# JIHUA HAO

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## Education

- **Ph.D. in Geochemistry** (Nov. 2016 finished; degree awarded in 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

- **Senior Research Scientist (PhD supervisorship)** Jan. 2021 – Present
  School of Earth & Space Sciences, USTC, Hefei, China
- **Affiliate Research Scientist** 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

- Nutrient cycles on 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

- **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.
- **Mentor**

Graduate students at USTC: Can Liu; Weiming Xu; Zongbin Zhang; Jie Li; Xing Li.

Undergraduate students at USTC: Bianyu Gao; Chengtao Zhang; Zhiyi Chen; Jinyi Yan; Ao Zhang

Graduate students at Rutgers University: Sarah Newport (2019 Fall); Orion Farr (2020 Fall)

Undergraduates at Ens-Lyon: Elena Giovenco (2017); Pauline Rocher (2017), Quentin Reynard-Feytis (2018); Marwane Mokhtari (2018); Valentine Magevand (2019); Cécile Bourquin (2019)

Undergraduates at Rutgers University: Nolan Fehon (2019, 2020); Havishk Tripathi (2020).

## Publications

- 27. Walton, C.R., Ewens, S., Coates, J.D., Blake, R., Planavsky, N.J., Reinhard, C., Ju, P., **Hao[#], J.**, Pasek[#], M.A. Phosphorus availability on the early Earth and the impacts of life. *Nature Geoscience* (co-corresponding, accepted)
- 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. (**co-corresponding author**)
- 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 $H_2$, $CH_4$ 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 $H_2$, $CH_4$ and hydrocarbon formation in experimental serpentinization using network analysis, *Frontiers in Earth Science* 8

- 14. **Hao[#], 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[#], 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*[#], E.K., **Hao*, 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[#], J.**, Sverjensky, D.A., and Hazen, R.M. (2019) 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.
- 7. **Hao[#], J.**, Mokhtari, M., Pedreira-Segade, U., Michot, L.M., and Daniel[#], 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[#], I. (2018) How do nucleotides adsorb onto clays? *Life*, 8(4), 59.
- 5. **Hao[#], 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[#], 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[#], C.F., Mamajov, I., **Hao, J.**, Sverjensky, D.A., Cody, G.D., Hazen, R.M. (2017) Aspartate transformation at 200 °C with brucite [$Mg(OH)_2$], $NH_3$, and $H_2$: implications for prebiotic molecules in hydrothermal systems. *Chemical Geology*, 457, 162-172. **Invited research article**
- 1. **Hao[#], 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.

## First/Corresponding-authored manuscripts submitted

- **Hao, J.,** Tang, M. Gravitational effect on topography and habitability of exoplanets. (in revision)
- 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. Global nutrient supply reshaped by continental sediment accumulation. *Science Advances* (**under review; co-corresponding**)

- Orion*, F., **Hao*, J.,** Liu, W., Fehon, N., Reinfielder, J., Yee, N. Archean phosphorus recycling facilitated by ultraviolet radiation. *Geology* (**under review; contributed equally**)
- Zhou*, Q., **Hao*, J.**, Gan, K., Dam, T., Zhu, M., Wu, C., Li, W. XAFS investigation of phosphorus and iron speciation in Ningxiang-type iron deposit: implication for disturbance of phosphorus biogeochemical cycling during Frasnian-Famennian marine anoxic events. (**in revision; contributed equally**)

## Grants

- 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, Chinese Academy of Sciences, China.

## Honors and Awards

- 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

- 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)*

- 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.
- 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.

## Service

- **Reviewer**
  Nature Communications; 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; Symmetry; European Journal of Mineralogy; Journal of Visualized Experiments; AIMS Geosciences
  Mars 2020 Participating Scientist Program; European Research Council Synergy Grants
- **Editorial services**
  Applied Clay Science (Guest Editor; 2019); The Innovation (Youth Editor; 2021 - ); Frontiers in Earth Science (Reviewer Editor; 2021 - ).
- **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

- 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).