Noel Alexander Heim

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Scholarly Interests

Stratigraphic Paleobiology—identifying how the structure of the stratigraphic record affects the fossil record, including biases, environmental drivers, and feedbacks

Causes and consequences of extinction in modern and ancient oceans—long-term impacts of extinction on evolutionary rates, biodiversity, and ecosystem function

Evolutionary trends—quantifying and explaining evolutionary trends, including morphological complexity, ecological diversity, and body size, over the past 550 million years

Conservation paleobiology—application of paleontological approaches and data to study society-relevant issues with particular focus on conservation biology and ecosystem restoration efforts

Citizen science & conservation—coupling environmental sensor data with biological data from citizen scientists, e.g., iNaturalist, LiMPETS, to generate models of local and regional change

Education

2008	Ph.D., Geology, University of Georgia, Ph.D. in Geology Dissertation: *The spatial structure of biodiversity in the fossil record: contrasting global, continental and regional responses to climate change.* Advisor: Steven M. Holland
2003	M.S., Geological Sciences, University of California, Riverside Thesis: *Trilobites from the Tethyan Himalaya and the Cambrian biostratigraphy and biogeography of equatorial peri-Gondwanaland.* Advisor: Nigel C. Hughes
2000	B.S., Geophysical Sciences with Honors, University of Chicago Honors Thesis: *Rare earth element abundances in minerals in the vesicles and vugs of Ibitira and ordinary chondrites.* Advisor: Meenakshi Wadhwa

Professional Appointments

2019-present	Lecturer, Tufts University, Department of Earth and Ocean Sciences
2016-2019	Basic Life Science Research Scientist, Stanford University, Department of Geological Sciences
2012-2016	Basic Life Science Research Associate, Stanford University, Department of Geological Sciences
2012-2019	Director & Mentor, Stanford Earth Young Investigators: Biodiversity Program, Stanford University, Department of Geological Sciences
2011-2012	Assistant Scientist, University of Wisconsin-Madison, Department of Geoscience
2008-2011	Postdoctoral Research Associate, University of Wisconsin-Madison, Department of Geoscience

2005-2006	Adjunct Instructor, Georgia Perimeter College, Science Department (now Perimeter College at Georgia State University)
2001	Middle School Summer Camp Director, Maine School of Science and Mathematics
2000,2001,2003	Middle School Summer Camp Instructor, Maine School of Science and Mathematics
2001	High School Instructor, Maine School of Science and Mathematics
2001	Residential Assistant, Maine School of Science and Mathematics

Additional Training & Professional Development

2017	Cornell University, Civic Ecology Lab, Environmental Education Outcomes Certificate
2013	Stanford University, Applied Ichnology: The Use of Trace Fossils in Sequence Stratigraphy, Exploration & Production Geology
2013	Stanford University, The Writer's Studio, Creative Nonfiction
2010-2011	University of Wisconsin-Madison, Delta Program in Research, Teaching and Learning
2002	University of Washington, Friday Harbor Laboratories, Marine Invertebrate Zoology2

University Teaching Experience

(i=undergrad intro, u=undergrad upper level, g=graduate level)

Tufts University

- Earth History and Paleontology, Fall 2019 (u)
- Mass Extinctions: Past, Present and Future of Biodiversity, Spring 2020 (u)
- Geological Research, Spring 2020 (u)
- Environmental Geology Labs, Spring 2020 (i)

Stanford University

†cross listed in Biology, ‡cross listed in Earth Systems

- Undergraduate Research in Geological Sciences, Winter 2019, Spring 2019 (u)
- ‡Coevolution of Earth and Life, Fall 2018 (i)
    - supervised 2 graduate teaching assistants
- †‡Evolution of Marine Ecosystems, Fall 2017 (u, g)
    - supervised 1 graduate teaching assistant
- †‡Invertebrate Paleobiology, Spring 2013, Spring 2016 (u, g)
    - supervised 1 graduate teaching assistant
- "Big Data" in Historical Earth Systems Science, Spring 2014 (g)

University of Wisconsin-Madison

- Invertebrate Paleontology, Winter 2011 (u)
- Geoscience Data Analysis, Spring 2012 (g)
- Seminar in Paleontology, Fall 2010 (u)

