Precambrian geology of the Van Horn area, Texas

Donald M. Davidson Jr.

1980, pp. 151-154. https://doi.org/10.56577/FFC-31.151

in:

Trans Pecos Region (West Texas), Dickerson, P. W.; Hoffer, J. M.; Callender, J. F.; [eds.], New Mexico Geological Society 31st Annual Fall Field Conference Guidebook, 308 p. https://doi.org/10.56577/FFC-31

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

PRECAMBRIAN GEOLOGY OF THE VAN HORN AREA, TEXAS

DONALD M. DAVIDSON, JR.
Department of Geological Sciences
University of Texas at El Paso
El Paso, Texas 79968

INTRODUCTION

Precambrian rocks are exposed in the Van Horn, Texas area as a result of block faulting of a number of adjacent, but spatially disconnected mountain ranges (fig. 1). The area has been referred to as the Van Horn Dome (King and Flawn, 1953) but can be considered domical only in the sense that it has tended to be a positive structural element during Phanerozoic time.

This domical physiographic structure consists of two distinctive geological terrains of late Precambrian (Proterozoic) age. The southern third of the area is composed of a thick (6000-7000 m) sequence of older, low- to medium-grade metamorphic rocks, while the northern two-thirds contains a thinner (3000 m) assemblage of younger, relatively unmetamorphosed sedimentary and volcanic units.

A major structural discontinuity, the Streeruwitz overthrust, forms the boundary between these two terrains, and movement along this surface presumably placed the older, southern metamorphic rocks over portions of the younger lithologies, locally folding them, at 950 to 1000 m.y. (Denison and Hetherington, 1969).

Erosion and incisement of the area occurred prior to the deposition of a late Precambrian(?) clastic unit some 300 m thick, the Van Horn Sandstone. The region underwent tilting prior to deposition of younger Paleozoic and Mesozoic sedimentary units which, together with the older Precambrian rocks, have been offset by faults of Tertiary age.

STRATIGRAPHY

Carrizo Mountain Group

The Carrizo Mountain Group constitutes the oldest assemblage of Precambrian rocks within the study area (fig. 2). These Proterozoic units occur in the southern part of the area under investigation and have been dated at 890 to 1090 m.y. (Wasserberg and others, 1962).

The sequence consists of meta-arkose, metaquartzite, schist, phyllite and marble units which have been intruded by rhyolite and diorite. These latter intrusive rocks have subsequently been metamorphosed to metarhyolite and amphibolite, respectively. The sequence is at least 6300 m thick and displays moderate homogeneity within lithologic units, yet exhibits variable intensity, as well as type, of metamorphism. Regional metamorphic facies vary northward from amphibolite to greenschist. Dynamic (cataclastic) metamorphism appears superimposed upon both regional and thermal metamorphic events, producing retrograde and cataclastic assemblages in the vicinity of the Streeruwitz overthrust zone (King and Flawn, 1953; Denison and Hetherington, 1969).

Foliation is well developed in these units and trends predominantly N40-50°E with a southeastward dip. Folded foliation patterns have been noted in the high-grade rocks to the south (King and Flawn, 1953), and interference fold patterns were observed in the lower grade units. According to King and Flawn (1953), lineations are developed only in metarhyolite units from the northwest part of the area where, they plunge southward at 30 to 60°; however, recent field investigations indicate that lineation is also developed in other units to the south, again with southward plunges. Further detailed structural analysis appears warranted.

Pegmatites and various quartz veins appear to have intruded these units both before and after regional metamorphism (King and Flawn, 1953).

Allamoore Formation

The oldest unit exposed in the northern terrain is the Allamoore Formation which consists of 800 m of volcanics, talcose phyllite and carbonate rocks. These units have been tilted and locally complexly folded and faulted. Determination of the stratigraphic sequence is therefore difficult, and an estimate of total thickness is nearly impossible.

Volcanic rocks constitute from one-quarter to one-half of the total volume of the Allamoore Formation and are usually interbedded with limestone. These massive, mafic volcanic rocks apparently formed as subaerial or subaqueous lava flows while the thicker bodies, which occur less commonly, may represent hypabyssal intrusives. Additional volcanic units are of either pyroclastic or sedimentary origin and may include pebbly sandstones and interbedded volcanic conglomerates (King, 1965).

Phyllite occurs interbedded with or spatially associated with volcanic rocks; this suggests that the phyllite may have a volcanic origin. Bedding, as indicated by alternation of gray, black (apparently graphitic) and calcareous varieties, is extremely contorted and is crossed by well-developed slaty cleavage which parallels the axial planes of folds.

