

CADEN J. HOWLETT

PhD Candidate

Department of Geosciences

University of Arizona, Tucson, AZ

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EDUCATION

Ph.D. Geosciences, University of Arizona (2020-present)

Advising Committee: Barbara Carrapa, Peter DeCelles, Paul Kapp, Susan Beck

Dissertation: Structural and thermal evolution of the south-central Andean thrust belt

M.S. Earth Sciences-Geology, Montana State University (2020)

Advising Committee: Andrew Laskowski, Devon Orme, Dave Lageson, Colleen Elliott

Thesis: Syn-orogenic magmatism, mid-crust exhumation, and placer gold deposition: The Anaconda metamorphic core complex of western Montana

B.S. Earth Sciences-Geology, Honors, Montana State University (2018)

Advisor: Andrew K. Laskowski

Thesis: Detrital zircon U-Pb geochronology and GIS terrain analysis to determine provenance of gold placer deposits of the Pioneer District, Flint Creek Range, SW Montana

Field Camp | Montana State University Field Camp 2018 | Western Interior USA

Research specialties: Convergent margin systems, thrust belts, geologic mapping, structural geology, helium thermochronology, apatite fission-track thermochronology, science communication

TEACHING EXPERIENCE AND LAB MANAGEMENT

Research Assistant, University of Arizona Fission Track Laboratory, Dec 2022-present

Department of Geosciences

- Co-manager of the UA Fission Track Laboratory. Maintain laboratory equipment/supplies in the FT and the mineral separation labs and oversee the shipment and delivery of irradiations.

Teaching Assistant, August 2020-present

University of Arizona

- Geology Field Camp (GEOS414, Su24)
- Physical Geology (GEOS251)
- Historical Geology (GEOS255)
- Sedimentology & Stratigraphy (GEOS302)
- Geological Hazards (GEOS218)
- Oceanography (GEOS212, twice)

Teaching Assistant, August 2018-May 2020

Montana State University

- GIS and Cartography (GPHY284, twice)
- Advanced GIS & Spatial Analysis (GPHY384)
- Sedimentary Petrology (GEO443, twice)

Space Public Outreach Team (SPOT) Presenter, February 2016-August 2018

Montana Space Grant Consortium/NASA, Bozeman, MT

- NASA presentations to K-12 public schools with the Montana Space Grant Consortium (MSGC).

FIELDWORK

2018 Anaconda-Pintler Wilderness, Montana. 8 weeks

- 2019 Flint Creek Range, western Montana. 1 week
 2019 Tangra-Yumco Rift, southern Tibet. 4 weeks
 2020 Northern Laramide, Montana & Wyoming. 4 weeks
 2021 Little Belt Mountains, central Montana. 3 weeks
 2022 South-central Andes (31-36°S). 10 weeks
 2023 South-central Andes (31-36°S). 6 weeks
 2024 South-central Andes (31-36°S). 7 weeks

PEER-REVIEWED PUBLICATIONS

- [6] Reynolds, A.N., Laskowski, A.K., **Howlett, C.J.**, Orme, D.A., Sundell, K.E., Taylor, M.H., Guo, X., Ding, L., Kinematic evolution of the Tangra Yumco Rift, south-central Tibet, *in press*, *Tektonika*.
- [5] Ronemus, C.B., **Howlett, C.J.**, DeCelles, P.G., Carrapa, B., George, S.W.M., 2024, The Manantiales basin, Southern Central Andes (~32°S), preserves a record of late Eocene-Miocene episodic growth of an east-vergent orogenic wedge. *Tectonics*, v. 43, 1-37, doi:10.1029/2023TC008100.
- [4] Sundell, K.E., Laskowski, A.K., **Howlett, C.J.**, Kapp, P., Ducea, M., Chapman, J.B., Ding, L., 2024, Episodic Late Cretaceous to Neogene crustal thickness variation in southern Tibet. *Terra Nova*, v. 6, 45-52, doi:10.1111/ter.12689.
- [3] **Howlett, C.J.**, Jepson, G., Carrapa, B., DeCelles, P.G., Constenius, K.N., 2024, Late Cretaceous exhumation of the Little Belt Mountains and regional development of the Helena salient, west-central Montana, USA. *GSA Bulletin*, v. 136, 2256–2280, doi:10.1130/B37081.1.
- [2] **Howlett, C. J.**, Reynolds, A. N., & Laskowski, A. K., 2021, Magmatism and extension in the Anaconda metamorphic core complex of western Montana and relation to regional tectonics. *Tectonics*, v. 40, 1-31, doi:10.1029/2020TC006431.
- [1] **Howlett, C.J.**, and Laskowski, A.K., 2021, Determining the source of placer gold in the Anaconda metamorphic core complex supradetachment basin using detrital zircon U-Pb geochronology, Pioneer District, western Montana. *Geosphere*, v. 17, 154–170, doi:10.1130/GES02226.1.

