

BRAD T. CARTER, Ph.D.

SUMMARY

Applied Quantitative Structural Geologist with extensive experience conducting structural mapping, interpretation, analysis, and modeling in complex structural settings around the world. Also has experience in teaching courses in structural geology, hydrogeology, and regional geology and developing and mentoring student research projects. Expert-level skills in (1) interpreting and integrating seismic, gravity/magnetic, well, core, and surface geologic data to construct basin- to reservoir-scale 3D structural framework models; (2) conducting and integrating structural, petrological, and thermochronological studies to decipher the depth-temperature-time deformation histories of geologic structures in orogenic systems and sedimentary basins; and (3) fault seal and resolved stress analysis for predicting the impact of faults on subsurface fluid flow.

CORE TECHNICAL COMPETENCIES

Seismic Interpretation • 3D Structural Framework Model Building • Kinematic Modeling • Strain Modeling • Fault Seal Analysis • Mechanical Stratigraphy • Geomechanics • Resolved Stress Analysis • Thermal Modeling • Python Programming

EXPERIENCE

REPSOL OIL AND GAS Houston, Texas

Senior Structural Geologist 2018-2024

Basins worked: Gulf of Mexico (Mexico and US), sub-Andean basins (Colombia; Peru), Southern Caribbean (Colombia), North Sea (United Kingdom), and Appalachian Basin

- Constructed viable (physically possible) and admissible (geologically reasonable) 3D structural framework models via interpretation and integration of seismic, well, core, and where applicable, surface geological map data. These robust 3D structural frameworks were used to define the structural geometry of the subsurface and provided the foundational geometric boundary conditions for gross rock volume calculations, structural trap risk assessment, fault seal and resolved stress analysis, and kinematic, seismic velocity, and reservoir modeling.
- Conducted kinematic forward-modeling and restoration of geologic structures to ensure interpretations of the structural geometry were physically possible and geologically reasonable and to decipher how the growth of geologic structures impacted sediment routing systems through time. Results of the latter work aided in the prediction of reservoir distribution.
- Conducted fault seal and resolved stress analysis to reduce risk uncertainty of faulted structural traps, identify possible reservoir structural compartments, and characterize how faults may impact subsurface fluid flow.
- Risked, assessed, and matured prospects via integrated subsurface geologic characterization to evaluate and prioritize prospects. Used RoseRA for prospect assessments.
- Led the structural geology component of an integrated structure-stratigraphy field course in Southern California to discuss stratigraphic architecture, reservoir-scale structures (faults, fractures, and deformation bands), mechanical stratigraphy, and structural vs. stratigraphic reservoir compartmentalization in deepwater turbidites.
- Defined company guidelines and workflows for quality control of structural interpretations and constructing robust 3D structural frameworks for reservoir characterization and modeling.
- Conducted research on kinematic and geomechanical modeling of geologic structures to evaluate their feasibility for modeling the magnitude and spatial distribution of strain within geologic structures and their potential for using model results for subseismic resolution fault and fracture prediction.
- Published three papers and one meeting abstract on the structural geometry and kinematic evolution of geologic structures in the Peruvian Andes, Colombian Andes, and the Lake Superior Region of northern Michigan (see list of publications below).

BRAD T. CARTER CONSULTING Houston, Texas

Petroleum Exploration Consultant 2017-2018

Basins worked: Anadarko, Arkoma-Ouachita, and Appalachian basins

- Constructed GIS-based play element maps for the Arkoma / Ouachita and Appalachian basins, using public-domain datasets. Used these maps to evaluate prospectivity and delineate prospective acreage in both basins.
- Deciphered trap geometry via seismic interpretation for a prospect in the Anadarko basin, which reduced trap risk and allowed for more geologically-constrained directional well plans.

CGX ENERGY

Houston, Texas

Geologic Advisor 2016-2017

Basins worked: Guyana-Suriname basin

- Created depth-structure maps for regional tectonostratigraphic horizons in the Guyana-Suriname basin via the interpretation and integration of seismic and well data. These maps were used to define the regional structural and stratigraphic framework of the basin and aid in de-risking source rock, reservoir, trap, and seal presence within the basin.
- Constructed regional-scale cross-sections across the Guyana-Suriname basin and used these sections as the foundational geometric boundary conditions for gravity / magnetic and basin modeling to decipher thickness and composition of the crust that underlies the basin and constrain thermal history of the basin, respectively.

