GEOLOGICAL HISTORY OF GLACIAL LAKE ASSINIBOINE, SASKATCHEWAN

BY

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CHAPTER 4 - GEOMORPHOLOGY AND RELATED SEDIMENTS OF THE PORCUPINE HILLS, LAKE ASSINIBOINE BASIN, AND THE ASSINIBOINE VALLEY

Kehew and Lord (1987) and Wolfe (1990) suggested that a flood entered Lake Assiniboine from the north through a precursor to the Swan spillway (FIGURE 1-14) and that this led to the lake's final drainage downstream through the Assiniboine valley (see **CHAPTER 1**). In order to better understand the flow into and out of Lake Assiniboine, the geomorphology in the Porcupine Hills area, the Lake Assiniboine basin, and the Assiniboine valley was investigated.

This chapter begins with the identification of channels and glacial lakes in the Porcupine Hills area whose outflow may have led directly to Lake Assiniboine. Strandlines and inlet and outlet channels are described in the Lake Assiniboine basin. Finally, geomorphic features that may have been related to catastrophic flow along the Assiniboine valley are examined. The strandlines and inlet and outlet channels in the lake basin were studied in detail. In **CHAPTER 5**, these data are integrated with the sedimentology discussed in the previous two chapters.

PORCUPINE HILLS AREA

A reconnaissance survey was conducted in the Porcupine Hills region (FIGURES 1-14, 4-1) to investigate the nature of discharge through valleys draining to Lake Assiniboine, including the ancient Swan River valley (i.e. proto-Swan River channel). Major meltwater channels, north of Lake Assiniboine (FIGURE 4-1), were traced in the field and on topographic maps in order to evaluate the nature and magnitude of discharge through them. Unfortunately, due to the heavily forested nature of the region, lack of roads, and extremely rare exposures, most of the following description comes from

