

Oklahoma! From rift to drift then back again

Undergraduate majors head for the hills

by **Shanan Peters**

Although a long history of past field trips have left many GeoBadgers in the know, few are aware of the fact that Oklahoma boasts three, yes THREE, mountain ranges: the western Wichitas, the eastern Ouachitas, and the mighty Arbuckles in between. During Spring Break 2009 (March 14-22), thirteen more undergraduate GeoBadgers got to know these OK ranges and the excellent geology they expose.

Led by **Shanan Peters**, fly-boy **Alan Carroll**, and a fearless, but all-too-patient TA **Chloë Bonamici**, the crew left Madison, caravan style. After a missed turn by the cargo van while still on Madison's beltline, we reached the edge of Oklahoma without further incident. A fuel-up and cultural experience at Okie Burger in the little burb of Miami left everyone ready to crash at a nearby state park in preparation for the next

day's much shorter drive.

After an early reveille and Shanan's call to identify the rocks that you slept on (it's kind of an unspoken requirement on the field trips), we loaded 'em up and headed to the Wichitas. Holding our breath as we passed over the fault that bounds the southern edge of the deep Anadarko Basin, our first goal was to find scrappy exposures of the contact between the Meers Quartzite and the Wichita Granite Group. Although we could pin down the area of the contact fairly precisely, the only good exposures were of each unit individually. After giving up on that, we climbed Mt. Scott, made up of the Cambrian Mount Scott Granite, and scanned the horizon for Alan's self-built plane. Having met up with Alan, we returned to camp and planned our trek through the igneous rocks that record the rifting of the continent.

Another day or two spent hiking on a layered mafic intrusion at the Peterson Ranch and the volcanics

and sediments of the Kimball Ranch, we were ready to head upward and into the Paleozoic, to the drift phase of the trip. The trek to the Arbuckles wasn't without trouble. Our trusty cargo van "Garnet" decided to become untrustworthy and broke down along the road. But guess what? It did so right beside a beautiful Permian outcrop, one of the only exposures for miles! This was, ironically, a very positive turning point for the trip. Shanan, Chloë,

Boomer Bain, Brian Boston, Angeline



Sophomore major **Boomer Bain** explains the origin of box-work vein structures in Ordovician turbidites in the Ouachitas to a group of students on the 2009 Spring Break trip "Three OK Mountain



Spring Breakers digging for Pennsylvanian plant fossils in the Ouachitas of Oklahoma.

Catena, Aaron Firnstahl, Jordan Gonnering, Ben Gottsacker, Sam Hayes, Reba Heiden, Dylan Loss, Hana Millen, Lynsey Spaeth, and Carolyn Streiff all bonded over the experience by geologizing, frisbee throwing, and other shenanigans. **Jim Senn** and Alan were absent from that experience for aerial reasons.

The rest of the trip was excellent. We spent time on Paleozoic carbonates deposited on the passive margin and then watched the siliciclastics and too-many (according to some) turbidites of the Ouachitas give testament to the collision of Laurentia and Gondwanaland. The Cretaceous coastal plain sediments told us the tale of the final rift-to-drift phase and, our story complete, we headed north.

To see the trip virtually in Google Earth, visit <http://strata.geology.wisc.edu/home/geo737.html> ●

Base Metals in the Snow

Canadian mines and spring camping

by Phil Brown

The day after graduation, Monday May 18, 2009, a hardy group of 11 undergraduates, one graduate student and I left for Manitoba as the reward for sitting through a semester of my Economic Geology class (G515). Most of us travelled in a small 14 passenger “bus” reserved from Car Fleet but as this has no storage space, we also took along “Garnet”—one of the aging department 15-passenger vans that has had all the bench seats removed turning it into a trailer with a motor. Our destinations for the trip were the famous mining areas of Thompson and Flin Flon, Manitoba.

Day one ended with us camping in downtown Grand Forks, North Dakota. The campground occupies the flood plain of the Red River and it is a bit surreal to be camping on the grassed areas where, until the great flood of 1997, houses stood. The curbs and sidewalks are still largely present, as are the streets. The ambiance of a campground was lacking but partially made up for by having a choice of licensed establishments on the edge of the flood plain. The following morning began a long day’s drive north, north, north to Paint Lake Provincial Park a half-hour south of Thompson, Manitoba. I had promised the students that we would likely be watching the ice melt in the lakes during our trip but we got off to a poor start on this—Paint Lake was frozen solid and there was snow on the ground and we were likely the first campers of the year.

The next morning we were due in Thompson early to have a mine tour hosted by Vale-Inco at their underground mine. We awoke to several additional inches of heavy wet snow and there were a few anxious moments as we wondered whether our 14-passenger “short bus” was going to climb the hill out of the campsite. Thompson is one of the most famous nickel mining areas of the world with the nickel sulfides occurring in



Early spring in the shadow of the South Main headframe, Flin Flon, Manitoba. The combination of human activity and climate have made the Flin Flon area the premier location to examine large expanses of Proterozoic seafloor with features including dikes, lava tubes, and pillows.

mafic and ultramafic rocks comprising part of a very complicated package of rocks marking the boundary of the Archean Superior province with the Proterozoic Churchill province. Deformation here was broadly contemporaneous with the Penokean Orogeny that formed much of the Precambrian basement of Wisconsin. Vale-Inco gave us a nice underground tour, followed by a welcome (indoor) lunch and talk. The weather was too poor for us to have an organized surface trip that afternoon so we returned to our very white camp and ended the day with a fire on the rocky beach of frozen Paint Lake.

