Facets of the geology of the Sierra del Presidio area, north-central Chihuahua

Donald S. Webb

1969, pp. 182-185. https://doi.org/10.56577/FFC-20.182

in:

The Border Region, Chihuahua and the United States, Cordoba, D. A.; Wengerd, S. A.; Shomaker, J. W.; [eds.], New Mexico Geological Society 20th Annual Fall Field Conference Guidebook, 228 p. https://doi.org/10.56577/FFC-20

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

FACETS OF THE GEOLOGY OF THE SIERRA DEL PRESIDIO AREANORTH-CENTRAL CHIHUAHUA

by

DONALD S. WEBB

Department of Geology, The University of Texas at Austin

ABSTRACT

Sierra del Presidio is in the basin-and-range physiographic province about 25 miles southeast of Ciudad Juarez, Chihuahua, Mexico. A large dune field in the area contains a number of dunes that stand approximately 550 feet above their base. The rocks of the Sierra del Presidio were deposited in the narrow arm of the Mesozoic Mexican sea called the Chihuahua trough. These rocks were later folded, faulted, intruded by igneous rocks and partly covered by extrusive volcanic rocks. The entire area was then block faulted. Economic minerals in the area are copper ore, iron ore, barite and Mexican onyx.

RESUMEN

La Sierra del Presidio esti localizada en la provincia fisiográfica de cuencas y valles, aproximadamente a 25 millas al sureste de Ciudad Juarez, Chihuahua, Mexico. Un extenso campo de dunas del area tiene algunas dunas que sobresalen aproximadamente 550 pie sobre sus bases. Las rocas de la Sierra del Presidio fueron depositadas en el estrecho brazo de mar Mesozoico Mexicano llamado Canal de Chihuahua. Estas rocas fueron más tarde plegadas, falladas e intrusionadas por rocas igneas y cubiertas en parte por rocas extrusivas volcánicas. El area entera fue entonces fallada en bloques. Los minerales económicos del area son menas de cobre, hiero, barita y ónix mexicano.

GEOGRAPHIC SETTING

Sierra del Presidio is about 25 miles south southeast of Ciudad Juarez in northern Chihuahua, Mexico. The nearest population center is Estacion Samalayuca about 5 miles west of the sierra. This sierra is within the basin-and-range physiographic province of Raisz (1964) although actually the Sierra del Presidio is a dividing point between closed basin drainage to the south and west, and drainage to the Rio Grande river system to the north and east. This area marks the northeastern margin of the great Chihuahua desert. The basins stand at an elevation slightly more than 4,000 feet above sea level, whereas the tops of the highest ranges have an elevation a little above 6,000 feet. Topographic relief in the area is commonly as high as 1,500 feet within a short distance. Rainfall in the area is about 10-15 inches per year, occurring mostly during the months of August and September. The vegetation is dominated by creosote bush on the lower slopes, and by cactus, grasses, some juniper, and a few pines at the higher elevations. Irrigated farms near Samalayuca produce cotton, corn, and beans.

Just southwest of the town of Samalayuca stands a breached anticline, the Sierra de Samalayuca. Because of three large springs along the north side of this sierra, it has long been a population center. On joint blocks of the sandstone of the Sierra Samalayuca, Indian pictographs show illustrations of deer and mountain goats, perhaps alluding to a more amiable climate in the not-too-distant past.

THE DUNE FIELD

An outstanding feature of this area is the dune field to the west of Sierra del Presidio that covers an area of about 97 square miles. The sand is composed primarily of quartz grains which are well sorted, with a median size of about 2.5 phi. Sorting ranges from a sigma of 0.26 phi on the crests of the dunes to a sigma of 0.41 phi on the flats between the dunes. About 75 per cent of the quartz grains are clear and about 25 per cent are yellowish, with about 5 per cent of the grains being miscellaneous rock and fossil fragments. Some of the clear grains show good cleavage faces and may be sanidine feldspar rather than quartz. Thus, about 80 per cent of the grains are definitely quartz grains which seem to have a bimodal origin. The yellowish grains are well rounded and frosted, whereas the clear grains show some crystal faces, are angular, polished, and have abundant inclusions.

