Exponent®
Engineering & Scientific Consulting

Kirk Townsend, Ph.D.

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Professional Profile

Dr. Townsend is a geologist and geomorphologist with experience in near-surface geophysics, geochronology, and geomorphic and geologic site characterization through field mapping, digital topographic analyses, satellite photo analyses, and subsurface investigations. He specializes in the characterization of weak and fractured rock masses, mapping and quantifying erosion following wildland fire, and digital terrain analyses for erosion and slope stability problems.

Dr. Townsend also has experience with the application of remote sensing technologies and LiDAR, shallow seismic and electrical resistivity surveying for near-surface investigations, logging and characterizing stratigraphic sections, OSL geochronology and radiocarbon dating, and USDA soil taxonomy. He has experience with technical software including ArcGIS, CloudCompare, LASTools, SeisImager, MATLAB, and GeoStudio. He has also been involved in geologic and geotechnical field investigations of landslides, debris flows, soil creep, fault rupture, earthen dam failure, wetland restoration, mine remediation, and archeological resources.

Prior to joining Exponent, Dr. Townsend earned his Ph.D. from the University of Michigan. His doctoral work focused on the role of scale-dependent rock-mass strength in controlling the erosion and morphology of mountainous topography. Within this research area, Dr. Townsend mapped earthquake-triggered landslides from aerial and satellite imagery, modelled regional distributions of rock-mass strength from inversion of topography and mapped landslides, and applied field geotechnical approaches to characterize and quantify variability in the strength of fractured rock masses. Dr. Townsend also resolved the timing of initiation and propagation of tectonically active fault systems in southern California from thermochronology and structural geology analyses. As a doctoral student, he led a study assessing the influence of rock strength on the map distribution and volumes of eroded sediment following the 2018 Woolsey Fire in southern California using repeat airborne-LiDAR surveys and field mapping. For this project, he collaborated with geoscientists at the Landslides Hazards Program in the U.S. Geological Survey through an internship award from the National Science Foundation.

At the University of Michigan, Dr. Townsend served as a Graduate Student Research Assistant and was the Graduate Student Instructor for five graduate and undergraduate courses in Geographic Information Systems (GIS) and geologic field methods. At Utah State University, he served as a Graduate Teaching Assistant for laboratory courses in introductory geology and Optically Stimulated Luminescence (OSL) geochronology.

Academic Credentials & Professional Honors

Ph.D., Earth and Environmental Science, University of Michigan, 2021

M.S., Geology, Utah State University, 2015

B.S., Summa Cum Laude, Earth Sciences, California Polytechnic State University, San Luis Obispo, 2013

Honors, Scholarships, Awards

First Place Presentation, Michigan Geophysical Union Annual Meeting, 2019

Highest-Ranked Research Proposal, Department of Earth and Environmental Sciences, University of Michigan, 2019

Steward R. Wallace Fellowship Recipient, Department of Earth and Environmental Sciences, University of Michigan, 2016

Robert Q. Oaks, Jr. Graduate Citizenship Award Recipient, Department of Geosciences, Utah State University, 2015

Presidential Research Fellowship Recipient, Utah State University, 2013

Outstanding Earth Sciences Professional of the Year, Natural Resources Management and Environmental Science Department, California Polytechnic State University, 2013

Recipient of the Highest Earth Sciences GPA Award, Natural Resources Management and Environmental Science Department, California Polytechnic State University, 2013

Academic Appointments

Graduate Student Instructor and Research Assistant, Department of Earth and Environmental Sciences, University of Michigan, 2016-2021

Teaching and Research Assistant, Department of Geosciences, Utah State University, 2013-2015

Prior Experience

Research Intern, Landslide Hazards Program, U.S. Geological Survey, 2020-2021

Laboratory Technician, Luminescence Geochronology Laboratory, Utah State University, 2015-2016

Soil Science Intern, Sierra National Forest, U.S. Forest Service, 2012

Professional Affiliations

American Geophysical Union (AGU)

Geological Society of America (GSA)

Publications

Townsend, K.F., Clark, M.K., and Niemi, N.A, 2021, Reverse faulting within a continental plate boundary transform system: Tectonics, 40, e2021TC006916.