Thursday morning we headed west across the Province to Flin Flon, the city lies astride the Saskatchewan border. We camped for three nights just SE of the city at the beautiful Baker’s Narrows Provincial Park where there was actually liquid water on the surface of the lake! Hudson Bay Mining and Smelting was our host for two exciting days examining the massive sulfide ores and their host rocks both underground in the Triple 7 mine and in surface outcrops. Rather more relaxed environmental regulations (i.e., none) in the past led to clear cutting of

timber for the mines, extreme acid rain killing the rest of the vegetation, and then denudation of the thin soil typical of the Canadian shield. This triple threat attack has yielded dozens of acres of naked rock that provide the finest study area in the world for examining Proterozoic pillow lavas, lava tubes and crosscutting feeder dikes. Sunday morning we loaded up our “land yacht” and trusty “trailer van” and headed back south in search of spring which was only a rumor in Thompson and Flin Flon. We made it all the way to Rushing River PP in Ontario’s Quetico

just a bit north of International Falls. The river was running high but the high point of this campground was I believe the showers.

The following day we tried a little road geology on both sides of the border but our field guides were 10-15 years old and most of the road cuts were obscured by lichen, underbrush and hundreds of saplings; we gave up and returned to Madison. Before big international field trips in the past the Ontario Geological Survey would send seasonal workers out with pressure washers, bleach and scrub brushes to make the outcrops presentable. Thus many of the published outcrop photographs provide misleading views of what you will find today. The high point of the geology on this day was looking at the Archean-aged Banded Iron Formation outcrops of the Vermillion Range. All of us had a tremendous time and learned a lot of geology. This trip was made possible by those generous donations that have established the Student Field Experience Fund—both the students and I are grateful for the opportunity. ●

Field Trip: Evolution of the California Margin

by Laurel Goodwin and Basil Tikoff

We left Wisconsin early on May 26, bound for San Francisco. That is, most of us left then. Co-leader **Alan Carroll** left a day early in his own plane. Co-leader **Shanan Peters** joined us on the more traditional route via commercial airline. Traditional, but not boring; we were surrounded by a wonderfully diverse and good-natured group of ten graduate students, nearly evenly divided among structural geologists, sedimentologists, and geophysicists, with a geomorphologist thrown in for good measure. Following a semester-long seminar, we were off to explore the tectonic, structural, and sedimentologic evolution of the west coast.

Alumnus **Eric Horsman** (then at the USGS, now on the faculty at Eastern Carolina University) met us in the Santa Cruz Mountains on that first day, jump-starting the trip with a remarkably clear overview of the tectonic history—including important faults and sedimentary basins—of the San Francisco Peninsula. We camped that night among the spectacular trees of Big Basin Redwoods State Park. Up the next morning before dawn (with nary a complaint from our stellar group of graduate students), we rolled down to the coast to catch the low tide exposures of the San Gregorio fault zone at Moss Beach. In a pattern to be repeated in following days, we had animated discussions about sedimentary rocks

and deformation on first fault outcrops then spectacular examples of Franciscan mélange to the north.

For the next eight days, we rambled south down the coast, then looped inland and north again, examining the rock record of both the San Andreas transform fault system and the older Mesozoic convergent tectonic system on which it was imposed. Our coastal route took us first to the petroleum seeps and deformation bands in sand intrusions at Panther Beach south of Santa Cruz, then south of Monterey Bay to Point Lobos with its amazing exposures of a submarine channel, spectacular soft-sediment deformation (see picture below of Shanan appreciating well deformed rocks), uplifted terraces, marine life, and a fair bit of poison oak. After our coastal foray, we were joined by alumnus **Mike Smith** (a faculty member at Sonoma State University) and his colleague Matty Mookerjee at the more pedestrian King City Campground. These two provided local insight and (especially Mike) entertainment. Astute graduate students picked up on key mannerisms that Alan and Mike share—but that’s another story.

