The Plio-Pleistocene Quemado Formation of west-central New Mexico

Steven M. Cather and William C. McIntosh, 1994, pp. 279-281

in:

Mogollon Slope (West-Central New Mexico and East-Central Arizona), Chamberlin, R. M.; Kues, B. S.; Cather, S. M.; Barker, J. M.; McIntosh, W. C.; [eds.], New Mexico Geological Society 45th Annual Fall Field Conference Guidebook, 335 p.

This page is intentionally left blank to maintain order of facing pages.

THE PLIO-PLEISTOCENE QUEMADO FORMATION OF WEST-CENTRAL NEW MEXICO

STEVEN M. CATHER and WILLIAM C. MCINTOSH
New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico 87801

Abstract—The Plio-Pleistocene Quemado Formation (new name) consists of 29.5 m of volcaniclastic and siliciclastic sandstone and conglomerate at its type section in northwestern Catron County, New Mexico. The Quemado ranges in age from ~4 to <1 Ma, and consists of fluvial deposits that accumulated in several basin/paleovalley systems in upper reaches of tributaries to the ancestral Little Colorado River. The Quemado Formation is, at least in part, correlative with the upper part of the Bidahochi Formation.

INTRODUCTION

Reconnaissance geologic mapping of the Quemado 30′x 60′ quadrangle (Chamberlin et al., 1994) has led to improved understanding of the stratigraphy, structure and geomorphologic evolution of a large area of west-central New Mexico. Numerous $^{40}Ar/^{39}Ar$ ages from volcanic units within the map area (McIntosh and Chamberlin, McIntosh and Cather, this volume) have created a geochronologic framework for the area. Based on the geologic and geochronologic relations, it is apparent that this area of west-central New Mexico has experienced a regime of general fluvial degradation since the late Oligocene, interrupted by at least two periods of fluvial aggradation (McIntosh and Cather, this volume). The earliest episode of aggradation is represented by the Fence Lake Formation (Marr, 1956; McLellan et al., 1982), which accumulated <14.5 Ma to ~7 Ma. The Fence Lake Formation and associated late Miocene basalts cap the high mesas in the vicinity of US-60 in western New Mexico (e.g. Tejana Mesa, Largo Mesa, Cimarron Mesa, Mesa Redonda, and numerous unnamed mesas, Fig. 1).

The younger aggradational sequence (mapped as Quaternary alluvium by Willard [1957] and Willard and Weber [1958]) is topographically lower than, and inset against, the Fence Lake Formation that typically caps interfluves between the younger aggradational basins. The younger aggradational deposits range in age from ~4 Ma to <1 Ma, and accumulated in a series of erosional basins or paleovalleys in the upper reaches of the tributaries to the ancestral Little Colorado River. We propose the new name Quemado Formation for these Plio-Pleistocene deposits.

The Quemado Formation, which is nowhere exposed in its entirety, crops out discontinuously within at least four basins in west-central New Mexico (Fig. 1). These are, from east to west, the Omega Basin, the Largo Basin, the Red Hill Basin and the Cow Springs Basin. Thin gravelly sequences beneath early Pliocene basalts in eastern Arizona (McIntosh and Cather, this volume; see also Day Two road log) may represent remnants of deposits within a fifth basin in eastern Arizona (Nutrioso Basin), although correlation of these deposits is uncertain and will require further work.

LITHOLOGY AND TYPE SECTION

The type section of the Quemado Formation is designated in W/2 sec. 4, T1S, R21W, Catron County, New Mexico. The type section (Fig. 2) is exposed in roadcuts where an unimproved road ascends a

