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MISSISSIPPIAN STRATIGRAPHY AND GEOLOGY OF THE NORTHWESTERN PART OF THE KLONDIKE HILLS, SOUTHWESTERN NEW MEXICO*

by

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INTRODUCTION

This paper is a preliminary report of the geology of the northwestern part of the Klondike Hills (Fig. 1) and represents an initial phase of a restudy of the outcrop area of the Mississippian carbonates, focused on petrology, facies, megafossils and microfossils, and biostratigraphy.

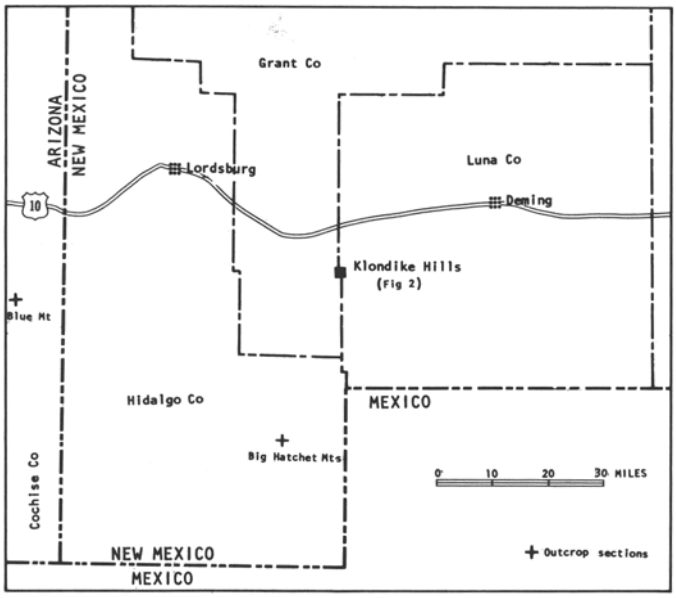

FIGURE 1.
Index map of southwestern New Mexico and adjoining Arizona showing location of Klondike Hills, Blue Mountain, and Big Hatchet Mountains.

A geologic map of the northwestern part of the Klondike Hills is shown on Figure 2. The Klondike Hills trend northwest-southeast and rise some 300 feet above the surrounding pediment surface. The pediment surface is cut on upper Paleozoic limestones and generally has a thin veneer of gravel and soil. This obscures the details of the bedrock geology of the pediment surface. The sequence of Paleozoic strata is badly broken by two sets of Tertiary faults, one set trending N. 50° to 60° W., and the other set trending N. 50° to 60° E. Inconclusive field evidence suggests that the northeast-trending set may be a series of high-angle reverse faults (Fig. 5). A conservative approach was taken in reconstruction of the fault planes in cross section A-A' (Fig. 3), and they are shown as vertical.

The map units are the Percha Shale, the Keating and Hachita Formations of the Escabrosa Group, and the Paradise Formation. In the Klondike Hills the Keating Formation can be subdivided into two mappable units which do not correspond to members A and B as defined at the type section at Blue Mountain, in Arizona. These are a lower unit of light-gray limestones formed by all of member A and the lower part of member B, and an upper unit of dark-gray crinoidal limestone formed by the upper part of member B (see Fig. 4). This particular subdivision of the Keating Formation is unique to the Klondike Hills and is due to a facies change within the Keating Formation from the typical lithology of the type section and exposures in the Big Hatchet Mountains. The overlying Horquilla Limestone is of Pennsylvanian age. In the Klondike Hills the basal brown sandstone of the Horquilla can readily be mapped as a separate unit from the overlying limestone. Small hills in the northeastern and south-central part of the map area are covered by Tertiary pyroclastic rhyolite. The pediment surfaces are covered in part by Quaternary alluvium composed of unconsolidated to poorly consolidated gravel, sand, and silt.

DEVONIAN SYSTEM

PERCHA SHALE

The Box Member, the upper member of the Percha Shale, crops out in the north-central part of the Klondike Hills as shown on Figures 2 and 5. Generally the area underlain by the Percha Shale is covered with a thin soil and grass, hut exposures can be found in small gullies. The upper 100 feet of the Box Member is exposed, and it consists of light-brown to grayish-orange, calcareous shales and nodular, argillaceous limestones. A small fauna of brachiopods was collected at two localities, which are shown on Figure 2. The fossils are poorly preserved and are: Paraphorhynchus sp., Schizophoria australis Kindle, and *Plano*-productus? sp. This assemblage appears to represent part of the fauna that Bowsher (1967, p. 264) considered typical for the Box Member of the Percha Shale and characteristic of a Famennian (Late Devonian) age.

