Maine Geological Survey
DEPARTMENT OF CONSERVATION
Walter A. Anderson, State Geologist

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**Title:** Surficial Geology of Portions of the Grand Falls Lake Area: An Investigation of Evidence for Holocene Faulting

**Author:** Geoffrey W. Smith

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This report is preliminary and has not been edited or reviewed for conformity with Maine Geological Survey standards.

**Contents:** 3 page report and map

## INTRODUCTION

Surficial geologic mapping was conducted during the summer of 1983 in the vicinity of Grand Falls Lake in eastern Maine. The area studied includes portions of the Calais, Big Lake, Kellyland, and Waite U.S.G.S. 15-minute Quadrangles (see accompanying map). The study was undertaken to determine whether or not there is evidence in the surficial sediments of the Grand Falls Lake area to indicate Holocene faulting or other crustal movement. Field mapping on available topographic maps (scale 1:62,500) was supplemented by interpretation of aerial photographs (scale approx. 1:20,000), and visual interpretation of band-5 Landsat images of the area.

## INVESTIGATIVE PROCEDURE

The surficial geology of much of the Grand Falls Lake area has been mapped at a reconnaissance level by previous workers (Borns and Andersen, 1982; Brewer, in press; Holland, in press). As a result, the present study involved detailed site-specific studies of localities that were judged to be of particular importance in providing information concerning recent faulting in the area. Two classes of localities were defined: large-scale morphologic features (eskers, drumlins), and smaller-scale exposures of glacial and post-glacial sediments and glacially abraded bedrock surfaces. Study of the large-scale features entailed determination of offset (or lack of offset) or other disruption of trends of features or groups of features. Small-scale features were examined to determine whether or not sediments or abraded surfaces display any evidence of deformation or displacement that cannot be explained in terms of glacial processes. In an effort to restrict the size of the study area, sites were selected largely on the basis of the occurrence of intersections of glacial features and faults inferred from interpretation of topographic maps, aerial photographs, and Landsat images.

## RESULTS OF STUDY

Analysis of gross morphologic features in the Grand Lake area (including patterns of drainage) suggest, within the limits of resolution, the presence of three, and possibly four, faults that trend ENE-WSW across the area (see attached figure). There is, however, no clear indication in either the small-scale or the large-scale features of recent movement on these faults.

Two large esker systems cross the area, trending in a general N-S direction. One esker follows the course of Tomah Stream, crosses Grand Falls Flowage, and continues southward about two miles west of the town of Woodland. The second esker follows the valley of East Branch Big Musquash Stream, and enters the valley of Big Musquash Stream approximately two miles north of Grand Lake. This esker was traced no further than the north shore of Grand Lake.

These eskers transect positions of inferred faults at localities 1-4. In no instance is there any clear evidence of fault displacement associated with the eskers. There is no lateral or vertical displacement of esker morphology. Nor is there tectonic deformation within esker sediments to suggest post-depositional structural modification. At locality 3, the esker is breached at a position where it intersects an inferred fault. This break in esker morphology is most probably related to the manner in which the esker was formed (as a beaded esker), though it may record post-depositional displacement by faulting.

Drumlin orientation displays no pattern that would suggest post-depositional displacement. The effect of topographic control on drumlin formation is great enough that all but a drastic change in orientation related to post-depositional deformation would be impossible to delineate. There is clearly no instance of offset of individual drumlins or abrupt deflection of drumlin orientation, as would be expected if the features had been modified by recent fault movement.

The abandoned railroad right-of-way between Woodland and Princeton, particularly the section crossing the Grand Falls Flowage, also shows no evidence of displacement. A small section of the right-of-way about midway across Grand Falls Flowage has been removed by wave erosion. There is no evidence at this locality to suggest that erosion was initiated by fault displacement.

All available exposures of surficial materials occur within deposits of coarse clastic sediments, and all display significant ice-contact deformation. There is nothing in the exposures to suggest that the deformation is of other than glacial origin, though that possibility is not precluded.

Bedrock in the Grand Falls area is predominantly calcareous metasandstone and metasiltstone (Flume Ridge Formation?). These lithologies do not preserve small-scale glacial markings well. In the few instances where glacial striations were recorded (see attached figure), there was no suggestion of offset by recent faulting.

In summary, there is no clear indication in the surficial geology to suggest that there has been any significant recent movement on faults in the Grand Falls area.

## REFERENCES

Borns, H. W., and Andersen, B., 1982, Reconnaissance surficial geology of the Calais Quadrangle, Maine: Maine Geological Survey Open-File Map 82-1.

Brewer, T., in press, Reconnaissance surficial geology of the Kellyland and Waite Quadrangles, Maine: Maine Geological Survey Open-File maps.

Holland, W. R., in press, Reconnaissance surficial geology of the Big Lake Quadrangle, Maine: Maine Geological Survey Open-File map.

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# SURFICIAL GEOLOGY OF AREAS BORDERING INFERRED BEDROCK FAULTS IN THE PRINCETON REGION, MAINE

by
**Geoffrey W. Smith**

Maine Geological Survey
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Walter A. Anderson, State Geologist

Qs — Holocene alluvium and swamp deposits

Qp — Glaciomarine deposits

Glaciofluvial deposits

Qg — Qg Ice contact - stratified drift

Qge — Qge Eskers

Qt — Till

rk — Bedrock and areas of thin surficial sediments

Drumlin

180 — Glacial striation

Meltwater channel

Narrow glacial till ridge

(1) Locality where esker transects position of inferred fault

Fault

Fault - inferred, possible

1 0 1 Miles

1 0 1 Kilometers

**1984**

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