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Fence Lake Formation (Tertiary), west-central New Mexico

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A series of fluvial sandstones and conglomerates that unconformably overlies the Cretaceous rocks in the Moreno Hill, Rincon Hondo, Fence Lake, and Fence Lake SW 7½-min quadrangles, as well as in Twentytwo Spring and Cantaralo Spring quadrangles to the west (Anderson, 1981) and The Dyke and Cerro Prieto quadrangles to the east (Campbell, 1981), all in the north part of the Salt Lake coal field of west-central New Mexico (figs. 1 and 2), is here named the Fence Lake Formation for the community of Fence Lake in southwest Cibola County, New Mexico.

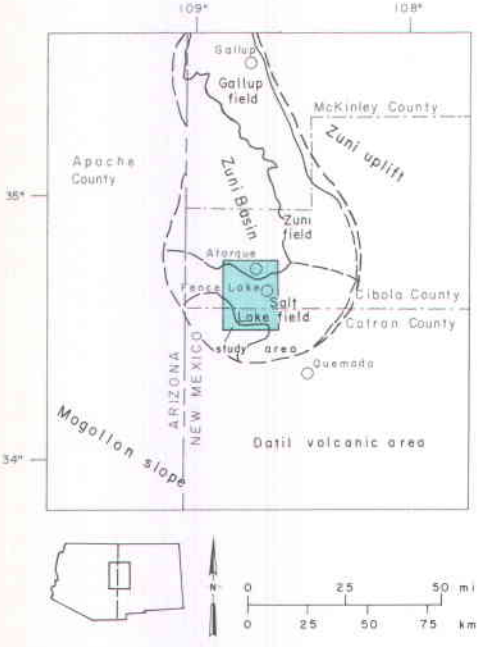

FIGURE 1—INDEX MAP SHOWING STUDY AREA, COAL FIELDS, AND SURROUNDING GEOLOGIC FEATURES; modified from Trumbull (1960).

These rocks were mapped as the upper member of the Bidahochi Formation by Repenning and Irwin (1954, p. 1,821–1,826), who mapped all Tertiary rocks on the Zuni Plateau as the upper member of the Bidahochi Formation. Reagan (1924, p. 366) originally had named the Bidahochi Formation for 35 ft of coarse, well-cemented conglomerate that overlies the Cretaceous rocks in the Ganado, Arizona, region, northeast of Bidahochi, but gave no other description of the rocks.

Repenning and Irwin described the Bidahochi Formation in northeast Arizona as being composed of three members. The lower member is composed of banded gray, brown, and pink flat-bedded mudstone and argillaceous fine-grained sandstone and a few beds of white rhyolitic ash. This member was considered to be a lacustrine deposit, which is present only in the area near Bidahochi, Arizona, attaining its maximum thickness of 214 ft approximately 15 mi east of there. A volcanic middle member composed of lava flows, extruded in the Bidahochi area, and of detrital