Guest Lecturer

- Paleobiology: 2 lectures on diversity and the fossil record, Spring 2009 (i)
- Evolution & Extinction: 1 lecture on the Permian mass extinction, Fall 2010 (i)
- Evolution & Extinction: 2 lectures on evolutionary development and adaptation, Fall 2012 (i)

Georgia Perimeter College (now Perimeter College at Georgia State University)

- Physical Geology Lecture, Spring 2006 (i)
- Physical Geology Lab, Spring 2005 (i)

University of California, Riverside

Teaching Assistant

- Oceanography, Fall 2002 (i)
- The Earth's Dynamic Surface, Winter 2003 (i)
- Natural Hazards and Disasters, Spring 2003 (i)

UNIVERSITY SERVICE

2019-present	Department Liaison, Work & Life Committee, Tufts University
2019-present	Department Work Load Committee, Tufts University

UNDERGRADUATE RESEARCH STUDENTS

2020-present	Stephanie Lechki, Tufts Env. Geology & Biology, Extinction selectivity in Permian & Triassic therapsids
2020	Grace Goetcheus, Tufts Biology & Anthropology, Dinosaur paleopathologies
2019	Devin Jamar Hagan, Stanford Earth System Science, California intertidal invertebrate ecology & climate change
2018-present	Niza Contreras, Stanford Earth System Science, Extinction threat in dragonflies
2017	Teke Dado, Stanford Earth System Science, Early Paleozoic body size evolution
2015-2016	Mary Cirino, Stanford Computer Science, Building a species-level body-size database using PaleoDeepDive

UNDERGRADUATE WORKERS SUPERVISED

2018	Johannah Farner, Stanford Earth Systems Sciences, Dragonfly body size data collection
2016	Andrea Contreras, Stanford Earth Systems Sciences, Dragonfly body size data collection
2016	Joanna Tang, UC Davis Environmental Science, Fish & trilobite body size data collection
2016	Natalie Cheng, Stanford Post-baccalaureate, Bivalve body size data collection
2015-2016	Rebia Khan, Stanford Biology, Fish body size data collection
2015-2016	Margaret Deng, UC San Diego Earth Sci., Fish and protist body size data collection
2012-2014	Galen Griggs, U. Wash. Post-baccalaureate, Marine animal body size data collection

2011-2012 Annaka Clement, U. Wisconsin Geoscience, Macrostrat data entry

Research Experience

2012-2019 Research Scientist, Stanford University, Department of Geological Sciences

- Impacts of climate change on Eastern Pacific intertidal ecology
- Evolution of biological complexity
- Evolution of marine animal body size and ecosystems over the past 550 million years
- Predicting extinction threat in poorly-evaluated species such as butterflies and dragonflies
- Extinction selectivity in modern and ancient animals
- Ecological consequences of the emerging sixth mass extinction
- Compilation, management, and analysis of a large body size and ecological database

2008-2012 Research Scientist, University of Wisconsin-Madison, Department of Geoscience

- Evolution of Earth's sedimentary record
- Co-evolution of marine life and environments over the past 550 million years
- Compilation, management, and analysis of large paleobiological and geological databases, the Paleobiology Database and Macrostrat, respectively

2003-2008 Doctoral Student Researcher, University of Georgia, Department of Geology

- Field-based study of climate-induced extinction in marine communities 320 million years ago
- Long-term evolution of the latitudinal diversity gradient in fossil marine animals
- Impacts of intercontinental species migration on biodiversity dynamics

2001-2003 Master's Student Researcher, University of California, Riverside, Department of Earth Sciences

- Field-based study of 520 million year old trilobites from the Indian Himalaya
- Systematics and geometric morphometrics of Cambrian trilobites
- Biostratigraphy of early and middle Cambrian trilobites

1999 Undergraduate Research Intern, National Museum of Natural History, Paleobiology Department

- Sample early Cenozoic fossil plants in the field, Big Horn Basin, Wyoming, USA
- Devise a test to see how well paleobotanist identify species from partial leaf specimens

1999-2000 Undergraduate Research Assistant, Field Museum of Natural History, Geology Department

- Digitize published images of Paleozoic tetrapods

1998-2000 Undergraduate Research Assistant, Field Museum of Natural History, Geology Department

