

## Kimberly V. Lau

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### **APPOINTMENTS**

Assistant Professor, Department of Geosciences, Penn State University	2020-present
Associate, Earth and Environmental Systems Institute, Penn State University	2020-present
Graduate Faculty, Astrobiology and Biogeochemistry Ph.D. Dual-Title Programs	2021-present
Assistant Professor, Department of Geology and Geophysics, University of Wyoming	2019-2020
Agouron Geobiology Postdoctoral Fellow, Department of Earth Sciences, UC Riverside	2017-2018

### **EDUCATION**

**Stanford University**, Ph.D. in Geological Sciences, completed 2016, degree conferred 2017  
**Yale University**, B.S. in Geology & Geophysics, with Honors, 2009

### **OTHER PROFESSIONAL EXPERIENCE**

Environmental Consultant/Geologist, Roux Associates, Inc., Woburn, Massachusetts	2009-2011
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### **AWARDS AND FELLOWSHIPS**

Sloan Research Fellow	2023
GSA Donath Young Scientist Medal	2022
GSA Geobiology and Geomicrobiology Division Pre-Tenure Award	2021
Scialog Fellow, Signatures of Life in the Universe	2020
Geological Society of America Doris M. Curtis Outstanding Woman in Science Award	2019
Agouron Institute Geobiology Postdoctoral Fellowship	2017-2019
Outstanding Graduate Student Award – for achievement in teaching, research, and mentoring in the Department of Geological Sciences, Stanford University	2017
AAPG Grants-in Aid, David Worthington Named Grant	2015
GSA Research Grant, Gretchen L. Blechschmidt Award	2015
ARCS Foundation Fellowship (covers tuition and stipend)	2014-2016
Certificate of Achievement in Mentoring in the School of Earth Sciences, Stanford University	2014
Distinction in the Major, Yale University	2009

### **PROFESSIONAL ACTIVITIES**

- Associate Editor, *American Journal of Science* (2020-present)
- Sedimentary Geochemistry and Paleoenvironments Project (SGP) leadership team (2020-present)
- Society Memberships: AGU, GSA, SEPM, NAGT, ESWN
- Proposal reviewer for NSF, NASA Exobiology, ACS-PRF, NSERC, SSRL
- Panelist for NASA, NSF
- Journal reviewer for *American Journal of Science*; *Chemical Geology*; *Earth and Planetary Science Letters*; *Earth-Science Reviews*; *Geobiology*; *Geochemistry*, *Geophysics*, *Geosystems*; *Geochimica et Cosmochimica Acta*; *Geology*; *Global Biogeochemical Cycles*; *Gondwana Research*; *Nature*; *Nature Geoscience*; *Nature Communications*; *Palaogeography*, *Palaeoclimatology*, *Palaeoecology*; *Paleoceanography*; *PLOS One*; *Precambrian Research*; *Proceedings of the National Academy of Sciences*, *Science*

**2024:**

- Invited Speaker, Gordon Geobiology Research Conference, *Geochemical Tracers of Life and Habitats*

**2023:**

- Convener, AGU Fall Meeting, *Understanding the Influences of Sedimentary and Oceanographic Processes on Geochemical Archives Across Geologic Time*
- Convener, GSA Connects, *Mass Extinctions as Natural Experiments in Earth System Perturbations*
- Journal Reviewer: *Geophysical Research Letters, Science*

**2022:**

- Convener, AGU Fall Meeting, *Understanding the Influences of Sedimentary and Oceanographic Processes on Geochemical Archives*
- Convener, GSA Pardee Keynote, *The Proterozoic-Phanerozoic Transition: Laying the Foundation for the Modern Earth System*
- Convener, GSA Annual Meeting, *Do carbon sources or sinks drive the Phanerozoic carbon cycle? Understanding geobiologic forcings and feedbacks*
- Journal Reviewer: *Chemical Geology; Geochemistry, Geophysics, Geosystems; Geochimica et Cosmochimica Acta; Paleoceanography and Paleoclimatology*