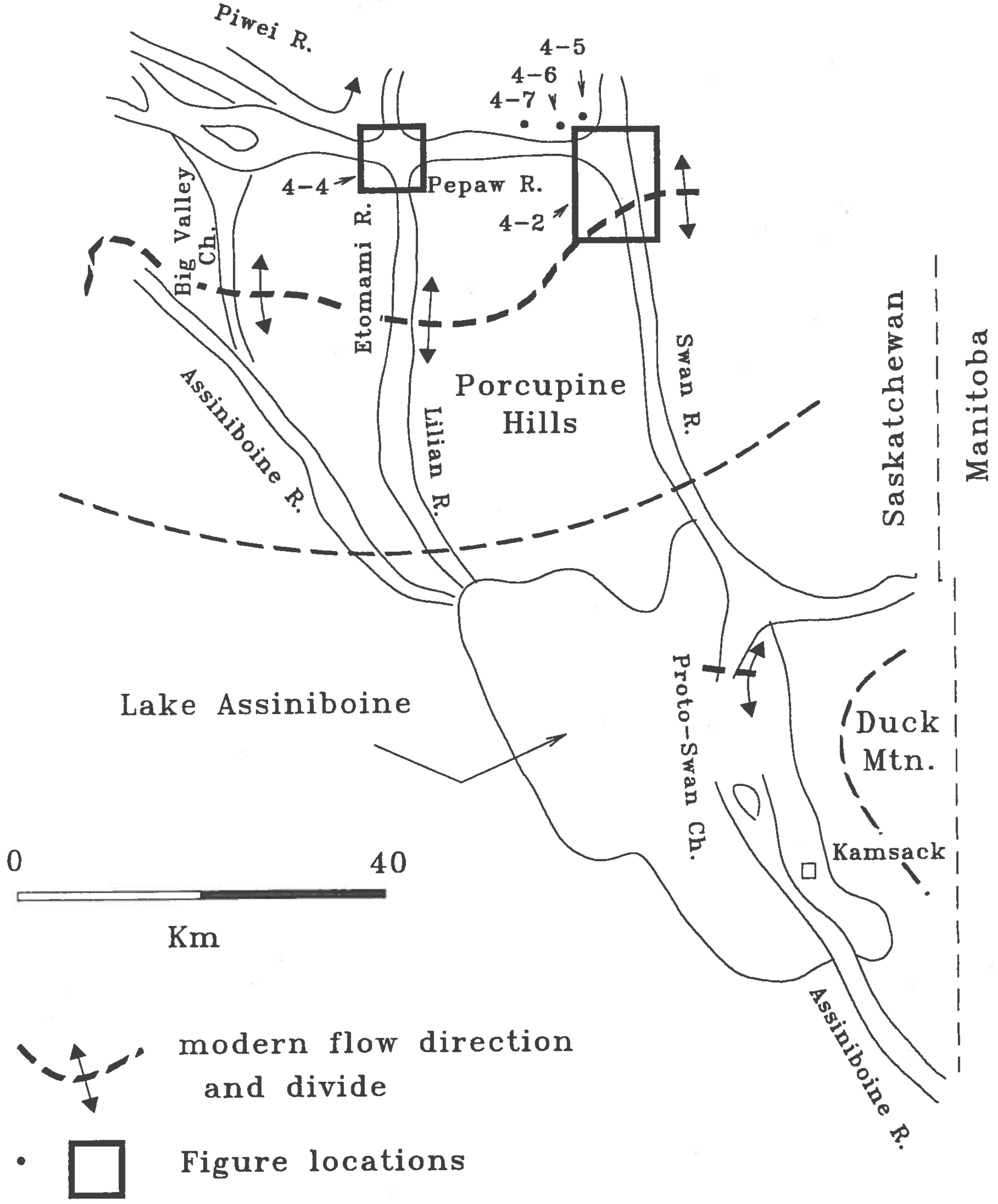

FIGURE 4-1. Meltwater channels and modern flow direction in the Porcupine Hills area north of Lake Assiniboine. Also shown are locations for FIGURES 4-2, 4-4, 4-5, 4-6, and 4-7.

regional geology studies by Moran (1969) and Klassen (1972, 1975), a regional soil survey by Stonehouse and Ellis (1983), and topographic maps.

Of primary concern to Lake Assiniboine are the many southward draining rivers on the Porcupine Hills Upland, which may have formerly entered the lake, but today meander through the lake basin or, in the case of the Swan River, bypass the lake plain to the northeast. This region has been described as a "rolling morainic area with some undulating lacustrine plains and dissected escarpments" by Stonehouse and Ellis (1983, p.3). The modern day drainage divide, separating northerly and southerly flow, extends through the Porcupine Hills Upland and cuts across many former meltwater spillways (FIGURE 4-1) resulting in unusual channel junctions (FIGURE 4-2). Drainage to the south off the Porcupine Hills is through the Assiniboine, Lilian, and Swan Rivers (FIGURE 4-1). The Piwei, Etomami, and Pepaw Rivers carry flow to the north (FIGURE 4-1).

Several major glacial lakes have been identified in the Porcupine Hills region by other workers (Moran 1969; Klassen 1972, 1975), including supraglacial Lake Kelvington, glacial Lake Mistatim, supraglacial Lake Somme, and supraglacial/glacial Lake Melfort (FIGURE 4-3*a*-*d*), and whose drainage contributed to the formation of the meltwater channels shown in FIGURE 4-1 (Moran 1969; Klassen 1972, 1975).

In a regional context, outflow from these lakes may have entered Lake Assiniboine. Initially, Lake Kelvington drained through the Assiniboine channel (Moran 1969; FIGURE 4-3*a*). Following retreat of the ice to the northeast, Lake Mistatim (FIGURE 4-3*b*) flowed south through the Etomami-Lilian channels. Later, outflow from Lake Somme (Moran 1969; FIGURE 4-3*c*) drained through the Etomami-Lilian channels and the Pepaw-Swan River channels. One or more of these lakes may represent the meltwater source that deposited the sand and gravel of Facies B in the northwestern part of Lake Assiniboine (FIGURE 2-6*a*).

