




YISHEN (EASON) ZHANG

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PERSONAL INFORMATION

Place and Date of Birth: China, 17th December 1993

Institution: Department of Earth, Environmental and Planetary Sciences, Rice University

Address: 6100 Main Street, MS-126 Houston, TX 77005

GENERAL RESEARCH INTERESTS

My research interests focus on igneous petrology and planetary sciences, including:

- Mantle structure and magmatic differentiation in terrestrial planets: I explore the composition and thermal structure of planetary mantles and their relationship to volcanic products and crust formation.
- Evolution of rocky planetary interiors: I investigate phase equilibria and differentiation processes to understand the chemical evolution and compositional diversity of rocky and terrestrial planets.
- Crystallization kinetics in magmatic systems: I study crystal growth habits, their textural and chemical responses to changes in magmatic conditions, providing insights into kinetics in volcanic processes.
- Development of thermodynamic background for phase equilibria/trace element partitioning: I develop thermodynamic framework to understand elemental partitioning between silicate phases.

To carry out my research, I use experiments combining with numerical modelling, thermodynamics, statistics, textural and geochemical analyzes

EDUCATION & ACADEMIC APPOINTMENTS

Rice University <i>CLEVER Planet postdoc associate</i>	03. 2024 – present <i>Houston, TX</i>
KU Leuven <i>PhD in Geology</i>	06. 2019 – 02. 2024 <i>Leuven, Belgium</i>
University of Liège <i>Visiting scholar</i>	10. 2018 – 04. 2019 <i>Liège, Belgium</i>
China University of Geosciences (Beijing) <i>Master in Geology</i>	09. 2016 – 05. 2019 <i>Beijing, China</i>
China University of Geosciences (Beijing) <i>Bachelor in Geology</i>	09. 2012 – 07. 2016 <i>Beijing, China</i>

LABORATORY EXPERIENCE

- **Experimental petrology:**
1 atm gas mixing furnace
Over 300 runs with 1 atm high to low-temperature experiments, kinetic cooling experiments
Piston cylinder apparatus:
Experienced in 1-2GPa half inch experiments, capsule, assemblage preparation
- **Electron microprobe:**
Over 1000 hours experience with EPMA, experienced in instrument calibration, analytical method development, high precision measurement, mapping
- **Scanning Electron Microanalysis:**
Imaging of BSE and SE
- **X-ray tomography (nanotom system):**
Experienced in geo-material 3D scanning, data processing
- **NanoSIMS:**
Two week analytical experience, data reduction on mapping, trace element analysis
- **LA-ICP-MS:**
Data reduction and analysis

COMPUTER SKILLS

- Fluent in programming with python, including package development, numerical modelling, data analysis, PCA analysis.
- Proficient with Matlab, numerical modelling.
- Standard knowledge of shell scripting, julia, web building language including Django framework, HTML and 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 *North China*, *Tianchi volcano*, 2 weeks
2018 Yunnan *China* *Tengchong volcano*, 2 weeks
2018 Emeishan Province *China*, 2 weeks
2018 Zhangjiakou *North China*, *Yaojiazhuang complex*, 1 week
2014 Akesu, *Xinjiang China*, *Gold deposits*, 3 weeks
2013 Zhoukoudian *China*, *field mapping courses*, 4 weeks
2012 Beidaihe *China*, *excursion*, 3 weeks

RESEARCH VISITS

University of Cambridge, 2 days, research discussion
ETH Zürich, 1 week, Conference & lab visiting
University of Münster, 3 weeks, Microprobe analysis
University of Hannover, 1 week, Microprobe analysis
University of Lausanne , 1 week, ion probe workshop
Royal Observatory of Belgium , 2 days, research discussion
German Aerospace Center (DLR), 3 days, ESA Mercury Bepicolombo Mission workshop
Open University, 2 weeks, NanoSIMS analysis session

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*
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 World III, Zürich, 2023 (€500)
2023 Belgian FWO travel grant for Goldschmidt, Lyon, 2023 (€500)
2018 Institute travel grant for attending Goldschmidt, 2018 (¥12000 = USD 1700)
2018 National Awards for Excellent Graduate Students (¥30,000 = USD 4300, 1%)
2014.12 Third prize in professional course. (15%)
2014.6 Third prize in professional course. (15%)
2014.5 Fourth prize in Institute Scientific Research Activity.