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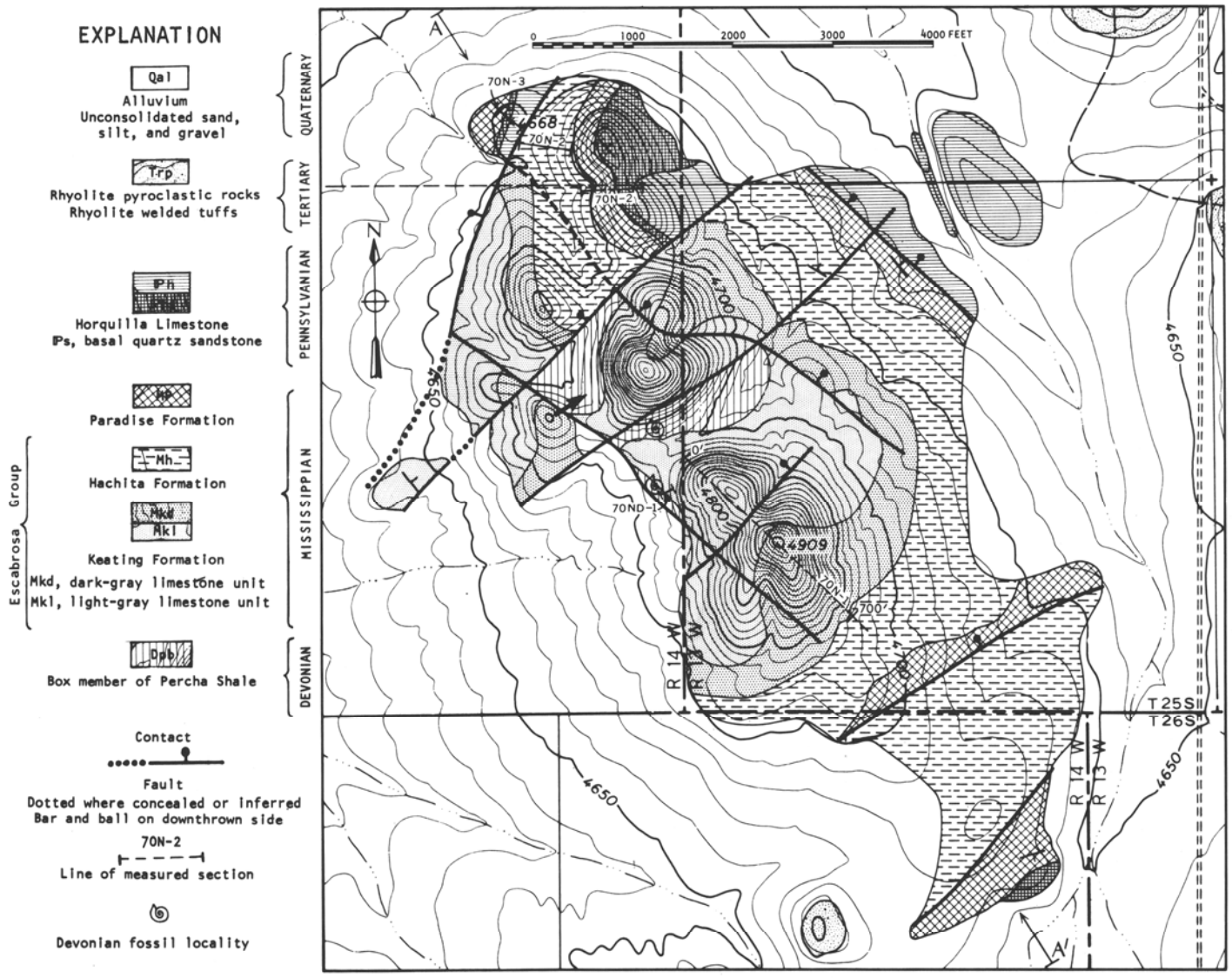


FIGURE 2.