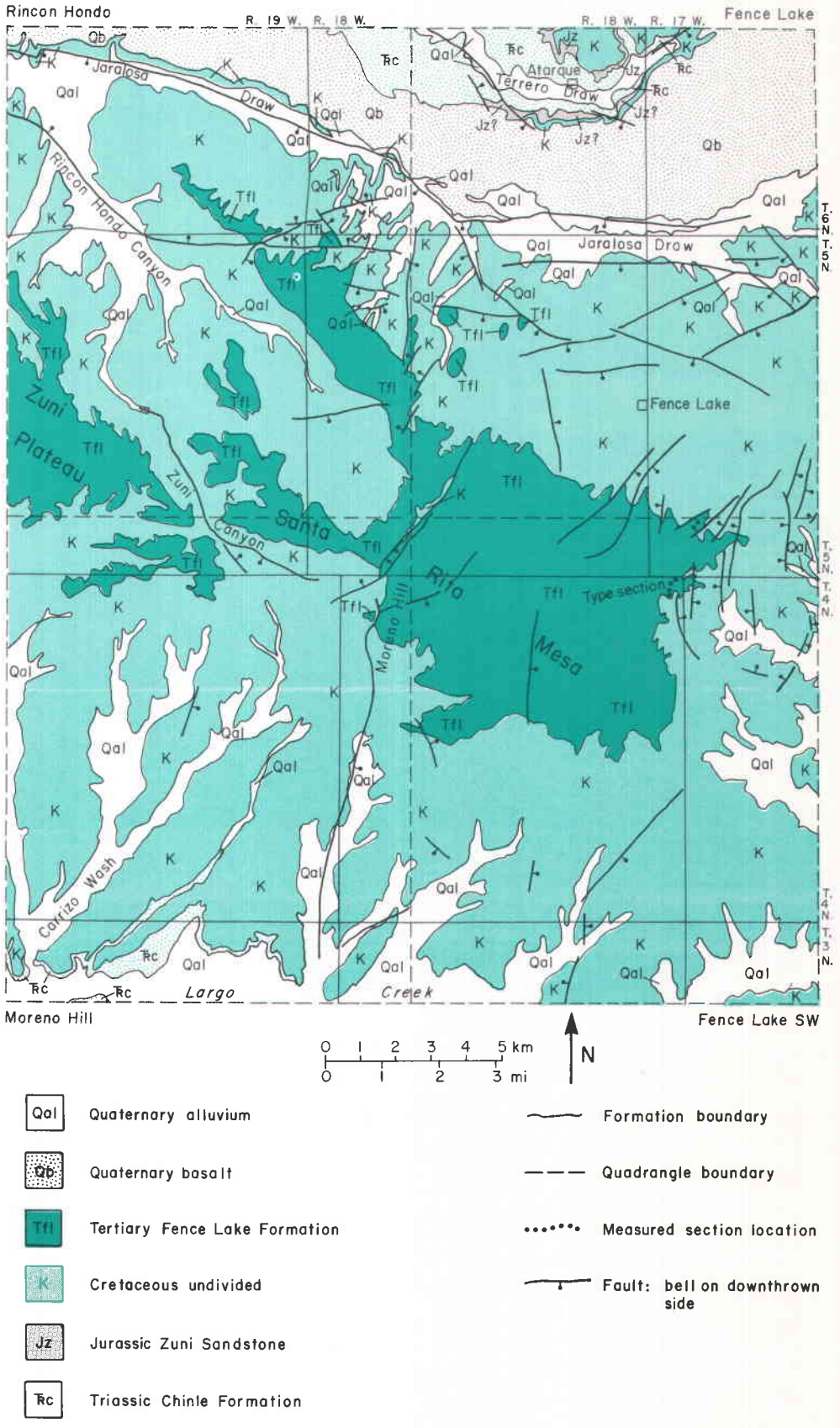

FIGURE 2—GENERALIZED GEOLOGIC MAP OF MORENO HILL, RINCON HONDO, FENCE LAKE, AND FENCE LAKE SW QUADRANGLES SHOWING AREAL EXTENT OF FENCE LAKE FORMATION (TERTIARY) AND LOCATION OF TYPE SECTION (FIG. 3); base from U.S. Geological Survey 1:100,000 topographic base, 1981.

volcanic material derived from them was described as separating the lower member from the upper member in the Bidahochi area. The middle volcanic member was reported to attain a maximum thickness of 100 ft in places, but no locations or detailed descriptions of its thicker sections were shown. The one measured section published showed 5 ft of pale yellowish-brown conglomerate composed of 5–15 mm subangular to angular quartzite and basalt pebbles in a matrix of fine- to medium-grained subrounded to rounded clear quartz grains. Repenning and Irwin (1954) described the upper member as mostly white to very pale brown, crossbedded, poorly cemented, medium- to fine-grained, argillaceous sandstone and a few beds of white rhyolitic ash. They stated that the member is as much as 450 ft thick in drill holes on the Navajo Indian Reservation.