- SEM characterization and elemental mapping of meteorites

1998-2000 Undergraduate Research Assistant, University of Chicago, Department of the Geophysical Sciences
- Pick and count marine carbonate sediments for fossils and sedimentary grains
- Measure mass of bivalve shells before and after taphonomy experiment
- Curate Cenozoic fossil bivalve collection

1997-1998 Fossil Preparator, University of Chicago, Department of Organismal Biology & Anatomy
- Prepare dinosaur fossils for study by removing rock matrix from bones

1997 Field Assistant, Montana State University, Museum of the Rockies
- Prospect for Cretaceous dinosaurs in central and eastern Montana badlands
- Excavate dinosaur fossils and prepare them for safe transport to the museum

HIGH SCHOOL & MIDDLE SCHOOL TEACHING EXPERIENCE

Stanford University

2012-2019 Director & Mentor, Stanford Earth Young Investigators: Biodiversity Internship

Innovative Program Planning & Development
- Set the vision and goals for the program.
- Develop engaging hands-on conservation, evolution, and paleontology curriculum.
- Design, coordinate, and lead day-long and overnight field trips to study living and fossil animals.
- Evaluate program and implement improvements.

Teaching and Intern Management
- Oversee an 8-week program: recruit, hire, train and manage high school cohorts of 20 interns who collect scientific data and work in groups to conduct original citizen science research projects.
- Mentor interns in conducting original research projects from hypothesis development to communicating results. 34 student pairs presented their work at a professional meeting (AGU).
- Provide feedback on intern projects in a way that is compassionate and fosters improvement.
- Deliver science curriculum that consists mainly of hands-on, inquiry-based activities.

Maine School of Science and Mathematics

2000-2001 Adjunct High School Instructor
- Physical Geology, with lab, Fall 2000
- Earth History, with lab, Spring 2001
- Statistics, Academic Year 2000-2001

2001 Middle School Summer Camp Director of Academics & Instructor

- Hire 11 instructors to teach week-long, hands-on science courses for boys in grades 5-9.
- Provide course feedback to camp instructors and approve 18 course curricula.
- Manage camp budget and procure teaching materials.
- Teach hands-on courses in ecology, paleontology & geology (also in 2000 & 2003).

HIGH SCHOOL RESEARCH INTERNS (SUMMER)

2018 10 Bay Area high school students, scientific analysis & writing marine animal body size
2017 19 Bay Area high school students, extant Lepidoptera body sizes
2016 19 Bay Area high school students, extant nematode body sizes
2015 18 Bay Area high school students, extant bacteria and archaea cell sizes
2014 16 Bay Area high school students, fossil and extant ostracod body sizes
2014 19 Bay Area high school students, fossil and extant echinoderm and ostracod body sizes

HIGH SCHOOL RESEARCH STUDENTS (ACADEMIC YEAR)

2017-2018 Dipashreya Sur, Notre Dame HS, Body size co-evolution in mammals & nematodes
2016-2018 Charin Park, Saratoga HS, Body size co-evolution in birds & parasitic

OUTREACH & K-12 FIELD TRIPS

Geology & Paleontology of New Brighton Beach, Capitola, CA
2013-2018 Stanford Earth Young Investigators: Biodiversity Interns, High School
2017 Wilkinson School, Half Moon Bay, 7th and 8th grades
2014-2016, 2018 Bay Area Science Festival, General Public

Paleontology of Monterey Formation, Santa Cruz Mountains, Scotts Valley, CA
2015 Discovery Charter School, San Jose, 5th grade

Geological Walking Tour of Stanford's Building Stones, Stanford, CA
2015 The Girls' Middle School, Palo Alto, 6th grade

Sedimentary Geology of the Panoche Hills, California's Central Valley
2015 Stanford Earth Young Investigators: Biodiversity Interns, High School

Paleontology of the Monterey Formation, Salinas Valley, California
2014-2018 Stanford Earth Young Investigators: Biodiversity Interns, High School

Geological Hiking Tour of Pinnacles National Park, California

2014-2018 Stanford Earth Young Investigators: Biodiversity Interns, High School

Sedimentary Geology of Black Diamond Mines, Antioch, CA
2014 Stanford Earth Young Investigators: Biodiversity Interns, High School

Tide Pools at Bean Hollow, San Mateo County, California
2013-2014 Stanford Earth Young Investigators: Biodiversity Interns, High School

