

Colorado Plateau Beauty: Rocks, Structures, Landscapes, and People

University of Arizona Humanities Seminars Program, Spring 2014

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George Davis is Regents Professor Emeritus in the Department of Geosciences and Provost Emeritus at The University of Arizona. His core expertise is structural geology and tectonics. One of George's favorite field-based 'laboratories' is the Colorado Plateau, which he has explored over the decades. Liberal arts education has been a core-value for George, who received in June 2012 an honorary degree from Carleton College. George received his PhD degree from the University of Michigan (1971) and in 1988 was selected by UofM's Graduate School as among Michigan's 100 most distinguished Ph.D. recipients. George is immediate Past President of the Geological Society of America. <http://www.geo.arizona.edu/GDavis>

Pete Kresan led all efforts in teaching the introductory geology courses in the Department of Geosciences at the University of Arizona for 25 years. He retired from his Senior Lecturer position in Geosciences in 2005 and now focuses on his other career, photography. Peter served as an associate editor for Arizona Highways Magazine, Board President of the Desert Museum, naturalist for University of Arizona Alumni Association, Smithsonian, and Desert Museum eco-tours, and naturalist for *The Desert Speaks* PBS TV programs. He has explored and photographed the Colorado Plateau for more than forty years. <http://www.kresanphotography.com>

Class Schedule

January 23: Introducing the Colorado Plateau

Blakey and Raney, pp. 1-12

We will travel to the Colorado Plateau by different routes and from a number of different directions. As we enter the Colorado Plateau we will cross its physiographic and geologic boundaries, thus gaining perspective on where the Plateau resides within the enormous Western North American Cordillera. Once inside we will begin to wrap our minds around rock layers, the fossils they contain, and the ways that a geologist pieces together the relationships between rock layers. These fundamentals in turn will draw us into the vastness of geologic time, which is the calibration for framing the natural history of the Colorado Plateau.

January 30: The Changing Landscapes and Seascapes

Blakey and Raney, pp. 13-56

Sedimentary rocks and the fossils and textures contained in them preserve the record of the changing landscapes and seascapes of the Colorado Plateau. We will probe the succession of ancient landscapes as they developed and as they changed over geologic time. Our guide to the past will be none other than the lead author of our textbook, Ron Blakey, who is Professor Emeritus, Department of Geology, Northern Arizona University. [see <http://www2.nau.edu/rcb7/>]. Ron will divulge the science and art of reconstructing ancient landscapes. Among other things, we will emphasize the importance of the fossil record in decoding ancient environments. The ancient Colorado Plateau rock record will come alive as we travel through deep time.

February 06: Deformation and Mountain Building

Blakey and Raney, pp. 57-102

The Colorado Plateau not only retains a record of ancient landscapes and seascapes, but also the record of compressive tectonic forces that produced gigantic mountain ranges from ~1700 to 1600 million years ago. The North American continental crust grew and thickened as a result, but ‘shortly afterwards’ the crust split down the middle, through a great rifting approximately 1000 to 600 million years ago. From ~80 to 45 million years before present, there was another round of compression that created the signature folds and uplifts of the present-day Colorado Plateau. Interpreting and describing all of this requires a primer in plate tectonics, and a candid disclosure of the unusually versatile capacity of ‘solid’ rocks to deform as if they were soft. The innocent flat-lying rock layers of the Colorado Plateau become ‘catiwampus’ as a response to tectonic forces and mountain building!

February 13: Continue with “Big Folding”, followed by Colorado Plateau Region Igneous Activity, including the Mid-Tertiary Volcanic Flare-up and Igneous Activity

Blakey and Raney, pp. 102-120

In the Basin and Range province to the west and south of the Colorado Plateau, all hell broke loose during the period of ~35 to 20 million years before present. The crust of Earth became hyper-extended through tectonic stretching, and explosive volcanism produced glowing avalanches and immense volcanic caldera. The Colorado Plateau was not insulated from this dramatic episode in its natural history. To add insult to injury, beginning

~15 million years ago and continuing to today, Basin and Range faulting is eating away the margins of the Colorado Plateau and permitting the rise of mantle-derived magma to reach the surface to form cinder cones and other volcanic phenomena.

February 20: Basin and Range Extension, Faulting, and Relation to the San Andreas Fault

Having learned about the volcanic expressions of Basin and Range faulting along the edges and in the interior of the Colorado Plateau, it is time to look at the Basin and Range faulting proper, both geometry, map relations, and origin. Earthquakes associated with Basin and Range create a 'present and future damage', especially evident along the Wasatch Front and south-southwest to St. George, Utah, and Hurricane, Utah. Collateral damage associated with earthquakes is expressed in rock falls and landslides, big and small.