Geologic map of the northwestern part of the Klondike Hills. Arrow marks location of Figure 5. A-A' is line of section shown in Figure 3.

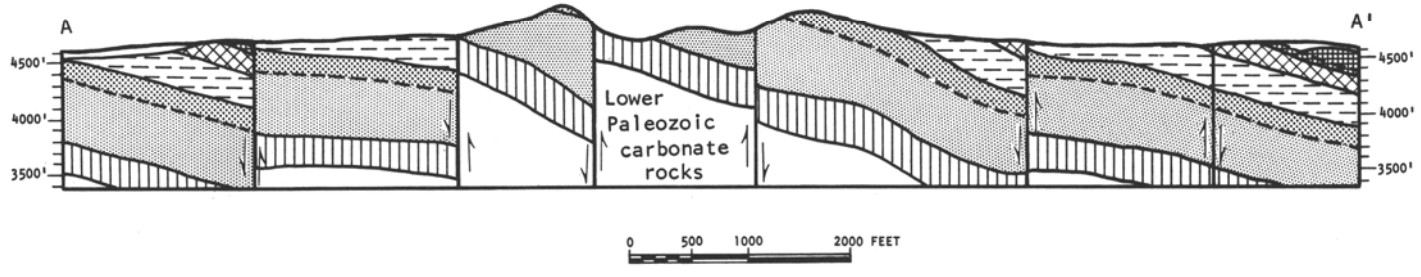


FIGURE 3.

Geologic section of the northwestern part of the Klondike Hills. For location of line of section, see Figure 2. No vertical exaggeration.

