Yishen Zhang

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PERSONAL INFORMATION

Institution: Department of Earth, Environmental and Planetary Sciences, Rice University
Address: 6100 Main Street, MS-126, Houston, TX 77005, USA

EDUCATION & ACADEMIC APPOINTMENTS

Rice University — Houston, TX, USA
CLEVER Planets Postdoctoral Associate — 03/2024 – present

KU Leuven — Leuven, Belgium
Ph.D. in Geology — 06/2019 – 02/2024

University of Liège — Liège, Belgium
Visiting Scholar — 10/2018 – 04/2019

China University of Geosciences (Beijing) — Beijing, China
M.Sc. in Geology — 09/2016 – 05/2019
B.Sc. in Geology — 09/2012 – 07/2016

GENERAL RESEARCH INTERESTS

My research is rooted in igneous petrology, and I am broadly interested in the physical and chemical processes that govern interior evolution, volcanic activity, and magmatic differentiation on Earth and other rocky planets. I focus particularly on 1) mantle melting, differentiation and volatile evolution in the context of large-scale mantle heterogeneity, 2) the growth habits of crystals and their response to magmatic dynamics, and 3) the mechanisms of metal enrichment in magmatic ore-forming systems.

To carry out my research, I integrate geochemical datasets, experimental petrology, field observations, thermodynamics, computational modelling, and geophysical constraints to quantitatively interrogate natural samples and experimental products in a multidisciplinary framework

TEACHING

- **2025** Cosmochemistry — Guest lecturer, *Rice University.*
- **2024** Igneous Petrology — Guest lecturer, *Rice University.*
- **2022** Soil Science & Geology (practical), *KU Leuven.*
- **2021** Soil Science & Geology (practical), *KU Leuven.*

SUPERVISION & MENTORSHIP

- Yale Zhang — Lunar mantle melting. *High school intern, 2025.*
- Ayush Gupta — Lunar mantle melting. *Master's student, 2024.*
- Soetkin Willemyns — Mantle melting and mantle mineralogy in exoplanets. *Master's student, 2023.*
- Kinjal Ganguly — Interior structure and mineralogy of exoplanets. *Master's student, 2023.*
- Lander Cuypers — Experimental study of olivine morphology. *Bachelor student, 2021.*

- Sarah Stammen — Experimental study of olivine and spinel equilibrium. *Master's student, 2020.*

GRANTS

- **2026** University of Liège, Exoplanet Geology, IPD-STEMA Postdoctoral fellowship (€82k). *PI.*
- **2023** University of Münster, ECR postdoctoral fellowship (declined, €30k). *PI.*
- **2020** Europlanet TA call — 2-week ion probe at CRPG Nancy, France. *co-PI; proposal writing.*

PUBLICATIONS

Peer-reviewed journal publications (14 total; 5 first-author, 1 equal-contribution as second author)

2025

14. **Zhang Y**, Dasgupta R, Ji D, Lee C.T., Peng Y, Charlier B, Jin Z, Chen J, Namur O. (2025). Mantle melting conditions of mare lavas on South Pole–Aitken basin of lunar farside. *Geophysical Research Letters 52, e2024GL112418.*
13. Saracino F, Charlier B, **Zhang Y**, Lécaille M, Lin Y, Namur O. (2025). The role of sulfur on the liquidus temperature and olivine–orthopyroxene equilibria in highly reduced magmas. *Chemical Geology, 683, 122777.*
12. Jin Z, Hou T, Zhu M.H., **Zhang Y**, Namur O. (2025). Late-stage microstructures in Chang'E-5 basalt and implications for the evolution of lunar ferrobasalt. *American Mineralogist, 110(4), pp.560-569.*
11. Li W, Shorttle O, Maclennan J, Matthews S, **Zhang Y**, Namur O, Soderman C, Geist D. (2025). Taking the temperature of ocean islands: a petrological approach. *Journal of Petrology, 66(5), egaf033.*