The middle volcanic member of Bidahochi Formation, near White Cone Settlement in Arizona, has recently been dated by K-Ar methods at about 6.7 m.y. (Scarborough and others, 1974, p. 472).

In 1958, Repenning, Lance, and Irwin excluded the high-level gravel deposits near Fence Lake, New Mexico, from their discussion of the Bidahochi Formation in the Black Mesa Basin (p. 123). However, they did include older alluvium in adjacent parts of the valley of Carrizo Wash in the upper member of Bidahochi Formation (Repenning and others, 1958, p. 126, fig. 3). This poorly consolidated sandstone-to-siltstone unit is inset below and clearly younger than the high-level conglomeratic unit near Fence Lake. Recent work by Anderson (1981, and personal communication, January 1982), as well as earlier work by Akers (1964), supports identification of the deposits in the valley of Carrizo Wash (and in the Twentytwo Spring and Cantaralo Spring quadrangles in the western part of the Zuni Plateau) as the upper Bidahochi member.

Two main units comprise the Fence Lake Formation: a lower coarse conglomerate in a sandstone matrix with some sandstone strata and an upper sandstone with a few lenses of conglomerate. The lower unit covers most of the Zuni Plateau and Santa Rita Mesa, but the upper unit is present only on a few small mesas. A type section containing both units was measured in sec. 1, T. 4 N., R. 18 W. (figs. 3 and 4). The age of Fence Lake Formation is Miocene (John Hawley, personal communication, November 1981). The Fence Lake is older than the upper Bidahochi Formation of the Twentytwo Spring area, and clasts in it were derived from Oligocene-age basaltic andesites and rhyolites of the Datil-Mogollon area (John Hawley, personal communication, January 1982).

The lower conglomerate unit (fig. 5) was referred to informally as the "Fence Lake gravel" by R. J. Marr (1956). This unit is composed of subrounded to subangular granules, pebbles, cobbles, and boulders of basalt and rhyolite, as well as other volcanic rocks, chalcedony, petrified wood, sparse agate, and rare jasper and quartzite, in a matrix of fine- to coarse-grained poorly sorted pinkish-gray (5 YR 8/1) or light-gray (N6–N8) calcareous sandstone. On most exposed surfaces the sand matrix weathers readily, leaving a lag-gravel-covered slope. Caliche also occurs as thin beds within or on top of the conglomerate. A few thin lenses of sandstone, similar to the matrix, are interbedded with the conglomerate in most outcrops.

Along the Zuni Plateau in the western parts of Moreno Hill and Rincon Hondo quadrangles, the lowest part of the lower unit is composed of sandstone. It is a subangular fine- to coarse-grained, poorly sorted, weakly cemented, calcareous, mostly light-gray (N6–N8) sandstone composed mainly of quartz but containing some grains of orthoclase and mafic minerals. In some places, thin beds of volcanic-pebble and -cobble conglomerate alternate with the lowest sandstone beds. The maximum thickness measured was 50 ft in sec. 6, T. 5 N., R. 19 W. This sandstone apparently was not deposited on the higher parts of Santa Rita Mesa and the Zuni Plateau, and at this time it is considered a fine-grained lens of the lower unit.

On the eastern part of the Zuni Plateau and over most of Santa Rita Mesa, the lower unit lies unconformably on the upper member of the Moreno Hill Formation (Cretaceous), beveling it and filling joints within it (fig. 6). To the north, at places near Jaralosa Draw, and to the west on the Zuni Plateau, Cretaceous rocks were eroded even more deeply and the Fence Lake conglomerate lies on the lower member of the Moreno Hill. The lower Fence Lake Formation is much more resistant to erosion than the underlying Cretaceous sandstones and shales and overhangs on the Cretaceous along much of its outcrop on the east side of Santa Rita Mesa (fig. 5). Where the cement of the lower Fence Lake has dissolved, boulders from the conglomerate cover the slope concealing the contact between the Cretaceous and the Fence Lake Formation. In sec. 1, T. 4 N., R. 18 W., at the type section, the conglomerate is 41 ft thick. It is 100 ft thick in sec. 35, T. 5 N., R. 19 W., in the north-central part of Moreno Hill quadrangle, where it contains subrounded boulders as large as 2 ft in diameter; the conglomerate was reported by

