RATES OF ROCK SURFACE EROSION AND SEDIMENT PRODUCTION ACROSS THE HYPERARID NAMIB DESERT AND THE GREAT NAMIBIAN ESCARPMENT, SOUTHERN AFRICA

BIERMAN, Paul R., Geology Department, University of Vermont, Burlington, VT 05405
CAFFEE, M., Livermore National Laboratory, Livermore, CA.94550
MATMON, A., Institute of Earth Sciences, Hebrew University of Jerusalem, Jerusalem, Israel, 91904

The Namib Desert, one of the driest places in the world, rises 1000m across the coastal plain to the mountainous Great Escarpment, thought to have originated over 100 Mya when Africa drifted away from South America. King believed the escarpment retreated over 100 km to its present position, a rate approaching 1000 m/My. Fission track studies by R. Brown (pers. comm.) and cosmogenic measurements by Cockborn (1999)suggest the escarpment is more stable.

Cosmogenic samples we analyzed (n=53) support escarpment stability and establish that the Namibian landscape changes slowly. The most stable rock surfaces (e = 1 m/My) are near the base of the escarpment where precipitation remains low, but salt weathering and coastal fog are rare. On average, erosion rates below the escarpment are 3.7+/-2.0 m/My, similar to rates above the escarpment, 3.2+/-1.9 m/My. Thus differential erodability cannot explain why the coastal plane is 2000 m below the uplands. Erosion rates calculated using ephemeral streambed sediments, above and below the escarpment, are slightly higher than rock-derived rates (3 to 11 m/My) but can only be calculated as limits because we do not know the elevations at which the sediment was dosed by cosmic rays. The highest erosion rate we measured was from a small tributary heading on the Great Escarpment, 15 m/My. Extrapolating this rate yields only a few kilometers of retreat since continental break up, implying the escarpment has not retreated significantly; thus, retreat is not an active pedimentation mechanism forming the coastal plain today.

Consideration of 10-Be and 26-Al data suggests erosional steady state is reasonable for all of the samples from rock outcrops; there is no indication of burial or stripping of previous cover. Comparison with fission track data suggests that erosion rates have been similar over the 10^5 to 10^6 year time scale. Furthermore, a series of samples from just north of the Namib Sand Sea at Gobabeb shows no isotopic evidence of burial suggesting that for at least the last half million years, the sand has not migrated north and the appearance of the landscape has not changed.