

JIHUA HAO

jihuahao.com

Department of Marine and Coastal Sciences, Rutgers University

71 Dudley Rd., New Brunswick, NJ 08901-8520

E-mail: haojihua@gmail.com

[Google Scholar](#): Jihua Hao; [ORCID](#): 0000-0003-3657-050X

Education

- **Ph.D. in Geochemistry** May 2017
Johns Hopkins University, Baltimore, USA
Advisor: Prof. Dimitri A. Sverjensky
Dissertation: Geochemical signatures of weathering and surface water chemistry in the late Archean
- **M.A. in Geochemistry** Mar. 2014
Johns Hopkins University, Baltimore, USA
- **B.Eng. in Environmental Science** July 2012
University of Science and Technology of China, Hefei, China

Employment

- **Postdoctoral Researcher** Sep. 2019 –
NASA Astrobiology Institute, Rutgers University, USA
- **Postdoctoral Fellow** Dec. 2016 – Aug. 2019
Institut des Origines de Lyon, Université de Lyon, France
- **Research & Teaching Assistant** 2012 – 2016
Department of Earth and Planetary Sciences, Johns Hopkins University, USA

Research Interests

- Early Earth surface environments
- Origin of life on Earth and habitability of life in other planets
- Photochemistry under planetary conditions
- High temperature and pressure aqueous geochemistry
- Interfacial geochemistry and mineral-water surface processes
- Thermodynamic theories with applications to geochemistry and environmental science
- Big data analysis of the co-evolution of the geo- and biospheres

Teaching Activities

- **Guest Lecturer**, Tsinghua University, China
Planets and Life (Prof. F. Tian), 1 lecture entitled “Evolution of the Earth: a brief introduction”, 2017 Fall.
- **Teaching Assistant**, Johns Hopkins University, USA
Introduction to Sustainability (Prof. C. Parker), 2015 Spring.
Guided Tour: The Planets, (Prof. B. Marsh; Prof. D. Strobel), 2014 Spring.
Conversations with the Earth, (Prof. B. Marsh; Prof. D. Strobel), 2013 Fall.
- **Mentor**
Undergraduates at Ens-Lyon: Elena Giovenco (2017); Pauline Rocher(2017), Quentin Reynard-Feytis (2018); Marwane Mokhtari (2018); Valentine Magevand (2019); Cécile Bourquin (2019)

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Publications

- 2019, Huang, J., **Hao, J.**, Huang, F., Sverjensky, D. Mobility of chromium in high-temperature crustal and upper mantle fluids. *Geochemical Perspectives Letters* (**accepted**)
- 2019, Pedreira-Segade, U., **Hao, J.**, Montagnac, G., Cardon, H., Daniel, I. Spontaneous polymerization of glycine under hydrothermal conditions. *ACS Earth and Space Chemistry* (**in press**)
- 2019, **Hao, J.**, Sverjensky, D.A., and Hazen, R.M. Redox states of Archean surficial environments: the importance of H_{2,g} instead of O_{2,g} for weathering reactions. *Chemical Geology*, 521, 49-58.
- 2019, **Hao, J.**, Mokhtari, M., Pedreira-Segade, U., Michot, L.M., and Daniel, I. Transition metals enhance the adsorption of nucleotides onto clay: implications for the origin of life. *ACS Earth and Space Chemistry*, 3(1), 109-119.
- 2018, Pedreira-Segade, U., **Hao, J.**, Razafitianamaharavo, A., Pelletier, M., Marry, V., Le Crom, S., Michot, L., Daniel, I. How do nucleotides adsorb onto clays? *Life*, 8(4), 59.
- 2018, **Hao, J.**, Giovenco, E., Pedreira-Segade, U., Montagnac, G., Daniel, I. Compatibility of amino acids in ice Ih: implications for the origin of life. *Astrobiology*, 18, 381-392. **Featured and cover article**
- 2018, Moore, E.K., **Hao, J.**, Prabhu, A., Zhong, H., Jelen, B.I., Meyer, M., Hazen, R.M., Falkowski, P.G. Geological and chemical factors that impacted the biological utilization of cobalt in the Archean era. *Journal of Geophysical Research: Biogeosciences*, 123, 743-759.
- 2017, **Hao, J.**, Sverjensky, D.A., and Hazen, R.M. Mobility of nutrients and trace elements during weathering on the Archean. *Earth and Planetary Science Letters*, 478, 148-159.
- 2017, Estrada, C.F., Mamajov, I., **Hao, J.**, Sverjensky, D.A., Cody, G.D., Hazen, R.M. Aspartate transformation at 200 °C with brucite [Mg(OH)₂], NH₃, and H₂: implications for prebiotic molecules in hydrothermal systems. *Chemical Geology*, 457, 162-172. **Invited research article**
- 2017, **Hao, J.**, Sverjensky, D.A. and Hazen, R.M. A model for late Archean chemical weathering and world average river water. *Earth and Planetary Science Letters*, 457, 191-203.

