# Zunli Lu

Address: 310 Heroy Geology Lab, Syracuse University, Syracuse, NY, 13244

Office: (315) 443-0281

Email: zunlilu@syr.edu

SU webpage: http://thecollege.syr.edu/people/faculty/pages/ear/Lu-Zunli.html

Google Scholar: <https://goo.gl/w323im>

**EDUCATION AND EMPLOYMENT**

2017- Department of Earth Sciences, Syracuse University

Associate Professor

2011-2017 Department of Earth Sciences, Syracuse University

Assistant Professor

2008-2011 Department of Earth Sciences, University of Oxford

Post-doctoral Research Associate

“Ikaite as a paleo-environmental proxy” Advisor: Ros Rickaby

2005-2008 Department of Earth and Environmental Sciences, University of Rochester

Ph.D. “Halogen and I-129 Systematics in Gas Hydrate Fields: Implications for the Transport of Iodine and Methane in Active Margins” Advisor: Udo Fehn

2003-2005 Department of Earth and Environmental Sciences, University of Rochester

M.S. Geological Sciences

1998-2002 Department of Earth Sciences, Nanjing University

B.S. Geochemistry

**FUNDING**

“The fate and impact of halogens in dynamic water environment” 2018-2019, CUSE Grant $29,940 (Lead-PI Zunli Lu, co-PI Kristina Gutchess, Christa Kelleher, Teng Zeng, Li Jin)

“Collaborative Research: Refining foraminiferal I/Ca as a paleoceanographic oxygenation proxy for the glacial Atlantic Ocean” 2017-2019, NSF OCE $423,739 (Lu $300,538; Andy Ridgwell UC-Riverside $63,938; Ellen Thomas Yale $59,263)

“Seasonality, Summer Cooling, and Calibrating the Approach of the Icehouse in Late Eocene Antarctica” 2016-2018, NSF PLR $312,182 (Lead-PI Linda Ivany Syracuse University, co-PI Scott Samson, Zunli Lu, Christopher Junium)

“Collaborative Research: Iodine-Calcium Ratios in Modern Carbonate Sediments: Developing a Novel Proxy for Evolving Surface Oxygenation in Precambrian Oceans” 2014-2016, NSF EAR $319,989 (Lu $139,989; Tim Lyons UC-Riverside $180,000)

“Collaborative Research: Consequences of sub-lethal hypoxia exposure for teleosts tracked with biogeochemical markers: a trans-basin comparison” 2014-2017, NSF OCE $588,748 (Lu $47,224; Ben Walther TAMU $257,960; Karin Limburg SUNY ESF $283,564)

“Collaborative Research: Iodine in foraminifera as a proxy for ocean deoxygenation during the Paleocene- Eocene Thermal Maximum” 2012-2016, NSF OCE $399,479 (Lu $270,454; Ellen Thomas Yale University $150,929)

“Early Career: Acquisition of an Isotopic Liquid-Water Analyzer for Hydrology and Earth Science Research and Education at Syracuse University” 2012-2013, NSF EAR $88,098 (Lead-PI Laura Lautz Syracuse University, co-PI Zunli Lu, Gregory Hoke)

“RAPID: Developing sensitive tests for detecting water chemistry changes associated with shale bed methane production in the Appalachian Basin” 2013-2015, NSF EAR $95,574 (Lead-PI Laura Lautz, Syracuse University, co-PI Zunli Lu, Donald Siegel, Scott Samson, Gregory Hoke)

**PUBLICATIONS (\*Student authors):**

44. \*Lu, W., Ridgwell, A., Thomas, E., Hardisty, D. S., Luo, G., Algeo, T. J., Saltzman, M. R., Gill, B. C., Shen, Y., Ling, H.-F., Edwards, C. T., Whalen, M. T., Zhou, X., Gutchess, K. M., Jin, L., Rickaby, R. E. M., Jenkyns, H. C., Lyons, T. W., Lenton, T. M., Kump, L. R., and **Lu, Z**., 2018, “Late inception of a resiliently oxygenated upper ocean”. *Science*, v. 361, no. 6398, p. 174.

