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RELICT ICEBERG FURROWS ON THE FLOOR OF GLACIAL LAKE OJIBWA, QUÉBEC AND ONTARIO

JEAN-CLAUDE DIONNE
Environment Canada, C.P. 10100, Québec, Qué., G1V 4H5

INTRODUCTION

To the author's knowledge, relict iceberg furrows on the floor of former glacial lakes in Canada have not yet been reported. Many examples of recent and relict iceberg features on sea floors are known in the Arctic Ocean (Kovacs 1972, Pelletier and Shearer 1972, Moign 1973, Reimnitz and Barnes 1974, Shearer and Blasco 1975), and in the North Atlantic Ocean (Belderson *et al* 1973, Belderson and Wilson 1973, Harris 1974, Harris and Jollymore 1974, King 1976, Linden *et al* 1976). In addition Berkson and Clay (1973) have reported iceberg furrows on the floor of Lake Superior, and Clayton *et al* (1965) have interpreted the intersecting minor lineations on Lake Agassiz plain as grooves made by drifting ice floes. Examples of modern grooving by drift-ice in lake bottom sediments are given by Koshechkin (1958) for the north Caspian Sea, by Weber (1958) for the Great Slave Lake, and by Mollard (1973) for the Great Slave Lake, and lakes Manitoba and Montreal (Saskatchewan). Ice-made grooves in the tidal flats of the Lower St. Lawrence Estuary have been fully described by Dionne (1968, 1969, 1971).

This paper reports furrows observed on air photos and in the field of a clay plain in northwestern Québec and adjacent Ontario.

OBSERVATIONS

When the author was mapping Quaternary deposits, linear features similar to drift-ice and iceberg-made furrows were observed in the Matagami area. Although they are evident on air photos, the features are less distinguishable in the field because of the forest and peat cover. Except for a few well-preserved forms, the majorities of the furrows have not been field-checked. Observations reported here were made mainly on air photos.

Furrows are found at the surface of the clay plain south of James Bay, between Long. W 77°45' and 80°00' and between Lat. N 49°07' and 50°05', an area of about 17 000 km^2 (Fig. 1). Most furrows are within the area covered by Map 32E (National Topographic Series). The clay plain or the floor of the glacial lake Ojibway formed during the retreat of the Wisconsin ice sheet between 8500 and 7900 years B.P. (Hardy 1976).

A total of 326 furrows have been mapped. Although they have a random distribution throughout the area, they are commonly concentrated at the summit of low hills which were shoals in the former glacial lake. Individual forms (8%) occur here and there, but most are in series or groups of 2 to 41 furrows. They are as follows: 2 furrows were observed at 6 sites, 3 and 5 at 2 sites each, 4 at 7 sites, 6 and 7 at 3 sites each, 8 at 5 sites, and 14, 17, 23, 31, 38 and 41 furrows respectively per site.

Furrows occur between 245 and 300 m elevation. However, most are found between 275 and 290 m elevation. Those found at the lowest level (245 to 250 m) occur in the northern part of the area, while those found at the highest level (290 to 300 m) occur in the southern part, except one furrow cutting through the slope of the Matagami esker at N. Lat. 49°37'.

Furrows are generally straight, but about a dozen are slightly curved and one has a sinuous course. They have various orientations and often intersect: 4 percent are oriented north-south, 39 percent are north-northwest, 28 percent are north-northeast and 8 percent are east-northeast.

They are 75 m to 7 km long, 25 to 100 m wide and up to 4 m deep. Although the forest and peat cover obscures the land surface, low lateral and frontal push ridges, along a few furrows, can be discerned on air photos. A few furrows have a lobate-shaped head similar to ice-made grooves reported by Dionne (1971, p. 15) for the St. Lawrence tidal flats.

DISCUSSION

Considering the late-glacial history of the area, it is suggested that furrows were cut into the clay floor of glacial lake Ojibway during the Cochrane episode. This probably happened during the second readvance of the ice (Cochrane II), dated about 7975 years B.P. (Hardy 1976), because several furrows occur in the area between the limits of the Cochrane I and II.

Drifting icebergs rather than ice floes scored the floor of the lake when grounding on shoals or on shallow banks. As the lake level at the time was 75 to 100 m above the grooved surface, the icebergs, calved from the edge of the glacier in the Ojibway lake were the major eroding agents. Additional evidence of iceberg activity in the glacial lake is provided by the presence of scattered boulders and other coarse sediments commonly found in the varved clays in that area, and several patches of drifted till lying over lake clays. The thickness of the Quaternary sedimentary cover in the area considered makes it unlikely that these lineations reflect fissures from the underlying bedrock.

