Geophysical Research Abstracts
Vol. 12, EGU2010-5033-2, 2010
EGU General Assembly 2010

The use of the durometer to measure rock hardness in geomorphology. Advantages and limitations.

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The durometer is a hardness tester developed to measure hardness of metallic materials that has been recently introduced to measure rock hardness in weathering studies. Aoki & Matsukura (2007) highlight some advantages of the durometer compared with the Schmidt Rock Test Hammer: the smaller plunge allows measurements in small surfaces such as taffoni or rock carvings, the wider measurement range and the lower impact energy. This last makes it a non destructive method that can be used on relatively soft rocks. In this work the durometer Equotip (©) has been tested in different environments in the field and in the laboratory to explore its applicability and limitations.

We applied the device on small rock samples of granite and limestone and a T-test showed that smaller sample size gave smaller hardness values ($p < 0.01$). Testing the effects of water content, there were no statistically significant differences between water saturated and dry samples. The influence of rock surface roughness was evaluated applying the durometer in ancient rock carvings in medium to coarse grain granites. We compared the values obtained inside and outside the grooves of the carvings using two different support rings, one flat and one concave. The flat ring was not able to reach the bottom of the groove, meanwhile the concave ring adjusts fairly well given its semi spherical section. A t-test confirmed the difference ($p < 0.01$) between lower rebound values obtained in the grooves using the flat ring and the higher and less scattered values obtained when the concave ring is used.

As a very sensitive device, there are some problems in the use related with rock roughness and rock grain size. In weathered medium to coarse grained rocks, with very irregular surfaces, is not easy to get a good contact between the plunge and the rock surface. A poor contact caused by surface roughness causes the scattering and lowering of rebound values. On the contrary, in homogeneous fine grained rocks and in uniform rock surfaces the device gave very good results. The data obtained in glacial, nival and rock coastal environments showed the potential of the device in the identification of changes in rock hardness. We were able to asses the changes in the weathering degree of glacial striations and marked differences in the rock surfaces subjected or not to abrasion.

A. Feal-Pérez is supported by the grant AP2006-03854 (Spanish Ministry of Education)