SIMPSON LAKE MAP-AREA (97B)

DISTRICT OF MACKENZIE

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ABSTRACT

Exposed rocks in the Simpson Lake map-area belong to the Cambrian, Ordovician, Devonian, and Cretaceous Systems. About 2,000 feet of Paleozoic rocks, chiefly carbonates with subordinate shales, are mapped as: "Ronning Group", and Bear Rock, Hume, and Hare Indian Formations (from oldest to youngest). Paleozoic strata are regionally truncated by widespread, but poorly exposed, Cretaceous clastic rocks which have an estimated cumulative thickness of about 1,500 feet. Informal Cretaceous units (from oldest to youngest) are the "Silty", Bentonitic", and "Bituminous zones".

Rocks in the map-area dip regionally westward and northwestward at low angles. There appear to be few structural complications, although small structures may be concealed by the extensive cover of Pleistocene drift.

SIMPSON LAKE MAP-AREA (97B), DISTRICT OF MACKENZIE

INTRODUCTION

Geological field studies of Simpson Lake map-area were conducted in 1968 as part of Operation Norman (Aitken et al., 1969).

The eastern one-third of the map-area is part of Horton Plateau, which is a barren upland where Paleozoic rocks are widely exposed; the remainder lies within the Anderson Plain, a region of hummocky terrain and lake-filled depressions, underlain by relatively thick and continuous drift with a topographically prominent moraine (Qm) in the north (See Klassen in Yorath et al., 1969). Bedrock is well exposed along Anderson and Horton Rivers and over much of Horton Plateau; elsewhere there are few outcrops.

TABLE OF FORMATIONS

Series	Formation and thickness (feet)		Lithology
Upper Cretaceous	"Bituminous zone" 200 ±		Black bituminous shale; yellow bedded jarosite; local earthy hematite; pale grey clay; local basal ironstone-pebble and shale-chip conglomerate.
Unconformity			
Lower Cretaceous	"Bentonitic zone" 300 - 500 ±		Black, soft, plastic shale; fossiliferous orange ironstone concretionary beds.
	"Silty zone" 800 - 1,000 ±		Upper division: argillaceous siltstone and mudstone; Lower division: light grey, friable sandstone and coal.
Unconformity			
Middle Devonian	Hare Indian Formation 300 +		Shale: black and highly fissile at base; green- grey above; beds of siltstone and fossiliferous limestone locally developed.
	Hume Formation 150 ±		Limestone: well bedded and rubbly; highly fossiliferous; shales in middle and lower parts.
(?)Lower and Middle Devonian	Bear Rock Formation 700 ±		Bedded limestone in upper part; dolomite and limestone solution breccia with minor gypsum in lower part.
Unconformity			
Upper Cambrian and Lower Ordovician	"Franklin" Group	Unit 2b 500 - 700'	Dolomite: pale yellow brown to pale grey; mainly medium crystalline; abundant white and yellowish grey, stromatolitic and locally oolitic chert; abundant drusy quartz.
		Unit 2a 150' +	Dolomite: pale brownish grey, fine to coarse crystalline; interbedded with greyish-orange dolomite, partly laminated.

STRATIGRAPHY

Exposed strata belong to the Cambrian, Ordovician, Devonian and Cretaceous Systems. Informal nomenclature and age designations of Cambrian and Ordovician strata are based upon personal communications with B. S. Norford and R. W. Macqueen. Stratigraphic nomenclature and assignments of geologic age to Devonian strata are based upon designations southwest of the map-area (Bassett, 1961) and personal communications with A. E. H. Pedder and W. S. Mackenzie. Informal Cretaceous units were named by J. C. Sproule and Associates Ltd. in 1959 field studies.

Paleozoic

Grey-weathering, thick-bedded, fine to medium-crystalline dolomites are the oldest (Upper Cambrian and Lower Ordovician) rocks in the Simpson Lake map-area. These rocks (€Or2a) are assigned to Macqueen's (in press) informal rhythmic unit, one of the four stratigraphic units which he recognized in rocks mapped as the "Ronning Group" in the Operation Norman area. Unit €Or2a is conformably overlain by 500 to 700 feet of light to medium-grey and buff, thick-bedded, fine to predominantly

medium and coarse-crystalline dolomites (€Or2b) assigned to Macqueen's informal cherty unit. Unit €Or2b is distinguished by drusy quartz that lines vuggs and by beds of light grey and white chert, and abundant stromatolites replaced by grey and white chert. The strata have poor to fair vuggy and intercrystalline porosity.

