

Patrick Duff is a geoscientist with broad experience in geology and applied geophysics, including structural geology, sedimentology and stratigraphy, seismology, near surface geophysics, remote sensing, and geodesy. He has spent nine years working on diverse projects in subsurface characterization and geoscience education, such as vibrocore sediment sampling and core logging for geotechnical and environmental characterization; 3D modeling of modern sedimentary deposits using seismic, ground penetrating radar, core, and drone photogrammetry for change detection and fluid flow prediction; mapping and modeling basement structure from land and airborne potential fields data, surface geology, and multi-physics for seismic hazard assessment, geothermal, and mining exploration; and continuing education instruction in modern fluvial to shallow marine depositional systems.

EDUCATION

Ph.D., Department of Geology, University of South Carolina (USC), Columbia (December 2018). Dissertation Title: The evolution of basement along the southeastern North American margin from integrated analyses and modeling of potential field data – continent-continent collision and rifting

B.S., Department of Geology, Geophysics and Economics, USC, Columbia (2011)

EMPLOYMENT HISTORY

Research Planning, Inc.: July 2018 – present

Athena Technologies, Inc. (Summer 2009 – Present)

University of South Carolina Geophysical Exploration Lab (Summer 2009 – Present)

AREAS OF EXPERTISE

Developing integrated methods for imaging and modeling basement structure and composition by integrating potential fields, seismic, borehole, and surface geologic data. Methods are applied to better constrain the evolution of the North American and conjugate West African rifted margins: identifying inherited basement structures, structural domains within the ocean-continent transition, and magmatic additions to the crust; delineating basin geometry, subsidence history, and thermal structure; and assisting assessment of potential for economic resource preservation, CO₂ sequestration, and geothermal power generation.

Studying the structure and stratigraphy of modern fluvial to shallow marine deposits using seismic, GPR, core, and UAS drone photogrammetry. Reservoir analogue projects test conceptual depositional models and supply deterministic inputs to stochastic reservoir models. Results also guide correlability models for well to well correlation, and help de-risk exploration targets by predicting reservoir thickness changes, connectivity, heterogeneity, net/gross, and facies distribution by linking sub-seismic scale depositional features and stratigraphic architecture to seismic scale geometry and geomorphology resolved in amplitude space or from seismic attributes.

PROFESSIONAL EXPERIENCE

RPI, 2018- present, U.S. Pipeline Hazardous Materials Safety Administration, drinking water sensitivity assessment – establishing aquifer boundaries and hydrogeologic framework by assimilating public domain surface geology and well data

Athena Technologies, 2012-present, assistant instructor, AAPG/Nautilus Modern Terrigenous Clastic Depositional Systems and Reservoir Analogues – communicating geologic concepts and depositional system elements in a field-based short course

Oceana Gold, 2017-2018, Haile Exploration Program – integrating potential field, surface geology, core, and rock properties to produce maps and models of units prospective for mineralization

Earth Science Resource Institute, University of South Carolina, 2017-2018, Integrated Methods for Change Detection and Environmental Monitoring – developing a method for change detection and monitoring of riparian and coastal environments for human impact and flood risk using drone remote sensing and near surface geophysics

SC Department of Natural Resources, SC Geological Survey, 2016-2017, Earthen Dam Assessment and Monitoring Program – developing and validating a method for monitoring the integrity of earthen dams using ground penetrating radar

SC Department of Natural Resources, SC Geological Survey, 2015-2016, Low-Temperature Geothermal Resource Assessment – identifying and characterizing low-temperature geothermal targets using surface geology and potential fields

Athena Technologies, 2009-2014, Research Associate – participated in more than 20 vibrocore sediment sampling projects for subsurface characterization in support of pre-dredge, beach renourishment, marine construction, and coastal and wetland environmental restoration

SELECTED PUBLICATIONS

Duff, P. D., and Kellogg, J. N., (submitted, *Geology*), Tectonophysics of the Brunswick Magnetic Anomaly: The Geophysical Signature and a Geologic Source for the BMA.

