THE MARQUEZ DOME IMPACT STRUCTURE, LEON COUNTY, TEXAS; Virgil L. Sharpton, Lunar and Planetary Institute, Houston, TX 77058, and John W. Gibson, Jr., Chevron USA, Exploration, Houston, TX 77251

Background. The Marquez Dome, located in the northwestern corner of Leon County, Texas, is an ~3 km diameter circular inlier of Cretaceous marls and shales (principally Taylor Group) within the flat-lying Paleocene/Eocene Calvert Bluff Formation (Wilcox Group). Its proximity to the East Texas salt basin led early workers to ascribe the structure's origin to salt diapirism. Subsequently, however, drilling has demonstrated that a salt core is not present under Marquez Dome. Furthermore, unlike salt structures, this structure has a positive gravity signature of approximately 2.5 mGals, with steep gradients, indicating a shallow source of excess mass. Consequently, the Marquez Dome has been excluded from recent compilations of salt domes of the East Texas Basin and its origin has remained problematic. We have recently assembled compelling evidence that Marquez Dome is the central peak of an otherwise buried meteorite impact structure. Here we discuss these data and emphasize the distinctions between Marquez Dome and impact structures in more competent targets.

Field observations. Topographic relief around the structure is subtle and not attributable to impact. The Cretaceous inlier consists predominantly of chaotic outcrops of poorly-consolidated clays and sands containing numerous cobble- to large boulder-sized limestone blocks of the Pecan Gap Formation (Taylor Group) with well-developed shatter cones. Shatter cones within individual boulders do not have consistent orientations, perhaps due to complex shock wave propagation in the heterogeneous, strongly layered target material.

We also have identified two types of impact breccias: a white mixed breccia with a homogeneous, fine-grained, glassy matrix containing shocked and melted clasts ranging up to 2 cm in length; and a brown mixed breccia with a sandy-clay matrix containing shocked clasts up to 20 cm in length. White breccia deposits appear in some localities to be draped over the Cretaceous units suggesting a fallback origin. In other places dikes of white breccia, 1-2 m wide, are recognizable on the surface for several 10s of meters.

Petrography. Quartz grains from both breccias have been examined petrographically in oil mounts and these grains contain planar deformation structures (planar fractures/cleavages in > 50% of the grains; multiple sets of planar elements in ~1% of the grains). The planar elements (Fig. 1) are clearly shock-induced, but are less abundant, less continuous, and more broadly spaced than those typical of shocked quartz from impact sites in crystalline targets. In addition, the white breccia contains up to 40 vol % glass, in the form of frothy aggregates, glass-rimmed quartz, and clasts of up to 10 mm diameter. Aerodynamically-shaped clasts (tear drop (Fig. 2), dumbbell shapes) are common and support the field relations indicating this unit represents fallback breccia. Preservation of fallback deposits demonstrates that this structure has undergone very little erosion. Glass also occurs as layered or "bread-crusted" clasts, suggesting the impact occurred in a water-laden target.

Subsurface data. A wealth of petroleum industry geophysical and bore hole data have been collected over Marquez Dome, including over 160 km of migrated reflection seismic data and 18 wells penetrating the structure. Sixteen of the wells have been logged and provide a precise subsurface control grid for the seismic data. These subsurface data (Fig. 3) indicate that deformation associated with the Marquez Dome is limited to shallow depths; reflector horizons below 1800 m continue across the structure without significant interruptions or vertical offsets. They also clearly show that the Cretaceous outcrops have been structurally uplifted approximately 1200 m from their regional elevation, and that a broad annular zone of intense faulting extends outward beyond the "dome" for a distance of at least 7 km.

Size, age, geological setting. The geophysical and geological observations summarized above unequivocally establish the Marquez Dome as a complex impact crater, but one with some fundamental distinctions when compared to impacts in competent targets. From the extent of subsurface deformation evident in the seismic data, this structure's diameter is at least 15 km and probably exceeds 20 km. Field relationships indicate that the impact was into predominately unconsolidated coastal sediments during deposition of the (upper) Calvert Bluff Formation. Recently revised age assignments place this formation at Late Paleocene/Early Eocene; thus the age of the impact event appears to be $58 \pm 2$ my. The structure was then covered by ongoing deposition of Calvert Bluff units followed by Eocene deposits of the Carizzo Formation (Clairborne Group), apparently with minimal erosion. The central peak (the Marquez Dome, sensu stricto) currently is undergoing exhumation with the headward denudation of the Carizzo cover. The structural height of the central peak and the apparent absence of rim outcrops indicate the Marquez Dome...
The impact structure is unusual in that the central peak height exceeds the rim height. This suggests that large impacts into unconsolidated, water-laden sediments may not produce a distinct "crater" similar to those produced by impacts into more competent targets.

We thank Chevron USA for graciously providing the subsurface data used in this investigation.

**Fig. 1** (left). Shocked quartz clast with multiple sets of planar features. Sample of white breccia matrix; crossed Nicols; oil mount; long dimension of grain is 0.7 mm.

**Fig. 2** (right). Glass tear drop shape taken from white breccia matrix; plane light; length of clast is 0.8 mm.

**Fig. 3** (below). Seismic line running NW to SE through Marquez Dome, and its structural interpretation. Depths, and stratigraphic correlations based on borehole information. Depths are referenced to sea level.