PEER-REVIEWED GEOLOGIC MAPS

- [1] **Howlett, C.J.**, Reynolds, A.N., and Laskowski, A.K., 2020, Geologic Map of the Northern Half of the Pintler Lake 7.5' Quadrangle and the Southern Half of the Warren Peak 7.5' Quadrangle, southwestern Montana: Montana Bureau of Mines and Geology EDMAP portion of the National Geologic Mapping Program 13, 1 sheet, scale 1:24,000.

PUBLICATIONS IN REVIEW/REVISION

- [3] **Howlett, C.J.**, Ronemus, C.B., Carrapa, B., DeCelles, P.G., Miocene construction of the High Andes recorded by exhumation of the Frontal Cordillera, La Ramada Massif of western Argentina (31°S), *in review*, *Geochemistry, Geophysics, Geosystems*.
- [2] Jepson, G., Carrapa, B., DeCelles, P.G., Reehner, L.J., **Howlett, C.J.**, Sherpa, T.L., Caylor, E.A., Wang, J.W., Constenius, K.N., Regional exhumation of the Laramide, *in revision*, *GSA Bulletin*.
- [1] George, S.W.M., Carrapa, B., DeCelles, P.G., Jepson, G., Nadoya, H., Tabor, C., **Howlett, C.J.**, Ronemus, C.B., Clementz, M.T., Intensification of the South American Monsoon in the south Central Andes at the start of the Middle Miocene Climatic Optimum, *in review*, *Nature Communications*.

PUBLICATIONS IN PREPARATION

- [4] **Howlett, C.J.** and Ronemus, C.B., A Cretaceous-Eocene orogenic plateau in the northern US Cordillera, *in prep*, *Geology*.
- [3] Ferroni, F.R., DeCelles, P.G., Carrapa, B., Veramendi, J.O., Jepson, G., **Howlett, C.J.**, Tectono-thermal evolution of the Sub-Andean fold-thrust belt (21°-22°S), *in prep*.
- [2] Jepson, G., Carrapa, B., Jones, S., Kohn, B.P., Gleadow, A.J.W., George, S.W.M., Gehrels, G., **Howlett, C.J.**, Triantafyllou, A., Monazite fission-track thermochronology as a possible proxy for low-magnitude erosion, *in prep*.

- [1] Reeher, L.J., Davis, G.H., Hughes, A.N., **Howlett, C.J.**, DeCelles, P.G., Regional analysis of Laramide deformation across the Colorado Plateau, *in prep*, *GSA Bulletin*.

BOOK

Howlett, C.J., 2024, LIFE & SPACE, Philosophical and Scientific Fragments, *independently published*, 210 p. ISBN-13: 979-8394266355.

INVITED† AND SPECIAL* TALKS

- [2] ***Howlett, C.J.**, ROCKY PLANETS AND ICY MOONS: Geology of the Solar System, 16th Gem & Jam Festival Guest Speaker, Tucson, AZ, February 2024.
- [1] †**Howlett, C.J.**, Thin- and thick-skinned deformation along the northern margin of the Helena salient, west-central Montana, University of Idaho Department of Earth and Spatial Sciences Seminar Series, February 2024.