The sand is migrating from the west to the east and appears to have been derived from ancient lake deposits west of the area. The line of extremely high dunes on the eastern edge of the dune field have prominent topographic relief standing about 550 feet above their northeastern base. These high dunes may lie on some structurally controlled topographic foundation inasmuch as the line is parallel to some of the major faults in the area. At the northern end of the line I have found one small outcrop, with about 15 meters of stratal section dipping approximately 25°, and nearly buried by the flank of one of the large dunes. These dunes have not changed appreciably in position or size since 1956 when air photographs of the area were flown.

The dunes do not appear to fit any conventional classification of dune forms, but are rather nondescript piles of sand with irregular and inconsistent shapes. At one point near the southern end of the Sierra del Presidio the dunes

have blown through a low pass in the sierra and are migrating into the large valley on the east side of the sierra.

STRATIGRAPH IC SETTING

During the Mesozoic, a narrow arm of the Mexican sea extended between the Diablo platform on the east and the Aldama platform on the west, occupying the Chihuahua trough. Faunal zones that occur in 3,000 feet of section in the Van Horn Mountains of Trans-Pecos Texas near the Diablo platform, expand to nearly 15,000 feet of section in the southern Quitman Mountains some thirty miles to the west and nearer the axis of the Chihuahua trough. The rocks in the Sierra del Presidio area represent sediments deposited near the center of this arm of the Mexican sea. Figure 1 is a generalized stratigraphic cross section extending westward into the Chihuahua trough from Trans-Pecos Texas.

The oldest rocks in the area are exposed at Sierra de Samalayuca where sandstone, conglomerate, and shale have been slightly metamorphosed and folded into an anticline. The rocks of this anticline have yielded no reliable fossils to indicate their age. Surrounding this anticline are beds of Cretaceous Neocomian marine sedimentary rock comprising siltstone and sandstone with scattered interbeds of limestone and conglomerate.

The next youngest rocks in the area are at the base of the Sierra del Presidio, where nearly 3,000 feet of the Las Vigas Formation of Aptian or Neocomian age is exposed. The Las Vigas Formation contains siltstone, limestone, and cross-bedded sandstone. The upper part of this formation bears distinctive red shale with interbeds of sandstone and siltstone and some nodular gray micrite. Conformably above the Las Vigas Formation lies the Cuchillo Formation, in which nearly 3,000 feet of Aptian and Albian rocks are exposed. The lower part of the Cuchillo Formation contains thick beds of sedimentary gypsum whereas the upper parts are predominantly dark gray limestone. Above the Cuchillo Formation, Albian limestone and shaly limestone of the Chihuahua Group are exposed.

At the northwest end of the Sierra del Presidio a good all-weather road is maintained to a telephone microwave relay tower. An excellent view of imbricate biohermal mounds in the Chihuahua Group can be seen from this road. At many places in this part of the section biohermal mounds occur directly above beds containing the large foraminifer Orbitolina. These biohermal mounds appear to be algal in some locations and rudistids (with Toucasia and *Monopleura)* and caprinids in other locations. More than 7200 feet of continuous section is exposed in the Sierra del Presidio.

