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PAPER 62-33

GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

DAHADINNI AND WRIGLEY MAP-AREAS, DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES

95 N, and 95 O

(Report, 2 figures, Map 44-1962 and 45-1962, appendix)

R. J. W. Douglas and D. K. Norris

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CANADA

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DAHADINNI RIVER AND WRIGLEY MAP-AREAS, DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES

INTRODUCTION

These map-areas are in southwestern District of Mackenzie. Dahadinni River map-area is bounded by latitudes 62 and 64°N and longitudes 124 and 126°W; Wrigley map-area lies to the east, between longitudes 122 and 124°W. This report and the accompanying maps are the last of a preliminary series covering the region investigated geologically in 1957 on Operation Mackenzie, a general account of which has been published (Douglas, 1959)[1].

Officers of the Geological Survey on Operation Mackenzie were W. B. Brady, B. G. Craig, R. J. W. Douglas, P. Harker, D. J. McLaren, A. W. Norris, D. K. Norris, B. R. Pelletier, and D. F. Stott. They were assisted in the field by D. A. Andrews, F. J. A. Arthur, R. K. Broeder, K. P. R. Cole, W. N. Hamilton, I. M. Harris, R. N. McCowan, D. B. McKennitt and J. B. Read. Crew of the helicopters, supplied by Associated Helicopters Limited, were N. R. Staniland, R. Huff, J. Brochu, and R. Barnes, and crew of the Beaver aircraft, supplied by Pacific Western Airlines Limited, were W. McKinney and J. Furber. A boat and barge were operated by G. P. J. Turner and D. Turner. Other members of the party included W. T. Spratt, radio operator; and E. A. Konisenta, H. Martell and M. McKay, canoemen. To all these men, the writers and other officers of the party extend their appreciation.

The geology of McConnell and Camsell Ranges was mapped and compiled by D. K. Norris, the remaining parts by R. J. W. Douglas. Cretaceous rocks were examined by D. F. Stott; Upper Devonian by D. J. McLaren and D. F. Stott. Sections of Middle Devonian and older Palaeozoic systems were studied by A. W. Norris, D. J. McLaren, B. R. Pelletier, P. Harker and W. B. Brady; the Proterozoic and Cambrian by A. W. Norris. Fossils have been examined and identified from the Devonian by D. J. McLaren, A. W. Norris and P. Sartenaer, a former post-doctorate fellow with the Geological Survey, and from the older beds by B. S. Norford and G. W. Sinclair. Subsurface data is based on contributions by H. R. Belyea, and examination of samples stored at the Geological Survey of Canada, Ottawa.

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[1] Names and/or date in parentheses refer to publications listed in the References.

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PHYSICAL FEATURES

Dahadinni River and Wrigley map-areas include a small part of the northern Interior Plains in the east, extend through the southern Franklin Mountains and Mackenzie Plain, and embrace the Canyon Ranges and a small part of the Backbone Ranges of Mackenzie Mountains in the west (Bostock, 1948).

The Interior Plains are traversed by several large meandering rivers which occupy low, broad valleys. Valleys are below 1,000 feet in elevation, generally tree covered, and studded with small lakes or filled by large bodies of water—i.e. Blackwater and Fish Lakes. Intervening regions are low plateaux bounded by gently sloping scarps, heavily streaked by solifluction streams. The higher parts, 1,500 to 2,000 feet in elevation, are tundra covered and strongly marked with glacial fluting, small lakes and abandoned water courses. The Plains terminate rather abruptly in the west against the scarps and ridges of Franklin Mountains.

Franklin Mountains include the southern part of McConnell Range east of Mackenzie River and the northern end of Camsell Range to the west. The latter range and the southernmost elements of McConnell Range, Smith and Bell Ridges, are low, northerly trending ridges. The northern part of McConnell Range within Wrigley map-area is a broad, deeply dissected plateau. The rocks of McConnell Range are partly bare and characteristically knobby and intermittent in outcrop pattern. The range is split transversely by Blackwater and Ochre Rivers. The highest peak is Cap Mountain, over 5,100 feet in elevation, but the bulk of the range rarely exceeds 3,500 feet. Northern Camsell Range is a high east-facing escarpment which changes to partly isolated peaks trending towards Mount Gaudet and Roche-qui-Trempe-à-l'Eau east of Mackenzie River. The bulk of the lowland which lies west of Mackenzie River is a nearly level plain at about 1,000 to 1,500 feet elevation, tree covered, and containing many small lakes. Higher parts like Wrigley Plateau and the high ground adjacent to Dahadinni Range are sparsely treed and rise to over 2,500 feet. Four large rivers tributary to the Mackenzie flow northeasterly across the plain in low canyons but expose little of the bedrock. Tributaries exhibit dendritic patterns reflecting the gentle structures in the nearly flat lying bedrock.

The Canyon Ranges of Mackenzie Mountains—Dahadinni, Dusky, Redstone and Rouge Ranges—are separated by broad forested valleys or low plateaux. The ranges are northerly trending and sublinear. The more easterly attain 4,000 to 4,500 feet elevation and are partly bare, whereas the most westerly, the Rouge Range, is devoid of vegetation and most peaks exceed 5,000 feet. This range exhibits striking colour laminations and its core is formed of red-weathering rocks. The principal rivers, particularly the Redstone, flow in deep to low canyons where they cross the Canyon Ranges and intervening plateau. A small part of the Backbone Ranges, comprising a high,

dissected plateau formed in nearly flat lying grey-weathering rocks, lies west of Rouge Range in southwestern Dahadinni River map-area.

STRATIGRAPHY

The stratigraphic succession beneath the Plains is probably more like that in Franklin Mountains than that of the more easterly Plains (Douglas and A. W. Norris, 1960). The succession in McConnell Range of Franklin Mountains was established by Williams (1922, 1923) at Cap Mountain and Mount Kindle within Wrigley map-area and at Mount Clark and Saline River just north of the area. He proposed the following Cambrian to Silurian formations: Mount Clark, Mount Cap, Saline River, Franklin Mountain and Mount Kindle. Their use here is as close as possible to their original definition, although it has been found necessary to raise the base of the Mount Clark Formation to correspond with an unconformity and the Mount Kindle Formation is now considered to be late Ordovician and early Silurian in age. Most of the formations of the Mackenzie Mountain sequence as established in adjacent Camsell Bend and Root River map-areas (Douglas and D. K. Norris, 1961) extend into Dahadinni River map-area. These are the Whittaker, Delorme, Sombre, Arnica, Funeral, Manetoe, Landry and Headless Formations, of Ordovician to Middle Devonian age.

PROTEROZOIC

The sequence of beds exposed on the northeast flank of Cap Mountain in McConnell Range is divisible into at least five units of formational rank. The uppermost, which consists of 530 feet of sandstone, was reported by Williams (1923) to contain Lower Cambrian trilobites. This rock unit was found to be underlain by a strong angular unconformity and is tentatively considered to mark the base of the Palaeozoic succession. As it forms the bulk of the Mount Clark Formation as proposed by Williams, that name is retained. The underlying four map-units are provisionally considered to be Proterozoic in age, no fossils having been discovered. They were not named by Williams, although the term 'Lone Land Formation' was introduced on the legend of a map (GSC Map 2022; see Hume, 1924) for dark shales underlying the Mount Clark Formation. This term, Lone Land, is here applied to the uppermost unit, map-unit 4. It overlies map-units 2 and 3 unconformably and is itself overlain unconformably by the Mount Clark Formation. The underlying map-units 1 to 3 are left unnamed.