CONFERENCE ABSTRACTS

- [20] Jepson, G., Carrapa, B., Jones, S., Kohn, B., Gleadow, A., George, S., Gehrels, G., **Howlett, C.J.**, and Triantafyllou, A.: Monazite fission-track thermochronology as a possible proxy for low-magnitude erosion, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-5153, doi:10.5194/egusphere-egu24-5153.
- [19] **Howlett, C.J.**, Ronemus, C.B., Carrapa, B., DeCelles, P.G., Age-elevation relationships from Cerro Mercedario (6720m) record exhumation of the La Ramada massif, high Andes of western Argentina, Geological Society of America Abstracts with Programs. Vol 55, No. 6, October 2023. doi:10.1130/abs/2023AM-394540. *Talk*
- [18] George, S.W.M., Carrapa, B., DeCelles, P.G., Jepson, G., **Howlett, C.J.**, Ronemus, C.B., Intensification of the South American Monsoon at the Start of the Middle Miocene Climatic Optimum in the Central Andes as a Modulator of Orogenic Shortening, Geological Society of America Abstracts with Programs. Vol 55, No. 6, October 2023. doi:10.1130/abs/2023AM-392282.
- [17] Ronemus, C.B., **Howlett, C.J.**, DeCelles, P.G., Carrapa, B., Miocene wedge-top sedimentation adjacent to out-of-sequence thrust faults in the Manantiales Basin, southern central Andes (~32°S), Geological Society of America Abstracts with Programs. Vol 55, No. 6, October 2023. doi:10.1130/abs/2023AM-389672.
- [16] Sabor, F.S., Ronemus, C.B., **Howlett, C.J.**, Sedimentologic insights into Late Cretaceous–Early Miocene foreland basin development in the southern Central Andes (~36°S), Geological Society of America Abstracts with Programs. Vol 55, No. 6, October 2023. doi:10.1130/abs/2023AM-395718.
- [15] **Howlett, C.J.**, Ronemus, C.B., Carrapa, B., DeCelles, P.G., Age-elevation relationships from Cerro Mercedario (6720m) record exhumation of the La Ramada massif, high Andes of western Argentina, 18th International Conference on Thermochronology. Riva del Garda, Italy, September 2023. *Poster*
- [14] DeCelles, P.G., Constenius, K.N., Gehrels, G.E., Yonkee, A., Wells, M., **Howlett, C.J.**, Geological Constraints for Late Jurassic-Eocene Cordilleran Orogeny in the Western U.S.A.: Review and Actualistic Comparisons. 2023 GSA Cordilleran Section Meeting. Reno, NV, May 2023.
- [13] Jepson, G., Carrapa, B., DeCelles, P.G., Reeher, L.J., **Howlett, C.J.**, Sherpa, T.L., Caylor, E.A., Wang, J.W., Constenius, K.N., Tracking Laramide Exhumation as a Proxy for Upper Crustal Response to Subduction Processes. 2023 GSA Cordilleran Section Meeting. Reno, NV, May 2023.
- [12] **Howlett, C.J.**, Ronemus, C.B., Exhumation of the La Ramada Massif of western Argentina: field and thermochronological data from Cerro Mercedario (6720m). 51st Annual University of Arizona GeoDaze symposium. Tucson, AZ, March 2023. *Talk*
- [11] **Howlett, C.J.**, Jepson, G., Carrapa, B., DeCelles, P.G., Late Cretaceous exhumation of the Little Belt Mountains in relation to regional development of the Helena salient, west-central Montana, USA,