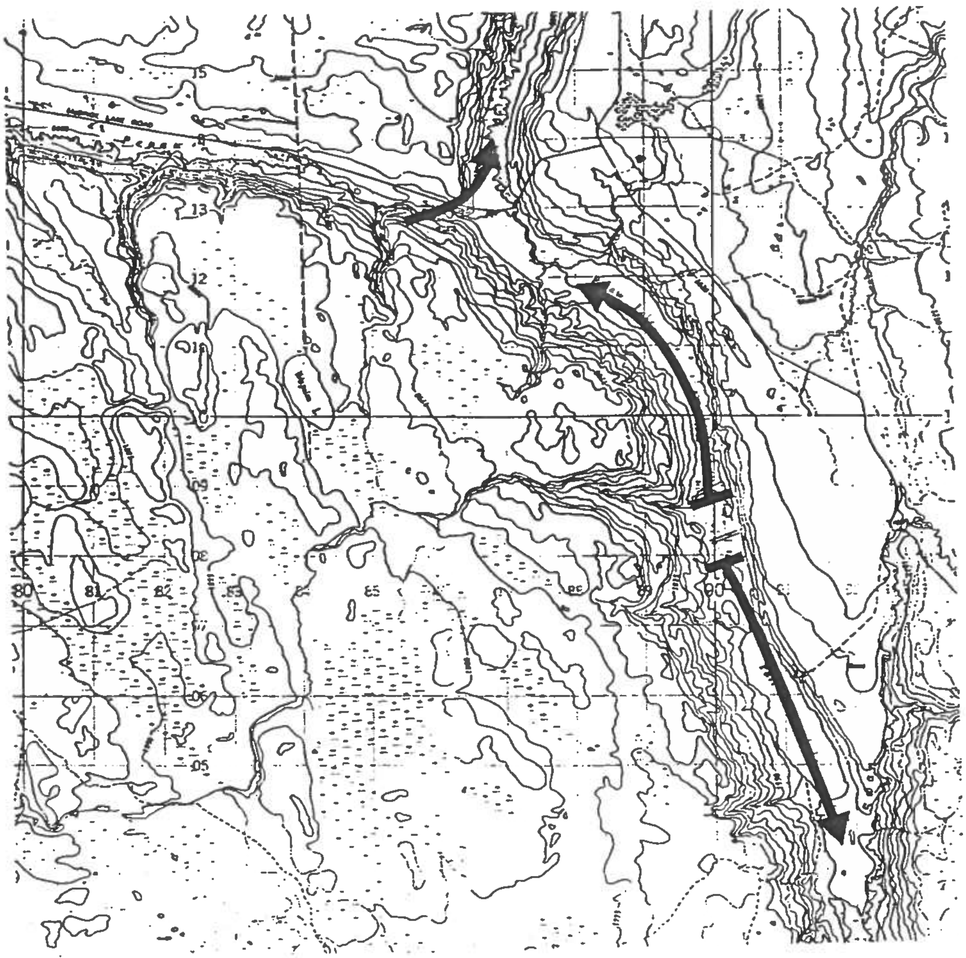

FIGURE 4-2. Junction of modern Pepaw and Swan Rivers. Note drainage divide cuts across former spillway channel. Width of map area shown is approximately 15 km. Contour interval is 25 feet. North is towards top of map. Refer to FIGURE 4-1 for location of area.