Table of Formations*

Era	Period or Epoch		Formation	Map-unit	Lithology	Thickness (feet)
Cenozoic	Pleistocene and Recent			28	Alluvial sands, silts and muds of Mackenzie River	
Mesozoic	Cretaceous			27	Shale and sandstone	0-2,500±
Palaeozoic	Devonian	Upper		26	Shale, grey, green, red, calcareous; siltstone and sandstone, fine-grained, greenish grey; limestone, fossiliferous	0-4,525
				25	Limestone, massive-bedded, reefy	0-110
				24	Sandstone, calcareous, greenish grey, fine-grained; shale, grey and greenish grey	510±
			Fort Simpson	23	Shale and mudstone, grey; siltstone and sandstone (may include Horn River Formation)	1,950±
		Middle	Horn River	22	Shale, black, pyritic, sulphur-stained	725±
			Nahanni	21	Limestone, fine- to coarse-grained, grey, medium- to thick-bedded, grey-weathering (may include Headless Formation)	300-750
			Headless	20	Limestone, argillaceous, grey, thinly bedded; commonly covered, recessive	0-120
			Funeral	19	Limestone, argillaceous, fine-grained, thinly bedded, buff- to pink-weathering	550
			Landry	18	Limestone, cryptocrystalline, grey, medium-bedded	410-730
			Manetoe	17	Dolomite, coarse-grained, grey, thickly bedded, fractured and veined; porous	135
			Bear Rock	16	Massive brecciated dolomite and limestone, orange-weathering; dolomite and anhydrite in subsurface	1,070±
			Arnica	15	Dolomite, crypto- to fine-grained, banded grey and dark grey, finely porous and vuggy	435-2,420

Palaeozoic	Devonian	Devonian or older	Sombre	14	Dolomite, crypto- to fine-grained, banded grey and light grey	0-2, 870
			Camsell	13	Massive breccia, cryptograined grey limestone: grey; yellow; and orange-weathering	1, 700-1, 850
		Ordovician and younger		12	Dolomite, fine- to medium-grained, grey, variably silty, buff-weathering	540+
			Delorme	11	Limestone and dolomitic limestone, fine-grained, grey, buff-weathering	2, 100
			Whittaker	10	Dolomite, massive, medium-grained, vuggy and porous, and fine-grained, thinly bedded, grey-weathering	3, 360
			Mount Kindle	9	Dolomite, fine- to medium-grey, massive to thickly bedded, grey-weathering, porous	900±
			Franklin Mountain	8	Dolomite, fine-grained, grey to brown, light brown and yellowish weathering	1, 265
	Ordovician(?) or older			7	Dolomite, silty and sandy, fine-grained, pink to grey, reddish buff weathering	600+
		Cambrian	Saline River	6	Shale, buff, green and red; salt and gypsum	500±
			Mount Cap		Shale, olive-green, soft	200±
			Mount Clark	5	Sandstone, fine-grained, white, crossbedded	450
Proterozoic			Lone Land	4	Sandstone, fine-grained, white varying to ferruginous brown; conglomerate; shale, grey; mudstone purplish red and green	970
				3	Shale, dusky-red and olive-green, hard; siltstone and sandstone, hematitic, fine-grained	1, 510
				2	Shale, dusky-red and green, hard; siltstone	1, 585
				1	Sandstone, fine-grained, green; dolomite, cryptocrystalline, green and brown; shale, dusky-red and green	1, 700

*Relative position of map-units in this table does not necessarily imply relative stratigraphic position.

Map-unit 1

Map-unit 1 comprises about 1,700 feet of strata consisting of interbedded dolomite, sandstone, siltstone and shale. The sandstones are commonly less than 10 feet thick, fine-grained, green or dark dusky-red and hematitic, evenly bedded, hard and resistant. The dolomites are cryptocrystalline, light brown to light olive-green, thinly bedded, vaguely laminated, varying to silty dolomites and siltstones, and weather light to dark orange. Some of the shales are dusky-red or light olive-green, partly steatitic with a greasy texture, thinly bedded to platy and weather light yellowish orange. The base of the map-unit is underlain by Cap fault.

Map-unit 2

Map-unit 2 consists mainly of shale—hard to fissile, dusky-red, varying to thinly bedded, fine-grained, red, ferruginous siltstone and sandstone. The unit as a whole weathers dull red and, being recessive, forms grass-covered slopes. It is 1,585 feet thick.

Map-unit 3

Map-unit 3 is about 1,510 feet thick. It consists of interbedded shales, siltstones and sandstones. The shales are commonly dark dusky-red, fissile to platy and dark olive-green, and hard to fissile. The siltstones are mainly thinly bedded, 2 to 6 inches thick, and coloured similarly to the shales with which they may be interbedded. The sandstones are hard, varying to quartzites, fine to medium grained, light yellowish green to grey or dark brown, variably hematitic, thinly bedded or lenticular, and commonly laminated or separated by thin shale partings. The unit as a whole is recessive but the hard beds within it form low disconnected ridges. The contact with the overlying Lone Land Formation is angularly unconformable. The strata below the unconformity strike 130° and dip 35°SW; those above the unconformity dip about 13°SW. The unit thins to about half its measured thickness southward along the east flank of Cap Mountain as a result of bevelling on the unconformity.

Lone Land Formation (Map-unit 4)

The Lone Land Formation is about 965 feet thick where measured on the northeast flank of Cap Mountain. The basal 200 feet is sandstone—fine-grained, white, thinly bedded and cross-laminated, ferruginous in part with numerous blebs of orange-brown-weathering powdery limonitic material. Scattered throughout, particularly in more massive to thickly bedded units, are lenses of rounded pebbles of clear and milky white quartz up to about 1/10 inch in diameter. The upper part is mainly black hard fissile shales interbedded with laminated

siltstone—fine-grained, light greenish grey, and weathering rusty brown. Some 37 feet of mudstone and shale—hard, laminated, hematitic thinly to evenly bedded, purplish red to dark green—occurs at the top, separated from the sandstones of the Mount Clark Formation by a covered interval of 28 feet. The basal sandstones form a resistant rib which is truncated against the unconformity beneath the Mount Clark Formation short distances northwest and southeast of the described section.

PALAEOZOIC

Cambrian

Mount Clark Formation (Map-unit 5)

The Mount Clark Formation was examined near the peak of Cap Mountain, where a thickness of 450 feet was measured. The formation consists of sandstone—mainly fine-grained, mainly white but with purplish red laminae and bands, massive to thinly and irregularly bedded, in part crossbedded, and weathering light and dark purplish red. No fossils were found. Williams (1923) reported Lower Cambrian trilobites from near the upper part of the formation at Mount Clark, north of the map-area.

Mount Cap and Saline River Formations (Map-unit 6)

Only a few feet of shales referred to the Mount Cap Formation are exposed within the map-area, occurring at the south end of Cap Mountain. They consist of light olive-green, soft, fissile shale, and weather light green to light orange-red and yellowish orange. Olenellid trilobites were found and according to A. W. Norris are of Lower Cambrian age. Williams (1923) collected Middle Cambrian fossils from the shales on Saline River and from basal shales and siltstones on the flank of Cap Mountain. The thickness of the formation is not known, but was estimated by Williams (1923) to be about 200 feet.

The overlying Saline River Formation is not well exposed within the map-area and was not examined. Williams (1923) described the formation as comprising about 500 feet of buff and green shale, red shale, salt and gypsum.

The Mount Cap and Saline River Formations occupy a recessive interval, generally covered, delineated as map-unit 6 as they are inseparable with available control. The map-unit at the north border appears from graphic estimates to include about 1,200 feet of strata. The map-unit as mapped elsewhere may appear to exceed this figure in thickness, but is probably tectonically thickened.

	Camsell Bend and Wrigley Map-areas (Douglas and D.K. Norris, 1961)	Dahadinni River Map-area		Wrigley Map-area		Horn River Map-area (Douglas and A.W. Norris, 1960)
		Rouge, Redstone and Dusky Ranges	Dahadinni Range	Camsell Range	McConnell Range	
Overlying beds	Arnica (11)	Arnica (15)	Arnica (15)	Arnica (15)	Bear Rock (16)	(12)
Devonian(?)	Sombre (10)	Sombre (14)				
	Camsell (5)	Camsell (13)	Camsell(?) (13)			
Silurian	Delorme (4)	Delorme (11)		? (12) ?		
	Whittaker (3)	Whittaker (10)			? Mt. Kindle (9) ? Franklin Mt. (8) ?	? (10) ? (9)
Ordovician	Sunblood (1)				?	? (8)
?	?	?			? Saline River (6) Mt. Cap Mt. Clark (5)	? (7) ?
Cambrian						
Proterozoic		(7)			Lone Land (4) (3) (2) (1)	

Figure 1. Correlation of Lower Palaeozoic formations of Dahadinni River, Wrigley and adjacent map-areas.

Ordovician(?) or Older

Map-unit 7

Map-unit 7 is exposed in Mackenzie Mountains forming the core of ranges in western Dahadinni map-area (see Figure 1). The map-unit is characteristically red weathering and may include several thousand feet of strata. The upper 600 feet was examined north of Blue Lake in Redstone Range just south of Redstone River and consists mainly of silty and sandy dolomites and sandstones. Dolomites are fine grained, grey to pale brown or pinkish grey, variably silty to sandy, generally medium to thickly bedded, and weather buff to yellow and reddish buff. Sandstones are fine grained, light grey to light brown, buff and red weathering, varying to medium or coarse grained, grey to pink and weathering brownish red. Some algal structures were noted in dolomites about the middle of the interval.

