**GEOLOGY OF SOUTHERN QUINTANA ROO (MEXICO) AND THE CHICXULUB EJECTA BLANKET.**
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**Introduction:** The Chicxulub ejecta blanket was first discovered on Albion Island in NW-Belize [1, 2]. This region has been considered as being completely covered by platform carbonates of a continuously retreating lower Tertiary (Paleogene) sea [3]. The discovery of KT rocks, the finding of further localities of the ejecta blanket in adjacent Quintana Roo (Mexico) and central Belize and the presence of Karst features atop the underlying Cretaceous [2, 4] question the traditional geological model of the Yucatán peninsula.

**General observations:** The geology of the S Yucatán Peninsula is poorly constrained due to bad surface exposures and the lack of reliable biostratigraphic data. A Paleogene age was proposed for the evaporitic rocks of the Central Peninsula (Buena Vista and Icaiche Fms.) based on erroneously assigned foraminifera from Petén, N Guatemala [5, 3]. In the Pemex well Y1 to the N the Icaiche Fm. instead revealed an Upper Cretaceous (Maastrichtian) age [3].

*Physical geology.* Throughout the Cretaceous and the Cenozoic the Yucatan carbonate platform was situated in the tropics. The present land surface displays a strong Karst development and is heavily weathered. The flat N' peninsula is characterized by subsurface drainage with intense cave systems and the typical sinkholes (Cenotes). These features are absent S' of the Tikul fault, where a hilly topography with surface drainage and interfingering karst plains prevail.

**Distribution and properties of the ejecta blanket:** Numerous localities of the Chicxulub ejecta blanket were identified W of the Rio Hondo fault system between 298 and 365 km (3-4 crater radii) from the impact centre ([4], Fig.1). Crater derived debris, such as crystalline clasts and shocked quartz grains at various localities confirm their impact origin.

In this region the ejecta surrounded hills of Cretaceous rocks (e.g. Agua Dulce and Alvaro Obregon localities) and overrode karst features as dolines, that formed within the Cretaceous bedrock. It is usually exposed at the surface and in the NE study area (near Bacalar) overlain by Neogene deposits. Further to the W various new localities of ejecta deposits were identified up to 275 km from Chicxulub Puerto (Fig. 1).

The Chicxulub ejecta blanket is a highly chaotic breccia or diamictite, with very variable grain size distributions and boulders of up to 12 m in size. No bedding or stratification is present. Slickensided or grooved shear planes a common in the ejecta blanket, especially pronounced at the base and around obstacles. Measurements of shear planes indicate a NNW-SSE flow in the Rio Hondo Region, roughly radially away from the impact centre. In the W the measurements reveal a motion from a NNE to a SSW (Fig. 1).

**Mapping the ejecta blanket:** The eroded bedrock lithologies determine the petrographic characteristics of the ejecta blanket and strongly influenced the secondary ejecta flow [6]. Therefore, the knowledge of the pre-impact geology is crucial for the identification of ejecta localities and the understanding of depositional processes during ejecta emplacement. The well stratified Cretaceous bedrock can be correlated and mapped over large distances across the peninsula.

*Cretaceous formations and fault systems.* In the Rio Hondo region the Cretaceous is represented by dolomites and dolomitic limestones of the Barton Creek Fm. that are overlain by fine-crystalline limestones of the Estero Franco Fm. Due to an obliquity of the Rio Hondo Fault, the Barton Creek dolomites are elevated in the S, where they are not covered by the Estero Franco limestones.

W' of the Rio Hondo region a N-S trending, escarpment (Kohunlich fault, Fig. 1) is formed by heavily recrystallized, thickly bedded carbonates of the Cerro de Pavo Fm. They are overlain by an alternate bedding of thin dolomites, marls and clays, with rare gypsum intercalations (Morocoy Fm.). These deposits represent the lateral equivalent of the Icaiche Fm. of the Central Peninsula and were deformed by the overriding ejecta blanket. Towards the W the Cerro de Pavo Fm. forms another escarpment (Tesoro fault, Fig. 1) and are overlain by the evaporitic Icaiche Fm.

*Identification of ejecta localities.* Since the petrographic characteristics of the ejecta blanket are strongly influenced by the eroded bedrock lithologies [4, 6], sedimentologic criteria should be aplied for its identification in the field. These criteria are:

- presence of abraded, striated or facetted clasts
- clasts and boulders with clay or matrix coatings
- slickensided, grooved or clay coated shear planes
- clay rich shear zones or of sheared clay pockets
- deformation of the bedrock

Due to the scattered outcrops of the ejecta blanket in a large area, its chaotic nature, the absence of stratification and its complex interfingering with the bedrock, it cannot be mapped by classical means. To map its areal extent, additional methods have to be applied.