**2021:**

- Invited speaker, *Phanerozoic climate through space and time: Approaches, advances, and challenges in reconstructing the evolution of Earth's climate*, AGU Fall Meeting
- Keynote speaker, *New Voices in Geobiology*, GSA Connects
- Keynote speaker, *Integrative Approaches to Understanding Mesozoic Environmental and Biologic Perturbations*, GSA Connects
- Convener, AGU Fall Meeting, *Understanding the Influences of Sedimentary and Oceanographic Processes on Geochemical Archives*
- Moderator, AGU Fall Meeting, *Asian Americans and Pacific Islanders in Geosciences Town Hall*

**2020:**

- Convener, AGU Fall Meeting, *Global Geochemical Cycles and Earth's Climate over Geologic Time*
- Convener, GSA Annual Meeting, *Rare Earth Elements: The Behavior of Critical Minerals in Sedimentary, Magmatic, and Magmatic-Hydrothermal Systems*
- Panelist, Stanford Earth Diversity, Equity & Inclusion Virtual Panel on Asian American representation in the Geosciences
- SEPM Nominating Committee, Early Career Representative
- Convener, Goldschmidt Honolulu Session 14b, *Multi-Proxy Approaches for Paleoredox Reconstruction in the Carbonate Record*
- Workshop co-leader, Ocean Chemistry and Carbonate Sediment Production, International Sedimentary Geosciences Congress 2020/International SEPM Congress, Flagstaff, Arizona. Conference postponed due to COVID-19, to be rescheduled.

**2019:**

- Invited speaker, *Icehouse Collapse and Extreme Environments—Paleoclimate of the Continental Permian*, AGU, San Francisco, CA
- Invited speaker, 2<sup>nd</sup> Geobiology Society Conference, Banff, Canada
- Invited keynote speaker, *A look into the future of energy and sustainability using the sedimentary record* research symposium, SEPM/AAPG ACE Meeting, San Antonio, TX
- Convener, Goldschmidt Barcelona Session 9h, *Geobiological Controls on Critical Zone Evolution and Weathering, Past, Present and Future*
- SEPM student poster judge, SEPM/AAPG ACE Meeting, San Antonio, TX
- Poster judge, Rocky Mountain Geobiology Symposium, University of Colorado, Boulder

**2018:**

- Invited poster, Session PP33F *Trace Metals as Recorders of Biogeochemical Cycling in Modern and Ancient Settings*, AGU Fall Meeting, Washington, D.C.
- Convener, Goldschmidt Boston Session 7c, *Seafloor Diagenesis, Hydrothermal Processes, and Biogeochemistry: Implications for the Earth System through Time*
- Co-editor, *Early Earth and the Rise of Complex Life* Special Issue in *Emerging Topics in Life Sciences* (with Profs. Tim Lyons, Mary Droser, and Susannah Porter)

**Prior to 2018:**

- Invited keynote, *New Voices in Geobiology* session, GSA Annual Meeting, Seattle, WA
- Convener, GSA, *High-resolution investigations of the Permian-Triassic transition*
- Convener, Goldschmidt Paris Session 14d, *Phanerozoic mass extinctions and the biogeochemical co-evolution of the Earth-ocean system*
- Invited talk (with Honorarium), ARCS Symposium, The Tech Museum of Innovation, San Jose CA

