

FINAL
GEOLOGICAL REPORT
on
THE SOUTH BANK OF THE MACKENZIE RIVER
BETWEEN
HOOSIER RIDGE AND MOUNTAIN RIVER.

H.W.T. (Canada)

Assignment No. 7.

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Read and accepted by: *Monte L. Ladd*

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A B S T R A C T

The writer and two assistants spent the month of June 1943, in mapping the south bank of the Mackenzie River between Hoosier Ridge and Carcajou River, and in making a plane table traverse of West Mountain.

On the Mackenzie River most of the rocks exposed are of Cretaceous age, consisting of sandstones and shales which are flat lying or very gently dipping. Workable exposures are relatively few and there are long intervals over which outcrops are absent.

Northward dipping Upper Devonian rocks are exposed immediately downstream from Hoosier Ridge. These are composed of sandstones and sandy shales which contain fossils similar to those found in the Besworth formation.

After reviewing the data accumulated in this assignment and that reported by Parker and Hancock in adjacent areas north of the Mackenzie, the writer is inclined to the belief that the rock exposures on the south bank of Mackenzie River are not sufficient to provide reliable information concerning structural conditions which possibly exist. It is therefore recommended that geophysical work be undertaken to verify, if possible, the small anticline reported by Hancock between Perry Island and the south mainland, and to prove or disprove the suspected presence of flexures along the left bank opposite the western end of Carcajou Rock.

West Mountain is an eroded anticline in which Middle Devonian rocks are exposed, and is not recommended as a drilling prospect unless a test of the Bear Rock and lower formations is desired. It is pointed out, however, that axial extension of West Mountain leads to East Mountain on Mackenzie River and to the Whirlpool anticline reported by Parker on Mountain River, and this opens up new possibilities in the flat muskeg-covered areas along this extension.

Previous Work

Many explorers have previously examined the rocks in this part of the Mackenzie basin, the most detailed work being that of R. P. Miller (2) for Imperial Oil Limited in 1921. The writer found only slight variance in some observations, and for the most part the two surveys agree. So far as is known no detailed survey has previously been conducted on West Mountain.

Field Work

From Hoosier Ridge the party traversed downstream, travelling by canoe, and making side trips up the larger tributary streams, omitting only those on which no outcrops were observed during the preliminary flight of May 27th.

C. P. A. vertical aerial photographs were used wherever possible, and the geology was plotted on the 1" to 1 mile sectional sheets which covered the area. R. P. Miller's plane table sheets of Maida and Raspberry creeks were also used.

On reaching the mouth of Carcajou River the party ascended this stream for a distance of about seven miles to the mouth of "Royal" creek. Here a base camp was established and a plane table traverse was carried up "Royal" creek to West Mountain. The latter was mapped in detail, with both the aerial photographs and the plane table being used in locating outcrops.

Chapter II.

TOPOGRAPHY

Mackenzie River Traverse

Between Hoosier Ridge and Carcajou River the Mackenzie flows northwest to westward. The north bank of the river averages 35 to 40 feet in height and is usually fairly well covered with trees and brush. It is cut through by many small streams which head in inland muskeg lakes south of the river. Near their mouths these streams are deeply incised in narrow steep-walled gullies in which spruce, willow and alder form a thick tangled underbrush.

"Royal" Creek - West Mountain Traverse

"Royal" Creek is a small stream which originates in muskeg lakes west of West Mountain. The stream valley is fairly open, gravel-floored, and is cut down into unconsolidated fluvio-glacial material which forms slumped banks and mud flows. Outcrops of bed rock are few.

West Mountain lies west of the Mackenzie between Carcajou and Mountain Rivers. The mountain is anticlinal, about three miles long and one mile wide, trending approximately N. 50° E., and rising more than 800 feet above the surrounding muskeg plain. The crest of the anticline has been eroded and a small lake now occupies the central part. The top and the slopes of West Mountain are thickly overgrown with trees and brush.

Chapter III.