The Middle Devonian Bear Rock Dormation (Dbr) disconformably overlies the "Ronning Group"; the contact is well exposed along Horton River where local relief on the disconformity is as great as 50 feet. The lower part of the Bear Rock Formation is generally thin to medium-bedded, calcareous and gypsiferous, buff and grey dolomite that has excellent intercrystalline and local cavernous porosity. Some beds in this successi are extensively brecciated with random, non-sorted angular blocks and fragments of fine-crystalline dolomite in a calcareous, gypsiferous, coarse-crystalline dolomite matrix. Evidence that some of the brecciation is geologically recent is furnished by large, sub-cylindrical sink-holes that truncate rocks throughout the Bear Rock succession. These karst features are particularly well expressed along Anderson and Horton Rivers. Locally however, minor thin beds of unbrecciated, fine-crystalline dolomite are interlayered with beds of breccia which are unrelated to sink-holes, suggesting a much earlier phase of brecciation. The upper part of the formation consists of slightly

to moderately dolomitic, medium brown-grey limestones that are distinguished by abundant calcarenite beds with fine-grained, well-rounded clasts. These rocks are generally thick-bedded and resistant, and are well exposed along Anderson and Horton Rivers where they locally constrict streams to narrow canyons (Fig. 1). Thin to platy-bedded, medium grey-brown limestone, composed of microcrystalline calcite with a few bioclasts (broken and unidentifiable) occur within the calcarenite strata. The upper part of the Bear Rock Formation has only local, poor intergranular porosity. The formation is estimated to be about 700 feet thick in the Simpson Lake map-area.

The Bear Rock Formation is conformably overlain by the Middle Devonian Hume Formation (Dh), which consists of distinctively thin and nodular beds (Fig. 2) of medium grey-brown, argillaceous limestone with calcarenitic and biosparitic textures. Laminations and thin beds of dark grey calcareous shale are interlayered with limestone and compose about one-third of the sequence. Well preserved fossils (chiefly brachiopods, but also gastropods, crinoids, bryozoans, corals and trilobites) are abundant. The Hume Formation is about 150 feet thick in good exposures along Anderson River.

Dark grey, bituminous shale of the Middle Devonian Hare Indian Formation (Dhi) conformably overlies the Hume Formation. Tentaculites sp. and inarticulate brachiopods

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Figure 7. Limestone beds in the upper part of the Bear Rock Formation (Dbr), Anderson River at 68°30'N., 126°05'W. Folds, which have amplitudes of a few tens of feet, are apparently random in orientation; many similar structures in the map-area are probably concealed by the extensive cover of Pleistocene drift.

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Figure 2. Distinctively nodular beds of limestone in the Hume Formation (Dh), Anderson River, at 68° 25'N., 127° 30'W. Note large tetracoral in rubble at lower left (indicated by arrow).

are abundant in the lower beds of the formation. The upper part of the unit is predominantly medium green-grey, soft, fissile shale. The formation is about 300 feet thick in the map-area; this incomplete development of the unit is due to truncation by Cretaceous strata. (in adjoining Crossley Lake Map-area, where the formation is about 600 feet thick, it is overlain by the ~~Middle~~ Upper Devonian Canol Formation.

Cretaceous

Paleozoic rocks are unconformably overlain by widespread, but poorly exposed, poorly to moderately well indurated Lower Cretaceous clastic strata of varied lithologies, which are assigned to the informal "Silty zone" (Ks).(Yorath et al., ibid). In the eastern part of the area, south of Horton River, lowest strata of the "Silty zone" overlie the "Ronning Group" on a disconformable surface with sharp local relief. These basal deposits are fine to very coarse-grained, friable quartz sandstones with conglomeratic lenses. Pebbles and cobbles in the conglomerates are light grey and white chert, and were apparently derived from the underlying "Ronning"

sequence (Cor 26). Extensive cross-bedding and channelling within the deposits, local distribution of conglomerate lenses, and the sharp relief on the disconformity with underlying Ordovician strata, suggest that these materials are of fluvial origin. Further, the general decrease in clast size towards the northwest, and westerly azimuths of cross-stratification indicate that the streams may have drained highlands in the region of the Coppermine Arch to the east of the map-area (Yorath et al., ibid., p. 22).