43. **\***Gutchess, K.M., Jin, L., Ledesma, J., Crossman, J., Kelleher, C., Lautz, L.K., **Lu, Z.,** 2017, “Long-term climatic and anthropogenic impacts on stream water salinity in New York State: INCA simulations offer cautious optimism”. *Environmental Science & Technology*, DOI: 10.1021/acs.est.7b04385

42. \*Lu, W., Zhao, W., Balsam, W., Lu, H., Liu, P., **Lu, Z**., & Ji, J., 2017. “Iron mineralogy and speciation in clay-sized fractions of Chinese desert sediments”. *Journal of Geophysical Research: Atmospheres*, 122.

41. Z. Levy, C. T. Mills, **Z. Lu**, M. B. Goldhaber, D. O. Rosenberry, D. M. Mushet, L. K. Lautz, \*X. Zhou, and D. I. Siegel., 2018, “Using halogens (Cl, Br, I) to understand the hydrogeochemical evolution of drought-derived saline porewater beneath a prairie wetland”. *Chemical Geology* 476, 191-207.

40. Edwards, C., Fike, D.A., Saltzman, M.R., \*Lu, W., and **Lu, Z.,** 2018, “Evidence for local and global redox conditions at an Early Ordovician (Tremadocian) mass extinction”. *Earth and Planetary Science Letters* 481, 125-135*.*

39. \*Lu, W., Wörndle, S., Halverson, G.P., \*Zhou, X., Bekker, A., Rainbird, R.H., Hardisty, D.S., Lyons, T.W., and **Lu, Z.,** 2017, “Iodine proxy evidence for increased ocean oxygenation during the Bitter Springs Anomaly”. *Geochemical Perspectives Letters*

38. \*Zhou, X., Jenkyns, H. C., \*Lu, W., Hardisty, D. S., Owens, J. D., Lyons, T. W., and **Lu, Z**., 2017, “Organically bound iodine as a bottom-water redox proxy: preliminary validation and application”. *Chemical Geology,* 457, 95-106.

37. Hardisty, D.S., **Lu, Z**., Bekker, A., Diamond, C.W., Gill, B.C., Jiang, G., Kah, L.C., Knoll, A.H., Loyd, S.J., Osburn, M.R., Planavsky, N.J., Wang, C., \*Zhou, X., Lyons, T.W., 2017 Perspectives on Proterozoic surface ocean redox from iodine contents in ancient and recent carbonate. *Earth and Planetary Science Letters* 463, 159-170.

36. Owens, J.D., Lyons, T.W., Hardisty, D.S., Lowery, C., **Lu, Z**., Lee, B., and Jenkyns H.C., 2017. “Patterns of local and global redox variability during the Cenomanian–Turonian Boundary Event (OAE 2) recorded in carbonates and shales from central Italy”. *Sedimentology*. doi:10.1111/sed.12352.

35. **\***Zhou, X., Thomas, E., Winguth, A., Ridgwell, A., Scher, H., Rickaby, REM, and **Lu, Z.**, 2016. “Expanded oxygen minimum zones during the late Paleocene - early Eocene: hints from multi-proxy comparison and ocean modeling”. *Paleoceanography,* 31, doi:10.1002/2016PA003020.

34. **\***Gutchess, K.M., Jin, L., Lautz, L.K., Shaw, S.B., \*Zhou, X., **Lu, Z.,** 2016, “Chloride sources in urban and rural headwater catchments, central New York”. *Science of the Total Environment,* 565, 462–472.

33. **Lu, Z.,** Hoogakker, B.A.A., Hillenbrand C.D., \*Zhou, X., Thomas, E., \*Gutchess, K., \*Lu, W., Jones, L., Rickaby, R.E.M., 2016, “Oxygen depletion recorded in upper waters of the glacial Southern Ocean”. *Nature Communications,* 7:11146 doi: 10.1038/ncomms11146.