February 27: Raising the Plateau and Cutting the Canyons

It has been difficult to defer until now the fuller description of the physiography and landscape of the Colorado Plateau, particularly its canyons, plateaus, and river systems. It is largely this chiseled semi-arid landscape that creates the 'open book' we call the Colorado Plateau. But when were these canyons cut? What 'motivated' the canyon cutting? Why are slot canyons so abundant? What is the relation between drainages and Colorado Plateau fracturing and faulting? How old is the Colorado River? How is it that we find Cretaceous sharks teeth at elevations of 8000 feet? What has produced the very high elevations of the Colorado Plateau, for example at Powell Point (10,000+ ft)? To try to answer some of these questions we plan to raft some of the rivers, enter some of the slots, climb the slickrock to plateau- and mesa-tops, and learn lessons from other classic high plateaus in Asia and South America.

March 06: Geoarchaeology of the Colorado Plateau, and the Great Surveys of the West

During the first hour, Jefferson Reid, University Distinguished Professor in UofA's Department of Anthropology [see <http://anthropology.arizona.edu/user/46>] will be our guest speaker. He will introduce us to the fascinating history of southwestern archaeology, focusing mainly on the first arrival of humans into the American Southwest (e.g., the

Clovis people), the large prehistoric pueblo ruins of the Colorado Plateau (e.g., Mesa Verde, Chaco), and the Mogollon culture of the Arizona mountains immediately adjacent to the Colorado Plateau.

During the second hour, Vic Baker, Regents Professor in the Department of Hydrology, will tell us about the Four “Great Surveys” of the American West, which were conducted between 1860-1879 by King, Wheeler, Hayden, and Powell. Sponsored by the U.S. Government, these expeditions were designed to map the geology and geography of vast unexplored regions. The richness of detailed maps and documents emerging from these surveys were a major impetus in establishing the U.S. Geological Survey. All 4 scientific explorations were heroic, and revealed astonishing new dimensions of natural history. John Wesley Powell’s explorations of the Colorado River and its tributaries is fine example of this. (Powell’s views on the problems of aridity and human adaptation were prescient). Vic Baker is an acclaimed student of the history of geology [see <http://www.hwr.arizona.edu/users/baker>]. We will touch on the photography of William Henry Jackson and the art rendered by Thomas Moran.

March 13: Colorado River Drought

Colorado River Basin flows are among the lowest in more than 1200 years. Extreme drought is the present, prevailing condition! We want to spend some time thinking about prehistoric droughts that led to abandonment of Mesa Verde and Chaco Canyon, and how such droughts are recorded in the tree-rings records. Moreover, we want to touch on the implications of the drought today, including the ways in which Colorado River Basin drought impacts a huge number of people, ... in Las Vegas, Los Angeles, Phoenix, and Tucson, how it affects major enterprises such as modern agriculture. The fact of this drought has important implications regarding how much CAP water is available for Tucsonans, and how ‘our’ water will be treated and blended. We have invited Connie Woodhouse, Associate Professor of UA Geography and Regional Development, to disclose for us the record of drought captured in tree rings, including the past droughts in the Colorado Plateau [<http://www.u.arizona.edu/~conniew1/website/personalhomepage.html>]. Also, Gary Woodard, Associate Director, UofA Hydrology, will present factors and trends in Tucson municipal water demands in relation to CAP forecasts, and he will offer best practices on water conservation. Gary’s homepage web site is [<http://www.environment.arizona.edu/gary-woodard>].

March 27: Tour of Colorado Plateau Parks and Monuments [3 Hours]
Blakey and Raney, pp. 127-146

We want this Humanities Seminar to culminate in a tour of a number of the National Parks and Monuments that are contained within the Colorado Plateau. This 'field trip' will be a mechanism for integrating and applying many of the basics concepts and notions that we have learned, and to point out that the special dimensions of each Park or Monument emerge from a special set of distinctive geological conditions. We start out in southern Utah, visiting Zion, Bryce, and Cedar Breaks. Then we head northeast to embrace Capitol Reef, Arches, and Canyonlands. Then we turn south-southwest, through Monument Valley, the Petrified Forest, Sunset Crater, and to the Grand Canyon, where we will peek over the edge one last time. We anticipate that the field tour of Parks and Monuments will underscore how much we have learned about those things that make the Colorado Plateau a truly unique province of Earth.