



Eskers in Ireland, analogs for sinuous ridges on Mars

Xavier Pellicer (1) and Mary Bourke (2)

(1) Geological Survey of Ireland, Quaternary Section, Dublin, Ireland (xavier.pellicer@gsi.ie), (2) Department of Geography, Trinity College, Dublin 2, Ireland

Sinuous ridges on the surface of Mars are often inferred as putative esker ridges. Eskers cover several hundred kilometers of the Irish landscape and are one of the dominant landforms in the Irish Midlands. Well exposed stratigraphic sections and the body of existing knowledge due to extensive research carried out on these landforms make the Irish eskers an excellent analog for sinuous ridges on Mars.

The Irish Eskers are sinuous ridges 0.1 – 80 km long, 20 – 500 m wide and 4 – 50 m high laid down by glacial meltwater in tunnels and crevasses in stationary or retreating ice sheets. They are commonly composed of sands and gravels with rounded boulders and cobbles. The gravels are usually bedded and the beds often slump towards the flank of the esker, indicating collapse as the confining ice walls melt. Four types of eskers have been identified in Ireland: (i) Continuous subglacial tunnel fill represents deposition within tunnels underneath or within an ice body originally used as water escape conduits; (ii) Continuous fluvial ice-channel fill deposit in channels cut into the ice on top of the glacier or down to the substrate subsequently infilled by sediments; (iii) Long beads - subglacial tunnel fill are segmented ridges, with a length-width ratio of 5:1 to 10:1, representing sequential deposition near or at the ice margin as the ice sheet retreats; (iv) Short beads are glaciolacustrine deposits interpreted as sequential deposition of ice-contact subaqueous outwash fans.

Irish eskers have significant morphological similarities with those identified on Mars providing an opportunity for an insightful morphological and morphometric analysis to determine potential formative environments on Mars. Putative Martian eskers are 2-300 km long, 50-3000 m wide and 10-150 m high. The Irish eskers are similar in scale and present dimensions within these ranges. Eskers in Ireland are composed of sand and gravel with cobbles and boulders. Mars esker-like ridges observed in high resolution images also show the presence of large boulders. Large glacial lakes in the Irish Midlands during ice withdrawal aided the outstanding preservation of these features. This permitted the cataloguing of 'pristine' morphologies and morphometries. Esker-like ridges identified on Mars are often located in low relief and depressions and show similar topographic conditions to those in Ireland.

The ExoMars rover scheduled to be launched on the surface of Mars by 2018 carries the first space-borne GPR system (Wisdom) with the objective of characterizing the top 3 m of the Martian subsurface. Ground Penetrating Radar (GPR) surveys carried out on the Irish eskers and associated sediments depicted the landforms internal architecture and paleocurrent indicators. A throughout investigation of the Irish eskers as Mars analogs using remote sensing methods and GPR will contribute to the understanding of sinuous ridges on Mars.