

Potential Natural Gas Plays in Ductile Duplexes: An Example from a Recess in the Appalachian Thrust Belt in Georgia

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In a well-defined small-scale recess in the Appalachian thrust belt in northwestern Georgia, two distinct regional strike directions intersect at approximately 50°. Fault intersections and interference folds enable tracing of both structural strikes. Around the recess, tectonically thickened weak stratigraphic layers-- mainly shales of the Cambrian Conasauga Formation-- accommodated ductile deformation associated with the folding and faulting of the overlying Cambrian-Ordovician regional stiff layer. The exposed stiff-layer structures are analogous to those over the ductile duplexes documented along strike to the southwest in Alabama, and a ductile duplex is interpreted within the recess in Georgia.

The tectonic thickening of the weak-layer shales is evident in palinspastically restored cross sections, which demonstrate a nearly 100% increase in volume over the restored state cross sections. This surplus of shale volume is likely a result of some combination of pre-thrusting deposition of thick shale in a basement graben and movement of shale out of the planes of cross sections during deformation. The volume balance of the ductile duplex is critical for palinspastic reconstruction of the recess, and the understanding of the kinematic history and mechanics that formed this potential natural gas reservoir.