

RUIGUANG PAN

Postdoctoral Research Associate

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APPOINTMENTS

- 1) Postdoctoral researcher studying molecular complexation of rare earth elements (REE) in high temperature and pressure supercritical geologic fluids, and development of thermodynamic database at Indiana University Bloomington, *May 2023 - Present*
- 2) Postdoctoral researcher studying critical minerals (REE) and development of thermodynamic database at New Mexico Bureau of Geology & Mineral Resources; New Mexico Institute of Mining and Technology, Socorro, *Nov. 2021 - Apr. 2023*

EDUCATION

Ph.D. Applied Earth Sciences, Indiana University-Purdue university Indianapolis, *Nov. 2021*

Dissertation: *Metamorphic P-T path and multiple fluid events during burial and exhumation of the Tso Moriri UHP Terrane, NW Himalaya*. Supervisor: Catherine A. Macris

M.S. Igneous geochemistry, Florida State University, Tallahassee, *Dec. 2015*

M.S. Ore deposit geology, China University of Geosciences, Beijing, *Jul. 2013*

B.S. Mineral resource exploration, Northeastern University, Shenyang, *Jul. 2010*

RESEARCH INTERESTS

- 1) **Rare earth element (REE) minerals in hydrothermal fluids** (REE minerals, REE molecular complexation, developing the next generation of internally consistent thermodynamic database for REE species at hydrothermal conditions, thermodynamic parameter optimization of REE species)
- 2) **Probing zircon reactivity in aqueous solutions at solubility equilibrium using isotope tracers** (mineral recrystallization, near-equilibrium kinetics, non-traditional isotopes; solubility equilibrium)
- 3) **Metamorphic petrology, thermodynamic modeling, and fluid-rock interactions** (Metamorphic *P-t* path, phase equilibria diagram/pseudosection, thermodynamic database/program evaluation,

thermobarometry, elemental and isotopic geochemistry, geochronology, metasomatism, effective bulk composition (EBC) in subduction zones)

4) Other geologic/geochemical interests (Arc magmatism in subduction zones (major and trace elements, isotopes, geochronology, and magmatism modeling); Ore deposit geology (gold deposits, fluid inclusions, and stable isotopes))

CURRENT & PAST RESEARCH PROJECTS

- 1) Molecular complexation of rare earth elements (REE) in high temperature and pressure supercritical geologic fluids. DE-SC0022269, *PI: Chen Zhu. May 2023 – Present*
- 2) Probing zircon reactivity in aqueous solutions at solubility equilibrium using isotope tracers. NSF EAR -2221907, *PI: Chen Zhu. May 2023 – Present*
- 3) An internally consistent thermodynamic database for the rare earth elements (REE) at hydrothermal conditions. DOE DE-FOA-0002181, *PI: Alexander Gysi. Nov. 2021 – Apr. 2023*
- 4) Stable Isotopes as Tracers of Fluid-Rock Interactions in the Subduction Zone Factory: A Case Study of UHP Rocks and Ophiolites from the Himalaya. NSF EAR -1822524, *PI: Catherine A. Macris. Dissertation Topic: Metamorphic P–T path and multiple fluid infiltrations during burial and exhumation of the Tso Moriri UHP terrane, NW India. Aug. 2016 – Oct. 2021*
- 5) Miocene arc magmatism in Bocas del Toro, Panama, and its constraints on mantle wedge and tectonic change. *Advisor: David Farris, Aug. 2013 – Aug. 2016*
- 6) Evolution of ore-forming fluids of the Xinli gold deposit, Jiaodong peninsula, Eastern China. *Advisor: Jun Deng, Jul. 2010 – Aug. 2013*
- 7) Genesis and fluid inclusions of the Hongtoushan Cu-Zn deposit, Liaoning. *Advisor: Ende Wang, Sep. 2009 – Jul. 2010*

PROFESSIONAL EXPERIENCE

Teaching Litho-geochemistry (GEMS & GEMSFITS), New Mexico Tech, Socorro *Mar. 2023*

