Paper No. 244-1

Presentation Time: 9:00 AM-6:00 PM

A GLOBAL SUMMARY AND ANALYSIS OF EXPOSED BEDROCK EROSION RATES ESTIMATED USING *IN SITU* ^{10}BE

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We compiled ^{10}Be concentrations for samples collected from eroding, quartz-bearing bedrock outcrops worldwide (n = 372); most samples are from temperate mid-latitudes. On the global scale, outcrops have erosion rates between 0.05 and 113 m/My with a mean rate of 10.7 ± 1.6 m/My. ^{10}Be erosion rates were compared with latitude, elevation, mean annual precipitation (MAP), mean annual temperature (MAT), peak ground acceleration (PGA; a proxy for seismicity), lithology, and climate zone. Linear correlations explain some of the variance between erosion rates and MAP ($p < 0.0001$), and PGA ($p < 0.0003$). Correlations between erosion rates and latitude and MAT are better described by a quadratic fit ($p < 0.0001$).

Sedimentary rocks (n = 47, 18.5 ± 2.8 m/My), perhaps reflecting weaknesses imparted by bedding planes and poor cementation, erode significantly faster than igneous rocks (n = 241, 8.3 ± 1.3 m/My; $p < 0.0001$), metamorphic rocks (n = 52, 12.6 ± 1.8 m/My; $p = 0.0411$), and pure quartz (n = 5, 2.3 ± 0.3 m/My; $p = 0.0292$). When samples are grouped by climate zone, exposed bedrock in temperate zones (n = 78, 25.5 ± 3.7 m/My) erodes faster than rock in any other zone ($p < 0.0014$); erosion rates in cold climates (n = 32, 15.7 ± 2.4 m/My) are higher than those in polar, tropical, and arid climates (n = 34, 3.1 ± 0.4 m/My; n = 15, 5.9 ± 1.1 m/My; and n = 213, 6.0 ± 0.9 m/My, $p < 0.0295$), possibly a result of more frequent freeze/thaw cycling.

Forward stepwise regressions show that latitude, elevation, MAP, MAT, and PGA explain 62% of variance in sedimentary rocks; MAP and MAT explain 100% in pure quartz but latitude and MAP explain only 14% of variance in igneous rocks and elevation, MAP, and PGA explain only 26% in metamorphic rocks. The ubiquity of bedding planes in sedimentary rock and the unquantified variability of joint and fracture density in crystalline rock may explain these results.

Latitude, MAP, MAT, and PGA explain 97% of variance in tropical zones; latitude, elevation, MAP, MAT, and PGA explain 12% in arid zones; latitude, elevation, MAP, and PGA explain 43% in temperate zones; latitude, MAP, and MAT explain 71% in cold zones; and latitude, elevation, and MAP explain 73% in polar zones. When all samples are considered, 23% of the variation of erosion rates can be explained by latitude, elevation, MAP, MAT, and PGA. Only precipitation seems to matter in all cases.

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General Information for this Meeting

Session No. 244--Booth# 42
Geomorphology (Posters)
Oregon Convention Center: Hall A
9:00 AM-6:00 PM, Wednesday, 21 October 2009