System for Interpretation of 3-D Data in Virtual-Reality Displays and Refined Interpretations of Geophysical and Topographic Data from the Chicxulub Impact Crater

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ABSTRACT

We extend our earlier work on a visualization system that allows an interpreter to navigate, manipulate and interpret 3-D data directly in 3-D space, and present an updated interpretation of data over the Chicxulub impact crater on the Yucatán Peninsula. The system supports multiple 3-D interaction and 3-D display techniques, and it allows the interpreter to collaborate with remote users in real time, even though they may be in different locations and using different display types.

The system's utility is illustrated using combined geophysical and topographic data sets over the Chicxulub impact crater. We present images with interpretive marks, shown from the perspective of an interpreter viewing the data in a mirror-based "fish-tank" virtual-reality (VR) display (in contrast to our earlier work, which focused on a head-mounted display view). This display allows a user to navigate and interpret data using a pen-type device (PHANTOM) in a desktop-sized 3-D volume. The impression of reaching into a 3-D volume is created by visual feedback that appears co-located with the pen and that includes depth cues such as stereoscopic images and motion parallax for user head motion. Multiple datasets or multiple views of the same dataset can be managed using a 3-D "volumetric window" system that we are developing as a 3-D version of the windows found in 2-D visualization systems.

Interpretations of topographic and gravity features of the Chicxulub impact crater data have been updated. The advantages of interpretation in our VR system have led to recognition of new features in the topographic data and of new correlations between the topographic and gravity data sets.