South and east of the Sierra del Presidio near the village of El Vergel, rocks correlative with upper beds of the Sierra del Presidio are exposed. Another outcrop near El Vergel

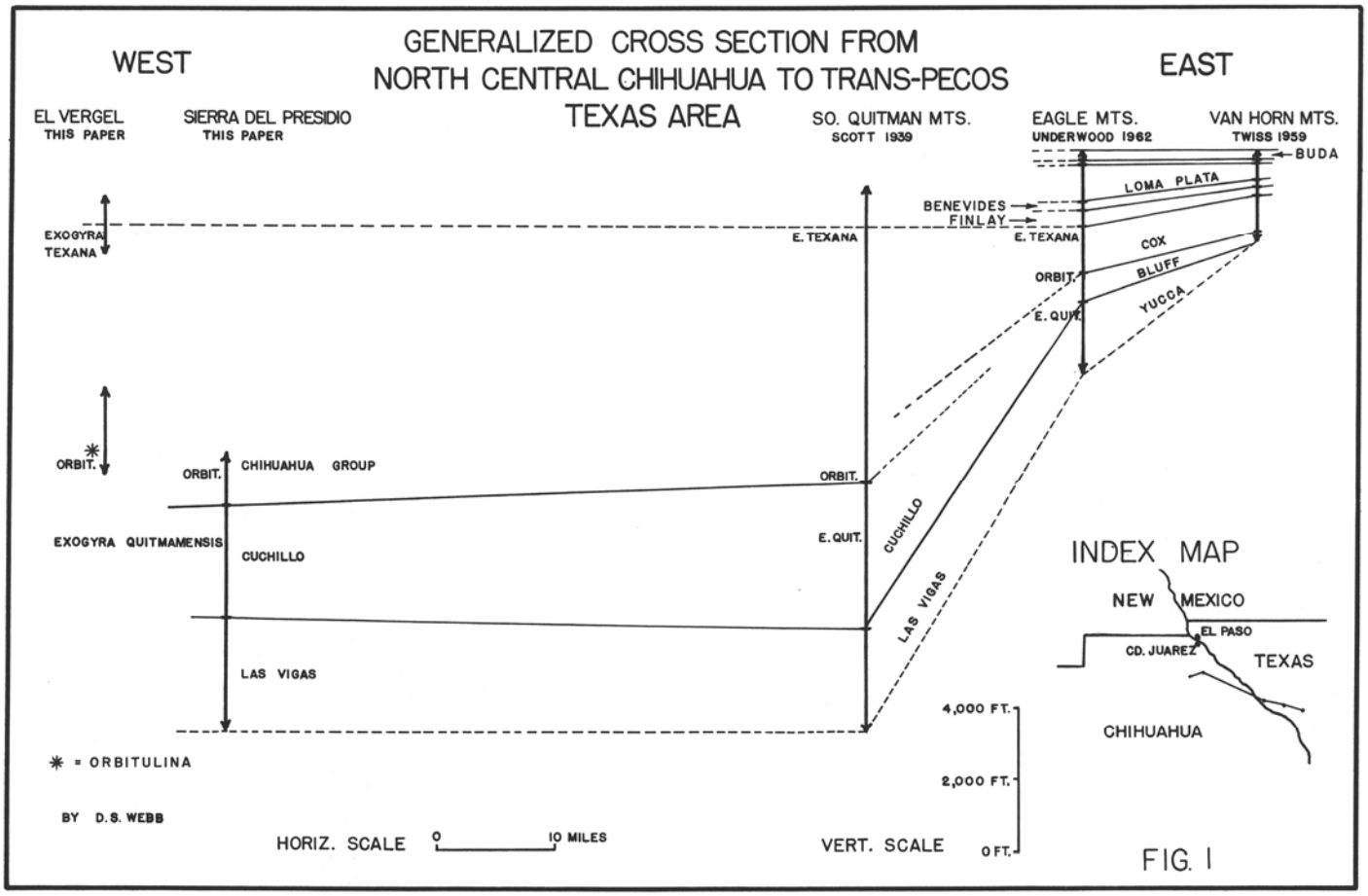

FIG. 1

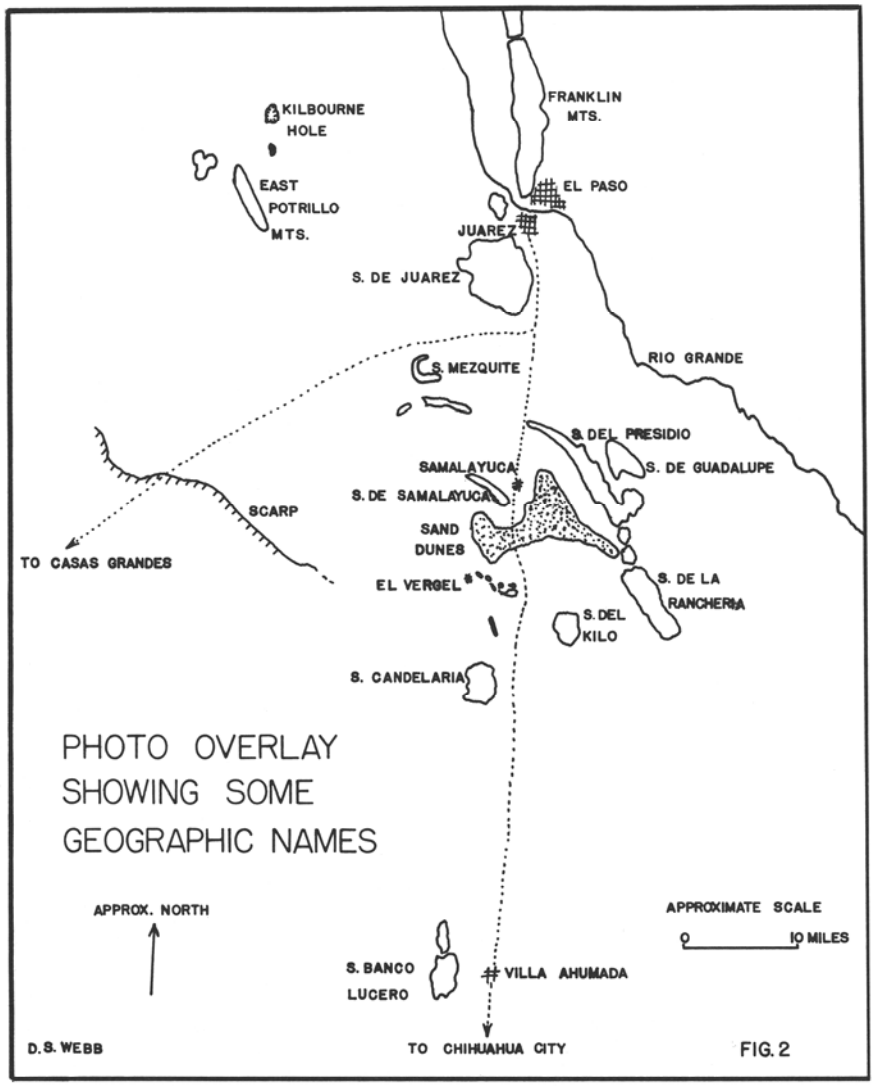
KILBOURNE HOLE
EAST POTRILLO MTS.
FRANKLIN MTS.
EL PASO
JUAREZ
S. DE JUAREZ
RIO GRANDE
S. MEZQUITE
S. DEL PRESIDIO
S. DE GUADALUPE
SAMALAYUCA
S. DE SAMALAYUCA
SCARP
SAND DUNES
TO CASAS GRANDES
EL VERGEL
S. DE LA RANCHERIA
S. DEL KILO
S. CANDELARIA
PHOTO OVERLAY SHOWING SOME GEOGRAPHIC NAMES
APPROX. NORTH
APPROXIMATE SCALE
0 10 MILES
S. BANCO LUCERO
VILLA AHUMADA
D. S. WEBB
TO CHIHUAHUA CITY
FIG. 2

FIGURE 3.

yields a fauna correlative with that of the Benevides Formation.