S T R A T I G R A P H Y

Mackenzie River Traverse

Plate III, accompanying this report, shows a composite columnar section representing graphically the stratigraphic section encountered in the field.

A comparison of this columnar section with the former one submitted by the writer in the preliminary report (1) shows that considerable revision of the section has been made. This was necessary because the previous section did not conform with the data obtained by Hancock (3) and Parker (4) in adjacent areas north of the Mackenzie. In view of the scarcity of workable exposures on the left bank it seemed reasonable that such revisions be made. The section was revised after consultation with Parker and Hancock, and on the basis of paleontologic and lithologic considerations made while reviewing the regional structure.

Upper Devonian - Bosworth Formation

In traversing downstream from Hoosier Ridge the oldest beds exposed are soft, greenish, micaceous sandstones and sandy shales which were identified as Upper Devonian in age by the presence of Buchiola (5510)* (Plate II, Station 2). These beds represent the Bosworth formation. The base of the formation was not seen, but in the interval traversed a stratigraphic thickness of about 350 feet was represented. The upper boundary of the formation is marked by a conglomerate zone (Plate II, Station 3).

* Numbers refer to fossil suites. See Appendix.
See also Columnar Section Plate III.

Cretaceous

Cretaceous rocks exposed along the south bank of the Mackenzie are made up of a basal sandstone about 200 feet thick, overlain by a series of nodular and sandy shales. The total thickness of Cretaceous rocks exposed is thought to be only about 700 feet.

The Lower Cretaceous ammonite Beudanticeras was found in exposures at Station 7, Maida Creek, Raspberry Creek and Stations 8, 9 and 11. Since Beudanticeras is usually confined to the basal part of the Cretaceous in the Mackenzie basin, it is assumed that the stations at which it occurs represent approximately the same stratigraphic horizon. This assumption seems reasonable since it places the exposures at Stations 8 to 12 and in Maida and Raspberry Creeks low down in the section where they apparently should be because of their close proximity to the Devonian Cretaceous contact along the western end of the Carcassou anticline.

West Mountain Traverse

Middle Devonian - Ramparts Formation

The oldest rocks exposed on West Mountain are thinly-bedded limy grey shales which yielded no fossils but which are thought to be equivalent to the lower part of the Ramparts formation. Similar rocks occupying approximately the same stratigraphic position were reported by Parker (4) on East Mountain. The thickness of these beds on West Mountain is unknown, since they are poorly exposed and the formation limits could not be determined.

Most of the exposures on West Mountain consist of massive limestone of the upper part of the Ramparts formation and referred to generally as Ramparts - Beavertail limestone. The exposed thickness of these massive limestones is about 350 feet. They carry an abundant variety of fossils similar to suites collected from equivalent horizons

elsewhere in the Mackenzie basin. (For list of fossils see Appendix).

Cretaceous

Near the southwestern end of the mountain a sandstone member was found, 180 feet stratigraphically above the uppermost limestone horizon (Plate IV, Station 30). This sandstone is grey to brown, fine grained and well indurated, with abundant brown iron oxide. The exposure is only five feet thick. At Station 29D, three hundred and sixty feet stratigraphically above Station 30, a similar sandstone was found. Neither of these outcrops extended laterally for any distance, nor were these beds found outcropping elsewhere on the mountain. No information was obtained regarding the lithology of the interval between these sandstones or between the lower sandstone and the top of the Beavertail - Ramparts limestone. Lack of fossils prohibits positive determination of the age of these beds. However, Parker (4) reports that similar sandstones, probably representing the same horizon, are found overlying the Beavertail limestone on East Mountain, and the writer is inclined to agree with Parker that they are Cretaceous in age. Lithologically their resemblance to Cretaceous sandstones is far greater than to any Upper Devonian sandstones observed.

On "Royal" creek no exposures were found along the strike of West Mountain. About 4,000 feet southeast of the mountain (Plate IV, Stations 17, 18, 19) good exposures of sandstone and shaly sandstone occur, dipping 45 to 50 degrees southeast. Fossil evidence here definitely identifies these beds as Cretaceous in age.

