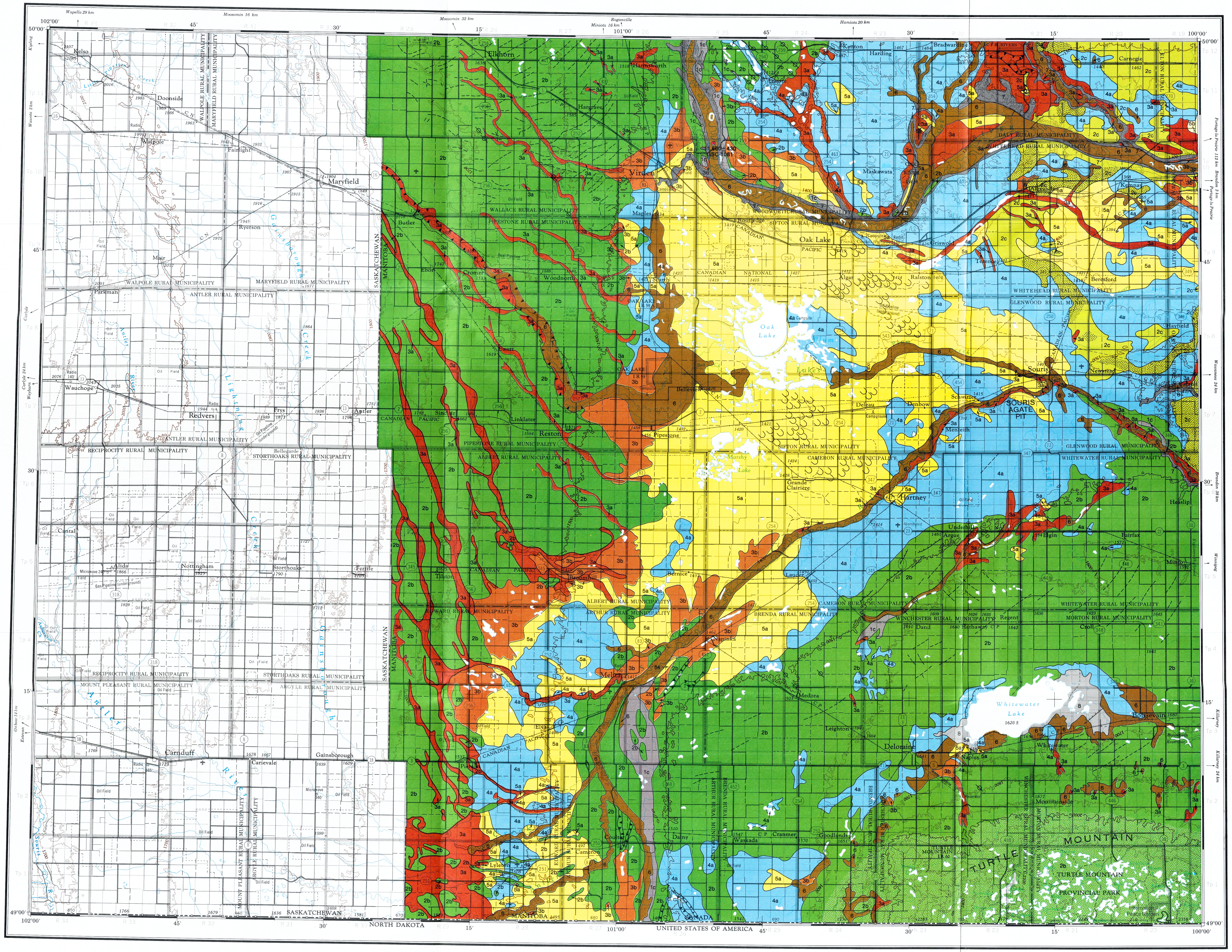
MANITOBA
DEPARTMENT OF ENERGY AND MINES
MINERAL RESOURCES DIVISION

QUATERNARY GEOLOGY MAP: SOUTHERN MANITOBA 62F VIRDEN



LEGEND

HOLOCENE

8	Swamp: peat and peripheral mud with some alluvium
7	Colluvial slumps, slope wash and some ice push deposits
6	Alluvial silt, sand and clay, including alluvial fans along the escarpment and present day alluvial deposits
5b	Offshore silt, locally interbedded with sand or clay
5a	Littoral and nearshore gravel, sand and silt including minor deltaic deposits