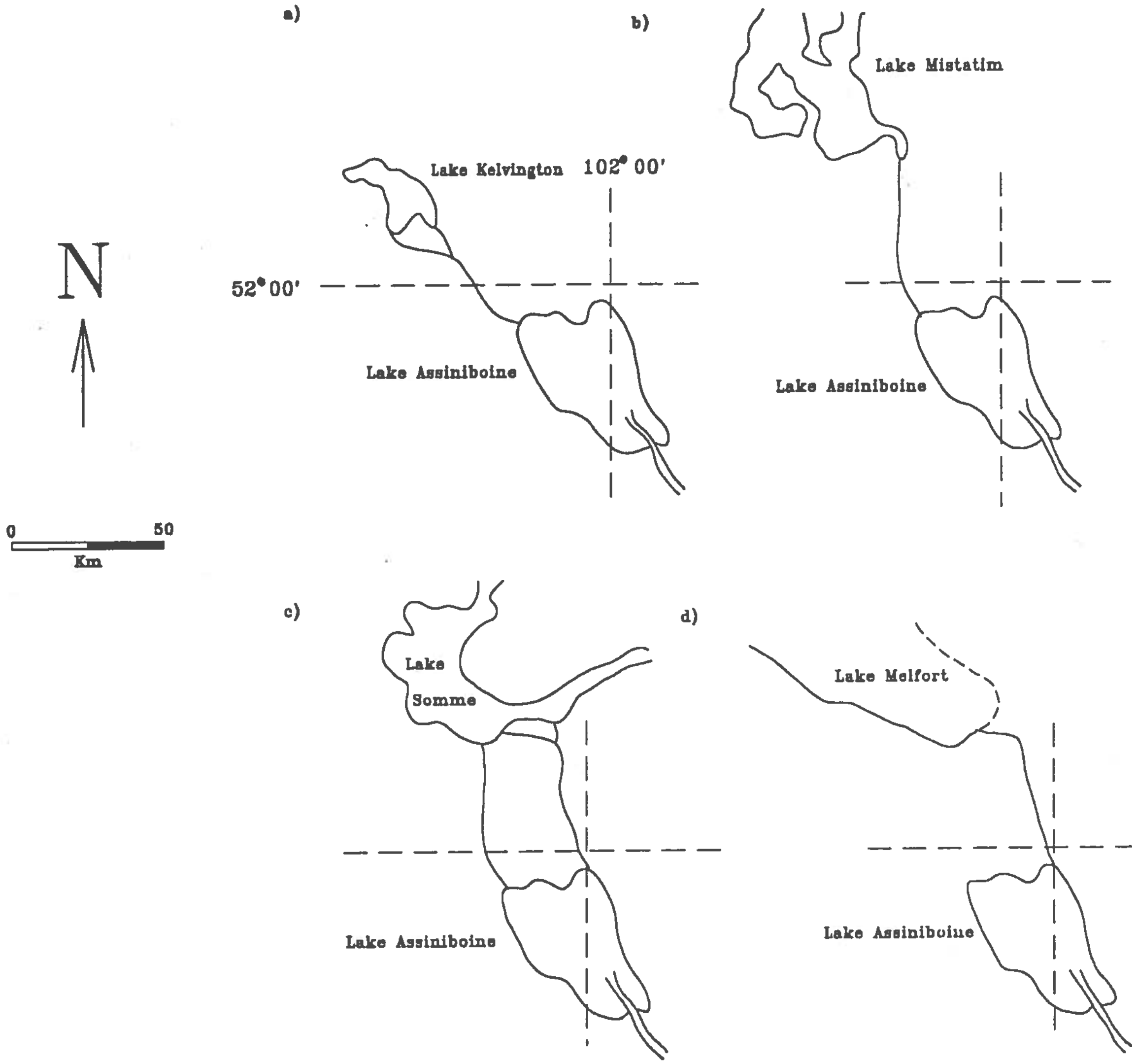

FIGURE 4-3. Drainage of glacial lakes in the Porcupine Hills area through channels leading to the Lake Assiniboine basin. In a), Lake Kelvington drained through the Big Valley Creek channel and the Assiniboine River channel (after Moran 1969: Phase III). In b), Lake Mistatim drained through the Etomami-Lilian River channel (after Moran 1969: Phase IV). In c), Lake Somme drained down both the Etomami-Lilian River channel and the Pepaw-Swan River channel (after Moran 1969: Phase V). In d), Lake Melfort drained through the Piwei-Pepaw-Swan River channel (after Klassen 1975: Phase 3).