FRONTERA ENERGY (formerly Pacific Rubiales)

Houston, Texas

Senior Structural Geologist2014-2016

Basins worked: Ucayali Basin (Eastern Peru) and Talara-Tumbes-Progreso Basin (Northwest Peru / Southwest Ecuador)

- Built robust 3D structural framework models for both basins via the interpretation and integration of seismic, well, gravity / magnetic, and surface geological map data.
- Constructed and restored regional-scale cross-sections in both basins to determine the kinematic evolution of structural traps and burial history of key stratigraphic intervals. Used as input for basin (thermal history) modeling.
- Results of this work led to acreage divestiture in the Ucayali Basin and identification of economically viable prospects in the Talara-Tumbes-Progreso Basin.

GUILFORD COLLEGE

Greensboro, North Carolina

Visiting Assistant Professor2013-2014

- Taught undergraduate courses in structural geology, hydrogeology, physical geology, and Appalachian regional geology.
- In the Appalachian regional geology and structural geology courses, developed and led field trips in the southern Appalachians to teach about the evolution of orogenic systems and sedimentary basins and field-based structural mapping and analysis.
- Mentored two undergraduate students that conducted a field-based geologic mapping and structural analysis project in the North Carolina Appalachians. This work provided new insights into the kinematic evolution of the Laurentia-Gondwana paleocontinental collision. Results were presented at the 2014 Geological Society of America-Southeastern Section Meeting.
- Conducted structural and petrologic studies in the Virginia Appalachians. This work led to new insights into the kinematic and thermal evolution of this region. Results presented at the 2014 Geological Society of America-Southeastern Section Meeting.
- Learned Python and MATLAB programming languages and used them to improve numerical modeling skills for quantitative structural, basin, and geodynamic analysis.

ExxonMobil Corporation

Houston, Texas

Petroleum Geologist2007-2013

Basins worked: Northern Zagros Fold Belt (Kurdistan Region of Iraq), Eastern Mediterranean Basin, Santos Basin (Brazil), Møre / Vøring Basin (Norway), and carbonate fault zone outcrop in Central Texas

- Constructed regional-scale structural, tectonostratigraphic, and thermal framework models for the Northern Zagros Fold Belt in Kurdistan. Used as the technical foundation for acquisition of lease blocks.
- At the block-scale in Kurdistan, due to limited data coverage, constructed 3D models of geologic structures via the serial 2D cross-section method, using surface geological maps and offset well data. This constrained trap geometries for structural trap risk assessment, gross rock volume calculations, and well planning.
- Constructed regional-scale structural cross-sections across the Eastern Mediterranean Basin via integration and interpretation of seismic, well, and surface geological map data to define the regional structural framework. Results used as input for petroleum system analysis.
- Led research on the controls of mechanical stratigraphic stacking patterns on the style, intensity, and spatial distribution of fractures within a carbonate fault zone outcrop in Central Texas. This work was used to improve predictability of sub-seismic resolution faults and fractures in subsurface carbonate fault zones.
- Characterized and analyzed faults and fractures observed in core from carbonate reservoirs within the Santos Basin (Brazil) and assessed their impact on fluid flow.
- Deciphered the structural, tectonostratigraphic, and thermal evolution of the Møre / Vøring Basin (Norway) via construction of GIS-based structural domain, paleogeographic, and heat flow maps through geologic time. Led to the delineation of prospective areas within the basin and the acquisition of a lease block.

EDUCATION

NORTH CAROLINA STATE UNIVERSITY, Raleigh, North Carolina

Doctor of Philosophy (Ph.D.), Geology

AUBURN UNIVERSITY, Auburn, Alabama

Master of Science (M.S.), Geology

RADFORD UNIVERSITY, Radford, Virginia

Bachelor of Science (B.S.), Geology

GRADUATE RESEARCH

NORTH CAROLINA STATE UNIVERSITY, Raleigh, North Carolina

PhD Dissertation: *Geological Investigations in Smith River Allochthon and Lynchburg Group, Southern Appalachians: Implications for evolution of eastern Laurentian margin*

- Deciphered kinematic and thermal evolution of metamorphic rocks in hinterland of South-Central Virginia Appalachians via integration of geological mapping, structural and petrographic analysis, metamorphic phase equilibria modeling and geothermobarometry, and $^{40}\text{Ar} / ^{39}\text{Ar}$ white mica and U-Pb detrital zircon geochronology
- This work provided new insights into depth-temperature-deformation-time history and paleo-continent affinity of two enigmatic tectonic terranes in southern Appalachians and overall geodynamic evolution of Appalachian orogenic system.