2024

10. **Zhang Y**, Charlier B, Krein S.B., Grove T.L., Namur O, Holtz F. (2024). The very late-stage crystallization of the lunar magma ocean and the composition of immiscible urKREEP. *Earth and Planetary Science Letters 646, 118989.*
9. Jin Z, **Zhang Y**, Bose M, Glynn S, Couffignal F. (2024). Petrogenesis of Erg Chech 002 Achondrite and Implications for an Altered Magma Ocean. *The Astrophysical Journal 965(1), 24.*
8. Xu Y, Lin Y, Wu P, Namur O, **Zhang Y**, Charlier B. (2024). A diamond-bearing core–mantle boundary on Mercury. *Nature Communications 15(1), 5061.*
7. Dekoninck A, de Putter T, Ruffet G, Mees F, **Zhang Y**, Namur O, Kapoma J. (2024). Depositional setting and hydrothermal alteration of Paleoproterozoic manganiferous metasedimentary rocks in the Ampanihy district (Southern Madagascar). *Journal of Geochemical Exploration, 107579.*

2023

6. **Zhang Y**, Namur O, Li W, Shorttle O, Gazel E, Jennings E.S., Thy P, Grove T.L., Charlier B. (2023). An extended calibration of the olivine–spinel aluminum exchange thermometer: Application to the melting conditions and mantle lithologies of large igneous provinces. *Journal of Petrology 64(11), egad077.*
5. **Zhang Y**, Namur O, Charlier B. (2023). Experimental study of high-Ti and low-Ti basalts: liquid lines of descent and silicate liquid immiscibility in large igneous provinces. *Contributions to Mineralogy and Petrology 178(1): 1–24.*
4. Pirotte H, Cartier C, Pommier A, Namur O, **Zhang Y**, Berndt J, Klemme S, Charlier B. (2023). Internal differentiation and volatile budget of Mercury inferred from trace element partitioning experiments at highly reduced conditions. *Icarus 115699.*

3. Vlieghe M., Rochez G., Pire-Stevenne S., Storme J.Y., Dekoninck A., Vanbrabant Y., Namur O., **Zhang Y**, Van Ham-Meert A., Donnadieu J.P., Berbigé M. (2023). Ni-rich mineral nepouite explains the exceptional green color of speleothems. *Scientific Reports 13(1), 15017.*

2022

2. Dekoninck A., Rufet G., Baptiste J., Wyns R., Philippo S., **Zhang Y**, Namur O. (2022). Petrogenesis and $^{40}Ar/^{39}Ar$ dating of epithermal romanechite from the subaerial fault-related Romanèche Mn deposit (France). *Chemical Geology 121280.*

2018

1. **Zhang Y**, Hou T, Veksler I.V., Lesher C.E., Namur O. (2018). Phase equilibria and geochemical constraints on the petrogenesis of high-Ti picrite from the Paleogene East Greenland flood basalt province. *Lithos 300–301, 20–32.*

Ph.D. thesis

Zhang Y. (2024). *Magmatic differentiation and thermal structure in large igneous provinces.* KU Leuven.

Manuscripts under review & in revision

5. **Zhang Y**, Dasgupta R. (under review in *Geochimica et Cosmochimica Acta*). The effects of sulfur on near-liquidus phase relations of highly reduced mafic silicate melts with implications on magmatism in Mercury.
4. L. Gu, **Zhang Y**, Haupt C., Klemme S., Li W., Jin Z. (under review in *EPSL*). New lunar clinopyroxene-based thermobarometers and implications for magma storage in the Moon.
3. Saracino F., Charlier B., **Zhang Y**, Namur O. (under review in *AGC*). Crystallization of Mercury's magma ocean and the formation of its primordial mantle structure.
2. Bai Y., Su BX., Xiao Y., He YS., **Zhang Y**, Charlier B. (in revision in *Minerals*). Magnesium isotopes record the origin of stratiform chromitite.
1. Kat Shepherd, Namur O., Neave D., **Zhang Y**, van Gerve T., van Acker T., van Helden T., Vanhaecke F., Klemme S., Berndt-Gerdes J., Charlier B. (under review in *Volcanica*). Insights into the magma plumbing system architecture beneath an off-ridge ocean island (Terceira, Azores) from crystal zoning.