Paleontology of the Fossil Cliffs at Joggins & Parrsboro, Nova Scotia, Canada
2001 Maine School of Science and Mathematics, High School

Other Outreach & K-12 Teaching Experience

2017 Invited Speaker, Milstein Science Series: Prehistoric Ocean Dwellers, American Museum of Natural History, New York.
2017 Volunteer Judge, Sea Lion Bowl: Northern California Regional National Ocean Science Bowl Competition for High School Students, Stanford, California.
2016 Invited Speaker, Think Evolution VIII: A Summer Institute for Science Educators, University of California Museum of Paleontology, Berkeley, California.
2015 STEM Career Panel, Upward Bound Math & Science, University of San Francisco.
2005-2006 Guest Programs Volunteer (Docent), The Georgia Aquarium, Atlanta.
2000-2003 Middle School Instructor, Maine School of Science & Mathematics Summer Camps, Limestone, ME.
2000-2001 High School Instructor, Maine School of Science & Mathematics, Limestone, ME.

Group Research Initiatives

2015-2018 ePANDDA Working Group: Enhancing Paleontological & Neontological Data Discovery
2014-2015 NESCent Working Group: Evolutionary Macroecology of Body Size
2008-2012 Developer and contributor, Macrostrat (http://macrostrat.org)
2003-present Member, The Paleobiology Database (http://paleobiodb.org)

Professional Service

2019 Session organizer and co-chair, *The Sixth Extinction: Integrating Paleobiological, Ecological, and Physiological Perspectives*, North American Paleontological Convention (NAPC), Riverside, California
2013-2014, 2019 Proposal Reviewer, NSF Sedimentary Geology & Paleobiology Program
2018 Proposal Reviewer, American Chemical Society-Petroleum Research Fund
2015 Proposal Reviewer, European Research Council
2015 Proposal Reviewer, National Science Center, Poland

2006-present Manuscript Reviewer

Computers & Geosciences	*Journal of Paleontology*	*Peer J*
Ecology	*Nature Communications*	*PLoS One*
Evolution	*Palaeontology*	*Proceed. of the Nat. Acad. Sci. USA*
Geology	*PALAIOS*	*Proceed. of the Royal Soc. B*
Global Change Biology	*Paleobiology*	*Scientific Reports*
Journal of Geology	*Paleontological Soc. Special Pubs.*	*Yale University Press*
Journal of the Geological Soc., London		

2004-2008 Geology Department Representative, Graduate Student Association, University of Georgia

2007-2008 Graduate Student Representative, Geology Depart. Faculty Meetings, University of Georgia

2007 Session co-chair, Geographic Diversity Patterns, GSA Annual Meeting, Denver, Colorado

2005-2007 Secretary and Webmaster, Graduate Student Association, University of Georgia

2003 Co-organizer, Grad Fest, Evolution & Ecology Graduate Research Unit, University of California, Riverside

2002-2003 Co-organizer, Hewett Club Lecture Series, Department of Earth Sciences, University of California, Riverside

Invited Presentations

2019 Tufts University, Department of Earth & Ocean Sciences, Medford, Massachusetts

2017 Stanford University, Department of Geological Sciences, Stanford, California

2017 University of California Museum of Paleontology, Berkeley

2017 Milstein Science Series, American Museum of Natural History, New York

2016 Department of Earth Sciences, Dartmouth College, Hannover, New Hampshire

2016 Think Evolution Workshop, University of California Museum of Paleontology, Berkeley

2016 Department of Earth & Planetary Sciences, University of California, Davis

2016 Department of Earth & Planetary Sciences, University of California, Santa Cruz

2016 Department of Biology, University of San Francisco

2015 Department of Geology, University of Georgia, Athens

2015 Department of Geology, Grand Valley State University, Allendale, Michigan

2014 Department of Geology & Environmental Earth Science, Miami University of Ohio

2013 University of New Mexico, Albuquerque

2013 University of California Museum of Paleontology, Berkeley

2012 School of Geography & Geosciences, University of St. Andrews, Scotland, UK

2012 William Smith Meeting, London, *Strata and Time: Probing the gaps in our understanding*

2012 Geosciences Program, Midwestern State University, Wichita Falls, Texas

2011 Evolution Seminar Series, Crow Institute, University of Wisconsin-Madison

2009 Department of the Geophysical Sciences, University of Chicago

2008 Department of Geoscience, University of Wisconsin-Madison

2008 Department of Geology, Geography & Planning, Missouri State University

Fellowships

2005-2008	US EPA Science to Achieve Results (STAR) Graduate Fellowship (3 years full funding)
2003-2005	Graduate School Assistantship, University of Georgia (2-year competitive assistantship)
2001	Summer Fellowship, Evolution & Ecology Graduate Research Unit, U. of California, Riverside
2001-2002	Dean's Fellowship, Graduate Division, University of California, Riverside