AUBURN UNIVERSITY, Auburn, Alabama

Master's Thesis: *Geological Investigations in Steigen-Engeløya, North-Central Norway, and Their Significance for Tectonic Evolution*

- Deciphered kinematic and thermal evolution of metamorphic rocks exposed in Steigen-Engeløya area of North-Central Norwegian Caledonides via integration of geological mapping, structural and petrographic analysis, metamorphic geothermobarometry, and $^{40}\text{Ar} / ^{39}\text{Ar}$ white mica and potassium feldspar geochronology
- This work provided new insights into tectonic evolution of North-Central Norwegian Caledonides from initial contractional deformation and metamorphism through post-orogenic extension and exhumation.

PUBLICATIONS & MEETING PRESENTATIONS

Published Papers

- DeGraff, J.M., and **Carter, B.T.**, 2023, Detached Structural Model of the Keweenaw Fault System, Lake Superior Region, Michigan, U.S.A: Implications for its Relationship to the Midcontinent Rift System, *Geological Society of America Bulletin*, 135, 449-466
- Carter, B.T.**, and Zamora, G.V., 2022, Chapter 23: The Sagari-Kinteroni Anticline: An Example of an Out-of-Sequence Tectonic Wedge in the Camisea Area, Peru, in Zamora, G.V., and Mora, A., eds., *Andean Structural Styles: A Seismic Atlas*, p. 299-312, Elsevier.
- Zamora, G.V., and **Carter, B.T.**, 2022, Chapter 21: Large Transport Thrust in the Huallaga Basin (Northern Peruvian Sub-Andean Zone), in Zamora, G.V., and Mora, A., eds., *Andean Structural Styles: A Seismic Atlas*, p. 275-284, Elsevier
- Steltenpohl, M.G., **Carter, B.T.**, Andresen, A., and Zeltner, D., 2009, $^{40}\text{Ar} / ^{39}\text{Ar}$ thermochronology of late- and post-orogenic extension in the Caledonides of north-central Norway, *Journal of Geology*, 117, 399-414
- Carter, B.T.**, Hibbard, J.P., Tubrett, M., and Sylvester, P., 2006, Detrital zircon geochronology of the Smith River Allochthon and Lynchburg Group, southern Appalachians: Implications for Neoproterozoic-Early Cambrian paleogeography, in McCausland, P., Murphy, B., and MacNiocaill, C, eds., *Endings and Beginnings: Paleogeography of the Neoproterozoic-Cambrian Transitions*, *Precambrian Research*, 147, 279-304
- Hibbard, J.P., Miller, B.V., Tracy, R.J., and **Carter, B.T.**, 2005, The Appalachian peri-Gondwanan realm: A paleogeographic perspective from the south, in Vaughan, A.P.M., Leat, P.T., and Pankhurst, R.J., eds., *Terrane Processes at the Margins of Gondwana*, *Geological Society of London, Special Publication*, 246, 97-111

Professional Meeting Presentations

- Carter, B.T.**, Machado, O., Varela, C., Franques, J., Carballo, J., and Rojette, M., 2019, Kinematic Evolution of the Humadea Anticline, Llanos Foreland Basin, Colombia, American Association of Petroleum Geologists (AAPG) International Meeting – Buenos Aires, Argentina
- DeGraff, J.M., **Carter, B.T.**, and Tyrell, C.W., 2018, Keweenaw Fault Geometry and Kinematics North of Portage Lake, Michigan, *Geological Society of America-Annual Meeting*, 50, 6, ISSN 0016-759

