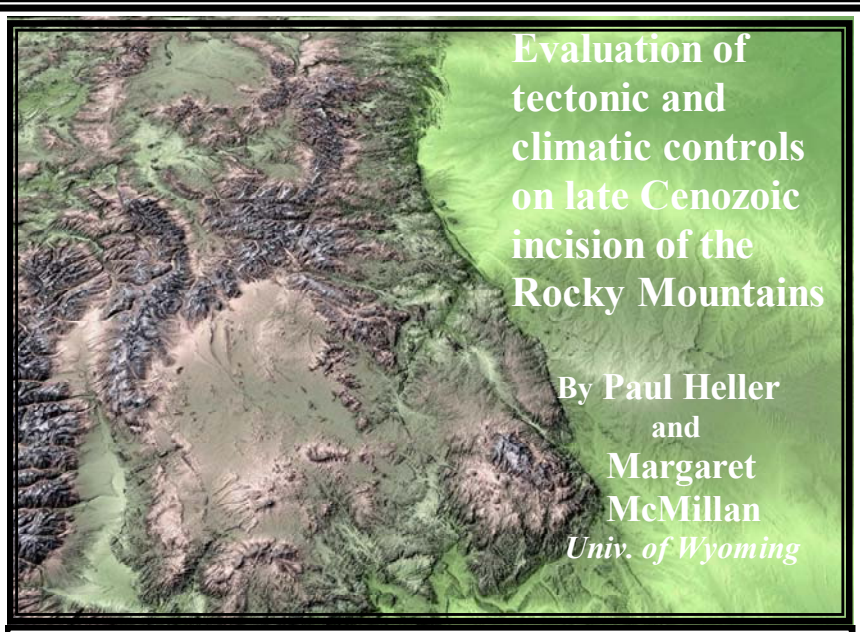
Colorado Scientific Society

The objective of the Society is to promote the knowledge and understanding of Earth science, and its application to human needs

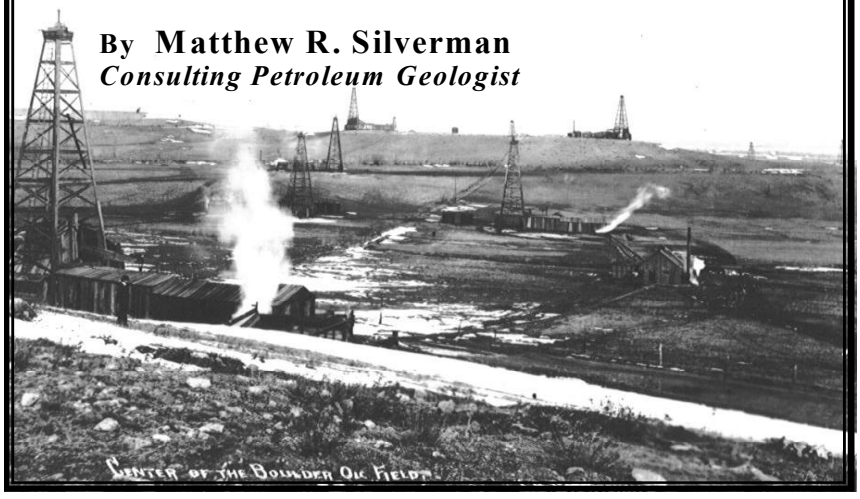


Evaluation of tectonic and climatic controls on late Cenozoic incision of the Rocky Mountains

By Paul Heller
and
Margaret McMillan
Univ. of Wyoming

Even in Boulder: The Boulder Oil Field, 1901 – Today

By **Matthew R. Silverman**
Consulting Petroleum Geologist



Thursday, March 20, 2003

American Mountaineering Center
710 10th St. (NE corner of 10th and Washington), Golden
Social half-hour – 7:00 pm. Meeting time – 7:30 pm.

Abstract

Evaluation of tectonic and climatic controls on late Cenozoic incision of the Rocky Mountains

By Paul Heller and Margaret McMillan, Department of Geology, Univ. of Wyoming

The Rocky Mountain orogenic plateau is characterized by high elevations (>2 km) and deep post-Laramide incision (up to 1.2 km). While it is not clear when modern elevations were first attained, most studies indicate that incision began during the past 10 m.y. and may coincide with elevation gain. The ultimate cause of downcutting reflects the interplay between regional tectonic uplift and climate change. We evaluate the relative roles of these driving mechanisms by mapping the distribution of, and incision into, a variety of paleodatums. These datums include high-level subsummit erosion surfaces, the maximum elevation of once-continuous remnants of post-Laramide basin deposits, young volcanic flows, and pedimented terraces. These surfaces are not contemporaneous, but they are all post-Laramide in age and so provide an envelope for the magnitude of incision.