Grants Awarded

2018, 2019	Mentoring Undergraduates in Interdisciplinary Research Grant, Stanford Woods Institute
2004	Stephen J. Gould Grant, Paleontological Society
2004	Geological Society of America Research Grant
2004	Gilles and Bernadette Allard Award, Department of Geology, University of Georgia
2004	Miriam Watts-Wheeler Award, Department of Geology, University of Georgia

Awards & Honors

2015	Heim *et al.* (2015) recommended by *Faculty of 1000*
2008	Graduate Student of the Year, Department of Geology, University of Georgia
1997-2000	Dean's List, University of Chicago

Professional Affiliations

The Geological Society of America
The Paleontological Society
National Association of Geoscience Teachers

Peer-reviewed Journal Articles

Payne, J.L., A. Bachan, **N.A. Heim**, P. Hull, and M.L. Knope. *In press*. The evolution of complex life and the stabilization of the Earth system. *Interface Focus*. Accepted March 2020.

Heim, N.A. , S.H. Bakshi†, L. Buu†, S. Chen†, S. Heh†, A. Jain†, C. Noll†, A. Patkar†, N. Rizk†, S. Sundararajan†, I. Villante†, M.L. Knope, and J.L. Payne. *In press*. Respiratory and circulatory anatomy constrains size evolution in marine macrofauna. *Paleobiology*. Accepted February 2020. † = *high school student advisee*.

Knope, M.L., A.M. Bush, L.O. Frishkoff, **N.A. Heim**, and J.L. Payne. 2020. Ecologically diverse clades dominate the oceans via extinction resistance. *Science*, 367(6481):1035-1038. *DOI: 10.1126/science.aax6398* .

Payne, J.L. and **N.A. Heim**. 2020. Body size, sampling completeness, and extinction risk in the marine fossil record. *Paleobiology*, 46(1):23-40. *DOI: 10.1017/pab.2019.43*.

Bush, A.M., S.C. Wang, J.L. Payne, and **N.A. Heim**. 2020. A framework for the integrated analysis of the magnitude, selectivity, and biotic effects of extinction and origination. *Paleobiology*, 46(1):1-22. *DOI: 10.1017/pab.2019.35*

Saulsbury, J., D.K. Moss, L.C. Ivany, M. Kowałewski, D. Lindberg, J.F. Gillooly, **N.A. Heim**, C.R. McClain, J.L. Payne, P.D. Roopnarine, B.R. Schöne, D. Goodwin, and S. Finnegan. 2019. Evaluating the influences of temperature, primary production, and evolutionary history on bivalve growth rates. *Paleobiology*, 45(3):405-420. *DOI:* 10.1017/pab.2019.20.

McClain, C.R., **N.A. Heim**, M.L. Knope, and J.L. Payne. 2018. Is biodiversity energy-limited or unbounded? A test in fossil and modern bivalves. *Paleobiology*, 44(3):385-401. *DOI: 10.1017/pab.2018.4*

Heim, N.A., J.L. Payne, S. Finnegan, M.L. Knope, Kowałewski M, S.K. Lyons, D.W. McShea, P.M. Novack-Gottshall, F.A. Smith, and S.C. Wang. 2017. Hierarchical complexity and the size limits of life. P*roceedings of Royal Society of London B*, 284: 20171039. *DOI: 10.1098/rspb.2017.1039*.

Payne, J.L., A.M. Bush, **N.A. Heim**, M.L. Knope, and D.J. McCauley. 2016. Ecological selectivity of the emerging mass extinction in the oceans. *Science*, 353(6305):1284-1286. *URL: http://science.sciencemag.org/content/early/2016/09/13/science.aaf2416*.