Ordovician and Younger

Franklin Mountain Formation (Map-unit 8)

Franklin Mountain Formation occurs in McConnell Range of Franklin Mountains. On the northeast face of Mount Kindle a thickness of 1,265 feet was measured. The contact with the underlying Saline River Formation is not exposed. The upper part of the formation, 745 feet thick, consists mainly of dolomite—fine-grained, light grey to light brownish grey, thinly bedded to platy, and weathering light yellowish grey to medium brown. Some beds are finely laminated and silty and some contain small vugs, minor chert lenses, and stromatoporoid structures. The underlying 260 feet comprises yellowish brown, pale green and red shales with some thin bands of finely laminated quartzose sandstone and silty dolomite, in turn underlain by 155 feet of dolomite—grey, fine-grained, thinly bedded, and weathering light brownish grey—and thence by 105 feet of platy, fine-grained grey limestone and calcareous shale.

Mount Kindle Formation (Map-unit 9)

Overlying the Franklin Mountain Formation, apparently conformably, are massive dolomites of the Mount Kindle Formation. The formation was examined at two localities on McConnell Range. At Mount Kindle the uppermost part of the formation and the contact with the overlying Bear Rock Formation are not exposed. The formation there consists of 533 feet of massive to thickly bedded dolomite—medium grey, fine- to medium-grained, sugary, and finely vuggy. The basal beds are reefy and contain large colonial corals dated as Upper Ordovician (Richmondian) by Sinclair and Norford.

At the north end of Smith Ridge the basal beds are succeeded by medium-bedded, fine- to medium-grained, light brownish grey to light grey dolomites—grey to yellowish-grey-weathering and becoming mainly fine-grained to micrograined and finely silty near the top. Fossils from beds near the top are of early Silurian age according to Norford. A covered interval of 10 feet separates the formation from the breccias of the Bear Rock Formation. A thickness of 753 feet was measured at this locality and 533 feet was measured on Mount Kindle. These sections overlap to a considerable degree and the total thickness of the formation is estimated at 900 feet.

Whittaker Formation (Map-unit 10)

The Whittaker Formation is present in Mackenzie Mountains and it was examined on Redstone Range north of Blue Lake. Some 3,360 feet of strata was measured, divisible into three parts; the lower and upper are recessive and the middle is massive and resistant.

The lower part of the Whittaker Formation is 620 feet thick; the basal 320 feet consists of dolomite—variably argillaceous and silty, fine-grained, thinly bedded, partly finely laminated, and weathering grey and yellowish grey. These beds are overlain by 290 feet of dark grey, fine-grained limestone—thin- to medium-bedded, and light and dark grey weathering. Some black chert nodules occur near the top.

The middle part of the formation, 2,060 feet thick, comprises generally massive and resistant dolomites—light to dark grey, medium-grained, partly porous and vuggy, variably cherty, and weathering medium to dark grey. Coral and brachiopod fossils from beds low in the unit are of Late Ordovician age according to Sinclair and Norford, whereas those higher within the unit are Silurian (Clinton or Lower Lludlow-Wenlock).

The upper part of the Whittaker was found to be 680 feet thick and composed of dolomite—fine- to medium-grained, grey to dark grey, medium- to massive-bedded towards the base but thin- to medium-bedded and more recessive near the top. It weathers grey. The unit contains fossils of Silurian age (Sinclair). The upper part of the Whittaker was also examined in the core of Rouge Range where there is about 100 feet of thinly bedded, light and dark grey, fine-grained limestones—in part slightly dolomitic and weathering light to dark grey.

Delorme Formation (Map-unit 11)

In Rouge Range some 2,100 feet of beds assigned to the Delorme Formation were measured on a tributary of the north fork of Root River. These consist of platy limestones and dolomitic limestones — commonly fine-grained, light to medium grey, weathering buff to greyish buff and yellowish orange, and generally recessive. Alternations of units with these weathering characteristics impart a banded or striped appearance to the mountains. The uppermost 475 feet comprises distinctively dark-grey-weathering, platy, dolomitic limestones—cryptograined but varying to finely bioclastic, and partly irregularly mottled by dolomite which weathers grey and yellowish orange. The unit carries vegetation and is generally resistant relative to the overlying beds of the lower part of the Camsell Formation. Sparse fossils were found, indicative of a Silurian age according to Sinclair. The basal 400 feet was examined on Redstone Range south of Redstone River. It consists of dolomite—grey, fine-grained, partly silty, thin- to medium-bedded, and weathers recessive and buff to greyish brown.

Map-unit 12

On Camsell Range beneath beds provisionally included in the base of the Arnica Formation is 540 feet of dolomites and silty dolomites. These are mainly fine to medium grained, light grey to brownish grey, thin to medium bedded, variably silty and sandy, and weathering grey to light brown. The basal beds are partly brecciated and underlain by the Camsell thrust. No fossils were found. These strata probably represent the Delorme Formation if the unconformity beneath the Arnica and Bear Rock Formations cuts regularly down section from west to east (see Figure 1).

Devonian or Older

Camsell Formation (Map-unit 13)

The Camsell Formation in Mackenzie Mountains is composed mainly of limestone and dolomite commonly brecciated, either devoid of bedding or massive to thickly bedded. It weathers characteristically light grey, with interbeds of buff, yellow and orange. The limestone is light grey, cryptograined, varying to medium grained, and weathering light or dark grey. The dolomite, which is minor, is fine to coarse grained. Breccia fragments vary in size from a few inches to several feet, being angular to subrounded. The matrix is mainly calcite—fine- to medium-grained, partly forming a fine stockwork—and towards the top it includes large salt casts. The upper part outcrops strongly, forming persistent ridges, whereas the basal beds are more recessive and outcrop sparingly. The latter are characteristically brightly coloured and are readily separated from the

dark-weathering uppermost beds of the Delorme Formation. Where flat lying, the formation weathers in hoodoos and irregular masses.

On Rouge Range the Camsell Formation was found to be 1,850 feet thick; the basal 390 feet is mainly covered. On Redstone Range where crossed by Redstone River, 1,700 feet of strata was measured, the basal 360 feet of which is recessive and partly concealed; in addition to rocks previously described it contains argillaceous limestones—thinly bedded, finely laminated, and fine-grained to cryptograined. No fossils were found in the formation.

At the base of Mount Haywood on Dahadinni Range, 150 feet of massive breccia is provisionally referred to the Camsell Formation. The fragments consist of fine-grained, medium grey dolomite, in part laminated, set in a calcareous matrix. They are overlain by dolomites assigned to the Arnica Formation (see Figure 1).

Sombre Formation (Map-unit 14)

The Sombre Formation as developed on southern Rouge Range in Dahadinni River map-area is about 2,870 feet thick and divisible into three parts.

The lower part, totalling 1,800 feet in thickness, comprises 1,250 feet of mainly fine-grained, grey to dark grey dolomite, weathering into alternate light and dark grey bands. These strata are overlain by 550 feet of fine-grained, grey limestone and dolomite that weathers light grey. Some beds are finely brecciated by cryptograined limestone and white calcite. The middle part, 250 feet thick, is partly covered but appears to be mainly dark-grey-weathering, dark grey dolomite—cryptograined to fine-grained, thinly bedded and partly brecciated. The upper part, 820 feet thick, is medium grey dolomite—medium-grained, partly vuggy and partly finely laminated. It weathers banded light and medium grey.

The Sombre Formation thins northward. It appears to be only about 700 to 800 feet thick on Dusky Range, thinning to nearly zero in northern Redstone Range. On a tributary to Root River in central Dusky Range some 360 feet of dolomite and dolomitic limestone—medium-grained, medium to light grey, thickly bedded, light-grey-weathering—is present. The basal 55 feet is sandy and interbedded with thin calcareous sandstones.

The variations in thickness of the Sombre Formation are provisionally attributed to pre-Arnica erosion (see Figure 1, and Douglas and D.K. Norris, 1961).