Teaching Assistant, Indiana University-Purdue university Indianapolis *Aug. 2021–Oct. 2021*

Research Assistant, Indiana University-Purdue university, Indianapolis *Aug. 2016–Jul. 2021*

Teaching Assistant, Florida State University, Tallahassee *Aug. 2013–Dec. 2015*

WEBSITE

Thermodynamic Modelling for Beginners: <https://ruiguangpan.wixsite.com/iupui-thermodynamics>

GEOLOGICAL PROGRAMMING/MODELING EXPERIENCE

- Aqueous Geochemical Modeling (Geochemist's Workbench, GEMS and GEMFITS, SUPCRTBL, PHREEQC, etc.)
- Thermodynamic Modeling Programs (THERMOCALC, Theriak-Domino, Perple_X, and Gibbs)
- Computational petrology programs (XMapTools/Bingo-Antidote, Theria_G, AX, TC Ave PT, TWQ, and (MATLAB) best-fit P - T path using Theriak)
- Magma (MELTS, MAGMA, Arc Basalt Simulator, and magma PM and FC simulation)
- Mössbauer Spectral Analysis (Recoil)

WORKSHOP PARTICIPATIONS/ORGANIZER

- Organizer: Ore-forming processes and metasomatism: combining experimental and modeling methods to interpret field observations| 2-DAY IN-PERSON WORKSHOP (AP Gysi, NC Hurtig, R Pan, DE Harlov, GD Miron, DA Kulik), Goldschmidt 2023 Conference 2023
- SIMS-NanoSIMS workshop 2023
- ExTerra 2023: Understanding subduction through the study of exhumed terranes 2023
- pyGeoChemCal: Ambient to Deep Earth geochemical thermodynamic calculations July 2022
- Diffusion modelling to determine timescales of processes (Diffusion Chronometry) 2021
- Phase equilibrium modeling: approaches and pitfalls May 2021
- UNLV Epithermal Ore Deposits (SEG), Las Vegas April 2021
- Program for DMG-MSA Short course/Workshop, Bochum April 2021
- Recent developments and applications in Earth sciences of electron probe microanalysis April 2021
- P - T - t Trajectory of Metamorphic Processes Dec. 2020
- Thermodynamic modeling of magmatic processes with alphaMELTS 2 Nov. 2020
- Modeling local phase equilibria an introduction to Theriak-Domino XMapTools and Bingo-Antidote Aug. 2019
- Applied Geochemical Modeling (using GWB) Nov. 2018

HONORS & AWARDS

- 2021 GSA Travel Grant, Geological Society of America
- 2017 Graduate School Travel Grant, Indiana University-Purdue University Indianapolis
- 2017 GSA Travel Grant, Geological Society of America
- 2015 GSA Travel Grant, Geological Society of America
- 2016 Dr. Arthur Mirsky Geology Fellowship, Indiana University-Purdue University Indianapolis
- 2014 Scholarship Grt NRA, Florida State University
- 2010 Fellowship, China University of Geosciences

2007 Zeng Xianzi Education Scholarship, Northeastern University

VOLUNTEERING

2020 The American Geophysical Union Annual Meeting, Online

2019 The American Geophysical Union Annual Meeting, San Francisco

2018 The Geological Society of America Annual Meeting, Indianapolis

PROFESSIONAL SOCIETY MEMBERSHIPS

Geochemical Society, since 2020

Mineralogical Society, since 2020

American Geophysical Union, since 2019

Geological Society of America, since 2014

New Mexico Geological Society, since 2023

PUBLICATIONS

Pan, R., Macris, C. A., and Menold, C. A., 2023. Fluid evolution during burial and exhumation of the Tso Moriri UHP complex, NW India: Constraints from mineralogy, geochemistry, and thermodynamic modeling. *Contrib Mineral Petrol*, 178 (3), 1-25.

Pan, R., Macris, C. A., and Menold, C. A., 2020. Thermodynamic modeling of high-grade metabasites: a case study using the Tso Moriri UHP eclogite. *Contrib Mineral Petrol*, 175(8), 1-28.