With Mike and Matty in tow we cruised up Salinas valley (Steinbeck country) on dusty outcrops of folds in the Monterey formation next to the Rinconada fault and thought about strain partitioning, then visited sandstones

exposed in the Santa Lucia Range. Following the San Andreas fault to the south, we had to stop at Parkfield (attempting to “be there when it happens”, or at least get the group photograph) and the famous Wallace Creek. Our most southerly stops were in the Ridge Basin—interspersed with roadside investigations of the battered core of the San Andreas fault. Having had enough of a brush with southern California, we retreated north to Pacheco Pass to explore blueschists and the older record of subduction processes. We also followed a transect through the Great Valley sequence to see the Del Puerto ophiolite. On the last day, taking it a little easier, we saw the offset sidewalks of Hollister (including meeting a very funny inhabitant of one of the houses directly over the fault), the old San Benito winery (also built directly on the fault—hmmm, there seems to be a pattern here), and took a lovely hike to the top of the Pinnacles to think about the cumulative 315 km of dextral displacement on the San Andreas fault. After a nice meal on the Santa Cruz pier, we bought postcards for some of the alumni supporters of the Field Experience Fund who made the trip possible for our graduate students (many thanks!) and decided to head home to the stable craton. Overall, it was a great trip, and the perfect way to end the academic year. ●



The Wisconsin group at the Parkfield Bridge.



Shanan Peters makes a point.

Greenland Fieldtrip 2009

Students in the Field

Glacial geology at the edge

by Anders Carlson

This past summer, six graduate students (**Kallina Dunkle, Elizabeth "Lisa" Colville, Andrew Leaf, Ian Orland, David Ullman, and Kelsey Winsor**) and I traveled to Kangerlussuaq located ~20 km from the west Greenland Ice Sheet margin. For the first two days, we acclimatized ourselves to the dry air and constant sunlight while examining the type locality for much of the glacial geology of western Greenland. We then headed inland, trekking the 20 km with full packs to the Greenland



Graduate students at the Greenland Ice Sheet margin: Ian Orland, Lisa Colville, David Ullman, Kallina Dunkle, Andrew Leaf, and Kelsey Winsor. Photo: Anders Carlson

ice margin where we stayed for six days. We studied ice margin sedimentation with an excellent exposed ice cliff that allowed viewing of the glacier bed. Another excellent feature of the region was the bottom of a recently drained ice-marginal lake. All told, we covered ~180 km in nine days, most of it with full packs and no trails. Given the exertion, we were grateful to relax at the end with musk ox roast and reindeer steaks before sojourning to Copenhagen for an evening (see "Greenland Ice on the Scales," page 16). ●

GEOLOGICAL ENGINEERING UPDATE

By **Craig H. Benson, PhD, PE**
Chair, Geological Engineering

After a year hiatus from the University of Wisconsin, I am glad to be back and to have the opportunity to chair Geological Engineering. GLE continues to attract some of UW's best students, and produces exceptional engineers and scientists that are highly sought by industry, despite the nation's current economic woes. Industry representatives repeatedly tell me that our dual-degree (GLE and Geoscience) is particularly valuable. Our graduates have excellent credentials as geologists, practical engineering skills in a broad range of engineering topics that most schools teach at the MS level, and effective communication skills. Recent graduates have gone on to work at large international firms such as Shell and Golder Associates, as well as regional firms such as Natural Resources Technology in the Milwaukee area. Needless to say, leading this cadre of excellent students is a tremendous opportunity.

This fall we graduated Elliot Mergen and Erica Hagen at the undergraduate level with double majors (Geoscience/GLE), and Jonathan O'Donnell, Paul Schlicht, Alex Summit, Andrew Millspaugh, and Hoang-Hung Tran-Nguyen at the graduate level. Hoang-Hung is our first GLE graduate from Viet Nam, and has returned home to be a professor. Elliot, Jonathan, Paul, Alex, and Andrew have headed off to industry. Erica is pursuing her MS in GLE under the direction of Professors Fratta and Wu. We wish all of our fall graduates the best as they take this next step in their career.

I am also glad to announce that Ms. Sabrina Bradshaw has joined GLE as an academic staff member. Sabrina has a BS in Geology and a MS in GLE, both from UW. She will be working primarily as a research scientist in GLE's Recycled Materials Resource Center, which conducts applied research on sustainable geotechnical construction for the US government. Sabrina will also be assisting with GLE outreach to high school students and incoming freshman. Sabrina can be reached at sbradshaw@wisc.edu.

We are currently updating the undergraduate curriculum to reflect both traditional and current themes in practice. The technical elective component of the new curriculum has six tracks: Energy and Minerals,

Sustainability and Environment, Geohazards, Infrastructure, Water, and Engineering Geology. The curriculum is also being revised to incorporate changes being made to the undergraduate curriculum in the Department of Geoscience and to provide students with the opportunity to obtain BS degrees in both GLE and Geoscience without taking any additional courses (historically students needed to complete two additional courses to complete both degrees). Course revisions are also anticipated to enhance our offerings in each of the six tracks. For example, our course in vadose zone hydraulics will be updated to include principles of multiphase flow that are important to reservoir engineering.

During the fall semester we received industrial gifts from Barr Engineering, BP, and Golder Associates along with several personal gifts from our alumni. Budget cuts during the past year have made this support essential. We would not be able to offer our students the high quality education that is the hallmark of UW's GLE without this support. We are thankful for this generosity.

We are always glad to hear from our friends and alumni. Please feel free to contact me any time at chbenson@wisc.edu or +1 (608) 262-7242. And if you are in Madison, please stop by for a visit. ●