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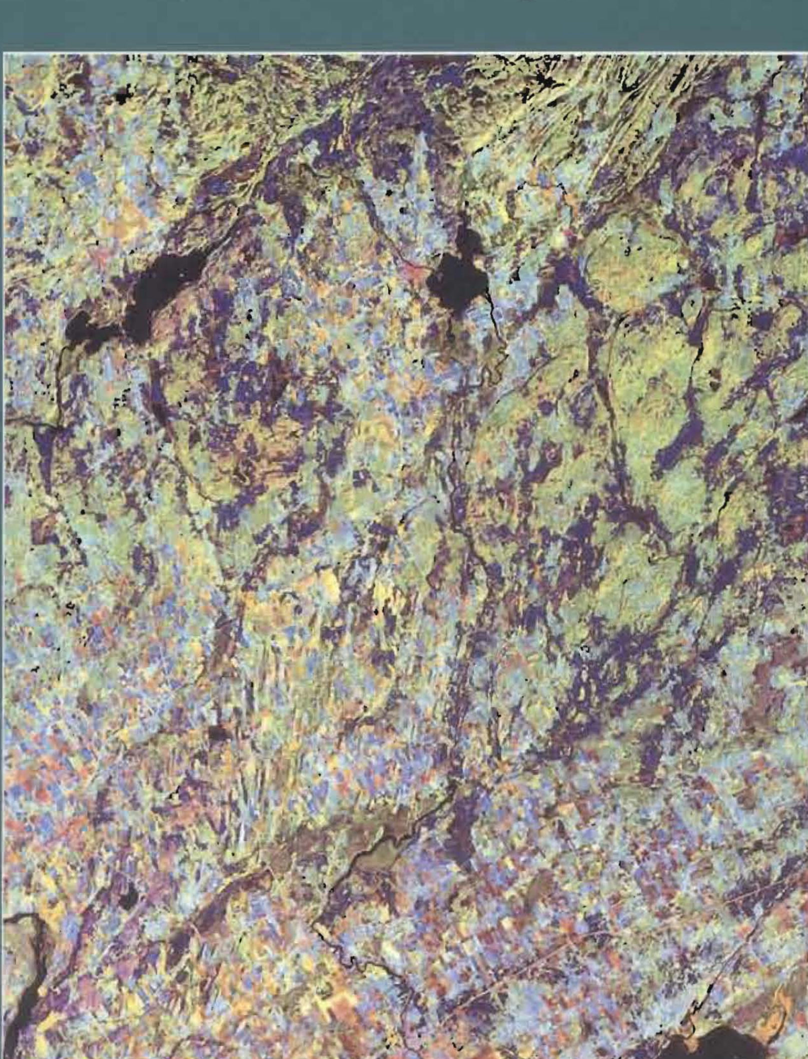
A FIELD GUIDE TO THE GLACIAL AND POSTGLACIAL LANDSCAPE OF SOUTHEASTERN ONTARIO AND PART OF QUEBEC

Robert Gilbert, compiler



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Cover description

Portion (approximately 42 km x 33 km) of satellite image of area north of Bay of Quinte. The thickness of sediment varies across southeastern Ontario due to erosion and deposition of glacial drift. Deformed Precambrian Shield rocks carry little drift cover in the north, whereas Paleozoic carbonate sediment thickness increases to the southwest, south of the Shield margin. Drumlins are cut into this thicker drift (lower left). Tunnel channels (purple) and eskers traverse the region. (Data provided by RADARSAT International Inc. and distributed under authority provided by the Canada Centre for Remote Sensing; reference: 80 km x 80 km, TM 16-29, bands 3, 4, 6, May 1988.)

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☑ STOP 11 Tweed esker

Tracy Brennand and John Shaw

NTS 31C/6, UTM 121153

Follow Highway 37 21.2 km north from Highway 401 through Roslin to the Moira side road. Turn west toward Moira for 1.4 km to where the road crosses the esker. The stop is in a gravel pit to the south of the road. If coming from Stop 10, continue 11 km west from Coulters Hill to Highway 37 at Roslin (turn right and cross the Moira River at Chisholm on this road). At Roslin turn right (north) on Highway 37 for 2.8 km to the Moira side road.