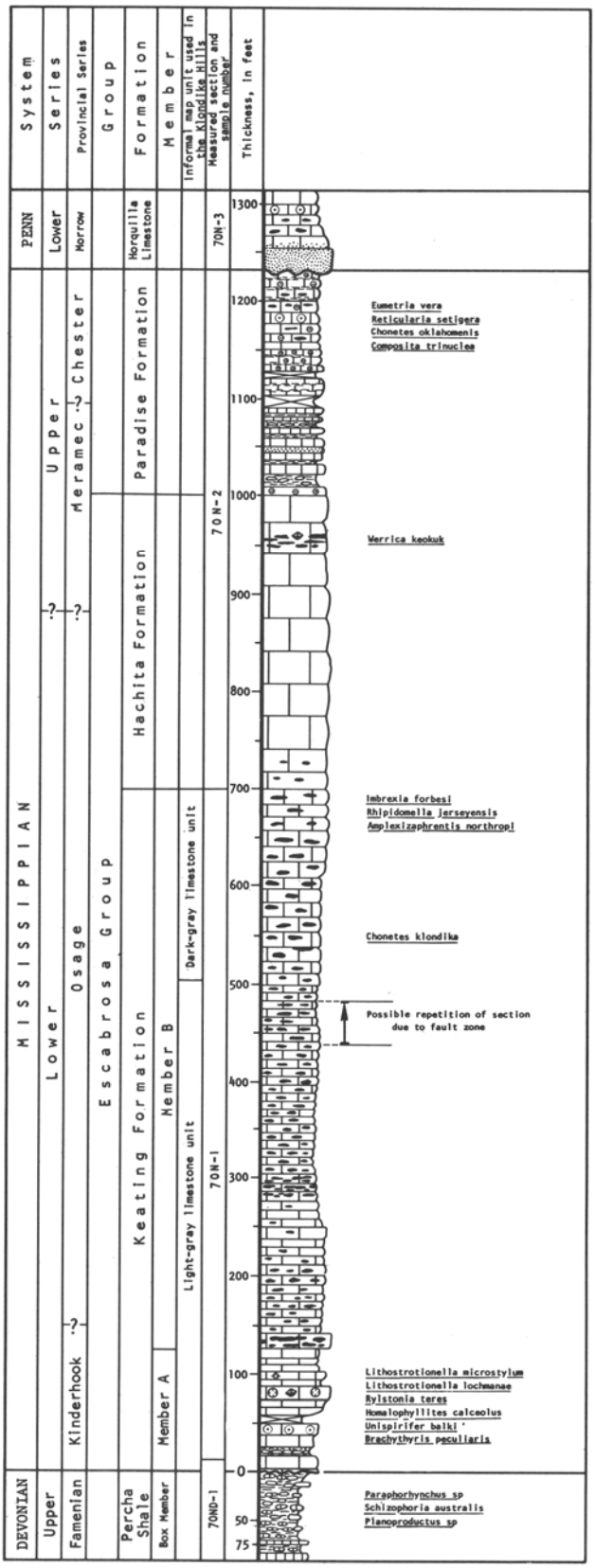


FIGURE 4.
Stratigraphic section, northwestern Klondike Hills.

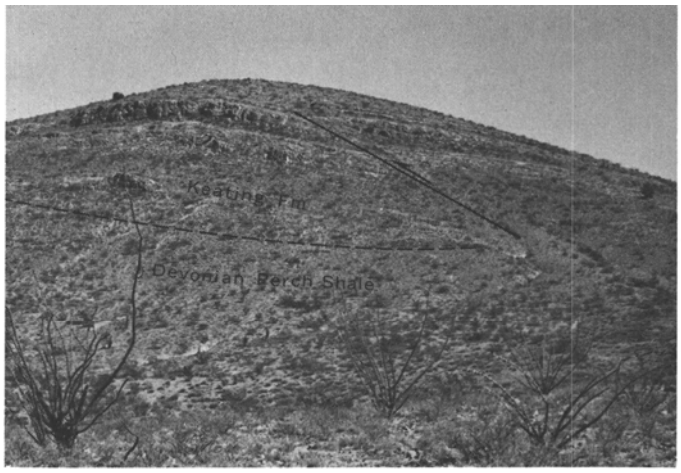


FIGURE 5.
High-angle fault plane cutting Keating Formation, which overlies the Devonian Percha Shale. Klondike Hills, view east. For exact location of photograph see Figure 2.

MISSISSIPPIAN SYSTEM

ESCABROSA GROUP

Armstrong (1962, p. 5) elevated the Escabrosa Limestone of southwestern New Mexico and adjacent southeastern Arizona to group status with two formations, the Keating and overlying Hachita Formations. The type section of the Keating Formation is at Blue Mountain, in the Chiricahua Mountains of Arizona. It contains two members. The oldest, member A, rests on the Devonian with a disconformity and is characterized by light-gray, massive limestones 150 to 200 feet thick. Member B is 300 to 350 feet thick at the type section and is characterized by thin-bedded limestone with dark-gray chert which is not as resistant to weathering as member A or the overlying Hachita Formation.

The type section of the Hachita Formation as defined by Armstrong (1962, p. 10) is also at Blue Mountain. The Hachita Formation, typically 300 to 380 feet thick, is composed of massive, light-gray, crinoidal-wackestones to grainstones and is relatively chert free.

The carbonate rock classification used in this paper is Dunham's (1962).

KEATING FORMATION

Member A.—The contact between the Devonian and Mississippian Systems is a paraconformity (Fig. 4). The basal Mississippian bed, a pelletoidal-crinoidal wackestone, rests on the gray, calcareous shales of the Percha Shale. The lower 30 feet of member A is formed by 2- to 8-foot-thick beds of chert-free, gray limestones and alternating beds of argillaceous limestone. A distinctive 10- to 12-foot-thick bed of oolitic packstone-grainstone occurs some 40 feet above the base. Member A is 125 feet thick. The upper half of the unit is composed of 1- to 5-foot-thick beds of gray, coral-bearing, pelletoidal to oolitic-echinoderm, wackestones-grainstones.

Member A contains a coral fauna of Lithostrotionella microstylum (White), Lithostrotionella lochmanae Armstrong, Rylstonia teres (Girty), Homalophyllites calceolus (White and Whitfield), Vesiculophyllum incrassatum (Easton and Gutschick). The most common brachiopods are Unispirifer balki Armstrong, and Chonetes cf. C. glenparkensis Weller. Armstrong (1962, p. 8) considered the fauna of member A to straddle the Kinderhook-Osage boundary. Sando, Mamet, and Dutro (1969, p. E7) reported that, in the northern Cordillera, Lithostrotionella microstylum and Rylstonia tercs occur in their megafossil zone C_1. They indicated the base of zone C_1 as beginning at the very top of the Kinderhook and extending upward into the lower Osage (p. E21).