Payne, J.L., A.M. Bush, E.T. Chang, **N.A. Heim**, M.L. Knope, and S.B. Pruss. 2016. Extinction intensity, selectivity, and their combined macroevolutionary influence in the fossil record. *Biology Letters*, 12(10): 20160202. *DOI: 10.1098/rsbl.2016.0202*.

Smith, F.A., J.L. Payne, **N.A. Heim**, M. Balk, S. Finnegan, M. Kowałewski, S.K. Lyons, C.R. McClain, D.W. McShea, P.M. Novack-Gottshall, P.S. Anich, and S.C. Wang. 2016. Body size evolution across the Geozoic. *Annual Review of Earth and Planetary Sciences*, 44:523-553. *URL: http://www.annualreviews.org/doi/abs/10.1146/annurev-earth-060115-012147*.

Heim, N.A., M.L. Knope, E.K. Schaal, S.C. Wang, and J.L. Payne. 2015. Cope's Rule in the Evolution of Marine Animals. *Science*, 347(6224):867-870. *DOI: 10.1126/science.1260065*.

M.L. Knope, **N.A. Heim**, L.O. Frishkoff, and J.L. Payne. 2015. Limited role of functional differentiation in early diversification of animals. *Nature Communications*, 6:6455. *DOI: 10.1038/ncomms7455*.

Payne, J.L., **N.A. Heim**, M.L. Knope, and C.R. McClain. 2014. Metabolic dominance of bivalves predates brachiopod diversity decline by more than 150 million years. *Proceedings of the Royal Society B*, 281(1783):20133122. *DOI: 10.1098/rspb.2013.3122*.

Rook, D.L., **N.A. Heim**, and J. Marcot. 2013. Contrasting patterns and connections of rock and biotic diversity in the marine and terrestrial fossil records of North America. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 372: 123-129. *DOI: 10.1016/j.palaeo.2012.10.006*.

S. Finnegan, **N.A. Heim**, S.E. Peters, and W.W. Fischer. 2012. Climate Change and the Selective Signature of the Late Ordovician Mass Extinction. *Proceedings of the National Academy of Sciences of the U.S.A.* (PNAS), 109(18): 6829-6834. *DOI: 10.1073/pnas.1117039109*.

Heim, N.A. and S.E. Peters. 2011. Local Environmental Breadth Determines Geographic Range and Longevity in Fossil Marine Genera. *PLoS One*, 5(6): e18946. *DOI: 10.1371/journal.pone.0018946*.

Heim, N.A. and S.E. Peters. 2011. Covariation in macrostratigraphic and macroevolutionary patterns in the marine record of North America. *The Geological Society of America Bulletin*, 123: 620-630. *DOI: 10.1130/B30215.1*.

Peters, S.E. and **N.A. Heim**. 2011. Stratigraphic distribution of marine fossils in North America. *Geology*, 39: 259-262. *DOI: 10.1130/G31442.1*.

Peters, S.E and **N.A. Heim**. 2010. The geological completeness of paleontological sampling in North America. *Paleobiology*, 36: 61-79. *DOI: 10.1666/0094-8373-36.1.61.*

Peng, S., N.C. Hughes, **N.A. Heim**, B.K. Sell, X. Zhu, P.M. Myrow, and S.K. Parcha. 2009. Cambrian trilobites from the Parahio and Zanskar Valleys, Indian Himalaya. *Journal of Paleontology*, 83(sp. 71): 1-95. *DOI: 10.1666/08-129.1.*

Heim, N.A. 2009. Stability of regional brachiopod diversity structure across the Mississippian/ Pennsylvanian boundary. *Paleobiology*, 35: 393-412. *DOI: 10.1666/0094-8373-35.3.393.*

Heim, N.A. 2008. A null biogeographic model for quantifying the role of migration in shaping patterns of global taxonomic richness and differentiation diversity, with implications for Ordovician biogeography. *Paleobiology*, 34: 195-209. *DOI: 10.1666/0094-8373(2008)034[0195:ANBMFQ]2.0.CO;2.*

Myrow P.M., K.E. Snell, N.C. Hughes, T.S. Paulsen, **N.A. Heim**, and S.K. Parcha. 2006. Cambrian depositional history of the Zanskar Valley region of the Indian Himalaya: tectonic implications. *Journal of Sedimentary Research*, 76: 364-381. *DOI: 10.2110/jsr.2006.020.*