Manuscripts submitted

- Moore*, E.K., **Hao***, J., Spielman, S.J., Yee, N. The Evolving Redox Chemistry and Bioavailability of Vanadium in Deep Time (*co-first author). *Geobiology* (**under review**)
- **Hao, J.**, Rocher, P., Reynard-Feytis, Q., Cardon, H., Montagnac, G., Daniel, I. Compatibility of amino acids in ice VI and VII: delivery of organics through the icy mantle in ocean bodies. *Geophysical Research Letters* (**under revision**)
- **Hao, J.**, Knoll, A.H., Fang, H., Hazen, R.M., Daniel, I. Cycling of phosphorus on the Archean Earth: Part I. Continental weathering and riverine transport of phosphorus. *Geochimica et Cosmochimica Acta* (**under review**).
- **Hao, J.**, Knoll, A.H., Fang, H., Schieber, J., Hazen, R.M., Daniel, I. Cycling of phosphorus on the Archean Earth: Part II. Phosphorus Limitation on Primary Production in Archean Ecosystems.
- Barbier, S., Huang, F., Andreani, M., Tao, R., **Hao, J.**, Eleish, A., Prabhu, A., Minhas, O., Fontaine, K., Fox, P., Daniel, I. Abiotic hydrocarbon formation in serpentinization experiments: network analysis on a comprehensive dataset

Manuscripts in preparation

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- **Hao, J.**, Pedreira-Segade, U., Michot, L.M., and Daniel, I. Effects of transition metals on the adsorption of nucleotides onto non-swelling clays
- **Hao, J.**, Huang, J., Cao, X., Sverjensky, D.A., and Hazen, R.M. Chromium redox equilibria in fluids and water-rock interactions during metamorphism.

Honors and Awards

- International Union of Crystallography Travel Award, International Union of Crystallography, USA, 2018
- Postdoctoral Fellowship, Institut des Origines de Lyon, Université de Lyon, France, 2016 - 2019
- Early Career Science Ambassador, European Association of Geochemistry, 2017
- Pre-doctoral Associate, Geophysical Laboratory, Carnegie Institution of Washington, USA, 2013 - 2016
- Elliott Field Fund for field research expenses, Johns Hopkins University, 2016
- US Student NASA Funding-Goldschmidt 2016, NASA, 2016
- DCO travel grant, Deep Carbon Observatory, 2014
- Ph.D. Fellowship, Johns Hopkins University, USA, 2012
- Zhao JIUZHANG Scholarship, Chinese Academy of Sciences, China, 2011
- National Scholarship, Ministry of Education, China, 2010

Invited Seminars and Colloquia

- 2019, Habitability of early Earth and other water planets, Macau University of Science and Technology, Macau, China
- 2018, Geochemistry of nutrients and transition metals on the early Earth: implications for the evolution of habitability, Sun Yat-Sen University, Shenzhen, China
- 2018, Geochemistry of trace elements: co-evolution of geosphere and biosphere, China University of Geosciences, Wuhan, China
- 2018, Mineral, water, and biomolecules: how to make life? University of Science and Technology of China, Hefei, China
- 2018, Effects of trace elements on the surface adsorption of nucleotides onto clay minerals, Université Claude Bernard Lyon1, Lyon, France.
- 2017, Geochemical environments of the Earth and other habitable planets: implications for the origin of life, Louisiana State University (Bao's group), Baton Rouge, USA.
- 2017, Geochemical environments of the early Earth: implications for the origin and evolution of life, The 1st International Young Scholars Geo-Symposium, Peking University, China.
- 2015, Earth prebiotic environment & the origin of life, Department of Geochemistry and Environmental Sciences, University of Science and Technology, Hefei, China, China.
- 2014, Basaltic and granitic weathering during the Archean: including thermodynamic properties of ferrous-clay minerals, Deep Carbon Observatory Forum, Geophysical Laboratory, Carnegie Institution of Washington, USA.

