Early Compressional Deformation in a Shelf Salt Mini-Basin Setting: Pre-Stack Depth-Migration Imaging and Palinspastic Reconstruction of the Mozart Structure, South Marsh Island South Additions, Offshore Louisiana

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ABSTRACT

New pre-stack depth migration of 3-D seismic data over a previously-unrecognized reverse-faulted anticline in the South Additions of South Marsh Island has revealed a relatively unusual deep shelf compressional feature formed in the early stages of salt mini-basin development. The structure is a reverse-faulted, doubly-plunging anticline trending northwest. In earlier processed 3-D post-stack migrated seismic data, the Mozart structure appears to be a zone without continuous reflectivity which led to previous interpretations as diapiric salt. The new pre-stack depth migration has clearly imaged both the hanging-wall and footwall sections. Mapping of Pliocene and Miocene horizons on and off the structure rigorously demonstrates that the relative displacement is that of a high-angle reverse fault with more than 9,000 ft of maximum net slip at the Upper Miocene. We have reconstructed the structural development by flattening successive horizons and making the usual constant bed-length assumption. Overall shortening lies in the range of 16 to 18%. Reconstruction suggests the shortening was largely over by *Buliminella* 1 time. A buried synkinematic structural unconformity is well developed over the crest of the anticline. We suggest that the structure developed as a result of updip gravity loading which induced downdip upward rotation and local compression. Early updip loading caused expulsion of ductile salt into a downdip salt sheet. Formation of a steep secondary salt weld downdip prevented further ductile salt flow into the sheet and reverse faulting accommodated the continued late-stage shortening. The later-formed reverse fault appears localized over a minor bulge in the ductile substrate, as suggested by published physical scale model studies. The Mozart structure represents one of the few places in the Louisiana South Additions where Miocene rocks have been brought up as shallow as 15,000 ft sub-sea and therefore will be a key stratigraphic test of Miocene prospectivity between the deep-water and inner-shelf Miocene plays.