ESTIMATING LONG-TERM EROSION RATES IN A HYPER-ARID REGION USING IN SITU PRODUCED COSMOGENIC 10-BE AN 26-AL IN SEDIMENT AND BEDROCK

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Establishing long-term rates of erosion within a drainage basin is critical to understanding the impacts of human and climate induced landscape change. Using in situ-produced cosmogenic 10-Be and 26-Al in quartz, extracted from sediment and bedrock, we have estimated long-term, time-integrated rates of erosion (37.5 +- 3.7 m/My) in Yuma Wash Drainage Basin (190 km^2), Yuma Proving Grounds, AZ. A detailed study of a 7.5 km^2 sub-drainage gives erosion rates of (28.8 +- 1.2 m/My) indicating that erosion rates of individual sub-basins may be significantly different than the basin-wide average of all sub-basins. Our data also show no significant relationship between isotopic concentration and sediment particle size; however, isotope abundances in coarser particle size fractions appear more variable than finer fractions, most likely due to fewer particles per unit weight.

Isotopic signatures of individual geomorphic "compartments" (bedrock, hillslope colluvium, alluvial fans and terraces, and stream channel sediments) can be used to indicate sediment source areas and degree of sediment mixing within a basin. Resistant bedrock uplands have relatively high isotopic concentrations (2.7 +- 0.15 x 10^5 atoms/g), while downstream in the basin, sediments have lower isotopic concentrations (1.26 +- 0.08 x 10^5 atoms/g) suggesting mixing of high concentration bedrock-derived material with lower concentration material from weathering of bedrock beneath the hillslope colluvium. The compartmental isotopic signatures can be used to support the assumption that drainage networks are a good integrator of sediment and therefore isotopic concentrations of the material throughout the drainage basin. We believe that erosion rates determined from stream channel sediments may give better estimates of basin-wide erosion rates than those from bedrock outcrops, which represent the most erosion-resistant surfaces within a basin.