MANITOBA
DEPARTMENT OF ENERGY AND MINES
MINERAL RESOURCES DIVISION

MAP GR 81-1-1

To accompany Geological Reports GR 81-1 and GR 82-3

GEOLOGY OF THE WESTERN PART OF THE FOX RIVER BELT

(53 M/15, 16; 53 N/11, 12, 13, 14)

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Work was conducted during the summers of 1969, 1975, 1976, and 1977. Diamond drill holes were logged and sampled during the summers of 1972, 1973 and 1974.

The base map was prepared in 1979 by J.J. Macek from 1:250,000 topographic maps with additional data from 1:59 200 aerial photographs. Diamond drill holes were located by their relation to grid lines and by air photo interpretation.

Aerial photographs numbered A 23745 (181-211; 254-268), and A 23811 (249-263) provide complete coverage of this area at a scale of 1: 59 000 and may be obtained from the National Air Photo Library, Ottawa.

NOTES ON STRATIGRAPHIC RELATIONSHIPS

Supracrustal rocks of the Fox River Belt consist of two broadly similar successions of sedimentary, volcanic and intrusive rocks. The similarity of these successions could be explained by tectonic repetition. This would require the presence of a fault at or near the contact between Middle sedimentary formation and Lower volcanic formation rocks. This contact has not been observed and evidence for a fault in this area has not been found. The following discussion is considered relevant to the problem of possible large-scale tectonic repetition.

The Lower and Upper volcanic formations are each subdivided into two broadly different thicknesses and possess substantially different proportions of pillowed and massive flows than the equivalent Lower volcanic formation zones. The differentiated intrusions are vastly different in size, the Fox River Sill being several times thicker than the Lower differentiated intrusions. The latter also lack the internal zones and repetitive cyclic units that characterize the Sill. The Lower sedimentary formation contains calcareous rocks near the contacts with some Lower differentiated intrusions, whereas calcareous rocks are rare in the Middle sedimentary formation. Such differences between the volcanic and sedimentary formations may be considered significant and consequently support the concept of simple succession of rocks.

The Fox River Sill is interpreted to represent the subvolcanic chamber from which the overlying lavas of the Upper volcanic formation were derived, and a similar relationship has been suggested relating the Lower differentiated intrusions and lavas of the Lower volcanic formation. Given this concept, large-scale tectonic repetition would be precluded because Upper massive zone rocks of the Lower volcanic formation were metamorphosed by intrusion of the Fox River Sill. Small-scale repetition within the volcanic formations and intrusions is unlikely because these major units display apparently uninterrupted progressive changes in composition. Thus, the continuity of the geology of the volcanic formations and intrusions suggests that, with the exceptions noted below, the Fox River Belt is structurally not complex.

The absence of major faults, parallel with the layering of units of the belt, cannot be unequivocally demonstrated, given the sporadeness of outcrop. A fault is indicated between the Lower sedimentary formation and the Southern Gneiss on the basis of deformation observed in drill core from the stratigraphically lowest part of the Fox River Belt. A fault is interpreted as separating Fox River Belt rocks from the Northern Gneiss on the basis of the north-facing, homoclinal character of Fox River Belt rocks.

An apparent large-scale fold at the approximate mid-point of the Fox River Sill marks a slight change in direction of strike of the Sill and associated units. Relationships between the upper units of the Sill and Middle sedimentary formation rocks based on drill hole intersections are uncertain due to an absence of outcrop in this area.

POSITION OF GEOLOGICAL CONTACTS

Geological contacts have been located in the field in areas of outcrop, and by diamond drill hole intersections. Contacts have been extended in drift-covered areas on the basis of changes in aeromagnetic signature. Many contacts extended in this manner coincide with sharp deflections of streams and river bends. This suggests that the coincidence of change in magnetic signature with deflections in the drainage pattern is significant, pinpointing the precise position of contacts between major geological units. Major contacts defined this way on the geological map are those between the Fox River Belt and the Southern and Northern Gneiss Belts, between sedimentary and volcanic formations and between differentiated intrusions and enclosing country rocks.

LEGEND

PRECAMBRIAN
PROTEROZOIC

NORTHERN GNEISS (undivided)[1]
garnet-bearing, quartz-feldspar-biotite±hornblende gneiss and cataclastic and retrogressed equivalents; rocks resemble the greywacke- and mudstone-derived gneisses of the Rumbowski River metamorphic suite. Unscreened area drift covered, geology inferred.

UPPER SEDIMENTARY FORMATION (undivided)
siltstone, argillite, shale, carbonaceous shale. Stippled area drift covered, geology inferred.

UPPER VOLCANIC FORMATION
d) Upper Zone – pillowed and massive basalt, hyaloclastite breccia, minor pillow breccia, minor layered flows, interflow sulphide-bearing carbonaceous shale.
c) Middle Zone – pillowed olivine clinopyroxenite and basalt, layered and massive komatiitic basalt, minor pillow breccia.
b) Lower Zone – layered komatiitic basalt, massive and pillowed komatiitic basalt, minor massive basalt, interflow sulphide-bearing carbonaceous shale.
a) undivided. Drift covered area, geology inferred.