**JOURNAL PUBLICATIONS AND BOOK CHAPTERS (all peer reviewed)**

31. Hardisty, D.S. and **Lau, K.V.** (2023) Present and Past Ocean Redox Chemistry. Treatise on Geochemistry, 3<sup>rd</sup> Edition. \*Joint first-authors
30. Kukla, T., Ibarra, D.E., **Lau, K.V.**, Rugenstein, J.K.C. (2023) All aboard! Earth system investigations with the CH2O-CHOO TRAIN v.1.0. Accepted, *Geoscientific Model Development*.
29. Singh, P., Lu, W., Lu, Z., Jost, A.B., **Lau, K.V.**, Bachan, A., van de Schootbrugge, B., Payne, J.L. (2022) Reduction in animal abundance and oxygen availability during and after the end-Triassic mass extinction. *Geobiology* 21, 175-192.
28. **Lau, K.V.** and Hardisty, D.S. (2022) Modeling the impacts of diagenesis on carbonate paleoredox proxies. *Geochimica et Cosmochimica Acta* 337, 123-139. \*Joint first-authors
27. Nana Yobo, L., Holmden, C., Brandon, A.D., **Lau, K.V.**, Eldrett, J.S., and Bergman, S. (2022) LIP volcanism (not anoxia) tracked by Cr isotopes during Ocean Anoxic Event 2 in the proto-North Atlantic region. *Geochimica et Cosmochimica Acta* 332, 138-155.
26. Isson, T.T., Zhang, S., **Lau, K.V.**, Rauzi, S.M., Tosca, N.J., Penman, D.E., Planavsky, N.J. (2022) Marine siliceous ecosystem decline led to sustained anomalous Early Triassic warmth. *Nature Communications* 13, 3509.
25. Pimentel-Galvan, M., **Lau, K.V.**, Maher, K., Mukerji, T., Lehrmann, D.J., Altiner, D., Payne, J.L. (2022) Duration and Intensity of End-Permian Marine Anoxia. *Geochemistry, Geophysics, Geosystems* 23, e2021GC010130.
24. **Lau, K.V.**, Hancock, L.G., Severmann, S., Kuzminov, A., Cole, D.B., Behl, R.J., Planavsky, N.J., Lyons, T.W. (2021) Variable local basin hydrography and productivity control the uranium isotope paleoredox proxy in anoxic black shales. *Geochimica et Cosmochimica Acta* 317, 433-456.
23. Hülse, D., **Lau, K.V.**, van de Velde, S.J., Arndt, S., Meyer, K., Ridgwell, A. (2021) End-Permian marine extinction due to temperature-driven nutrient recycling and euxinia. *Nature Geoscience* 14, 862-867.
22. Farrell, U., ... **Lau, K.V.**, ... Sperling, E.A. (2021) The Sedimentary Geochemistry and Paleoenvironments Project. *Geobiology*.
21. Nana Yobo, L., Brandon, A.D., Holmden, C., **Lau, K.V.**, Eldrett, J. (2021) Changing inputs of continental and submarine weathering sources of Sr to the oceans during OAE 2. *Geochimica et Cosmochimica Acta* 303, 205-222.
20. Zhang, F., del Rey, A., Planavsky, N.J., Chen, X., Dahl, T.W., Lenton, T.M., Clarkson, M.O., Li, Z., Romaniello, S.J., **Lau, K.V.**, Algeo, T.J., Anbar, A.D. (2020) Uranium isotopes in marine carbonates as a global ocean paleoredox proxy: A critical review. *Geochimica et Cosmochimica Acta* 287, 27-49.
19. Kelley, B.M., Lehrmann, D.J., Yu, M., Jost, A.B., **Lau, K.V.**, Schaal, E.K., Meyer, K.M., Payne, J.L. (2020) Controls on carbonate platform architecture across the Paleozoic to Mesozoic transition: a high-resolution analysis of the Great Bank of Guizhou. In press in *Sedimentology*.