Lake Melfort (FIGURE 4-3*d*) also drained through the Piwei-Pepaw-Swan River channel according to Klassen (1972, 1975) when the active ice had retreated from this area. The waters from these lakes (i.e. Lake Somme and Lake Melfort) entered Lake Assiniboine through the proto-Swan River channel in the northeastern part of the basin (FIGURE 4-1).

Topographic studies indicate that both the Piwei and Pepaw River (FIGURE 4-1) channels were ice marginal. The southern channel walls are commonly defined by as many as nine closely spaced 25′ contours while the northern bank is usually less than 3 contours (FIGURE 4-4). The width of this channel is consistently about 1 km. Downstream from the Piwei and Pepaw channels, the Swan River channel is topographically defined by two similar valley walls and is approximately 225′ (69 m) deep and 3 km wide. The depth of the Swan River valley is significantly greater than either the Assiniboine or Lilian valleys which are both about 23 m deep. The Etomami channel is similar to the Piwei and Pepaw channels in depth, but the Etomami's meandering (FIGURE 4-4) and more V-shaped profile suggest that much of the erosion in this channel is due to post-glacial grading to the lower, northern Piwei and Pepaw channels (FIGURE 4-1).

Field studies in the Pepaw River channel revealed exposures of very coarse material. Close to where the Pepaw River bends north (site 4-5, FIGURE 4-1), a 3 m deposit of sand and boulder gravel was found (FIGURE 4-5). 5 km upstream there are boulder deposits (FIGURE 4-6); several 1-2.5 m diameter boulders have been collected from the shores of McBride Lake in the Pepaw River channel and have been placed in front of the McBride Lake Lodge (FIGURE 4-7).

Although these observations are limited, valley dimensions and large boulder deposits suggest that one or more strong flows may have occurred in the Piwei-Pepaw-Swan River channel system, perhaps due to drainage from either Lake Melfort and/or Lake Somme. Certainly more detailed studies on