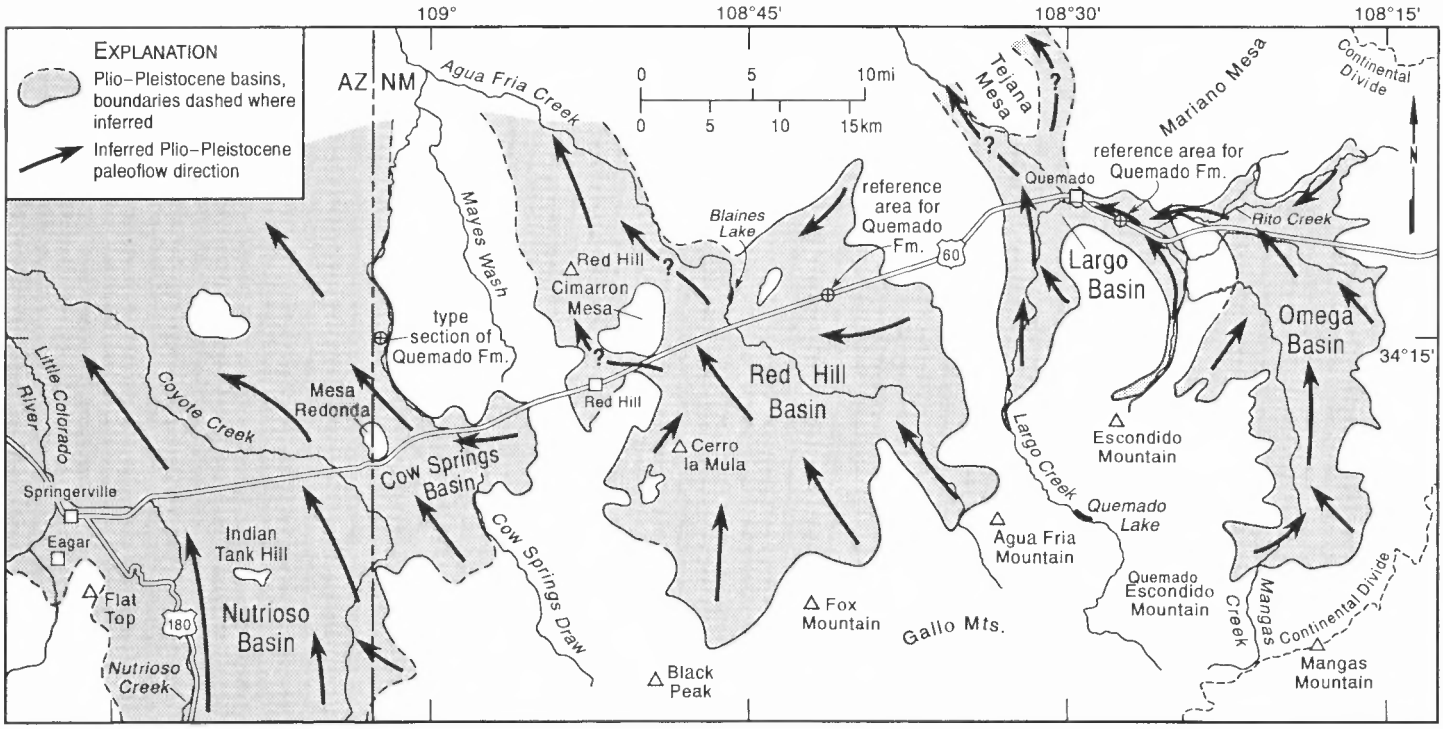


FIGURE 1. Map showing basins that contain sediments of Quemado Formation, inferred paleoflow directions, selected geomorphic features, and locations of type section and reference areas of Quemado Formation.

