Going LOCO

Investigations along the Lower Colorado River

Robert E. Reynolds, editor

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Front cover: saguaro catus, Copper Basin Dunes. Reynolds photo.

Back cover:

Top: strong deformation in the Bouse interbedded siliciclastic unit in western Chemehuevi Valley. House photo.

Bottom: Sandhill cranes near Cibola. Reynolds photo.

Title page: wildlife, Copper Basin Dunes. Reynolds photo.

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Armchair investigation of Bouse parameters: A discussion of the Plio-Pleistocene environment with emphasis on southwestern North America and the Lower Colorado River

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The purpose of this discussion is to set the larger context for the later focus on the development of the Lower Colorado River.

The Pliocene (5.3 - 2.6 Ma) was the last period of sustained high temperature in Earth's history, with global temperature about 3° C higher than today. Greenland's ice sheet was 60 percent smaller than today, the West Antarctic Ice Sheet was small and unstable, and sea levels are variously estimated to have been 10–25m higher than today, with consequent shifts in atmospheric and ocean circulation. During this warm period, the head of the Gulf of California reached to the vicinity of Blythe, and Lower Colorado River began to form. Over the ensuing few million years the planet as a whole cooled and became more susceptible to astronomically driven climate cycles, culminating in the glacial cycles of the Pleistocene.

This discussion will begin with a quick overview of the paleogeography of the mid Pliocene, and ask questions concerning the development of the Lower Colorado River Corridor: What mechanisms played a part in the development – plate tectonics, tectonism (local and upstream), sea level rise (and fall), climate cycling, hydrology, and possibly other factors?

A set of focused points or major questions are presented keep this discussion on track:

1. The global and regional setting: What were the conditions (tectonic, hydraulic, climatic, and biotic) in western North America at 4.8 Ma? This is coincident with the Pliocene thermal maximum, the Hemphillian-Blancan transition, elevated sea levels, and presumed redirection of the Colorado river. What may have driven the overflow into Black Canyon and Cottonwood Valley? Where did the volume of water now entering the Colorado flow previously?
2. What was the region like during Bouse time? What are the major tectonic, geomorphic, climatic, and biotic changes that occurred as the LC developed?
3. How should we interpret the apparent marine-lacustrine dichotomy in fossils and outcrops of the southern Bouse? Is the extreme variability of Colorado discharge (both floods and droughts) in the historic record a clue to understanding the Bouse? How might astronomically driven sea level fluctuation as recorded in the MIS 18O data inform understanding?
4. What are the major gaps in understanding the LC through the late Pliocene and Pleistocene? How can these be addressed? What aspects of our better understanding of the LC constrain hypotheses about regional issues?
5. What does the present understanding of the Bouse region suggest for new field work? How can we connect this with the Colorado Delta?

Structure of the Clark Mountains, Mescal Range and Ivanpah Mountains, San Bernardino County, California.

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The three published bedrock geologic maps within the Clark Mountains, Mescal Range, and Ivanpah Mountains study area are those by Hewett (1956) for the Ivanpah Quadrangle 1:125,000 scale, Evans (1971) for the Mescal Range 1:64,500 scale, and Clary (1967) for the Eastern Clark Mountains 1:24,000 scale. Dobbs (1961) has a geologic map as part of his Master's Thesis. These are compiled and described on-line at http://vredenburgh.org/mining_history/pdf/gw/

The structure of the study area is dominated by westward-dipping layered rocks and westward-dipping low angle faults, originally interpreted to be thrust faults.

Some of these were later determined to be detachments. (Reynolds, 1993; Reynolds and Nance, 1988; Reynolds and Reynolds, 1991; Reynolds, and Reynolds, 1995.; Reynolds, and Reynolds, 1996). From west to east, the primary faults are:

- Prospect Low Angle
- Pioche Low Angle
- Mequite Low Angle
- Bird Spring Fault
- Mescal Low Angle
- Aztec Fault – Keystone Fault
- Clark Mountain Normal Fault
- Ivanpah Fault (mostly buried in Ivanpah Valley. Hewett, 1956)
- State Line Fault (Hewett. 1956)

North of Highway I-15, this generalized sequence is truncated by the North Fault in the southwestern Clark Mountain Range. South of Mountain Pass, the Clark Mountain Fault merges with the Mescal Thrust.

