

Origin and Evolution of Bowl Welds in the Central Louisiana Deepwater, Northern Gulf of Mexico

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Many young supra-canopy minibasins in the central Louisiana deepwater are underlain by what are commonly referred to as bowl welds or bucket welds. The floors of the minibasins are often deep, ranging from 35,000 ft to over 45,000 ft, and a few even appear to touch down at the Louann level. The prevailing interpretation is that the minibasins formed by late subsidence into vertical, flaring feeders linking the Louann and allochthonous levels. Adjacent sub-weld strata in primary minibasins (e.g., the Wilcox) are typically shown to be truncated against the welds on all sides of the suprasalt minibasins. Potential problems with this model include: (1) at least one proximal flank (NW, N, or NE) is usually poorly imaged; (2) the geometry often requires lateral salt extrusion during Cretaceous and/or Wilcox time, earlier than seen in more proximal areas; (3) withdrawal geometries such as turtle structures are largely absent; and (4) there is no clear mechanism for why late minibasins form directly over old vertical feeders.

We suggest an alternative model in which most of the deep bowl welds are underlain by asymmetric expulsion-rollover structures bounded to the SW, S, or SE by basinward-leaning, welded feeders and associated counterregional faults. In other words, on at least one proximal, updip flank, the top Cretaceous and Wilcox are not truncated by the welds, but are folded beneath them before stepping back up to higher levels beneath the more basinward or lateral flanks. The expanded section in the rollovers has variable ages. It may include Wilcox strata or the Wilcox and Mesozoic may be condensed beneath the suprasalt minibasins. In either case, the deepest allochthonous level is always above the Wilcox. If allochthonous salt extruded from a more proximal feeder overrides an inflated autochthonous salt body before or while it collapses, the expanded section will be taken up by shallow salt. The canopy is effectively part of the rollover, and folding of the base canopy due to underlying withdrawal of Louann salt provides a trigger for supra-canopy minibasin formation, which in turn ultimately leads to bowl-shaped welds.

The rollover model has important implications for exploration in this province. Three-way truncations are the dominant trap style but are found only on basinward or lateral flanks of the bowl welds. Moreover, the timing of expansion in the rollovers influences sediment transport and deposition and thus reservoir distribution.