Since 67 percent of furrows are oriented in north-northwest and west-northwest directions, northwest winds prevailed at the time.

Because several furrows are preserved, it is suggested that the rate of sedimentation after their formation was relatively small or that these furrows were cut mainly during the late stage of glacial lake Ojibway which drained northward into the Tyrrell Sea about 7900 years ago (Hardy 1976). However, it is possible that some furrows have been completely obliterated by clay and masked by the peat and forest cover.

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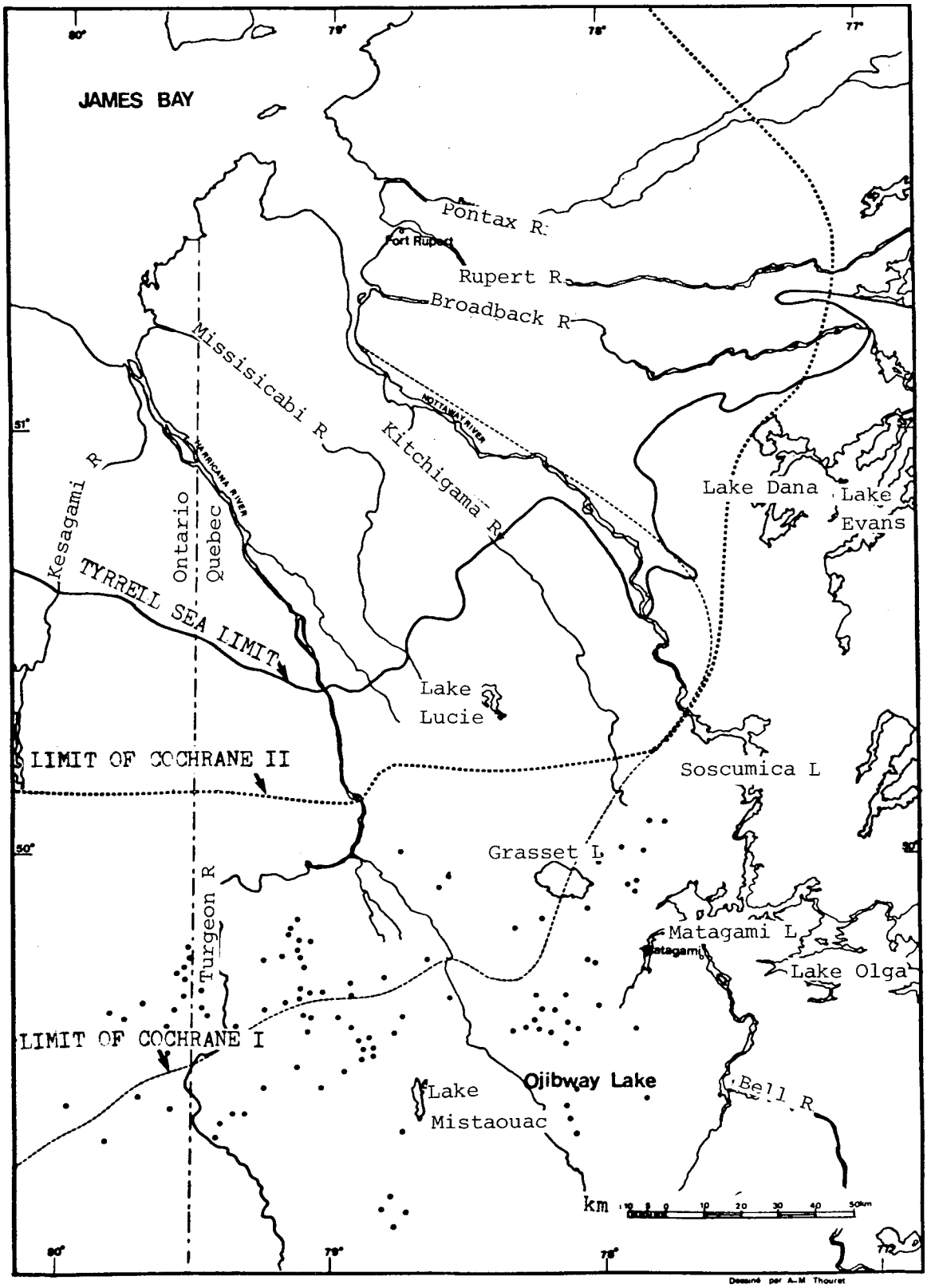

FIG. 1 Location map. Sites of relict iceberg furrows, clay plain of glacial lake Ojibway, Quebec and Ontario.

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