Imaging igneous plutons and faults associated with continental collision and rifting using potential field, seismic, and well data, South Georgia rift basin and vicinity, South Carolina

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Potential field data, with its excellent spatial coverage, used in collaboration with seismic imaging, can help to illuminate basement and upper- to mid-crustal structures, especially igneous rock bodies associated with the Alleghanian orogeny and features attributed to subsequent continental rifting. The nature of the metamorphic and igneous basement rocks underlying coastal-plain sediments along the southern portion of the Eastern North American (ENAM) passive margin, including depth to basement and basement geology, is poorly constrained. These rocks record the large scale geologic processes responsible for the evolution of continental lithosphere in ENAM spanning a Wilson cycle, including continental assembly, mountain building, continental rifting, and post-rift passive margin evolution. In order to better characterize these rocks, maps and two-dimensional cross-section models of the basement beneath the South Carolina Coastal Plain are being developed through forward and inverse modeling of the aeromagnetic and gravity fields, and constrained by deep-well and seismic data, through collaboration involving the University of South Carolina (USC), the South Carolina Geological Survey (SCGS), and the U.S. Geological Survey (USGS). Exploratory data analysis and a quality assessment have been performed on gridded aeromagnetic data (USGS) and land gravity data (SCGS). In addition, a database of rock properties, including densities and magnetic susceptibilities, is being compiled from publications and ongoing lab analyses. Prior to inversion of the non-unique potential field data, forward two-dimensional density/magnetic models are being developed with deep-well, seismic reflection and refraction data control, to better constrain inverse models.

The initial crustal profile (Fig. 1) crosses the Dunbarton basin and Savannah River National Laboratory, where the interpretation is constrained by a database of 21 wells to basement, 19 two-dimensional seismic reflection lines, and a seismic refraction survey. The profile location is ideal for the investigation of major regional tectonic and geologic elements, including major Paleozoic faults, Triassic rift basins, granitic intrusions, and mafic dikes and plutons. Because of the high densities and magnetic susceptibilities of the mafic rocks, the potential field imaging should be particularly useful for the estimation of rock volumes, areal extent, and depth of the mafic plutons associated with continental rifting and the Central Atlantic Magmatic Province (CAMP). The coastal-plain basement maps and profiles will also assist assessment of the potential for CO_2 sequestration and geothermal power generation in and near the South Georgia and Dunbarton rift basins.

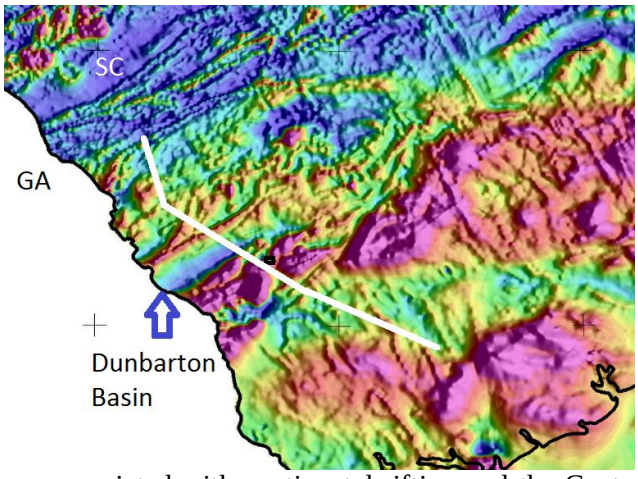

Figure 1. Location of Basement Mapping Profile 1 on Aeromagnetic map of South Carolina