32. Christian, K.M., Lautz, L.K., Hoke, G.D., Siegel, D.I., **Lu, Z**., Kessler, J., 2015 “Methane occurrence is associated with sodium-rich valley waters in domestic wells overlying the Marcellus Shale in New York State”. *Water Resources Research*, 52, 206–226, doi:10.1002/2015WR017805.

31. Jin, L., Edmunds, M.W., **Lu, Z.**, Ma, J., 2015 “Geochemistry of sediment moisture in the Badain Jaran desert: Insights into palaeo-environmental changes and water rock interaction”. *Applied Geochemistry,* 63, 235-247.

30. \*Zhou, X., Jenkyns, H.C., Owens, J.D., Junium, C.K., Zheng, X., Sageman, B.B., Hardisty, D.S., Lyons, T.W., Ridgwell, A., and **Lu, Z.,** 2015, “The I/Ca proxy and upper ocean oxygenation dynamics across the Cenomanian–Turonian OAE 2”. *Paleoceanography*, 30, 510–526. doi:10.1002/2014PA002741. Cover story for that issue.

29. \*Zhou, X., **Lu, Z.,** Rickaby, R.E.M., Domack, E., and Wellner, J., 2015, “Ikaite abundance controlled by porewater phosphorus level: implications for extensive glendonite deposits”. *Journal of Geology*, Vol. 123, No. 3, pp. 269-281

28. **Lu, Z.,** \*Hummel, S.T., Lautz, L.K., Hoke, G.D., \*Zhou, X., Leone, J., and Siegel, D.I., 2015, “Iodine as a sensitive tracer for detecting influence of organic-rich shale in shallow groundwater”. *Applied Geochemistry*, Vol. 60, pp. 29–36.

27. \*Zhou, X.,Thomas, E., Rickaby, R.E.M., Winguth, A.M.E., and **Lu, Z.,** 2014, “I/Ca evidence for upper ocean deoxygenation during the Paleocene‐Eocene Thermal Maximum (PETM)”. *Paleoceanography*, DOI: 10.1002/2014PA002702.

26. Lautz, L.K., Hoke, G.D., **Lu, Z.,** Siegel, D.I., Christian, K., Kessler, J.D., and Teale, N.G., 2014, “Using Discriminant Analysis to Determine Sources of Salinity in Shallow Groundwater Prior to Hydraulic Fracturing”. *Environmental Science & Technology*, 48 (16), 9061-9069.

25. Hardisty, D.S., **Lu, Z.,** Planavsky, N.J., Bekker, A., Philippot, P., \*Zhou, X. and Lyons T.W., 2014, “An iodine record of Paleoproterozoic surface ocean oxygenation”. *Geology*, G35439. 1.

24. Limburg, K.E., Walther, B.D., **Lu, Z.,** Jackman, G., Mohan, J., Weber, P.K., Schmitt, A.K., 2015, “In search of the dead zone: use of otoliths for tracking fish exposure to hypoxia”. *Journal of Marine Systems*, 141, 167-178.

23. **Lu, Z.,** 2013, Comment on “Iodine-129 and Iodine-127 Speciation in Groundwater at the Hanford Site, U.S.: Iodate Incorporation into Calcite”. *Environmental Science & Technology*, 47 (22), pp.13203–13204. DOI: 10.1021/es404049s

22. Jin, L., Whitehead, P.G., Futter, M.N. and **Lu, Z.,** 2012, Modeling the impacts of climate change on flow and nitrate of the River Thames: Assessing potential adaption strategies. *Hydrology Research*, vol. 43, pp.902-916. doi: 10.2166/nh.2011.080

21. Jin, L., Siegel, D.I., Lautz, L.K., and **Lu, Z.,** 2012, Identifying streamflow sources during spring snowmelt using water chemistry and isotopic composition in semi-arid mountain streams. *Journal of Hydrology*, vol. 470–471, pp. 289–301