Peer-reviewed Book Chapters

Railsback, L.B., K.M. Layou, **N.A. Heim**, S.M. Holland, M.L. Trogdon, M.B. Jarrett, G.M. Izsak, D.E. Bulger, E.J. Wysong, K.J. Trubee, J.M. Fiser, J.E. Cox, and D.E. Crowe. 2012. Geochemical evidence for meteoric diagenesis and cryptic surfaces of subaerial exposure in peritidal carbonates of Late Ordovician age from the Nashville Dome, central Tennessee, USA *In* Morad, S., M. Ketzer and L.F. de Ros (eds) *Linking Diagenesis to Sequence Stratigraphy*. International Association of Sedimentologists Special Publication no. 45, p. 257-270. *DOI: 10.1002/9781118485347.ch11*

S.E. Peters and **N.A. Heim**. 2011. Macrostratigraphy and macroevolution in marine environments: testing the common-cause hypothesis. *In* McGowan, A. and A.B. Smith (eds.), *Comparing the Geological and Fossil Records: Implications for Biodiversity Studies*. Geological Society Special Publication 358, p. 95-104. *DOI: 10.1144/SP358.7*.

Field Guides & Other Publications

Heim, N.A. and D.H. Geary. 2013. The Fossil Record. *In* Losos, J. (editor in chief). *The Princeton Guide to Evolution*. Princeton University Press, Princeton, N.J., p. 112-119.

Heim, N.A.. 2013. Extinction Rates and the Fossil Record. *In* MacLeod, N. (editor in chief). *Grzimek's Animal Life Encyclopedia, Extinction*. Cengage Learning, Detroit, p. 103-109.

N.C. Hughes and **N.A. Heim**. 2005. Paleozoic: Cambrian. *In* Selley, R.C., L.R.M. Cocks, and I.R. Plimer (eds.), *Encyclopedia of Geology*. Elsevier, Amsterdam, p. 163-175.

Jensen S., M.L. Droser, and **N.A. Heim**. 2002. Trace fossil and ichnofabrics of the Lower Cambrian Wood Canyon Formation, southwest Death Valley area. *In* Corsetti, F.A. (ed.), *Proterozoic-Cambrian of the Great Basin and Beyond*, Pacific Section SEPM Book 93, p. 123-135.

Meeting Abstracts

Heim, N.A., M.L. Knope, and J.L. Payne. 2019. *North American Paleontological Convention*. Respiratory and circulatory anatomy supersede ecological escalation in driving size increase in marine animals. PaleoBios 36(Supplement 1):166. URL: https://escholarship.org/uc/item/6r18f8wn.

Payne, J.L. and **N.A. Heim**. 2019. *North American Paleontological Convention*. Body size and extinction risk in the fossil record and the modern world.

Munstermann, M.J., **N.A. Heim**, D.J. McCauley, J.L. Payne, S.C. Wang, and M.L. Knope. 2019. *International Congress for Conservation Biology*. The global ecological signature of extinction risk in terrestrial vertebrates.

Heim, N.A. and J.L. Payne. 2018. *GSA Annual Meeting*. Eco-physiological drivers of body size evolution in marine animals. GSA Abstracts with Programs, 50(6). DOI: 10.1130/abs/2018AM-320104.

Heim, N.A., J. Saltzman, and J.L. Payne. 2018. *GSA Annual Meeting*. Summer paleobiology research experience for high school students. GSA Abstracts with Programs, 50(6). DOI: 10.1130/abs/2018AM-320109.

Werbin, Z.R., J.D. Wojciehowski, H. Wang, C. Habermeier, **N.A. Heim**, S. Finnegan, J.L. Payne, and S.C. Wang. 2018. *GSA Annual Meeting*. Comparing the age selectivity of modern extinctions with Phanerozoic background and mass extinctions. GSA Abstracts with Programs, 50(6). DOI: 10.1130/abs/2018AM-324110.

Wang, H., C. Habermeier, **N.A. Heim**, S. Finnegan, J.L. Payne, and S.C. Wang. 2018. *GSA Annual Meeting*. Are we entering a sixth mass extinction? Age selectivity of modern extinctions. GSA Abstracts with Programs, 50(6). DOI: 10.1130/abs/2018AM-323991.