WISCONSINAN

4c	Fluvio-lacustrine clay and silt, deposited as alluvial fill in major river valleys
4b	Lacustrine silt and clay deposited in deep basins of Lake Agassiz
4a	Lacustrine silt and clay deposited in basins peripheral to the main Lake Agassiz basin
3b	Deltaic coarse gravel and sand, deposited primarily as the Assiniboine delta deposits
3a	Glaciofluvial and outwash sand and gravel, with minor silt, clay and till: includes eskers, kame deltas, outwash terraces and outwash plains
2c	Till: grey calcareous silty till derived primarily from Paleozoic carbonate rocks
2b	Till: brown clay till, deposited in part as hummocky stagnation moraine: includes wave washed till and minor clay basins
2a	Till: sandy till derived primarily from Precambrian bedrock: includes minor amounts of clay till
1c	Mesozoic bedrock :primarily shales
1b	Paleozoic bedrock :primarily carbonates
1a	Precambrian bedrock :primarily crystallines

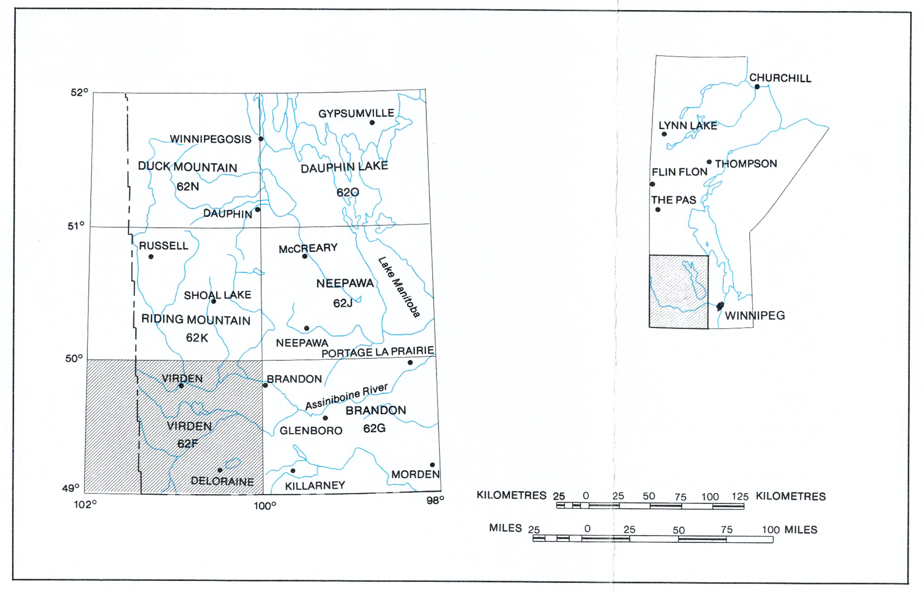
SYMBOLS

- Sand dunes, wind direction inferred
- 14,300±320 GSC-1369 — Significant stratigraphic section (Radiocarbon Date)
- Flutings, ice advance direction inferred
- Minor till ridges
- End moraine , hummocky stagnation moraine
- Beach ridges — strandlines
- Esker (direction unknown ,direction known)
- C — Elbow of capture
- Spillway
- Buried Valley

Scale 1:250 000

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES
MILES 5 0 5 10 15 20 MILES

Geological Map Q80-2
Compiled by Aggregate Resources Section
Mineral Resources Division
Winnipeg 1980



