Geophysical Research Abstracts
Vol. 19, EGU2017-15401-3, 2017
EGU General Assembly 2017

Molards: "forgotten" periglacial landforms revealing landslide-processes and permafrost degradation

Costanza Morino (1), Susan J. Conway (2), Þorsteinn Sæmundsson (3), Jón Kristinn Helgason (4), Matthew R. Balme (5), Colm Jordan (6), John Hillier (7), and Tom Argles (1)

(1) School of Environment, Earth & Ecosystem Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK (costanza.morino@open.ac.uk), (2) Laboratoire de Planétologie et Géodynamique de Nantes UMR-CNRS 6112, 2 rue de la Houssinière, BP 92208, 44322 NANTES Cedex 3, France, (3) Department of Geography and Tourism, University of Iceland, Askja, Sturlugata 7, IS-101 Reykjavík, Iceland, (4) Icelandic Meteorological Office, Avalanche Centre, Suðurgata 12, Ísafjörður, Iceland, (5) School of Physical Science, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, (6) British Geological Survey, Environmental Science Centre, Keyworth, Nottingham NG12 5GG, UK, (7) Department of Geography, Loughborough University, Loughborough LE11 3TU, UK

The first records of molards date back to the beginning of the 20th century, but since then they have been rarely described in literature. This work aims to reawaken academic interest in these "forgotten" landforms, because they are an indicator of permafrost degradation and can be readily recognised in the field. Molards are conical mounds of debris that can form in landslide deposits. They have a variety of shapes and sizes (< 1 m to ∼10 m height; ∼30 cm to 20 m diameter), and their composition reflects the source material of the landslide. Molards have been observed in association with landslides affecting glacial and periglacial landscapes. Recent studies propose that molards form from blocks of ice-cemented soil and rock that are emplaced during transport in the landslide. These blocks subsequently thaw, resulting in cone-shaped mounds of debris: molards [e.g., 1, 2].

There is still a lot to learn about molards. For instance, how ice-cemented blocks interact and behave in the dynamics of the landslide is still unknown. A further complication is that other conical mounds can form in hummocky terrains of large rock avalanches and as ice-cored degradation features near the cold-based margins of ice sheets and outlet glaciers. This study aims to: (i) highlight the importance of defining molards as a distinct landform, (ii) understand how they form and their role in the dynamics of landslides in cold environments, and (iii) understand whether they can be used as a paleo-indicator of permafrost degradation.

Here, we report on two sets of molards found in the deposits of two different landslides in northern Iceland: (1) Móafellshyrna Mountain, and (2) Árnesfjall Mountain. Both originated from talus deposits perched on topographic benches. Immediately after the landslides, blocks of ice-cemented debris were found in the landslides' deposits. These blocks subsequently decayed into conical molards due to their ground ice thawing. At Móafellshyrna, we found only isolated molards, while at Árnesfjall we found also a dense group of elongate molards just below the main scarp of the landslide. We used ground-based 'Structure from Motion' (SfM) photogrammetry, in one case both before and after the ice-cemented block thawed, to measure (i) the distribution of the molards, (ii) the relative volume of molards compared to the whole landslide, (iii) the ground ice content of the original block. We infer that the isolated molards derive from a process similar to rock fall, while the densely-packed elongated molards derive from the rotational movement of the frozen-talus downslope.

We conclude that the distribution of molards can give insights into the dynamics of a landslide, and their relative proportion can be used to estimate the ratio of frozen to unfrozen mass at the time of failure. Furthermore, this study shows the importance of distinguishing molards from other conical deposits, because their presence can be used as an indicator of present/past permafrost degradation.

References:
[1] Milana, J.P., 2015. Perm. Peri. Proc., 27: 271–284.
[2] Brideau, M.A. et al., 2010. Yukon Expl. Geol, 2009, Canada: 119–133.