Results indicate that (1) the incision pattern is broadly domal, paralleling the trend of the Rio Grande Rift in Colorado and the Bighorn Mountains in Wyoming, and decaying to the north and east over distances of several hundred kilometers; (2) the pattern of incision matches regional topography of the Rockies, except in areas of most active recent tectonics; (3) in several places, most notably the western Great Plains, incision is associated with surfaces that have been tilted after deposition, and (4) the turnaround from net aggradation to incision took place ~6 ± 1 Ma.

The distribution of incision suggests that tectonic uplift exerts major control. The broad wavelength of downcutting, which parallels regional isostatic anomaly trends, suggests upper mantle involvement in the origin of uplift. Climate clearly influences second-order features such as knick-zone migration and details of the erosion pattern. Our results appear to differ with those derived from published paleobotanical estimates of elevation change since the end of the Laramide orogeny. However, the uncertainties in those estimates (up to ±1.5 km) are not inconsistent with our results.

Even in Boulder: The Boulder Oil Field, 1901 – Today

By **Matthew R. Silverman,**

An oil field in Boulder? Tofu and granola, yes. Sandals and love beads, sure. Even *Mork and Mindy*. But an oil field?

Over one hundred years ago, in 1901, the Boulder Oil Field was discovered just northeast of the eponymous Colorado town. It is the second oldest field in the state and one of the oldest producing anticlines in the Rockies. The field was discovered the same year as Spindletop, and its early development shares some of that boomtown atmosphere and scandal. An effort is now underway to get landmark designation at the Boulder discovery, now ironically the site of the only well still producing in the field.

Wells had been drilled in the area to follow up on oily odors and seeps as early as 1892. Dowsing by a group associated with Isaac Canfield, one of the pioneers of Colorado's oil industry at Florence, led to the Boulder discovery, the McKenzie Well. Early wells were drilled with cable tools, and production generally came from depths of 800 to 3,000 feet. Most wells were shot with nitroglycerin to improve production. About 100 wells were drilled in the first few years; nearly 200 have been drilled in all.

Boulder was the focus of a forgotten boom. Over a hundred oil companies sprouted up, and promoters promised "Oil or money refunded." One University of Colorado professor (later to become the State Geologist) raised $500,000, equivalent to several million dollars today. A now-venerated pioneer photographer used doctored pictures to promote investment. Wells were drilled with "other people's money" and with little or no financial reward for most investors. The wily Canfield got out early, in 1902.

Located at the western margin of the Denver Basin, the field is associated with one of the en echelon anticlines near the foothills of the Front Range. A nose and small closure, whose axes are roughly parallel to the mountains, control the field structurally. Production is from sand lenses and fold-related fracture porosity in the Late Cretaceous Pierre Shale, which is also the source rock. Fractures have contributed most of the production.

Boulder Field opened the oil industry of the northern Denver Basin. It has produced about 800,000 barrels of oil, but the lone remaining well—one of the longest continuously producing wells in the country—may be slated for the salvage yard of history. Efforts are underway to preserve the McKenzie Well as an historic landmark, safeguarding a rich chapter in the development of oil and gas in the Rockies.

Biographical Information

Paul Heller is Professor of Geology at the University of Wyoming and has been on the faculty since 1983. He was at the USGS prior to that. His Ph.D. is from the University of Arizona, where he studied under Bill Dickinson. Paul is the author or co-author of 120 articles and abstracts on such diverse topics as alpine lakes, development of ooid textures, sea-floor spreading, mantle plumes, thrust sheet propagation, environmental geology, and the application of stream transport to the understanding of tectonic history. Much of this talk is based on research done by Margaret McMillan for her Ph.D. thesis at the University of Wyoming. Margaret's research was supported by the Colorado Scientific Society.

Matt Silverman is a consulting petroleum geologist with more than 25 years of experience. He was previously employed by major and independent oil companies and by an international consulting group. Silverman's professional experience is in oil, gas, and coal bed methane exploration, production, and appraisal throughout the Rockies, in the Midcontinent, and overseas, principally in Eastern Europe, the Middle East, and China. He is a past president of the Denver International Petroleum Society and an honorary member of the Rocky Mountain Association of Geologists.

