SHALLOW SEISMIC TEST AT MARQUEZ IMPACT STRUCTURE. R. R. Herrick and V. L. Sharpton, Lunar and Planetary Institute (3600 Bay Area Blvd. Houston, TX 77058; herrick@lpi6.jsc.nasa.gov)

Marquez Dome is the filled and eroded remnant of an ~15-km diameter, 58 Ma impact into unconsolidated sediments in Southeast Texas (31°17'N, 96°18'W). The 3-km diameter central peak outcrops as Cretaceous marls and shales at the surface and is flanked by pre- and post-impact Tertiary sands and clays. Petroleum exploration data for Marquez include over 160 km of reflection seismic data crisscrossing the site and numerous logged wells. These data have been used to roughly define the extent of the central peak from a zone of no continuous reflectors and the rim from low-angle, modest offset normal faults [1, 2]. A minimum group interval of 33 m and near offset of 100 m cause the industrial seismic data to be of low quality in the upper 250 ms, and consequently these lines do not image the flanks of the central peak and the shallow rim faults. We conducted a shallow seismic investigation to see if engineering seismic equipment could be used to image the flanks of the central peak and fill in the missing 250 ms in the industrial data.

METHOD. We collected about 500 m of reflection seismic data along a dirt road running oblique to the edge of the central uplift. The location was chosen for convenient access and its position on the flank of the central uplift. Group and shot intervals were 3 m (10 ft.). Shooting was conducted so that we started at one end and rolled onto the spread until we reached split spread. We then moved half the spread to the end of the line so we were shooting end-on again and repeated the process. In this way we were able to maintain constant 24-fold data, utilize all 48 channels of the recording unit without having a roll-along switch, and obtain some far offset data for velocity analysis. Our source was a Betsy Seisgun which fired a 400-grain 8-guage shotgun blank. Shots were fired in two-foot deep, two-inch diameter shotholes drilled with a one-man auger. With a two-man crew we averaged 60 shots per day.

Time-based rental of the processing software necessitated a basic processing sequence. Processing steps were automatic gain control (AGC), filtering, AGC, muting, elevation statics, refraction statics, common-midpoint sorting, normal-moveout correction, and stacking. The critical processing step was a 55 Hz low-cut Butterworth filter to reduce the ground roll. After filtering ~150 Hz of usable bandwidth remained producing a pulse width of 15-20 ms. We were surprised to find that heavy rains prior to shooting saturated the sediments so that the water table was less than 10 m deep and the first refractor had a sound velocity of ~1800 m/s. This produced much less moveout than anticipated and we could only make crude guesses at appropriate stacking velocities.

RESULTS. Figure 1 shows the final processed seismic section. The horizontal axis is shotpoint number (multiply by 3 for distance in meters) and the vertical axis is two-way travel time in seconds (multiply by ~1000 for depth in meters). Plots below the section show stacking fold and statics corrections. The black line shows the dominant feature on the section, an approximate division between zones of coherent and noncoherent reflectors. This may be a stratigraphic horizon between uplifted Cretaceous limestones and marls within the central peak and pre- and post-impact clays and sands. Portions of the section show direct reflections off this boundary. The surface projection of the boundary matches well with our observation of cuttings of calcareous material as we drilled the shot holes beyond about shotpoint 130. We consider our seismic source adequate to fill in the upper part of industrial seismic data, as coherent reflectors can be seen to nearly 300 ms (~300 m) at the eastern end of the line. Apparent dip on the marked feature is ~40°. The road we shot data along appears to be highly oblique to true dip direction, so true dip may be substantially higher.

REFERENCES. [1] Sharpton V.L. and Gibson J.W. (1990) *LPSC XXI*, 1136. [2] Gibson J.W. (1991) M.S. Thesis, U. Houston.

