
Chicxulub is a buried 180 km diameter impact crater occurring on the Yucatan peninsula, Mexico(1). It is the largest known Phanerozoic crater on Earth. Although the exact age of impact is not known it may coincide with the K/T boundary and thus may have caused the K/T mass extinction.

Like the majority of terrestrial impact craters, Chicxulub exhibits a characteristic geophysical signature, most noticeably in terms of its gravity and magnetic anomaly(2,3,4). Bouguer gravity data show a concentric pattern consisting of a central gravity high of 20-25 mGal and 20 km diameter superimposed on a gravity low of \(-25\) mGal whose extent may define the crater rim. The concentric gravity anomaly is truncated offshore to the north, which may indicate post-impact faulting. For craters with \(D > 30\) km, the maximum gravity anomaly reaches a limiting value of \(-30\) mGal(5). This corresponds to a maximum depth of the fractured/brecciated low density zone produced by impact, as limited by lithostatic pressure(6). The Chicxulub crater has a maximum associated gravity anomaly in accord with this limiting value. Figure 1 shows the mass deficiency of Chicxulub \((\sim 1.5 \times 10^{16} \text{ kg})\) in comparison with a number of terrestrial(7,8,9) structures. Its mass deficiency is on the trend defined by other terrestrial craters.

Concentric with the central gravity anomaly is an area of magnetic anomalies up to 1000 nT in magnitude and extending to 30-50 km radius. Central magnetic anomalies are found at most terrestrial impact craters with \(D > 40\) km(5). The central high magnitude anomalous zone is surrounded by a roughly circular zone of low amplitude anomalies extending to \(~105\) km radius(2). Figure 2 shows two radial profiles of the magnetic field anomalies which were collected starting near the crater center along orientations \(\sim 340^\circ\) and \(358^\circ\). Gaps in the profiles indicate where the survey ship drifted perpendicular to the profile orientation. Because of the wide and irregular sample spacing, only a maximum depth to magnetic source can be derived from analysis of the slope characteristics. For the highest amplitude anomaly on the profiles, the maximum depth to source is \(~2\) km below sea level. Depth determinations based on high quality proprietary data suggest a depth of \(1.1\) to \(1.3\) km(2). The largest high amplitude anomaly appears to be reversely magnetized because its magnetic high is to the north. This is consistent with...
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the Chicxulub crater having a K/T boundary age as the K/T boundary occurs in the reversed polarity interval 29R. However, large normally magnetized anomalies are also associated with the crater. These two magnetic anomaly profiles cross the feature which truncates the crater’s gravity anomaly. This indicates that this feature has not significantly disrupted the crater’s magnetic signature and that a completely circular structure is present in the subsurface.

Although the Chicxulub structure exhibits gravity and magnetic signatures in keeping with an impact origin, only petrographic evidence can confirm such a hypothesis. Shocked quartz has been reported from the structure and illustrated (1,11) previously from one sample of breccia (Y6N14) from a depth of ~1210 m in Yucatan well #6, drilled 50 km from the center of the structure. A second sample, Y6N17, from a depth of ~1297 m from the same well has been described both as an "andesite"(3) and as an impact melt rock(1,11). Although bearing a textural resemblance to impact melt rocks from known craters, shocked minerals were previously not reported from this sample(1,11). We have examined two thin sections from these samples and report here initial observations of planar deformation features (PDF) in quartz from both the samples.

The basic petrographic description of Y6N14 has been given previously(1,11). PDF occur in single crystal clasts (up to 0.25 mm) in the carbonate matrix of the breccia. They also occur more rarely and less obviously in quartz aggregate clasts (after sandstone) which occur in the "igneous clasts" of the breccia. We have measured the orientations of the planar deformation features by standard universal-stage techniques. They occur as multiple sets with orientations, such as ω and π, found in lithologies from known impact structures (Fig. 3). Thus, we confirm the interpretation that the lithologies in the breccia are impact-related(1,11).

The basic petrographic description of Y6N17 has been given previously and quartz clasts surrounded by pyroxene-feldspar coronas have been noted (1,11). Previously, no multiple PDF were observed, although the presence of such coronas is a common feature of impact melt rocks (12). However, three quartz grains with multiple PDF were observed in the thin section studied (Fig. 3). On the basis of this limited set of observations, we confirm the interpretation that the "andesite" is an impact melt rock. The amount of sample currently available for study from Chicxulub is very small and dramatically out of proportion to the potential importance of the structure for K/T studies and understanding the nature of large impact structures. Given the international and multidisciplinary nature of K/T studies, Chicxulub presents an important target for scientific drilling and cooperative consortium studies.

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