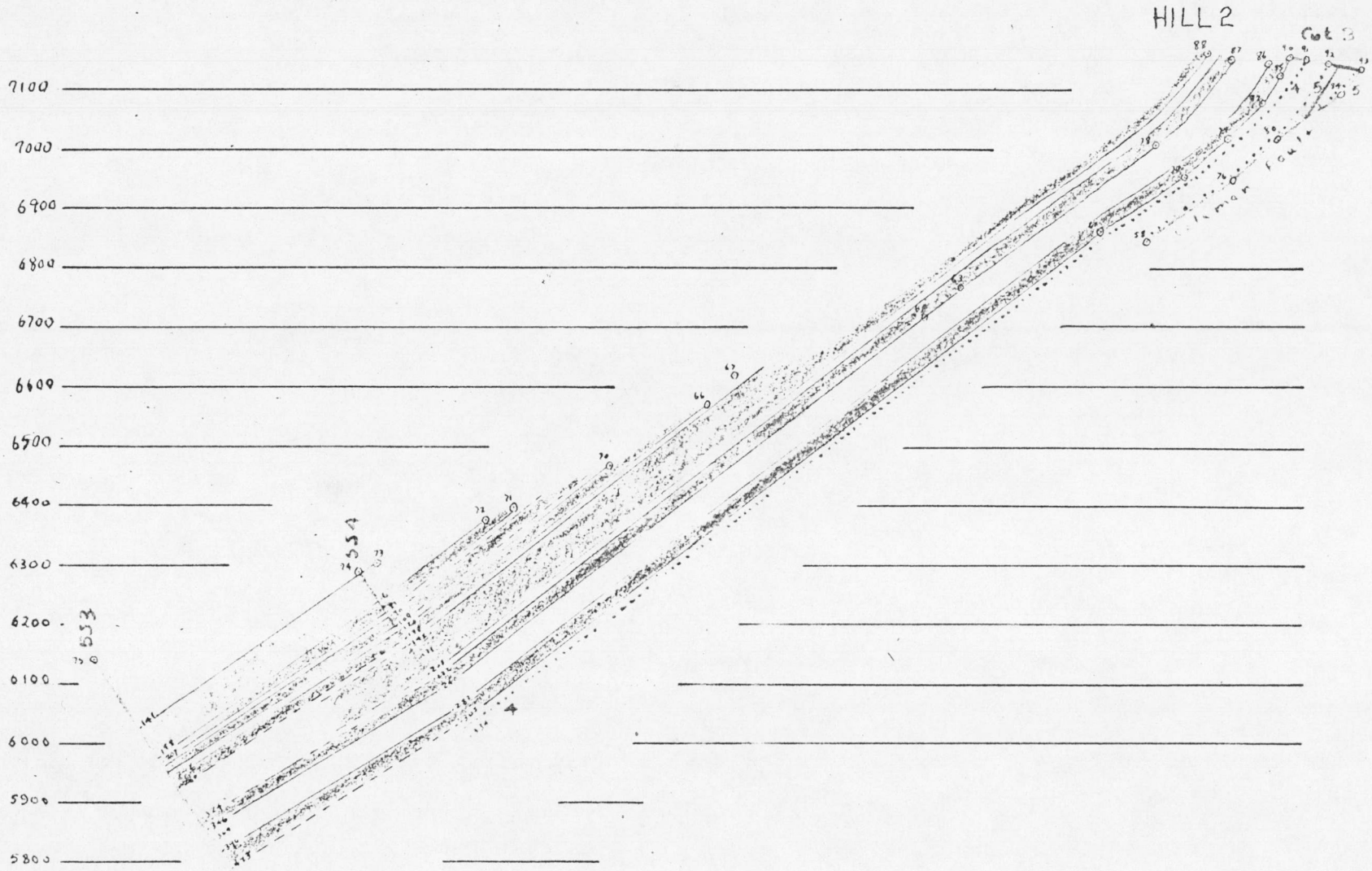
3. Coal seam No. 5 apparently thickens northward. The thickness and character should be established from deepening of diamond drill hole No. 5S4 and if conditions warrant tested by additional drill holes.