Duff, P. D. (in preparation), Understanding Clastic Channel Belt Reservoirs and Fluid Flow from Modern Analogues Resolved by GPR, Seismic, Vibrocore, and UAS Drone Imagery.

Duff, P. D., and Kellogg, J. N., 2017, Reinterpretation of ADCOH and COCORP seismic reflection data with constraints from detailed forward modeling of potential field data - implications for Laurentia-Peri-Gondwana suture, *Tectonophysics*, Vol. 712-713, p. 426-437.

Clendenin Jr., C. W., and Duff, P.D., 2015, Superimposed oblique extension on the South Georgia Rift, *South Carolina Geology*, Vol. 49, p. 25-36.

CONFERENCE ABSTRACTS

Duff, P. D., and Kellogg, J. N., 2018, The nature and distribution of CAMP magmatism along the southeastern North American margin from integrated analyses of potential field data, *Geological Society of America Abstracts with Programs*, Vol. 31, No. 5.

- Duff, P. D., and Kellogg, J. N., 2017, Reinterpretation of ADCOH and COCORP seismic reflection data with constraints from detailed forward modeling of potential field data - implications for Laurentia-Peri-Gondwana suture, Fall Meeting, American Geophysical Union (AGU).
- Duff, P. D., 2017, Toward a higher resolution understanding of fluvial to shallow marine clastic reservoir analogues as resolved by GPR, Annual Conference and Exhibition, American Association of Petroleum Geologists (AAPG).
- Duff, P. D., 2016, The sedimentary structure of a coarse grained point bar as resolved by GPR, Congaree River Valley, SC, Annual Conference and Exhibition, American Association of Petroleum Geologists (AAPG).
- Duff, P. D., J. Kellogg, 2015, Reinterpretation of ADCOH AND COCORP Seismic Reflection Data with Constraints from Detailed Forward Modelling of Potential Field Data— Implications for Laurentia-Peri-Gondwana Suture, Geological Society of America *Abstracts with Programs*, Vol. 47, No. 2, p. 83.
- Duff, P., J. Kellogg, S. Howard, J.W. Horton, 2014, Imaging granites, igneous plutons and faults associated with continental collision and rifting using potential field, seismic, and well data, South Georgia rift basin and vicinity, Georgia, Geological Society of America *Abstracts with Programs*, Vol. 46, No. 3.
- Duff, P. D., J. N. Kellogg, S. Howard, and J. W. Horton Jr., 2013, 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, *Abstracts, EarthScope National Meeting*, Raleigh, May 13-15.
- Duff, P., J. Kellogg, S. Howard, J.W. Horton, 2013, South Carolina Basement Mapping Project: Implications for Geothermal Prospectivity, *NGDC Geothermal Resources Workshop*, Charlottesville, VA, August 6-8.
- Duff, P.D., 2013, The sedimentary structure of a coarse graded point bar as resolved by GPR, Congaree River Valley, SC, *Abstracts, AAPG-SEG Student Expo*, Houston, September 13-15.

CERTIFICATES

- 3D Seismic Attributes to Define Structure and Stratigraphy 2018
- GSH Azimuthal P-P, Imaging, Fractures, Stress Analysis 2017
- EAGE Geomechanical Modeling using 3D/4D Seismic 2017

AFFILIATIONS

- SEG, AAPG, AGU, GSA, SSA, Global H2O, Association of Women Geoscientists

SKILLS

- Computer Skills: Geosoft Oasis Montaj, Petrel, PetroMod, Midland Valley MOVE, SeisSpace, Echoes, ArcGIS, MatLab (1000 hours), Python, Unix, SQL, Adobe Graphics Suite
- Language Skills: Spanish (intermediate), French (intermediate), Portuguese (beginner)