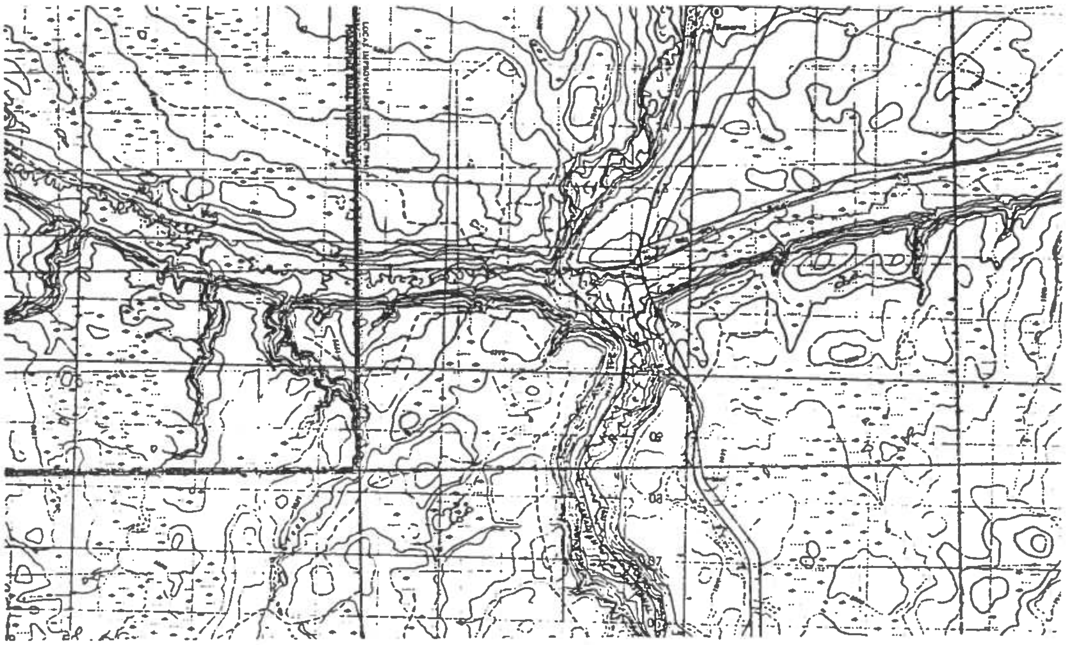

FIGURE 4-4. East-west trending Piwei and Pepaw River channels. Topographic incision is apparent only on the southern valley wall indicating that ice formed the northern boundary when the valley was eroded. Note the north-south trending Etomami channel's distinct meandering pattern and V-shaped valley. Width of map area shown is about 18 km. Contour interval is 25 feet. North is towards top of map. Refer to FIGURE 4-1 for location of area.

FIGURE 4-5. 3 m deposit of sand and boulder gravel along the Pepaw River. Refer to FIGURE 4-1 for location.

FIGURE 4-6. Boulder deposits 5 km upstream of FIGURE 4-5. Refer to FIGURE 4-1 for location.

FIGURE 4-7. 1-2.5 m boulders removed from the shores at McBride Lake in the Pepaw River channel. Refer to FIGURE 4-1.

these lakes and their relationship to the valleys through which they drained are required to assess the drainage that flowed through them.

LAKE ASSINIBOINE BASIN

FIGURE 4-8 is a map of the Lake Assiniboine area, illustrating selected geomorphological features. Many of these landforms are critical to the Lake Assiniboine history, notably strandlines, inlets, and outlets.

STRANDLINES

Strandlines were identified in the field and their lateral extent was traced on aerial photographs. Elevations near the top of the slopes were estimated from 1:50,000 topographic maps. In general, the few strandlines identified are fragmentary and poorly developed. The most prominent strandline occurs in the southwestern corner of the lake (FIGURES 4-8, 4-9) and has a distinct gravelly surface indicative of former wave reworking and deposition. This strandline occurs at the same elevation as strandline segments along the Duck Mountain Uplands (FIGURES 4-8, 4-10). An isolated, though fairly well developed lower strandline at 488 m was recognized in the southern part of the basin (FIGURE 4-8). These observations indicate that Lake Assiniboine established at least 2 lake levels: 488 m and 495 m.

INLETS

Major meltwater channels entering the Lake Assiniboine basin include the Assiniboine, Whitesand, Little Boggy Creek and proto-Swan River channels (FIGURE 2-1). The Assiniboine and Whitesand River channels have already been suitably described at the beginning of **CHAPTER 2**, but the latter two require further attention.

Little Boggy Creek (FIGURE 4-11) drains the Duck Mountain Uplands and is greater than 3 km wide and 120 m deep in some