Member B.—The contact of member A with member B is placed at the lowest occurrence of abundant nodular black chert. The common carbonate rock type in member B is medium-gray, lime mudstone. The beds are generally 6 inches to 2 feet thick. Member B is 575 feet thick in the Klondike Hills. The lower 375 feet of member B in the Klondike Hills is a monotonous sequence of light-gray to gray, lime mudstoncs to micropelletoid packstones. Nodular to lenticular, gray to yellowish-orange-gray chert comprises 15 to 30 percent of the rock. Sedimentary features seen within these beds are laminations (on a millimeter scale) and fine ripple cross-laminations. Cutting these structures are numerous small worm burrows (Fig. 6).

FIGURE 6.

Worm burrows in lime mudstone of the middle beds of member B, Keating Formation. Note nodules and lens of dark-gray chert. Klondike Hills section 60 N-1, 350 feet above base.

The lower 300 feet of member B in the Klondike Hills differs subtly in lithology from stratigraphically equivalent beds of member B at the type section at Blue Mountain and the outcrops in the Big Hatchet Mountains. These beds of member B in the Klondike Hills have lime mudstones, with a higher percentage of argillaceous and organic material, and are virtually devoid of fossil fragments or fossils.

The top 200 feet of member B is composed of 1- to 6-foot-thick beds of gray to dark-gray, crinoidal, lime mudstones to packstones. These beds are gradational with the underlying unit. The chert in these higher beds is nodular and dark gray.

Careful mapping and section measurement reveal that the Keating Formation in the Klondike Hills is thicker than originally indicated (Armstrong, 1962). Recent field studies which indicate member B is 575 feet thick were made across the crest of two small hills (Fig. 2). The line of traverse appears to be structurally simple, but obscure bedding-plane faults may have gone undetected. Detailed micropalcontologic studies may indicate whether there is any repetition in this monotonous sequence of carbonates.

In the Klondike Hills the lower 375 feet of member B contains no significant megafossils. The basal beds of member B are transitional with fossiliferous beds of member A, which contains a fauna of very latest Kinderhook or earliest Osage age. The carbonates of the lower 300 feet of member B in the Klondike Hills are stratigraphically equivalent (Armstrong, 1962) to beds of member B in the Big Hatchet Mountains of New Mexico and at Blue Mountain, Arizona, where a megafauna of Osage age is found. The crinoidal limestones in the upper 100 feet of member B in the Klondike Hills contain a relatively abundant brachiopod fauna of Chonetes klondikia Armstrong, Imbrexia forbesi (Norwood and Pratten), Rhipidomella jerseyensis (Weller), and Amplcxizaphrentis northropi Armstrong. Imbrexia *forbesi* is very common in the upper 50 feet of member B. This species is apparently a widespread index fossil.

In discussing the Mississippian of the northern Cordillera, Sando, Mamet, and Dutro (1969, p. E8) reported the occurrence of *I. forbesi*, an Osage index fossil, in their megafossil zones $C_{1,}$ and C_2 (rare).

HACHITA FORMATION

The Hachita Formation is more than 300 feet thick in the Klondike Hills and consists of massive, light-gray, crinoidal wackestones to packstones. Chert is relatively rare and generally consists of light-gray to white nodules in the lower part and orange-gray nodules or bands in the top part of the formation (Fig. 4). The thickness of the Hachita Formation is difficult to measure in the Klondike Hills because of lack of distinctive bedding in the lower two-thirds of the formation, exposure on a structurally complex pediment surface in the southern part of the map area, and a fault cutting out the lower part of the formation in the area where it was measured and studied (Fig. 2). The Hachita Formation is at least 300 feet thick and is probably 350 feet thick.

The contact of the Hachita Formation with the underlying Keating Formation, as exposed at the top of section 70 N-1, is gradational over a stratigraphic distance of 10 to 15 feet.

The upper 50 to 100 feet of the Hachita Formation reflects a shift in carbonate sedimentation. The limestones contain less crinoid debris and more bryozoan and brachiopod bioclasts and hard pellets, ooids, and Foraminifera.

