

# JIHUA HAO

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## Education

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

## Employment

- **Professor** Feb. 2024 - Present  
School of Earth & Space Sciences, USTC, Hefei, China
- **Senior Research Scientist** April 2023 – Jan. 2024  
Deep Space Exploration Laboratory, Hefei, China
- **Senior Research Scientist (PhD supervisorship)** Jan. 2021 – Oct. 2023  
School of Earth & Space Sciences, USTC, Hefei, China
- **Research Investigator** Jan. 2021 – Present  
Blue Marble Space Institute of Science, Seattle, Washington, USA
- **Postdoctoral Researcher** Sep. 2019 – Dec. 2020  
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

- Habitability of the early Earth and planetary oceans
- Photochemistry under planetary conditions
- Origin of life hypotheses
- Thermodynamic theories with applications to geochemistry and environmental science

## Teaching Activities

- **Instructor**, University of Science and Technology of China, China  
Astrobiology, 2023 Fall.  
Science and Society, 2023 Fall and 2024 Spring.
- **Co-instructor**, Rutgers University, USA  
One lecture in History of Earth Systems (Prof. P. Falkowski), 2019 Fall.  
One lecture in Chemical Oceanography (Prof. S. Severmann), 2020 Spring.

- **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.
- **Mentorship**  
Current graduate students at USTC: Can Liu; Weiming Xu; Zongbin Zhang; Jie Li; Xing Li; Zhangqin Zheng; Cao Fang, Javed Mondal, Ao Zhang, Haotian Guo.  
Current graduate students outside of USTC: Shiyan Liu (HUT).  
Current undergraduate students at USTC: Shenglin Zhang; Chengtao Zhang; Ying Zhao.  
Current undergraduate students outside of USTC: Yuxuan Cai (Hohai University).  
Graduate students at Rutgers University: Orion Farr (2020 Fall).  
Undergraduates at Rutgers University: Nolan Fehon (2019, 2020); Havishk Tripathi (2020).  
Undergraduates at Ens-Lyon: Elena Giovenco (2017); Pauline Rocher (2017), Quentin Reynard-Feytis (2018); Marwane Mokhtari (2018); Valentine Magevand (2019); Cécile Bourquin (2019).
- **USTC Astrobiology Lab alumni (graduation year)**  
Postdoc: Xing Cui (visitor from University of Hong Kong, 2023).  
Graduate students: Haofan Jiang (co-mentored with Prof. Gentao Zhou; 2022).  
Undergraduate students: Jiawei Wang (2022; Cornell University); Xi Chen (2022; Brown University); Guofan Yan (HUT).  
Summer interns: Angela Murphy (2022-23; Rutgers University); Siyuan You (2023; PSU).

## **Publications**

- 37. Zhang, S., Wang, H., Wang, X., Zheng, W., Hao, J., Pogge von Strandmann, P.A.E., Ye, Y., Shi, M., Liu, Y., Lyu, Y. (2024) Subaerial volcanism broke mid-Proterozoic environmental stasis. *Science Advances*, 10, eadk5991.
- 36. **Hao\***, J., Knoll, A.H., Cui, X., Song, Y., Jing, Z., Huang, F. (2024) Evolving weathering processes during the Archean Eon. Chapter in “The Archean Earth: Tempos and Events” (Homann, M., Altermann, W., Ernst, R., Heubeck, C., Lyons, T., Mason, P., Mazumder, R., Papineau, D., Stueeken, E., Zerkle, A., Webb, A., eds.)
- 35. Moore, E.K., Li, J., Zhang, A., **Hao, J.**, Morrison, S., Hummer, D., Yee, N. (2024). Uranium Redox and Deposition Transitions Embedded in Deep-Time Geochemical Models and Mineral Chemistry Networks, *Geochemistry, Geophysics, Geosystems*, 25, e2023GC011267.
- 34. Daga, K. R., Feray Çoşar, M., Lowenkron, A., **Hao\***, J., Rouillard\*, J. (2023). Environmental Stability and Its Importance for the Emergence of Darwinian Evolution. *Life*, 13(10), 1960.
- 33. Zheng, Z., Jin, J., Nie, Y., **Hao, J.**, Xue, Y., Liu, C., Chen, Y., Emslie, S.D., Liu, X. (2023) Historical population changes of Adelie penguins in the Ross sea region, Antarctica and its climatic forcings. *Quaternary Science Reviews*, 318, 108308.
- 32. Farr<sup>#</sup>, O., **Hao\***, J., Liu, W., Fehon, N., Reinfelder, J.R., Yee, N., Falkowski\*, P.G. (2023) Archean Phosphorus Recycling Facilitated by Ultraviolet Radiation. *PNAS*, 120 (30) e2307524120