FOX RIVER SILL
e) Hybrid Roof Zone – gabbro, gabbronorite, quartz gabbro, granophyre-bearing gabbro, plagioclase-bearing websterite, serpentinized therzolite, gabbroic pegmatite, granophyre and diverse quartz-rich rocks derived from the melting of basaltic to felsic sedimentary formation rocks, includes xenoliths of hornfels derived from Middle sedimentary formation rocks.
d) Upper Central Layered Zone – serpentinite, serpentinized plagioclase-bearing therzolite-wehrlite, metatrocktolite, serpentinized olivine metagabbronorite, plagioclase-bearing olivine websterite-clinopyroxenite, olivine gabbronorite-gabbro, minor quartz gabbro and granophyre-bearing gabbro, minor serpentinized dunite, some sulphide-bearing rocks and chromiferous rocks; well developed repetitive cyclic units, m-scale grain size graded layers locally developed.
c) Lower Central Layered Zone – serpentinite, serpentinized dunite, serpentinized wehrlite, minor therzolite, olivine clinopyroxenite, minor olivine gabbro-gabbronorite, minor chromiferous dunite and chromitite; well developed repetitive cyclic units, cm- and m-scale grain size graded layers locally developed.
b) Marginal Zone – serpentinized hornblende-bearing olivine metagabbronorite, serpentinized plagioclase- and hornblende-bearing therzolite-wehrlite, plagioclase-bearing olivine websterite-clinopyroxenite, olivine gabbronorite, minor gabbroic pegmatite, minor sulphide-bearing rocks; some repetitive cyclic units, rhythmic layering locally developed.
a) undivided. Drift covered area, geology inferred.

MIDDLE SEDIMENTARY FORMATION (undivided)
laminated quartz-rich siltstone, argillite, shale, feldspathic sandstone, quartzite, minor greywacke, minor calcareous rocks, includes mafic-ultramafic intrusions; rocks adjacent to the base and roof of the Fox River Sill have been converted to hornfels by contact metamorphism. Stippled area drift covered, geology inferred.

LOWER VOLCANIC FORMATION
d) Upper Massive Zone – massive basalt, plagioclase-phyric basalt, intercalated pillowed basalt, some interflow sulphide-bearing carbonaceous shale.
c) Middle Pillowed Zone – pillowed olivine clinopyroxenite and basalt, massive and layered komatiitic basalt flows.
b) Lower Massive Zone – massive and layered komatiitic basalt flows, minor basalt, interflow sulphide-bearing carbonaceous shale.
a) undivided. Drift covered area, geology inferred.

LOWER DIFFERENTIATED INTRUSIONS
d) Clinopyroxenite zone, gabbro zone, and hybrid roof zone (undivided) – plagioclase-bearing olivine websterite, olivine gabbronorite, quartz-bearing gabbronorite, granophyre-bearing gabbronorite.
c) Peridotite zone – serpentinized plagioclase-bearing therzolite-wehrlite.
b) Marginal zone – highly altered plagioclase-bearing olivine clinopyroxenite.
a) undivided. Drift covered area, geology inferred.

LOWER SEDIMENTARY FORMATION
c) specular hematite-magnetite iron formation; limits of unit defined from interpretation of aeromagnetic anomalies. Light hatching drift covered, geology inferred.
b) siltstone, argillite, calcareous siltstone, silty limestone, dolomitic limestone, feldspathic sandstone, sandstone, shale, carbonaceous shale, minor conglomerate; rocks adjacent to Lower differentiated intrusions are converted to hornfels by contact metamorphism.
a) Drift covered area, geology inferred.

ARCHEAN
SOUTHERN GNEISS (undivided)
biotite gneiss, hornblende-biotite gneiss, feldspar-biotite gneiss, amphibolite, migmatite. Unscreened area drift covered, geology inferred.

[1]The age relation between Northern Gneiss and Fox River Belt rocks is uncertain. The Northern Gneiss may be older than is shown. It may be time equivalent with or older than Fox River Belt rocks.

SYMBOLS

- Bedding, tops known (inclined, vertical, overturned, dip unknown).
- Volcanic bedding, tops inferred from pillow structures (inclined, vertical, overturned, dip unknown).
- Igneous layering, tops known (inclined, vertical; overturned, dip unknown)
- Foliation (inclined, vertical, dip unknown)
- Geological boundary (defined, approximate, assumed, located by interpretation of aeromagnetic anomalies).
- Diamond drill hole. Number refers to Inco drill hole.
- Cross-section line
- Two drill holes collared on the same section line and drilled in the same direction at the same angle of declination.
- Reef
- Swamp
- Rapids, Falls
- Intermittent lake, Intermittent stream

LOCATION MAP

Location of the Fox River map

Churchill, Gods Lake, Thompson, Island Lake, Winnipeg, Red Lake, Ontario, Manitoba, Saskatchewan, Hudson Bay, Fox River, Gillam, Split Lake, Nelson River, Limestone Rapids, Kettle Rapids, Long Spruce, Lake Winnipeg, Lake Manitoba, Lake Winnipegosis, Cedar Lake, Lake Athapapuskow, Flin Flon, Cranberry Portage, Thompson, Lynn Lake, Leaf Rapids, Snow Lake, Wabowden, Swan River, Dauphin, Brandon, Winnipeg, Red River, Manitoba, Ontario, Saskatchewan, U.S.A.

KILOMETRES 0 50 100 Km
MILES 0 50 100

Scale 1:50 000

KILOMETRES 0 1 2 3 4 5
MILES 0 1 2 3

The magnetic declination at the centre of the map is 02°42'E. (1982). The mean annual change is 12.8' easterly.