Drumlins: Are They What They Are Cracked Up To Be?

Terry W. Noble, Environmental Consultant, Thunder Bay, Ontario, Canada (2003).

Any classic surficial geology text worth its weight includes a picture of a group of drumlins. Typically, these elongated knolls or ridges are described as appearing like a field of inverted spoons, the backs of whales, a basket of eggs or eggs set in jelly. Although a standard in texts they are often taken for granted in the real world. Farmers farm on them and motorists drive across or along them not knowing what they are on. Indeed, 'experts' don't know, or more accurately, aren't sure, what they are either. The origin of drumlins probably causes more circumspection by geomorphologists than any other 'glacial' landform. They may, in fact, be the most studied surficial landform in the Northern Hemisphere. Drumlins have been measured from all angles, poked with drills and even torn apart to see what is inside them. They have been classified, ranked, grouped by length, width, height, degree of elongation, steepness of slope and lumped using algebraic formulas yet there is no certainty as to how they formed.

Like Stonehenge, there is something to be appreciated in the mystery of not knowing their origin, however, for most, the only cure for curiosity is the satisfaction of knowing, which, of course, leads to the "pursuit of knowledge." Theories abound as to how drumlins form but each theory has one common aspect: they were formed under glacial ice. From this sub-glacial commonality, however, some variations on the theme have evolved. Modes of formation range from erosional to depositional or even constructional (i.e., molding of soft sediments) depending on the speed of ice-movement, the materials the ice moved over or whether the ice was stationary. Recently hydrostatic pressures related to sub-glacial floods rather than streamlining by moving glacial ice has been gaining some acceptance.

My experience with drumlins pertains to terrain mapping. I rely on my knowledge of their spatial form to identify them from aerial photographs. Given the right scale and contour interval, drumlins can be identified from topographic maps (excellent maps and photos can be accessed at www.topozone.com for the United States and www.multimap.com for the British Isles). I don't have to know how drumlins formed to do my work but this doesn't stop me from having an opinion. Based on 30 years of photo interpretation I don't believe their genesis relates to continental glaciers. I believe drumlins, and their many shape variations, are evidence of a disconnect between the earth's land mass and its seawater. When I see drumlins I see evidence of land submerging under water either completely or partially as the earth rotates through the polar region. The repetitive nature of this process results in many drumlin types ranging from long plough lines (fluted till plains) to much-modified remnant drumlins (i.e., rogen moraine). The latter are difficult to identify as such. The important constituent in this process is the action of floating sea-ice in conjunction with tides. One has to search diligently for evidence of former seawater levels amongst these features given their age, the discontinuous nature of any surviving shoreline segments, the high degree of tilt of these short shoreline remnants and the impact of the ice itself. Often the only clue might be one shoreline segment or possibly a tombolo or tombolo-like feature linking individual drumlins. Truncated drumlins (i.e., steeply scarped across the front face) mark ice rampart zones that consist of a terrace step (i.e., riser and bench) and/or push ridges (see figures below). The figures below represent a drumlinized till plain although it is difficult to detect that on the map given its scale. The area outlined in the photo has been designated in the research literature as kame moraine marking a halt in the movement of glacial ice or, in some cases, as an esker ridge marking a drainage route for water either on, within or under the glacier. I believe the outlined area marks an ice rampart zone where floating ice impacted land. The severity of this impact is seen in the presence of a truncated drumlin. There are similar ice rampart zones at lower elevations to the east of the area covered by the photo.

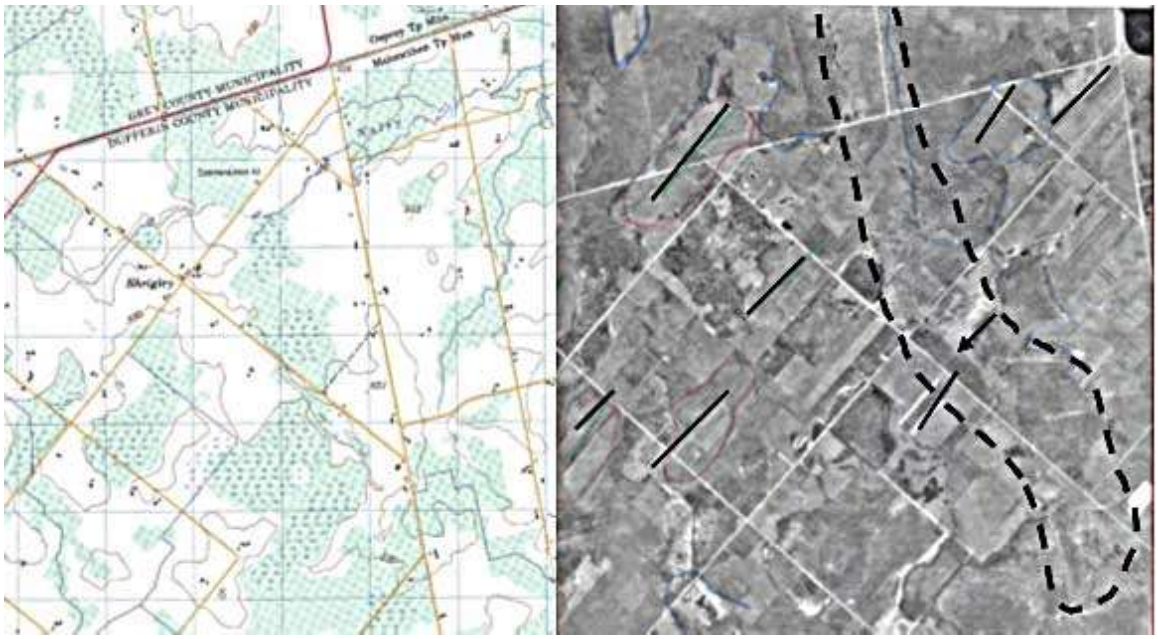

Figure 1. Drumlin field showing an ice rampart zone. The arrow points to a truncated drumlin (Energy, Mines and Resources Canada, NTS Map 41A/01; Ontario Ministry of Natural Resources Photo B83-30-199-23)