

## ATV-DRILL PERFORMANCE: A CASE STUDY, FORT SIMPSON, DISTRICT OF MACKENZIE

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### Introduction

During late March and April 1977 Terrain Sciences Division and the Department of Geology, University of Alberta took part in a joint project about 40 km south of Fort Simpson, Northwest Territories (Fig. 1). The purpose of the field work was to gather ground ice and groundwater data on a distinctive, widespread organic terrain type in upper Mackenzie Valley.

Drilling through seasonal frost and permafrost into the unfrozen material below was necessary for installation of piezometers and thermistor strings. Holes were located along previously surveyed profiles. Cores were taken, and maintained in the frozen state, in order to log detailed stratigraphy and to provide undisturbed samples for determination of geotechnical properties and ground ice geochemistry.

The ATV-drill (Veillette and Nixon, 1975) used for this drilling and sampling is a light soil auger mounted on a 3 m mast and carried by an eight wheel drive all terrain vehicle (ATV) (Fig. 2). The project provided an opportunity for further evaluation of the equipment.

This report deals with the performance of the ATV-drill and related equipment and the implications for future use.

### Site Location and Description

The study area covers less than 1 km<sup>2</sup> of raised peatland and low fen and ponds south of the confluence of Liard and Mackenzie rivers and north of Jean Marie Creek in map sheet 95H (Fig. 1). It is within the southern fringe of the discontinuous permafrost zone (Brown, 1967).

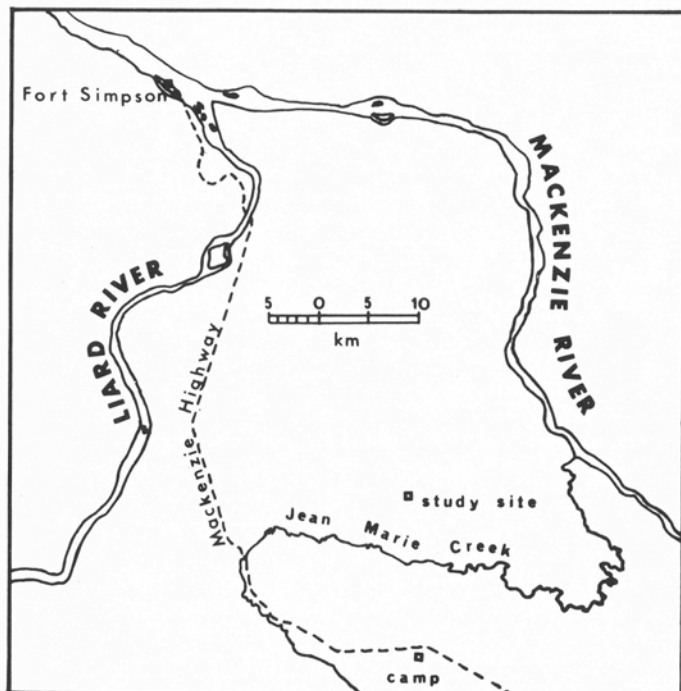


Figure 1. Location map for the study site, south of Fort Simpson, Northwest Territories.

Relief on the glaciolacustrine plain may be more than 3 m and commonly consists of steep banks of raised peat plateaus. The plateau surfaces are irregular with hummocks, closed depressions, and frost fissures. Vegetation is an open spruce wood of generally small trees.

The general stratigraphy of the raised peatland includes up to 3.5 m of peat over glaciolacustrine silty clay. Permafrost extends to a maximum depth of 9 m. In possible collapse structures within the plateaus the peat is thinner and only seasonal frost was encountered.

Access to the site from a camp at the highway was via an overgrown seismic line for 13 km and over frozen ponds and fen for another 5 km. The seismic line crosses two steep beach bluffs and the moderately steep banks of Jean Marie Creek. Across areas of marshy ground, the surface is extremely rough.

### Equipment

The ATV-drill was conceived as a self-contained mobile permafrost coring auger for rapid drilling to 3 m depth, but can be used to greater depths, and has considerable drill tool flexibility, including diamond drilling equipment and continuous flight augers.

Two major modifications were tested. A drill head (power and transmission unit) that provided higher torque and lower speed (49 kg-m and 50 rpm) than that originally mounted was employed, and optional snow tracks were fitted over the standard low pressure tires. Modified CRREL core augers (Veillette, 1975a) for 5 and 7.5 cm diameter cores were used. These consist of core barrels with carbide cutters and double helical flights to carry cuttings to the top; they were developed by U.S. Army Cold Regions Research and Engineering Laboratory (Geotest, 1974). A continuous flight auger stem, producing a 7.5 cm diameter hole, also was used.



Figure 2. ATV-drill in drilling position; note the Stihl 4308 drill head (GSC 203314-F).