Macris, C. A., Newton, R. C., Wykes, J., **Pan, R.**, and Manning, C. E., 2020. Diopside, enstatite and forsterite solubilities in H₂O and H₂O-NaCl solutions at lower crustal and upper mantle conditions. *Geochimica et Cosmochimica Acta*.

Liu, X., Deng, J., Liang, Y., Wang, Q., **Pan, R.**, Qin, C. and Yang, Y., 2018. Petrogenesis of Early Cretaceous intermediate-felsic dikes in the Jiaodong Peninsula, south-eastern North China Craton: Constraints from geochronology, geochemistry and Sr-Nd-Pb-Hf isotopes. *Gondwana Research*, 60, 69-93.

Zhao, R., Wang, Q., Liu, X., Wang, W. and **Pan, R.**, 2016. Architecture of the Sulu crustal suture between the North China Craton and Yangtze Craton: constraints from Mesozoic granitoids. *Lithos*, 266, 348- 361.

Zhao, R., Liu, X., **Pan, R.**, Zhou, M., 2015, Element behaviors during alteration and mineralization: A case study of the Xinli (altered rock type) gold deposit, Jiaodong Peninsula, *Acta Petrologica Sinica*, 31(11), 3420-3440.

Deng, J., Wang Q., Liu, X., **Pan, R.**, Zhao, R., 2015, Origin of the Xinli gold deposit, Jiaodong

peninsula, China: constraints from fluid inclusion and C-D-O-S-Sr isotope compositions, *Ore Geology Review*, 65, 674-686.

Yang, L., Wang, Q., Liu, X., Zhang, Y., **Pan, R.**, Feng, Y., 2014, Compositions and Genesis of the Fault Gouge in the Ore-controlling Fault in Jiaodong Peninsula: A Case Study from the Xinli Gold Deposit, *Geotectonica et Metallogenia*, 38(4), 908-918.

ARTICALS IN PREPARATION

Pan, R. Gysi, A., Miron G. D., Zhu, C., An internally consistent thermodynamic dataset for REE aqueous species and phosphate minerals (monazite, xenotime, and rhabdophane) from 25 to 300 °C. Submitted to *Geochimica et Cosmochimica Acta*

Pan, R. Zhu, C., Gysi, A., Miron G. D. Linear correlations and prediction of standard state thermodynamic properties for REE solids. to be submitted to *Geochimica et Cosmochimica Acta* (in preparation)

Pan, R. Zhu, C., Gysi, A., An inventory of standard state thermodynamic properties for REE aqueous species and solids and research needs, to be submitted to *Acta Geochimica* (in preparation)

Pan, R. Gysi, A., Miron G. D., Zhu, C., Harlov, D., Internally consistent thermodynamic data for aqueous species to 350 °C in the system REE-Cl-F-O-H. to be submitted to *Geochimica et Cosmochimica Acta* (in preparation)

Macris, C. A., **Pan, R.**, Menold, C. A., Shahar, A. Iron, Oxygen, and Boron Isotopes in UHP rocks from the Tso Morari, NW India (in preparation)

Pan, R., Macris, C. A., Menold, C. A., Alp, E. E., Phase equilibrium modelling of UHP eclogite retrogression in subduction zone: mineral-fluid evolutions and exhumation paths. to be submitted to *Chemical Geology* (in revision with co-authors)

Pan, R., Farris, W. D. Fowler, G. D. Miocene back-arc magmatism in Bocas del Toro, Western Panama: Constraints from mantle wedge chemical modelling, fractional crystallization, and tectonic change. to be submitted to *Lithos* (in revision with co-authors)

CONFERENCES

Pan, R., Gysi, A., Miron G. D., Zhu, C., An internally consistent thermodynamic dataset for REE aqueous species and phosphate minerals (monazite, xenotime, and rhabdophane) from 25 to 300 °C. Goldschmidt 2023, Lyon, 2023

Pan, R., Gysi, A., Miron G. D., Optimization of the thermodynamic properties of the rare earth elements (REE) at hydrothermal conditions: An internally consistent thermodynamic and experimental dataset in the REE-P-O-H-Na-Cl system. Goldschmidt 2022, Honolulu, July 2022

