

Erosion of Archeologic Sites and Terraces, Colorado River, Grand Canyon

by

Richard Hereford

U.S. Geological Survey

Flagstaff, Arizona

in collaboration with

Janet R. Balsom and Helen C. Fairley

National Park Service





CROSS-SECTION SHOWING ARCHEOLOGY AND TERRACES,
 COLORADO RIVER, EASTERN GRAND CANYON





Indirect Erosion



Direct Erosion

REGULATED FLOWS AND EROSION OF ARCHEOLOGIC SITES

- Direct Erosion
 - 33 of 475 sites have been directly eroded
 - Potential for direct erosion is problematic because the subsurface extent of sites is unknown
- Indirect Erosion
 - A substantial but unknown number of sites have been indirectly eroded
 - Occurs during entrenchment and widening of the short tributary streams draining the river corridor
 - Controlled by "effective baselevel" of the tributary streams, which was maintained by sand deposition at the stream mouths



F10

5.5 cm





6-65



9-83

An aerial photograph showing a rugged, rocky landscape. The terrain is covered with dark, jagged rocks and patches of light-colored soil or sand. Sparse, low-lying green vegetation is scattered across the ground. A wooden boardwalk or path runs diagonally across the lower right portion of the image. The overall scene appears to be a natural, possibly volcanic or high-altitude, environment.

6-65

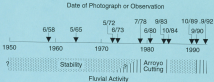
An aerial photograph showing a rugged coastline. In the lower-left corner, a dark, rocky shoreline meets the water. The rest of the image shows a steep, rocky hillside covered with sparse, low-lying vegetation in shades of green and yellow. The terrain is uneven and appears to be a natural, undeveloped area.

11-91









*Time Line Showing Fluvial Activity
in Terms of Stability and Arroyo Cutting*

DRAINAGE OF THE COLORADO RIVER CORRIDOR BY SHORT TRIBUTARY STREAMS

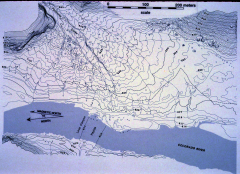
River-based streams

- Presently drain to the Colorado River
- These streams have entrenched since closure of Glen Canyon Dam, causing erosion of archeologic sites
- Entrenchment resulted from lowering of stream gradient to the present level of the Colorado River

Terrace-based streams

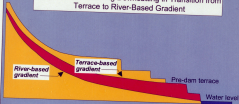
- Do not reach the Colorado River, baselevel is an older higher depositional level of the river
- Erosion of archeologic sites along these streams is unrelated to operation of Glen Canyon Dam
- Terrace-based streams have the potential to regrade to the post-dam level of the Colorado River, which will result in stream entrenchment and erosion of archeologic sites


100 200 meters
scale





Cross-section Showing Downcutting in Transition from Terrace to River-Based Gradient



 Downcutting occurring in the transition from terrace to river-based gradient

**POST-DAM DECREASE OF BASELEVEL
AND DEPOSITIONAL LEVEL OF THE COLORADO RIVER**

MAP AREA	ELEVATION (meters)		DECREASE (meters)
	<i>Pre-dam alluvium</i>	<i>Post-dam Fluctuating flow sand</i>	
Upper Unkar	804-805	800-801	4
Lower Tanner Can.	805-806	802-803	3
Tanner Canyon	807-808	803-804	4
Palisades Creek	820-821	816-817	4

Cumulative frequency, in percent



**Basin Area and Channel Length
of Terrace- and River-Based Streams**

• River-Based Basins are Larger with
Longer Channels

High Precipitation of
Winter 1978 through Spring 1985