20. **Lu, Z.,** Rickaby, R.E.M., Kennedy H., Kennedy, P., Shaw S., Lennie, A., Pancost, R.D., Wellner, J., and Anderson, J.B., 2011, An ikaite record of late Holocene climate at the Antarctic Peninsula. *Earth and Planetary Science Letters*, vol.325-326, pp. 108-115, doi:10.1016/j.epsl.2012.01.036

19. Küpper, F. C., Feiters, M. C., Olofsson, B., Kaiho, T., Yanagida, S., Zimmermann, M. B., Carpenter, L. J., Luther, G. W., **Lu, Z.,** Jonsson, M. and Kloo, L., 2011, Commemorating Two Centuries of Iodine Research: An Interdisciplinary Overview of Current Research. *Angewandte Chemie International Edition*, 50: 11598–11620. doi: 10.1002/anie.201100028

18. **Lu, Z.,** Tomaru, H., and Fehn, U., 2011, Comparison of iodine dates from mud volcanoes and gas hydrate occurrences: relevance for the movement of fluids and methane in active margins. *American Journal of Science*. Vol. 311, (632–650), DOI 10.2475/07.2011.03

17. **Lu, Z.,** Jenkyns, H.C., and Rickaby, R.E.M., 2010, Iodine to calcium ratios in marine carbonate as a paleo-redox proxy during oceanic anoxic events. *Geology*, 38(12), 1107–1110.

16. **Lu, Z.,** Rickaby, R.E.M., Wellner, J., Georg, B., Charnley, N., Anderson, J.B. and Hensen C., 2010. Pore fluid modeling approach to identify recent meltwater signals on the west Antarctic Peninsula. *Geochem. Geophys. Geosyst*., 11, Q06017, Doi 10.1029/2009gc002949.

15. Scholz, F., Hensen, C., **Lu, Z.,** and Fehn, U., 2010. Controls on the I-129/I ratio of deep-seated marine interstitial fluids: 'Old' organic versus fissiogenic 129-iodine. *Earth and Planetary Science Letters*, 294(1-2), 27-36.

14. **Lu, Z.,** Fehn U., Zhao X., Kieser W.E. and Tomaru H., 2010, Comparison of three chemical extraction methods for I-129 determinations: *Nuclear Instruments and Methods in Physics Research B*, 268, 952–955.

13. Tomaru, H., Fehn, U., **Lu, Z.,** Takeuchi, R., Inagaki, F., Imachi, H., Kotani, R., Matsumoto R., and Aoike, R., 2009, Dating of Dissolved Iodine in Pore Waters from the Gas Hydrate Occurrence Offshore Shimokita Peninsula, Japan: 129I Results from the D/V Chikyu Shakedown Cruise. *Resource Geology*, 59(4), 359-373.

12. Tomaru, H., **Lu, Z.,** Fehn, U., and Muramatsu Y., 2009, Origin of hydrocarbons in the Green Tuff region of Japan: 129I results from oil ﬁeld brines and hot springs in the Akita and Niigata Basins : *Chemical Geology*, v. 264, p. 221-231.

11. **Lu, Z.,** Hensen, C., Fehn, U., and Wallmann, K., 2008, Halogen and 129I systematics in gas hydrate fields at the northern Cascadia margin (IODP Expedition 311): Insights from numerical modeling: *Geochem. Geophys. Geosyst*., 9, Q10006, doi:10.1029/2008GC002156.

10. **Lu, Z.,** Tomaru, H., and Fehn, U., 2008, Iodine ages of pore waters at Hydrate Ridge (ODP Leg 204), Cascadia Margin: implications for sources of methane in gas hydrates: *Earth and Planetary Science Letters*, v. 267, p. 654-665.

9. **Lu, Z.,** Hensen, C., Fehn, U., and Wallmann, K., 2007, Old iodine in fluids venting along the Central American convergent margin: *Geophysical Research Letters* 34, L22604, doi: 22610.21029/22007GL031864.