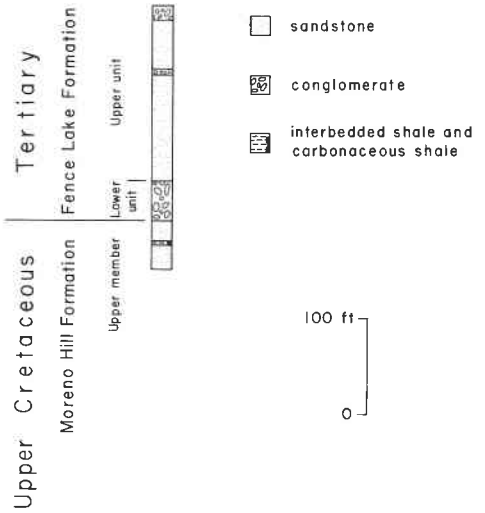

FIGURE 3—TYPE SECTION OF FENCE LAKE FORMATION (TERTIARY), SEC. 1, T. 4 N., R. 18 W., CIBOLA COUNTY, NEW MEXICO.

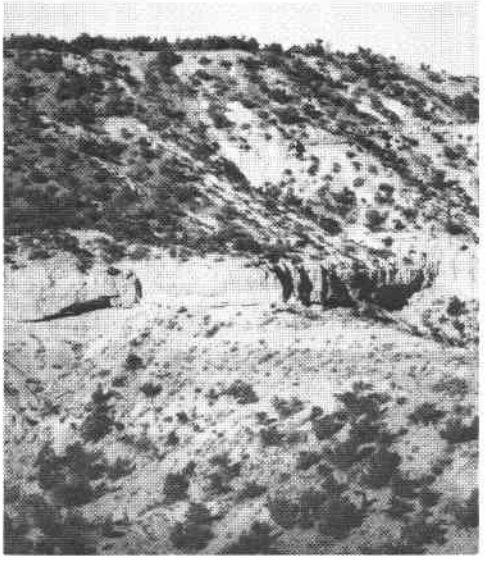

FIGURE 4—FENCE LAKE FORMATION (TERTIARY) OVERLYING UPPER MEMBER OF MORENO HILL FORMATION (CRETACEOUS) IN AREA OF TYPE SECTION, SEC. 1, T. 4 N., R. 18 W.

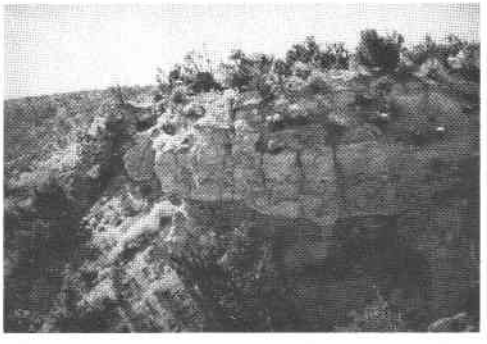

FIGURE 5—LOWER UNIT OF FENCE LAKE FORMATION, SEC. 1, T. 4 N., R. 18 W.; note overhang of Fence Lake on Moreno Hill Formation.