Elsewhere, in the eastern part of the region, basal strata of the "Silty zone" are principally light grey to light buff, fine to medium-grained, friable, clean quartz sandstone with minor interbedded mudstone and lignite. At Horton River (68° 51' N.; 125° 24' W.) 220 feet of the unit rests disconformably upon the Bear Rock Formation, large angular blocks of which are incorporated in the basal sandy mudstones (Fig. 3). These basal sandstones, mudstones and coals are informally called the lower sandstone and coal division of the "Silty zone" (Yorath et al., ibid.)

In the central and western parts of ~~the~~ Simpson Lake map-area, the "Silty zone" is represented by dark grey, soft, argillaceous siltstone and silty mudstone, collectively called the upper siltstone and mudstone division. Persistent minor concretionary limestone beds, with pelecypod coquinas, occur at several intervals.

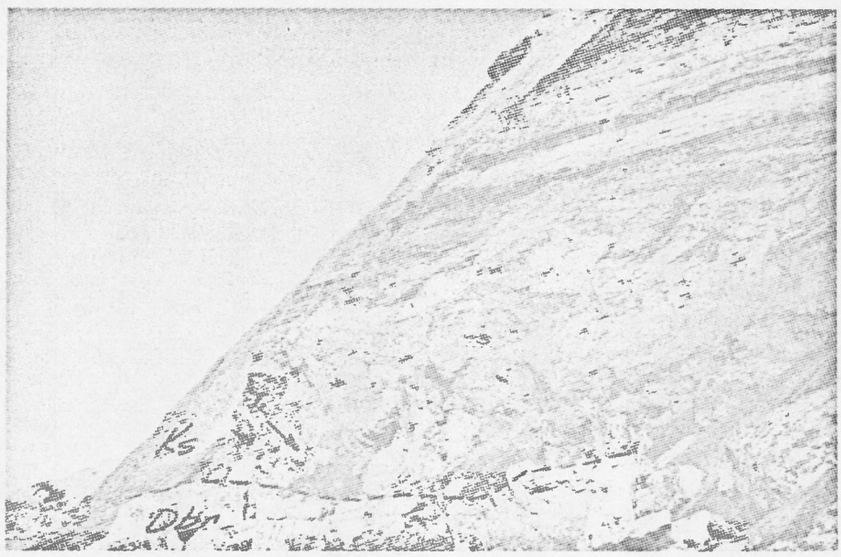

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Figure 3. Poorly consolidated sandy mudstone and sandstone of the Cretaceous "Silty zone" (Ks) disconformably overlying limestone beds of the Bear Rock Formation (Dbr), Horton River at 68°51′ N., 125°24′ W. Note large limestone blocks (indicated by arrow) in basal Cretaceous beds.

Complete sections of the "Silty zone" are not exposed in the map-area. On a regional basis its composite thickness is estimated to be about 1,200 feet,(Yorath et al., ibid.), but structural considerations suggest that it is thinner than this in Simpson Lake map-area.

To the west, in the Crossley Lakes area, and to the north, in the Franklin Bay area, the "Silty zone" was observed in conformable contact with overlying dark grey, plastic, concretionary shales of the "Bentonitic zone" (Kb). No exposures of this unit were observed in the map-area due to extensive cover by glacial drift but extrapolation of the contact from adjoining map-areas (107A and 97C) permits its schematic representation on the accompanying map.

Near Anderson River (map-area 107A) the "Bentonitic zone" is about 600 feet thick; it appears to be thinner than this in the Simpson Lake area, probably in part due to erosion and truncation by Upper Cretaceous strata.