The contact of the Hachita Formation with the overlying Paradise Formation appears to be gradational.

The lower 50 feet of the Hachita Formation contains the same fauna as the underlying Keating Formation. Characteristic species are Amplexizaphrentis northropi Armstrong, Imbrexia forbesi (Norwood and Pratten), and Rhipidomella jerseyensis (Weller). These taxa indicate an Osage age.

Diagnostic fossils are rare in the middle part of the Hachita Formation. The upper 50 feet of the formation contains the large brachiopod Werriea keokuk (Hall). Armstrong (1962, p. 46) reported that this species is a zone marker in the Hachita Formation and is found in the Big Hatchet Mountains of New Mexico and at Blue Mountain, Arizona, in association with Syringothyrus subcuspidatus (Hall). W. keokuk is believed to indicate an early Meramec age in the Hachita Formation.

PARADISE FORMATION

The Paradise Formation in the Klondike Hills is some 220 feet thick and consists of gray to primarily dusty yellow-gray to dusty greenish-gray limestones alternating with thin-bedded, calcareous shales and siltstones. The carbonates in the Paradise Formation are typically ooid to oolitic packstones and grainstones. These beds may be 1 to 5 feet thick and are crossbedded. Lime mudstones and wackestones are less common. Chert is brown to brownish gray and is lenticular to nodular. Fine-sand to silt-size grains of detrital quartz are common within the carbonates.

The Paradise Formation appears to be gradational with the underlying Hachita Formation of the Escabrosa Group and is unconformably overlain by the 6- to 10-foot-thick basal sandstone of the Horquilla Limestone. Bromfield and Wrucke (1961) mapped this sandstone as the top unit of their Paradise Formation. It is a transgressive, possible beach sand containing abundant impressions of tree logs and branches and leaves, and it grades into the overlying beds of the Horquilla Limestone.

The relatively abundant megafossil fauna from the Paradise Formation in the Klondike Hills region has not been adequately studied in detail to determine the taxa present and their age. Also present is a fairly abundant, nonfusulinid smaller Foraminifera microfauna. Common brachiopods in the upper part of the section are Eumetria *vera* (Hall), Reticularia sctigera (Hall), Chonetes oklahomensis Snider, Composita trinuclea (Hall), and Spirifer *pellaensis* var. cavecreekensis Hernon. Very tentative and preliminary analysis of microfauna in the lower part of the formation and brachiopods in the upper part indicate a Meramec and Chester age, respectively.

PENNSYLVANIAN SYSTEM

HORQUILLA LIMESTONE

The base of the Horquilla Limestone is a 6- to 10-foot-thick bed of brown quartz sandstone cemented by silica. The unit is crossbedded and contains casts and molds of logs and branches of "Lepidodendron" and impressions of leaves. The contact with the underlying Paradise Formation is very sharp to undulating; the contact with the overlying limestones of the Horquilla is gradational. Only the basal 60 feet of the Horquilla Limestone was studied, and it consists of 1- to 4-foot-thick beds of gray limestone containing nodules of gray to black chert. The limestones are pelletoid to ooid and oolitic packstone and grainstone; some beds are composed of lime mudstone. The fusulinid microfauna is still being studied, but a Morrow age can be tentatively assigned.