Chapter IV.

STRUCTURE

Mackenzie River Traverse

The area traversed by the writer lies at the northern end of the structural basin referred to by Link (5) as the Fort Norman "Long Reach" area, which extends from Bear Mountain to the "Anticlinal Area" of Carcajou Rock and East and West Mountains. Hoosier Ridge is a relatively smaller anticline lying within the basin (6).

Except for the beds in exposures immediately adjacent to Hoosier Ridge, all of the outcrops examined were found to be gently dipping or flat lying, and little direct evidence of flexuring was seen. The more highly inclined beds just below Hoosier Ridge lie on the north flank of the Hoosier anticline. Down river from Hoosier Ridge, for a distance of about five miles, the beds dip downstream at an average of three degrees. Hancock (3), in mapping the islands and the right bank of the Mackenzie, found northeastward dips opposite this locality and concluded that a possible structure existed between Perry Island and the south mainland.

In traversing downstream from Hoosier Ridge it is impossible to determine local structural conditions in the long intervals throughout which no workable outcrops occur. It is unlikely that extreme folding of the type which formed the Carcajou anticline on the right bank of the Mackenzie would leave the rocks on the left bank completely undisturbed. The structure between Station 9 and Station 12 is synclinal, but downstream below Station 12, where the axial extension of the Carcajou anticline would reach the left bank, outcrops are absent and it is not

apparent from surface data if any reversal occurs.

There is little to be gained by postulating structures in an area such as this where surface exposures do not provide enough information to prove or disprove their presence. The determination and delineation of any flexures which may exist must be regarded as a geophysical problem and in the opinion of the writer the area adjacent to the south bank of the Mackenzie between Hoosier Ridge and Carcajou River is one in which a seismic program should certainly be considered.

West Mountain Traverse

West Mountain is a slightly asymmetrical anticline with its axis trending N. 50° E., and with the steeper dips on the southeast flank.

Dips on the northwest vary from 35 to 45 degrees and those on the southeast from 40 to 55 degrees. The anticline is slightly faulted at the southwest end and plunges 15 to 20 degrees southwestward. Evidence of a possible northeastward plunge has been mostly obscured by erosion but slight plunging in this direction is suggested by strikes recorded at the northeastern end of the mountain. The northeastward extension of the axial trend of West Mountain heads directly to the western end of East Mountain and it appears likely that structural continuity exists between the two. Furthermore, as pointed out by Parker (7), a southwestward extension of this axial trend leads to the "whirlpool" anticline on Mountain River.

NOTE: For discussion of "Historical Geology" see Reference (5) (Bibliography).

Chapter V.

CONCLUSIONS AND RECOMMENDATIONS

Mackenzie River Traverse

The traverse of Mackenzie River and its tributaries failed to establish the presence of any structures which might be considered favorable as petroleum prospects. However, it is felt that the exposures which are present are insufficient to provide complete information on the structural possibilities of the area and that geophysical work might be of considerable value.

It is recommended that a geophysical program be undertaken to verify the presence and extent of the small anticline reported by Hancock between Perry Island and the South mainland, and that this program be extended over the area adjacent to the Mackenzie between Hoosier Ridge and Carcajou River. This is particularly important in view of the "reef conditions" encountered in the outcrops on the north side of the Mackenzie River (4, 8, 9).

West Mountain Traverse

West Mountain itself can hardly be recommended as an oil prospect since it is a structural high from which the cap has been eroded and in which no prospective oil-producing formations are found. The apparent absence of reef conditions above the Beavertail limestone precludes the possibility of a structural trap and discourages the hope of flank production unless the structure is drilled to test the rocks below the Ramparts formation. In this connection it is pointed out that the Bear Rock formation has been found to be cavernous and sometimes petroliferous in nearby areas north of the Mackenzie, (8, 9) and could be considered a possible reservoir rock.

The suggested structural continuity between West Mountain and the Whirlpool anticline on Mountain River should be kept in mind in case the Whirlpool anticline is tested and found to be favorable. In this case further investigations are warranted in the area between West Mountain and Mountain River.