- Geological Society of America Abstracts with Programs. Vol 54, No. 5, October 2022. doi: 10.1130/abs/2022AM-382668. **Poster**
- [10] **Howlett, C.J.**, Ronemus, C.B., Building and Destroying an Orogenic Plateau in the Northern US Cordillera. 50th Annual University of Arizona GeoDaze symposium. Tucson, AZ, March 2022. **Talk**
- [9] **Howlett, C.J.**, Jepson, G., Carrapa, B., Low-temperature thermochronology of the Little Belt Mountains of central Montana with implications for models of Laramide tectonism. 17th International Conference on Thermochronology. Sante Fe, NM. September, 2021. doi:10.1002/essoar.10508006.1. **Talk**
- [8] **Howlett, C.J.**, Jepson, G., Carrapa, B., Low-temperature thermochronology of the Little Belt Mountains of central Montana. 49th Annual University of Arizona GeoDaze symposium. Tucson, AZ, April 2021. *Best graduate talk award*. **Talk**
- [7] **Howlett, C.J.**, Reynolds, A.N., Laskowski, A.K., Farallon slab removal as a driving force of Cordilleran metamorphic core complex formation: details from the Anaconda Range of western Montana, Geological Society of America Abstracts with Programs. Vol 52, No. 6, 2020, doi:10.1130/abs/2020AM-355195. **Talk**
- [6] **Howlett, C.J.**, and Laskowski, A.K., Using detrital zircon U-Pb geochronology to determine the source of placer gold: a case-study from the Pioneer District, western Montana, Geological Society of America, Phoenix, AZ, September 2019. doi:10.1130/abs/2019AM-335775. **Talk**
- [5] **Howlett, C.J.**, Reynolds, A.N., Laskowski, A.K., Geologic Map of the Northern Half of the Pintler Lake 7.5' Quadrangle and the Southern Half of the Warren Peak 7.5' Quadrangle, Southwestern Montana, Geological Society of America, Phoenix, AZ, September 2019. doi:10.1130/abs/2019AM-331565. **Poster**
- [4] **Howlett, C.J.**, Investigating the Anaconda Metamorphic Core Complex of western Montana—Insights into the extension dynamics of convergent orogenic belts. Himalaya-Karakorum-Tibet (HKT) Conference, Bozeman, MT, June 2019. doi:10.5281/zenodo.3238707. *Best student poster award*. **Poster**
- [3] **Howlett, C.J.**, Determining the relationship between magmatism and exhumation in the Anaconda Metamorphic Core Complex using igneous zircon U-Pb geochronology, western Montana, 2019 Montana State University Earth Sciences Colloquium. **Talk**
- [2] **Howlett, C.J.**, and Laskowski, A.K., Detrital zircon U-Pb geochronology and GIS terrain analysis to determine provenance of gold placer deposits of the Pioneer District, Flint Creek Range, SW Montana, 2018 Undergraduate Scholars Program Student Research Celebration. **Poster**
- [1] **Howlett, C.J.**, and Laskowski, A.K., Determining the source of placer gold in the Anaconda Metamorphic Core Complex supradetachment basin using detrital zircon geochronology, Pioneer District, Western Montana. Geological Society of America, Indianapolis, IN, October 2018. Abstract #286-12. **Talk**

NON PEER-REVIEWED PUBLICATIONS

- Howlett, C.J., 2020, Syn-orogenic magmatism, mid-crust exhumation, and placer gold deposition: the Anaconda metamorphic core complex of western Montana. MS thesis, Montana State University, 140 p.
- Howlett, C., 2019-2020, recurring weekly column in MSU Exponent (university newspaper), [23 published articles](#).
- Howlett, C., 2017, MSU Geology Club Bridger Canyon Exploration: *Montana Geological Society Newsletter*, v. 61, no. 10, p. 9-10.
- Howlett, C., 2017, MSU Geology Club Paradise Valley Camping Trip: *Montana Geological Society Newsletter*, v. 61, no. 13, p. 5-6.
- Howlett, C., 2017, MSU Geology Club South Fork Deep Creek Exploration: *Montana Geological Society Newsletter*, v. 62, no. 2, p. 6-7.

GRANTS/AWARDS

2018 **Undergraduate Scholars Program Research Grant**, Montana State University (\$900)
 2019 **Foster Scholarship**, Tobacco Root Geological Society (\$1000)
 2019 **Donald L. Smith Memorial Scholarship**, Montana State University Earth Sciences (\$2100)
 2019 **Graduate Student Grant**, Geological Society of America (\$2000)
 2021 **Best Graduate Talk (GeoDaze)**, University of Arizona Department of Geosciences (\$500)
 2021 **Sibanye-Stillwater/Wheaton Precious Metals Scholar**, Tobacco Root Geological Society (\$1000)
 2021 **Bert Butler Scholarship**, University of Arizona Geosciences (\$1500)
 2022 **Galileo Circle Scholar**, University of Arizona College of Science (\$1000)
 2022 **William and Clara Sulzer Scholarship**, University of Arizona Geosciences (\$2000)
 2022 **GSA Connects Travel Grant**, Geological Society of America Rocky Mountain Sector
 2023 **Graduate & Professional Student Council Travel Grant**, UArizona (\$1000)
 2023 **College of Science Excellence in Service Award**, UArizona College of Science
 2023 **GSA Connects Travel Grant**, Geological Society of America Cordilleran Sector
 2024 **American Philosophical Society**, Lewis and Clark Field Scholar (\$3700)

