[PS]The Late Triassic-Late Cretaceous Flooding of the Gulf of Mexico from the Pacific through Mexico*

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Abstract

During the Late Triassic a major system of graben and horsts were formed as a consequence of the break-up of western Pangea, and the Laurasia Plate started to drift apart from the Gondwana Plate, all along under the influence of the Farallon Plate. In the early stages of this tectonic event thick sequences of continental clastics were deposited over the Pre-Mesozoic basement, as well as local lava flows in the floor of these low relieve areas. The continuous subsidence of these grabens allowed the invasion of marine water from the Pacific developing an extensive shallow water seaway through these basins across Mexico. The basement highs remained emerged acting also as source of clastic sediments. There are different opinions about the time and location of invasion of marine water to flood the GOM, but there is also field evidence that indicate that the seaway to flood the GOM was the Portal del Balsas. One piece of evidence is the Callovian age of the extensive salt masses in the GOM which indicate that the basin was completely open by that time, and that it had a low relief and probably an east-west rise in between the Yucatan Block and the northern rim of the GOM. A second piece of evidence are the Early Mesozoic rocks in Mexico; marine Triassic rocks are located only in three states in western part of the country: Baja California, Sonora, and Zacatecas, indicating that the transgression of pacific marine water through the GOM started by that time. However, Early Jurassic marine rocks with ammonites and bivalves crop-out in Guerrero and Oaxaca States, which indicate that a younger southern transgression from the Pacific Ocean took place eastward through the Guerrero Embayment and the Portal del Balsas. A third piece of important evidence in the tectonic reconstruction of the opening of the GOM are the regional gravity maps recently published by Sandwell et al. (2014).

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The Late Triassic-Late Cretaceous flooding of the Gulf of México from the Pacific through México

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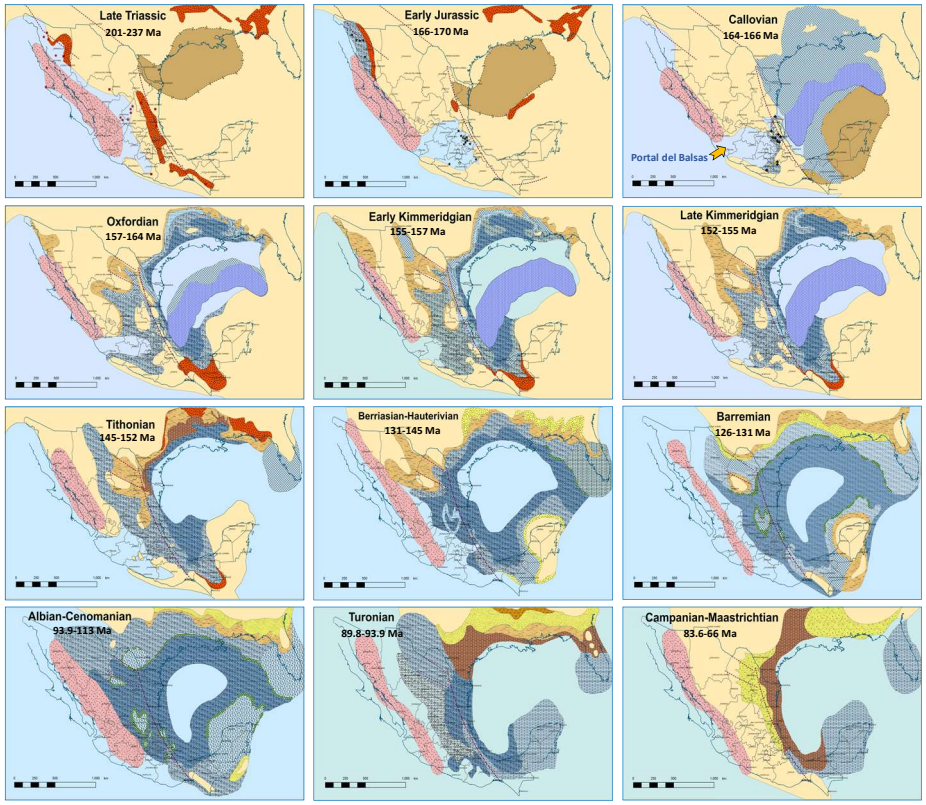
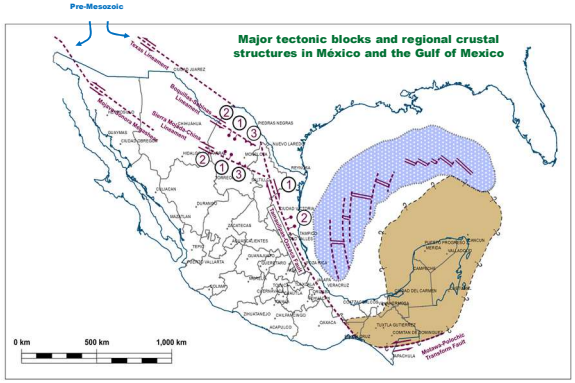
ABSTRACT

