Glacial Geomorphology Features Observed on LiDAR Imagery, Halifax, Nova Scotia[1]

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Spectacular images of glacial geomorphology features, especially drumlins and flutings, are evident in the 'bare-earth' model of the LiDAR survey in the Halifax metropolitan area. Subtle variations in drumlin orientations and shape are clearly defined on the LiDAR imagery, allowing for identification of previously unmapped features which can be used to interpret the glacial history.

Prior to the LiDAR survey, the glacial history was based primarily on coastal sections, which fortuitously cut approximately perpendicular to the drumlins' long-axis and reveal their multi-phase genesis history. The landforms have a 'core' grey till, thought to relate to an early southeastward flow. This is overlain by a red till from an ice flow event towards the south and southwest. This till is predominantly composed of material derived many 10's of kilometers from the study area, possibly resulting from an ice-stream event. Later glacial events deposited tills derived of locally derived material that apparently did not significantly modify the drumlins' shape.

Drumlins and flutings are located primarily over metasedimentary bedrock and are mostly absent over granitic terrain; topography does not vary significantly over the area. Down-ice of one zone of drumlin-free granitic bedrock is an area of landforms transverse to ice-flow. Geomorphologically these can be compared to hummocky-active ice moraine in Finland, or Rogen moraine formed along the boundary of sliding to non-sliding ice in northern Canada. The distribution of these landforms in the study area suggests that bedrock type strongly influenced glacial dynamics, including the routing of ice-streams and locations of predominantly cold-based patches of ice. Likely drainage at the bed of the glacier was a key control, as the metasedimentary units tending to be fractured and better drained, compared to granite that is poorly drained. Because the drumlins are formed from distally derived material the relative erodibility of the surfaces is probably not a factor. Along the margins of the ice-streaming zone overtop of granitic rock, the surface appears (at least in places where the surface is observable) to be ice-molded and striated.

The LiDAR image allows for identification of other previously unmapped glacial features, including eskers and small drumlins. The imagery also allows the author to make general estimates of till thickness (veneer vs. blanket), aided by depth-to-bedrock measurements in a well-log database. Because the new LiDAR based maps are more detailed, they include previously unmapped alluvium, lacustrine/wetlands, and anthropogenic deposits.

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