Since 1952 talc has been mined from this phyllite unit; talc content within the unit varies locally from 10 to 80 percent (see Edwards, this guidebook). The mineral may have formed as a result of chemical alteration of an original fine-grained, magnesium-bearing tuff, as adjacent carbonate units contain little magnesium (King and Flawn, 1953).

The upper limestone beds are characterized by interbedded seams of chert, which parallel bedding and are spaced over intervals of a few centimeters. The chert is either primary or diagenetic and antedates folding and faulting, as chert seams are sliced and broken where the rocks are strongly deformed. The limestone is thin-bedded, compact, evenly laminated, generally dolomitic and commonly contains a wavy structure similar to that of stromatoporoids.

Hazel Formation

The Hazel Formation unconformably overlies the Allamoore Formation and consists of more than 1700 m of interbedded conglomerate, arkosic sandstone and limestone. The basal portion contains a thick, coarse conglomerate composed almost wholly of angular rock fragments derived from the Allamoore. Near its top the conglomerate is interbedded with and eventually succeeded by a thick section of fine-grained, silty, red sandstone interbedded with well laminated, algae-bearing carbonate rocks (Reid, 1974). Reid (1974) stated that sediment of the Hazel Formation was deposited within an alluvial fan system, the sediment for which was derived from a granitic highland source area to the south.

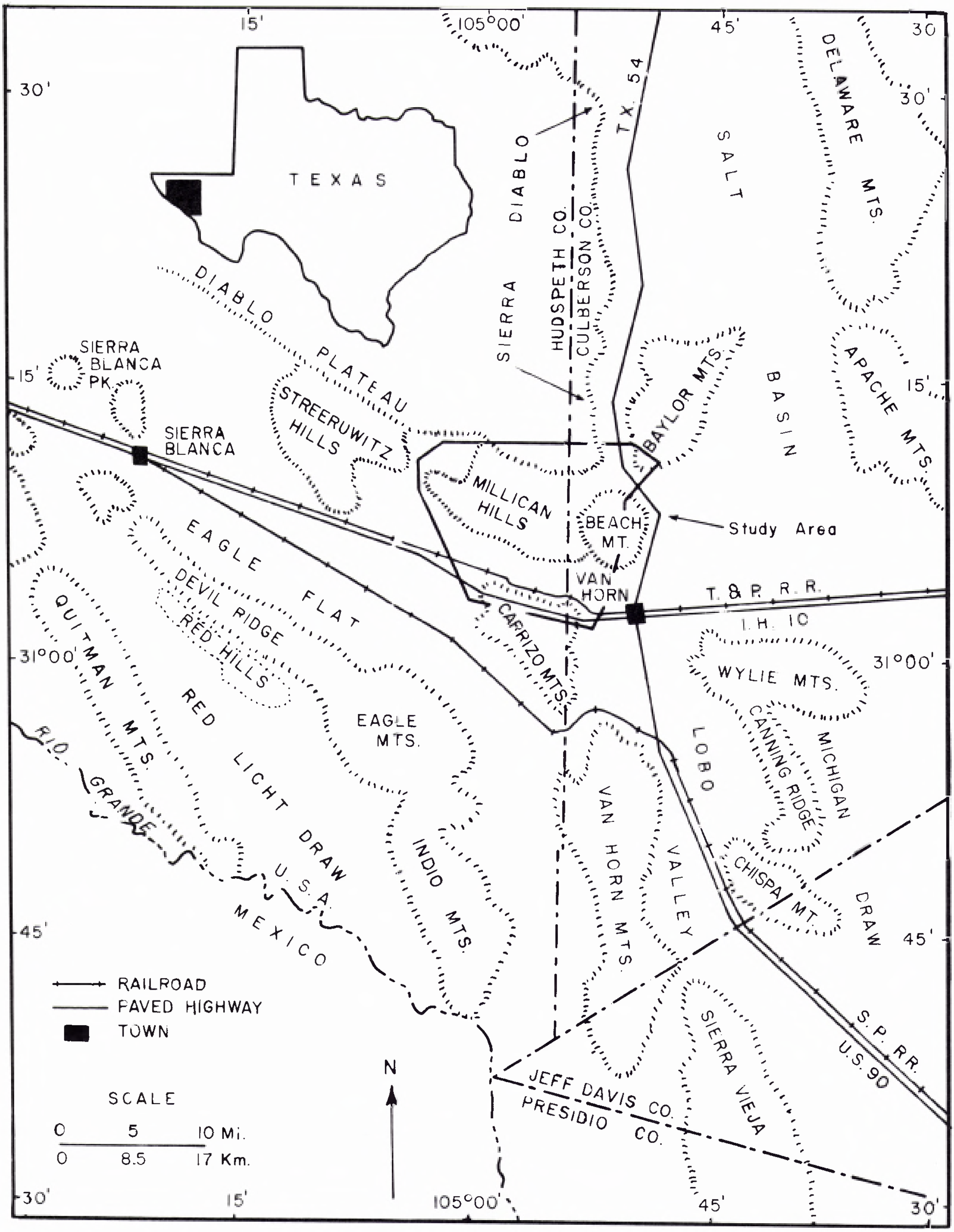

Figure 1. Physiographic map of part of Trans-Pecos Texas (after Wiley, 1970).

