

OMAR KHALIL DROUBI

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EDUCATION

PhD Geoscience

University of Wisconsin, Madison, Expected August 2027

PhD dissertation: TBD

Advisor: Dr. Chloë Bonamici

M.Sc. Geoscience

University of Wisconsin, Madison, August 2022

Master's thesis: Multiphase petrochronology of Archean gneiss complexes

Advisors: Dr. Annie Bauer and Dr. Chloë Bonamici

B.Sc. Earth Science, minor in Spatial Science

University of California, Santa Barbara, June 2020, GPA: 3.73

Undergraduate thesis: Origin and composition of deep crustal xenoliths from Madagascar

Advisor: Dr. Roberta Rudnick

RESEARCH INTERESTS

Integration of geochemistry, petrology, geochronology, microstructural analysis, field work, and modeling to study: evolution of tectonics and the continental lithosphere; Precambrian geology; mineral deposits; deep crustal fluids; xenoliths; complex metamorphic records; high-temperature and high-pressure metamorphism

RESEARCH EXPERIENCE

Investigating trace-element systematics in minerals from ultrahigh-temperature deep crustal xenoliths— Penn State

Nov 2022–May 2023

- Research on granulite-facies, deep crustal metapelitic and metagneous xenoliths from Mesa Central in Mexico.
- Experience includes: Detailed petrography; trace-element analysis and mapping of garnet, titanite, clinopyroxene, and feldspar using LA-ICP-MS techniques; EPMA WDS measurements; phase equilibria modeling using Theriak-Domino; numerical modeling of Rayleigh fraction garnet growth and finite difference/volume modeling of trace-element diffusion in garnet; communication of research at Metamorphic Studies Group conference (2023) and publication of manuscript in Journal of Geophysical Research: Solid Earth (2024)

Accessory phase petrochronology of Archean gneisses – UW-Madison

Aug 2020–Aug 2022

- Research on titanite and apatite in different lithologies of Archean rocks from the Acasta Gneiss Complex, Northwest Territories Canada and Watersmeet, MI.

- Experience includes: Gaining sampling consent, sampling, and taking structural measurements in Watersmeet, MI; cutting rock billets for thin sections; petrography; characterizing published and unpublished titanite and apatite reference materials for U-Th-Pb isotope and trace-element work; developing method for EPMA WDS major-, minor-, and trace-element analysis and mapping of titanite; developing method for LASS-ICP-MS U-Th-Pb isotope and trace-element analysis of titanite and apatite; analyzing, reducing, and interpreting data using variety of software; communication of results in form of multiple conference presentations, a written thesis, and three first-author manuscripts (one accepted, one in review, and one in preparation) for peer-reviewed journals.

Petrography and thermobarometry of deep crustal xenoliths – UC Santa Barbara

Dec 2018–July 2020

- Senior Honor's research on deep crustal, granulite-facies xenoliths from Madagascar.
- Experience includes: Sample collection in central Madagascar; cutting rock billets for thin sections; detailed petrography; EPMA WDS measurements; ImageJ analysis used to calculate mineral modes; mineral pair thermobarometry; thermodynamic modeling using PerpleX; and communication of results in the form of presentation for UC Santa Barbara Petrology discussion group (PET Food) and written thesis.

LABORATORY EXPERIENCE

Part-time Research Associate, LionChron LA-ICP-MS lab – Penn State

Supervisor: Dr. Andrew Smye

Nov 2022-May 2023

- Trace-element measurements and mapping of garnet, titanite, clinopyroxene, and feldspar using a Thermo Scientific iCAP RQ-ICP-MS coupled to a Teledyne/Photon Machines Analyte G2 Excimer nanosecond laser ablation system.
- LASS-ICP-MS trace-element and U-Th-Pb isotopic mapping of titanite using Thermo Scientific Element XR HR-ICP-MS and Thermo Scientific iCAP RQ-ICP-MS coupled to a Teledyne/Photon Machines Analyte G2 Excimer nanosecond laser ablation system.
- Experience with thin section scanning and image acquisition using Zeiss Axioscan.Z1 and replacing load coil on Thermo Scientific iCAP RQ-ICP-MS.

Graduate Research Assistant, ICP-MS TIMS Facility – UW Madison

Supervisors: Dr. Brian Beard and Michael Tappa

Oct 2020-Aug 2022

- Developed laser-ablation (LA)-inductively-coupled plasma mass spectrometry (ICP-MS) method for trace-element analysis and mapping on Agilent 8900X quadrupole ICP-MS.
- Developed LA-ICP-MS method for U-Th-Pb analysis of titanite and apatite using Nu-Plasma II multi-collector ICP-MS, which included isotope dilution (ID-ICP-MS) analysis of reference materials.
- Experience with preparing tantalum filaments for tuning and running Rb-Sr analyses using Sector 54 TIMS instrument.