Pradel, D., Lobbestael, A., Brooks, C. N., Dobson, R., Marion, N., Oommen, T., Esser, A. J., Athanasopoulos-Zekkos, A., Zekkos, D., Clark, M., Townsend, K., Niemi, N., Midttun, N., Hille, M., 2021, The May 19, 2020, failure of Edenville Dam near Midland, Michigan, Geo-Extreme 2021: Case Histories and Best Practices, American Society of Civil Engineers Geotechnical Special Publications, v. 328, p. 266 – 274.

Pradel, D., A. Lobbestael, A. Athanasopoulos-Zekkos, C. Brooks, C. Champagne, M. Clark, R. Dobson, D. Edmonds, A. Esser, W. Gong, M. Hille, J. Manousakis, N. Marion, H. Martin, N. Midttun, N. Niemi, T. Oommen, K. Townsend, B. Yanites, D. Zekkos, 2021, Edenville and Sanford Dam Failures: Field Reconnaissance Report, American Society of Civil Engineers Geotechnical Special Publications, v. 327 , 164 pp.

Townsend, K.F., Clark, M.K., and Zekkos, D., 2021, Profiles of near-surface rock mass strength across gradients in burial, erosion, and time: Journal of Geophysical Research: Earth Surface, 126, e2020JF005694.

Townsend, K.F., Gallen, S.F., and Clark, M.K., 2020, Quantifying near-surface rock strength on a regional scale from hillslope stability models: Journal of Geophysical Research: Earth Surface, 125, e2020JF005665.

Townsend, K.F., Nelson, M.S., Rittenour, T.M., and Pederson, J.L., 2019, Anatomy and evolution of a dynamic arroyo system, Kanab Creek, southern Utah, USA: Geological Society of America Bulletin, v. 131, p. 2094-2109.

Stahl, T., Clark, M.K., Zekkos, D., Athanasopoulos-Zekkos, A., Willis, M., Medwedeff, W., Knoper, L., Townsend, K., and Jin, J., 2017, Earthquake science in resilient societies: Tectonics, v. 36, p. 749–753.

Presentations

Townsend, K.F., Rengers, F., Clark, M.K., and DeLong, S., The influence of rock-mass strength on post-wildfire erosion, Santa Monica Mountains, southern California, USA. Abstract EP22A-08, Fall Meeting, American Geophysical Union. Oral Presentation, New Orleans, LA, December, 2021

Townsend, K.F., The contribution of rock-mass strength to topographic form and post-wildfire erosion: Insights from the Western Transverse Ranges, southern California. Invited presentation, Landslides Hazards Program, U.S. Geological Survey, July 2021. https://www.usgs.gov/media/videos/contrib-rock-mass-strength-topographic-form-and-post-fire-eros

Townsend, K.F., and Clark, M.K. The scale-dependent and non-linear relationship between topographic metrics and rock strength. Abstract EP031-0011, Fall Meeting Online, American Geophysical Union, December, 2020

Niemi, N.A., Athanasopoulos-Zekkos, A., Champagne, C., Clark, M.K., Edmonds, D., Gong, W., Hille, M., Martin, H., Midttun, N., Townsend, K.F., Yanites, B.J., Zekkos, D. Impacts of human interventions in fluvial systems: observations from the Edenville Dam disaster in central Michigan. Geological Society of America Abstracts with Programs, Abstract 187-1, GSA 2020 Connects Online, October, 2020

Townsend, K.F. Interactions between rock strength, tectonics, and topography in the Western Transverse Ranges, southern California, USA. Invited presentation, Department of Earth Sciences, University of Southern California, September, 2020