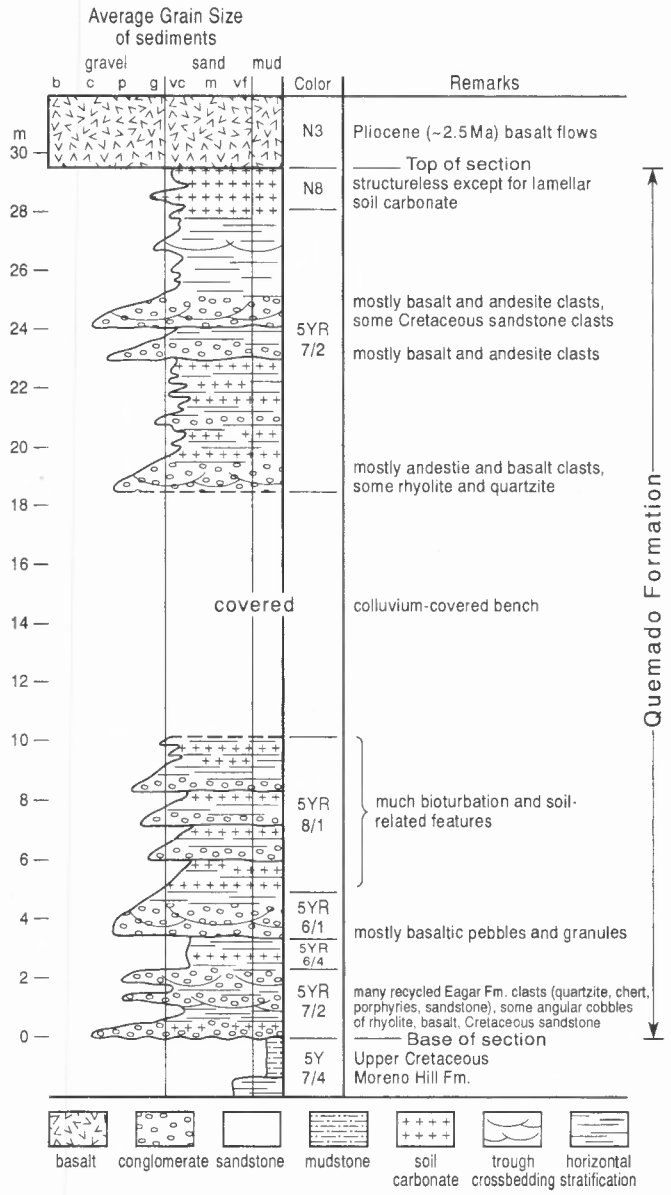


FIGURE 2. Type section of the Quemado Formation in W/2 sec. 4, T1S, R21W, Catron County, New Mexico. Section was measured with Jacob staff and Brunton compass by S. M. Cather.

basalt-capped mesa about 9 km north of US-60 and 0.5 km east of the New Mexico-Arizona state line.

At the type section the Quemado Formation consists of 29.5 m of mostly light brown to buff sandstone and conglomerate. The unit contains a mixture of volcanic detritus reworked from the Fence Lake Formation and Spears and Datil Groups as well as siliciclastic materials reworked from Upper Cretaceous sandstones and from Eocene Baca/Eagar strata. Cements appear to be largely calcite. The base of the Quemado is conglomeratic and rests unconformably on grayish-yellow mudstone and sandstone of the Upper Cretaceous Moreno Hill Formation. The middle part of the Quemado Formation is not exposed at the type section due to colluvial cover. The upper part of the Quemado is disconformably(?) overlain by late Pliocene (~2.5 Ma) basalt. Calcareous paleosols are common in the type section.

The lithology of the Quemado Formation at the type section reflects its location near the margin of the Cow Springs Basin. The proximal deposits at the type section are considerably coarser than is typical in the centers of most Quemado-age basins, and paleosols are typically more abundant than in distal, basin-center deposits. In order to represent the range of Quemado lithologies present in the region, we designate two additional reference areas, one each in the central parts of the Largo and Red Hill Basins. These reference areas consist of roadcut exposures of the Quemado which reflect the typical lithology (dominantly sandstone and siltstone) of the basin-center areas. The reference areas are located along US-60 3.4 km east and 19.9 km west, respectively, from the Quemado, New Mexico, post office (see Fig. 1 and Day Two road log).

AGE AND CORRELATION

At the type section in the Cow Springs Basin, the Quemado is inset against an unnamed mesa that is capped by basalts ranging in age from 6.03 Ma to 5.20 Ma (McIntosh and Cather, this volume). The basalt that caps the type section is one of a series of related flows that cap both the Quemado Formation to the south near US-60 (there dated 2.46 ± 0.04 Ma) and the Bidahochi Formation in eastern Arizona north of Mesa Parada (there dated 2.37 ± 0.03 Ma). These relationships argue for an age range for the Quemado type section of <5.2 to ~2.5 Ma, and suggest that the Quemado is, at least in part, temporally equivalent to the upper Bidahochi Formation.

West of the type section, in the Nutrioso Basin, possible Quemado-equivalent gravels are younger than and apparently inset against a 6.80-Ma basalt that caps Flat Top near Springerville, Arizona. These gravels are capped by 3.87-3.67-Ma basalts (see fig. 5 of McIntosh and Cather, this volume). East of the type section, in the Red Hill Basin, the Quemado Formation is inset against a 5.20-Ma basalt and interfingers with basalts as young as 0.970 Ma. In the Largo Basin, the Quemado can only be constrained to be younger than the 6.73-Ma basalt that caps Tejana Mesa (Dethier et al., 1986). Quantitative constraints on the age of the Quemado Formation in the Omega Basin are lacking.

