GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

PRELIMINARY SERIES

105-I

LEGEND

CENOZOIC

PLEISTOCENE AND RECENT

20 Unconsolidated glacial and alluvial deposits

MESOZOIC

CRETACEOUS

19 Medium-grained biotite, biotite-hornblende and hornblende-quartz monzonite, granodiorite and minor granite; commonly porphyritic; 19a, biotite-bearing hornblende granite; 19b, quartz latite porphyry

PALAEOZOIC

DEVONIAN AND (?) MISSISSIPPIAN

18 Black shale and argillite, in part light grey-weathering, minor brown sandstone, siltstone and light to dark grey-weathering banded chert; 18a, dark grey to brown chert pebble conglomerate, chert sandstone and siltstone; 18b, undivided 18, 18a and minor 10

MIDDLE DEVONIAN

17 NAHANNI FORMATION: resistant, fine- to medium-grained light grey-weathering limestone; 17a, fine- to coarse-grained light grey limestone, in part bioclastic and dolomitic; correlation uncertain

16 HEADLESS FORMATION: buff-brown-weathering argillaceous and silty fine-grained limestone, platy to thin-bedded; minor calcareous shale and resistant light grey-weathering massive limestone; 16a, probably includes Funeral Formation; 16b, resistant light grey-to white-weathering crinoidal limestone and grey dolomite, massive and thick bedded

15 Dark grey-to black-weathering very fine- to crypto-grained platy limestone; in part flaggy and thin-bedded; minor black chert; rouge hematite-rich bands and laminations common; 15a, includes much light and medium grey dolomite, mainly correlative with the Arnica and Landry Formations but includes rocks as old as Upper Ordovician

14 LANDRY FORMATION: light silvery grey-weathering fine-grained dark grey limestone, thin- to thick-bedded; in part crinoidal and massive

13 ARNICA FORMATION: dark grey, well-bedded dolomite; in part interbedded light and dark grey

LOWER DEVONIAN

12 SOMBRE FORMATION: light and medium grey banded dolomite; 12a, dark grey dolomite

SILURIAN AND DEVONIAN

11 DELORME FORMATION: buff, orange, light grey-weathering dolomite and limestone

ORDOVICIAN AND SILURIAN

UPPER ORDOVICIAN AND SILURIAN

10 Black graptolitic shale, dark grey to black, fissile to flaggy, argillaceous limestone; minor black chert, cherty argillite and dolomite

MIDDLE ORDOVICIAN TO SILURIAN

9 Light and medium grey, thick-bedded, medium-grained dolomite and massive, light to medium grey-weathering, dark grey, fine-grained limestone, in part argillaceous, silty and dolomitic, platy and buff- or pink-weathering; 9a, mainly limestone

CAMBRIAN AND (?) ORDOVICIAN

8 Undifferentiated units 4, 5, 6 and 7; 8a, mainly 6 or 7; 8b, mainly 4 or 5

UPPER CAMBRIAN AND (?) ORDOVICIAN

7 Irregularly banded blue-grey-weathering, dark grey, fine-grained limestone; buff- to orange-weathering dolomitic siltstone; minor flaggy and thin-bedded orange-weathering silty dolomite; locally includes sandy dolomite and quartzite at base; 7a, red, orange, and brown-weathering sandstone, sandy dolomite and quartzite locally includes 7; 7b, correlation uncertain, possibly includes 6

CAMBRIAN

MIDDLE CAMBRIAN

6 Grey and brown siltstone, limestone and orange-weathering silty dolomite; platy to thin-bedded; 6a, possibly includes 7

LOWER AND (?) MIDDLE CAMBRIAN

5 Brown- to orange-weathering thin-bedded quartzite, siltstone dolomite and shale; minor green and purple, probably tuffaceous shale and argillite in upper part; 5a, undivided 4 and 5; 5b, bright yellow- and orange-weathering silty and sandy dolomite; 5c, buff-weathering dolomite, silty and sandy dolomite, minor sandstone and shale