8. **Lu, Z.,** Fehn, U., Tomaru, H., Elmore, D., and Ma, X., 2007, Reliability of 129I/I ratios produced from small sample masses: *Nuclear Instruments and Methods in Physics Research B*, v. 259, p. 359-364.

7. Tomaru, H., **Lu, Z.,** Fehn, U., Muramatsu, Y., and Matsumoto, R., 2007 Age variation of pore water iodine in the eastern Nankai Trough, Japan: evidence for different methane sources in a large gas hydrate field: *Geology*, v.35, p.1015-1018.

6. Tomaru, H., **Lu, Z.,** Snyder, G.T., Fehn, U., Hiruta, A., and Matsumoto, R., 2007, Origin and age of pore waters in an actively venting gas hydrate field near Sado Island, Japan Sea: interpretation of halogen and 129I distributions: *Chemical Geology*, v. 236, p. 350-366.

5. Tomaru, H., Fehn, U., **Lu, Z.L**., and Matsumoto, R., 2007, Halogen systematics in the Mallik 5L-38 gas hydrate production research well, Northwest Territories, Canada: Implications for the origin of gas hydrates under terrestrial permafrost conditions: *Applied Geochemistry*, v. 22, p. 656-675.

4. Tomaru, H., Ohsawa, S., Amita, K., **Lu, Z.L.,** and Fehn, U., 2007, Influence of subduction zone settings on the origin of forearc fluids: Halogen concentrations and I-129/I ratios in waters from Kyushu, Japan: *Applied Geochemistry*, v. 22, p. 676-691.

3. Fehn, U., **Lu, Z.,** and Tomaru, H., 2006, Data Report: 129I/I ratios and halogen concentrations in pore water of Hydrate Ridge and their relevance for the origin of gas hydrates: A progress report: *Proceedings of the Ocean Drilling Program, Scientific Results*, v. 204.

2. **Lu, Z.,** Ling, H.F., Zhou, F., Jiang, S., Chen, X., and Zhou, H., 2005, Variation of the Fe/Mn ratio of ferromanganese crusts from the Central North Pacific: implication for paleoclimate changes: *Progress in Natural Science*, v. 15, p. 530-537.

1. Ling, H.F., Jiang, S.Y., Frank, M., Zhou, H.Y., Zhou, F., **Lu, Z.L.,** Chen, X.M., Jiang, Y.H., and Ge, C.D., 2005, Differing controls over the Cenozoic Pb and Nd isotope evolution of deepwater in the central North Pacific Ocean: *Earth and Planetary Science Letters*, v. 232, p. 345-361.

**INVITED TALKS**

2018 Fall: GSA annual meeting, keynote, “Earth history of oxygen and the iProxy”

2018 Fall: University of Rochester “Earth history of oxygen and the iProxy”

2018 Fall: Ocean Deoxygenation Conference (Kiel, Germany), keynote, “Looking back into the future with a geochemical oxygenation proxy (I/Ca)”

2017 Fall: Texas A&M “Earth history of oxygen and the iProxy”

2017 Spring: Rutgers University “I/Ca as an oxygenation proxy: co-evolution of life and planet”

2016 Summer: Tongji Univeristy “I/Ca as an oxygenation proxy: Precambrian to Pleistocene”

2016 Summer: Xiamen University “I/Ca as an oxygenation proxy: co-evolution of life and planet”

2016 Summer: University of Science and Technology of China “I/Ca as an oxygenation proxy: co-evolution of life and planet”

2016 Summer: China University of Geosciences “I/Ca as an oxygenation proxy: Precambrian to Pleistocene”

2016 Spring: Princeton University “I/Ca as an oxygenation proxy: Precambrian to Pleistocene”

2015 Fall: AGU “A Phanerozoic I/Ca compilation: potential links to ocean oxygenation, carbon cycle and bio-diversification”

