A revolutionary 2012 seismic reflection survey, SuperCache, consisting of 17,000 kilometers (km) of 2D Pre-Stack Depth Migration (PSDM) data was acquired across the United States deep-water Gulf of Mexico (GOM). The acquisition configuration of long-offset, powerful source, and deep-tow of both source and receivers was designed to optimize the imaging of crustal architecture. The source was found to be at least 40% more powerful in the 3-40 Hertz range than prior seismic surveys in the GOM. A 15 km. single contiguous solid streamer, the first known commercial application of such an ultra-long streamer, improved velocity estimation to 15 km.

As a result of these parameters, the crustal architecture of the GOM basin has been illuminated to a depth of 40 km. Based on these seismic data, the base of the post-rift, sag, and syn-rift sequences, as well as the Moho, have been mapped around the basin. Geodynamic basin-modeling, including basin-wide 3D gravity inversion and targeted 2D flexural backstripping, has been used to test, corroborate and quantify the kinematic and subsidence implications of the seismic interpretations, further constraining and quantifying the timing and spatial distribution of crustal thinning.

The area of investigation extends from low-extension through highly-attenuated continental crust onto oceanic crust. The ocean-to-continent transition zone exhibits along-strike (~2000 km) variations from anomalously thin, possibly magma-poor crust in the northwestern GOM, to an area of thicker oceanic crust and volcanic seaward-dipping-reflectors (SDRs) in the east. The original depositional extent, thickness, and basinward allochthonous translation of the Middle Jurassic salt can be related to these along-strike changes in continental breakup.

Within the area of probable oceanic crust, mid-ocean spreading valleys and transform faults have been mapped on both the seismic and the gravity data. The orientation of these crustal elements suggests that the separation phase of the basin occurred with a north-northeast to northeast orientation. West to east variations in apparent width and thickness of the oceanic crust suggest that seafloor-spreading was initiated in the western GOM and propagated eastwards towards the pole of rotation. Inferred spreading rates, from analogs with present day global spreading axes, suggest seafloor-spreading occurred within the Late Jurassic.