**Joshua Tree National Park 1**

1. A typical Joshua Tree landscape does not obviously share much in common the other Basin and Range parks we’ve looked at.
2. Again, location within the province plays a key role. Joshua Tree just barely qualifies as Basin and Range and is greatly affected by the proximity of the San Andreas Fault…
3. …which pretty much forms the park’s southwestern boundary. Joshua Tree National Park boasts probably the largest semi-contiguous exposure of Precambrian basement in the far western United States and includes a significant portion what was once a vast mountain system built by Mesozoic orogeny.
4. The park’s Cenozoic landscape was shaped by the interaction of the Eastern California Shear Zone and the southern San Andreas Fault system.
5. The Eastern California Shear Zone gets nowhere near the attention of San Andreas, but it is quite active and has been responsible some major earthquakes, like the widely felt, magnitude 7.1 Hector mine quake in 1999.
6. Like the San Andreas Fault (SAF), the Eastern California Shear Zone (ECSZ) is a right-lateral. Movement along these faults exerted torque on the block of rock between the two - fracturing it along the two major “cross faults” which cut through the park. The southern of these, the Blue Cut Fault (BCF), is largely buried beneath alluvium. The northern one is the Pinto Mountain Fault (PMF), …
7. … which has created fault scarps that are young enough to have been not yet eroded. Can you spot the scarp? Hint: Connect the palms.
8. It’s basically this little ridge. Palms grow near the fault because clayey fault gouge has ponded groundwater in this area.
9. As right lateral motion occurs on the main faults, the in-between block not only breaks into pieces, but the pieces each rotate clockwise. Try to visualize that clockwise rotation and then determine if the motion on the PMF and BCF will be right or left lateral?
10. If you picked left you’re either lucky or smart! It may not be obvious, but not only do the blocks rotate, they also stretch west to east in typical Basin and Range style. In the animation that follows see if you can recognize the rotation, left-lateral strike slip faulting and extension of these blocks.
11. If the animation was more sophisticated it would also show the blocks breaking up along Basin and Range style normal faults as they undergo extension. You might want to rewind and replay this a few times until you get the idea.
12. Normal faulting has broken the park into Western, Central and Eastern Provinces. Uplift and consequent erosion is greatest in the west, probably because the crust was more greatly thickened there by the emplacement of Mesozoic plutons.
13. The distribution of Mesozoic rocks across the park is consistent with an east to west increase in exposure level. In the west, deep erosion has exposed the cores of Mesozoic plutons, and completely removed the overlying Proterozoic rocks into which the plutons intruded. The mostly gneissic Proterozoic rocks, are more common in the central and eastern provinces where they are frequently seen capping the Mesozoic plutons.
14. Here’s a typical scene from the central province. Can you spot the contact between the Proterozoic gneiss and the Mesozoic granite?
15. Actually the entire foreground is granite. In most places the granite decomposes faster than the metamorphic rocks.
16. Gneiss is pretty darn durable. In fact, this gneiss has been around for a whopping 1.8 to 1.69 billion years, which makes it the oldest rock in the park. Several different early Proterozoic gneisses form the basement rocks of the park including …
17. … the Lost Horse Gneiss, …
18. … the Wilson gneiss, and …
19. … the Music Valley Gneiss. Each of these represents a different geologic *formation*, which is a rock unit capable of being mapped. Thus each of these gneisses must have unique characteristics, although I haven’t a clue what they are!
20. The various gneisses are overlain by a shallow water sedimentary cover sequence deposited between 1.63 and 1.45 billion years ago including …
21. … the middle Proterozoic Quartzite of Pinto Mountain. Note the cross-bedding here indicating deposition by shallow water currents.
22. All of these rocks occur with various Proterozoic plutonic rocks, including this granite porphyry.
23. Collectively the early Proterozoic rocks represent the roots and erosional debris of vast mountain ranges formed in various orogenies that built the southern margin of Laurentia prior to the formation of Rodinia.
24. At this point you might be anticipating the entrance of our old friends – the Paleozoic DCM sediments. However, there is a conspicuous absence of Paleozoic strata in Joshua Tree National Park. Why?
25. Location, location, location. Unlike the other Basin and Range parks we have studied that were on the continental platform during the Paleozoic, Joshua Tree was positioned over oceanic crust, whose inevitable subduction will obliterate any record of Paleozoic sedimentation.