Geophysical Research Abstracts
Vol. 17, EGU2015-3065, 2015
EGU General Assembly 2015

Comparison of Acoustic Energy Meter (AEM) and Schmidt hammer 'R' for rapid assessment of rock surface hardness: a preliminary assessment from southeast Queensland, Australia

Martin Brook (1) and Stefan Winkler (2)

(1) School of Geography, Planning & Environmental Management, The University of Queensland, St Lucia, Queensland, Australia (m.brook@uq.edu.au), (2) Department of Geological Sciences, University of Canterbury, Christchurch, New Zealand

This research focuses on one of the key challenges in geomorphology - quantifying rock surface hardness via in situ measurements, to provide information on rock physical properties. This has been a focus in recent years with the rapid emergence of studies that center on surface and near surface weathering impacts, and rates of material loss. Indeed, a key element to understanding how weathering and erosion processes combine to influence rock surface (and landscape) evolution is the measurement and monitoring of rock surface hardness.

We provide results from a preliminary assessment of the applicability of the Acoustic Energy Meter (AEM) to subaerial rock surface hardness, in comparison with an N-Type Schmidt hammer. The AEM apparatus consists of a geophone which is in contact with the rock surface and some electronics. The AEM is held normal to the surface to be tested and the surface is struck with a small hammer (typically 0.75 kg), with the AEM quantifying the decay time of seismically-induced oscillations within the top c. 1-2 m of the rock mass. Previous work using an AEM has focused on measuring roof stability and delamination in South African underground coal, gold and platinum mines, where long AEM reverberation times correlated well with weak rock mass and dense microfracturing. However, the technique has rarely been applied to the assessment of rock surfaces in a subaerial setting.

We applied the technique to a range of lithologies at five sites in southeast Queensland in the Brisbane area, each an exposure of phyllite, granite, mudstone, argillite or volcanic tuff. The aims were: (1) quantifying the response of different rock masses to the AEM technique; and (2) assessing the applicability of the AEM as a rapid in situ measure of rock hardness by comparing results with Schmidt hammer 'R' values from the same exposures.

Results showed that the AEM is useful in discriminating rock hardness across rocks with different lithological properties. Second, an inverse relationship exists between Schmidt 'R' and AEM values, whereby outcrop with the highest AEM values (on mudstones) coincided with lowest Schmidt 'R' values. Conversely, the lowest AEM values (on volcanic tuff) coincided with the highest Schmidt 'R' values. Third, and most promisingly, the AEM data provided a much lower amount of scatter than the Schmidt 'R' data, which indicates that that the AEM may provide a more accurate proxy of rock surface hardness than the N-type Schmidt hammer. Nevertheless, although the AEM has been successfully applied in this limited case study, the degree of success in the various potential geomorphological applications needs to be established in detailed field evaluation programmes.