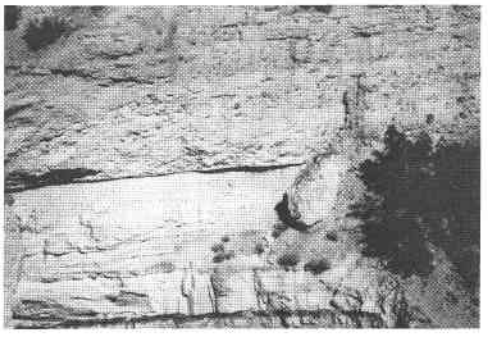

FIGURE 6—BASAL FENCE LAKE FORMATION FILLING FRACTURE IN UPPER MEMBER OF MORENO HILL FORMATION, SEC. 1, T. 4 N., R. 18 W.

Marr (1956) to be 120 ft thick in the SE¼ sec. 30, T. 5 N., R. 19 W. To the north and to the west it seems to become thinner and less coarse. Approximately 50–60 ft of the conglomerate overlies the 50-ft sandstone lens in sec. 6, T. 5 N., R. 19 W.

The upper unit, at the type section, is 180 ft thick and is composed mostly of poorly sorted, very fine-grained to coarse-grained, calcareous, grayish-pink (5 R 8/2) sandstone, containing grains of multicolored quartz, feldspar, and mafic minerals, and some beds of caliche. Approximately 71 ft below the top of the upper unit is a 6-ft-thick conglomerate lens composed of volcanic granules, pebbles, and cobbles in a sandstone matrix. The lens is similar to, but not as coarse as, the conglomerate of the lower unit. At the top of the upper unit is a 15-ft-thick lens of coarse volcanic-boulder conglomerate that is partly concealed by eolian sand. Some basalt boulders within this conglomerate are 3.3 ft in diameter. The upper unit remains only on a few mesas where it has been protected from erosion by such lenses of conglomerate. Near the middle of the upper unit at the type section is a petrocalcic soil horizon underlying a 10–15-ft-thick reddish zone (John Hawley, personal communication, November 1981).

On Cerro Blanco, a high mesa in sec. 35, T. 5 N., R. 16 W., approximately 320 ft of Fence Lake Formation is exposed (John Hawley, personal communication, November 1981). The basal 30–40 ft of this section seems to belong to the lower unit and the remainder to the upper unit. Within the upper unit on Cerro Blanco, lenses of gray, volcanic conglomerate interfingering with the pink sandstone (fig. 7) are much more numerous than at the type section, 10 mi west, and become increasingly common nearer the top of the section. Basaltic boulders within the conglomerate lenses are shown in fig. 8. To the east of Cerro Blanco the contact of Fence Lake Formation with the Moreno Hill Formation is exposed in the arroyo wall of Frenches Draw.

Other outcrops of Fence Lake Formation were observed by us on Mariano Mesa, approximately 2 mi north of Quemado, and by Anderson (1981) who mapped the Fence Lake Formation capping the northwest part of the Zuni Plateau in the Cantaralo Spring quadrangle, west of Rincon Hondo quadrangle, where the formation is more than 125 ft thick.

To the east, Campbell (1981) mapped the formation in the southeast quarter of The Dyke quadrangle, where it rests on successively younger members of Moreno Hill Formation in an eastward direction, and in the Cerro Prieto quadrangle where the Fence Lake Formation crops out on higher levels in the northeast quarter, just west of Cerro Blanco, and caps Flattop Mesa and Hawkins Peak. In this eastern area, Campbell (1981) reported that the formation is as much as 100 ft thick, but averages 60 ft, and he pointed out similarities of the clasts in the Fence Lake conglomerates to the Oligocene-age volcanic rocks of the Datil Group, which forms the Datil Mountains to the southeast. This correlation suggests that Fence Lake rocks are a northwest-trending alluvial fan derived from eroded Oligocene volcanics of the Datil Mountains region. Chamberlin's work (1981, p. 6) farther southeast supports this suggestion.

FIGURE 7—NORTH SLOPE OF CERRO BLANCO SHOWING PINK SANDSTONE STRATA INTERFINGERING WITH GRAY SANDY VOLCANIC-BOULDER-CONGLOMERATE STRATA.

