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MIDDLE DEVONIAN STRATIGRAPHY

OF THE

SOUTH NAHANNI AREA

NORTHWEST TERRITORIES

by

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MIDDLE DEVONIAN STRATIGRAPHY

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SOUTH NAHANNI RIVER AREA, NORTHWEST TERRITORIES

INTRODUCTION

In the early part of June, 1961 geologists of Texaco Exploration Company carried out geological investigations in the South Nahanni River area of the southern Northwest Territories. The camp for the operation was established at the mouth of Prairie Creek on the South Nahanni River approximately 50 miles upstream from Nahanni Butte, (see Fig. 1).

The purpose of the investigation in the South Nahanni region was to study the facies relationships of the Middle Devonian sequence with regard to their economic significance. The work of Douglas and Norris (1960) provided an excellent background for the study. The information gained from this investigation will be useful in forming an interpretation of the Middle Devonian rocks underlying Texaco Permits 1004 and 1005 to the south.

The localities examined during the course of the study were denoted by a coded name and letter, derived from a nearby topographic feature. The location of these field observations are shown on the accompanying topographic map of the Virginia Falls area.

Transportation, Communication and Supply

The fuel, food supplies, camp equipment and personnel were moved to Nahanni Butte by boat and barge from Fort Nelson, B. C. during the latter part of May. A smaller tug-boat was used to transport the fuel up the South Nahanni River to the Prairie Creek campsite. The camp gear and personnel were flown in from Nahanni Butte by a "Beaver" float

FIG. 1

AREA OF OPERATIONS
&
TEXACO ACREAGE

0 50 100
MILES

135° 130° 125° 120° 115°

60°

WRIGLEY

SOUTH NAHANNI RIVER

MACKENZIE RIVER

AREA OF OPERATION

BASE CAMP

YUKON

NORTHWEST TERRITORIES

FT. SIMPSON

LIARD RIVER

NAHANNI BUTTE

HAY RIVER

ALASKA

TEXACO PERMITS
1004 & 1005

HIGHWAY

LIARD R.

FT. NELSON RIVER

MACKENZIE HIGHWAY

BRITISH COLUMBIA

ALBERTA

FORT NELSON

60°

130° 125° 120°

plane. A Bell 47-G-2 helicopter was used for transportation while doing the actual field work.

The "Beaver" and helicopter were equipped with two-way radios. A battery powered, transistorized short wave receiver was monitered in the base camp during the day in case of emergency calls from the helicopter.

Personnel and Acknowledgments

The geologists on the party were D. R. Yont and P. W. Hay. The boat and barge were owned and operated by R. Turner of South Nahanni. Aircraft personnel consisted of P. Peterson and N. Silvers, pilots, and H. Eskelson, engineer.

All concerned cooperated loyally in the interest of a successful operation.

Previous Geological Work

The earliest geological investigation in the region was a reconnaissance study of the exposures along the South Nahanni River by Kingston in 1951.

Patton (1958) studied the Carboniferous succession in the area in 1953.

The Geological Survey of Canada carried out extensive geological work in the South Nahanni River area during Operation Mackenzie in 1957. The results of this investigation are published in a series of reports by various officers of the Survey.

Texaco Exploration Company geologists carried out a stratigraphic reconnaissance of the same region during the summer of 1957 under the direction of J. Lowther.

Physiography

The area of study lies mainly within the southern extension of the Mackenzie Mountains. The western part of the area is entirely mountainous with prominent north-south trending ridges reaching elevations in excess of 5000 feet. The Nahanni Plateau, an area of nearly flat lying rocks deeply disected by east-flowing streams, occupies the eastern portion of the region.

The main drainage system in the region is that of the South Nahanni River which flows southeasterly and joins the Liard River at Nahanni Butte. In the mountainous area, the South Nahanni River flows swiftly through several narrow, steep-walled canyons and over the spectacular Virginia Falls. The stream is navigable, with some difficulty, during periods of high water as far upstream as Virginia Falls.