REFERENCES

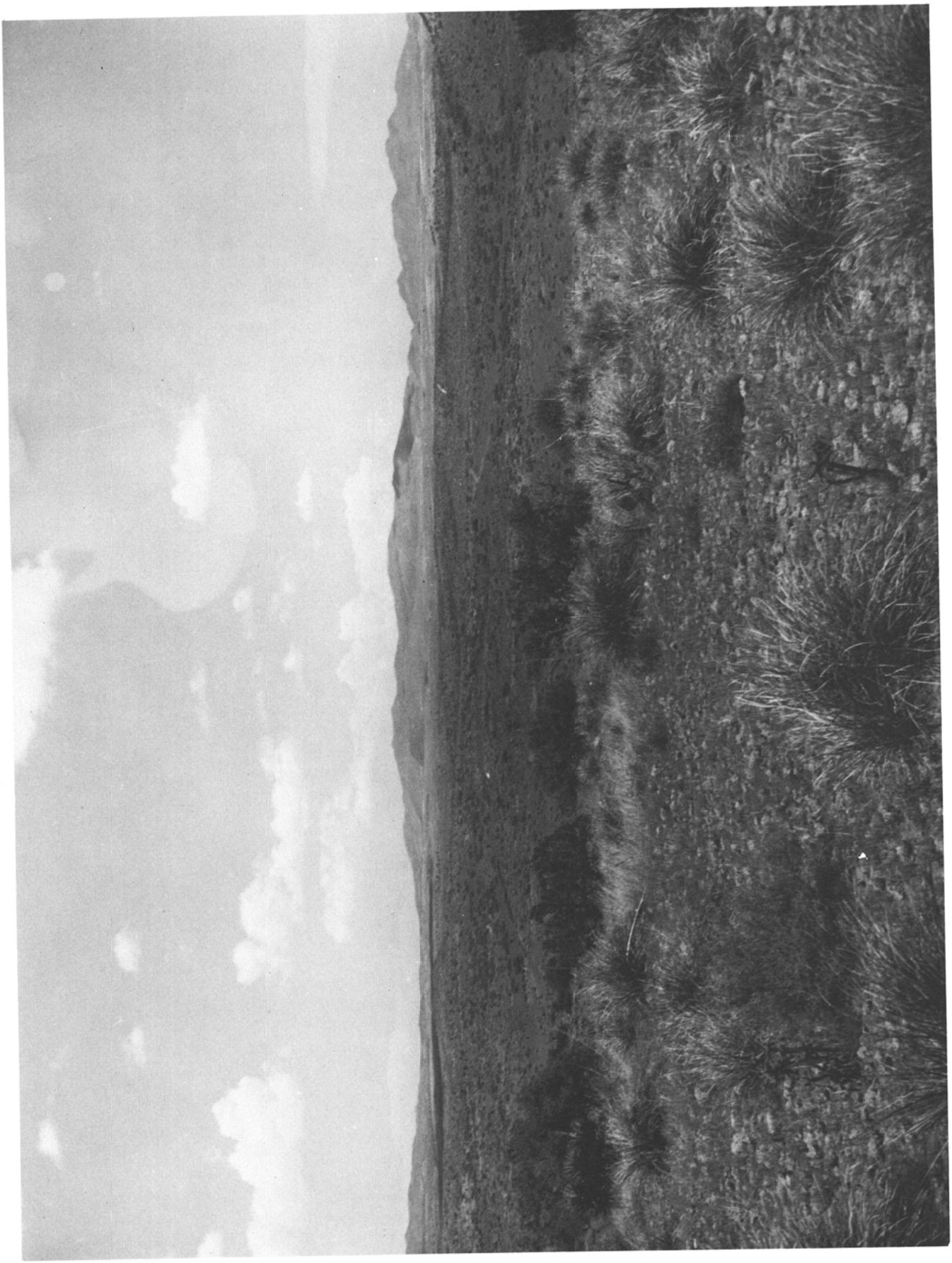
Armstrong, A. K., 1962, Stratigraphy and paleontology of the Mississippian System in southwestern New Mexico and adjacent southeastern Arizona: N. Mex. Bureau of Mines and Min. Res. Mem. 8, 95 p.

Bowsher, A. L., 1967, The Devonian System of New Mexico: Tulsa Geol. Soc. Digest, v. 35, p. 259-276.

Bromfield, C. S., and Wrucke, C. T., 1961, Reconnaissance geologic map of the Cedar Mountains, Grant and Luna Counties, New Mexico: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-159.

Dunham, R. J., 1962, Classification of carbonate rocks according to deposition texture, in Classification of carbonate rocks, a symposium: Am. Assoc. Petroleum Geologists Mem. 1, p. 108-112.

Sando, W. J., Mamet, B. L., and Dutro, J. T., Jr., 1969, Carboniferous megafaunal and microfaunal zonation in the northern Cordillera of the United States: U.S. Geol. Survey Prof. Paper 613-E, 29 p.



South end of Animas Range; view north from N.M. Highway 79 through San Luis Pass, north of the San Luis Mountains. Strata in foreground are Tertiary volcanics and Quarternary gravels.
(Photograph by Wengerd)