Colorado Scientific Society, January 2003 President's Note

Jim Cappa

At our meeting on March 20th, Matt Silverman will be giving a talk on the Boulder oil field. This talk will be geological and historical and will deal with one of the state's oldest oil fields. One well in the field has been producing for 100 years! Mineral and mineral fuel resources are an important part of our modern world (and the most important part of my job at the Colorado Geological Survey).

All we have to do is look at the news today and see how resources are playing an important role in world politics. Oil is what makes our modern economy work, now and for the foreseeable future. Oil prices have been going up over the past few months for several reasons, including the strike of oil field and refinery workers in Venezuela and the possibility of a war in Iraq. So you are paying about 15 cents more for a gallon of gasoline than you did two months ago. Natural gas prices have been going up in concert with oil prices but not for the same reasons. Natural gas prices have more to do with the severity of winter in the populous east half of the country and pipeline availability than with international tensions.

It is interesting to speculate about how much this potential war in Iraq is about oil resources. Surely, it is in our national interest now to protect the oil resources in Kuwait and Saudi Arabia as we did in 1991. But what about the huge oil resources in Iraq? Is this upcoming war about those resources?

Here in Colorado we have oil resources the equal of the Middle East; however, they are tightly locked up in oil shales of the western slope. Will these resources ever be utilized? In the 1970s and early 1980s billions of dollars were spent on attempts to develop these resources, but to no avail. The economic goals were never met and the environmental consequences of oil shale development were, to many citizens, unacceptable.

The departure of most major oil companies from their oil shale projects heralded the tail end of another boom–bust cycle for western Colorado. However, one company has quietly continued research into development of oil shale. Shell Oil Company is conducting experiments using *in situ* borehole heaters to heat the oil shale, causing the oil to become more liquid and flow to a production well. It's a difficult technology, but they are making advances one step at a time.

There are conventional oil resources in our country that could be developed—the Arctic National Wildlife Refuge, for example. Controversial, yes, but one of the few places left in the USA where a giant oil field could be discovered. Conservation of hydrocarbons using more fuel efficient vehicles and mass transit along with other measures will be important as our oil resources dwindle.

Someday the world will evolve beyond a hydrocarbon-based economy. Interesting experiments to that effect are already taking place. Honda Motors is leasing a fleet of hydrogen cell-powered vehicles to the City of Los Angeles. These test vehicles give scientists and engineers a chance to evaluate this technology on a day-to-day basis. The cars are expensive, ridiculously so, and the

hydrogen that powers the fuel cells comes from natural gas—so we are still a long way from evolving beyond the hydrocarbon economy. But the cars have so far performed well, and perhaps someday cost effective technologies to separate hydrogen from seawater will be developed. But, until that day we must still use hydrocarbon fuels and worry about oil resources in troublesome places like Iraq.

Western Interior Paleontological Society Symposium

Speakers and Schedule for the WIPS 2003 Founders Symposium: Volcanoes, Camels and Volcanoes—The Eocene/Oligocene Story

The transition between the Eocene and Oligocene epochs was marked by the greatest single drop in global temperature in the Cenozoic. This temperature drop was forced by a series of geologic events that included a major bolide impact in the late Eocene, a very large number of huge volcanic eruptions in western North America, and the splitting of Australia and Antarctica. This last event isolated Antarctica from warm water currents and started extensive glaciations in the southern continent. All of these events cooled the Earth from a greenhouse world to the beginnings of our modern icebox world. Marine life and land plants were greatly affected, but mammal faunas in North America showed little change across this climatic transition. The Western Interior Paleontological Society (WIPS) will be hosting a two-day symposium on the Eocene to Oligocene transition, especially as it is reflected in the western United States. The schedule and list of speakers is as follows.

Saturday March 29

8:00 AM - Lou Taylor, Western Interior Paleontological Society – Introduction
8:15 - Emmett Evanoff, University of Colorado Museum – General Geologic Setting
9:00 - Ed Larsen, University of Colorado, emeritus – Regional Volcanism
10:30 - Liz Nesbitt, Burke Museum of Natural History, Seattle – Oceanic Realm and its Influence on the Land
11:15 - Herb Meyer, Florissant Fossil Beds National Monument – Changes in Forest Composition
1:30 PM - Steve Manchester, Florida Museum of Natural History – Green River Fossil Lake Flora
2:15 - Carrie Herbal, South Dakota School of Mines Museum – Mammal Evolution and Paleontology
3:30 - Robert M. Chandler, Georgia College & State University – Birds of the Eocene and Oligocene

Also research posters, exhibition of fossil reconstruction art, and vendor booths.