The Quemado Formation is lithologically similar to parts of the upper Bidahochi Formation (Reagan, 1924, 1932; Repenning and Irwin, 1954; Love, 1989). The Quemado is also, at least in part, temporally equivalent to the upper Bidahochi (Love, 1989), although the upper part of the Quemado in the Red Hill Basin apparently post-dates the Bidahochi. It is possible that both the Quemado Formation and the Fence Lake Formation may represent proximal correlatives of the Bidahochi and that the inset nature of the Quemado in proximal areas may give way to normal stratigraphic superposition in the type area of the Bidahochi to the northwest. Further research will be necessary to evaluate this hypothesis. The Quemado Formation is temporally equivalent to parts of the upper Santa Fe Group to the east and upper Gila Group to the south, although it is clear that the paleodrainage net within the Quemado basins was not interconnective with those of the Gila or Santa Fe.

THICKNESS AND GENESIS

In the basins depicted in Figure 1, the Quemado ranges in thickness from a feather edge to as much as about 60 m in the Omega Basin. The Quemado is anomalously thick in the Omega Basin due to the effects of subsidence along the Hickman fault zone (Chamberlin et al., 1994). Other basins to the west are largely erosional paleovalleys which probably contain substantially thinner (<50 m?) accumulations of Quemado sediments, although thickness constraints are lacking in many areas.

The Quemado Formation appears to be entirely alluvial in origin. Although no paleocurrent data were collected, basin configurations indicate paleoflow was generally northerly (Fig. 1). The Quemado was deposited within paleovalley/basin systems that developed in the upper reaches of tributaries to the ancestral Little Colorado River. The paleovalley/basin systems depicted in Figure 1 become substantially narrower where they cross a series of late Miocene eruptive centers that compose a narrow, linear zone through Mesa Redonda, Cimarron Mesa and Tejana Mesa. The basalts that erupted from these vents just prior to incision and filling of the Quemado paleovalleys were relatively resistant to erosion and thus constricted the width of the paleovalleys where they crossed the late Miocene vent zone. South of the vent zone, the Quemado paleovalleys became broader where they were incised into the poorly indurated sediments of the Spears Group.

ACKNOWLEDGMENTS

The paper was improved by reviews from Matt Heizler and Dave Love. The manuscript was typed by Terry Telles and the figures were drafted by Becky Titus.

REFERENCES

Dethier, D. P., Aldrich, M. J., Jr. and Shafiqullah, M., 1986, New K-Ar ages for Miocene volcanic rocks from the northeastern Jemez Mountains and Tejana Mesa, New Mexico: Isochron/West, no. 47, p. 12-14.

Love, D. W., 1989, Bidahochi Formation: an interpretive summary: New Mexico Geological Society, Guidebook 40, p. 273-280.

Marr, R. J., 1956, Geology of the Lynch Ranches, Catron and Valencia Counties, New Mexico [M.A. thesis]: Austin, The University of Texas.

McIntosh, W. C. and Cather, S. M., $^{40}Ar/^{39}Ar$ geochronology of basaltic rocks and constraints on late Cenozoic stratigraphy and landscape development in the Red Hill-Quemado area, New Mexico: New Mexico Geological Society, Guidebook 45.

McIntosh, W. C. and Chamberlin, R. M., 1994, $^{40}Ar/^{39}Ar$ geochronology of middle to late Cenozoic ignimbrites, mafic lavas, and volcaniclastic rocks in the Quemado-Datil region, New Mexico: New Mexico Geological Society, Guidebook 45.

McLellan, M., Robinson, L., Haschke, L., Carter, M. D. and Medlin, A., 1982, Fence Lake Formation (Tertiary), west-central New Mexico: New Mexico Geology, v. 4, p. 53-55.