LOWER CAMBRIAN

4 Light grey- to buff-weathering, massive dolomite, interbedded buff and orange-weathering dolomitic siltstone and grey silty limestone; 4a, "swiss-cheese" limestone; 4b, in part equivalent to 5

CAMBRIAN AND EARLIER

3 Brown weathering, grey to green interbedded siltstone, fine-grained quartzite and slate; 3a, buff-weathering light grey dolomite

2 Brown to red-brown-weathering vari-coloured slates and phyllites; minor siltstone and fine-grained quartzite; in part equivalent to 3

1 Grey- and buff-weathering gritty feldspathic quartzite, quartz and feldspar pebble conglomerate, sandstone, grey, green and maroon shale and phyllite; minor limestone; 1a, mainly grey and green shale and phyllite

Geological boundary (defined, approximate, assumed)

Bedding, tops known (horizontal, inclined, vertical)

Bedding, tops unknown (inclined)

Bedding (estimated attitudes, may include foliation; dip: g, gentle; m, medium; s, steep)

Foliation (inclined, vertical)

Lineation (inclined)

Fault (defined, approximate, assumed)

Anticline (defined, approximate; arrow indicates plunge)

Syncline (defined, approximate; arrow indicates plunge)

Glacial striae (direction of ice movement known, unknown)

Fossil locality (F)

Mineral prospect or occurrence ×W

Location of measured section

MINERALS

Arsenic . . . . . As Tungsten . . . . W
Copper . . . . . Cu Zinc . . . . . Zn
Gold . . . . . Au

Geology by L. H. Green and J. A. Roddick, 1960, S. L. Blusson, 1962, 1966

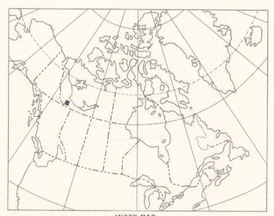
Geological cartography by the Geological Survey of Canada, 1967

Base-map prepared by the Army Survey Establishment, R. C. E., 1949–1954 with minor revisions by the Geological Survey of Canada, 1961

Magnetic declination 1967 varies from 34° 27' easterly at centre of west edge to 34° 36' easterly at centre of east edge. Mean annual change, decreasing 5.4'

Elevations in feet above mean sea-level

Published 1968
Copies of this map may be obtained from the Director, Geological Survey of Canada, Ottawa



MAP 8-1967
(SUPERSEDES PART OF MAP 14-1961)

GEOLOGY

NAHANNI

DISTRICT OF MACKENZIE AND YUKON TERRITORY

Scale 1:253,440
1 inch to 4 miles

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres

Printed by the Surveys and Mapping Branch

DESCRIPTIVE NOTES

Access to the southeast corner of the area is provided by a 200 mile, all-weather gravel road linking Watson Lake on the Alaska Highway with Canada Tungsten mine, and lakes suitable for float-equipped light aircraft at the head of Flat River valley.

The area has been extensively glaciated to at least 6,500 feet elevation. During one stage of glaciation an ice centre probably formed in the western part of the area, mostly southwest of the drainage divide, away from which ice at the higher levels moved to the northeast, west and southwest. At lower levels ice principally followed the present stream drainage.

Two broad divisions of unit 1 are recognized; a lower heterogeneous succession of argillaceous to pebbly rocks at least 9,000 feet thick and an upper persistent argillaceous sequence of dominantly maroon and green shale totalling perhaps 3,000 feet. Where best exposed in the vicinity of Mount Pike the lower division consists about equally of calcareous, gritty, feldspathic sandstone ranging to pebble conglomerate and greenish grey commonly silty argillite and slate. These rocks form separate members as much as 1,000 feet thick or are interbedded in varying proportions. Rarely they include thin beds of dark grey, fine-grained, impure limestone. Lowermost exposed strata, totalling almost 3,000 feet, consist of medium- to thick-bedded, coarse, gritty, feldspathic sandstones with thin interbeds of fine-grained sandstone and siltstone.