18. Gussone, N., Ahm, A-S.C., **Lau, K.V.**, Bradbury, H. (2020) Calcium isotopes in Deep Time: Potential and Limitations. *Chemical Geology* 544, 119601.
17. **Lau, K.V.**, Lyons, T.W., Maher, K. (2020) Uranium reduction and isotopic fractionation in reducing sediments: Insights from reactive transport modeling. *Geochimica et Cosmochimica Acta* 287, 65-92.
16. Fantle, M.S., Barnes, B.D., **Lau, K.V.** (2020) The Role of Diagenesis in Shaping the Marine Carbonate Record. *Annual Reviews in Earth and Planetary Sciences* 48, 549-583.
15. Brüske, A., Weyer, S., Zhao, M.-Y., Planavsky, N.J., Wegwerth, A., Neubert, N., Pierau, N., Dellwig, O., **Lau, K.V.**, Lyons, T.W. (2020) Correlated molybdenum and uranium isotope signatures in modern anoxic sediments. *Geochimica et Cosmochimica Acta* 270, 449-474.
14. **Lau, K.V.**, Romaniello, S. J., Zhang, F. (2019) The Uranium Isotope Paleoredox Proxy. An invited chapter in: *Geochemical Tracers in Earth System Science*, Cambridge Elements, Cambridge University Press.
13. Lefebvre, P., Noël, V., **Lau, K.V.**, Jemison, N.E., Weaver, K.L., Williams, K.H., Bargar, J.R. Maher, K. (2019) Isotopic fingerprint of uranium accumulation and redox cycling in floodplains of the Upper Colorado River Basin. *Environment, Science & Technology* 53(7), 3399-3409.
12. Ibarra, D.E., Caves Rügenstein, J.K., Bachan, A., Baresch, A., **Lau, K.V.**, Thomas, D.L., Lee, J.-E., Boyce, C.K., Chamberlain, C.P. (2019) Modeling the consequences of land plant evolution on silicate weathering. *American Journal of Science* 319, 1-43.
11. Zhang, F., Romaniello, S.J., Algeo, T.J., **Lau, K.V.**, Clapham, M.E., Richoz, S., Hermann, A.D., Smith, H., Horacek, M., Anbar, A.D. (2018) Multiple episodes of extensive marine anoxia linked to global warming and continental weathering following the latest Permian mass extinction. *Science Advances* 4:e1602921.
10. Silva-Tamayo, J.C., **Lau, K.V.**, Jost, A.B., Payne, J.L., Wignall, P.B., Newton, R.J., Eisenhauer, A., DePaolo, D.J., Brown, S., Maher, K., Lehrmann, D.J., Altiner, D., Yu, M., Richoz, S., Paytan, A. (2018) Global Perturbation of the Marine Calcium Isotope Cycle During the Permian-Triassic Transition. *GSA Bulletin* 130, 1323-1338.
9. **Lau, K.V.**, Maher, K., Brown, S., Altiner, D., DePaolo, D.J., Eisenhauer, A., Jost, A.B., Kelley, B.M., Lehrmann, D.J., Paytan, A., Silva-Tamayo, J.C., Yu, M., Payne, J.L. (2017) The influence of diagenesis, mineralogy, and seawater changes on calcium isotope variations in Lower-Middle Triassic carbonate rocks. *Chemical Geology* 471, 13-37.
8. Jost, A.B., Bachan, A., van de Schootbrugge, B., **Lau, K.V.**, Weaver, K.L., Maher, K., Payne, J.L. (2017) Uranium isotope evidence for an expansion of marine anoxia during the end-Triassic extinction. *Geochemistry, Geophysics, Geosystems* 18, 3093-3108.
7. Bachan, A., **Lau, K.V.**, Saltzman, M.R., Thomas, E., Kump, L.R., Payne, J.L. (2017) A model for the decrease in amplitude of carbon isotope excursions throughout the Phanerozoic. *American Journal of Science* 317(6), 641-676.
6. Kelley, B.M., Lehrmann, D.J., Yu, M., Minzoni, M., Enos, P., Li, X.W., **Lau, K.V.**, Payne, J.L. (2017) The Late Permian to Late Triassic Great Bank of Guizhou: An isolated carbonate platform in the Nanpanjiang Basin of Guizhou Province, China. *AAPG Bulletin* 101, 553-562.
5. **Lau, K.V.**, Macdonald, F.A., Maher, K., Payne, J.L. (2017) Uranium isotope evidence for temporary ocean oxygenation in the aftermath of the Sturtian Snowball Earth. *Earth and Planetary Science Letters* 458, 282-292.
4. Caves, J.K., Jost, A.B., **Lau, K.V.**, Maher, K. (2016) Cenozoic carbon cycle imbalances and a variable weathering feedback. *Earth and Planetary Science Letters* 450, 152-163.
3. **Lau, K.V.**, Maher, K., Altiner, D., Kelley, B.M., Kump, L.R., Lehrmann, D.J., Silva-Tamayo, J.C., Weaver, K.L., Yu, M., Payne, J.L. (2016) Marine anoxia and delayed Earth system recovery after the end-Permian extinction. *Proceedings of the National Academy of Sciences of the United States of America* 113, 2360-2365.
2. Schaal, E.K., Meyer, K.M., **Lau, K.V.**, Silva-Tamayo, J.C., Payne, J.L. (2015) Oceanic anoxia during the Permian-Triassic transition and links to volcanism. Invited book chapter in: *Volcanism and Global Environmental Change*, Cambridge University Press, p. 275-290.