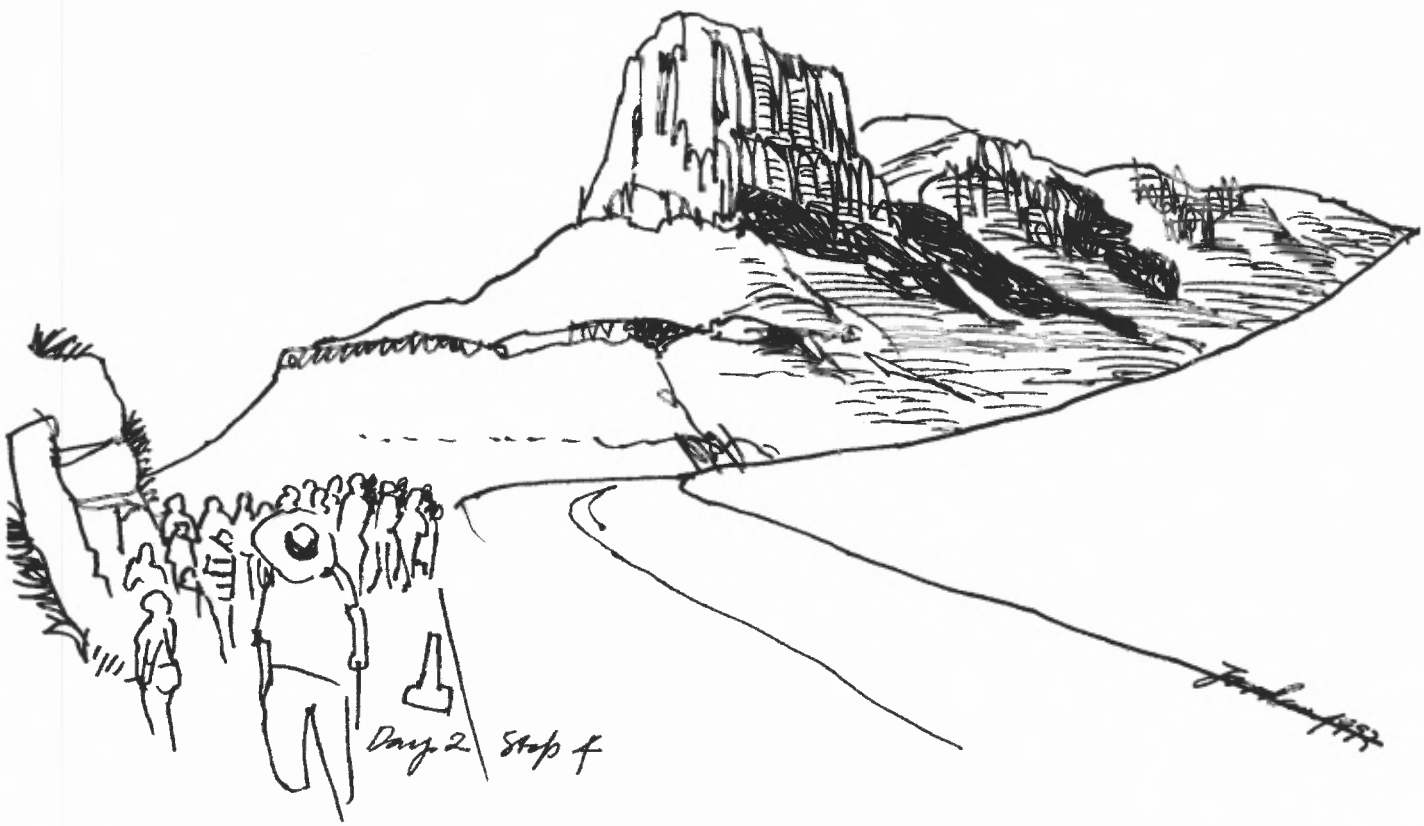
Reagan, A. B., 1924, Stratigraphy of the Hopi Buttes volcanic field, Arizona: Pan-American Geologist, v. 41, p. 355-366.

Reagan, A. B., 1932, The Tertiary-Pleistocene of the Navajo country in Arizona, with a description of some of its fossils: Kansas Academy of Science Transactions, v. 35, p. 253-259.

Repenning, C. A. and Irwin, J. H., 1954, Bidahochi Formation of Arizona and New Mexico: American Association of Petroleum Geologists Bulletin, v. 38, p. 1821-1826.

Willard, M. E., 1957, Reconnaissance geologic map of the Piñonville thirty-minute quadrangle: New Mexico Bureau of Mines and Mineral Resources, Geologic Map 3, scale 1:126,720.

Willard, M. E. and Weber, R. H., 1958, Reconnaissance geologic map of Cañon Largo thirty-minute quadrangle: New Mexico Bureau of Mines and Mineral Resources, Geologic Map 6, scale 1:126,720.


Day 2 Step 4