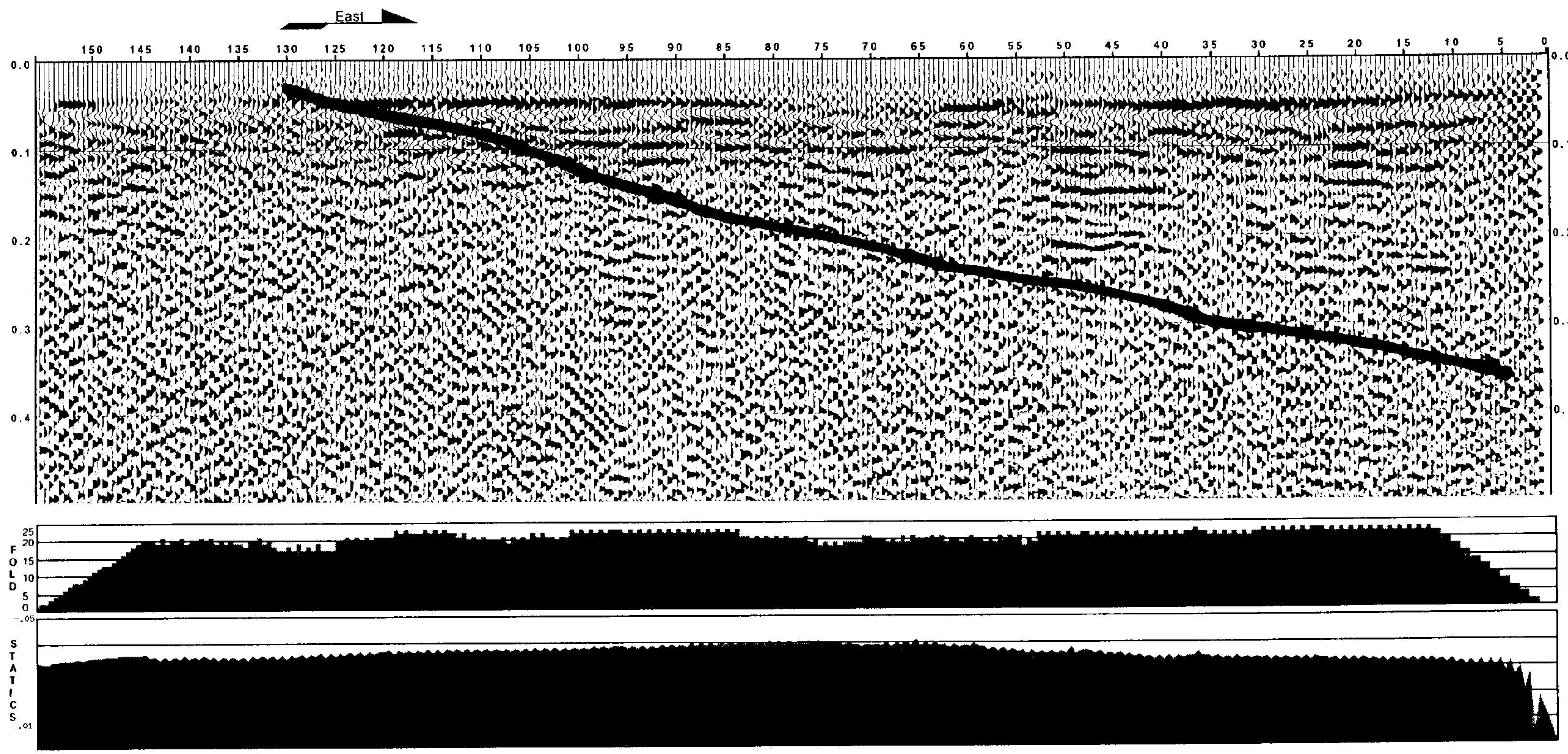

Figure 1. Shallow seismic line on the flank of the central peak at Marquez impact structure, Texas. Line runs NW-SE and was shot from right-to-left. Horizontal axis shows shotpoint number (3 m shot interval) and vertical axis shows two-way travel time. Solid black line shows boundary between zones of coherent and noncoherent reflections. Bottom plots show stacking fold and statics corrections that were applied.