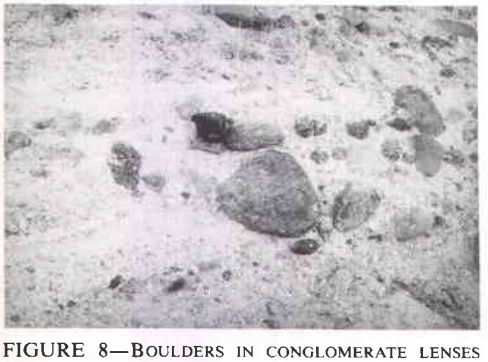

FIGURE 8—BOULDERS IN CONGLOMERATE LENSES WITHIN PINK SANDSTONE OF FENCE LAKE FORMATION ON CERRO BLANCO, SEC. 35, T. 5 N., R. 16 W.

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Geologic Highway Map of New Mexico published

The New Mexico Geological Society in cooperation with the New Mexico Bureau of Mines and Mineral Resources is publishing a completely revised Geologic Highway Map of New Mexico. Modeled after the 1975 Utah Geological Highway Map and, in part, after the series of Geological Highway Maps of the American Association of Petroleum Geologists, the new map will be a complete revision of the Dane and Bachman Geologic Map of New Mexico issued in 1965 by the U.S. Geological Survey in cooperation with the New Mexico Bureau of Mines and Mineral Resources and the Department of Geology at the University of New Mexico. The map, compiled on a scale of 1:1,000,000, was printed by the Williams and Heintz Map Corporation.

The Society's original 1961 edition of the Geologic Highway Map of New Mexico went out of print in 1978. Because of the popularity of this map and the need for a completely revised edition, a committee consisting of Russell E. Clemons, chairman, Robert W. Kelley, Frank E. Kottlowski, and James M. Robertson was organized to plan and supervise compilation of a new map. The committee first met January 30, 1979.

On March 13, 1981, all preliminary copy and map compilations were in the hands of the map committee. Revised compilations, drafting, and editing were completed by the end of 1981 and the map was ready for the printer. The new map will be available by late 1982.

The size of the sheet will be 26 x 46 inches and folded down to pocket size. When opened, the front of the sheet will contain the geologic highway map on one half. The base for the map will show roads and highways, county lines, major streams, geographic features, and municipalities. Adjacent to the map will be seven stratigraphic columnar sections serving as legends for the corresponding areas of the state. The seven subdivisions are entitled: San Juan Basin (northwest), Datil-Mogollon (west-central), Pedregosa Basin (southwest), Northern Rio Grande (north-central), Southern Rio Grande (south-central), Northeast, and Southeast. The compilers of these seven regions respectively are: W. J. Stone, W. E. Elston, E. G. Deal, L. A. Woodward, W. R. Seager, and V. C. Kelley (northeast and southeast). One northwest-southeast and three east-west cross sections are included.

The back of the sheet features a full-color version of the new satellite photomap of New Mexico, also at a scale of 1:1,000,000 (now available in black and white as Resource Map 12 of the New Mexico Bureau of Mines and Mineral Resources—see v. III, no. 1, p. 5, 10, and 11 of *New Mexico Geology*). Adjacent to the photomap are four smaller maps of New Mexico (approximately 1:3,500,000 scale) illustrating tectonic features, physiographic features, New Mexico Geological Society guidebook routes, and the location of parks, monuments, and other geological features. Brief explanations accompanying these maps have been prepared by V. C. Kelley, J. W. Hawley, J. E. Mueller, and R. E. Clemons.

A column entitled "Interpreting the Geologic Map" by F. E. Kottlowski makes the map beneficial to the public at large. The map is available for $3.50 from the Publications Room, New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico 87801.

The Geologic Highway Map of New Mexico is not intended to replace the state geologic map. It is meant as an aid to anyone traveling in the Land of Enchantment—geologists, students, teachers, tourists—in obtaining a better appreciation and understanding of the "mosaic of New Mexico's scenery, rocks, and history."