Structure of the Chicxulub Impact Basin, Mexico

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The collision between a large extraterrestrial object (probably a meteor) on the surface of the Earth 60 million years ago in the Yucatan led to the extinction of about 70 percent of the planet's species, including all dinosaurs, at the end of the Cretaceous Period. The Chicxulub impact basin on the northern coast of Yucatan appears to be the site of this catastrophic impact event. The crater is completely buried by Cenozoic platform rocks, so conventional geophysical techniques and drilling must be employed to study the style and extent of deformation associated with its formation.

Bouguer gravity anomalies indicate a configuration of multiple concentric rings, the largest of which has a diameter of nearly 300 km. Recently acquired seismic data substantiates this morphology and delineates in remarkable detail the smaller central basin formed by inward slumping of the excavation crater walls. Central crater diameter is of nearly 200 km and modest extensional deformation extendsthe area to approximately where the outer gravity ring is located.

The weakly circular northwest quadrant of the crater is interpreted as the superposition of the impact onto an older linear gravity high, rather than a post-impact fault as assumed by other workers. Such a linear feature may have resulted from processes that tore the Yucatan Peninsula away from the southern United States as the Gulf of Mexico opened during the Jurassic.

Several lines of evidence suggest that the basement rock under the crater is 500 million years old. Zircon minerals found in the strata in the western United States that mark the 65 million-year-old impact event have been determined to be about 550 million years old, consistent with the emplacement of the zircons as debris from the K-T-age impact basin.

Stratigraphic and paleo-environmental constraints derived from deep exploration drilling by Pemex and shallow drill coring by UNAM indicate that the higher-standing topography associated with the inner basin flanks has undergone substantial deformation. Large blocks, some exceeding 50 m in thickness, were ejected more than 70 km from the edge of the excavation cavity. The breccias and melt rocks are mixtures of Pan-African crystalline rocks and Cretaceous sediments. The abundance of anhydrite and carbonate in the platform section, which was melted and vaporized by this impact event, contributed to the destructiveness of the impact deformation.

Biographical Sketch

Buck Sharpton received his Ph.D in geological sciences from Brown University in 1984. Dr. Sharpton first became a post-doctoral fellow at the Geological Survey of Canada's Earth Physics Branch. In 1986 he joined the research staff at the Lunar and Planetary Institute in Houston. His research interests center on meteorite impacts and their geological consequences.

For the past eight years he has investigated several large impact scars on Earth, including the Chicxulub crater in Yucatan, and has published extensively on other craters. He is currently the chairman of theIUGG/IUGS Global Impact Studies program, and leads an international team interested in deep drill sampling of the Chicxulub crater. Sharpton has authored over 60 research papers on impact cratering and he currently holds four research awards to study impact structures on Earth and the Earth-like planets.

Sharpton received distinguished performance awards from the government of Canada and the National Aeronautics and Space Administration. He served as guest investigator on the NASA Magellan Mission to Venus, was editor of the Proceedings of Lunar and Planetary Science, and is a member of NASA's Lunar and Planetary Geoscience Review Panel. He served as co-investigator on the recent project of reflection seismic profiling over the offshore portion of the Chicxulub crater.

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