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New constraints on buried triassic basins and regional implications for subsurface CO_2 storage from the seisdata6 seismic profile across the south east georgia coastal plain

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Abstract

Reprocessing of the SeisData6 Coastal Plain profile was motivated by the need to provide enhanced subsurface imaging critical to site characterization studies for CO2 storage within the South Georgia Rift (SGR) basin. The objectives were to identify and interpret subsurface reflectors for evidence of the buried Triassic basin and its underlying characteristics. Our new interpretation, supported by analysis of well data, has helped substantiate the presence of a Triassic basin beneath the Coastal Plain sediments in South East Georgia. This basin is about 2.2 km deep and 170 km wide and appears to coincide with the subsurface convergence of the southwest and northeast extensions of the Riddleville and Dunbarton basins that are subsidiaries of the main SGR. It is characterized by distinctively higher seismic velocities relative to the overlying Coastal Plain sediments and manifests a series of sub-horizontal reflectors below the topmost reflector. We reinterpreted the topmost reflector to originate from a change in velocity and density between the Cretaceous Coastal Plain sediments and the underlying Triassic rocks. This does not always originate from the Pre-Cretaceous basalt contrary to previous interpretations. The interpreted absence of basalt from this study is consistent with Heffner et al. (2012) showing that basalt is not prevalent throughout the SGR basin. Absence of basalt implies that erosion, uplift and possibly fault reactivation may have limited the regional extent of basaltic flows extruded during post-rifting and by extension the Eastern North America's magmatism. Structurally, the basin defines an asymmetric half-graben possibly bounded by normal faults. Our data show no clear evidence for the Augusta fault that was identified in other studies in the vicinity of the Piedmont - Coastal Plain boundary in Georgia and South Carolina.