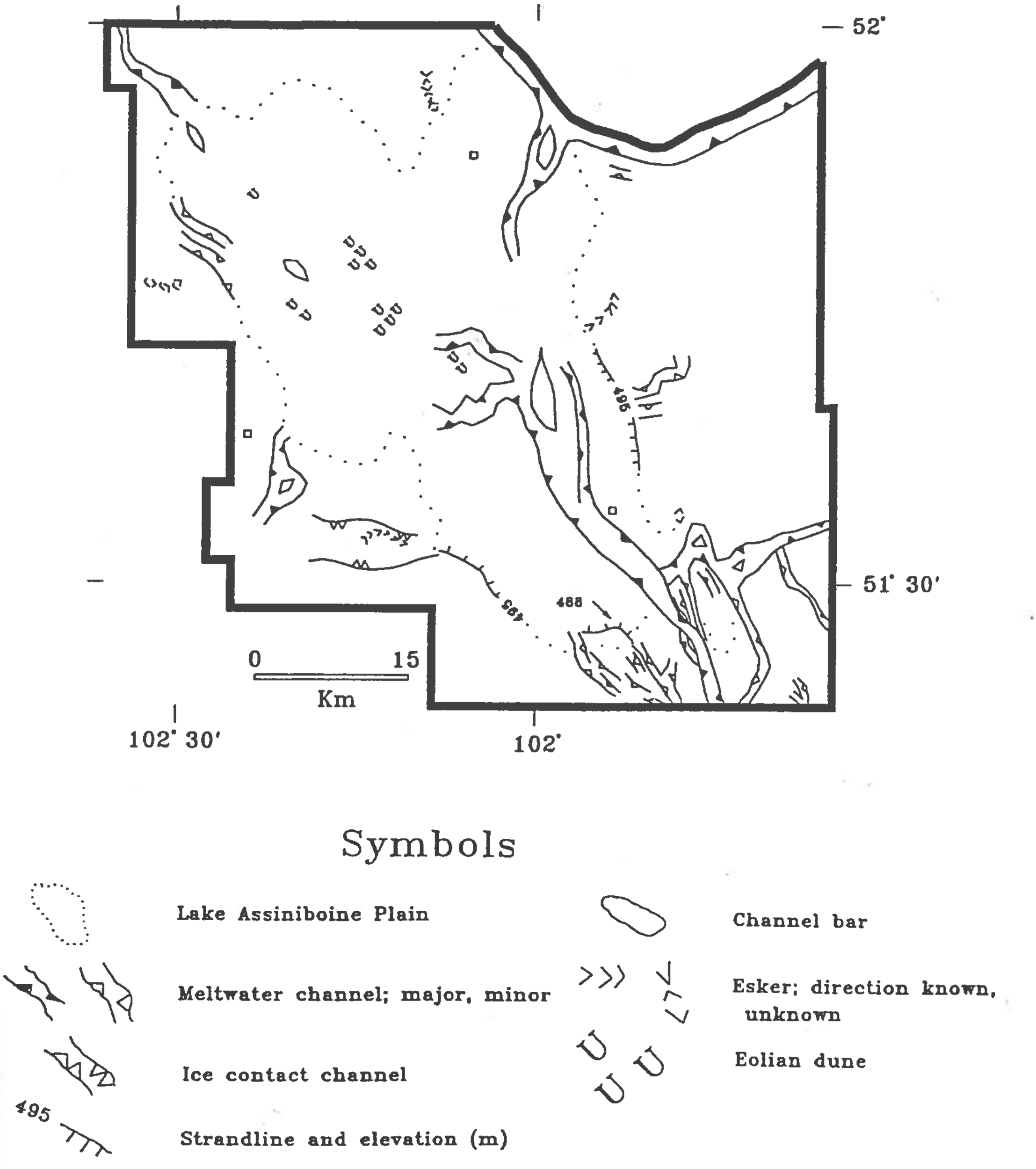

FIGURE 4-8. Selected geomorphology of the Lake Assiniboine area. Notice strandlines related to Lake Assiniboine are located at 488 and 495 m. Inlets discussed in text include the Assiniboine channel from the northwest, the Whitesand channel from the west, the proto-Swan River channel from the north-central area and the Little Boggy Creek channel from the Duck Mountain Uplands to the east of Lake Assiniboine. See FIGURE 2-1 for physiography of the Lake Assiniboine area.

FIGURE 4-9. A gentle rise in the distance can be seen at southern end of the lake. The elevation near the top of this slope is approximately 495 m.

FIGURE 4-10. Rise along Duck Mountain Upland. Elevation near the top of this slope is approximately 495 m.