2015 Fall: Columbia University “I/Ca as an oxygenation proxy: Precambrian to Pleistocene”

2014 Spring: SUNY Binghamton “The tale of the O2: the voyage with the purple eye”

2014 Spring: Nanjing University “The tale of the O2: the voyage with the purple eye”

2013 Fall: AGU “I/Ca in foraminiferal shells as a paleoceanographic proxy”

2013 Spring: University of Rochester “Potential of ikaite as a paleo-environmental proxy: from Holocene ice-sheet stability to Mesozoic phosphorous cycling”

2012 Spring: Yale University “Potential of ikaite as a paleo-environmental proxy: from Holocene ice-sheet stability to Mesozoic phosphorous cycling”

2012 Spring: University at Buffalo “Potential of ikaite as a paleo-environmental proxy: from Holocene ice-sheet stability to Mesozoic phosphorous cycling”

2011 Spring: Northwestern University “I/Ca ratios in marine carbonate as a paleo-redox proxy during oceanic anoxic events”

2011 Spring: UC Riverside “I/Ca ratios in marine carbonate as a paleo-redox proxy during oceanic anoxic events”

2010 Fall: IFM-GEOMAR, Kiel, Germany “I/Ca ratios in marine carbonate as a paleo-redox proxy during oceanic anoxic events”

2010 Fall: Scottish Association for Marine Science, Oban, UK “Iodine as a natural tracer for the migration of subsurface fluid flow and methane”

2007 Spring: State key Laboratory of loess and Quaternary Geology, Xian, China. “I-129 investigations in active continental margins”

**TEACHING**

EAR 111 Climate Change: 2011-2018, yearly, 250 students each year

EAR 205 Water and the Environment: 2014-2015, yearly, 60 students each year

EAR 419/619 Aqueous Geochemistry: 2011-2015, biannually, 5 students each year

EAR 400/600 Chemical Oceanography: 2015, 6 students

**SERVICE**

**Professional:** Associate editor of Marine and Petroleum Geology; Session conveners for AGU Fall Meeting and Goldschmidt conferences; Reviewer for European Research Council; Panelist and reviewer for National Science Foundation (Marine Geology and Geophysics, Sedimentary Geology and Paleobiology, Geobiology and Low-Temperature Geochemistry).

**Journal reviewer:** Science Advances; Nature Geoscience; Geology; Earth and Planetary Science Letters; Geochimica et Cosmochimica Acta; Paleoceanography; Chemical Geology; G-cubed; Palaeogeography, Palaeoclimatology, Palaeoecology; Biogeosciences; Marine Chemistry; Scientific Reports; Marine and Petroleum Geology; Environmental Science & Technology; Water Resources Research; Science of the Total Environment; Ground Water; Quaternary International; PLOS ONE; The Cryosphere.

**University:** Curriculum Committee at the College of Arts and Sciences; Slepecky Undergraduate Research Awards Reviewing Committee; SU Water Initiative Advisory Board; Earth Science Department Chair review/nomination committee

**Department:** Director of Graduate Studies; Graduate Advisory Committee; Curriculum Committee; Faculty Hiring Search Committee; Space Committee; Analytical Facilities Committee; Thesis committees for 9 graduate students

**GRADUATE STUDENTS**

2018- PhD Ruliang He

2015- PhD Wanyi Lu

2016-2018 MS Shannon Garvin

2013-2018 PhD Kristina Gutchess

2011-2016 PhD Xiaoli Zhou

2011-2013 MS Sunshyne Hummel

**HORNORS**

2017 Excellence in Graduate Education Award, Syracuse University

2017 Syracuse Center of Excellence Faculty Fellow

2008-2009 British Council, Research Exchange Fund

2007 MARGINS Student Prize for outstanding presentation, AGU

2003-2005 Sproull Fellowship, University of Rochester

2002 Thesis with High Distinction, Nanjing University

1998-2002 Renmin Scholarship, Nanjing University