SEISMIC STRATIGRAPHY OF THE YUCATAN PLATFORM

Elizabeth Guzman and Gregor P. Eberli

PROJECT OBJECTIVES

- Assess the tectonic deformation of the Cretaceous portion of the Yucatan Platform.
- Map the seismic sequences in the intraplatform seaway of the Yucatan Platform.
- Place the evolution of the Yucatan Platform into the regional context of Caribbean tectonics.

PROJECT RATIONALE

The Yucatan Peninsula and adjacent shelf form the 350,000 km^2 Yucatan Platform. The platform hosts the Chicxulub impact crater generated by the asteroid that led to the mass extinction at the end of the Cretaceous (Schulte et al., 2010). The asteroid impact deformed up to 40 km of the underlying basement and created a multi-ring crater 200 km in diameter. Scientific drilling penetrated the post-impact carbonates, an ~ 130 m thick sequence of impact strata and shocked and fractured basement rocks (Gulick et al., 2016). Regional seismic data reveals that the impact crater is located within a large N-S trending depression – the Intra-platform Yucatan Basin (Fig. 1; Guzman et al., 2019). The depression is filled with prograding clinoforms starting probably as early as Early Eocene (Whalen et al., 2013, Canales-García et al., 2018). The boundary between the Cretaceous and the Paleocene strata is a well-defined seismic horizon. The Cretaceous strata displays faults and deformation that are reminiscent of wrench faults. The question is how much

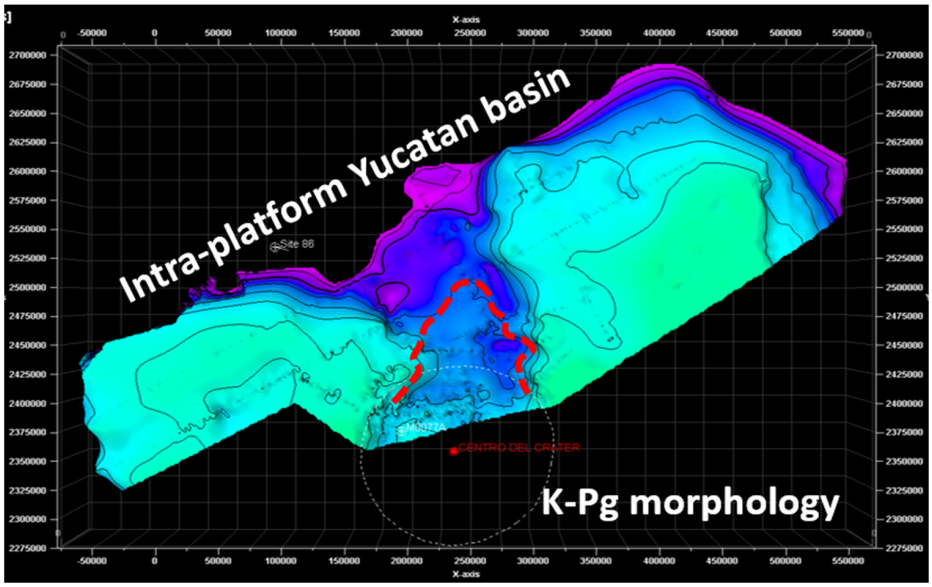

Figure 1: Topography of the Yucatan Platform at the Cretaceous-Paleogene boundary, displaying the roughly north-south oriented Intraplatform Yucatan Basin, which is nearly 180 km wide and up to 1200 m deep (from Guzman et al., 2019).

of this deformation is the result of the asteroid impact and how much is related to changes in the regional stress regime. This project aims to assess the structural evolution of the Yucatan Platform and also to analyze the prograding sequences with regards to sea-level control. A comparison of the timing and style of the deformation and the infill of the intraplatform basin are strikingly similar to the deformations observed in Great Bahama Bank and the Straits of Andros that are also filled with prograding clinoforms. We plan to compare and contrast these two areas.

DATA SET AND WORKPLAN

The seismic data in hand consists of seismic lines collected in conjunction with the IODP drilling of the impact crater, older data collected by the University of Texas, and newer data from the National Hydrocarbons Information Center (CNIH) in Mexico. In addition, we expect to secure more seismic data from CNIH in Mexico to cover crucial areas for our study goals.

We plan to build a robust seismic stratigraphic framework of the Yucatan Platform that relies on the ages acquired by dating material provided by existing onshore and offshore cores. Faults and deformation will be mapped within this framework and placed into the larger regional context. A detailed sequence stratigraphic analysis will be performed in the prograding sequences that fill the intraplatform basin. Results of the sequence analysis will be compared to timing and style of the prograding clinoforms in the Straits of Andros within Great Bahama Bank.

SIGNIFICANCE

The Yucatan Platform is a large and important – yet underexplored -carbonate platform within the Caribbean. It also offers the opportunity to investigate the consequences of a large impact on the deformation and subsequent recovery of a carbonate platform.

REFERENCES

Canales-García, I., Urrutia-Fucugauchi, J., and Aguayo-Camargo, E. (2018) Seismic imaging and attribute analysis of Chicxulub Crater central sector, Yucatán Platform, Gulf of Mexico. Geologica Acta, v.16, p., 215-235

Gulick, S., Morgan, J., and Mellett, C.L. (2016) Expedition 364 Scientific Prospectus: Chicxulub: drilling the K-Pg impact crater. International Ocean Discovery Program. http://dx.doi.org/10.14379/iodp.sp.364.2016

Guzman E., Aguayo, E., and Eberli G.P. (2019) Evidence of a Large Intra-platform Basin on the Yucatan Peninsula in the Vicinity of the Chicxulub Crater. CSL -Annual Review Meeting abstract book p. 107-110.

Schulte, P., et al. (2010) The Chicxulub asteroid impact and mass extinction at the Cretaceous-Paleogene boundary. Science, v. 327, p. 1214-8.

Whalen, M.T., Gulick, S.P.S., Pearson, Z.F., Norris, R.D., Perez Cruz, L., and Urrutia Fucugauchi, J. (2013). Annealing the Chicxulub impact: Paleogene Yucatán carbonate slope development in the Chicxulub impact basin, Mexico. *In* Verwer, K., Playton, T.E., and Harris, P.M. (Eds.), *Deposits, Architecture, and Controls of Carbonate Margin, Slope and Basinal Settings*. Special Publication—SEPM (Society for Sedimentary Geology), v. 105, p. 282–304.