- Clean lab experience includes: U-Th-Pb anion-exchange chromatography, making synthetic solutions as analogues for mineral compositions, and general practices, such as pipetting small volumes, titrations, and cleaning/sterilizing pipette tips and sample vials.

Visiting Researcher, LionChron LASS-ICP-MS lab – Penn State

Supervisor: Dr. Josh Garber

May 2020

- Assisted in development and application of LASS-ICP-MS U-Th-Pb isotope and trace element analysis of titanite and apatite in Archean rocks using Thermo Scientific Element XR HR-ICP-MS and Thermo Scientific iCAP RQ-ICP-MS coupled to a Teledyne/Photon Machines Analyte G2 Excimer nanosecond laser ablation system. Method published in *Geostandards and Geoanalytical Research* (2023)

Graduate Research Assistant, Electron Microbeam Facility – UW Madison

Supervisor: Dr. Will Nachlas and Bil Schneider

Oct 2020-Aug 2022

- Using Hitachi S3400 Variable Pressure SEM and Hitachi S3700N SEM: SE, BSE, and CL imaging, EBSD mapping (processed with MTEX), EDS spot analyses and mapping.
- CAMECA SXFive FE electron microprobe (EPMA): SE and BSE imaging; WDS spot analyses to measure major, minor, and trace-element concentrations; WDS mapping of minor and trace-elements; small activation volume WDS measurements, developed graphic user interface EPMA WDS data reduction and visualization software, UW-Madison course, GEO 777, on theory and practice of SEM and EPMA (3 units).

Sample Preparation for LA-ICP-MS – UC Santa Barbara

Supervisor: Dr. Roberta Rudnick

Dec 2017–July 2020

- Sample preparation for whole-rock geochemistry and U-Pb accessory phase geochronology using rocksaw, handcrushing, shatterbox, Frantz magnetic separation, heavy liquids separation, picking and mounting minerals, and fusing glass beads, experience with FEI Quanta 400F field emission source SEM and CAMECA SX-100 EPMA.

SOFTWARE EXPERIENCE

- **Python:** Geochemical/geochronological data processing, analysis, and numerical modeling; GUI development; Principal component analysis
- **Chromium/Iolite/IsoplotR:** Acquiring, reducing, and interpreting U-Th-Pb isotopic and trace element LA(SS)-ICP-MS data
- **Probe for EPMA/CASINO:** Acquiring, reducing, interpreting, and reporting EPMA data; Monte-Carlo modeling of X-ray activation volumes.
- **PerpleX/Theriak-Domino:** Intermediate experience pseudosection modeling; attended “Phase equilibrium modelling e-workshop” hosted by University of Calgary on PerpleX, ThermoCalc, Theriak Domino (May 2021).

- **QGIS/ArcMap/ArcPro:** Used in fieldwork preparation, generating map figures, and interpreting spatial relationships. Spatial Science minor at UCSB involved extensive GIS work.
- **Adobe Photoshop/Illustrator/Inkscape/ImageJ:** Annotating and mapping phases in thin section scans, analyzing imagery, and generating publication-quality figures.

FIELD EXPERIENCE

- **Florence, Wisconsin (2024)** Metamorphic and Geochemical sampling of Paleoproterozoic gneisses adjacent to lithium-rich pegmatite, 3 days
- **Scotland (2024)** Class field trip to observe historically important deformed and metamorphosed rocks for UW-Madison GEO 875: Geology of Scotland taught by Dr. Basil Tikoff, 11 days
- **Southwest California and Arizona (2024)** Metamorphic and Geochemical sampling in Cretaceous age metasomatic rocks, 10 days
- **Grand Canyon, Arizona (2023)** Backpacking in/out to motorized raft for metamorphic and geochemical sampling in Precambrian basement, 8 days
- **Duncan Hill pluton, Washington (2022)** Granitic pluton, structural measurements and geochronologic/AMS sampling while backpacking, 14 days.
- **Upper Peninsula, Michigan (2020, 2022)** Archean gneisses, structural measurements and geochemical sampling, 4 days.
- **Ring Mountain, California (2022)** Garnet blueschist and garnet amphibolite in Franciscan mélange, geochemical sampling, 1 day.
- **Bearpaw Mountains, Montana (2020)** Lower crustal xenoliths, gaining sampling consent with cadastral data and geochemical/geochronological sampling, 4 days.
- **Oman (2019)** Semail Ophiolite and Neoproterozoic sedimentary formations, structural measurements, mapping, and sampling for UCSB Earth 227: Field Petrology, 14 days
- **Proto-Kern Canyon Shear Zone and Central Mojave Core Complex (2019)**, Structural measurements and mapping as part of UCSB Earth 158: Advanced Structure, 6 days.
- **Madagascar (2019)**, Charnockite and lower crustal/mantle xenoliths, Field mapping, geochemical sampling, and measuring heat-production with handheld gamma ray spectrometer, 17 days.
- **Northern Schell Creek Range, Nevada (2019)**, Geologic mapping for UCSB Earth 118: Summer Field Geology taught by Dr. Phil Gans, 42 days.
- **Rainbow Basin, California (2019)**, Geologic mapping for UCSB Earth 104b: Field Methods taught by Dr. Brad Hacker, 9 days.