Sunday March 30

9:15 AM - Kirk Johnson, Denver Museum of Nature and Science – Green River Flora
9:45 - Bill Weber, University of Colorado Museum, emeritus – T.D.A. Cockerall at Florissant
10:30 - Russ Graham, Denver Museum of Nature and Science – Introduction to the Flora And Fauna of the White River
11:15 - Tom Steven, U.S. Geological Survey, retired – Geology of Creede and the San Juan Mountains.

(continued on next page)

1:00 to 5:00 PM - Workshops:

White River Formation fossils and geology
Green River Formation fossils and geology
Florissant Formation fossils and geology
Creede Formation and other topics
Fossil preparation and photographic techniques

Also research posters and vendor booths.

Contributors to the Workshops will include:

John Warme
Steve Manchester
Peter Houde
Steven Veatch
Emmett Evanoff
Mr. Vince Santucci

Note: Students can attend the Eocene/Oligocene boundary symposium at half price. Students should fill out a registration, pay the fee ($20/day) and include a photocopy of their student ID.

More Minerals Named for (or by) Coloradoans

(Richard M. Pearl recorded the following tidbits of Colorado mineralogical history in an article *Minerals Named for Colorado Men*, March, 1941, Colorado Magazine, v. 18, no. 2, p. 48–53. The information was updated in the new volume, *Minerals of Colorado* by Eckel et al. and the Friends of Mineralogy.)

Warrenite was named for E. R. Warren of Crested Butte, who sent some samples of "mineral wool,"—needle-like matted crystals from the Domingo Mine on the ridge between Dark Canyon and Baxter Basin in Gunnison County—to Denver. In June, 1888, the results of the chemical analysis of these fibers were announced at the CSS meeting, but it was not named Warrenite until 1890. It is now known that Warrenite (also called domingite) has been identified as either boulangerite, jamesonite, or owyheeite. From one mineral with two names came three others!

Emmonsite, was named for the great geologist Samuel F. Emmons, the first president of the CSS, by Hillebrand at the meeting of the CSS on June 1, 1885. R.C. Hills sent the original material from an uncertain locale near Tombstone, Arizona. It is a compound of iron and tellurium occurring in clear yellow-green scales. In Colorado, Emmonsite hails from the W.P.H., Moose, and Deadwood mines at Cripple Creek.

Rickardite carries the name of Thomas A. Rickard, for whom it was named in 1903. Rickard was the State Geologist of Colorado, the editor of many mining journals, and the author of mining monographs on many famous mining regions in the United States. Some say the original proposal was to name it Sanford after the metallurgist who identified the new mineral in 1901. Rickardite, the first known copper telluride, was found only at Vulcan, Gunnison County, in the Good Hope Mine. There it occurred with native tellurium, native sulphur, pyrite, petzite, and berthierite, and with weissite, vulcanite, and cameronite, other copper tellurium minerals. Later it was found in tellurium deposits in Boulder County, Lake County, and Saguache County.

Weissite came from the same mine. William P. Crawford of Denver named it in 1927 for Loui Weiss, who owned the Good Hope mine. Another copper telluride, this massive, dark bluish black mineral contains no gold or silver. It, too, occurs in Boulder County and Lake County.

Earth Science Meetings and Talks

*Newsletter items must be received by the 4th of each mont*h. Items may include special events, open houses, etc...thanks!

Colorado Scientific Society's regular meetings are held the 3rd Thursday of the month, American Mountaineering Center in Golden (unless otherwise advertised). Social time begins at 7:00 p.m. and talks start at 7:30 p.m. For information, contact Jim Cappa at (303) 866-3393, jim.cappa@state.co.us

Denver Mining Club meets every Monday (except when noted) at Country Buffet near Bowles and Wadsworth (at 8100 W. Crestline Ave.) 11:30 a.m.-1:00 p.m. Mar. 3-Jord Gertson, Consulting Hydrologist, **Rising Groundwater in the Leadville Mining District, Colorado-A Potential Serious Problem**. Mar. 10.-Al Hofstra, USGS., **Diverse Origins of Sedimentary Rock-Hosted Disseminated Gold Deposits Worldwide: An Overview.** Mar. 17-Ed Hunter, Mining Engineer, **A Concise History of Mine Hoisting in the Cripple Creek District through 1902.** Mar. 24.-Gerry Nix, National Renewable Energy Lab,. **Recovery of Minerals and Metals from Geothermal Brines.** Mar. 31.-Patrick Taylor, Colorado School of Mines, **Chemical Metallurgy - Then and Now.**

Denver International Petroleum Society meets the 2nd Friday of each month at the Wynkoop Brewing Co., 18th and Wynkoop Streets. Reception begins at 11:30 a.m., luncheon at 12 p.m., program at 12:30 p.m. Make reservations (required) by leaving message at (303) 623-5396. Reservations accepted after 8 a.m. on Friday until 10:30 a.m. on Wednesday prior to the meeting. Cancellations accepted until 11:00 am Wednesday prior to the meeting. Cost: $15 for lunches; talk only is available for $2 (make checks payable to "D.I.P.S."). Contact Keith Murray at (303) 986-8554 for information.