Owing to complex structure and lack of stratigraphic divisions, the thickness of unit 2 is uncertain but is a minimum of 8,000 feet in the southeast corner of the map-area. The unit consists dominantly of brown to red-brown-weathering, grey, greenish, and brownish grey slates and phyllite but becomes progressively richer in siltstone and fine-grained quartzite northeast of Flat River and near South Nahanni River probably passes laterally into unit 3.

Unit 3 is best exposed in an open anticline northeast of South Nahanni River where it consists of about 4,000 feet of red-brown-weathering interbedded siltstone, fine-grained quartzite and slate underlain by several hundred feet of buff-weathering massive dolomite (3a) exposed in the core of the anticline. Unit 3 is unfossiliferous but is conformable with overlying silty carbonates of Early Cambrian age.

Unit 4 is divisible into two lower silty carbonate members and an upper member of coarsely crystalline buff-weathering dolomite totalling about 700 feet. The descriptive term "swiss-cheese" has been informally applied to the lowermost division by Green and Roddick (1961)[1] on account of the distinctive weathered appearance which is produced by solution of discontinuous limestone layers, lenses and pods from within massive, more resistant siltstone. This member grades upward through a more regularly bedded transitional unit at least 200 feet thick into an upper member of massive grey to pinkish buff-weathering crystalline dolomite. Early Cambrian trilobites were found in the lowermost beds.

Unit 5 is an extremely varied thin-bedded sequence of brownish and orangish brown-weathering arenaceous, dolomitic, and argillaceous rocks. The lower part consists predominantly of thick- to thin-bedded quartzite, silty dolomite and dolomitic sandstone with minor dolomite and fossiliferous silty shale. The upper part is largely thin-bedded to laminated purple siltstone, silty argillite, green and brown, possibly tuffaceous, silty argillite and purple shale. Features indicative of shallow water deposition, such as mud-cracks, ripple-marks, crossbedding, and abrupt local facies changes are abundant. The top is marked by a conspicuous member of bright buff-orange and yellow-weathering, finely crystalline, in part silty, dolomite. Olenellus gilberti, present in the lower beds, indicates an Early Cambrian age for at least the greater part of unit 5.

Unit 6 is mainly thin-bedded to platy and recessive-weathering silty carbonate with some resistant limestone beds in the middle and upper parts. Rhythmic layering of limestones and silty dolomites is typically irregular and undulatory. Numerous fossil collections throughout the unit have been assigned to one Late Middle Cambrian zone, that of the Bathyuriscus-Elrathina fauna. As three major faunas representing the lower half of Middle Cambrian time are missing between this zone and that of Olenellus in unit 5, a disconformity is suspected beneath unit 6.

Throughout much of South Nahanni anticline unit 7 contains a basal red-bed sequence(7a), as much as 500 feet thick that unconformably overlies unit 6 and in large part probably represents recycled Lower Cambrian arenites. The unconformity is markedly angular near the anticline but farther north becomes disconformable and the basal sandstone is much thinner, uncoloured and locally absent. Fossils collected in the adjoining map-area to the east date the unconformity as pre-Franconian.

Unit 9 consists mainly of uniform, generally light grey-weathering thick-bedded, light and dark grey dolomite, but includes abundant, thinner-bedded commonly impure limestone in the northeast part of the area. Oolitic and pisolitic beds are common in the lower part and minor sandy dolomite, dolomitic bioclastic limestone and locally quartzite occurs near the base. Nodules and irregular, discontinuous bands of black chert are fairly common in dark grey dolomite beds within the middle part of the unit. At least 2,600 feet of strata are present on the southwest limb of Nahanni anticline and as much as 5,000 feet on the northeast limb. Unit 9 is mainly equivalent to the Sunblood Formation described previously in adjacent regions to the east[2, 3] but locally, at the top, includes some dark grey dolomite of Silurian age that is probably correlative with the Whittaker Formation.

