

Richard Styron, PhD, LG

Field and Computational Geoscience

Contact

21855 Bear Creek Road
Los Gatos, CA 95077
(785) 393-6416
richard.h.styron@gmail.com

Current Position

Active Fault Scientist
Global Earthquake Model Foundation
Pavia, Italy / Los Gatos, CA

Principal
Earth Analysis
Los Gatos, CA

Primary Research Interests:

- Active tectonics, earthquake processes and seismic hazard
- Scientific computing
- Innovation in quantitative geoscience

Education

University of Kansas, PhD, Geology, 2012
Thesis: Estimating fault slip rates in the Indo-Asian Collision Zone over 10-10⁶ yr timescales
Primary advisor: Michael Taylor

University of Arkansas, MS, Geology, 2008
Thesis: Kinematics of the western margin of Nicaragua from GPS geodesy
Primary advisor: Glen Mattioli

University of Arkansas, BS, Geology, 2005

Certifications

Licensed geologist in Washington State (License #3190)

Experience:

Roles:

- 2016-present: Active Fault Specialist, *Global Earthquake Model Foundation*. Primary task is the construction of the GEM Global Active Faults Database, the first public, comprehensive global dataset of active fault traces and associated attributes (geometry, kinematics, slip rate, etc.). Ancillary duties involve improving methods for Probabilistic Seismic Hazard and Risk analysis.
- 2016-present: Adjunct Researcher, University of Kansas
- 2014-present: Principal, *Earth Analysis*. Geophysical consulting, academic and governmental scientific collaboration.
- 2013-2014: Post-doctoral scholar, *University of Michigan, Ann Arbor*. Developed coupled physical and statistical computational model for topographic and tectonic stress calculations, with Eric Hetland.
- 2012-2014: Consultant, *Instituto Colombiano del Petroleo*. Worked with the ICP on thermal and kinematic modeling of the development of the Colombian Andes. Performed modeling, geologic cross-section construction, and software development (including HPC cluster and cloud software).
- 2008-2012: Patterson Fellow, Teaching Assistant, *University of Kansas*. PhD research into active faulting and fault evolution in south Tibet and the Himalaya, additional research on northern Andes faults, taught variety of geology field and lab courses.
- 2006-2008: Research Assistant, Teaching Assistant, *University of Arkansas, Fayetteville*. MS research in GPS tectonic geodesy in Nicaragua, and ancillary research in Caribbean volcano deformation, taught upper and lower-level geology lab courses.

Leadership, Logistics and Service:

- Extensive research collaboration with academics (professors, graduate and undergraduate students, laboratories), nonprofits, government researchers, and energy companies.
- 8 semesters (classroom) and 3 summers (field) teaching experience. Courses taught include Intro Geology, Petrology, Structure, Environmental Geology, Natural Hazards, Earth History, Field Camp, Advanced Field Methods
- Lead or co-lead 8 international field campaigns (Nicaragua, Dominica, Tibet, Mexico, Peru), several domestic field trips; whitewater raft, kayak and mountain bike guide.
- Organized and judged student research symposia, all officer roles in student geology clubs, founded undergraduate mentor program (grad students mentoring undergrads).
- Peer reviewer for *Geophysical Research Letters*, *G-Cubed*, *Tectonics*, *Journal of Geophysical Research*
- Creator/maintainer of active fault databases in Caribbean and Central America, North Africa, Northeastern Asia, Tibet/Himalaya and the Andes; also the GEM Global Active Fault Database

Consulting:

- Modeling (and model software construction) of thermochronologic and structural geologic cross sections in the Colombian Andes
- Analysis of the effects of topographic stresses on the 2015 Gorkha, Nepal earthquake
- Analysis of the stresses produced by magma chamber inflation, topography and tectonics at the Newberry, Oregon enhanced geothermal site
- Statistical characterization of paleo-earthquake magnitudes and recurrence intervals in the Puget Lowland, WA

Fieldwork:

- 5x GPS geodetic field campaigns in Nicaragua and Dominica, 2x tectonic (mapping, thermochronology, cosmogenic nuclide) field campaigns in Tibet, 2x mapping projects on/near Garlock fault (CA), stratigraphic section measuring in Peruvian Andes, LiDAR survey in Sierra El Mayor/ Cucapah (Mexico), 3x Teaching Assistant, KU Geology Field Camp, CO

