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## Hidden Structure Revealed by a Simple 3D Velocity Model— McAllen Ranch Field, Hidalgo County, Texas

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### ABSTRACT

A significant gas accumulation was discovered in an area surrounded by dry holes and marginal wells in the Vicksburg Formation in McAllen Ranch Field, Hidalgo County, Texas, by treating a seismic velocity anomaly as a geologic rather than a geophysical problem, and by simple application of arithmetic and geometry. Due to the effects of the anomaly, seismic data displayed in time gave no indication of the existence of an 800 acre (3.24 km<sup>2</sup>), 150 BCFG (billion cubic feet of gas) anticlinal structure. A velocity model that used an understanding of the rock properties causing the anomaly was able to predict its extent and severity by readily identifiable thickness changes in the anomalous units. The resulting discovery yielded a seven-fold increase in field production within a two-year time span.

Seismic check-shot surveys indicated that a 1,500 ft (500 m) thick interval in the Frio Formation 5,000 ft (1,500 m) above the objective reservoir had velocities that were as much as 50% faster than the overlying or underlying units. The top and base of the high-velocity unit were correlated over a wide area using 3D seismic and well data. A three-layer 3D velocity model of the units overlying the objective reservoir was constructed using the time surfaces of the anomalous velocity layer and the normal velocity layers above and below it. Within each layer an average velocity value was assigned by contouring known velocity control points. By computing a thickness for each point in each layer and then summing the layers, a depiction of the true shape and orientation of the objective reservoir was produced.