Manuscripts to be submitted

4. **Zhang Y**, Gupta A., Dasgupta R. (to be submitted to *GCA*). Partial melting of hybridized lunar mantle at 3 GPa.
3. **Zhang Y**, Dasgupta R. (to be submitted to *GCA*). Reaction between Ti-rich cumulate-derived melts and lunar mantle and generation of lunar basalts.
2. **Zhang Y**, Namur O., Hakim K., Dasgupta R., Shorttle O. (to be submitted to *MNRAS*). Forming Mercury-analog exoplanets in the solar neighborhood.
1. **Zhang Y**, Namur O., Charlier B., Shorttle O., Holness M.B. (to be submitted to *Contributions to Mineralogy and Petrology*). An experimental and thermodynamic model for olivine growth rate and morphology.

CONFERENCE ABSTRACTS

14. **Zhang Y**, Dasgupta R. (2025). Effects of sulfur on phase stability and melt generation in highly reduced planetary interiors. *AGU 2025* — poster.
13. **Zhang Y**, Dasgupta R., Ji D., Lee C.T., Peng Y., Charlier B., Jin Z., Chen J., Namur O. (2025). Mantle melting conditions of South Pole–Aitken basin of lunar farside. *56th Lunar and Planetary Science Conference* — oral.
12. **Zhang Y**, Namur O., Hakim K., Dasgupta R., Shorttle O. (2024). Forming Mercury-analog exoplanets

in the solar neighborhood. *Goldschmidt 2024, Chicago* — poster; *Geologica Belgica 2024, Liège* — oral.

11. **Zhang Y**, Charlier B., Grove T.L., Brown S.M., Namur O., Holtz F. (2024). The very late-stage crystallization of the lunar magma ocean and the composition of immiscible urKREEP. *Rocky Worlds III, Zürich* — poster.
10. **Zhang Y**, Namur O., Charlier B. (2023). Magmatic differentiation and silicate liquid immiscibility in large igneous province. *EMPG-XVIII 2023* — oral.
9. **Zhang Y**, Namur O., Charlier B., Holness M.B. (2023). A general model for olivine growth rate and morphology. *Goldschmidt 2023* — poster.
8. Namur O., Tosi N., Shorttle O., Cartier C., Lin Y., **Zhang Y**, Saracino F., Liado L., Pirotte H., Charlier B. (2023). Mercury's mantle as constrained by its crust. *Goldschmidt 2023* — keynote talk.
7. Saracino F., Charlier B., **Zhang Y**, Namur O. (2023). The role of sulfur on liquidus temperature and olivine–orthopyroxene equilibria in highly reduced magmas. *Goldschmidt 2023* — poster.
6. Pirotte H., Cartier C., Pommier A., Namur O., **Zhang Y**, Berndt J., Klemme S., Charlier B. (2023). Investigating Mercury's internal structure and volatile budget using trace element partitioning experiments. *Goldschmidt 2023* — poster.
5. Shepherd K., Namur O., Bachmann O., **Zhang Y**, Hendrickx T., Charlier B. (2022). Timescales and petrological processes in an area of plume–ridge interaction: Insights from the islands of Terceira and Flores, Azores. *AGU 2022* — oral.
4. **Zhang Y**, Namur O., Charlier B., Li W., Shorttle O., Gazel E., Jennings E.S., Thy P., Grove T.L. (2022). A re-evaluation of Al-in-Olivine geothermometer. *Goldschmidt 2022* — oral.
3. **Zhang Y**, Namur O., Charlier B. (2020). Experimental liquid lines of descent and silicate liquid immiscibility for low-Ti and high-Ti basalts of the Emeishan Large Igneous Province, SW China. *AGU 2021* — poster.
2. **Zhang Y**, Namur O., Charlier B. (2020). Experimental liquid lines of descent for low-Ti and high-Ti basalts of the Emeishan Large Igneous Province, SW China. *EMPG-XVII 2020* — poster.
1. **Zhang Y**, Hou T., Veksler I.V., Lesher C.E., Namur O. (2018). Phase equilibria and geochemical constraints on the petrogenesis of high-Ti picrite from the Paleogene East Greenland flood basalt province. *Goldschmidt 2018* — oral.