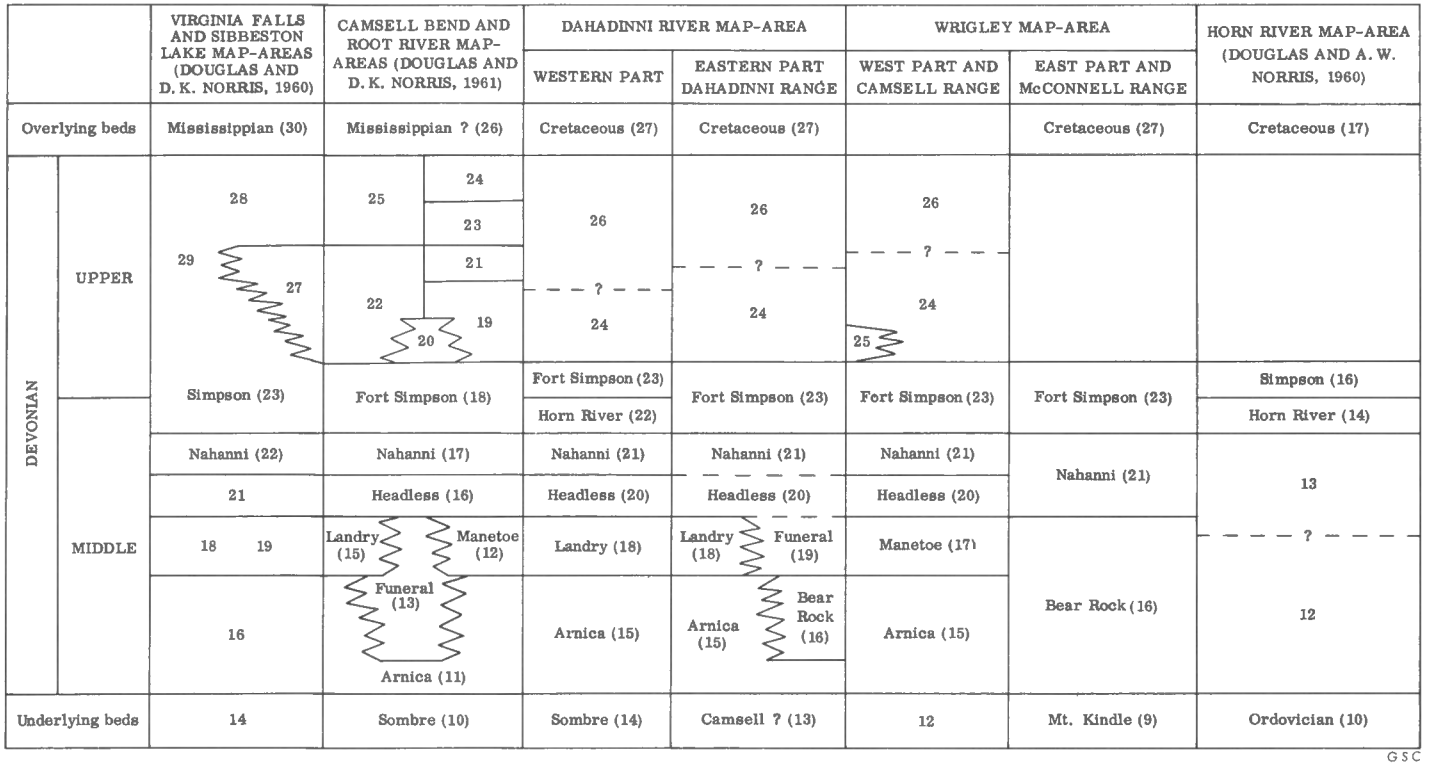

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Figure 2. Correlation of Devonian formations of Dahadinni River, Wrigley, and adjacent map-areas

Middle Devonian

Arnica Formation (Map-unit 15)

The Arnica Formation or its stratigraphic equivalents (see Figure 2) is exposed in all mountain ranges of both map-areas. The formation is typically dark grey to black dolomite—cryptograined to fine-grained, granular to finely porous and vuggy, variably fetid and in some places laminated. The rocks are massive, but medium and dark grey colour alternations impart a distinctive bedded and banded appearance. Thicknesses of the formation are 2,420, 1,775, 1,480, and 1,180 feet on Rouge, Redstone, Dusky, and Camsell Ranges respectively.

On Dahadinni Range the formation grades into the Bear Rock Formation. The lower part of the Arnica Formation appears to retain some of its characteristic lithologic features, whereas the upper part is largely brecciated and is included in the Bear Rock Formation. At Mount Haywood the beds retained in the Arnica Formation comprise 435 feet of dark grey dolomites, mostly massive but somewhat brecciated in the middle of the interval. They weather dark grey and recessive relative to overlying and underlying beds. Where examined on the northern end of Camsell Range the Arnica Formation includes some breccia and in some zones the beds are strongly veined with calcite. The extreme northern end of the range was not examined on the ground and the formation is presumed to grade into the Bear Rock near the northern end; the Bear Rock Formation is prevalent throughout McConnell Range and also present at Roche-qui-Trempe-à-l'Eau.

Facies variations between the Arnica and the Funeral and Landry Formations are discussed under the last-named formations.

Bear Rock Formation (Map-unit 16)

The Bear Rock Formation underlies much of McConnell Range of the Franklin Mountains. It weathers characteristically into massive isolated, greyish buff with orange, knobs and hoodoos, especially where it is nearly flat lying but also to a lesser degree where it is steeply inclined owing to the general lack of bedding in the unit. A thickness of 1,070 feet was obtained at the northern end of Smith Ridge, but thickness measurements were difficult to obtain due to the general massiveness and lack of marker beds.

The Bear Rock Formation consists of massive breccia; the fragments are angular, vary in size from minute to very large, and consist mainly of crypto- to fine-grained, light grey to light brownish grey limestone. Matrix is similar but commonly softer and weathers to give a porous and cavernous appearance. The uppermost 300 feet is similar lithologically but persistently outcrops more strongly. These upper beds may be the stratigraphic equivalent of the Manetoe and Landry Formations.

At Mount Haywood on Dahadinni Range the Bear Rock Formation is represented by 1,000 feet of massive breccia lying between thin representatives of the Arnica and Funeral Formations. The breccia consists mainly of angular fragments and lumps of fine-grained, dark grey limestone and fine- to medium- grained, brownish grey dolomite in calcite or granular limestone matrix.

Much anhydrite was penetrated in the interval assigned to the Bear Rock Formation in the Imperial Redstone No. 1 well just north of the map-areas (see Appendix), and also in the British American-Hudsons Bay Trail Creek No. 1 well south of the map-area (see Douglas and D.K. Norris, 1961). As indicated in Figure 1 the Bear Rock is thought to be approximately equivalent to the evaporites of map-unit 12 of Horn River map-area (Douglas and A.W. Norris, 1960).

Manetoe Formation (Map-unit 17)

Within Dahadinni River and Wrigley map-areas the Manetoe Formation is known only on Camsell Range. At the northern end of the range it consists of about 135 feet (partly concealed) of porous dolomite—grey, coarse-grained, thin to thickly bedded, much fractured and veined with calcite and dolomite.

The formation is probably represented by the uppermost beds of the Bear Rock Formation of McConnell Range and by the Funeral Formation of Dahadinni Range and may reasonably be inferred to extend northward from Camsell Range beneath Mackenzie Plain separating these two formations; this conclusion may be drawn from the facies relationships evident in the map-areas to the south (Douglas and D.K. Norris, 1960, 1961). A thin representative of the Manetoe Formation appears to be present in the Imperial Redstone No. 1 well which lies just north of the map-area, where it overlies beds referred to the Bear Rock Formation (see Appendix for description). The line of facies change between the Manetoe and Funeral Formations is accordingly presumed to lie west of the well and east of Dahadinni Range.

Landry Formation (Map-unit 18)

The Landry Formation outcrops in Mackenzie Mountains. It is relatively resistant and forms the crests of many of the peaks. It was examined on Dusky, Redstone and Rouge Ranges, where thicknesses of 410, 570 and 730 feet respectively were measured. The formation thickens to the southwest and grades laterally into the shaly beds of the Funeral Formation to the south in Root River map-area (Douglas and D.K. Norris, 1961) and to the east on Dahadinni Range.

The characteristic lithology of the Landry Formation is limestone—cryptocrystalline to finely crystalline, dark to light grey, weathering light to medium grey, and generally medium-bedded. The lower contact is transitional with the Arnica Formation, the basal limestones being partly dolomitized or alternating with fine-grained, medium grey, medium-bedded dolomite. The alternations are not everywhere evident but reach 260 feet in thickness on Redstone River where they are included in the Arnica Formation. No fossils were found in the formation.

Funeral Formation (Map-unit 19)

The Funeral Formation, which is the facies equivalent of the Manetoe, Landry and possibly part of the Arnica Formations, occurs on Dahadinni Range and possibly also on the northern part of Dusky Range. At Mount Haywood on Dahadinni Range some 550 feet of beds were measured. These are recessive, partly covered and consist of limestone—cryptocrystalline to finely biogenic, dark and light grey to brownish and olive-grey, variably argillaceous, laminated, pelletoid, fine- to medium-bedded, and weather grey and buff with pinkish tones. The development of the Funeral Formation on Dahadinni Range is probably an extension of that on Iverson Range of Root River map-area (Douglas and D.K. Norris, 1961). Lacking ground observations, the more resistant beds in stratigraphic continuity with the recessive Funeral Formation that form the crest of many of the peaks of southern Dahadinni Range and northern Iverson Range, are mapped as the Landry Formation. Similarly, in Dusky Range where the interval is poorly exposed, the Funeral Formation, rather than the more strongly outcropping Landry Formation, is presumed to be present.