## OTHER PUBLICATIONS

1. Lyons, T.W., Droser, M.L., **Lau, K.V.**, Porter, S.M. (2018) Early Earth and the rise of complex life. *Emerging Topics in Life Sciences* 2(2), 121-124.

## RECENT CONFERENCE ABSTRACTS

Mentees are underlined; \*invited presentation

### 2023:

- Ibarra, D., **Lau, K.**, Spearin, C., Mitsunaga, B., Chanchai, W., Fong, B., Ho, D.T., Legg, S., Rutberg, R., Wang, J., Ying, S. Research opportunities for Asian American undergraduate students: successes and challenges of the AGILE internship program. AGU Fall Meeting.
- Meyer, F., Chappaz, A., **Lau, K.** Characterizing uranium speciation in marine phosphorites to advance the paleo-redox proxy. GSA Connects.
- Kelley, B., Lehmann, D., Yu, M., **Lau, K.**, Altiner, D., Minzoni, M., Enos, P., Li, X., Payne, J. Increased microbial carbonate production following biotic recovery from the end-Permian mass extinction suggests that the controls governing microbial carbonate accumulation should be reconsidered. GSA Connects.
- Lau, K.**, Garber, J., Felker, G., Marshall, M., Bowman, C. Rare earth element distributions in carbonate fluorapatite (CFA): insights from spatially resolved U-Pb and trace element analyses of the Phosphoria Rock Complex, USA. GSA Connects.
- Lau, K.**, Ibarra, D., Spearin, C., Mitsunaga, B., Chanchai, W., Fong, B., Ho, D.T., Legg, S., Rutberg, R., Wang, J., Ying, S. Research opportunities for Asian American undergraduate students: successes and challenges of the AGILE internship program. GSA Connects.
- Meyer, F., Chappaz, A., Hancock, L., Marshall, M., **Lau, K.** Characterizing uranium speciation in marine phosphorites to advance the paleo-redox proxy. Goldschmidt Lyon.
- Garber, J.M., **Lau, K.V.**, Felker, G., Marshall, M. U-Pb and trace element analyses of carbonate fluorapatite (CFA): chemostratigraphy of the Phosphoria Rock Complex, USA. North American Workshop on Laser Ablation, Notre Dame, IN.
- Stone, A., Foley, B., **Lau, K.** Phosphorus Release Through Low-Temperature Hydrothermal Alteration on Waterworld Exoplanets. Chapman Conference on Hydrothermal Circulation and Seawater Chemistry, Cyprus.
- Horisk, K., **Lau, K.V.**, Ivory, S.J., Snider, J., Finkle, P.W. Assessing an interpretive exhibit through undergraduate lab assignments in Geosciences. SPNHC.

### 2022:

- Stone, A., Foley, B., **Lau, K.** Seafloor Weathering on Waterworld Exoplanets. AGU
- Hardisty, D.S., **Lau, K.V.** Modeling the impact of diagenesis on carbonate paleoredox proxies. AGU
- Kelley, B.M. Did microbial carbonate flourish when skeletal carbonate was in low abundance in the aftermath of the end-Permian extinction? AGU
- \***Lau, K.V.** Advancing the geochemistry of uranium in sedimentary rocks. GSA Denver.
- Kukla, T., **Lau, K.**, Ibarra, D.E., Rugenstein, J.K.C. Carbon cycle constraints on climate determinism in the geologic past. GSA Denver.
- Bowman, C.N., Marshall, M.S., Garber, J., Owens, J.D., Young, S.A., Soares, G., **Lau, K.V.** Insights into phosphogenesis from a multi-proxy paleo-redox reconstruction of the Permian Phosphoria Basin, Idaho, USA. GSA Denver.
- Chanchai, W., Smith, E., Nelson, L., Lonsdale, M., Hardisty, D., Burke, J., **Lau, K.** Multi-Proxy Redox Reconstructions of Ediacaran of Ediacaran-Cambrian Carbonate Successions. GSA Denver.
- Irizarry, K., Patzkowsky, M., **Lau, K.** Did persistently low oxygen conditions slow diversification during the latter half of the Cambrian? GSA Denver.
- Bergeron, L., Marshall, M., **Lau, K.** Stratigraphic Insights from Permian Shell Beds: Comparison of Franson Member Deposits of the Permian Phosphoria Rock Complex. GSA Denver.
- Irizarry, K., Patzkowsky, M., **Lau, K.** Did persistently low oxygen conditions slow diversification during the Cambrian? SACNAS Conference, San Juan, Puerto Rico.
- Chanchai, W., Smith, E.F., Nelson, L.L., Lonsdale, M., Hardisty, D.S., Burke, J., **Lau, K.V.** A Carbonate