"Bentonitic zone" strata are disconformably overlain by rocks assigned to the informal "Bituminous zone" (Kbt). The latter is a sequence of black, bituminous shale, bedded yellow jarosite, and locally, dark maroon beds of earthy hematite. At numerous localities in ~~other~~ adjoining map-areas an ironstone-pebble and shale-chip conglomerate occurs at the base which in turn rests upon an irregular erosion surface. It is believed that the hematite is the oxidation product of jarosite, a hydrous iron, potassium sulphate and occurs only in surface exposures of the unit. To the north, in the Franklin Bay area, the unit is actively burning at

a number of localities and the Smoking Hills derive their name from ~~the~~ columns of smoke that ~~can be seen rising~~ rise from outcrops along the cliffs.

No exposures of the "Bituminous zone" were observed in the map-area but immediately north of its northern boundary numerous exposures of the lower beds were observed in contact with the underlying "Bentonitic zone". In the Franklin Bay area the unit has a variable thickness of from 100 to 328 feet, and is conformably overlain by strata of the "Pale Shale zone".

Age assignments of Cretaceous units are based upon micropaleontological studies by T. P. Chamney and by comparison with formations of similar lithology on Banks Island. The lower sandstone and coal division of the "Silty zone" appears to be the lithologic equivalent of the Isachsen Formation as described by Thorsteinsson and Tozer (1962) and is probably pre-Albian in age. The upper siltstone and mudstone division is similarly correlative with the lower member of the Christopher Formation which has yielded diagnostic Early to Middle Albian faunas. The upper member of the Christopher Formation has been dated as Middle to late Middle Albian in age (ibid.) and is lithologically correlative with the "Bentonitic zone". Chamney (personal communication) has identified Middle Albian glomospirellid

foraminifers from the upper beds of the "Bentonitic zone". A few immature and fragmental ammonites were collected from the "Bentonitic zone" on Horton River north of the map-area. Jeletzky (G.S.C. Paleontology Report No. Km-3-1969) tentatively suggested that they represented the late Lower or early Middle Albian Arcthoplites or Beudanticeras affine zone, but was unable to provide positive identifications due to the paucity, immaturity and fragmental nature of the specimens collected.

A Late Cretaceous age (Late Coniacian to Early Santonian) has been assigned to the lower beds of the "Bituminous zone" by Chamney (1969). on the basis of the occurrence of Hedbergella cf. H. delrioensis (Carsey). The uppermost beds contain vertebrate remains including Hesperornis regalis Marsh, which indicate an Early Campanian age for these beds (Russell, 1967). Chamney (personal communication) believes that deposition of the "Bituminous zone" took place from Late Coniacian to Early Campanian.

STRUCTURAL GEOLOGY

Structural provinces, which include Anderson and Horton Plains (Douglas et al., 1963), largely coincide with physiographic disvisions (Anderson Plain and Horton Plateau). The vague boundary is marked by a gentle monocline (west side relatively down) that trends northwesterly from the southeastern part of the map-area (where it is locally anticlinal) to Gilmore Lake; this fold appears to be a regional feature which may extend through the western part of Franklin Bay.

Rocks in the map-area dip regionally westward and northwestward at low angles and there are few faults, well-delineated folds, or other structural complications (although many small structures may be concealed by the extensive cover of Pleistocene drift) (Fig. 1). Random small folds in basal strata of the Bear Rock Formation are partly due to depositional draping an erosional irregularities in underlying "Ronning" strata. Local, small folds in the "Ronning Group" appear to have tectonic origins. The Bear Rock Formation is exposed in the core of a narrow, northwesterly trending, doubly plunging anticline in the western part of the area; closure

on this fold is about 200 feet. This structure is aligned with, and may be genetically related to unusual anticlines near Colville Lake (Aitken et al., ibid.). Systematic joints are well developed in relatively brittle rocks ("Ronning Group", Bear Rock and Hume Formations) and are largely responsible for the abruptly rectangular courses of Anderson and Horton Rivers.

ECONOMIC GEOLOGY

The economic potential of the region depends mainly on the possibilities of hydrocarbon accumulation. (Metallic minerals were not observed other than very minor concentrations of iron sulfides?) Porous clastic strata of the 'Silty zone' crop out over much of the area and are unlikely reservoirs. The Bear Rock Formation is commonly petroliferous and has good intercrystalline and local cavernous porosity; supratenuous folds, which are developed in this unit over erosional knobs of 'Ronning Group' strata, may provide potential traps. 'Ronning' strata locally display fair to good intercrystalline and vuggy porosity.

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