Townsend, K.F., Clark, M.K., Niemi, N.A., Zekkos, D., Portenga, E., Hughes, A., and Rood, D. The co-dependency of erosion rate, rock strength, and topographic relief: a case study from the Western Transverse Ranges, southern California, USA. Abstract EP22A-08, Fall Meeting, American Geophysical Union. Oral Presentation, San Francisco, CA, December, 2019

Townsend, K.F., Clark, M.K., and Niemi, N.A. Short-term variability versus long-term consistency of inferred fault slip rates in the Western Transverse Ranges, Southern California. Abstract T42B-02, Fall Meeting, American Geophysical Union. Oral Presentation, Washington, D.C., December, 2018

Townsend, K.F., Gallen, S.F., and Clark, M.K. Evolution of rock strength and relief during incipient

mountain building. Poster Presentation, European Geosciences Union General Assembly. Vienna, Austria, April, 2018

Clark, M.K., Zekkos, D., Medwedeff, W., Townsend, K.F., and Gallen, S.F. Recent insights on the relationship between landscape form and landsliding during earthquakes. Geological Society of America Abstracts with Programs, Vol. 49, No. 6. Seattle, WA, October, 2017

Rittenour, T.M., Nelson, M.S., Riley, K., Townsend, K.F., Huff, W., and Hayden-Lesmeister, A., Arroyo cut-fill dynamics in southern Utah, chronology and causal linkages. American Quaternary Association 24th Biennial Meeting. Santa Fe, NM, September, 2016

Rittenour, T.M., Riley, K., Nelson, M.S., Townsend, K.F., Huff, W., and Hayden-Lesmeister, A. Arroyo cut-fill dynamics in southern Utah, chronology and causal linkages. Geological Society of America Abstracts with Programs, Vol. 48, No. 7. Denver, CO, July, 2016

Townsend, K.F., Nelson, M.S., Rittenour, T.M. and Pederson, J.L. A reconstruction of Holocene arroyo dynamics in Kanab Creek, southern Utah, using single-grain OSL dating. 11th New World Luminescence Dating Workshop. Oral Presentation, University of Nebraska, Lincoln, May, 2016

Townsend, K.F., Nelson, M.S., Rittenour, T.M., and Pederson, J.L. Fluvial architecture of episodic arroyo entrenchment and aggradation. Poster presentation, Spring Runoff Conference. Utah State University, Logan, UT, April, 2016

Townsend, K.F., and Rittenour, T.M. Processes of paleoarroyo aggradation in Kanab Creek, southern Utah. Abstract EP41A-0919, Fall Meeting, American Geophysical Union. Poster presentation, San Francisco, CA, December, 2015

Townsend, K.F., and Rittenour, T.M. Episodic arroyo entrenchment and aggradation in Kanab Creek, southern Utah: Geological Society of America Abstracts with Programs, v. 47, n. 7, p. 76. Oral presentation, Baltimore, MD, November, 2014

Townsend, K.F., and Rittenour, T.M. A chronostratigraphic record of arroyo incision and aggradation in Kanab Creek, southern Utah. Geological Society of America Abstracts with Programs, v. 46, n. 6, p. 799. Oral presentation, Vancouver, B.C., October, 2014

Research Grants

National Science Foundation, INTERN supplemental funding, 2020

Awards for Geochronology Student Research (AgeS2), research grant, 2019

National Center for Airborne Laser Mapping (NCALM), seed project for a post-wildfire airborne-LiDAR survey, 2019

University of Michigan, Rackham Graduate School, Research Grant, 2019, 2017

University of Michigan, Department of Earth and Environmental Sciences, Turner Research Grant, 2019, 2018, 2017

Evolving Earth Foundation, Research Award, 2018

University of Michigan, Rackham Graduate School, International Research Award, 2018

Geological Society of America, graduate research grant, 2018, 2014

Society for Sedimentary Geology, graduate research grant, 2014

Peer Reviews

Journal of Geophysical Research: Earth Surface