Fossils from the Funeral Formation on Mount Haywood are of Middle Devonian age according to McLaren.

Headless Formation (Map-unit 20)

The Headless Formation is present in southwestern Dahadinni River map-area where it is 100 and 125 feet thick on Dusky and Rouge Ranges respectively. The formation consists of grey to dark grey argillaceous limestone—fine-grained, thinly bedded, variably biogenic and fossiliferous—interbedded with greyish brown calcareous shale or mud-cracked argillaceous partings or separated by covered intervals. The formation is fossiliferous and contains a Middle Devonian fauna according to McLaren.

The formation is probably represented in the 300-foot covered interval on Redstone Range and by covered intervals of 130 feet on Camsell Range and 140 feet at Mount Haywood on Dahadinni Range. It forms a persistent recessive interval between the overlying

Nahanni Formation and the underlying resistant beds of the Landry or Manetoe Formations. Where, however, the Headless Formation overlies the recessive Funeral Formation, as on Dahadinni Range, its presence is largely inferred, particularly because the strata are not well exposed in that range; in contrast, in more southerly areas such as Iverson Range in the Nahanni Plateau, it can be more readily distinguished from the underlying Funeral Formation. The Headless Formation is not recognized on McConnell Range. Its stratigraphic equivalents, if present, are presumed to be included in the Nahanni Formation and are being discussed under that heading. The Headless was penetrated in the Imperial Redstone No. 1 well (see Appendix for description) in three fault slices, assuming a normal succession of the Manetoe, Headless and Nahanni Formations to be present.

Nahanni Formation (Map-unit 21)

The Nahanni Formation persists throughout the map-areas and there are good exposures in all ranges. It is thickest in the west, attaining about 750 feet, and thins to about 300 feet in the east on McConnell Range, apparently mainly as a result of convergence.

In Mackenzie Mountains the Nahanni Formation is an alternation of light-grey-weathering, recessive and resistant units. The resistant units are medium to thickly bedded limestone, varying from cryptocrystalline to medium-grained, and are coralliferous and fossiliferous; thicker fossiliferous beds are more prevalent in the middle part. The recessive units are covered or consist of thinly bedded to rubbly, dark grey, cryptocrystalline to fine-grained limestones, generally more argillaceous towards the base of the formation. The Nahanni is 750 feet thick on Rouge and Dusky Ranges; on Redstone Range at Redstone River 380 feet was measured. The underlying covered interval of 300 feet may include part of the formation.

On Dahadinni Range at Mount Haywood a thickness of 410 feet was measured. The formation there comprises several resistant units generally composed of medium to dark grey limestones—cryptocrystalline to fine-grained, medium to thickly bedded, variably biogenic and fossiliferous. These beds are partly dolomitized in irregular patches or mottled by fine-grained calcareous dolomite. They are separated by covered intervals and generally weather grey, but where partly dolomitized they are stained yellowish orange to reddish pink. The basal resistant unit is thick, very persistent, and characteristically pinkish weathering. The formation overlies a recessive, often poorly exposed interval referred to the Funeral and Headless Formations. As the Dahadinni Range is isolated there is a possibility that the basal resistant unit of the Nahanni is equivalent to part of the Landry.

On Camsell Range the Nahanni Formation forms well-exposed light-grey-weathering cliffs separated from the underlying dark-weathering beds of the Manetoe and Arnica Formations by the recessive interval occupied by the Headless Formation. A thickness of 360 feet was measured, comprising light grey to medium dark grey limestones—fine- to coarse-grained, and thick- to medium-bedded—forming resistant units separated by covered intervals. The beds are commonly veined with calcite and rarely altered to soft, medium-grained, fine-grained, calcareous dolomite.

The Nahanni Formation was examined on McConnell Range at the north end of Smith Ridge where a thickness of 310 feet was measured. It consists of dark to light brownish grey limestone—cryptocrystalline to fine-grained, thin to thickly bedded, and light-grey-weathering—occurring as resistant units separated by covered intervals. The upper beds are fossiliferous. The basal 40 feet of beds is partly brecciated. The Headless Formation was not recognized; these beds lie on dolomite and brecciated limestones included in the Bear Rock Formation.

In the Imperial Redstone No. 1 well (see Appendix) the Nahanni Formation was encountered in three fault slices. A drilling thickness of 150 feet in the uppermost slice consists of fine-grained and stromatoporoidal and coralliferous limestones.

Horn River Formation (Map-unit 22)

The Horn River Formation was examined on a tributary to Redstone River in Dahadinni River map-area. Some 725 feet of beds are provisionally assigned to the formation, of which the uppermost 230 feet comprises relatively resistant siltstones and sandstones. It has been possible to map the formation in the vicinity by reason of the presence of these resistant beds; in spite of the distinctive lithologic features of the formation, it was not mapped elsewhere because of insufficient ground control.

The lower 595 feet of the formation consists mainly of shale—platy to fissile, dark grey to black—interbedded in the upper 200 feet with hard, black, non-calcareous mudstone. It is calcareous in the lower 160 feet and interbedded in the basal 25 feet with argillaceous and arenaceous limestone—finally crystalline, black, and thinly bedded. Several beds weather rusty-brown and yellow sulphur staining occurs in the lower half. Selenite crystals are present between 25 and 100 feet above the base.

The upper 230 feet is interbedded silty shale and fine-grained, thinly bedded, platy siltstones and sandstones, rusty-brown-weathering.

Although no fossils were found the strata are lithologically similar to those referred to the Horn River Formation in adjacent map-areas (Douglas and A. W. Norris, 1960).

Upper Devonian

Fort Simpson Formation (Map-unit 23)

The Fort Simpson Formation is 1,950 feet thick where examined on a tributary to Redstone River. Most of the formation is fissile, soft, grey to black shale interbedded with siltstone and some sandstone. The siltstone is argillaceous, dark grey, finely laminated, platy to very thinly bedded and may have some interbedded finely laminated, fine-grained, grey sandstone. The siltstone and sandstone occur in greater proportion through 160 feet of strata lying 290 feet above the base; being more resistant to weathering they form low ridges and hills. No fossils were found in the Fort Simpson Formation.

Map-unit 24

Map-unit 24 is a resistant unit that forms most of the ridges and caps the highlands in plateaux of the region underlain by Upper Devonian strata. Fine-grained grey sandstone that is medium to thickly bedded and brownish-grey-weathering is characteristic, particularly of the lower part, and is interbedded with silty grey shale and grey micaceous, finely laminated siltstone. Map-unit 24 is 513 feet thick on the tributary to Redstone River.

Beds referred to map-unit 24 outcrop sparingly on Wrigley Plateau, and along Johnson and Mackenzie Rivers. Those on Johnson River are greenish grey calcareous sandstone that is dark reddish-brown-weathering; on Mackenzie River they are olive-grey platy shales and thin-bedded grey rubbly limestone. According to McLaren these occurrences contain faunas of Frasnian age.

No fossils were found in the map-unit on Redstone River, but the unit there is overlain by map-unit 26 which yielded fossils of Frasnian age from the lower beds. As shown on the map, map-unit 24 is essentially the resistant beds overlying the Fort Simpson shales and probably includes beds of different age (see Figure 2). In the region of Wrigley Plateau it is apparently equivalent to the sandstone of map-unit 22 of Camsell Bend and Root River map areas (Douglas and D.K. Norris, 1961) and hence map-units 19 and 21. In southwestern Camsell Bend map-area the uppermost sandstones are early Fammenian in age, whereas on Redstone River late Frasnian fossils occur as much as 1,000 feet above the sandstones. The sandstones may accordingly be diachronous or more probably, the boundary between the Frasnian and Fammenian stages may be an unconformity, 1,000 or more feet of younger beds being present beneath the

unconformity on Redstone River. A corollary to the latter supposition is a facies change in map-unit 21 of Camsell Bend map-area, the sandstones passing into shales and siltstones of map-unit 26 on Redstone River. This facies change was noted in Sibbeston Lake map-area (Douglas and D.K. Norris, 1960) where map-unit 27 of that area, which carries a Fammenian fauna in its uppermost beds, grades south and westward into shale. The equivalence of map-unit 19 of Camsell Bend map-area, if present in Sibbeston Lake area, may likewise be presumed to be replaced by shale or be bevelled by the pre-Fammenian unconformity.

