



**University of Dundee**

## **Thermal and dynamic behaviour of supraglacial clasts and the origin of sorting in supraglacial debris covers**

Kirkbride, Martin; Deline, Philip; Brock, Benjamin

*Publication date:*  
2014

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication in Discovery Research Portal](#)

*Citation for published version (APA):*

Kirkbride, M., Deline, P., & Brock, B. (2014). Thermal and dynamic behaviour of supraglacial clasts and the origin of sorting in supraglacial debris covers. Abstract from EGU General Assembly 2014, Vienna, Austria.

### **General rights**

Copyright and moral rights for the publications made accessible in Discovery Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from Discovery Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain.
- You may freely distribute the URL identifying the publication in the public portal.

### **Take down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



## **Thermal and dynamic behaviour of supraglacial clasts and the origin of sorting in supraglacial debris covers**

Martin Kirkbride (1), Philip Deline (2), and Ben Brock (3)

(1) University of Dundee, School of Environment, Geography, Dundee, United Kingdom (m.p.kirkbride@dundee.ac.uk), (2) Laboratoire EDYTEM, CNRS - Le Bourget du Lac, France, (3) Faculty of Engineering and Environment, Northumbria University, Ellison Place, Newcastle-upon-Tyne, United Kingdom

The transition zone from a discontinuous to a continuous debris cover is an extensive part of many glacier ablation zones. Although responsible for the highest specific melt rates of debris-covered glaciers, transition zones have received little research and are poorly understood. Here we consider the interactions between emergent clasts and melting ice surfaces at Glacier d'Estelette and Miage Glacier (Italian Alps). Debris-ice interactions are complex because dispersed heterogeneous debris both enhances and retards melt rate in the same locality, depending on the distribution of clast sizes. Observations reveal that thermal and dynamic clast interactions with the glacier surface increase the transport rate of coarse clasts, and initiate vertical sorting at the point when a continuous debris layer forms. This happens because, in summer, clasts exceeding the critical thickness for melt slide over the glacier surface. In contrast finer thermally-embedded material is transported at ice surface velocity and become covered by coarser material from upslope. Once established, debris-cover texture allows sorting to develop as the cover thickens downglacier. A two-layer temperature profile results, in which a coarse, drier clast layer of low thermal conductivity overlies a finer-grained, moist layer of higher thermal conductivity. Transition-zone processes establish inverse grading at the initiation of a debris cover, allowing subsequent sorting to operate as the cover thickens downstream. The processes by which this occurs are unknown, but analogy with periglacial active layers suggests convection within a frost-susceptible lower fine layer and eluviation of fines supplied by aeolian deposition and in-situ clast disintegration.