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B I B L I O G R A P H Y

1. McKinnon, F. A. "Survey of the South Bank of Mackenzie River from Hoosier Ridge to Mountain River" - Imperial Oil Ltd., Canol Project, Assignment No. 7, Preliminary Report No. 28.
2. Miller, R. P. "Report on Part of the Fort Norman Oil Field" (Included with T.A. Link "Geological Report on the Fort Norman Area") Imperial Oil Ltd., Report 1921.
3. Hancock, W. P. "Right Bank and Islands - Mackenzie River, Norman Wells to Carcajou Rock" - Imperial Oil Ltd., Canol Project, Assignment No. 39, Final Report in preparation, January 1944.
4. Parker, J. M. "Carcajou Rock - East Mountain Area" - Imperial Oil Ltd., Canol Project, Assignment No. 6, Final Report in preparation, January 1944.
5. Link, T. A. "Report on Fort Norman Area". Imperial Oil Limited. Report, 1920.
6. Dresser, M. A. "The Hoosier Ridge Anticline" - Imperial Oil Ltd., Canol Project, Report No. G.C. 42-16, 1942.
7. Parker, J. M. "Geological Report on Mountain River Area", Imperial Oil Ltd., - Canol Project, Assignment No. 19, Final Report in preparation. January 1944.
8. Laudon, Dr. L. R. "Morrow Creek - Cleaver Mountain Area". Imperial Oil Ltd., Canol Project, Assignment No. 5, Report No. 13, June 1943.
9. Smith, Dr. H. T. U. "The Hanna River Area" - Imperial Oil Ltd., Canol Project, Assignment No. 25, Report No. 27, August 1943.

APPENDIX

January 4, 1944.

MEMORANDUM:

TO: Dr. T. A. Link.

RE: Fossil Identification

Attached is a tentative identification of fossils
collected by Mr. F. A. McKinnon on Assignment No. 7, Hoosier
Ridge to Mouth of Carcajou River & West Mountain.

C. R. Stelck.

KH/can

FOSSIL IDENTIFICATION - - HOOSIER RIDGE TO MOUTH
OF CARCAJOU RIVER & WEST MOUNTAIN - F.A. McKinnon

<u>Suite No.</u>	<u>Date</u>	<u>Location</u>	<u>Fossil</u>	<u>Accession No.</u>	<u>Age</u>
5521	June 9	Sta. A. Raspberry Crk. 40' above river level	Inoceramus	43632	L.Cretaceous
C501	June 10	Sta. 9 Mackenzie River	Ammonite	43633	L.Cretaceous
"	"	"	Ammonite	43634	"
6530	June 15	Sta. 29A. West Mtn.	Martinia	43635	Beavertail ?
6528	June 14	Sta. 17 Royal Creek	Fucoids	43636	L.Cretaceous
5523	June 16	Sta. 33 West Mtn.	Martinia	43637	Beavertail - Ramparts
5522	June 9	Sta. 9 Mackenzie River 45' lower than 5521	Inoceramus	43638	L.Cretaceous
"	"	"	Neogastropolites	43639	"
6532	June 16	Sta. 36 West Mtn.	Cladopora	43640	Beavertail
"	"	"	Cyathophyllum	43641	"
"	"	"	Euomphalus	43642	"
6534	June 17	Sta. 37B West Mtn.	Cyathophyllum	43643	L. Beavertail
"	"	"	Cladopora	43644	"
5526	June 23	Carcajou River above Royal Creek	Pelecypod	43645	L.Cretaceous
6525	June 9	Maida Creek	Inoceramus	43646	L.Cretaceous
"	"	"	Pseudoceratite	43647	"
5538	June 19	Sta. 45 West Mtn.	Martinia	43648	Beavertail- Ramparts
"	"	"	Cladopora	43649	"
5519	June 6	Sta. 7 Mackenzie Rvr.	Fossil wood	43650	L.Cretaceous
6537	June 19	Sta. 45 West Mtn.	Muchisonia	43651	Beavertail
"	"	"	Cladopora	43652	"
"	"	"	Euomphalus	43653	"
5517	June 6	Sta. 7 Mackenzie Rvr.	Beudanticeras?	43654	L.Cretaceous
"	"	"	Pelecypod?	43655	"
6536	June 17	Sta. 37 West Mtn.	Aviculopora	43656	Ramparts
5524	June 19	Sta. 47 West Mtn.	Gastropod	43657	Beavertail
"	"	"	Gastropod	43658	"
"	"	"	?	43659	"
6525	June 9	Maida Creek	Unic	43660	Cretaceous
6527	June 14	Sta. 17 Royal Crk.	Pecten	43661	L.Cretaceous
"	"	"	Fucoid	43662	L. Cretaceous
5527	June 23	Carcajou River	Fish scale	43663	L. Cretaceous
6529	June 14	Sta. 18 Royal Crk.	Inoceramus	43664	L. Cretaceous
5511	May 31	Hoosier Ridge	Bellerophon	43665	Bosworth
6539	June 19	Sta. 45 West Mtn.	Gomphoceras	43666	Beavertail - Ramparts.
"	"	"	Gastropod	43667	"
6530	June 15	Sta. 29A West Mtn.	Chonetes	43668	Beavertail?
"	"	"	Cladopora	43669	"
"	"	"	Reticularia	43670	Beavertail
"	"	"	Hypothyridina	43671	"
"	"	"	Productella	43672	"
6541	June 19	Sta. 45 West Mtn.	Atrypa	43673	Beavertail
"	"	"	Schizophoria	43674	"
"	"	"	Productella	43675	"
"	"	"	Gastropod	43676	"