TECTONIC HISTORY

The thick sequence of Mesozoic sedimentary rock in the Chihuahua trough was folded and faulted near the end of the Cretaceous Period or during the early part of the Tertiary. Folding and faulting appear to intensify northward as one approaches the area of the Rio Grande. Overturned anticlines and synclines and imbricate thrust sheets are exposed in the sierras along the Rio Grande. Tertiary igneous intrusions and volcanic extrusions occurred and finally these folded—faulted—intruded rocks and volcanic rocks were subjected to the block faulting of the basin-and-range system.

ANALYSIS OF ORBITAL PHOTOGRAPHS

Much of the major structure of the area can be interpreted on orbital photographs. Figure 2 is an overlay of the orbital photograph shown in Figure 3 and will serve as a location map. An interesting feature visible in Figure 3 and accentuated in Figure 4 is the N 30° W trend of linear features.

FIGURE 4.
Trends of major linear features visible on orbital photograph shown in Figure 3.

These features are aligned drainages, tilted fault blocks, and linear scarps in the basin fill. Seismic evidence indicates that these aligned drainages and scarps are underlain by large faults. At places where these linear features intersect outcrops, the rocks are invariably faulted, folded sharply, or otherwise disturbed. This trend may reflect early structure that was initiated before the sediments in the Chihuahua trough were completely lithified, inasmuch as thick beds of limestone at Sierra del Presidio are sharply folded along one of these linears. Recent scarps in the basin fill attest to the continued motion along some of these features.

Another interesting tectonic feature that is suggested through the interpretation of the orbital photographs, and supported by field evidence, is the anticlinorium with Sierra de Samalayuca as its axis, Sierra del Presidio as its northeast flank, and the outcrops near El Vergel as its southwest flank.

ECONOMIC AND MINERAL DEPOSITS

Economic minerals occur in the area. Copper (azurite, malachite, and some bornite) has been mined at Sierra de Samalayuca. Deposits of hematite have also been mined in the area and near the southeast end of Sierra de Samalayuca a small pit is being worked for barite. Most of the minerals mentioned above are associated with intrusions in the rocks of the sierra and the surrounding hills. At the base of Sierra del Presidio, gypsum of the Cuchillo Formation has been mined for production of plaster. Gypsum is currently recovered from water that leaches the bolson fill; the mineralized water is evaporated in ponds near the northwest end of Sierra del Presidio. Many faults are mineralized with travertine and other forms of calcite, and in Sierra del Presidio these veins or faults have been mined for Mexican onyx, which is carved and polished at Juarez.

REFERENCES CITED

Berg, Edgar, 1969, Geology of Sierra de Samalayuca, Univ. of Texas Master's Thesis, (in progress) .

DeFord, R. K., 1964, History of geological exploration in Chihuahua, in Geology of Mina Plomosas-Placer de Guadalupe area, Chihuahua, Mexico: West Texas Geol. Soc. Field Trip Guidebook, 64-50, p. 116-129.

Haenggi, Walter T., 1966, Geology of El Cuervo Area, Northeastern Chihuahua, Mexico: University of Texas dissertation, 401 pp.

Raisz, Erwin, sec. cor. ed. 1964, (Map) Landforms of Mexico.

Ramirez, M., Jaime C., Francisco Acevedo C., 1957, Notas Sobre la Gcologia de Chihuahua: Assoc. Mexicana de Geologos Petroleros, v. 9 and 10.

Scott, Gayle, 1939, Cephalopods from the Cretaceous Trinity Group of the South-Central United States: The Univ. of Texas Publ 3945, pp. 969-1125.

Sellards, E. H., W. S. Adkins, F. B. Plummer, 1932, Mesozoic Systems; The Univ. of Texas Publ. 3232, Part 2.

Twiss, Page C., 1959, Geology of Van Horn Mountains, Trans-Pecos Texas, Univ. of Texas dissertation, pp. 234.

Underwood, James R., 1962, Geology of Eagle Mountains and Vicinity, Trans-Pecos Texas, Univ. of Texas dissertation, pp. 560.

Young, Keith, 1969, Ammonite Zones of Northern Chihuahua (this Guidebook) .