- 31. Chen, C., Yi, R., Igisu, M., Sakaguchi, C., Afrin, R., Potiszil, C., Kunihiro, T., Kobayashi, K., Nakamura, E., Ueno, Y., Antunes, A., Wang, A., Chandru, K., **Hao, J.**, Jia, T.Z. (2023) Spectroscopic and biophysical methods to determine differential salt-uptake by primitive membraneless polyester microdroplets. *Small Methods*, 2300119.
- 30. Zhang, Z., Jiang, H., Ju, P., Pan, L., Rouillard, J., Zhou, G., Huang, F., **Hao, J.\***. (2023) Evaluating the abiotic synthesis potential and the stability of building blocks of life beneath an impact-induced steam atmosphere. *Frontiers in Microbiology* 14, 1032073.
- 29. Walton\*, C.R., **Hao\*, J.**, Huang, F., Jenner, F.E., Williams, H., Zerkle, A.L., Kipp, A., Hazen, R.M., Peters, S.E., Shorttle, O. Evolution of the crustal phosphorus reservoir. *Science Advances* 9 (18), eade6923
- 28. Liu, Y., Ling, Y., Yang, Z., Liu, X., Lei, J., **Hao, J.** (2023) Laboratory generation of hazes in Titan's upper atmosphere using ECR plasma. *Planetary and Space Science*, 229, 105661.
- 27. Walton, C.R., Ewens, S., Coates, J.D., Blake, R., Planavsky, N.J., Reinhard, C., Ju, P., **Hao\*, J.**, Pasek\*, M.A. (2023) Phosphorus availability on the early Earth and the impacts of life. *Nature Geoscience*
- 26. Andreani, M., Montagnac, G., Fellah, C., **Hao, J.**, Vandier, F., Daniel, I., Pisapia, C., Galipaud, J., Lilley, M.D., Fruh Green, G.L., Borensztajn, S., Menez, B. (2023) The rocky road to organics needs drying. *Nature Communications*, 14, 347.
- 25. Chen, J., Jiang, H., Tang, M., **Hao, J.**, Tian, M., Chu, X. (2022) Venus' light slab hinders its development of planetary-scale subduction. *Nature Communications* 13(7647).
- 24. **Hao\*, J.**, Glein, C., Huang, F., Yee, N., Catling, D., Hazen, R.M., Postberg, F., Hillier, J.K. (2022) Abundant phosphorus for life in the Enceladus ocean. *PNAS*, 119 (39), e2201388119
- 23. **Hao, J.**, Liu, W., Goff, J.L., Steadman, J.A., Large, R.R., Falkowski, P.G., Yee, N. (2022) Anoxic photochemical weathering of pyrite on Archean continents. *Science Advances* 8(26), eabn2226.
- 22. Zheng, Z., Wang, X., Jin, J., **Hao\*, J.**, Nie, Y., Chen, X., Mou, J., Emslie, S.D., Liu\*, X. (2022) Fraction distribution and dynamic cycling of phosphorus in lacustrine sediment at Inexpressible Island, Antarctica. *Environment International* 164, 107228.
- 21. Moore, E.K., Golden, J., Morrison, S., **Hao, J.**, Spielman, S.J. (2022) The expanding network of mineral chemistry throughout earth history reveals global shifts in crustal chemistry during the Proterozoic. *Scientific Reports* 12, 4956.
- 20. Tang, M., Chu, X., **Hao, J.**, Shen, B. (2021) Orogenic quiescence in Earth's middle age. *Science* 371 (6530), 728-731.
- 19. Montagnac, G., **Hao, J.**, Pedreira-Segade, U., Daniel, I. (2021) Detection of nucleotides absorbed onto clay by UV Resonant Raman Spectroscopy: a step towards the search for biosignatures on Mars. *Applied Clay Science* 200, 105824.
- 18. Zhou, Q., Jiang, Y., **Hao, J.**, Ji, J., Li#, W. (2021) Advances in the study of biogeochemical cycles of phosphorus (in Chinese), *Geological Journal of China Universities*, 27(2), 183-199.
- 17. Huang, F., Barbier, S., Tao, R., **Hao, J.**, and others. (2020) Dataset for H<sub>2</sub>, CH<sub>4</sub> and organic compounds formation during experimental serpentinization. *Geoscience Data Journal*.
- 16. Liu, W., **Hao, J.**, Yee, N., Elzinga, E.J., Piotrowiak, P., Nanda, V., Falkowski, P. (2020) Anoxic photogeochemical oxidation of manganese carbonate yields manganese oxide. *Proceedings of National Academy of Sciences. USA* 117(37).
- 15. Barbier, S., Huang, F., Tao, R., **Hao, J.**, et al. (2020) A review of H<sub>2</sub>, CH<sub>4</sub> and hydrocarbon formation in experimental serpentinization using network analysis, *Frontiers in Earth Science* 8