SERVICES

Conference participation:

2023 Primary convenor, Goldschmidt 2023, *Dynamics and timescales in magmatic reservoirs, conduits and dikes*, (proposal writing, session convenor)

Journal reviewer:

American Mineralogist, GCA, Communications Earth & Environment, Icarus, Contributions to Mineralogy and Petrology, Geophysical Research Letters, Bulletin of Volcanology

Thesis reviewer:

1. Soetkin Willemyns, *Master thesis, Mantle melting behaviour in low-Mg exoplanets*.
2. Collin Isaline, *Master thesis, Crystallization temperature of parent magmas and nature of mantle sources for a selection of volcanoes in the Southern Volcanic Zone of the Andean Arc (Chile)*.

TEACHING

2024 Igneous Petrology - 3 lectures on phase diagrams, *Rice University*

2022 Soil Science & Geology (practical, igneous rocks), *KU Leuven*

2021 Soil Science & Geology (practical, igneous and sedimentary rocks), *KU Leuven*

SUPERVISION

1. Soetkin Willemyns, Mantle melting and mantle mineralogy in exoplanets. *Master. 2023*
2. Kinjal Ganguly, Interior structure and mineralogy of exoplanets. *Master. 2023*
3. Lander Cuypers, Experimental study of olivine morphology. *Bachelor, 2021*
4. Sarah Stammen, Experimental study of olivine and spinel equilibrium. *Master. 2020*

GRANTS

2023 University of Münster, Early career postdoc fellowship (declined). *PI*

2020 Europlanet TA call, 2-week ion probe at CRPG, Nancy, France. *co-PI, proposal writing*

PUBLICATIONS

Peer reviewed journal publications

1. **Zhang Y**, Charlier B, Krein SB, Grove TL, Namur O, Holtz F. (2024). The very late-stage crystallization of the lunar magma ocean and the composition of immiscible urKREEP. *Earth and Planet Science Letters* 646, 118989
2. Jin Z, Hou T, Zhu MH, **Zhang Y**, Namur O., (Accepted in American Mineralogist). Late-stage microstructures in Chang'E-5 basalt and implications for the evolution of lunar ferrobasalt
3. 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.
4. 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.
5. 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
6. **Zhang Y**, Namur O, Li W, Shorttle O, Gazel E, Jennings ES, Thy P, Grove TL, 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), p.egad077.
7. **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. *Contrib. Mineral. Petrol.* 178(1):1-24.
8. 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
9. Vlieghe, M., Rochez, G., Pire-Stevenne, S., Storme, J.Y., Dekoninck, A., Vanbrabant, Y., Namur, O., **Zhang, Y.**, Van Ham-Meert, A., Donnadiou, J.P. and Berbigé, M., 2023. Ni-rich mineral nepouite explains the exceptional green color of speleothems. *Scientific Reports*, 13(1), p.15017.

10. Dekoninck A, Rufet G, Baptiste J, Wyns R, Philippo S, **Zhang Y**, Namur O 2022. Petrogenesis and $^{40}\text{Ar}/^{39}\text{Ar}$ dating of epithermal romanechite from the sub-aerial fault-related Romanèche Mn deposit (France). *Chemical Geology*. 121280
11. **Zhang Y**, Hou T, Veksler IV, Leshner CE, 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.

PhD thesis

Zhang Y. 2024. Magmatic differentiation and thermal structure in large igneous provinces

Manuscripts under review & in revision

1. **Zhang Y**, Dasgupta R, Ji D, Lee CT, Peng Y, Charlier B, Jin Z, Chen J, Namur O., (under review in GRL). Mantle melting conditions of mare lavas on South Pole–Aitken basin of lunar farside.
2. Li W, Shorttle O, MacLennan J, Matthews S, **Zhang Y**, Namur O, Soderman C, Geist D. (in revision in JPET). Taking the temperature of ocean islands: a petrological approach.

Manuscripts to be submitted

1. **Zhang Y**, Namur O, Hakim K, Dasgupta R, Shorttle O. (to be submitted to MNRAS). Forming Mercury-analog exoplanets in the solar neighborhood.
2. **Zhang Y**, Namur O, Charlier B, Shorttle O, Holness MB (to be submitted to EPSL). An experimental and thermodynamic model for olivine growth rate and morphology.