Heim, N.A. and J.L. Payne. 2018. *SICB Annual Meeting*. Estimating global extinction threat levels in butterflies. 39-4.

Saulsbury, J., S. Finnegan, D.R. Lindberg, D.K. Moss, L.C. Ivany, J.F. Gilooly, D. Goodwin, **N.A. Heim**, C. Keating-Bitonti, M. Kowałewski, C.R. McClain, J.L. Payne, P.D. Roopnarine, and B.R. Schöene. 2017. *GSA Annual Meeting*. Evaluating the influences of temperature, productivity, and phylogenetic constraint on bivalve growth rates. GSA Abstracts with Programs, 49(6). DOI: 10.1130/abs/2017AM-304698.

M.L. Knope, A.M. Bush, L.O. Frishkoff, **N.A. Heim**, and J.L. Payne. 2017. *Evolution*. A comparative analysis of the filling of ecological 'space' by marine animals. T975

Heim, N.A. 2017. *Bay Area Conservation Biology Symposium*. An ecological shift in the Pacific mole crab (*Emerita analoga*) population at Ocean Beach, San Francisco.

Heim, N.A. 2017. *MARINE Oceans Colloquium*. Conservation paleobiology: What are the prospects and potential collaborations?

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13. Kothari, S., A. Gao, **N.A. Heim**, and J.L. Payne. 2015. *AGU Fall Meeting*. The Prevalence of Specific Ecologies in Marine Organisms with Relation to Environmental Factors. ED41A-0841.
14. Nolen, L., K. Duong, **N.A. Heim**, and J.L. Payne. 2015. AGU Fall Meeting. Analyzing the Differences Between Pathogenic and Nonpathogenic Prokaryote Species. ED41A-0862.
15. Park, C., J. Saux, **N.A. Heim**, and J.L. Payne. 2015. *AGU Fall Meeting*. Mass Extinctions' Selectivity on the Diversity of Marine Modes of Life. ED41A-0861.
16. Sundararajan, D., F. Gutierrez, **N.A. Heim**, and J.L. Payne. 2015. AGU Fall Meeting. The Influence of pH on Prokaryotic Cell Size and Temperature. ED41A-0863.
17. Tenorio, A., C. Duong, **N.A. Heim**, and J.L. Payne. 2015. *AGU Fall Meeting*. Correlation Between Ecospace and Metabolic Rate of Marine Organisms Through Geologic Time. ED41A-0844.
18. Wang, F., W. Wong, **N.A. Heim**, and J.L. Payne. 2015. *AGU Fall Meeting*. The Effect of Abiotic Factors on Marine Animal Body Size. ED41A-0859.
19. Yuan, A., C. Huynh, **N.A. Heim**, and J.L. Payne. 2015. *AGU Fall Meeting*. The effect of size and ecology on extinction susceptibility. ED41A-0842.
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24. A. Siram, S. Idgunji, **N.A. Heim**, and J.L. Payne. 2014. *AGU Fall Meeting*. Body Size Preference of Marine Animals in Relation to Extinction Selectivity. ED41A-3412.
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26. Webber, M., N. Wong, **N.A. Heim**, and J.L. Payne. 2014. *AGU Fall Meeting*. The Influence of Oxygen, Temperature, and Salinity on Ostracod Body Size in the Gulf of California and the Pacific Coast of North America, ED41A-3411.
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29. Low, A., S. Randhawa, **N.A. Heim**, and J.L. Payne. 2013. *AGU Fall Meeting*. Comparing the Effects of Environmental Factors on Echinoderm Body Size. ED41A-0726.
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31. Pathi, A., D. Guo, A. Sriram, **N.A. Heim**, and J.L. Payne. 2013. *AGU Fall Meeting*. Ostracod Body Size as a Variable of Biomass. ED41A-0713.
32. Soto, A., C. Tang, M. Pelagio, **N.A. Heim**, and J.L. Payne. 2013. *AGU Fall Meeting*. Effects of Mass Extinctions on Crinoids Body Size. ED41A-0727.
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34. Xu, C., P. Seshadri, V. Amin, **N.A. Heim**, and J.L. Payne. 2013. *AGU Fall Meeting*. Ostracod body size trends do not follow either Bergmann's rule or Cope's rule during periods of constant temperature increase. ED41A-0712.