Multi-Proxy Investigation of Oceanic Oxygenation across the Ediacaran-Cambrian Boundary. Goldschmidt Honolulu.

Isson, T., Zhang, S., **Lau, K.V.**, Rauzi, S., Tosca, N.J., Penman, D., Planavsky, N.J. Marine siliceous ecosystem decline led to sustained anomalous Early Triassic warmth. Goldschmidt Honolulu.

Farrell, Ú.C., Johnston, D.T., Planavsky, N.J., **Lau, K.V.**, Anjanappa, S., Sperling, E.A., The SGP Collaborative Team. The Sedimentary Geochemistry and Paleoenvironments Project (SGP): a collaborative approach to statistical analyses of deep-time data. Goldschmidt Honolulu.

Karas, J., **Lau, K.V.** Quantitative modeling of calcium and strontium isotope cycles to the ocean to predict responses to flux perturbations. Northeast Geobiology Symposium, MIT.

**2021:**

Bowman, C.N., Marshall, M.S., Owens, J.D., Young, S.A., **Lau, K.V.** Paleo-redox conditions of the eastern margin of the Permian Phosphoria Basin, eastern Idaho, USA. AGU Fall Meeting

Taylor, K., Kalderon-Asael, B., Payne, J., Ibarra, D., Lehrmann, D., Yu, M., Altiner, D., **Lau, K.** Early Triassic Weathering Intensity and Climate Recovery after the end-Permian Extinction. AGU Fall Meeting.

Kukla, T., **Lau, K.V.**, Rugenstein, J.K.C., Ibarra, D.E. Multiple stable states of global climate do not persist because of a balanced long-term carbon cycle. AGU Fall Meeting.

Pulkit, S., Lu, W., Lu, Z., Jost, A., **Lau, K.**, Bachan, A., van de Schootbrugge, B., Payne, J.L. Redox Dynamics and Reduced Benthic Faunal Abundance Across the Triassic-Jurassic Mass Extinction. AGU Fall Meeting.

\***Lau, K.V.**, Hülse, D., van de Velde, S.J., Arndt, S., Meyer, K., Ridgwell, A. Extreme Climate Effects on Nutrient Recycling: Impacts on Marine Deoxygenation and Implications for Reconstructing  $p\text{CO}_2$  Excursions. AGU Fall Meeting.

Pulkit, S., Lu, W., Lu, Z., Jost, A., **Lau, K.**, Bachan, A., van de Schootbrugge, B., Payne, J.L. Redox dynamics and reduced benthic faunal abundance across the Triassic-Jurassic mass extinction. GSA Connects.

\***Lau, K.V.**, Hardisty, D.S. A New Model-Data Comparison: Promises and Pitfalls of Paleoredox Proxies in Carbonate Rocks. GSA Connects.

\***Lau, K.V.**, Hülse, D., van de Velde, S.J., Arndt, S., Meyer, K., Ridgwell, A. Temperature-driven nutrient recycling controlled the global redox landscape during the end-Permian mass extinction. GSA Connects.

Romaniello, S.J., **Lau, K.V.**, Sabbatino, M., Parente, M. A Revised Paradigm for the Interpretation of  $\delta^{238}\text{U}$  During Periods of Calcite Seas. Goldschmidt Virtual.