ANALYSIS OF GRAVITY AND TOPOGRAPHIC/BATHYMETRIC DATA OVER THE CHICXULUB IMPACT STRUCTURE: A LOOK AT DETAILS; Gary L. Kinsland[1], Manuel Hurtado[2], Alejandro Ceron[2], Kevin Pope[3], Adriana Ocampo[4], William Smythe[4], Paul Bedard[1], [1]University of Southwestern Louisiana, [2]Instituto Mexicano del Petroleo, [3]Geo Eco Arc Research, La Canada California, [4]Jet Propulsion Laboratory, California Institute of Technology.

The Chicxulub impact feature, has been characterized as being relatively circular with a diameter of 180 Km [1], 240 Km [2], or 300 Km [3]. To arrive at these characterizations the authors have relied for the most part upon gravity data, sparse well control, a few seismic lines and a ring of cenotes (sinkholes). We are better defining the feature by analysis of the details of the gravity and topographic/bathymetric data.

Gravity and topographic/bathymetric data over the feature, which is expressed partly on the Yucatan Peninsula and partly on the Yucatan Shelf, are being gathered and analyzed. The data compiled so far include those available from the United States Defense Mapping Agency (USDMA), the United States National Geophysical Data Center (USNGDC), some released to the study by Instituto Mexicano del Petroleo, some we collected ourselves [4] and some traded to us by Alan Hildebrand.

In the gravity data we find small negative anomalies, generally <3 mgal and <10 km, which inside the crater are concentric with the crater and outside the crater are more nearly radial. Models of these anomalies indicate that they must have shallow sources. Essentially they must start at the surface and extend to no deeper than a few kilometers. From the model densities, shapes and extents we interpret these features to be solution zones developed along fractures which have propagated upwards into the Cenozoic rocks from features related to the buried impact structure. Inside the crater these anomalies are probably related to slumping over and around the central uplift as well as to slumping into the transient crater (maximum horizontal principal stresses roughly concentric). Outside the crater the more nearly radial anomalies may be related to fractures developed upon impact and explosion when maximum horizontal principal stresses were nearly radial.

From the USDMA data we created a digital elevation model (DEM) [5] which clearly illustrates that the Chicxulub structure has surficial topographic expression. Evident in the DEM are the topographic rim of the crater with a radius of 120 km, and several well developed troughs which correspond to the inner concentric gravity anomalies. We are attempting to determine whether the radial features can be detected in the gravity and topography data in the zone interior to the crater rim but exterior to the slumped position of the transient crater boundary.

If one ignores the "Merida Low" gravity anomaly, which may or may not be related to the impact, the peninsular and very

near shore portion of the gravity expression of the impact is remarkably concentric. This is not the case for that portion of the anomaly found over the shallow shelf. The most pronounced departures from circularity are to the north-northeast and to the northwest where lobes extend well beyond the diameter of the main anomaly. There has been considerable conjecture that these "Mickey Mouse Ear" portions of the anomalies may be due to either oblique impact or multiple impactors. We have yet to create a DEM from the USNGDC bathymetric data but detailed analysis of profiles indicates that at least the north-northeast ear is expressed as a shallow basin (relief about 8-10 meters) separated from the main crater basin by a distinct bathymetric high. If this interpretation holds up it would support the multiple impact hypothesis. We expect that further analysis of the details of the gravity and topography/bathymetric data will reveal that the rim and solution features found on land continue on the shelf. Perhaps analysis of these details will also shed light on the multiple impact and oblique impact hypotheses.

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REFERENCES. [1] Hildebrand, A. R., et al. (1995) Nature 376:415-417. [2] Pope, K. O. et al. (1993) Nature, 351:105. [3] Sharpton, V. L., et al. (1993) Science, 261:1564-1567. [4] Kinsland, Gary, et al. (1995) Lunar and Planetary Science Conference Proceedings, 26:755-756. [5] Pope, Kevin O., et al. (1995) submitted to Geology 8/18/95.