



## *Mesozoic stratigraphy of Sierra de la Alcaparra, northeastern Chihuahua*

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# MESOZOIC STRATIGRAPHY OF SIERRA DE LA ALCAPARRA NORTHEASTERN CHIHUAHUA, MEXICO

by

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## ABSTRACT

Sierra de Alcaparra is located about 45 km east of Villa Ahumada, Chihuahua. The local Mesozoic sequence includes units from the Tithonian-Neocomian to the top of the Lower Cretaceous; some of the lowermost units have been intruded by a diapiric body of gypsum, probably of early Oxfordian age. Ten mesozoic stratigraphic units have been mapped of which six were formal or previously named units and four were recently proposed by the author.

The structure of the range is rather simple than complex; the folds were effected by a diapiric gypsum, the Loma Blanca Formation and by plutonic magmatic activity that have changed the local structural trends and partially metasomatized the lower part of the stratigraphic sequence. Late Tertiary block faulting has left Sierra de La Alcaparra as an isolated range.

## RESUMEN

El área de la Sierra de la Alcaparra está localizada a unos 45 km. al oriente de Villa Ahumada.

La secuencia estratigráfica local mesozóica incluye unidades desde el Titoniano-Neocomiano hasta la cima de el Cretácico Inferior, algunas de las unidades inferiores han sido intrusionadas por un cuerpo diapirico de yeso de posible edad oxfordiana temprana. Fueron mapeadas diez unidades estratigráficas mesozoicas de las cuales seis eran unidades formales o previamente nombradas y cuatro han sido propuestas recientemente por el autor.

La estructura local, bastante simple, ha sido afectada por la actividad diapirica del yeso Loma Blanca y por la actividad magmática plutónica que ha cambiado localmente la posición de los estratos y metasomatizado parcialmente la parte baja de la secuencia estratigráfica.

El fallamiento en bloques, que en escala regional ha afectado a esta área, ha dejado a la Sierra de la Alcaparra como una unidad estructural y estratigráfica aislada.

## INTRODUCTION

The Sierra de La Alcaparra can be reached by a dirt road that goes from Villa Ahumada to the inactive Los Lamentos Mine.

The structure of Sierra de la Alcaparra is simple inasmuch as it is the west limb of an apparently symmetrical anticline with an almost north-south orientation, that has been affected by both transverse and longitudinal faults. Part of the uppermost Albian sequence, which lies in a stratigraphically inverted position just east of the eastern flank of Sierra de La Alcaparra, has been interpreted as the west limb of a westerly over-turned anticline, which could be the only relationship between this sierra and those located north and south of it.

## STRATIGRAPHY

### JURASSIC SYSTEM (?)

The lithologies of the possible Jurassic sediments that crop out in the Sierra de La Alcaparra represent a facies change as related to the Jurassic outcrops of the Malone Mountains; thus the nomenclature should be regarded as local.

Loma Blanca Formation.—In the lowermost part of the eastern talus slope of Sierra de La Alcaparra, an irregular mass of diapiric gypsum of undefined thickness crops out

and is partially covered by slope debris. The gypsum is poorly stratified and its internal structure suggests several tight folds. The unit is separated from an adjacent Jurassic outcrop by an elongated apophysis of a granodioritic intrusive, so that the true relationship with the remainder of the section is uncertain.

The gypsum here is not considered to be continuous with the Mesozoic sequence. Because of possible stratigraphic analogies between the Chihuahua trough and the Sabinas basin (Humphrey, 1954 *in de Cserna*, 1956), which are supported by inferred physiographic and tectonic features, the gypsum may be of Oxfordian age, rather than Permian as suggested by other workers for several evaporitic sequences south of the area.

Aleja Formation.—In the central part of Sierra de La Alcaparra a metasomatized calcareous sequence crops out, which, because of its stratigraphic position, could be of Late Jurassic or Neocomian age and correlative with the upper part of the Malone Formation of Texas. The physiographic expression of this unit is that of narrow and elongated outcrops which are in contact with a granodiorite intrusive. The measured thickness of 162 m has the following lithology: the lower unit is a light pink skarn that contains black garnet and epidote; the middle part is a slightly metasomatized, bluish gray limestone with highly metasoma-

lined shale interbeds that weather to reddish-yellow clay; the upper part of the sequence is a black, thin-layered limestone, with hematite nodules.

The age assignment; by stratigraphic inferences, is Late Jurassic Tithonian (or Early Cretaceous Neocomian) because the formation lies below probable Neocomian strata of the Alcaparra Formation.

#### CRETACEOUS SYSTEM

The Lower Cretaceous strata in Sierra de La Alcaparra are characterized by a well-defined facies change with respect to sediments of the same stratigraphic position in other areas of northern Chihuahua.

The older shallow water sediments were deposited in a discontinuous transgressive sea but they were covered by thin coastal deposits at the beginning of a continuous transgression that filled the basin, so that northeastern Chihuahua finally was covered by an almost continuous biogenic reef deposit.

