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# A submarine fan in the Mesa Central, Mexico

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**Abstract**

The contact between the Guerrero and Sierra Madre tectonostratigraphic terranes has been proposed to lie in the Mesa Central, east of the city of Zacatecas. Marine Triassic units have been assigned to the Guerrero Terrane. It is here proposed that this contact occurs to the west of the city of Zacatecas and the Triassic marine sequence assigned to the Sierra Madre Terrane.

We analyzed the stratigraphic record and structural features of pre-Late Jurassic sequences at four localities in the Mesa Central. They contain a marine turbiditic Triassic unit, which includes La Bellena, Taray, and Zacatecas Formations, and a continental unit of probable Middle Jurassic age. Triassic sandstones were derived from a cratonic area, without the influence of arc volcanism. The sequences were affected by two phases of deformation. The Triassic formations are unconformably overlain by a continental volcano-sedimentary sequence that contains fragments of sandstones derived from the underlying unit. Sedimentologic characteristics of the Triassic unit fit a submarine fan model. The submarine fan developed at the continental margin of Pangaea during Triassic times. Turbidite associations in the San Rafael Area indicate a middle fan depositional environment, while in the Real de Catorce Area, they correspond to the distal part (basin plain facies). At La Ballena and Zacatecas the turbidite associations occur in the middle part and perhaps the external part of the fan. 

*Keywords*: Submarine fan; Mesa Central, Mexico; Stratigraphic record and structural features

## 1. Introduction

Mesozoic strata in Mexico have a dual character; to the east, sequences are associated with the opening of the Gulf of Mexico, while in the west, sequences are associated with a convergent margin. The nature of the contact between these sequences is not clear as it is typically covered by Cenozoic rocks. In the Mesa Central (Fig. 1A), several structures have been proposed such as: the Zacatecas-Guanajuato Frontal Thrust of Early Jurassic age (DeCserna, 1971; the contact between the Sierra Madre and Guerrero tectonostratigraphic terranes (Campa and Coney, 1983) (Fig. 1B), and the contact between the Circum-Gulf and Pacific Provinces (Winker and Buffler, 1988). In these proposals, the marine character of the Zacatecas Formation has been emphasized and is assumed to be exotic. Marine rocks of Triassic age (or attributed to this period) of central and eastern Mexico are exceptional since most rocks are of a continental nature.

Global reconstructions of the Early Mesozoic era illustrate the dynamics of the opening of the Gulf of Mexico (Coney, 1983; Anderson and Schmidt, 1983; Pindell, 1985). These models have not fully considered the role of the Triassic marine strata that occur in the Mesa Central of Mexico, mainly due to the lack of information in the source, environment of deposition, stratigraphic relations and structure.

In the Mesa Central, rocks of pre-Late Jurassic age consist of two lithologic suites: the oldest suite, of marine aspect and Late Triassic age, has not been clearly documented in all cases, so the following stratigraphic units have been proposed: Zacatecas Formation (Carrillo-Bravo, 1968), La Pimienta Phyllite (Ranson et al., 1982), Taray Formation (Cordoba, 1964), El Bote and El Ahogado Formations (Monod and Calvet, 1992) and La Ballena Formation (Silva-Romo, 1994). The second lithologic suite, the Nazas Formation (Pantoja-Alor, 1963; 1972) is clearly controversial since its stratigraphic relations and lithic nature have not been clearly recognized. It has frequently been considered as part of the older marine unit. The Nazas Formation has a continental character and is clearly different from other units of pre-Late Jurassic age (Arellano-Gil, 1988), and unconformably overlies the marine Triassic rocks (Silva-Romo, 1994).

On the other hand, it has been proposed that the basement of the region is exposed in the Caopas area in Zacatecas, where Cordoba (1964) used the names Rodeo Formation

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