Conference Presentations (First Authors)

- 2019, Effects of transition metals on the adsorption of nucleotides onto clay mineral surfaces: implications for the origin of life, *International Conference on Clay Science and Technology*, Paris, France.

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- 2019 (**INVITED**), Effects of temperature and pressure on the interaction between mineral surfaces and life elements: implications for the origin and early evolution of life, *Astrobiology Science Conference*, Bellevue, USA.
- 2018, Transition metals enhance the adsorption of nucleotides onto clays: implications for the origin of life, *Goldschmidt Conference*, Boston, USA.
- 2018, Late Archean weathering of phosphorus: implications for Earth's early P cycle, *4-D workshop*, Washington DC, USA.
- 2017, Compatibility of amino acids in ice Ih and high-pressure phases: implications for the origin of life, *AGU Fall Conference*, New Orleans, USA.
- 2017, Compatibility of amino acids in ice Ih: implications for the origin of life, *Goldschmidt Conference*, Paris, France.
- 2016, Importance of atmospheric H₂ in surficial environments of the Archean, *Second DCO Yellowstone Summer School*, USA.
- 2016, Weathering and late Archean riverine transport, *Australasian Astrobiology Meeting*, Perth, Australia.
- 2016, Weathering and late Archean world average river water, *Goldschmidt Conference*, Yokohama, Japan.
- 2015, Chromium redox equilibria in fluids and minerals under hydrothermal and subduction-zone conditions, *AGU Fall Conference*, San Francisco, USA.
- 2015, Equilibrium chromium isotopic fractionation as functions of redox and pH on the early Earth, *Goldschmidt Conference*, Prague, Czech Republic.
- 2014, Limits on the partial pressure of H₂ in the Archean atmosphere during weathering of basaltic minerals, *Goldschmidt Conference*, Sacramento, California, USA.

Current and Recent Research Projects

- Role of Clay minerals and trace elements on the condensation and polymerization of DNA-RNA oligomers and their building blocks in primitive Earth. CNRS Défi Origines: AAP 2018, France, 2018-2019.
- Primitive Earth Biomolecules Interacting with Hydrothermal Oceanic Minerals, Agence Nationale de la Recherche, France, 2016-Present.
- The Co-Evolution of the Geo- and Biospheres: An Integrated Program for Data-Driven, Abductive Discovery in the Earth Sciences, Keck Foundation, USA, 2015-Present

Laboratory Skills

- **Analytical techniques:**
Ion Chromatography with Dionex ICS-5000 DP dual pump system; UV-spectroscopy; Raman Spectroscopy; Scanning Electron Microscope (SEM); X-ray Diffraction (XRD)
- **Interfacial geochemistry:**
Batch adsorption techniques under ambient *T-P*; high *T-P* adsorption facility
- **High *T-P* experiments on hydrothermal systems:**
PUK 3S Plus Professional Precision Welder; Gold tubes/gold bag hydrothermal techniques; Teflon autoclave reactors; Diamond anvil cell facilities

Modeling Skills

- **Aqueous speciation & water-rock interaction modeling under crustal and upper mantle conditions:**

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SUPCRT92b, EQ3/6 codes, EQPT, Deep Earth Water Model

- **Surface chemistry modelling:** Geosurf.

Service

- Reviewer
Nature Communications, Geochimica et Cosmochimica Acta, Chemical Geology, American Mineralogist, Frontiers in Earth Sciences, Origin of Life and Evolution of Biospheres, European Journal of Mineralogy, Journal of Visualized Experiments, AIMS Geosciences
- Session convener
“B6: The roles of clay minerals in the origin of life”, 2019 International Conference on Clay Science and Technology, Paris, France.
“07h: Planetary habitability and the origin of life: from solar system to exoplanets”, 2019 Goldschmidt Conference, Barcelona, Spain.
“83144: Big Data and Data Mining in Deep Time”, 2019 AGU Fall meeting, San Francisco, California, USA.
- Memberships:
The International Society for the Study of Origin of Life; European Association of Geochemistry; the Deep Carbon Observatory.

Languages

- Mandarin Chinese (native), English (proficient), French (beginner)

Outreach

- 2018, Diamond – a window to the interiors of the Earth and other planets, invited event speaker at Espace-Ulys, University of Lyon, Lyon, France.