The Tweed esker extends for approximately 75 km southwest from Actinolite and crosses both the Dummer Moraine and parts of the Belleville-Trenton drumlin fields (Fig. 47). Like other eskers in the drumlin field, the Tweed esker lies in a broad tunnel channel (Shaw and Gorrell, 1991). Transverse ridges are observed adjacent to the esker and within the tunnel channel, toward the southern end of this system.

For the most part, the esker is a single ridge, but in places it divides into multiple ridges (Fig. 47). The ridges reach a maximum height of about 15 m and are up to 50 m across

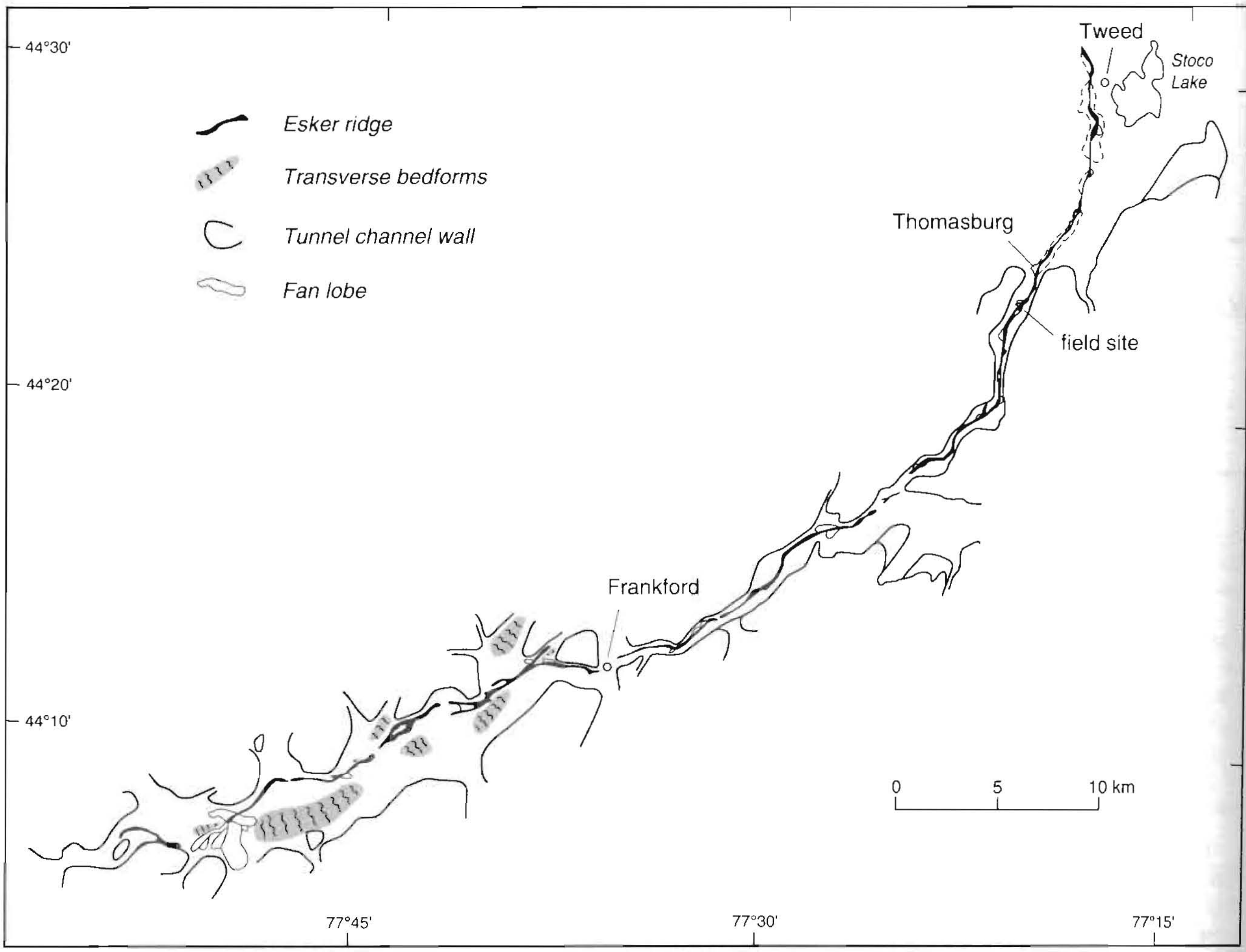

Figure 47. Tweed esker and associated tunnel channel.