Near Broken Skull River unit 10 consists of dark grey to black, fissile to flaggy, argillaceous limestone, interbedded in the middle part with black chert and minor black dolomite. The uppermost beds weather light to medium brown. Southwestward the middle, then the upper and lower parts of the unit change facies into silvery grey-weathering dark brown to black graptolitic shale that comprises almost the entire unit near the east limb of Nahanni anticline. Maximum thickness is less than 1,000 feet. This unit appears to be a shale facies equivalent to the Whittaker Formation.

The Devonian formations, units 11, 12, 13 and 14, which are present only in the northeast corner of the area, have been previously described by Gabrielse et al. [3] in the adjoining map-area to the east. Unit 15 includes black platy limestone equivalents of these carbonate units (11 to 14) and possibly shales of unit 10. As much as 3,000 feet of strata are exposed east of Broken Skull fault.

Unit 16a is a maximum of about 2,000 feet thick. Near Broken Skull River it contains fossiliferous platy limestone typical of the Headless Formation (16) at the top, but is largely unfossiliferous, light brown-weathering, impure, platy limestone similar to the Funeral Formation, a lateral equivalent of the Arnica and Landry Formations in Mackenzie Mountains to the east.

Unit 17a forms prominent light grey-weathering bluffs northeast of South Nahanni River. The rock is chiefly massive, bioclastic limestone with abundant crinoid, algal and coral forms, locally much altered to medium-grained dolomite. Fossils from the unit are assigned an age of Lower or Middle Devonian. The stratigraphic position and lithologic similarity suggests correlation with the Nahanni Formation (17) to the northeast.

Black shales, argillite and chert principally of Devono-Mississippian age (18b) total several thousand feet west of South Nahanni River. Minor amounts of graptolitic rocks (unit 10) known to be present are not differentiated due to similar lithology, lack of definitive marker beds, and intense deformation. A combined thickness is unknown but at least 3,000 feet and probably much more of Devono-Mississippian strata (18) occur.

Granitic intrusions (19), are typically discordant, non-foliated, essentially free of inclusions, and have well defined, steeply dipping contacts. All contain, in part, abundant megacrysts of potash feldspar. Proportion of mafic minerals vary appreciably from dominantly biotite in the southeast corner of the area to dominantly hornblende in the northwest and northern parts. Metamorphism and deformation of the wall-rock is conspicuously limited.

Regional fold axes trend dominantly northwest and intensity of folding increases generally from northeast to southwest and south. Folds are open and upright in the area of well stratified units to the northeast, tightly compressed and vertical to slightly overturned in the area of dominantly pelitic rocks southwest of South Nahanni River, and subisoclinal, strongly overturned to the northeast near the south border of the map-area. Local structural complexity, involving variations in trend, plunge and sense of overturning of folds, as at Mount Pike, is attributed to original inhomogeneities of the strata combined with a non-pervasive or non-penetrative structural style. No evidence of superposed folding was observed. Near Flat River, a well developed, axial plane, slaty cleavage associated with the regional folding clearly predates granitic intrusion suggesting a post Devono-Mississippian – Pre-middle Cretaceous age for the deformation. The two prominent reverse faults in the northeast part of the area, that intersect on Broken Skull River, appear to have appreciable left-lateral components to account for offset of facies and deflection of major fold trends.

Most intrusive bodies in the area have some indications of mineralization adjacent to them especially in associated carbonate rocks.

[1]Green, L. H., and Roddick, J. S.: Nahanni map-area; Geol. Surv. Can., Map 14-1961 (1961).

[2]Douglas, R. J. W., and Norris, D. K.: Virginia Falls and Sibbeston Lake map-areas, Northwest Territories; Geol. Surv. Can., Paper 60-19 (1960).

[3]Gabrielse, H., Roddick, J. A., and Blusson, S. L.: Flat River, Glacier Lake, and Wrigley Lake, District of Mackenzie and Yukon Territory; Geol. Surv. Can., Paper 64-52 (1965).