CLASSIFICATION OF DEPOSITS

The preglacial topography of the Virden map sheet includes the extensive channel of the "Missouri Valley," including the subsidiary Pierson channel and associated Virden and Medora valleys (Klassen and Wyder, 1970). In the north, the early Wisconsin Assiniboine valley is filled partially with mid-Wisconsin sediment, referred to as the Virden fill (Klassen, 1975). The area comprises the westward extension of the Manitoba escarpment till plain to the south centre of the map area , the lacustrine sediments of the early pro-glacial lakes system, the eastern extent of the Saskatchewan till plain and valleys of the Souris and Assiniboine Rivers.

PRE-TILL DEPOSITS

At Souris, sand and gravel overlies bedrock in the pre-glacial valley. The sediment, which occupies terraces of the present day Souris River contains a high proportion of agates and petrified wood which are collected by rockhounds. The type section for the "Souris gravel and sand" and most active pit occurs 1 km southeast of Souris at SW¼ LSD 9 34-7-21W. The sediment includes up to 75% rock types of western (Rocky Mountain) provenance, a distinct difference from the normal glacial sediments in the area. Clast types include well rounded to subrounded quartzite, argillite, chert, agate and porphyritic rock types, as well as glacially derived sediment. The Souris gravel and sand occurs as discontinuous patches along the valley side and in the valley bottom as shoestring type deposits (Klassen, 1969). Its situation suggests that following deposition in stream channels which originated in Montana and possibly Western Canada, the sediment was reworked by glacially derived streams, which added granitic and carbonate rocks to the clast content. The sediment was later re-deposited at relatively high levels in the Souris system.

TILL

A series of tills have been described along the escarpment zone by Elson (1956), although a clear definition of the tills in relation to chronologies forwarded by Klassen (1969) has not emerged. In the Tiger Hills region, Elson (1956) describes a lower clay till with >20% clay and a high Odanah shale content and on upper sandy or silty till, with about 40% sand, 40% silt (70% for silty till) and 20% clay. The later tills occur mainly in the Darlingford moraine. Clay till is separated from silty till by a discontinuous boulder pavement. The features south of the Pembina-Souris gorge were mapped by Elson (1956, 1959 in Halstead) as washboard moraines which result from increased water pressure in depressions resulting in expansion and shearing at the ice margin. The supposed simultaneous deposition of eskers tends to substantiate this origin.

ICE-CONTACT STRATIFIED DRIFT

Kames, eskers and pitted outwash deposits are found in the till plains as irregular, or linear bodies of moderately to poorly sorted sand, gravel and silt. Kames accumulated as small deltas, and eskers in glacial tunnels within stagnating ice. These provide local sources of sand and gravel. Outwash comprises gravel, sand and silt washed out of the debris on the ice margin by meltwater. Outwash to the western portion of the map sheet occurs as valley trains in the Assiniboine and Souris valleys from meltwater production consequent upon ice frontal recession northwestwards. The outwash is comprised of sand and gravel, and includes large shale pebbles.

BEACH DEPOSITS

Beach deposits occur on the southern margin of lake basins where the lacustrine deposits abut against the higher till plain.

DELTA AND LAKE DEPOSITS

A series of small lakes occupied the Souris basin. to the west of Lake Agassiz. Deeper water sediments comprise mainly silt, with some clay. Shallower water, nearshore deposits are composed of sand, with minor silt. In the southwestern portion of the map sheet, deltaic deposits have resulted from the deposition of sediment from the outwash filled valleys to the west, into the Souris basin lakes.

ALLUVIAL DEPOSITS

Alluvial deposits are primarily associated with spillway channels of the Souris and Assiniboine River valleys and with present day alluvial fans and river valleys.

Alluvial fill in the Assiniboine valley is comprised of the lower Virden fill and the Assiniboine alluvium (Klassen, 1975, p. 17). The Virden fill is 20-30 m thick and is absent in the Assiniboine valley between Virden and Brandon where the bedrock is anomalously high. The sediment comprises clay, silt, sand and some gravel. Three tills overlie the fill in the Virden valley suggesting an Early Wisconsin age.

