Guadalupe National Park 1

1. Once again we find ourselves looking at a park on the edge of the Basin and Range province – this time the far southeastern edge. Guadalupe Mountains National Park lies within a distinctively different portion of the Basin and Range known as the Rio Grande Rift.
2. Recent seismic studies across the Rio Grande Rift near Albuquerque reveal its characteristic structure…
3. … which consists of closely spaced, steeply dipping normal faults. Unlike other parts of the Basin and Range, very little rotation on the fault blocks has occurred along the Rio Grande Rift, …
4. … such that strata like these in the Guadalupe Mountains have only a gentle ENE dip caused by rift normal faults.
5. Because the faults are virtually inactive today, many geologists consider the Rio Grande rift to be an allochogen, which you of course remember is a failed rift. The rift opened almost 30 million yeas ago, but the degree of extension here never got anywhere close to that of the rest of the Basin and Range.
6. Perhaps that explains why the normal faults have not rotated to more gentle dips as is the case elsewhere in the Basin and Range.
7. At any rate, normal faulting along the rift produced well over 20,000 feet of vertical offset in many areas. Streams flowing into the rift were therefore given an enormous amount of gravitational potential energy by which they could erode the rift’s shoulders.
8. Guadalupe National Park is situated on one of those eroded shoulders. Here, the erosion which accompanied the formation of the Rio Grande Rift exposed an amazingly well-preserved reef from the Permian period. The reef’s massive core outcrops majestically on the cliffs of El Capitan – the park’s signature landmark and type locality for the Capitan Reef,…
9. … which is exposed in the Guadalupe, Apache and Glass Mountains. Extensive oil exploration in the region has revealed buried portions of the reef that complete a nearly continuous circuit around what during the Permian period was a deep ocean basin …
10. … known as the Delaware Basin. It and several other basins comprise what is collectively known as the Permian Basin.
11. Apparently these basins formed during the final stages of Pangaea’s formation. The collision of North and South America forced the southwestern margin of North America under South America, thereby causing subsidence.
12. Because these basins were near the equator during Late Permian time, the warm tropical sea water promoted reef growth …
13. … much in the same way that modern reefs form on the Bahaman Banks. These two diagrams are the same scale, so except for being next to deeper basins, the Bahamas Banks are pretty good modern analogues to the reefs of the Permian Basins. The Capitan Reef which surrounded the 600-meter deep Delaware Basin …
14. … is best exposed in the Guadalupe Mountains because that portion of the reef is closest to the Rio Grande Rift where maximum erosion occurs.
15. The degree to which the reef has been exposed is dramatically illustrated from the low point at Salt Basin where about a mile of relief separates the basin from Guadalupe Peak. Mostly what was eroded here was a soluble gypsum unit which we will cover in greater detail later.
16. The big story here is the complete set of ancient reef “facies” exposed in the Guadalupe Mountains.
17. In geology, facies refer to rock mass characteristics that reflect depositional environment.
18. Depositional environments in and around reefs vary from deep water basinal deposits, to mid-depth fore reef, to shallow water reef, lagoon and back reef deposits. In the Guadalupe Mountains each of these facies is represented by a different geological formation …
19. … on the geological map of the area.
20. Different facies are often depositing at the same time but in different environments. For example: The Capitan Limestone represents the reef front, but the Tansill and Bell Canyon formations where depositing at the same time in the back reef and deep basin respectively.