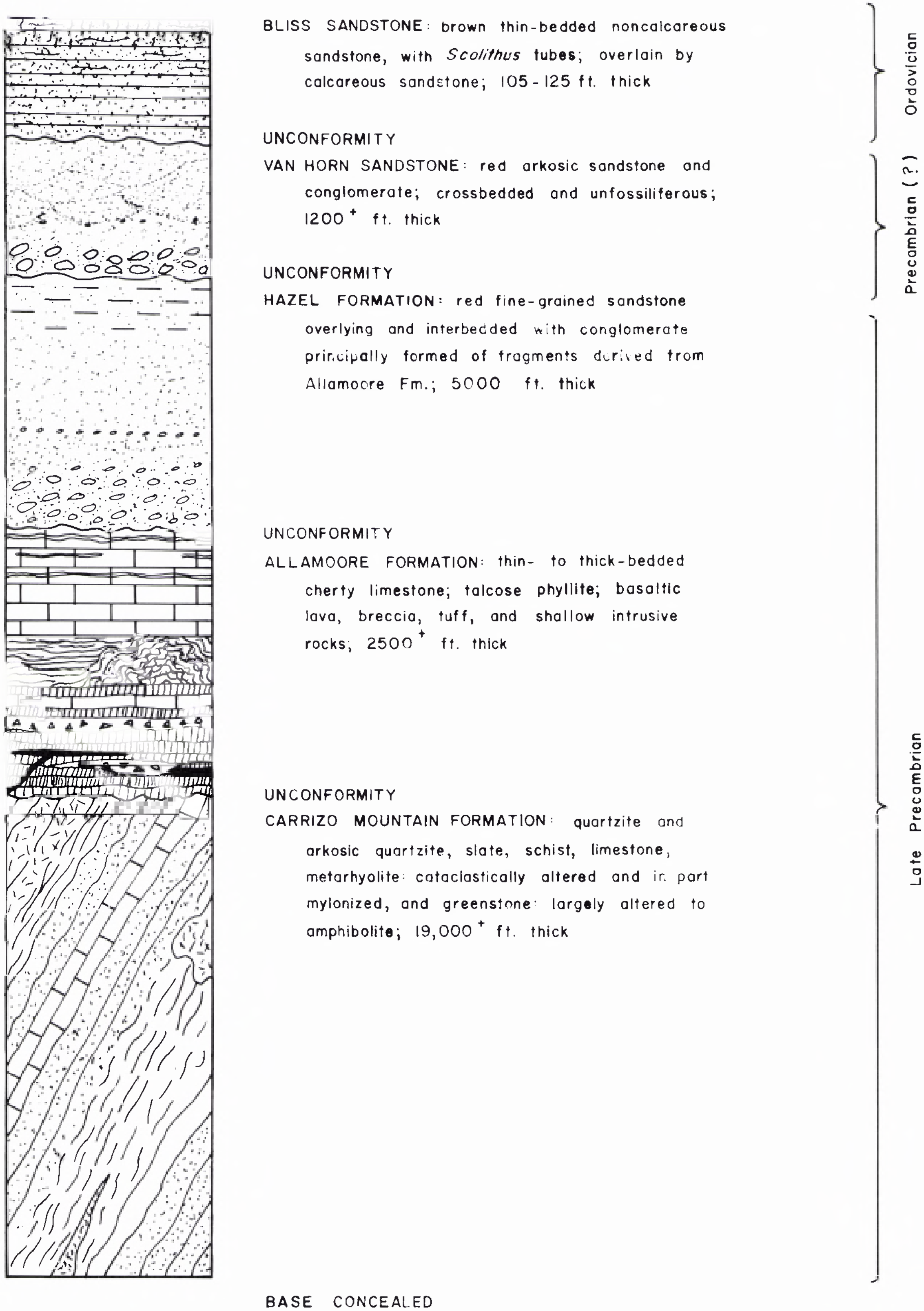

Figure 2. Generalized stratigraphic column of the Precambrian and associated rocks, Van Horn area, Texas.