<u>Suite No.</u>	<u>Date</u>	<u>Locetion</u>	<u>Fossil</u>	<u>Accession No.</u>	<u>Age</u>
6535	June 17	Sta. 373 West Mtns.	Cladopora	43677	Beavertail
"	"	"	Atrypa	43678	"
"	"	"	Cyathophyllum	43679	"
5510	May 31	Sta. 1 Mackenzie Rvr.	Crania	43680	Bosworth
"	"	"	Buchiola	43681	"
6521	June 2	Windy Creek	Fucoid	43682	L. Cretaceous

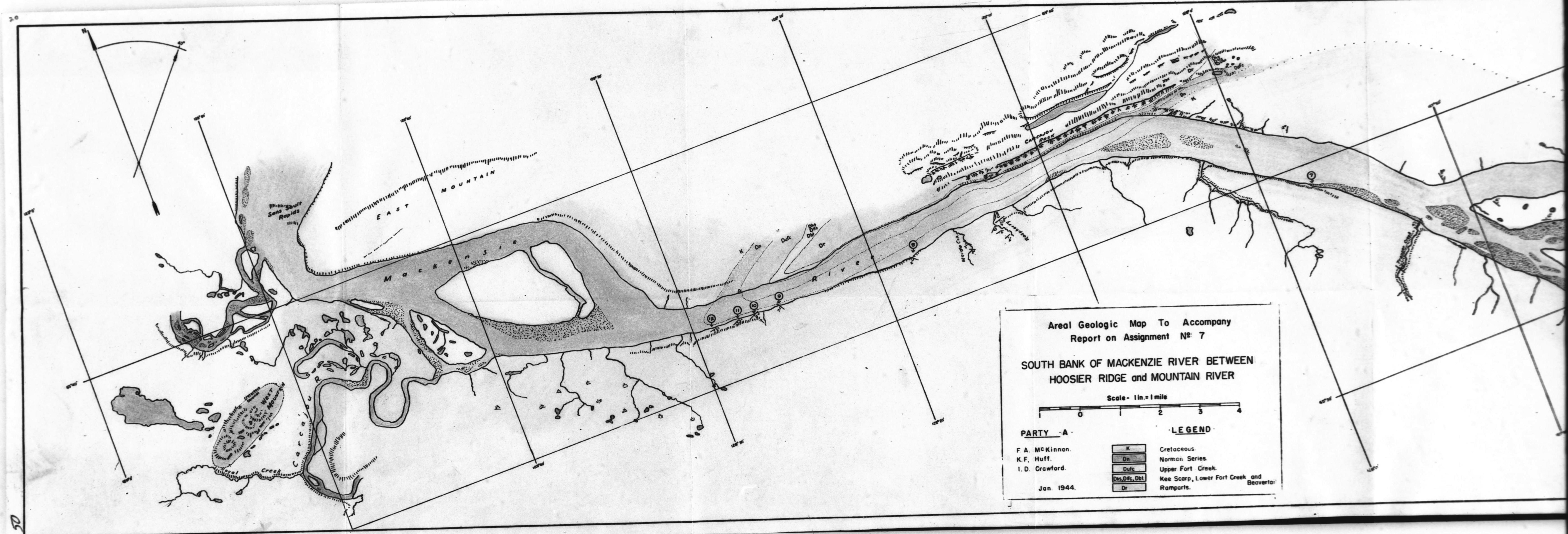
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PLATE I.