INVITED TALKS

- **Zhang Y** (2025). Brown University, Geochemistry, Mineralogy, and Petrology "Lunch Bunch" series.
- **Zhang Y** (2025). University College London.
- **Zhang Y** (2025). The University of Hong Kong.
- **Zhang Y** & Shorttle O (2024). RiMG Workshop: *Exoplanets: Compositions, Mineralogy, Evolution* — keynote talk.
- Namur O, van Gerve T, **Zhang Y** (2024). Earth and Environmental Sciences, University of Manchester.
- **Zhang Y** (2023). Guangzhou Institute of Geochemistry, Chinese Academy of Sciences.
- Namur O, Charlier B, Cartier C, **Zhang Y** et al. (2023). Department of Physics and Astronomy, KU Leuven.
- Namur O, Tosi N, Shorttle O, Cartier C, Lin Y, **Zhang Y** et al. (2023). Goldschmidt 2023 — keynote talk.

OUTREACH

- **2025**. K–12 Earth and planetary open house. *Rice University & R-STEM.*
- **2024**. Identification and building of molecular models of Venus' atmosphere. *Middle School Planetary Exploration, Rice University & Houston Independent School District.*

LABORATORY EXPERIENCE

- **Experimental petrology**
  - *1 atm gas-mixing furnace:* Over 300 runs with high- to low-temperature experiments, including kinetic cooling experiments.
  - *Piston-cylinder apparatus (1–2 GPa):* Experienced in half-inch experiments, capsule and assemblage preparation.
- **Electron microprobe (EPMA)**
  - Over 1000 hours of operation; experienced in instrument calibration, analytical method development, high-precision measurements, and compositional mapping.
- **Scanning Electron Microanalysis (SEM)**
  - BSE and SE imaging.
- **X-ray tomography (nanotom system)**
  - 3D scanning of geomaterials and data processing.
- **NanoSIMS**
  - Two weeks of analytical experience, including data reduction on mapping and trace element analyses.
- **LA-ICP-MS**
  - Data reduction and analysis of trace elements.
- **Raman spectroscopy**
  - Spectral analysis, data reduction, and calibration.

COMPUTER SKILLS

- Fluent in programming with Python, including package development, numerical modelling, data analysis, and PCA analysis.
- Proficient with MATLAB for numerical modelling.
- Standard knowledge of shell scripting, Julia, and web development (Django framework, HTML, CSS). Vim enthusiast.
- Experienced with thermodynamic modelling software: `alphaMELTS` family, MAGEMin, PerpleX.
- Experienced with scientific writing in Word, LaTeX, Overleaf.
- Experienced in design and editing with Adobe Illustrator, Photoshop, Premiere.

FIELD WORK EXPERIENCE

- **2023** Eifel volcano, *Germany* — 2 days.
- **2022** Fogo volcano, *Cape Verde* — 1 week.

- **2018** Changbai Mountain, Tianchi volcano, *North China* — 2 weeks.
- **2018** Tengchong volcano, *Yunnan, China* — 2 weeks.
- **2018** Emeishan Province, *China* — 2 weeks.
- **2018** Yaojiazhuang complex, Zhangjiakou, *North China* — 1 week.
- **2014** Akesu, Xinjiang, *China*, gold deposits — 3 weeks.
- **2013** Zhoukoudian, *China*, field mapping course — 4 weeks.
- **2012** Beidaihe, *China*, excursion — 3 weeks.