PUBLICATIONS

In Press:

- Droubi, O. K., Cipar, J. H., Smye, A. J., & Garber, J. M. (2024). Xenolith petrochronology (San Luis Potosi, Mexico) constrains heat sources for Cenozoic ultrahigh-temperature metamorphism in the lower crust. *Journal of Geophysical Research: Solid Earth*, 129(8), e2024JB029138.
- Droubi, O. K., Bauer, A. M., Bonamici, C., Nachlas, W. O., Tappa, M. J., Garber, J. M., & Reimink, J. R. (2023). U-Th-Pb and trace element evaluation of existing titanite and apatite LA-ICP-MS reference materials and determination of $^{208}\text{Pb}/^{232}\text{Th}$ - $^{206}\text{Pb}/^{238}\text{U}$ date

discordance in Archaean accessory phases. *Geostandards and Geoanalytical Research*, 47(2), 337-369.

In Review:

Droubi, O.K., Bonamici, C.B., Bauer, A.N., Garber, J.M., Tappa, M.J., Nachlas, W.O., Reimink, J.R., The Neoarchean-Paleoproterozoic tectonic transition in Laurentia: insights from the Watersmeet gneiss dome, MI, USA. *In review at Precambrian Research*.

In Preparation:

Droubi, O.K., Bauer, A.N., Bonamici, C.B., Nachlas, W.O., Garber, J.M., Tappa, M.J., Reimink, J.R., Titanite petrochronology reveals distinct tectonothermal events from 3.6–1.8 Ga at the Acasta Gneiss Complex, Northwest Territories, Canada

Co-authors TBD, UHT metamorphism recorded in deep crustal xenoliths potentially a product of lower crustal foundering in central Madagascar

Conference Presentations:

Droubi, O.K., Garber, J.M., Smye, A.J. 2023, Trace-element zoning in garnet from lower crustal xenoliths preserves record of crustal anatexis in response to Mexican Basin and Range extension. *Metamorphic Studies Group research in progress (RiP)*. [**Best Student Poster Award**]

Droubi, O.K., Bonamici, C.B., Bauer, A.N., Nachlas, W.O., Garber, J.M., 2022, Tectonothermal evolution of the southern Laurentian margin from the Neoarchean to the Paleoproterozoic recorded in the Watersmeet Gneiss Dome, MI, USA. *Geological Society of America Annual Meeting*, Abstract 223-4.

Droubi, O.K., 2022, Building Python-based analytical software for EPMA. *Geological Society of America Annual Meeting*, Pre-GSA Workshop: Connecting emerging lab data management capabilities to community geochemistry systems.

Droubi, O.K., Bonamici, C.B., Bauer, A.N., Nachlas, W.O., Tappa, M.J., 2021, Titanite petrochronology of the Acasta Gneiss Complex, Northwest Territories, Canada. *American Geophysical Union Fall Meeting*, Abstract V15A-0089.

AWARDS, GRANTS, SERVICE

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| • President, Geoscience Graduate Student Association | May 2024 |
| • UW-Madison Weeks Research Assistant Fellowship | Sep 2023 |
| • Metamorphic Studies Group, Best Student Poster | Apr 2023 |
| • UW-Madison Weeks/Senger Research Assistant Fellowship | Sep 2021 |
| • NSF/GSA Graduate Student Grant (\$2500) | May 2021 |
| • UW-Madison Advanced Opportunity Fellowship | Sep 2020 |
| • UCSB Earth Science Charles D. Woodhouse Award | June 2020 |
| • UCSB Earth Science Distinction in the Major Award | June 2020 |
| • UCSB Earth Science Outstanding Academic Achievement Award | June 2020 |
| • Coast Geological Society Award | May 2020 |
| • UCSB Department Field Award | June 2019 |