During the Late Triassic a major system of grabens and horsts were formed as a consequence of the break-up of western Pangea, and Laurasia Plate started to drift apart from the Gondwana Plate, all along under the influence of the Farallon Plate. In the early stages of this tectonic event thick sequences of continental clastics were deposited over the Pre-Mesozoic basement, as well as local lava flows in the floor of these low relieve areas. The continuous subsidence of these grabens allowed the invasion of marine water from the Pacific developing an extensive shallow water seaway through these basins across Mexico. The basement highs remained emerged acting also as source of clastic sediments. There are different opinions about the time and location of invasion of marine water to flood the GOM, but there is also field evidence that indicate that the seaway to flood the GOM was the Portal del Balsas. One piece of evidence is the Callovian age of the extensive salt masses in the GOM which indicate that the basin was completely open by that time, and that it had a low relief and probably an east-west rise in between the Yucatan Block and the northern rim of the GOM. A second piece of evidence are the Early Mesozoic rocks in Mexico; marine Triassic rocks are located only in three states in western part of the country: Baja California, Sonora, and Zacatecas, indicating that the transgression of pacific marine water through the GOM started by that time. However, Early Jurassic marine rocks with ammonites and bivalves crop-out in Guerrero and Oaxaca States, which indicate that a younger southern transgression from the Pacific Ocean took place eastward through the Guerrero Embayment and the Portal del Balsas. A third piece of important evidence in the tectonic reconstruction of the opening of the GOM are the regional gravity maps recently published by Sandwell et al. (2014).



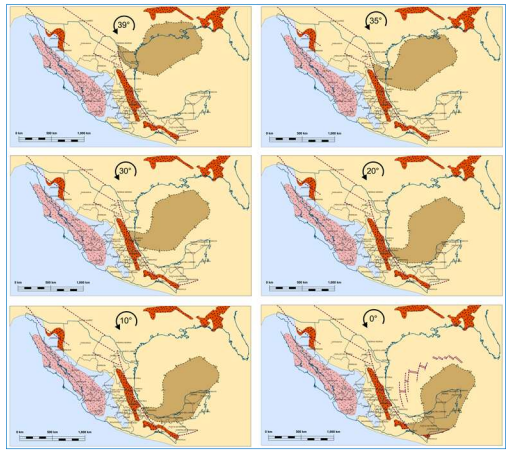
The Portal del Balsas: the seaway for the Pacific water

Imlay (1980, p. 59) say literally "*Marine limestone, shale, and sandstone between the nonmarine units are dated by ammonite genera as late middle Bajocian to early Bathonian. Above the highest coal-bearing beds are marine limestone and marl dated by ammonite genera as late Bathonian to late Callovian...These Jurassic sequences could represent an embayment directly from the south (Guerrero embayment), as suggested by Erben (1957, p. 36-41), or from the southwest (Balsas Portal), as suggested by Lopez Ramos (1974, p. 385-391, 395-397), or from both directions*".