Computational work:

- Wrote programs for calculating crustal and fault stresses, Monte Carlo simulations of earthquake rupture histories, cosmogenic nuclide depth profilers, statistical (Bayesian) and ‘cloud computing’ wrappers for thermochronology models, and many others
- Significant use of pre-existing modeling software for thermochronology and cosmogenic nuclide dating, GIS
- Familiarity with web development, and progressing on making scientific web applications for data visualization, statistical analysis, and mapping

Laboratory work

- Geochronology: Zircon and apatite (U-Th)/He mineral separation, picking, noble gas and ICP mass-spectrometry, ¹⁰Be and ³6Cl TCN sample preparation and isolation
- Dendrochronology: Tree-ring specimen preparation, ring width measurements, chronology development

Computing Skills and Interests

Programming Languages:

- Extensive use of Python (daily use for years), proficient with Matlab
- Some experience with C++, Mathematica, Lisp (Racket), R, SQL, JavaScript, Julia

Software:

- Very comfortable with Linux, OS X, Windows
- Amazon AWS, GMT, ArcGIS, QGIS, Envi
- Adobe Creative Suite, MS Office Suite, LaTeX
- Many geoscientific finite element modeling codes

Computing interests:

- Scientific Computing: Physical and statistical (esp. Bayesian) modeling, open-source scientific tools and application development
- Web development, learning new programming languages and frameworks

Scientific Output

15 peer-reviewed papers (~3/year), 5 in revision or review, 384 citations as of September 2019

Google Scholar profile: <https://scholar.google.com/citations?user=4XzNPZ4AAAAJ>

Publications:

1. Henremagne C. Peñarubia, Johnson, Kendra L., **Styron, R.**, Bacolcol, T. C., Sevilla, W. I. G., Perez, J. S., et al., 2019, Probabilistic Seismic Hazard Analysis model for the Philippines, *Earthquake Spectra*, in press.
2. **Styron, R.**, 2019, The impact of earthquake cycle variability on neotectonic and paleoseismic slip rate estimates, *Solid Earth*, vol. 10, p.15-25, doi: 10.5194/se-2019-10.