RESEARCH VISITS

- **2025** University of Texas at Austin — 2 day, icroprobe analysis.
- **2025** University of Cambridge — 1 day, research discussion.
- **2024** University of Cambridge — 2 days, research discussion.
- **2024** German Aerospace Center (DLR) — 3 days, ESA BepiColombo Mercury mission workshop.
- **2024** ETH Zürich — 1 week, conference and lab visit.
- **2024** University of Lausanne — 1 week, ion probe workshop.
- **2023** Royal Observatory of Belgium — 2 days, research discussion.
- **2023** Open University — 2 weeks, NanoSIMS analysis session.
- **2019–2020** University of Münster — 3 weeks, microprobe analysis.
- **2019–2020** University of Hannover — 1 week, microprobe analysis.

CURRENT & RECENT COLLABORATORS

- Oliver **Shorttle**, *University of Cambridge*
- Marian **Holness**, *University of Cambridge*
- Timothy **Grove**, *MIT*
- Bernard **Charlier**, *University of Liège*
- Jacqueline **Vander Auwera**, *University of Liège*
- Olivier **Namur**, *KU Leuven*
- Kaustubh **Hakim**, *KU Leuven*
- Anne **Pommier**, *Carnegie EPL*
- Stephan **Klemme**, *University of Münster*
- Anne-Sophie **Bouvier**, *University of Lausanne*
- Rajdeep **Dasgupta**, *Rice University*
- Cin-Ty **Lee**, *Rice University*
- Yanhao **Lin**, *HPSTAR*
- Weiran **Li**, *The University of Hong Kong*
- Ziliang **Jin**, *Macau University of Science and Technology*

PRIZES & AWARDS

- **2023** Belgian FWO travel grant for Rocky Worlds III, Zürich (€500).
- **2023** Belgian FWO travel grant for Goldschmidt, Lyon (€500).
- **2018** Institute travel grant for attending Goldschmidt 2018 (¥12,000 ≈ USD 1,700).
- **2018** National Award for Excellent Graduate Students (¥30,000 ≈ USD 4,300, top 1%).
- **2014.12** Third prize in professional course (top 15%).
- **2014.6** Third prize in professional course (top 15%).
- **2014.5** Fourth prize in Institute Scientific Research Activity.

SERVICE

- **2025** Member, ECR-Net Working Group, IAVCEI.
- **Primary convenor**, Goldschmidt 2023 session *"Dynamics and timescales in magmatic reservoirs, conduits and dikes"* (proposal writing and session convening).
- **Journal reviewer:** *Nature Astronomy, Nature Communications, Science Advances, Geology, American Mineralogist, Geochimica et Cosmochimica Acta, Communications Earth & Environment, Icarus, Contributions to Mineralogy and Petrology, Geophysical Research Letters, Bulletin of Volcanology.*
- **Thesis reviewer (KU Leuven):**
  - Soetkin Willemyns — *Master thesis: Mantle melting behaviour in low-Mg exoplanets.*
  - Collin Isaline — *Master thesis: Crystallization temperature of parent magmas and mantle sources for volcanoes in the Southern Volcanic Zone of the Andean Arc (Chile).*

CODE DEVELOPMENT

- Li W, **Zhang Y** — **pyAp**, a package for calculating magmatic volatile and trace element concentrations and oxygen fugacity using mineral apatite. *Python.*
- **Zhang Y** — Mass-balance calculation for petrology using non-negative matrix decomposition algorithms, with MCMC error propagation on phase proportions and bulk composition. *Python.*
- **Zhang Y**, Namur O, van Gerve T.D. — Multi-component olivine diffusion tool integrating uncertainties in temperature, pressure, and oxygen fugacity. *Python.*
- **Zhang Y** — Stepwise backward F-test model for multiple linear regression. *Python.*
- **Zhang Y** — Script to convert `alphaMELTS` output to formatted spreadsheets. *Python.*

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