Denver Region Exploration Geologists' Society (DREGS) meets in the Mutual Consolidated Water Building, 12700 West 27th Avenue, Lakewood. Social hour 6:00-7:00 p.m. Technical presentation at 7:00 p.m. Meetings are normally scheduled for the first Monday of each month. Next meetings: March 7, April 3. For information contact Jim Piper, (303) 932-0137, or the website http://www.dregs.org.

Denver Well Logging Society (DWLS) meets on the third Tuesday of each month, Sept. through May. Lunch and a technical talk at the Wynkoop Brewery begin at 11:30 a.m., 18th and Wynkoop Sts. in Denver. Subject matter usually deals with the application of well logs to oil and gas exploration. Mar. 18-Dick Merkel, STA, **Direct Oil Measurements Using NMR Logs Well Log Normalization**. Call Elice Wickham at 303-573-2781 for reservations. Web page: http://dwls.spwla.org.

Rocky Mountain Association of Geologists (RMAG) Reception at 11:30 a.m., lunch at 12:00 p.m., talk at 12:30 p.m. Reservations are taken by recording at 303-623-5396 until 10:30 a.m., Wed. before the luncheon. Cancellations are taken until 11:00 a.m. on Wed. at 303-573-8621. Luncheon cost is $20 payable to RMAG at the door. Reservations are not required for talk only—cost is $3. Meeting location: Denver Petroleum Club, Anaconda Tower, 555-17th St, 37th floor. Mar. 7- **Sheep Mountain Anticline: Backlimb Tightening and Sequential Deformation in the Bighorn Basin, Wyoming.** Mar. 21-**Natural Fractures in the Strata Overlying a Laramide Thrust: Teapot Dome, Wyoming**. Web page: http://www.rmag.org.

University of Colorado at Boulder, Geological Sciences Colloquium Wednesdays, 4:00-5:30 p.m., Rm. 180. Refreshments at 3:30 p.m on the 3rd floor. For information, call 303-492-8141. Mar. 7-Tim Stern, Victoria Univ., **North Island New Zealand Geophysical Transect (NIGHT);** Mark Williams, INSTAAR, Flow paths and source waters in a fractured rock setting: isotopic, hydrometric, and hydrogeological approaches; Mar. 19-Jill Dill Pasteris, Washington Univ., **Putting Carbon in Context: Not All Carbon is Biogenic.** Web page: http://www.colorado.edu/GeolSci.

Friends of Dinosaur Ridge; 7:00 pm at Red Rocks Elementary School in Morrison, CO. Join now. Mar. 11-Christine Turner, USGS, Denver, **Paleoenvironmental Studies of the Morrison Formation**. Web page: http://www.dinoridge.org.

Colorado School of Mines, Van Tuyl Lectures Fridays from 3:00PM to 4:00PM in Berthoud Hall room 108: Mar. 7.-Michelle Tuttle, USGS., Denver, **Gas Cloud Kills Thousands at Lake Nyos, Africa: Identifying the Culprit and Saving Lives in the Future.** Mar. 14--Peggy Ganse, Haley & Aldrich, Denver, **Interpreting Ground Conditions for Tunneling**. Mar. 28-Marsh Lavenue, Intera Incorporated, Boulder, **From Early Direct Methods to Today's PEST ASP: A Historical Overview of the Inverse.** Web page: http://www.mines.edu/academic/geology/calendar/vantuyl.html

USGS Central Region Colloquium Series Lectures held weekly, 1:30-2:30 p.m., Foord Conference Room, Bldg. 20 (entrance W-3), Denver Federal Center, Lakewood, CO. Mar. Mar. 6, Zhi-Liang Zhu, **LANDFIRE–Methods and Recent Results**; Mar. 13, Jason Neff, **The Coupled Cycles of C and N in the Colorado Alpine**; Mar. 20-Sheila Murphy, **The Boulder Watershed Study**; Mar. 27-to be announced. For more information call Pete Modreski, 303-202-4766, pmodreski@usgs.gov or see http://geology.cr.usgs.gov/crg/colloquia.htm.

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