GEOLOGY

The geology of the South Nahanni area is relatively complex due to several facies changes and unconformable relationships involved, particularly in the Paleozoic succession. North trending thrust faults, faulted folds and broad elongate uplifts and depressions further complicate the geological picture. The major stratigraphic and structural relationships of the area are discussed by Douglas and Norris (1960).

Middle Devonian Stratigraphy

The 1961 summer's operations in the South Nahanni area were concerned primarily with a study of the Middle Devonian succession. Douglas and Norris (1960) have divided the Middle Devonian rocks of this region into six main stratigraphic units (Map Units 16-22) as shown in

Figure 2.

Approximate Stratigraphic Relationships of Middle Devonian and Older Map-units

	Liard Plateau	Vicinity of Virginia Falls	Northern Funeral Range	Nahanni Plateau	Nahanni Range
Upper Devonian	(29)	(29)	(29)	Simpson (23)	Simpson (23)
Middle Devonian	(20)	(22)	Nahanni (22)	Nahanni (22)	Nahanni (22)
		(21)	(21)	(21)	(21)
		(17) (18)	(17)	(17) (18)	(18) (19)
		(16)	(16)	(16)	(16)
	(15)			(14) (13) (12) (11)	
		(5)	(9)	(6)	(10)
		(3)	(8)		(4)
Ordovician	(1) or (7)	Sunblood (1)	(7)		(2)

Fig. 2. A brief account of the thickness and lithology of each of these units is presented below.

Map Unit 16 (495 to 2630 Feet)

Map Unit 16 rests unconformably on the older Paleozoics. It consists of fine grained, black to banded dark and medium grey dolomite.

Map Unit 17 (2550 Feet)

Map Unit 17 is a facies equivalent of Map Unit 16 and of the overlying Map Unit 18. It consists of argillaceous, thinly bedded limestone, and dark grey shale.

Map Unit 18 (310 to 540 Feet)

Map Unit 18 rests conformably on Map Unit 16 and grades laterally into the limestones of the upper part of Map Unit 17. It consists of coarsely recrystallized, massive bedded dolomite.

Map Unit 19 (500± Feet)

Map Unit 19 is an equivalent of Map Unit 18. It consists of massive, cryptograined limestone.

Map Unit 21 (85 to 980 Feet)

Map Unit 21 overlies conformably Map Units 17 to 19. It consists of dark grey, calcareous shale and argillaceous limestone. In regions where Map Unit 21 cannot be separated from Map Unit 16, the combined rocks are mapped as Map Unit 20.

Map Unit 22 Nahanni Formation (310 to 830 Feet)

The Nahanni formation rests conformably on Map Unit 21. It consists of bioclastic, thick bedded limestone and calcareous shale. The Nahanni formation is overlain by the basal dark grey, pyritic shales of the Simpson formation.

LITHOLOGIC DESCRIPTIONS OF FIELD OBSERVATIONS

A total of thirteen separate localities were examined in six general areas during the course of the study. A lithologic description of the Middle Devonian map unit examined at each of these localities is presented below.

In some instances changes in the stratigraphic interpretation of Douglas and Norris (1960) were made. The reason for the revised interpretation accompanies the lithologic description in these cases.

Meilleur Creek Area

MEI - A (Map Unit 16)

Dolomite, medium to light gray, weathers medium gray to mottled gray, medium to coarsely crystalline, thick to massive bedded. Secondary calcite and quartz mineralization common. Upper part of exposure contains numerous crinoids. Resistant weathering, forming steep cliffs.

MEI - B (Map Unit 21)

Limestone, argillaceous, dark gray, weathers yellowish to medium gray, very fine grained, thin bedded, recessive weathering.

MEI - C (Map Unit 17)

Limestone, argillaceous, dark gray, weathers yellowish gray, very fine grained, platy, recessive weathering. This recessive weathering unit is overlain by a more resistant weathering medium gray limestone containing occasional brachiopods.