(Shulmeister, 1989). Esker deposits are up to 25 m thick. The surface of the esker rises and falls in a series of swells, perhaps suggesting deposition of the esker sediment in large-scale bedforms or macroforms; the latter probably corresponded to changes in height of the esker conduit. Small distributary ridges, terminating in lateral fans, extend from the main esker ridge (Fig. 47).

The sedimentary sequences in the esker core are dominated by thick couplets of gravel and sand. Much of the gravel in the esker core is disorganized and with no apparent lateral continuity to the internal bedding. There is an abrupt transition from gravel to sand or pebbly sand. The fine grained member of the couplet may be plane bedded, trough crossbedded, crosslaminated, or massive. Only two or three couplets are exposed at a section.

Sediments in the core of the esker are dramatically folded in the northern part of the section (Fig. 48). The core of the fold is a poorly sorted, almost diamictic, boulder gravel with a sand matrix. Gravel and sand couplets are arched over this core. The sand is discontinuous and the gravels amalgamated.

Clast fabric on imbricate gravels in the southeast side of the ridge indicates a down-ridge, crest-convergent paleoflow (toward 277°). This is interpreted as indicating a secondary flow vortex within the conduit. The esker sediment fines

Figure 48. Folded core of the Tweed esker. GSC 1993-164P

toward the sides of the deposit, becoming predominantly sand. Faulting is prevalent in these lateral deposits. Faults are mainly high-angled and normal.

The esker is a product of subglacial drainage and marks a late stage in a complex drainage history. As discussed at previous stops (6-8), earlier drainage events, which produced tunnel channels, were probably associated with catastrophic outburst floods of subglacially stored meltwater (Murray, 1988; Shaw, 1988; Shaw and Gorrell, 1991; Shaw and Gilbert, 1990). The drumlins through which the esker wends its way, are also products of major meltwater flows when the tunnel channels were overtopped and the area was inundated by regional sheet floods (Shaw and Gilbert, 1990; Stop 6). The eskers themselves appear to record more normal glacial drainage, with much of the meltwater being derived from the glacier surface. Since melt rates vary seasonally, the gravel-sand couplets of the core sediments may represent annual deposits. The diamicton beds in the esker then indicate winter periods when meltwater flow in the conduit had nearly ceased and debris flows were emplaced without winnowing (Gorrell and Shaw, 1991). The folding at this site may also indicate that there may have been a relative increase in the rate of conduit closure during periods of reduced flow, compared to the rate of melting back of the conduit walls by fast-flowing water. This closure would have exerted a pincer-like compression, folding the sediment between the ice walls (Fig. 48). Alternatively, low pressure within the conduit during a high discharge event (Röthlisberger, 1972) may have caused basal sediment to be sucked into the conduit.

In the final stages, the esker tunnel appears to have widened appreciably and finer grained deposits were laid down alongside the core deposits. These ice-contact deposits failed by faulting when lateral ice support was removed. Such widening may also have accompanied uplift of the ice sheet and the emplacement of the marginal fans (Gorrell and Shaw, 1991).

It is difficult to determine exactly when the transverse bedforms were formed in the tunnel valley. They may have preceded esker deposition and have formed at a late stage in the last tunnel-channel forming event. Indeed some ridges appear to be overlain by eskers as would be expected in this interpretation. Otherwise, they may have formed as the ice sheet was lifted from its bed in a late stage of glaciation. In this case, they would postdate the main phase of esker formation and possibly relate to the formation of the marginal fans.