- 14. **Hao<sup>\*</sup>, J.**, Knoll, A.H., Fang, H., Schieber, J., Hazen, R.M., Daniel, I. (2020) Cycling of phosphorus on the Archean Earth: Part II. Phosphorus Limitation on Primary Production in Archean Ecosystems. *Geochimica et Cosmochimica Acta*, 280, 360-377.
- 13. Mignon, P., Corbin, G., Le Crom, S., Marry, V., **Hao, J.**, Daniel, I. (2020) Adsorption of Nucleotides on Clay Surfaces. Effects of mineral composition, pH and solution salts. *Applied Clay Science*, 190, 105544.
- 12. **Hao<sup>\*</sup>, J.**, Knoll, A.H., Fang, H., Hazen, R.M., Daniel, I. (2020) Cycling of phosphorus on the Archean Earth: Part I. Continental weathering and riverine transport of phosphorus. *Geochimica et Cosmochimica Acta*, 273, 70-84.
- 11. Moore<sup>#</sup>, E.K., **Hao<sup>#</sup>, J.**, Spielman, S.J., Yee, N. (2020) The Evolving Redox Chemistry and Bioavailability of Vanadium in Deep Time (\*co-first author). *Geobiology* 18(2), 127-138.
- 10. Huang, J., **Hao, J.**, Huang, F., Sverjensky, D. (2019) Mobility of chromium in high-temperature crustal and upper mantle fluids. *Geochemical Perspectives Letters* 12, 1-6.
- 9. Pedreira-Segade, U., **Hao, J.**, Montagnac, G., Cardon, H., Daniel, I. (2019) Spontaneous polymerization of glycine under hydrothermal conditions. *ACS Earth and Space Chemistry*, 3(8), 1669-1677.
- 8. **Hao<sup>\*</sup>, J.**, Sverjensky, D.A., and Hazen, R.M. (2019) Redox states of Archean surficial environments: the importance of H<sub>2,g</sub> instead of O<sub>2,g</sub> for weathering reactions. *Chemical Geology*, 521, 49-58.
- 7. **Hao<sup>\*</sup>, J.**, Mokhtari, M., Pedreira-Segade, U., Michot, L.M., and Daniel<sup>#</sup>, I. (2019) Transition metals enhance the adsorption of nucleotides onto clay: implications for the origin of life. *ACS Earth and Space Chemistry*, 3(1), 109-119.
- 6. Pedreira-Segade, U., **Hao, J.**, Razafitianamaharavo, A., Pelletier, M., Marry, V., Le Crom, S., Michot, L., Daniel<sup>#</sup>, I. (2018) How do nucleotides adsorb onto clays? *Life*, 8(4), 59.
- 5. **Hao<sup>\*</sup>, J.**, Giovenco, E., Pedreira-Segade, U., Montagnac, G., Daniel, I. (2018) Compatibility of amino acids in ice Ih: implications for the origin of life. *Astrobiology*, 18, 381-392. **Featured and cover article**
- 4. Moore, E.K., **Hao, J.**, Prabhu, A., Zhong, H., Jelen, B.I., Meyer, M., Hazen, R.M., Falkowski, P.G. (2018) Geological and chemical factors that impacted the biological utilization of cobalt in the Archean era. *Journal of Geophysical Research: Biogeosciences*, 123, 743-759.
- 3. **Hao<sup>\*</sup>, J.**, Sverjensky, D.A., and Hazen, R.M. (2017) Mobility of nutrients and trace elements during weathering on the Archean. *Earth and Planetary Science Letters*, 478, 148-159.
- 2. Estrada<sup>#</sup>, C.F., Mamajov, I., **Hao, J.**, Sverjensky, D.A., Cody, G.D., Hazen, R.M. (2017) Aspartate transformation at 200 °C with brucite [Mg(OH)<sub>2</sub>], NH<sub>3</sub>, and H<sub>2</sub>: implications for prebiotic molecules in hydrothermal systems. *Chemical Geology*, 457, 162-172.
- 1. **Hao<sup>\*</sup>, J.**, Sverjensky, D.A. and Hazen, R.M. (2017) A model for late Archean chemical weathering and world average river water. *Earth and Planetary Science Letters*, 457, 191-203.

