FIELD TESTING A MODEL OF PALEOHYDROLOGY FOR PREHISTORIC SITE PREDICTION AT LAKE TEMAGAMI, NORTHEASTERN ONTARIO

Diana L. Gordon and John H. McAndrews

Fieldwork to test predictions of an isostatic rebound model was conducted at Lake Temagami at intervals during July, August and November 1991. The work involved extracting pollen cores from bogs near two predicted paleo-outlets, inland survey for geomorphological evidence of paleoshorelines and archaeological survey. The research aim is to reconstruct past shorelines of this deep Canadian Shield lake in order to predict archaeological site location since deglaciation (ca. 10,500 BP). Ian D. Campbell (Forestry Canada, Edmonton) developed the paleohydrology model. James B. Bandow, John C. Switzer and Zicheng Yu were the field assistants. Major funding was provided by The Ontario Heritage Foundation (ARG-433), with additional funds from the Royal Ontario Museum.

Lake and river shores formed an important ecotone for human occupation in the Upland Shield-Boreal Forest as seen from ethnographic (Jenkins 1939; Rogers 1973; Rogers and Black 1976; Tanner 1979) and archaeological studies (e.g. Ridley 1966; Pollock 1976; Knight 1977; Noble 1982; Hanks 1988). Archaeological surveys along modern Lake Temagami shores (Gordon n.d. 1987, 1989, 1990a, 1992) and adjacent Obabika Lake (Conway and Conway 1989) have successfully located Archaic to Woodland prehistoric habitation sites, lithic quarry workshops and rock painting sites. However, Gordon’s (n.d.) analysis of the Three Pines site (CgHa-6) and comparison with other assemblages, suggested that sites along the modern shoreline might not represent the full prehistoric sequence. This was particularly apparent for the poorly-known Paleo-Indian and Archaic periods. One possible explanation is that the configuration of the lake has changed over time.

Two lines of evidence indicated that water levels in the Lake Temagami basin had been dynamic. First, regional deglaciation studies (Veillette 1988) reveal that several post-Algonquin lakes and Lake Barlow had extended into the Northeast Arm of Lake Temagami (ca. 10,500-9,500
BP). Second, a peat bog core from the Three Pines site in the central hub of Lake Temagami reflected a four metre rise in lake levels over the past 6,400 years (Gordon n.d., 1990a, 1990b).

Given this information, it was feasible that paleohydrological and geochronological studies of Lake Temagami might provide a general framework for: 1) predicting and initially dating archaeological site locations beyond the current lake margins and 2) determining the antiquity of the present shoreline. As no paleoshorelines have been mapped at Lake Temagami, we needed to model the paleohydrology in order to direct fieldwork to specific locales for strandline mapping. Thus, we focused on one important landscape variable: isostatic rebound and its effects over time on shoreline location.

Glacial isostatic rebound is the adjustment of the earth's crust following the melting of the Late Wisconsinan ice sheet (Andrews 1989). The earth's crust, released from this weight, rebounds in the direction of ice retreat. This direction is northeast for the central Canadian Shield (Andrews 1989; Veillette 1988). The rate of rebound is differential with the most recently deglaciated areas rebounding faster than other areas. This phenomenon is well-known for the Great Lakes basin (cf. Karrow and Warner 1990). Along the 46 kilometre north-south length of Lake Temagami, the northeast end would have risen faster than the southwest.

To create a computer simulation of this effect, altitudes in the basin from topographic (1:20,000) and bathymetric (1:64,000) maps were digitized. Lake Temagami (293 metres a.s.l.) is long and narrow, with five arms radiating out from a central hub (Figure 1). Using published rebound curves (Lewis and Anderson 1989; Veillette 1988), the basin was tilted in a northeast direction and flooded with the same amount of water. For this model, a constant lake volume/basin area ratio and a smooth rate of change in the rate of isostatic rebound were assumed. (Imagine placing a long narrow container of water on a foam cushion and marking the level of the water around the container. Push one end deeper into the pillow, redraw the water level, then release.)

Results from this model indicate that 9,500 years ago, the northern end of Lake Temagami would have been 30 metres lower than the south end. As the rate of rebound has a half-life of 1,000 years, the difference in elevation between the two ends of the lake drops to 15 metres at 8,500 BP, 7.5 metres at 7,500 years, etc. At 9,500 BP the lake would have formed two, possibly three, separate basins, with a divide across the central hub. One paleo-outlet would occur at Sharp Rock Inlet (the current northern outlet) and the other would occur at the end of the Northeast Arm through the town of Temagami (the divide between Ottawa River and Lake Huron drainage). Near these paleo-outlets, paleoshorelines would be at or slightly above the current lake. In the rest of the basin, paleoshorelines would now be inundated.

Fieldwork concentrated on the two predicted paleo-outlets at the modern Sharp Rock Inlet (Figure 1:A) and at the Temagami townsite (Figure 1:B). At Sharp Rock, as well as at Sandy Inlet to the east, paleoshorelines were found up to seven metres above the current lake and between 16 and 280 metres inland, depending on slope and distance from the paleo-outlet. At Sharp Rock, the ancestral lake drained through a high-energy spillway caused by a narrow bedrock channel.