Map-unit 25

On Wrigley Plateau isolated patches of limestone reef occur within gently folded strata of map-unit 24. Precise and relative stratigraphic positions are not known, and although they are all designated as map-unit 25, they may not necessarily be correlative with the reefs (map-unit 20) of the adjacent Camsell Bend map-area (Douglas and D.K. Norris, 1961). The southwesternmost reef, which occurs near the base of map-unit 24, consists of more than 40 feet of strongly biogenic and stromatoporoidal limestone—light grey and varying to brownish and yellowish grey, mainly medium-grained and massive-bedded. These beds are underlain by 40 feet of weathered flaggy sandstones, partly covered, and thence by 30 feet of stromatoporoidal limestone—partly biogenic, grey to pink, massive-bedded and partly porous. The central reef body was found to be about 45 feet thick and composed of massive limestone, almost entirely stromatoporoidal with coarse green pockets and bands of bioclastic material, underlain by fossiliferous sandy limestones and grey shales. The faunas from these reefs are considered by McLaren to be of Frasnian age.

The northeasternmost reef, mainly in Wrigley map-area, was not examined in the field. It is described by Paskavich (1954) as 65 feet of dark grey limestone—fine- to medium-grained and silty: top part, reefoid (biostromal?); lower part, thinly, poorly bedded and weathering creamy. Corals, stromatoporoids, crinoid stems are abundant. The bottom 15 feet is thinly and well bedded.

Map-unit 26

Upper Devonian strata lying above map-unit 24 consist mainly of recessive shales and siltstones with a few limestone beds. The succession, which totals 4,525 feet where measured in three partial sections along Redstone River, was found indivisible with available mapping control. Shale—flaky and fissile, varying to platy, dark grey to olive-grey, weathering light olive-grey to yellowish grey and creamy, in part slightly calcareous—is interbedded with dark grey siltstone—partly calcareous and argillaceous and varying to very fine

grained, grey, laminated sandstone. Some shale is brown above 1,400 feet and red between 2,850 and 3,000 feet above the base. Red shales also occur in the uppermost 300 feet, interbedded with purplish red siltstones and sandstones. At several horizons occur thin limestone beds composed mainly of crinoid and other fossil debris. The fossils collected between 730 and 1,000 feet above the base are of late Frasnian age and those above 2,063 feet are of early Fammenian age. The top of the Frasnian stage is at least 1,000 feet above the base and may be as high as 2,000 feet.

MESOZOIC

Cretaceous

Map-unit 27

Cretaceous rocks outcrop on the Dahadinni and Redstone Rivers and are assumed to underlie the plains of eastern Wrigley map-area. They are not exposed on the plains and are presumed to be similar to those of the adjoining plains regions (see Stott, 1960). The general distribution of Cretaceous rocks and of subdivisions of the Upper Devonian sequences indicate the presence of a strong angular unconformity separating the two systems. The unconformity is well exposed in the cut-banks along Redstone River near the north boundary of the map-area. There, shales referred to the Cretaceous are in contact with shales of the Fort Simpson Formation, the local relief being of the order of 10 to 15 feet. Some 15 miles upstream, that is to the south, the Fort Simpson Formation is overlain by about 5,000 feet of Upper Devonian strata. To the east, in Horn River map-area (Douglas and A.W. Norris, 1960) and to the north, along Bear River (see Hume, 1924), the Cretaceous overlies the Fort Simpson and Middle Devonian Formations. The presence of some post-Fort Simpson Upper Devonian beds in eastern Dahadinni map-area suggests that the pre-Cretaceous bevelling is not entirely regular.

On Redstone River more than 75 feet of strata rest unconformably on the Fort Simpson Formation. They consist of dark grey silty and micaceous shale succeeded by massive-bedded, coarse-grained, conglomeratic sandstone forming the core of a syncline. Stott (1960) refers the shale to pre-Fort St. John Group and the sandstone to the base of that group. Similar sandstone is present on Dahadinni River and is reported by Hume (1924) near Cloverleaf Lake. Above the sandstone on Redstone River and occurring in the core of the syncline are younger beds. Graphic measurements indicate the presence of about 1,000 feet of recessive beds, probably mainly shale, succeeded by 500 feet of more resistant beds, probably partly sandstones, in turn overlain by some 500 feet of recessive beds. Fine-grained, argillaceous sandstone and dark grey concretionary shale (thought by Stott, 1960, to be equivalent to the Sikanni sandstones) are exposed near the mouth of Dahadinni River; these may be equivalent to the resistant beds noted above.

STRUCTURAL GEOLOGY

The main structural elements within Wrigley and Dahadinni River map-areas trend north or a little west of north. In so far as practicable they will be treated systematically from east to west across the areas. In these areas, as in other parts of the southern Mackenzie and Franklin Mountains, the principal structural elements in decreasing order of abundance are the folds, north-trending faults and cross-faults. To a considerable degree this also appears to be their order of chronologic development and tectonic significance.

The major folds have a general north trend, a wave length of 10 to 20 miles, and may extend on the order of 100 miles. The major synclines are simple gentle folds with low amplitude at the structural levels observed. The major anticlines are commonly complex, with the axes divided into smaller segments linked elliptically or en échelon, or terminated by longitudinal thrusts or cross-faults. They vary considerably in amplitude and acuteness, some being low and broad. Others associated with longitudinal thrust faults may be acute and of high amplitude. The low folds are nearly symmetric. The others are asymmetric either eastward or westward depending to a large degree on the direction of displacement on the associated thrust faults.

The thrust faults break the flanks or crestal regions of the folds and most commonly produce stratigraphic omissions rather than repetitions. They are accordingly thought to have been produced at various stages in the development of the folds. Some appear to have components of strike-slip movement such as may have been produced in response to a couple acting in a horizontal surface rather than to simple east-west compression. Components of strike-slip movement and rotation appear to be present on the cross-faults against which many of the longitudinal thrust faults and folds terminate.

INTERIOR PLAINS

On Willow Ridge in Wrigley map-area the northern part of Willow Ridge anticline is exposed. This fold for the most part lies in Camsell Bend map-area to the south (Douglas and D.K. Norris, 1961). The anticline as evident within the Nahanni Formation is acute and attenuated in its northern part and within the map-area is offset right-hand en échelon to the northeast.

Little is known of the bedrock geology of the remaining part of the Interior Plains because of the widespread mantle of glacial debris. It is assumed, however, from the general characteristics of the Upper Devonian and Cretaceous rocks that their thickness is not very great and that they are probably only mildly deformed. Structures comparable to Willow Ridge anticline may be present farther north adjacent to McConnell Range, although no indications were noted.

FRANKLIN MOUNTAINS

Franklin Mountains include the part of McConnell and Camsell Ranges within Wrigley map-area.

The structure of McConnell Range is essentially a major north-trending anticline, asymmetric eastward, divided by cross structures in the vicinity of Ochre River and modified in the south by another fold on its east flank. The northern part is termed "Blackwater anticline", faulted in the crestal region and bounded on the east flank by Blackwater fault which extends the length of the range. Strata forming the broad west flank generally dip less than 20 degrees and exhibit linear zones of fractures; on some of these, small displacements have apparently occurred. Steeper dips, small folds and faults, and the northern extension of Camsell thrust complicate the western margin of the range. Strata on the east flank dip moderately to steeply east and are broken by several northeast- and southeast-trending cross-faults. Blackwater anticline appears to terminate, in the south, against Cap fault. In this vicinity the fold is broken by cross-faults with apparent transcurrent displacements, and the west flank is replaced by the southeast-trending transverse Ochre syncline. Bear Rock strata were the youngest observed in the syncline but beds of the Nahanni and Fort Simpson Formations are probably present in the part shown as unmapped.

The southern part of the fold is termed "Cap anticline". The crestal region is evident only on the south ridge of Cap Mountain; elsewhere the crest is broken by Cap fault. The west flank dips at moderate angles whereas strata of the east flank are steeply inclined to overturned adjacent to Blackwater fault. Cap fault is north-trending in the south but changes to a northwest trend where Proterozoic strata occupy the core of the fold and thence, with the formation of two splays, changes to a westerly trend and cuts rapidly up-section. It appears to end against or merge with Camsell thrust. The southern end of Cap anticline is complicated by a small cross-fold. The underlying Blackwater fault continues into Camsell Bend map-area (Douglas and D. K. Norris, 1961) and may pass into foot-wall strata of Camsell thrust. Cap anticline is joined elliptically on the east by Bell anticline which plunges north into the foot-wall of Blackwater fault, and to the south, in adjacent Camsell Bend map-area. Willow Ridge anticline, previously described, lies en échelon in the plains to the southeast.