- Carter, B.T.**, Hames, W.E., and Miller, B.V., 2014, Pressure-Temperature-Time Paths for the Smith River Allochthon and Lynchburg Group, Virginia Appalachians: Implications for Late Ordovician Retroarc Underthrusting, Geological Society of America-Southeastern Section, Abstracts with Programs, 46, 3, 85
- Pastrana, C.R.*, Eller, G.A.*, and **Carter, B.T.**, 2014, Preliminary results of geologic mapping in the Greensboro, NC area, Geological Society of America-Southeastern Section, Abstracts with Programs, 46, 3 **students conducting undergraduate research*
- Steltenpohl, M.G., Andresen, A., Prouty, J., **Carter, B.T.**, Buchanan, J.W., and Augland, L.E., 2013, Late- and post-Caledonian tectonic exhumation of middle- and lower-crustal rocks exposed in the region between Bodo and the Lofoten Islands, Norway (Latitudes 67.5-69° N), European Geosciences Union General Assembly 2013, Vol. 15, EGU 2013-6328-1
- Carter, B.T.**, Hames, W.E., and Stoddard, E.F., 2012, Metamorphic and $^{40}\text{Ar} / ^{39}\text{Ar}$ muscovite thermochronology studies in the Smith River Allochthon and Lynchburg Group, southern Appalachians: Implications for Paleozoic evolution of the eastern Laurentian margin, Geological Society of America -Southeastern Section, Abstracts with Programs, 44, 4, 74
- Carter, B.T.**, Loehn, C.W., and Box, G.H., 2006, The Smith River Allochthon-Lynchburg Group contact, revisited: Does it represent closure of the Iapetus Ocean or a Laurentian rift-basin?, Geological Society of America-Southeastern Section, Abstracts with Programs, 38, 3, 63
- Carter, B.T.**, Hibbard, J.P., Tracy, R.J., and Henika, W.S., 2004, Preliminary reassessment of the tectonothermal evolution of the Smith River Allochthon, VA: Implications for terrane affinity, Geological Society of America-Southeastern Section, Abstracts with Programs, 36, 2, 105
- Hibbard, J.P., Miller, B.V., Tracy, R.J., and **Carter, B.T.**, 2004, The Appalachian peri-Gondwanan realm; a paleogeographic perspective from the south, Geological Society of America -Northeastern / Southeastern Section Joint Meeting, Abstracts with Programs, 36, 2, 104
- Carter, B.T.**, Steltenpohl, M.G., and Andresen, A., 2001, Digital geological maps using Micrografix Designer 4.0: An example from Steigen-Engeloya, north-central Norway, Geological Society of America-Southeastern Section, Abstracts with Programs, 33, 2, 23
- Carter, B.T.**, Steltenpohl, M.G., and Andresen, A., 2001, Late-orogenic extension in the southernmost Appalachians compared with the northern Caledonides: A kinematic pattern of collapse?, Geological Society of America-Southeastern Section, Abstracts with Programs, 33, 2, 20
- Carter, B.T.**, Steltenpohl, M.G., Andresen, A., and Kunk, M.J., 2000, $^{40}\text{Ar}/^{39}\text{Ar}$ and structural investigations of Engeloya, north-central Norway, from Precambrian basement to modern margin development, Geological Society of America-Southeastern Section, Abstracts with Programs, 32, 2, 9-10
- Carter, B.T.**, Dunston, J.F., Robitaille, K.R., and Steltenpohl, M.G., 1999, Geologic mapping of the Parker's Crossroads quadrangle, eastcentral Alabama: Implications for Laurentian margin evolution, Geological Society of America -Southeastern Section, Abstracts with Programs, 31, 3, 9
- Steltenpohl, M.G., **Carter, B.T.**, Dunston, J.F., Hall, T., and Robitaille, K., 1999, An update on geologic mapping in the east-central Alabama Piedmont: Implications for Laurentian margin evolution, Geological Society of America-Southeastern Section, Abstracts with Programs, 31, 3, 69
- Coates, B.H., Zeltner, D.L., **Carter, B.T.**, Steltenpohl, M.G., Andresen, A., and Kunk, M.J., 1999, $^{40}\text{Ar} / ^{39}\text{Ar}$ and structural investigations of extensional development of the north-central Norwegian margin, Geological Society of America-Annual Meeting, Abstracts with Programs, 31, 7, 118
- Knight, K.L., *Whitehead, W., and ***Carter, B.T.**, 1999, Fourier shape-analysis of quartz and shale grains along a four mile stretch of Little Stoney Creek, Giles County, Virginia, Geological Society of America-Southeastern Section, Abstracts with Programs, 31, 3, 26 **Undergraduate research project*