List of Accompanying Information

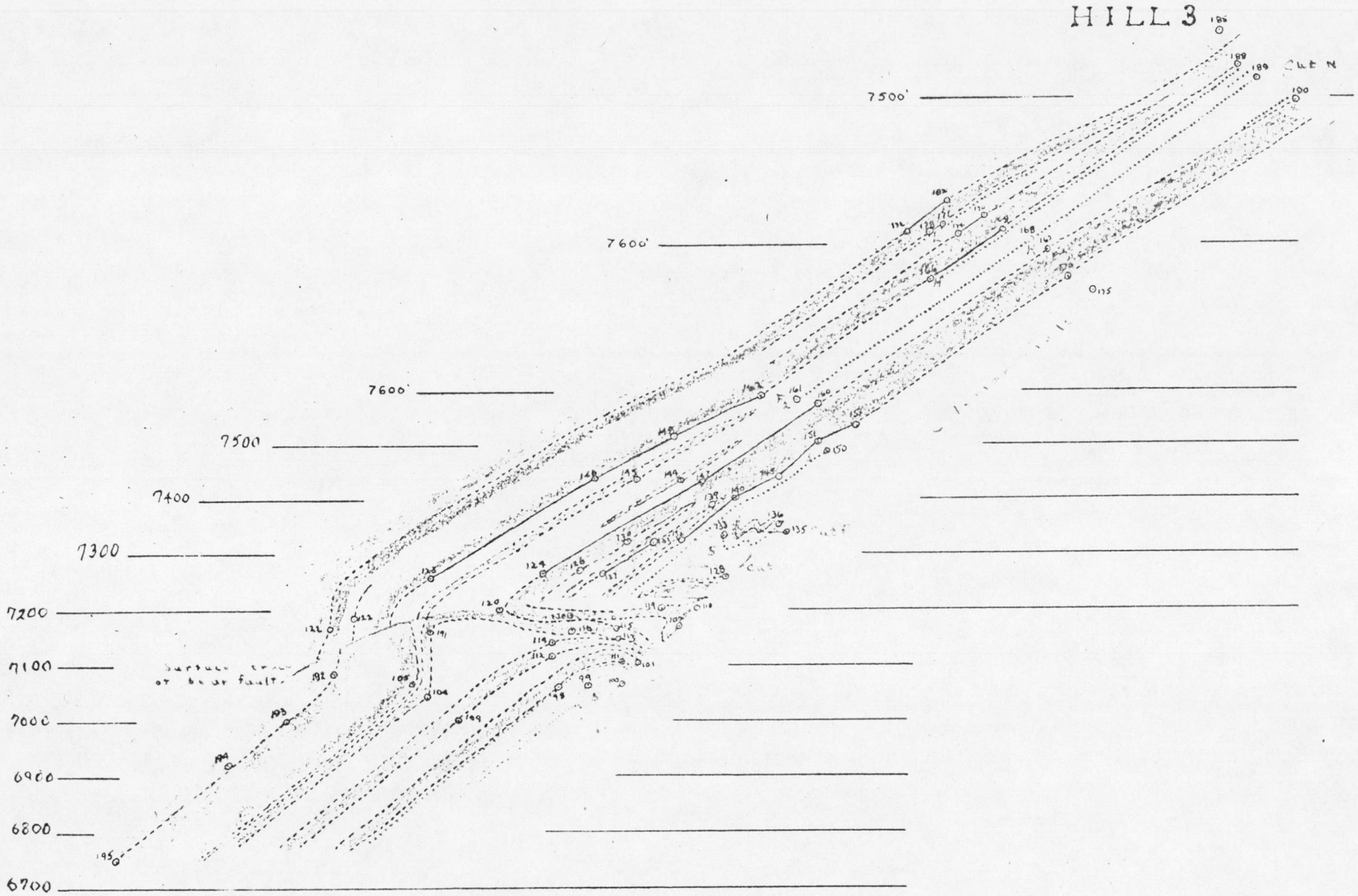
1. Geological map on scale of 1 mile to 20 inches.
2. Cross-sections 1, 2 and 3.
3. Graphic logs of diamond drill holes 583 and 584.



Cross-section 1



Cross-section 2



Cross-section 3