

**Keck Extensional Tectonics Field Seminar:
Colorado River Extensional Corridor/Black Mountains
Accommodation Zone 15-20 March, 1994**

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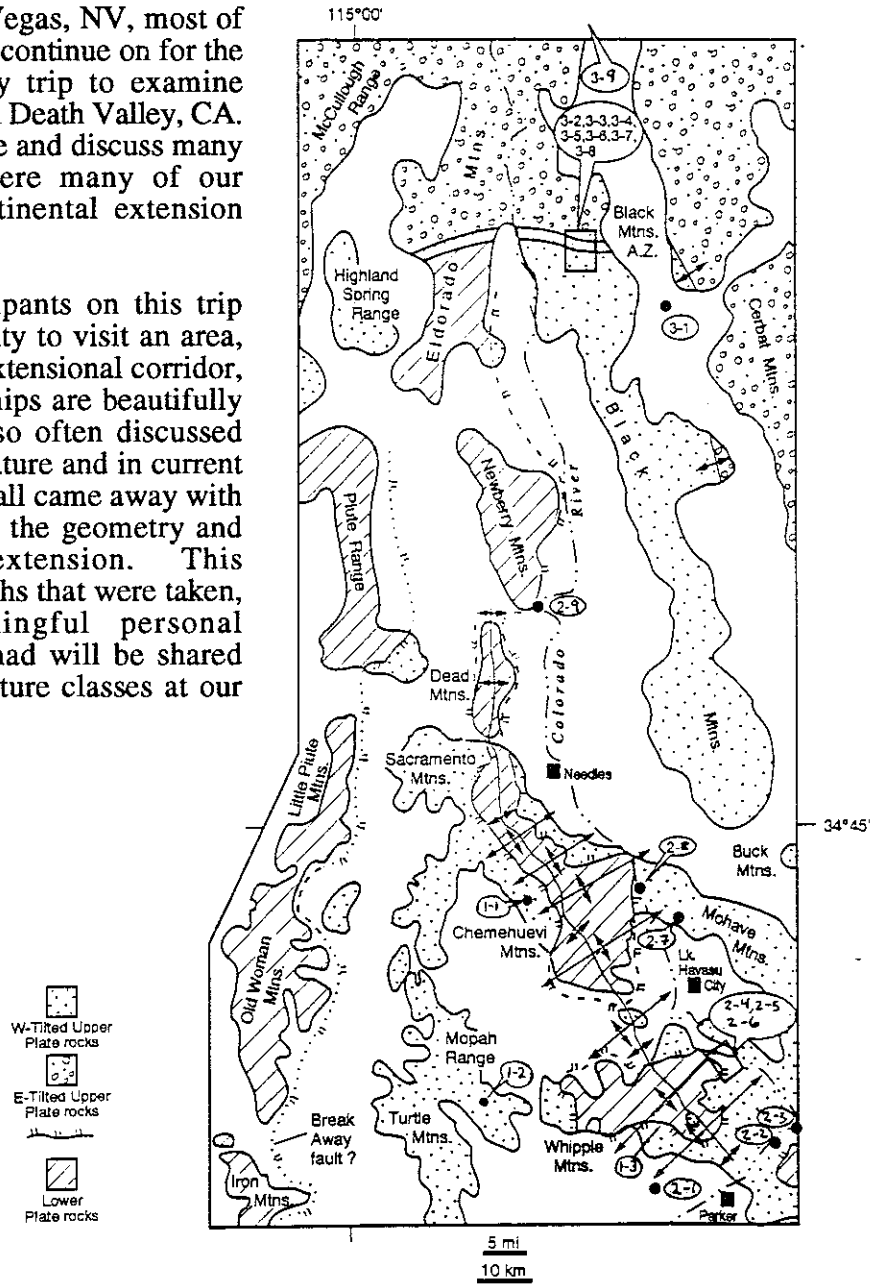
The purpose of this field workshop was to provide participants with the opportunity to examine and debate the structural style of extensional deformation and the interplay between extension and sedimentation where they are beautifully displayed in desert exposures of the Colorado River region. In addition to the mid-Tertiary extension which was the primary focus of the workshop, the region also displays a rich geologic history including Proterozoic deformation and intrusion, Cambrian-Triassic shallow marine sedimentation and Mesozoic plutonism and thrusting. Mid-Tertiary extension in the Colorado River region overprints these diverse geologic terranes and is part of a much larger region of extension within the Basin & Range including portions of Nevada, California, Utah, Idaho, and Arizona. These areas are characterized by detachment faulting, wherein the middle to upper crust has been significantly extended above originally low-angle faults of regional extent. Detachment faulting is generally Miocene in age throughout the region, although the exact timing of deformation varies from place to place. Punctuating the extensive region of detachment faulting are the mid-Tertiary "metamorphic core complexes". Metamorphic core complexes appear to be discrete regions in which the detachment terrane has been structurally warped and eroded such that they now provide windows into the middle crustal footwalls of detachment faults.

The great value of the workshop was clearly the lively discussions of key field relationships of mid-Tertiary extensional deformation as exposed within the Colorado River Extensional Corridor, between Parker, Arizona and Lake Mead, Nevada (see Figure for stops). Although the extended region we visited involved primarily rocks not generally considered of economic interest to the hydrocarbon industry, the *style* of deformation displayed there is quite typical of economically important extensional belts throughout the world. Detachment-style extensional deformation as documented in the Colorado River area has been observed in many intracontinental rifts (e.g. Gulf of Suez, Baikal Rift, North Sea) and may be the primary mode of extension at passive continental margins.

The first day of the trip focused on the basics of detachment-related extensional deformation and related magmatism as exposed within the Turtle Mountains and within the western part of the Whipple Mountains metamorphic core complex near Parker, AZ where we spent the night. During the second day, we will examine both footwall and hangingwall structures and discussed synextension sedimentation patterns in the eastern Whipple Mountains and along the Colorado River extensional corridor between Parker, Arizona and Laughlin, Nevada. Our evening accommodations in Laughlin, NV allowed the participants the opportunity to observe the unique human activity that characterizes this part of the extensional corridor. The third day of our trip was devoted to visiting the Black Mountains, AZ where we examined an accommodation zone separating major regions of opposing tilt direction and, possibly, opposing detachment polarity.

The geometry of this area, and accommodation zones in general, sparked the greatest and most lively of discussions during the trip as we grappled with these little-documented structures. The formal workshop ended with an overview of regional extensional relationships in the Lake Mead region at Hoover Dam. After an exciting evening in Las Vegas, NV, most of the participants elected to continue on for the fourth, but optional, day trip to examine extensional features within Death Valley, CA. There, we were able to see and discuss many of the classic sites where many of our modern theories of continental extension were first formulated.

I think all of the participants on this trip appreciated the opportunity to visit an area, like the Colorado River extensional corridor, where geologic relationships are beautifully displayed and which is so often discussed and examined in the literature and in current textbooks. Certainly, we all came away with a better understanding of the geometry and scale of continental extension. This knowledge, the photographs that were taken, and the many meaningful personal interactions that we all had will be shared with many students in future classes at our respective institutions.



Colorado River extensional corridor showing stops (numbered dots) taken during the Keck workshop.