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Inferred fracture patterns within overlapping normal fault zones from shallow, high-resolution gravity, seismic, and laser altimetry (LiDAR) data sets: Neotectonics along northern Gulf Coast of Mexico, Louisiana, USA.

Holocene, normal fault reactivation of Tertiary growth faults at and south of ~30.5 degrees N, Louisiana, generates linear, arcuate and splayed surface fault traces with overlap zones hundreds of meters to 10 km wide. Within overlap zones detailed, surface and subsurface data provide snapshots of the different stages of fault deformation within soft sediments, and aid in developing kinematic models for fracture growth and orientation.

Based on high-resolution seismic data (80-300 Hz, 1.5 m CDP spacing) and gravity (+/- .01 mGal per measurement error) simple interpreted cross-sections highlight a (1) broad ~100-m-wide brecciated fault zone and (2) antithetic, reverse, secondary faulting. LiDAR DEM's (at least ~25 cm vertical accuracy) available from the Louisiana Oil Spill Coordinator's Office, show reorientation of Holocene meander belts with older regional stream directions changing from NW-SE to N-S directions over time in response to growth and breaching of structural ramps in overlap zones.

We infer that during normal fault growth, within overlap zone, both E-W as well as ~N-S striking fractures interact to produce 'chocolate-tablet' fracture sets which divert surface drainage and complicate subsurface fluid pathways. We recommend 3-D seismic data seismic anisotropy measurements for P and S waves to test confirm subsurface orientations.