*Morphological approach.* Due to their different lithologies all formations reveal a very characteristic karst topography with distinct morphological features: The older Barton Creek and Cerro de Pavo formations form high plateaus with deeply incised dry valleys. The limestones of the Estero Franco Fm. are represented by a knobby karst topography without valleys. Both, the marls and clays of the Morocoy Fm. and the unsorted ejecta blanket form a smoothly undulating relief. Completely flat plains are interfingering with this smooth topography. The Neogene Bacalar Fm. is characterized by flat, slightly elevated plateaus.

The analogue 10 m contours of the INEGI 1:50.000 topographic maps and the digital 90x16 m elevation model of the Space Shuttle Radar Topography Mission (SRTM) where used to map the areal distribution of the ejecta blanket based on these criteria.

*Additional data sources.* Both, soil development and vegetation cover depend on bedrock. Thus, the detailed 1.:250.000 INEGI soil map [cf. 7] and scenes of the Landsat 7 Enhanced Thematic Mapper (ETM+) where used to refine the map in areas where outcrop data and morphological information were insufficient.

This combined approach of field work, laboratory data and remote sensing techniques resulted in a revised geologic map of S' Quintana Roo, that reveals a complex interfingering of Cretaceous, KT and Neogene deposits and suggests a completely new scenario for the geological evolution of this region (Fig. 1).

**Evolution of southern Quintana Roo:** The oldest rocks exposed in Quintana Roo are the Campanian/Maastrichtian (?) Cerro de Pavo and Barton Creek Fms. Deposition continued throughout the Maastrichtian with the open marine Estero Franco Fm. in the Rio Hondo Region and the Morocoy and Icaiche Fms in the Central Peninsula. The absence of marls, clays and evaporites in the Rio Hondo Region suggest that the Kohunlich Fault formed first, restricting an evaporitic basin to the W. Following another tectonic pulse prior to the KT boundary, the region became uplifted along the Rio Hondo fault, subaerially exposed and heavily karstified. These events might be contemporaneous with two compressional pulses recorded in the late Cretaceous of Guatemala and related to the final collision of the W Antilles Arch in the late Campanian and the onset of the collision of the Maya and Cortis block in the latest Maastrichtian [8, 9].

Within the first minutes after the Chicxulub impact event, a ground hugging, cohesive and highly erosive ejecta flow overrun, eroded and draped a karstified land surface on the SE Yucatán Peninsula. In the E the flow crossed the Rio Hondo Fault and was slightly deviated by the pre-existing relief. In the W it appears to follow a pre-KT escarpment (Fig. 1).

In the Cenozoic the ejecta blanket formed a seal, that inhibited the development of a subsurface drainage system. Karstification continues, pronouncing the topography of still exposed Cretaceous rocks and leading to the development of karst plains on the impermeable ejecta blanket. Only in the NE' study area a marine ingression occured in the Neogene, depositing the white, fossiliferous marls of the Bacalar Fm.

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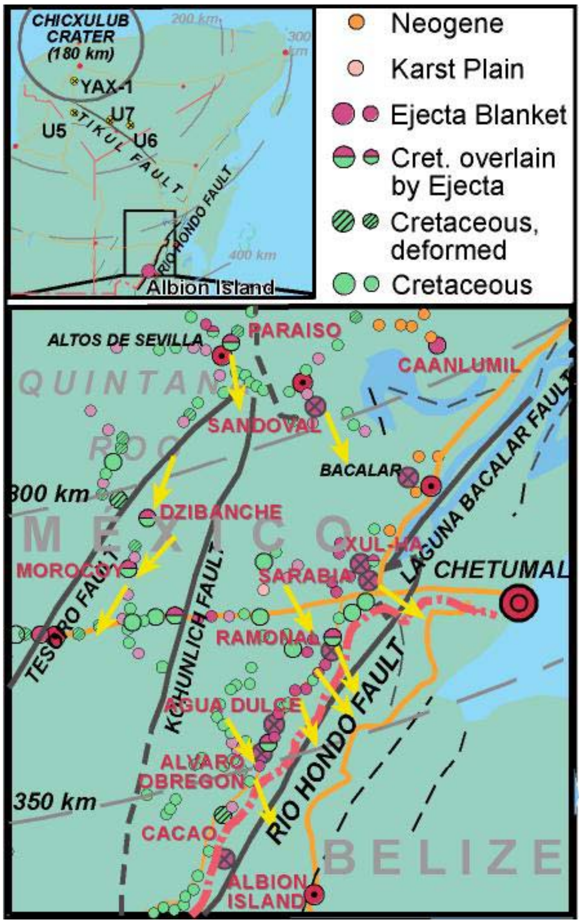


Abb. 1. Locality map of Southern Quintana Roo. Arrows indicate the motion of the secondary ejecta flow.