## **Grants**

- 2023-, PI, Starting Grant for 100 Elite Program, 4 M RMB, Chinese Academy of Sciences, China
- 2021.12 – 2026.11, PI, National Key R&D Program, Grant # 2021YFA0718200, 5.33 M RMB, Ministry of Science and Technology of China, China
- 2022.01 – 2025.12, PI, Grant # 42173083, 610 K RMB, National Natural Science Foundation of China, China.

- 2021.10 – 2023.09, PI, University Cultivation Fund # KY2080000090, 50 K RMB, University of Science and Technology of China, China.
- 2021.07 – 2023.06, PI, CIFAR Azrieli Global Scholar Program, 100 K CAD, Canadian Institute for Advanced Research, Canada.
- 2021.01 – 2023.12, PI, Starting Grant # KY2080000082, 1 M RMB, University of Science and Technology of China, China.

### **Honors and Awards**

- F. W. Clarke Award, Geochemical Society, 2024
- Changjiang Scholar (Youth), Ministry of Science and Technology, China, 2022
- DAMO Young Fellow Outstanding Finalist Award, Alibaba Damo Academy, 2022
- USTC Tang Scholar, Cyrus Tang Foundation, 2022
- Thousand Talents Program-Youth, Chinese Academy of Sciences, 2021
- Thousand Talents Program-Youth, Anhui Province, 2021
- CIFAR Azrieli Global Scholar, Azrieli Foundation and Love Family Leadership Development Fund, Canada, 2021.

### **Recent Seminars and Colloquia**

- 2023: Anhui Geological Survey; BMSIS (online); NASA PCE3 (online); Early Earth Symposium (Peking University); Ningbo University; Northwest University; Chinese Academy of Geological Sciences.
- 2022: PetrolChina Research Institute of Petroleum Exploration and Development (online); ELSI, Japan (online); New Mars Underground Working Group (online); CIFAR (online); Deep Space Exploration Institute Colloquium (Hefei); Nanjing University (online); Institute of Geology and Geophysics, CAS (online).
- 2021: University of Leicester Geology Society, UK; Peking University (Beijing); China University of Geosciences (Beijing); Chengdu University of Technology (Chengdu); CIFAR, Canada (online); Northwest University (Xi'an); Hefei University of Technology (Hefei).
- 2020 (online): Rutgers University, USA; Montclair State University, USA; ETH-Zurich, Switzerland; Earth-Life Science Institute, Japan; University of Science and Technology of China, China; Huiming Bao's group, Nanjing University, China; China University of Geosciences, China; ENIGMA Annual Symposium, Rutgers University, USA; Peking University, Beijing, China
- 2019: Deep Sea Institute, China; Nanjing University, China; ENIGMA seminar, Rutgers University, USA; Macau University of Science and Technology, China
- 2018: Sun Yat-Sen University, China; China University of Geosciences, China; University of Science and Technology of China, China; Université Claude Bernard Lyon1, France.
- 2017: Louisiana State University (Bao's group), USA; Peking University, China.