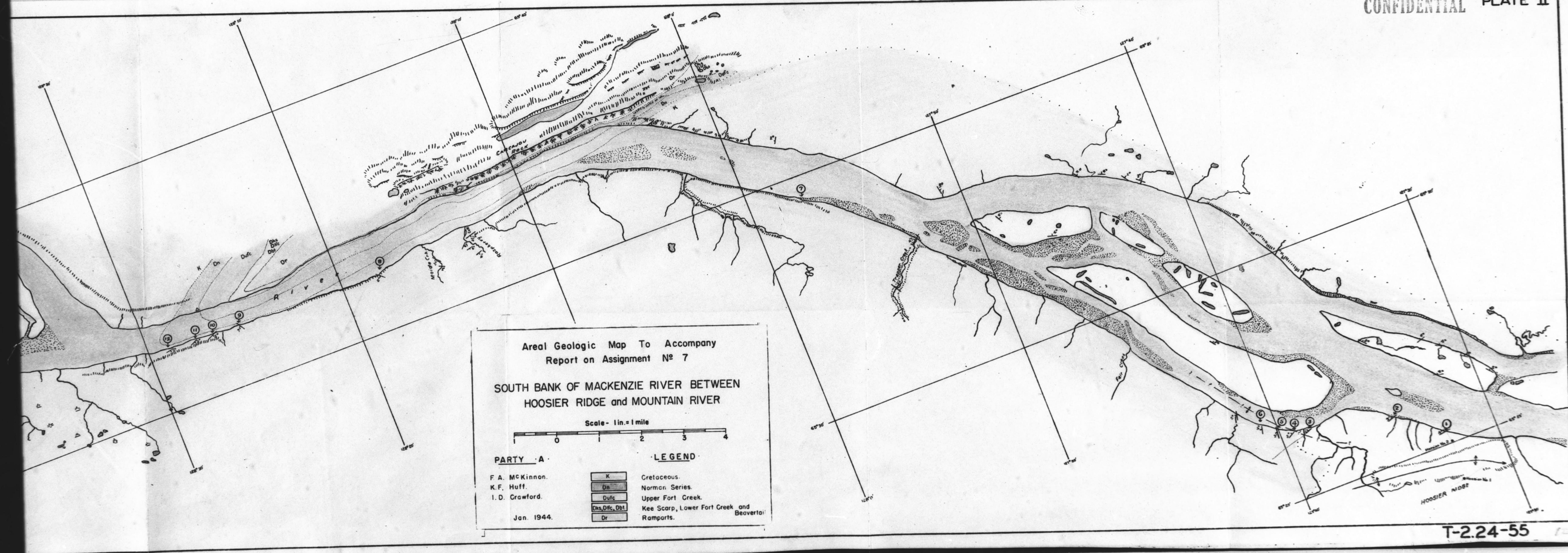
Index Map of North Western Canada, Showing Location of
South Bank of Mackenzie River, Hoosier Ridge to Mountain River