SERVICE, EXTRACURRICULAR, AND PROFESSIONAL DEVELOPMENT

Science communication (blog and videography), Spring 2016-present

- Science communication platforms focused on topics in geoscience, astronomy, field-based research, and travel/exploration. [Instagram](#): ~100k followers; [YouTube](#): >3.8k subscribers

University of Arizona

- Department of Geosciences, director of social media (August 2021-present)
- GeoDaze Research Symposium Committee, social media/public outreach (2021-2024)
- Assoc. of Women Geoscientists (AWG) Southern Arizona Outreach Coordinator (2023-present)
- AWG Scholarship Committee (2023)
- AWG Yoga Instructor (2023, 24)
- Epsilon Eta Earth Week Professional Panelist (2023)
- Tucson High School Field Trip co-leader, Catalina Mountains (April 2023)
- Hollinger K-8 School presentation: *What is a Geologist?* (May 2023)
- Legacy Traditional School 7th grade: *Field Geology and Geochronology in the Andes* (May 2022)
- ALFAMARS Team Member, analog astronaut program and Mars life detection team (Feb 2023-present)

Montana State University

- Geology Club, President, (2015-2018)
- MSU Earth Sciences Department Colloquium, chair social media/marketing (2018-2020)
- MSU Earth Sciences Department Party Planning Committee, public relations (2019-2020)
- Quaternary Interest Group, (2016-May 2017)

Selected Field Trips and Short Courses

- Western Interior US (MT, ID, WY, UT, AZ, NM, CA)—Numerous field trips (2014-present)
- 2018 Charles Bradley Inaugural Field Trip (Death Valley, CA), Montana State University
- ExxonMobil Petroleum Reservoir Characterization course, Boise, ID (October 2018)
- Scanning Electron Microscopy Short Course, Imaging and Chemical Analysis Laboratory, Montana State University, Jan. 2019
- Detrital Zircon Geochronology: U-Pb Data Acquisition, Reduction, Analysis, and Archiving, GSA, Phoenix, AZ, Sep. 2019
- Thermal History Modeling Short Courses, Thermo2021, Sante Fe, NM, Sep. 2021
- Chemical Evolution of the Earth Field Trip (UA Grad Course), Hawaiian Islands, Oct. 2021
- Structure of the Alps, with P.G. DeCelles and B. Carrapa, Italy and Switzerland, Sep. 2023

Member

- The Explorers Club (2023-present)
- Geological Society of America (GSA), (2018-present)
- Tobacco Root Geological Society (2019-present)
- Arizona Geological Society (2021-present)
- American Association of Petroleum Geologists (AAPG), (2014-2018)
- Montana Brewers Association, (2017-2020)
- Montana State University Geology Club (2014-2020)

Certifications

- Level 4 Swiftwater Rescue Certified (ACA)
- Advanced first aid/CPR (American Red Cross)
- UArizona Radioactive Materials Certification

CONFERENCE CONVENING

[1] “Convergent Margin Systems,” GSA 2023 Annual Meeting Session T160, Pittsburgh, PA. Conveners: Chelsea Mackaman-Lofland, **Caden Howlett**, Chance Ronemus, Mary Braza.

REVIEWER FOR:

Geophysical Research Letters

TECHNICAL EXPERIENCE

Analytical and Laboratory

Apatite fission-track, ap+zr (U-Th)/He thermochronology
LAICP-MS for U-Pb dating and Hf isotopes
Scanning electron microscopy for BSE and CL imaging
X-Ray diffraction, X-ray fluorescence

Software

Esri ArcMap & ArcGIS Pro, QGIS, MOVE, HeFTy, QTQt, PECUBE, Adobe Suite (including Premiere Pro, videography)

MEDIA (hyperlinked)

[Daily Interlake Profile](#): Daily Interlake, March 2019

[MSU Students Study North America's Middle Crust](#): Montana State University, September 2021

[UArizona College of Science Q&A](#): University of Arizona, February 2023