*Alcaparra* Formation.—Rodriguez (1969) proposed the Alcaparra Formation for the lowest part of the known Lower Cretaceous sequence. The unit crops out in the lower part of Sierra de La Alcaparra and its stratigraphic position is similar to the unit quoted by Humphrey (1961, Correlation Table; *in* West Tex. Geol. Soc. 64-50) and Diaz (1964) as "unnamed gypsum and limestone."

This unit forms slightly rounded slope promontories, just below the first hills of Las Vigas Formation. The measured thickness is 202 m and the basal member is an alternating sequence of gray quartz sandstone and gray to black limestone; the middle part is a coquinoidal limestone with several gypsum horizons with thin coquinoidal calcareous shale; the upper part is a thin-bedded, partially silicified, black limestone.

The age has not been paleontologically determined; nevertheless its stratigraphical position, below the Las Vigas Formation of middle Neocomian age suggests that the unit may be of early Neocomian age.

Las Vigas Formation.—In the lower part of the Sierra de la Alcaparra and forming a trend of elongated hills that breaks the almost continuous sierra slope, a 107 m section crops out that consists of partially metasomatized interbedded quartz sandstone and shale in its lower part; the middle part is a gray, massive, quartz sandstone; the upper part is a gray quartz sandstone interbedded with black sandy limestone.

The age is not defined paleontologically but it is supposed that it corresponds to the middle and late Neocomian.

Mosqueteros Formation.—The name Mosqueteros Formation was proposed by Rodriguez (1969) for a partially silicified and metasomatized calcareous sequence. The type section is in the western slope of Sierra de Mosqueteros, 4 km northwest from Sierra de La Alcaparra.

In Sierra de La Alcaparra, the lower part of the Mosqueteros Formation is a metasomatized, bluish-gray, micro-grained limestone; the middle part is a partially silicified gray limestone that weathers in yellowish brown nodules; the upper part is thin-bedded dark gray limestone.

The Mosqueteros Formation lies conformably below the Benigno Formation, which has fossils of early Albian age,

which stratigraphic position is suggestive that the Mosqueteros is of an Aptian-early Albian age.

Benigno Formation.—The upper part of the eastern slope of Sierra de La Alcaparra is a calcareous sequence with biostromes that represents the Benigno Formation of Córdoba (1969).

I measured a 372 m-thick section in the Sierra de Mosqueteros, in the neighborhood of the Sierra de La Alcaparra. The basal member consists of thin layers of pinkish-gray limestone with an *Orbitolina* sp. horizon; the middle part is massive, pinkish-gray, limestone with a thick reef of *Toucasia* sp. and *Caprina* sp.; the upper part is formed by a gray limestone with several *Toucasia* sp. zones. The stratigraphic position and the fossil content of this unit defines it as being Albian in age.

Informal names such as "Benigno Formation" have been used for this unit and lately Haengi (Cordoba, oral communication) has used the name Benigno Member of the Bluff Mesa Formation for the lower biostromatic strata of this unit.

The Benigno Formation is correlated with the Bluff Mesa (Gillcrman, 1955) and the Glen Rose Formations in Texas.

Lágrima Formation.—Cordoba (1969) used Lágrima Formation for the unit that lies between the Benigno and Finlay Formation in the Sierra de Juarez area.

In Sierra de La Alcaparra, the Lágrima Formation is 25 m thick and has lateral thickness change and may even disappear. It consists of interlayering of gray nodular limestone and gray calcareous marl; its fossils are *Exogyra texana* Romer, *Tylostoma* sp. and *Orbitolina* sp. which indicate an Albian age.

*Finlay Limestone*.—The uppermost limestone cliff of Sierra de La Alcaparra is a thick-bedded, light to dark gray limestone, whose lower part contains lenses and nodules of black chert; the upper part is mostly massive gray biostromatic limestone with abundant chert and *Rudistidac*. The lithology, stratigraphic position and fossil content is similar to the Finlay Formation as proposed by Richardson (1904); it crops out widely in northeastern Chihuahua and it is correlated with the Edwards Formation.

*Benavides* Formation.—In an isolated hill, just at the east side of Sierra de La Alcaparra, there is a highly dislocated, faulted, and overturned sequence that corresponds to the upper Albian.

The middle part of the sequence contains an unmeasured thickness of gray, nodular limestone with interbedded marl and shale of variegated color. The presence of *Oxytropidoceras bravaoense* in the middle part of the section defines a middle or late Albian age. The lithology of this part of the sequence is similar to Amsbury's (1957) lithologic description of the Benavides Formation, in the Pinto Canyon area in Presidio County, Texas.

Loma Plata Limestone.—In the lower part of the hill mentioned before, and stratigraphically above the Benavides Formation, a sequence of pink to gray limestone crops out that contains several thin reef zones of *Caprina* sp., which Córdoba (oral communication) considers as lith-

ologically similar to the Loma Plata Formation of other nearby sierras.

Because of the stratigraphic position above the Oxytropidoceras beds of the Benavides Formation, the unit may be of late Albian-early Cenomanian age.

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