A pollen core was extracted from Bear Bog, located two kilometres southeast of
Figure 1. Lake Temagami - predicted paleo-outlets (A, B). Arrows show modern drainage directions.
Bear Bog Pollen Diagram


Latitude 47.18 N, Longitude 80.16 W, Altitude is 304 m.

Figure 2. Pollen diagram for Bear Bog, northwest Lake Temagami (analyst: M. Andrews).

Depth (cm)

Organic matter Silicates

Bog Peat Radiocarbon Dates
Fen Peat
Pond Mud
Lake Mud
Glacial Clay

White Water-in Sedge Family Sphagnum Moss Heaths Spruce Balsam Fir Jack/Red Pine White Pine Birch

Pollen Zones

3a
2
1

0 0 0 0 0 0 0 0 0 0 30 60 0 30 60 0 30 60 0 30 60

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 30 60 0 30 60 0 30 60 0 30 60

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

plotted by CANPLOT
Sharp Rock. Bear Bog is 10 metres above and 100 to 400 metres inland from Lake Temagami. The stratigraphy (Figure 2) shows basal proglacial lake clay, overlain by deep lake mud, then pond mud and finally peat. The transition from a proglacial lake to ancestral Lake Temagami was dated at 8,720 ± 180 BP (BGS-1515). As predicted, this ancestral lake regressed from the northern end of the basin. The separation of the bog basin from the lake occurred at 5,500 ± 120 BP (BGS-1514).

In the town of Temagami, a 9,500 BP paleoshoreline was predicted along the 300 metre contour. To test this, two upland bogs were cored for stratigraphic information and C14 dating. Baseball Bog (292 metres a.s.l.) reveals a similar sequence to Bear Bog. Basal varved glaciolacustrine clay are overlain by lake mud, pond mud and finally peat. The transition from a proglacial lake to ancestral Lake Temagami is dated at 9,580 ± 200 BP (BGS-1543). Results from the second bog, Jessie Fen, were inconclusive. However a former beach of washed boulders occurs at the edge of the fen. This paleoshoreline was two metres above the current lake and 300 metres inland.

During a TransCanada Pipeline survey conducted by Gordon (1991) for Algonquin Associates particular attention was given to the three kilometre segment that crosses the paleo-outlet in Temagami. All erosional features were examined, with test pitting in several undisturbed areas. A 20th century native hunting camp (the Caribou Cabin site, CgGw-6), was found on a low rocky ridge, 100 metres west of Caribou Lake. Survey was also conducted along the one kilometre proposed pipeline deviation. The only artifact discovered is a single large bifacial flake struck from a dark brown metasediment core. This find spot was called the Portage site (CgGw-4), as it lies on the current canoe portage between Lake Temagami and Cassels Lake (Gordon 1992). We can speculate that when ancestral Lake Temagami flooded up to the 300 metre contour, this site would have been situated on the southwest corner of an island, 40 metres from the water. South-facing orientation and proximity to water are common characteristics of prehistoric sites on current Lake Temagami shores (Gordon n.d.).

Several other sites were recorded during fieldwork (Gordon 1992). At the north end of Lake Temagami two 20th century native encampments were discovered, the Stove site (ChHa-3) and the Cache site (ChHa-4). On Deer Island, the remains of the 1904 to 1912 Lady Evelyn Hotel (cf. Hodgins and Benidickson 1989) and a prehistoric component were recorded as the Lady Evelyn Hotel site (CgHa-35). Other sites discovered include two Woodland sites — Mayhue Rock (CgHa-33) and South Deer (CgHa-34) — and, north of Temagami, a historic sawmill (Owaissa Sawmill, CgGw-2).

In conclusion, fieldwork bore out several predictions of the isostatic rebound model. As an initial step in predicting archaeological site location since deglaciation, this study offers important data: 1) lake levels in the Lake Temagami basin underwent rapid change, first with proglacial lake flooding (ca. 10,500 BP), then with differential isostatic rebound acting on the ancestral lake (ca. 8720 BP onwards); 2) the effects of isostatic rebound on paleoshoreline location is differential, causing regressing water levels (and emergent shores) in limited locales while simultaneously causing transgressing water levels (and submerged shores) in the rest of the basin.

This study reduces the search area in this dense forest landscape to specific inland locales for potential Paleo-Indian or Early Archaic sites. Knowing which areas have
submerging shorelines aids the design of conventional shoreline survey, as lake transgression is differential depending on landform elevation. Understanding the local effects of dynamic water levels helps in the reconstruction of changing patterns of prehistoric land-use. This study also has implications for heritage planning or GIS predictive modelling which may benefit from considering both paleohydrology and modern drainages for assessing archaeological potential. Finally, the presence of two modern outlets, one north, the other south, on Lake Temagami has complicated the model by producing several paleo-lake basins with different outlets. We suggest that our approach may be even more useful for researchers working on modern lake basins with only southern outlets as these should have lake regression all around the basins (cf. Karrow and Warner 1990).

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