- Pan, R.,** Macris, A.C., Menold, A.C., Amphibolite-facies retrograde metamorphism and metasomatism of the Tso Morari UHP eclogites during exhumation. Metamorphic Studies Group 2022. April 2022
- Pan, R.,** Macris, A.C., Menold, A.C., Amphibolization of the Tso Morari UHP eclogites: a record of fluid infiltration at amphibolite-facies during uplift in the subduction channel. AGU Fall Meeting 2021, New Orleans, Oral
- Pan, R.,** Macris, A.C., Menold, A.C., Multiple fluid events during exhumation of the Tso Morari UHP eclogite, NW India: Constraints from mineralogy, geochemistry, and thermodynamic modelling. GSA Annual Meeting 2021, Portland, Oral
- Pan, R.,** Macris, A.C., Menold, A.C., Thermodynamic modelling on the peak metamorphism and fluid events during exhumation of the Tso Morari coesite-bearing eclogite, NW Himalaya. 3rd European Mineralogical Conference • Cracow, Poland, 28 Aug-02 Sep, 2021, Virtual
- Pan, R.,** Macris, A.C., Menold, A.C., Thermodynamic modelling on the UHP metamorphism and fluid infiltration of the Tso Morari coesite-bearing eclogite in NW India. Goldschmidt 2021, Virtual, Oral
- Pan, R.,** Macris, A.C., Menold, A.C., Phase equilibria modeling on the peak metamorphism and fluid infiltration of the Tso Morari coesite-bearing eclogite in NW India. Geologists' Association Student Symposium 2021, Virtual, Poster
- Pan, R.,** Macris, A.C., Menold, A.C., Evaluation of multiple thermodynamic modeling protocols on metabasites: using the Tso Morari UHP eclogite as a case study. AGU Fall Meeting 2020, eLightning Session
- Pan, R.,** Macris, A.C., Menold, A.C., Menold, Effect of garnet a-X solution models on the thermodynamic modeling of high-grade metabasites using a Tso Morari UHP eclogite in NW India. GSA Annual Meeting 2020, Virtual, Oral
- Pan, R.,** Macris, A.C., Menold, A.C., Thermodynamic Modeling of the Tso Morari UHP Eclogite, NW Himalaya. AGU Fall Meeting 2019, San Francisco, USA. Poster
- Pan, R.,** Macris, A.C., Menold, A.C., Thermodynamic Modeling of High-grade Metabasites: A Case Study Using the Tso Morari UHP Eclogite. 2019 IUPUI SOS Symposium, Indianapolis, USA. Poster
- Pan, R.,** Macris, A.C., Menold, A.C., Shahar, A., Metamorphic Evolution and Metasomatism in Tso Morari UHP Terrane, NW India, Constraints from Geochemistry, Fe Isotopes, and Thermodynamic Modeling, 2019 Crossroads Conference, Bloomington, USA, Poster
- Pan, R.,** Metamorphic Evolution and Metasomatism in Tso Morari UHP Terrane, NW India, Constraints from Geochemistry, Fe Isotopes, and Thermodynamic Modeling, 2018. GSA Annual

Meeting in Indianapolis, USA. Poster

Pan, R., Macris, A.C., Menold, A.C., Shahar, A., Metamorphic Evolution and Metasomatism in Tso Morari UHP Terrane, NW India, Constraints from Geochemistry, Fe Isotopes, and Thermodynamic Modeling. 2018 IUPUI SOS Symposium, Indianapolis, USA. Poster

Pan, R., Investigating the Metamorphic Evolution, Water-rock interaction, and Geochemistry of Tso Morari UHP Terrane, NW Himalaya, 2017 GSA Annual Meeting in Seattle, USA. Poster

Pan, R., Miocene Arc Magmatism in Western Panama and its Constrains on Mantle Wedge and Tectonic Change, 2015 GSA Annual Meeting in Baltimore, USA. Oral.

REFERENCES

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