

## Letter to Prospective Graduate Students 2019-2020,

Thank you for your interest in the structure/tectonics program at the University of New Mexico. There are lots of exciting projects underway and I am nearly always looking to add new graduate students to my research group at UNM as past students graduate and head off to their next endeavors.

I am a structural geologist/tectonicist. My research is eclectic, but I continue to work on field-based tectonic studies predominantly in the southwestern United States. One of my interests has been on understanding the processes that go on in the middle crust during orogenesis and crust formation, especially the interaction of deformation, metamorphism, and plutonism. The Proterozoic rocks of the Southwest provide a spectacular natural laboratory for these types of studies with excellent exposures of rocks that were tectonized at 10-25 km deep in the crust and now are spectacularly exposed in the southern Rocky Mountains, Grand Canyon, Transition Zone of Arizona, Basin and Range, Mojave Desert, and flanks of the Rio Grande rift (great places to do field work!). I am also very interested in the processes by which older zones of weakness get reactivated in younger tectonic events, right up to the present tectonism that is reshaping crust, mantle, and landscapes in the western United States. My current "basement" projects involve Hf and U-Pb studies of zircons in the various Proterozoic crustal provinces to try to better refine the processes of continental assembly of Laurentia and to develop better constraints on Precambrian supercontinent reconstructions for Rodinia (1.0 Ga) and Nuna (1.8 Ga). This also involves detailed structural and petrologic work on shear zones.

More recently, I have "moved toward the surface" and embarked on new research efforts that involves neotectonics, Quaternary incision history, uplift history in the Grand Canyon and Rocky Mountains, and interaction of denudational and neotectonic histories in the western United States. I do maintain a somewhat unusual "bottom-up" perspective. Some of my recent papers attempt to link neotectonics to mantle geophysics via mantle-to-surface interactions. One such interaction involves young and ongoing surface uplift of the Colorado Plateau and Rocky Mountain regions; we proposed this in Karlstrom et al. (2008, *Geology*; 2012, *Lithosphere*) and the concept is still a hot topic of debate and continued research. A second interaction involves upward flux of mantle-derived fluids along faults, as detected by helium isotope studies in the western U.S., Australia, and Egypt. Recent papers on the age of Grand Canyon (Karlstrom et al., 2014; *Nature Geoscience*; Karlstrom et al., 2017 *Geosphere*) have received lots of interest as a potential resolution to this 140-year-long debate.

I currently have five Masters students (Micael Albonico, Jordan Anderson, Christina Ferguson, Jeff Hrcir, Daniel Young) and two PhD students (Jacob Thacker, Carmen Winn). Five of them should finish this coming academic year (2019-2020). I like to maintain a research group of ~4 graduate students and often try to add 1-2 new graduate students each year. This is a large enough research group to have a critical mass for the exchange of ideas, but small enough that I can work closely with each student. Most of my students have projects that combine field mapping and structural analysis with one or more other aspects of geology, such as geochronology, metamorphic petrology, sedimentary tectonics, tectonic geomorphology, thermochronology, and a range of other analytical tools. It is increasingly important to develop a broad background, a "toolbox" of analytical tools, and be able to integrate different types of data. My style of working with students is to work closely together on problems of mutual interest. We often work as a collaborative team (with others in the UNM group or

with collaborators at different universities) with the goal of developing collaborative publications in peer reviewed journals and a very thorough merging of diverse datasets and ideas with the current scientific literature on a topic. I think the most exciting, fruitful, and enjoyable aspects of the geosciences involves collaborative and integrative science.

I have several research projects in mind for new students (with 2 grants presently in hand and others being applied for). I am always willing to think of other possibilities as well. Please give me a call or send me an email to discuss possible projects:

1) Grand Canyon: This effort has become a life-long work with many facets (Precambrian to Quaternary to outreach). The next steps involve compilation and completion of 1:24,000 mapping of the river corridor (much of it based on past theses, but new mapping needed as well). Students interested in helping with this need to be accomplished using GIS.

2) Cambrian systems of the Southwest. Our recent work (Karlstrom et al., 2018, Nature Geoscience, v. 11, p. 438-443) has led to new questions about what drove the Cambrian marine transgressions in the western US, and when they occurred, and how they related to the Cambrian explosion. This project involves stratigraphic studies and detrital zircon dating of Grand Canyon, central Arizona, and Mojave Desert sections.

3) My Rocky Mountains, New Mexico, and Arizona Proterozoic studies will focus on the ~ 1.45 billion year tectonic setting. This project involves structural analysis, metamorphic and pluton studies, U-Pb geochronology, and Ar-Ar thermochronology (with Matt Heizler).

4) My tectonic geomorphology efforts will concentrate on using Ar-Ar dating of detrital sanidine (also with Matt Heizler) to continue to study the differential incision history of various SW USA rivers to quantify differential surface uplift across the region.

For graduate student funding, my goal is provide a combination of funding from departmental teaching and NSF research grants. This gives you the opportunity to teach some semesters and have time for more concentrated research in other semesters. I try to fully fund students for both the academic year and for a couple of months in the summer. My current and pending funding situation is listed on my CV on my web page.

Please feel free to call me (505-277-4346; cell is 505-264-0483) or send me an email (kek1@unm.edu) with further questions about our program. I'd be glad to send pdf reprints and preprints, if you wish. If you get a chance to visit New Mexico, give me some warning and I'll try to arrange a fieldtrip to some nearby spectacular rocks! Also feel free to talk to my present or past graduate students about their projects and experiences at UNM.

All the best in your geologic pursuits,

Karl Karlstrom, Professor