Camsell Range lies mainly in Camsell Bend map-area and only the northern part falls within Wrigley area. It is underlain by Camsell thrust which extends beyond the limits of the range northward across Mackenzie River into the west flank of McConnell Range. The structure in northern Camsell Range is in part a west-dipping homoclinal succession in Middle Devonian and older rocks near the south boundary of the area; these are in contact with foot-wall strata of Upper Devonian age. Near the northern termination of the range and at Mount Gaudet the hanging-wall beds form prominent, generally

steeply-west-plunging folds, with the Camsell thrust appearing to cut indiscriminately across them.

MACKENZIE PLAIN

Beneath Wrigley Plateau, Upper Devonian rocks are folded into a group of right-hand en échelon elliptical folds. The axes of individual folds trend northwest, but the group as a whole trends northerly and lies between English Chief syncline on the west, and Camsell Range homocline and Wrigley and Johnson synclines on the east. The most prominent anticline is "Wrigley anticline". Within rocks of map-unit 24 and the Fort Simpson Formation, dips on the flanks of individual folds are commonly less than 10 degrees, rarely up to 20 degrees. The folds plunge northwesterly; younger Devonian rocks of map-unit 26 are present on Upper Johnson River and Cretaceous along Lower Dahadinni River. The folds may also be closed to the southeast where, along the west side of Wrigley River valley, the strata appear to dip southeasterly and to be separated by the southern extension of Wrigley syncline from the generally west-dipping strata forming the west flank of Camsell Range. This structure probably does not join directly with the very extensive Yohin syncline flanking Camsell Range in Camsell bend map-area (see Douglas and D.K. Norris, 1961).

Cretaceous rocks are exposed in the trough of the gently-north-plunging Johnson syncline on Lower Dahadinni River. The syncline is flanked to the west by Crescent Ridge anticline. Easterly dips in the basal Cretaceous sandstone and in beds of Upper Devonian map-unit 24 are evident. As westerly dips were not found it is possible that the anticline is faulted, if so the fault is probably an east-dipping thrust fault of small displacement. The structural relationship of Crescent Ridge anticline to the previously described folds of Wrigley Plateau is not known.

English Chief syncline is a north-trending linear structure extending north from Camsell Bend and Root River map-areas. Within Dahadinni River map-area it has little plunge, although 14 miles south of the map-area it ends within low Fort Simpson rocks and, in the vicinity of Dahadinni and Redstone Rivers, Cretaceous rocks are present. The western flank is marked by an extensive gently-east-dipping homocline in map-unit 24; this also forms the east flank of the compound anticline beneath Dahadinni Range, although separated from it by a fault.

MACKENZIE MOUNTAINS

Canyon Ranges

The structure of Dahadinni Range is complex but is essentially a north-trending anticline modified by bifurcation into the Silvan fold and several minor structures. The anticline plunges south at the south end of the Range and north at Mount Haywood. The eastern flank is faulted along most of its length with east-dipping beds usually present. The faults dip westward, and are termed the "North Dahadinni" and "South Dahadinni" faults. The South Dahadinni fault may extend north in the vicinity of Slim Lake to join with the North Dahadinni fault. North Dahadinni fault crosses from the east flank of the range into the interior and ends in the vicinity of a zone of northeast-trending transverse faults near the north end of Lyall fault. This is an east-dipping fault that breaks the west flank of Dahadinni anticline near the crest and, in the vicinity of Mount Lyall, changes on a small southeast-trending transverse fault to a west-dipping thrust fault that breaks the east flank of the anticline. At the south end of Dahadinni Range, South Dahadinni fault exhibits similar characteristics.

In northern Dahadinni Range a fault occurs in the crestal region of Dahadinni anticline, beneath which, and above North Dahadinni fault, the rocks of the east flank of the anticline are closely folded. Just north of the map-area North Dahadinni fault changes from its typical northern trend to a northwest trend following the northwest-striking rocks of the east flank of Middle Creek syncline.

Middle Creek syncline north of the map-area is tightly compressed, but along Redstone River it is broad and open. It appears to end against Silvan fault. This fault is an inferred feature that strikes northwesterly and is thought to terminate against North Dahadinni fault. Rocks of the Nahanni and Upper Devonian map-units lie structurally higher southwest of Silvan fault than northeast of it. There are also indications of pre-Cretaceous movement in this vicinity (see "Stratigraphy", map-unit 27).

Upper Devonian rocks underlie the region between Dahadinni Range and the Dusky and Redstone Ranges. The structure is relatively simple in the south. Iverson thrust terminates in the east flank of Trench Lake syncline with minor folds in the Nahanni Formation plunging north as these rocks pass beneath Upper Devonian strata. The west flank of Trench Lake syncline is truncated by a west-dipping fault bordering southern Dusky Range. In the northern part, however, the Upper Devonian rocks are thrown into a series of linked, right-hand, en échelon folds with Middle Devonian rocks being exposed in the core of the Moose Prairie anticline and along the southeastern part of Silvan anticline where that structure emerges with those of Dahadinni Range.

The structure of Dusky Range is essentially a large faulted anticline with en échelon elements appended to the northern and southern parts. The latter are terminations of structures extending from northern Whittaker Range of Root River map-area. The central anticline is broken in the crestal region by Dusky fault, a presumed west-dipping thrust fault with hanging-wall containing map-unit 7 and some Whittaker beds older than those in the foot-wall. The southern end of Dusky fault passes into Spirit fault which exhibits several splays and appears to have transcurrent movements in addition to vertical movements, as is evident from juxtaposition of the various formations. At its northern end, Dusky fault apparently emerges with transverse faults that connect it with an east-dipping thrust fault—the southern continuation of Redstone fault of Redstone Range.

Redstone Range is a faulted anticline of large amplitude; both flanks dip steeply to nearly vertical. The fold appears at the south end, plunging south with a series of associated minor folds. Redstone fault, an east-dipping thrust, passes from the east flank of the fold through the crestal region into the southwest flank and passes off the west border of the area. The fault trace exhibits sinuosities, but not all are thought to be produced by low dips of the fault plane. The northeast flank of Redstone range is also faulted, the trace occurring within Upper Devonian strata.

The broad valley between Redstone and Dusky Ranges and Rouge Range is underlain by Upper Devonian rocks which, although little exposed, appear to be mainly synclinal in structure and form Marten syncline. However, older rocks on its flanks exhibit small folds or dip very steeply.

The rocks of Rouge Range, the westernmost of the Canyon Ranges, form an anticline of high amplitude, faulted on its west flank and in the trough of the adjacent syncline by east-dipping thrust faults. The Camsell Formation of the west flank of the anticline is repeated, presumably by a west-dipping thrust. The crest of the fold near the west border of the map-area is broken by an east-dipping thrust which to the south connects with a small transverse fault and a west-dipping thrust on the east flank of the fold.

Backbone Ranges

The southwest corner of Dahadinni River map-area includes a small part of Backbone Ranges—the northern Painted Mountains. There, the strata are nearly flat, dipping gently eastward, and are broken by Amber fault. This is a southeast-trending fault on which the rocks of the southwest side lie relatively higher structurally, and which at the border with adjacent Root River map-area (Douglas and D.K. Norris, 1961) passes into the crestal region of Amber anticline.

ECONOMIC GEOLOGY

OIL AND GAS

The bedrock beneath the part of Interior Plains included in Wrigley map-area is not exposed. It is thought to consist of a thin veneer of Cretaceous rocks unconformably overlying the Upper Devonian Fort Simpson Formation. The stratigraphic succession of the older Palaeozoic rocks is probably comparable to that exposed in McConnell Range and in the northern part of Horn River map-area (Douglas and A.W. Norris, 1960). Prospective reservoir rocks are the Middle Devonian limestones of the Nahanni Formation and its possible equivalent, map-unit 13 of Horn River map-area. Limestone reefs, such as map-unit 15 of Horn River map-area, may occur near the top of the Horn River Formation. Beneath the evaporites of map-unit 12 and the Bear Rock Formation, the dolomites of the Mount Kindle Formation and the probable equivalent, map-unit 10 of the Horn River map-area, may be expected to be present. The Mount Kindle includes some massive coralliferous, finely porous and vuggy beds near the base, and the dolomites of map-unit 10 are massive bedded and minutely vuggy. Porous sands at the base of the Palaeozoic succession may be present. Strata beneath the Interior Plains are probably mainly flat-lying but adjacent to McConnell Range may have structures comparable to that of Willow Ridge anticline, whose northern part extends into Wrigley map-area from Camsell Bend map-area to the south (Douglas and D.K. Norris, 1961).