Although the unit was apparently deposited directly upon units of the Allamoore Formation, structural and stratigraphic relations between the Allamoore and Hazel Formations are complex and subject to differing interpretations. King (1965) stated that the contact represents a tectonic discontinuity, whereas Reid (1974) argued that it reflects a facies change as well as tectonic activity.

After deposition of the Hazel Formation, both it and the Allamoore were deformed by orogenesis probably related to the structural emplacement of the Carrizo Mountain Group and associated intrusive rocks along the Streeruwitz overthrust. For a few kilometers north of the trace of this thrust, the Allamoore and Hazel Formations have been complexly folded. Deformation, as measured by fold intensity, appears to decrease northward, with the northernmost exposures being relatively undisturbed. Thrust movement was apparently from south to north.

Van Horn Sandstone

The deformed and locally metamorphosed Allamoore and Hazel Formations together with the Carrizo Mountain Group were deeply eroded before deposition of the Van Horn Sandstone. The sandstone has a maximum exposed thickness of about 100 m and characteristically consists of coarse-grained, red, arkosic sandstone. The unit forms massive beds and is friable, poorly consolidated, cross-bedded and contains significant amounts of pebbles and cobbles. Underlying and interbedded with the sandstone are thin to thick beds of conglomerate consisting of rounded pebbles, cobbles and boulders made up of the older rocks of the area, as well as of granite and rhyolite porphyry unlike any exposed in the vicinity. McGowen and Groat (1971) have stated that highlands to the north, which are composed of granite and rhyolite porphyry, were the exclusive source for the continentally derived Van Horn sediments. They believe that these rocks were deposited as alluvial fans and fan deltas within an east-trending trough bounded on the south by deformed Carrizo Mountain, Allamoore and Hazel rocks. Most workers consider the Van Horn to be of Precambrian age (King and Flawn, 1953) as it is unfossiliferous and unlike any Cambrian rocks of the region; however, McGowen and Groat (1971) stated that it could also be as young as Ordovician.

PALEOZOIC AND YOUNGER ROCKS

The Van Horn Sandstone as well as older units were tilted and faulted prior to deposition of younger sediments. The Bliss Sandstone of Ordovician age unconformably overlies the Van Horn at a very low angle. The Ordovician and other older Paleozoic rocks have been extremely eroded from the Precambrian as a result of deformation in Late Pennsylvanian time, so that in many places the formation immediately above the Precambrian is the Hueco Limestone of Early Permian age (Wolfcamp). Locally within the Sierra Diablo foothills the Permian was also removed by erosion so that Cretaceous rocks lie directly on the Precambrian. Aside from unconsolidated bolson deposits of late Tertiary and Quaternary age, the only other rocks associated with the Precambrian are lavas and small intrusives, probably of early Tertiary age.

Cenozoic Development

The Precambrian as well as younger associated units are broken by normal faults of Tertiary or later age. In the south these faults show no systematic trend, but in the Sierra Diablo foothills most of them trend west-northwest, as do the major joints. Geologic evidence suggests that the west-northwest faults and joints of the Sierra Diablo foothills originated early in geologic time (King and Flawn, 1953). In one area in the Sierra Diablo foothills the west-northwest structures are crossed by the Hazel fracture zone, a set of en echelon, mineralized fractures with an easterly trend. Its age relation to other structures is uncertain but it appears younger (King and Flawn, 1953).

REFERENCES

Denison, R. E. and Hetherington, E. A., Jr., 1969, Basement rocks in far West Texas and south-central New Mexico, *in* Border stratigraphy symposium: New Mexico Bureau of Mines and Mineral Resources Circular 104, p. 1-16.

King, P. B. and Flawn, P. T., 1953, Geology and mineral deposits of Precambrian rocks of the Van Horn area, Texas: University of Texas Publication 5301, 218 p.

King, P. B., 1965, Geology of the Sierra Diablo region, Texas: U.S. Geological Survey Professional Paper 480, p. 1-179.

McGowen, J. H. and Groat, C. G., 1971, Van Horn Sandstone, West Texas: An alluvial fan model for mineral exploration: Texas Bureau of Economic Geology, Report of Investigations, 72, p. 1-57.

Reid, J. C., 1974, Hazel Formation, Culberson and Hudspeth Counties, Texas (M.S. thesis): University of Texas, Austin, 88 p.

Wasserburg, G. J., Wetherill, G. W., Silver, L. T. and Flawn, P. T., 1962, A study of the ages of the Precambrian of Texas: Journal of Geophysical Research, v. 67, p. 4021-4047.

Wiley, M. A., 1970, Correlation of geology with gravity and magnetic anomalies Van Horn–Sierra Blanca region, Trans-Pecos, Texas (Ph.D. dissertation): University of Texas, Austin, 351 p.