Boquillas Sabinas Lineament moved first as a normal fault (Late Triassic-Late Cretaceous), then as a sinistral strike-slip fault (Callovian-Late Paleocene-Early Eocene), and finally as a reverse fault (Late Paleocene-Early Eocene) with a vergence toward the northeast.
Sierra Mojada-China Lineament moved first as a normal fault (Late Triassic-Late Cretaceous), then as a sinistral strike-slip fault (Callovian-Late Paleocene-Early Eocene), and finally as a reverse fault (Late Paleocene-Early Eocene) with a vergence toward the southwest.
Tamaulipas-Oaxaca Fault moved first as a dextral transform fault (Callovian), and then as a normal fault (Oxfordian-Plio-Pleistocene), being the boundary between the continental crust to the west, and the transitional crust to the east.
Motawa-Polochic Transform Fault - Sinistral transform fault (Miocene)

The Drift of the Yucatán Block



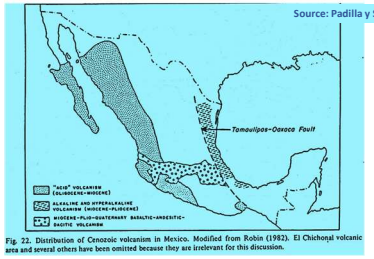
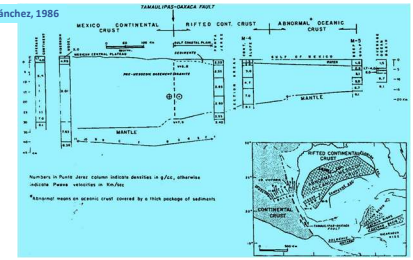
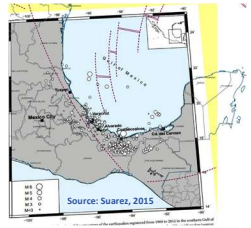


Fig. 22. Distribution of Cenozoic volcanism in Mexico. Modified from Robin (1982). El Chichonal volcanic area and several others have been omitted because they are irrelevant for this discussion.





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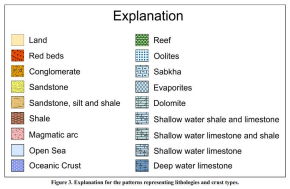
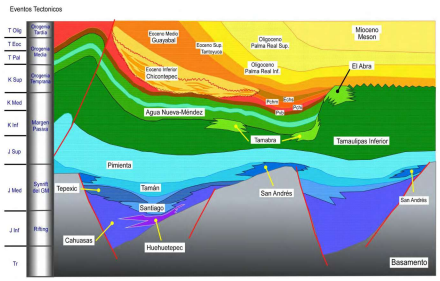


Figure 3. Explanation for the patterns representing lithologies and crust types.

Table 1. Stratigraphic units of the Huasteca Series. There are several unconformities not shown in this table. For detail see (Cantú-Chapa, 1992).

Stage	Formation
Upper Tithonian	Pimienta
Lower Tithonian	San Andrés, Tamán, Pimienta
Lower Kimmeridgian	Cahuasas (Red Beds), San Andrés, Tamán
Upper Callovian-Oxfordian	Cahuasas (Red Beds), Santiago
Middle Callovian	Cahuasas (Red Beds), Tepexic, Palo Blanco
Upper Bathonian-Middle Callovian	Cahuasas (Red Beds), Tepexic, Palo Blanco, Huehuetepec



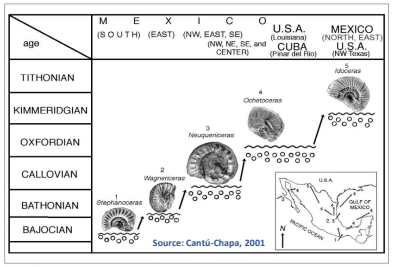
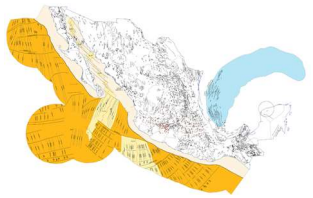


Figure 20. Middle and Upper Jurassic transgressive events from southern Mexico (Bajocian) to the Gulf of Mexico (United States and Cuba) (lower Oxfordian) determined by ammonites. Small map shows transgressive events explained in Figure 7a.



Source: Padilla y Sánchez et al., 2013