These faults give rise to the following generalized geologic setting, from west to east:

WEST

FAULT	LITHOLOGY
	Quaternary Deposits and Precambrian Prospect Mountain Quartzite
Prospect Low Angle	
	Pioche Shale
Pioche Low Angle	
	Goodsprings Dolomite
Mesquite Low Angel	
	Bird Springs Formation
Bird Springs Fault (South), Monte Crito Fault (North)	
	Goodsprings Dolomite and some Kaibab Limestone
Aztec Fault	
	Mountain Pass Rhyolite
Clark Mountain Normal Fault (South) and Mescal Low Angel (North)	
	PreCambrian granite augen gneiss complex with Tertiary andesite dikes
Ivanpah Fault	
	Goodsprings Dolomite, Monte Cristo Limestone, Bird Springs Formation
State Line Fault	
	Goodsprings Dolomite, Monte Cristo Limestone, Bird Springs Formation, PreCambrian Units

EAST

The geologic history represented in this structural interpretation is similar to that deduced in the adjoining Goodsprings quadrangle (Hewett, 1931, p. 54). It is summarized in Hewett (1956, p, 52) and reproduced below:

1. Initial folding of the region.
2. Bird Spring overthrust or detachment involving minor normal faults.
3. Contact overthrust, or detachment followed by Potosi thrust, and Wilson thrust.
4. Keystone overthrust or detachment, involving minor folding, followed by Ironside tear fault, and Puelz thrust.
5. Sultan overthrust or detachment, followed by Milford thrust, involving minor folding, and Tam O'Shanter tear fault.
6. Mescal thrust or detachment.
7. Clark Mountain normal fault.
8. Mesquite overthrust or detachment involving minor close folding and minor normal faults.
9. Winters overthrust, or detachment involving minor close folding.
10. Intrusion of Teutonia quartz monzonite and Kingston Range monzonite porphyry.
11. Early normal faults.
12. Dolomitization and other alterations of limestones.

Using .Pdf Aenza to access maps on your cell phone

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A series of land status and geologic maps of our field trip route have been prepared and georectified for access through the Avenza. Pdf Maps cell phone application. This application makes your cell phone into a GPS device and projects your location on the map as a blue dot. That dot moves around on the map as you change your location.

You do not need to be within range of a cell phone tower for this application to display .pdf maps on your cell phone view screen. You can download the map through any cell phone application store, or go to http://www.avenza.com/pdf-maps

After you have this application, go to this website http://vredenburgh.org/mining_history/pdf/gw/ and browse for "Field Trip Maps."

Click on these maps from within Avenza. They will automatically be downloaded to your cell phone.

Land status with mines

- 01 baker_to_nipton.pdf
- 02 nipton_to_vidal_junction
- 03_vidal_junction_to_needles
- 04_needles_to_cibola

250K geology maps

- 05 baker_to_nipton.pdf
- 06 nipton_to_vidal_junction
- 07_vidal_junction_to_needles
- 08_needles_to_cibola

Comparative stratigraphy of the Ivanpah Mountains, Mescal Range, and Clark Mountains, San Bernardino County, California

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Stratigraphic descriptions of the Ivanpah Quadrangle (1:125K) were made by Hewett (1956). Within this quadrangle, the stratigraphy of the Eastern Clark Mountains was made by Dobbs (1961) and of the Mescal Range by Evans (1971). The differences between these stratigraphic descriptions is summarized in Table 1. A detailed comparison and discussion is made in the on-line paper "Stratigraphy of the Ivanpah Mountains, Mescal Range and Clark Mountains" by Gregg Wilkerson posted at
http://vredenburgh.org/mining_history/pdf/gw/Wilkerson2016_CMI_Structure.pdf
http://vredenburgh.org/mining_history/pdf/gw/Wilkerson2016_Table01.pdf

Roving the Red Planet: A field geologist explores Gale Crater

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On August 5, 2012, NASA's Mars Science Laboratory rover *Curiosity* landed next to a ~5 km high mountain in northwest Gale Crater. With the most sophisticated suite of scientific instruments ever employed to investigate the martian surface housed within a small SUV-sized rover, *Curiosity* has been assessing the character of the ancient environments based on examination of clues contained within sedimentary rocks almost 4 billion years old. Modern Mars is a hyper-arid desert, but the story preserved in the rock record tells of dramatic environmental transitions. In this presentation, Williams will discuss latest insights from observations along *Curiosity's* journey with connections to terrestrial analogs including the Mojave Desert of southern California.