Alluvial Terrace Deposition and Soil Formation in Keet Seel Canyon, Navajo National Monument

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Introduction

Keet Seel Canyon, part of the Tsegi Canyon system in northeastern Arizona, contains several alluvial terraces deposited in repeated cycles of erosion and deposition in the Mid- to Late Holocene. Previous studies have correlated timing of deposition of alluvial terraces and subsequent arroyo formation from the Tsegi Canyon system to that of washes on nearby Black Mesa, suggesting widespread, climatically-driven arroyo formation (Hack 1942, 1954).

Keet Seel Canyon is the site of the well-preserved Keet Seel Pueblo, located in Navajo National Monument. Previous work has found that deposition of Keet Seel and other pueblos in the canyons occurred at c. 1300 A.D. (650 cal yr BP) (Dean 1996), a time that corresponds to alluvial downcutting, and was likely influenced by the loss of arable land in the canyon.

This study investigates buried soils on the alluvial terrace in Keet Seel Canyon, directly in front of Keet Seel Pueblo. Terraces of a similar age in the lower Tsegi Canyon were previously dated to >3000 B.C.-A.D. 1450 (≥5000–500 cal yr BP) (T. Karlstrom 1982, 1988).

Methods

• Soil geomorphic descriptions of a sequence of buried soils exposed in the arroyo directly in front of Keet Seel Pueblo, thought to correlate to the Tsegi-age terrace
• Radiocarbon dating of organic matter and macrobotanicals from buried soils

Results

• Buried sequence of five weakly developed soil horizons
• Soils show dark, organic-matter rich A-horizons that are poorly developed, over C horizons or B horizons with minimal soil development
• Radiocarbon dates are consistent with in-situ material (not likely younger organic matter)
• Deposition between >2800 BP to <600 BP (850 B.C. to A.D. 1340)

Study Area

Keet Seel Canyon is part of the Tsegi Canyon system in northern Arizona. The perennial Keet Seel wash has downcut through alluvial deposits in the canyon system, forming steep-sided arroyos. At least two alluvial terraces have been identified in lower Tsegi Canyon, which Hack (1942) termed the Tsegi and Naha terraces, after similar deposits on Black Mesa.

Discussion

• Dates presented here for the deposition of the terrace in front of Keet Seel Pueblo agree with earlier work that dates the deposition of the Tsegi-age terrace in the Tsegi Canyon system to >5000-6000 cal yr BP (9000 B.C.-A.D. 1350) followed by widespread downcutting between 1300-1340 A.D.
• The timing of downcutting in Keet Seel Canyon was consistent with that of the greater Tsegi Canyon system, and that the landscape in Keet Seel Canyon was a stable floodplain in front of the Keet Seel Pueblo until that time.
• Soil geomorphic data demonstrates that the terrace formed by rapid deposition of alluvial sediment followed by brief periods of stability and weak soil formation. The sequence of buried soils is very similar to a sequence of buried soils that have been documented on similar-age alluvial terraces on Black Mesa (E. Karlstrom 1988), further supporting models of a regional, climatic control on terrace deposition.
• A maize sample dated to 1460±70 cal BP presents additional evidence for very early use of the canyon during the Basketmaker period (1000 B.C.- A.D. 500). Sites of Basketmaker age are known for the region, but have only been dated in few locations in Keet Seel Canyon.

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