PROJECT SUMMARY

The last decade has witnessed the development of several new techniques that allow quantitative landscape analysis on a variety of temporal and spatial scales. Of particular interest to hydrologists and geomorphologists is a suite of approaches that allow estimation of the rate at which sediment is produced in and removed from drainage basins. These techniques include thermal modeling of fission track length and frequency, quantification of U and He abundance, and the analysis of ^{10}Be and ^{26}Al produced in rock by cosmic-ray bombardment. We now have the ability to look back at a variety of time scales and estimate the rate at which material is denuded and carried away by both tectonic and surface erosion.

Recently, analysis of cosmogenic nuclide activity in sediments, rather than rock, has expanded the spatial scale at which cosmic-ray produced ^{10}Be and ^{26}Al can be used to estimate rates of sediment production. Such work has used ^{10}Be (and occasionally ^{26}Al) to determine sediment budgets, sediment sources, and sediment transport rates in drainage basins ranging in size from $<10^1$ to $>10^4$ km^2. One particularly powerful approach has been the analysis of multiple sediment samples collected along drainage networks in single catchments. Such an approach has been taken in humid, semi-arid, and arid environments. However, only a handful of sediment measurements have been made in samples collected from hyper-arid regions, where rivers rarely flow, discharge decreases dramatically downstream, and sediment transport is extremely episodic.

This modest, one-year proposal seeks sample processing support for the analysis of 60 samples already collected from the drainage networks of several Namibian rivers. Two of these rivers have source areas in the semi-arid south African highlands, flow across the Namibian escarpment zone, and have rarely-active channels that cut through the hyper-arid Namib desert to the coast. The other rivers head on the escarpment. The basins we sampled range in size from small tributaries up to $> 10^4$ km^2. The samples come both from various locations on the main stems of these rivers and from numerous tributaries in the highlands, in the escarpment zone, and in the Namib desert. Analysis of these samples, for both ^{10}Be and ^{26}Al, will allow us to estimate rates of sediment production in bedrock-dominated highlands, on the escarpment, and in the coastal plain. Careful consideration of ^{26}Al/^{10}Be ratios will identify at what point in the network long-term ($> 10^5$ y) sediment storage becomes important and, along with nuclide activity and mixing models, will allow us to identify the source of sediment in transport at various locations in the drainage networks.

The project has a strong educational component. Data analysis will be done by senior graduate student, Nichols, who has extensive experience in arid regions and cosmogenic nuclides. He will work along with Matmon, a post doctoral associate with extensive experience analyzing nuclide activity in drainage networks. PI Bierman and technician Larsen will work with both of them to ensure the quality of analyses and data interpretation.