MEI - D (Map Unit 16)

Dolomite, light gray, weathers medium gray, medium to coarsely crystalline, thick to massive bedded, brecciated in part. This dolomite

is overlain by 150 - 200 feet of argillaceous limestones similar to those described at MEI - B.

Prairie Creek Area

PRA - A (Map Unit 17)

Limestone, argillaceous, dark gray, weathers yellowish gray, very fine grained, platy, recessive weathering. This limestone is underlain by gray weathering dolomite containing numerous crinoids.

PRA - B (Map Unit 16)

Dolomite, light gray weathers medium light gray, fine to medium crystalline, thick to massive bedded, fossiliferous with crinoids and tabulate corals.

PRA - C (Map Unit 19)

Limestone, dark gray weathers medium to light gray, fine grained, medium to thick bedded. Occasional interbeds of mottled gray weathering dolomite. Secondary veinlets of calcite and quartz show copper mineralization as evidenced by the presence of Azurite and Malachite. A few poorly preserved corals were observed in the uppermost beds of this exposure.

This exposure is shown as Map Unit 18 on the Geological Survey's Virginia Falls map sheet. Since limestone is the predominant lithology, the unit is better denoted by the equivalent Map Unit 19.

PRA - D (Map Unit 19)

Limestone with dolomite interbeds similar to the exposures at PRA - C. The dolomite interbeds are not as common as at PRA - C. This exposure is shown as Map Unit 17 on the Geological Survey's Virginia Falls map sheet. Since limestone is the predominant lithology and no

shale is present it is better denoted by the equivalent Map Unit 19.

PRA - E (Map Unit 19)

Limestone, medium dark gray weathers medium gray, fine grained, medium to thick bedded, fossiliferous with brachiopods, trilobites, gastropods, and stromatoporoids. Stringers of coarsely crystalline light gray weathering dolomite occur in the unit. This exposure is shown as Map Unit 18 on the Geological Survey's Virginia Falls map sheet. Since limestone is the predominant lithology the unit is better denoted by the equivalent Map Unit 19.

South Nahanni River - Second Canyon

NAH - A (Map Unit 16)

Dolomite, light gray weathers light to medium mottled gray, medium to coarsely crystalline, massive bedded, vuggy in part. Secondary quartz and calcite mineralization common.

Manetoe Range

MAN - A (Map Unit 18)

Dolomite, light gray weathers mottled light gray, coarsely crystalline, massive bedded. The dolomite weathers very resistantly, forming a series of spires along the strike of Manetoe Range.

Cathedral Mountain Area

CAT - A (Map Unit 19)

Limestone, medium dark gray, weathers light gray, medium to coarsely crystalline, massive bedded, contains abundant crinoidal debris. Fluorite crystals up to one inch across occur in large segregations of secondary mineralization.

This exposure is shown as Map Unit 18 on the Geological Survey's Virginia Falls map sheet. Since limestone is the predominant lithology

the unit is better denoted by the equivalent Map Unit 19.

Sombre Mountains Area

SOM - A (Map Unit 18)

Dolomite, white to light gray weathers medium light gray, medium to coarsely crystalline, massive bedded, vuggy in part with secondary infillings of quartz and calcite.

CONCLUSIONS

The Middle Devonian succession because of its numerous facies variations appears to be of great economic importance. The facies change from predominantly carbonates represented by Map Units 16, 18, 19 and 22 to the basinal shales of Map Units 17 and 20 is of particular interest. The presence of excellent reservoir and source rocks, associated with this facies change, should provide the necessary stratigraphic conditions for the accumulation of significant amounts of hydrocarbons.

South of the area of investigation the Middle Devonian is no longer exposed at the surface, because of the thick cover of younger sediments. The facies relationships observed in the South Nahanni area thus provide the closest surface evidence available for an interpretation of the Middle Devonian rocks underlying Texaco's Permits 1004 and 1005.