No wells have been drilled within the map-areas but Imperial Redstone No. 1 (see Appendix) is located near Mackenzie River some 10 miles north of Dahadinni River map-area. Situated on Mackenzie Plain about midway between McConnell and Dahadinni Ranges, this well penetrated Cretaceous and Upper Devonian rocks and older strata equivalent to that exposed on the adjacent ranges. It accordingly yields significant data on the distribution of these formations beneath Mackenzie Plain.

Mackenzie Plain is underlain by Upper Devonian strata and, near the north boundary of Dahadinni River map-area, by Lower Cretaceous sediments. These strata are gently folded, the most prominent anticlines occurring as an en échelon belt through Wrigley Plateau (see "Structural Geology"). To the west lies the broad English Chief syncline, whose west flank forms a homocline adjacent to the anticlinal structure of Dahadinni Range. The bedrock in the vicinity of the valley of Mackenzie River is largely obscured; the structure shown may be over-simplified.

Upper Devonian limestone reefs (map-unit 25) outcrop in Wrigley Plateau. The distribution of these reefs and those in adjacent map-areas to the south suggests a northwesterly trend. The possibility exists that reefs of this type are present at relatively shallow depths beneath the cover of younger Upper Devonian and

Cretaceous rocks in the northern Dahadinni map-area and the region beyond the north boundary. In these regions the sandstones of map-unit 24 may also be considered as potential reservoirs.

The Middle Devonian Nahanni Formation occurs in McConnell, Camsell and Dahadinni Ranges and was penetrated in the Redstone well. It probably underlies Mackenzie Plain, varying in thickness from 150 to 400 feet. Where examined, the limestones of the formation were not found porous, but vary in biogenic content and may be considered potential reservoirs. The underlying Manetoe Formation is present on Camsell Range and is thought to be represented by the uppermost part of the Bear Rock Formation on McConnell Range and by the Funeral Formation on Dahadinni Range. In the Redstone well, rocks of Manetoe facies overlie rocks of the Bear Rock Formation. The Manetoe Formation may accordingly extend beneath a part of Mackenzie Plain northward from Camsell Range toward the well and grade westward into Funeral shales short of Dahadinni Range. The facies boundary between the breccias of the Bear Rock Formation and the dolomites of the Arnica Formation crosses Mackenzie Plain from (approximately) Roche-qui-Trempe-à-l'Eau to central Dahadinni Range. The Arnica dolomites are in part finely porous. The Bear Rock includes much anhydrite in the Imperial Redstone well north of the area.

Beneath the unconformity at the base of the Bear Rock and Arnica Formations (see "Stratigraphy") the older formations may be expected to be progressively bevelled from west to east beneath Mackenzie Plain. The Camsell Formation is thought to underlie the Arnica on Dahadinni Range and the Mount Kindle Formation on McConnell Range, the intervening Delorme Formation being truncated beneath Mackenzie Plain. The stratigraphic position of map-unit 12 of Camsell Range is not established; these beds may be Delorme Formation or upper Mount Kindle. The strata of the Delorme Formation are mainly dense limestones or fine-grained silty dolomites. Some dolomites are however, finely porous. The Mount Kindle Formation as noted above and the middle part of the Whittaker Formation of Mackenzie Mountains, which include its stratigraphic equivalent, contain porous dolomites. Strata lower in the Palaeozoic are known best on McConnell Range. These are a succession of dense dolomites of the Franklin Mountain Formation, the evaporites of the Saline River Formation and the shale of the Mount Cap Formation, beneath which occur the sandstones of the Mount Clark Formation unconformably overlying rocks referred to the Proterozoic.

HEMATITE

The occurrences of hematite beds in the vicinity of Cap Mountain was reported by Kindle (1920). His stratigraphic section which was repeated by Williams (1923) indicates the presence of 120 feet of ferruginous beds immediately underlying 500 feet of sandstone

and underlain by 375 feet of dark shales. The sandstone is with little doubt that assigned to the Mount Clark Formation as restricted in this report. The dark shales are with less certainty those of the Lone Land Formation and if so the ferruginous beds seen by Kindle would be those at the top of the Lone Land,now partly covered. However the exact location of the section seen by Kindle is not known. If it was near the southern end of Cap Mountain the beds beneath the Mount Clark Formation might lie as low as map-unit 2 because of the bevelling of strata in that direction at unconformities beneath the Mount Clark and Lone Land Formations.

The Lone Land and map-units 1 to 3 of probable Proterozoic age, constitute a red-bed sequence of shales, siltstones and sandstones. Hematite is a constituent of many beds, mainly in minor amounts imparting red colours to the rocks. Thin sections were taken of those which appeared to be richer in hematite. Those samples taken from the top of the Lone Land Formation show very fine grained hematite dust and specks disseminated through silty shale or concentrated along fine laminae, 1 mm thick. Some occurs in thin veins. In samples from the middle part of map-unit 2, hematite forms part of the matrix of siltstones and fine-grained sandstones or is disseminated as flecks in silty shale. In none of the samples does hematite exceed 10 per cent.

Map-unit 2 extends for about 6 miles along the north-eastern side of Cap Mountain, the strata dipping about 30 to 40 degrees southwest into the slope. The uppermost beds of the Lone Land Formation are of little extent as the formation is entirely bevelled at the south and north ends of Cap Mountain beneath the Mount Clark Formation. Beds higher stratigraphically than those seen may be present in gullies on the west side of Cap Mountain or beneath the capping of sandstone as the Lone Land dips more steeply than the Mount Clark.

- APPENDIX -

Log of Imperial Redstone No. 1 Well

Location:

Elevation:

Summary of descriptions of samples stored at the Geological Survey of Canada, Calgary, Alberta, and at Ottawa, Ontario, by H. R. Belyea and R. J. W. Douglas respectively.

Depth (feet)	Lithology
0 - 30	Drift
	Cretaceous[1]
30 - 170	Shale, silty, grey, and minor sandstone, very-fine-grained, grey, argillaceous, micaceous
170 - 230	Sandstone, coarse-grained, light grey
230 - 470	Sandstone, fine-grained, grey, argillaceous, and shale, dark grey
470 - 540	Sandstone, coarse-grained, grey
	Imperial Formation[2]
540 - 1,390	Shale, dark grey, platy to hard, silty, micaceous; minor sandstone, light brown, fine-grained
1,390 - 1,600	Shale, light grey and dark grey, carbonaceous
1,600 - 1,710	Sandstone, fine- to medium-grained, light brownish grey, laminated and crossbedded; with clay pebbles at 1,710 feet, possibly cavings
1,710 - 1,770	Shale, grey to dark grey
	Canol Formation[2]
1,770 - 2,020	Shale, hard, dark grey to black, with dark brown streak; pyrite at 1,790 and at 1,990 to 2,010 feet.

Hare Indian Formation[2]

2,020 - 2,590	Shale, grey, greenish grey to dark grey, calcareous, splintery; some dark grey to black at 2,550 to 2,590 feet
2,590 - 2,630	Shale, black with dark brown streak; shale as above; pyrite

Nahanni Formation

2,630 - 2,780	Limestone, brown, very-fine-grained; fragments of stromatoporoids and corals at 2,670 to 2,740 feet

Headless Formation

2,780 - 2,970	Limestone, light brownish grey, aphanitic, pyritic, and shale, light grey, calcareous

Manetoe Formation

2,970 - 3,000	Dolomite, light grey, very coarsely crystalline, intergranular porosity
3,000 -	Fault[3]

Nahanni Formation

3,000 - 3,170	Limestone, brown, very-fine-grained; calcite and dolomite veins

Headless Formation

3,170 - 3,330	Limestone, light grey, very-fine-grained, argillaceous, and shale, dark brownish grey
3,330 -	Fault[3]

Nahanni Formation

3,330 - 3,380	Limestone, light brown, fine- to medium-grained, stromatoporoidal

	Headless Formation
3,380 - 3,510	Limestone, light grey, very-fine-grained, argillaceous, and shale, grey
	Manetoe Formation
3,510 - 3,530	Dolomite, light grey, very coarsely crystalline, intergranular porosity
	Bear Rock Formation
3,530 - 4,350	Dolomite, dark brown, finely crystalline, grey to dense to finely porous; anhydrite; limestone, brown, fine-grained, granular, fossil remains; fracturing evident in cores
4,350 - 4,500	Anhydrite, light brown to white; limestone, brown, fine-grained, granular
	Mount Kindle Formation
4,500 - 4,870	Limestone, brown, finely crystalline, dense; minor anhydrite; dolomite, brown, finely crystalline, porous

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[1]Undivided Cretaceous, probably equivalent to lower map-unit 28.

[2]Formational nomenclature in use in Norman Wells region to the north, not otherwise described in this report (see Bassett, 1961).

[3]Structural interpretation dependent on formational designations and normal succession.

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