3. Sundell, K., Saylor, J., Lapen, T., **Styron, R.**, Villareal, D., Usnayo, P., and Cárdenas, J., 2018, Peruvian Altiplano stratigraphy highlights along-strike variability in foreland basin evolution of the Cenozoic central Andes, *Tectonics*, vol. 37, no. 6, p. 1876-1904, doi: 10.1029/2017TC004775.
4. Staisch, L., Blakely, R., Kelsey, H., **Styron, R.**, and Sherrod, B., 2018, Miocene to present-day deformation rates in central Washington, USA, Revealed by stream profiles, potential-field geophysics, and structural geology of the Yakima folds, *Tectonics*, vol. 37, no. 6, p. 1750-1770, doi: 10.1029/2017TC004916.
5. Staisch, L., Kelsey, K., Sherrod, B., Möller, A., Paces, J., and **Styron, R.**, 2017, Miocene-Pleistocene deformation of the Saddle Mountains: implications for seismic hazard in central Washington, USA. *Geological Society of America Bulletin*, vol. 130, no. 3-4, p. 411-437, doi:10.1130/B31783.1.
6. Evans, S. L., **Styron, R. H.**, Soest, M. C., Hodges, K. V., and Hanson, A. D., 2015, Zircon and apatite (U-Th)/He evidence for Paleogene and Neogene extension in the Southern Snake Range, Nevada, USA. *Tectonics*, vol. 34, no. 10, 2142-2164. doi: 10.1002/2015TC003913.
7. **Styron, R.** and Hetland, E., 2015, The weight of the mountains: Constraints on tectonic stress, friction, and fluid pressure in the 2008 Wenchuan earthquake from estimates of topographic loading, *Journal of Geophysical Research: Solid Earth*, vol. 120, no. 4, 2697-2716. doi: 10.1002/2014JB011338.
8. **Styron, R.**, Taylor, M., and Sundell, K., 2015, Accelerated extension of the Tibetan plateau linked to the northward underthrusting of Indian crust, *Nature Geoscience*, vol. 8, no. 2, p. 131-134. doi: 10.1038/ngeo2336.
9. **Styron, R.** and Hetland, E., 2014, Estimated likelihood of observing a large earthquake on a continental low-angle normal fault and implications for low-angle normal fault activity, *Geophysical Research Letters*, vol. 41, no. 7, doi: 10.1002/2014GL059335.
10. McCallister, A., Taylor, M., Murphy, M., **Styron, R.**, Stockli, D., 2014, Thermochronologic constraints on the late Cenozoic exhumation history of the Gurla Mandhata metamorphic core complex, Southwestern Tibet, *Tectonics*, vol. 33, p. 27-52, doi: 10.1002/2013TC003302.
11. Sundell, K., Taylor, M., **Styron, R.**, Stockli, D., Kapp, P., Hager, C., Liu, D., Ding, L., 2013, Evidence for constriction and Pliocene acceleration of east-west extension in the North Lunggar rift region of west-central Tibet, *Tectonics*, vol. 32, no. 5, p. 1454-1479, doi: 10.1002/tect.20086.
12. **Styron, R.**, Taylor, M., Sundell, K., Stockli, D., Oalman, J., Möller, A., McCallister, A., Liu, D., Ding, L., 2013, Miocene initiation and acceleration of extension in the the South Lunggar rift, wester Tibet: Rates, timing and magnitude of deformation of an active detachment system, *Tectonics*, vol. 32, no. 4, p. 880-907, doi: 10.1002/tect.20053.
13. Veloza, G., **Styron, R.**, Taylor, M., Mora, A., 2012, Active Tectonics of the Andes: An open-source archive for active faults in northwestern South America, *GSA Today*, vol. 22, no. 10, p. 4-10, doi: 10.1130/GSAT-G156A.1.
14. **Styron, R.**, Taylor, M., Murphy, M., 2011, Oblique convergence, arc-parallel extension, and strike-slip faulting in the High Himalaya, *Geosphere*, vol. 7, no. 2, 587-596, doi: 10.1130/GES00606.1.
15. **Styron, R.**, Taylor, M., and Okoronkwo, K., 2010, *HimaTibetMap-1.0*: new 'web-2.0' online database of active structures from the Indo-Asian collision, *Eos*, vol. 91 no. 20. doi: 10.1029/2010EO200001.

Publications in revision

1. **Styron, R.**, García-Pelaez, J., and Pagani, M., CCAF-DB: The Caribbean and Central American Active Fault Database, *Natural Hazards and Earth System Science*, doi:10.5195/nhess-2019-46, in revision, 2019.
2. **Styron, R.** and Pagani, M. The GEM Global Active Faults Database (GAF-DB), *Earthquake Spectra*, accepted with minor revisions, 2019.

3. Pagani, Marco, García-Pelaez, Julio, Gee, Robin, Johnson, Kendra L., Silva, Vitor, Simionato, Michele, **Styron, R.**, et al., The 2018 version of the Global Earthquake Model: Hazard component, *Earthquake Spectra*, accepted with minor revisions, 2019.

Publications in review:

1. Poggi, V., Garcia-Peláez, J., **Styron, R.**, Pagani, M., and Gee, R., A Probabilistic Seismic Hazard Model for North Africa, *Bulletin of Earthquake Engineering*, in review, 2019.
2. Morell, K., Stirling, M., Griffin, J., Archuleta, R., **Styron, R.**, and Onur, T., Seismic Hazard analyses from geologic and geomorphic data: Current and future challenges, *Tectonics*, in review, 2019.
3. **Styron, R.** and Sherrod, B, Improving paleoseismic magnitude estimates with rupture length information: application to the Puget Lowland, WA USA, *Bulletin of the Seismological Society of America*, in review, 2019.

Ongoing projects

- Construction of the GEM Foundations's Global Active Faults database
- Seismic hazard modeling techniques, evaluations, and model development
- Statistical characterization of (paleo)seismicity: empirical, probabilistic descriptions of recurrence intervals, time-dependent earthquake forecasting, temporal clustering
- Quantification of topographic and tectonic stress fields, and their influence on earthquake ruptures and recurrence
- Creation of webapps for geoscientific visualization and analysis
- Active tectonics and strain partitioning in Himalaya and Tibet
- Tectonic and stratigraphic evolution of the Andes