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Holocene fluvial geomorphology of the Amargosa River through Amargosa Canyon, California

D.E. Anderson *

Center for Environmental Science and Education and the Quaternary Sciences Program, P.O. Box 5694, Northern Arizona University, Flagstaff, AZ 86011, USA

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Abstract

The 275-km-long, mostly ephemeral, Amargosa River flows through some of the driest terrain in the western U.S. and terminates below sea level at Badwater Basin in Death Valley. An understanding of the geomorphic history and climatic response of an 18-km reach of the Amargosa River through Amargosa Canyon was sought by: (1) the development of a fluvial chronology for Amargosa Canyon; (2) the analysis of the modern hydroclimatology of the Amargosa River; and (3) the comparison of the Amargosa River record with other local and regional paleohydrologic reconstructions. Late Holocene fluvial landforms preserved in the upper 11 km of Amargosa Canyon include a suite of five terraces ranging from the active floodplain level to approximately 12 m above modern stream. Terraces in this reach are both fill and fill-cut, deposits are generally fine-grained, and the stream is an incised, straight channel. Deposits underlying the dominant terrace in upper Amargosa Canyon represent two main aggradational periods, one around A.D. 646 to A.D. 760, and a later period of rapid aggradation around A.D. 1485 to A.D. 1663. These two aggradational periods were separated by an erosional period. Both aggradational periods are associated with wetter conditions. Hydroclimatologic analyses suggest that troughs or cut-off low-pressure systems over the west coast of the U.S. are the dominant synoptic patterns associated with modern flow events in the Amargosa River. The lower 7-km portion of the river through Amargosa Canyon is dramatically different. Here, the stream has a braided channel, and the coarse-grained deposits form a series of abandoned braid bars. Also present in Amargosa Canyon are pediments and truncated alluvial fan sediments interfingering with predominantly coarse-grained axial channel sediments that are topographically higher and older than preserved late Holocene fluvial deposits. The Amargosa River through Amargosa Canyon appears to be quite sensitive to the low-magnitude climatic fluctuations of the latest Holocene, but this record is periodically lost through higher magnitude climatic fluctuations that cause erosion.

Keywords: Holocene fluvial geomorphology; arid land geomorphology; Death Valley; Amargosa River

* Tel.: +1 928 523 1276; fax: +1 928 523 1276.
E-mail address: sally.evans@nau.edu.

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1. Introduction

The starkly beautiful landscape of the Death Valley region has inspired much geomorphic study. Tectonism and dramatic fluctuations in paleoclimatic regimes through the Quaternary have contributed to a landscape that displays a vast array of desert landforms (see Slate, 1999, for a comprehensive list of recent work). Death Valley and its major tributary, the Amargosa River, lie at the southernmost boundary of the Great Basin section of the Basin and Range Physiographic Province (Fig. 1; Dohrenwend, 1986). The Great Basin is characterized by internal drainage resulting in many basins that contained lakes during

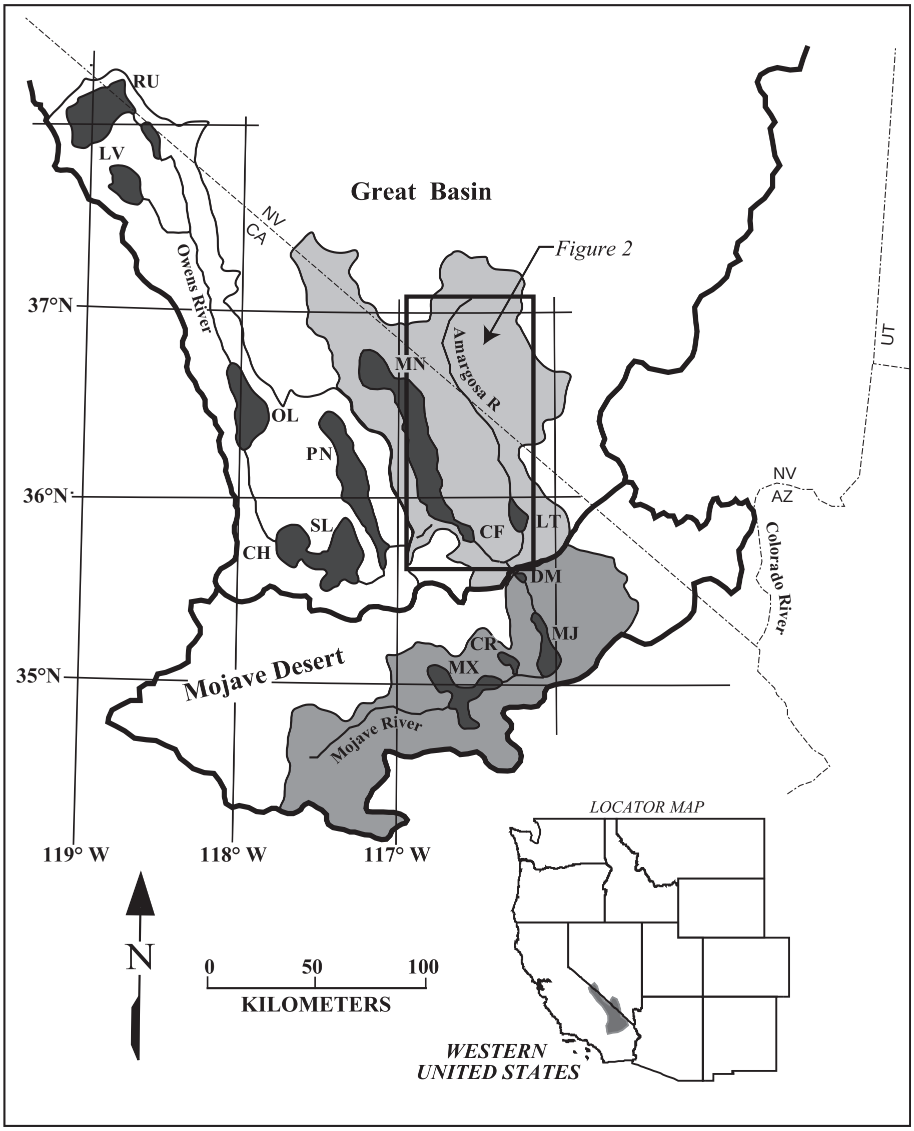

Fig. 1. Pluvial lakes in basins of the Owens, Mojave, and Amargosa Rivers. RU, Lake Russell; LV, Long Valley; OL, Owens Lake; CH, China Lake; SL, Searles Lake; PN, Panamint Lake; MN, Lake Manly; LT, Lake Tecopa; DM, Lake Dumont; MJ, Lake Mojave; CR, Cronese Lakes; MX, Lake Manix. CF denotes Confidence Flats sub-basin. Figure modified from Morrison (1991), and Anderson and Wells (2003a,b). Note inset square delineating the boundaries of Fig. 2.