Conference abstracts

1. **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*
2. **Zhang Y**, Charlier B, Grove TL, Brown SM, Namur O, Holtz F., 2024. The very late-stage crystallization of the lunar magma ocean and the composition of immiscible urKREEP. Rocky Worlds III Zurich. *poster*
3. **Zhang Y**, Namur O, Charlier B, 2023. Magmatic differentiation and silicate liquid immiscibility in large igneous province. EMPG-XVIII 2023. *oral*
4. **Zhang Y**, Namur O, Charlier B, Holness MB, 2023. A general model for olivine growth rate and morphology. Goldschmidt 2023. *poster*
5. 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*
6. 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*
7. 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 elements partitioning experiments. Goldschmidt 2023. *poster*
8. 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*
9. **Zhang Y**, Namur O, Charlier B, Li W, Shorttle O, Gazel E, Jennings ES, Thy P, Grove TL, 2022, A re-evaluation of Al-in-Olivine geothermometer. Goldschmidt 2022 *oral*
10. **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*
11. **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*
12. **Zhang Y**, Hou T, Veksler IV, Leshner CE, Namur O, 2018. Phase equilibria and geochemical constraints on the petrogenesis of high-Ti picrite from the Paleogene East Greenland flood basalt province. Goldschmidt Abstract 2018. *oral*

INVITED TALKS

1. **Zhang Y** & Shorttle O. Linking stars to exoplanet interiors 2024. *RiMG Workshop: Exoplanets: Compositions, Mineralogy, Evolution, keynote talk*
2. Namur O, van Gerve T, **Zhang Y**. Using olivine to reconstruct the magmatic processes of active volcanoes. 2024. *Earth and Environmental Sciences, University of Manchester*.
3. **Zhang Y**. Magmatic differentiation and thermal structure of large igneous provinces. 2023. *Guangzhou Institute of Geochemistry, Chinese Academy of Sciences*.
4. Namur O, Charlier B, Cartier C, **Zhang Y**, Nittler M, Collinet M, Grove T, McCammon C. Sulfur chemistry in planetary interiors - Effects of reducing conditions. 2023. *Department of Physics and Astronomy, KU Leuven*.
5. Namur O, Tosi N, Shorttle O, Cartier C, Lin Y, **Zhang Y**, Saracino F, Liado L, Pirotte H, Charlier B. Mercury's mantle as constrained by its crust. *Goldschmidt 2023 keynote talk*.

OUTREACH

1. **2024**. Identification and building of molecular models of Venus' atmosphere. *Middle School Planetary Exploration, Rice University & Houston Independent School District*.
2. **2024**. Identification and building of molecular models of Venus' atmosphere. *Middle School Planetary Exploration, Rice University & Houston Independent School District*.

CODE DEVELOPMENT

1. Li W, **Zhang Y** – pyAp, a package for calculating magmatic volatile, trace element concentrations, and oxygen fugacity using mineral apatite. *python*
2. **Zhang Y** – Mass balance calculation for petrology using non-negative and matrix decomposition algorithms, with MCMC propagating errors on phases and bulk composition. *python*
3. **Zhang Y**, Namur O, Gerve TDV – Multi-component olivine diffusion, integrated with uncertainties of temperature, pressure, oxygen fugacity. *python*
4. **Zhang Y** – Stepwise backward F-test model for multiple linear regression. *python*
5. **Zhang Y** – Script converts alphaMELTS output to formatted spreadsheet. *python*

REFEREES

1. Olivier Namur (KU Leuven, Belgium): olivier.namur@kuleuven.be, *PhD supervisor*
2. Bernard Charlier (University of Liège, Belgium): b.charlier@uliege.be, *PhD co-supervisor*
3. Oliver Shorttle (University of Cambridge, UK): os258@cam.ac.uk, *collaborator*
4. Rajdeep Dasgupta (Rice University, USA): rajdeep.dasgupta@rice.edu, *Postdoc supervisor*
5. Cin-Ty Lee (Rice University, USA): ctlee@rice.edu, *collaborator*

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