The Assiniboine alluvium is about 20 m thick and is comprised of clay, silt and fine sand. It is less compact and has a higher content of organic detritus and fossils.

The Souris River channel consists of present day alluvium in the valley bottom and coarser deposits on terraces along the valley walls.

ALLUVIAL AND EOLIAN DEPOSITS

Eolian deposits, in the central portion of the map sheet, represent sediment dispersal, in the form of sand dunes. This is reactivated near shore sand deposited originally in the Souris basin lakes.

GLACIAL HISTORY

Souris gravel and sand was probably deposited by interglacial streams, occupying preglacial valleys after the first Quaternary glaciation of the area. This resulted in a mixing of Tertiary gravel and sand with gravel sediment. Wood from the early glacial sediment has yielded radiocarbon dates of >41,000 years B.P. (GSC-678) and >42,000 years B.P. (GSC-750), (Klassen, 1967, p. 60 and Lowden and Blake, 1968, p. 218).

Ice advanced into the region from the northwest depositing the lower gray till and from the north, northeast depositing the upper brown till. Given the present state of knowledge, the two advances were probably contemporaneous; the former producing stagnation moraine on the escarpment while the latter developed the till of the Darlingford morain (Ringrose, in preparation). Ice stagnation and recession took place as the Red River ice lobe was advancing southwards into Iowa and Minnesota about 14,000 years B.P. As the ice thinned, stagnation moraine was deposited on the Tertiary paleocene outlier of Turtle Mountain, forming a recessional moraine position between Boissevain and Goodlands. With further recession, a small proglacial lake formed northwest of Boissevain which eventually enlarged down the axis of the Souris basin, into the Goodlands Lake Phase (Elson, 1956). A later split of northwestern and northeastern ice produced the enlarged proglacial Lake Souris, which extended from Rivers in the north, to Souris and southwestwards to the United States border. This may be dated to between 12,000 and 13,000 years ago. Deltas and ice contact deposits developed along the northwestern (ice marginal) shore of the lake. With further ice recession, and water escape through the Pembina trench, the lake shrank occupying the northeastern portion of the map area. The smaller lake is referred to as Lake Hind, which occupied the Souris basin north of Melita. Deltas were developed at Melita and Napinka, where the early Souris River flowed into Lake Hind. The southeastern shores of the lake were now fringed by the recently ice-free escarpment zone whereas the northwestern shore was still ice bound to west of Alexander. The large delta at Rivers developed where the Minnedosa River entered first, Lake Souris, then Lake Hind. The western shore of the lake was completely ice free; the northwestern ice having receded northwest of Virden. Ice marginal drainage incised and deposited outwash in the Assiniboine valley, depositing a large delta into Lake Hind, in the vicinity of Virden.

Further recession of northwestern ice saw the Assiniboine River valley being used increasingly as a conduit for meltwater flow, and as the northeastern ice receded to north of Brandon, Lake Hind finally drained and Lake Agassiz developed. The Souris River was therefore extended across the old lake plain past Souris and Bunclody, whence it joined the Pembina system. As the Assiniboine-Qu'Appelle system took all the meltwater drainage from the northwestern ice, a tributary of the Assiniboine River cut back and captured the Souris River, thereby diverting it into the Assiniboine system. The Assiniboine continued to flow into Lake Agassiz depositing the Assiniboine delta. Increased alluvial deposition in the valley was caused by fluctuations in the level of Lake Agassiz. Two radiocarbon dates from the Virden-Alexander area (10,000±280, GSC-1428, Lowden and Blake, 1973 and 11,600±430, GSC-1081, Lowden, Robertson and Blake, 1971) suggest that the period of alluvial fill deposition occurred between 10,000 and 11,000 years ago.

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