### **Selected Conference Presentations (First Authors)**

- 2024, (**Medalist**), Availability of nutrients in the Enceladus ocean: Implications for habitability, Goldschmidt, Chicago, USA.
- 2024, (**Keynote**), Evolving weathering processes during the Archean Eon, Goldschmidt, Chicago, USA.

- 2023, (**Invited**), Evaluating the potential for abiotic synthesis of organic compounds in the subsurface ocean of Enceladus, Goldschmidt, Lyon, France.
- 2023, (**Invited**), “Light to life”: Important Roles of Photogeochemistry in Regulating the Availability of Nutrients on the Early Earth, NASA PCE3, online.
- 2022 (**Invited**), Evolution of early phosphorus cycle. Annual Meeting of Chinese Geoscience Union, Fuzhou, China.
- 2021 (**Invited**), The Archean phosphorus cycle and the implications for the early bioproductivity, 7th Youth Geoscience Workshop, Guiyang, China.
- 2020 (**online**), Abundant phosphorus for life in the Enceladus ocean, *AGU Fall Conference*.
- 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.

## **Service**

### ▪ **Reviewer**

Science Advances, Nature Communications; PNAS, Communications Earth & Environment; Geology; Geochimica et Cosmochimica Acta; Geophysical Research Letters; Precambrian Research; Science Bulletin; Astrobiology; Applied Clay Sciences; ACS Earth and Space Chemistry; Chemical Geology; Microorganisms; American Mineralogist; Frontiers in Earth Sciences; Mineralogical Magazine; Life; Origin of Life and Evolution of Biospheres etc.

Mars 2020 Participating Scientist Program; European Research Council Synergy Grants

### ▪ **Editorial services**

Fundamental Research (Youth Editor; 2024-2026); The Innovation (Youth Editor; 2021 - ); Applied Clay Science (Guest Editor; 2019); Frontiers in Earth Science (Reviewer Editor; 2021 - ).

### ▪ **Conference organizer**

#### **Conference organizing committee:**

Theme chair, Theme 9 Biogeochemical Cycles and Their Signatures, Goldschmidt Conference, 2024, Chicago, US

Secretary General, The 9<sup>th</sup> Young Scientist Forum of Earth Science, 2025, Hefei, China

Chairman, The 6th Young Scientist Forum of Planetary Science, 2025, Hefei, China.

#### **Session convener:**

The minerals and the fluids of the ocean worlds, 2022, 23rd general meeting of the IMA, Lyon, France.

105592: Photogeochemistry of air-mineral-water-life on Earth and extraterrestrial planets, 2020 AGU Fall meeting, San Francisco, California, USA.

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.

EP013: Application of data and machine learning in Earth science, 2019 AGU Fall meeting, San Francisco, California, USA.

### ▪ **Memberships**

Chinese Society for Mineralogy, Petrology and Geochemistry; International Society for the

Study of Origin of Life; American Geophysical Union; Deep Carbon Observatory; Origins of Life Early-career Network

### **Recent Outreach Activities**

- 2023, translation of Professor David Catling's book "Astrobiology: A Very Short Introduction", Yilin Press.
- 2023, lectures about Exploration of Alien Signals for middle and high school students.
- 2022, translation of Professor Jeffery McDonnell's book "Navigating an Academic Career: A Brief Guide for PhD Students, Postdocs, and New Faculty", USTC Press.
- 2021.01 – 2022.10, Advisory Board (1/2) of Chemical Planets official account on Wechat (most popular social media in China).