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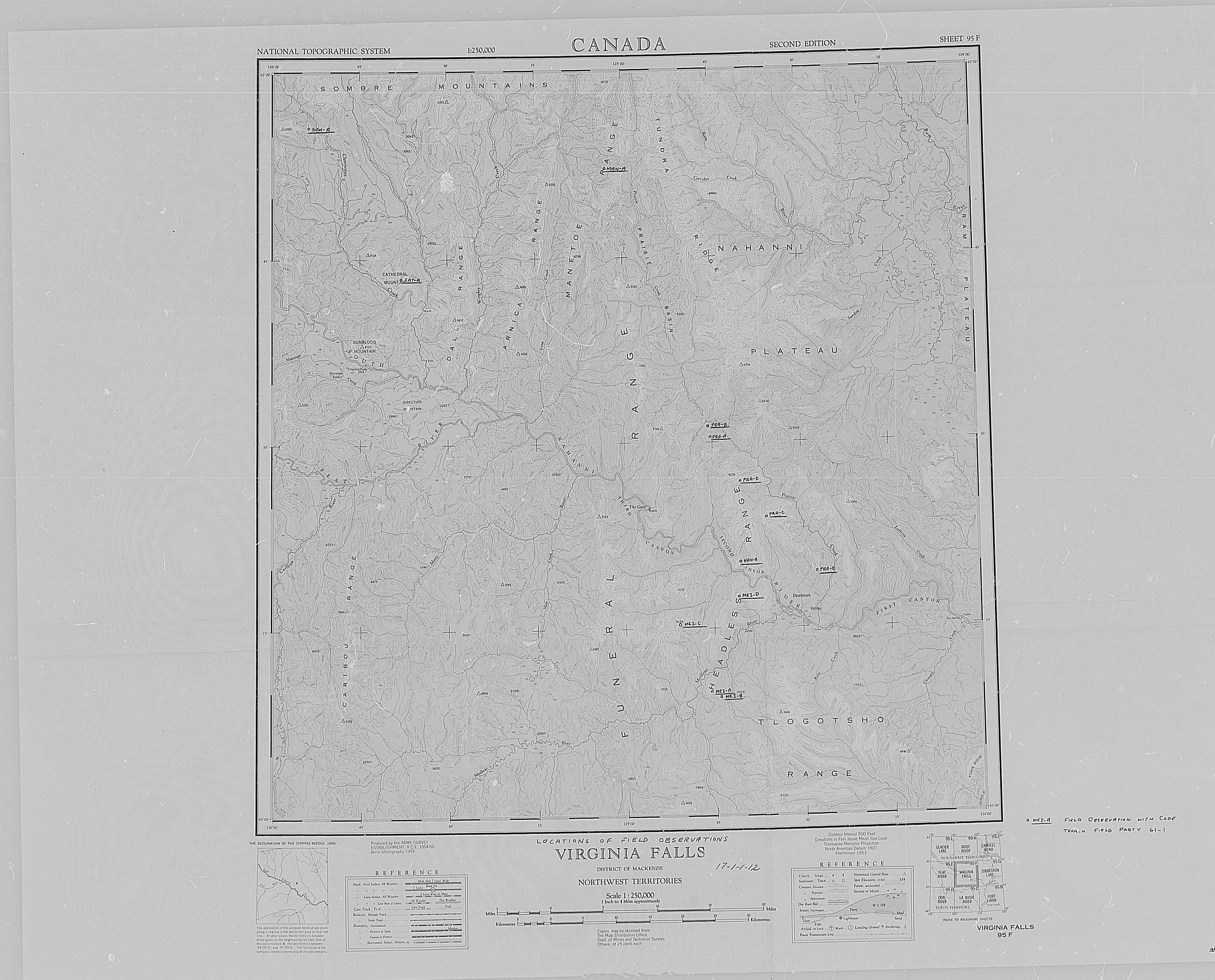

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