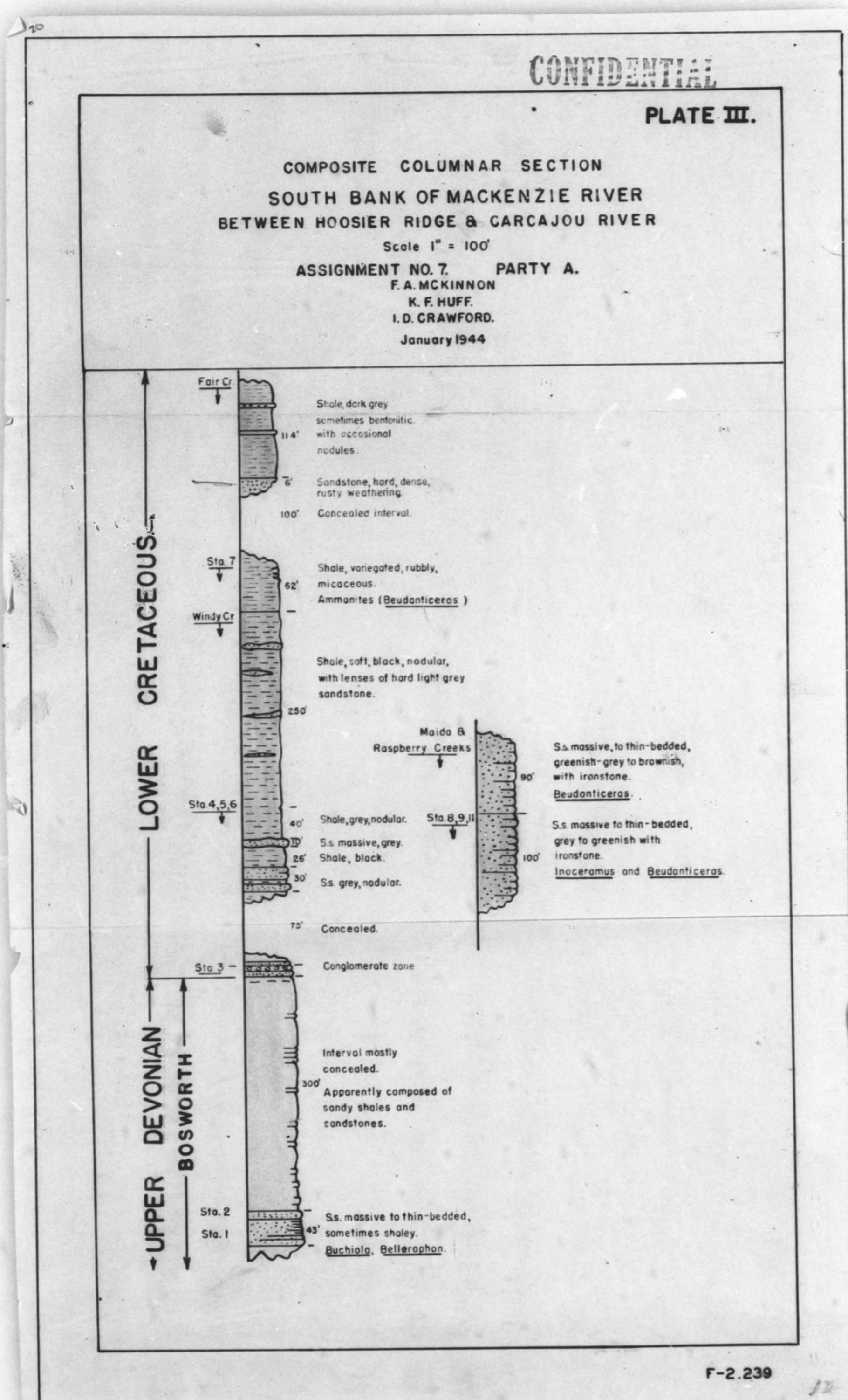
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PLATE IV.

