**Canyonlands 2**

1. The unusual behavior of salt in the Paradox Formation is subtly linked to many of the park’s attractions.
2. For example, in the Island in the Sky district,
3. … near the Green River Overlook, …
4. … stress from the movement of salt gently folded the overlying, relatively plastic Organ Rock Shale while the brittle layer of White Rim Sandstone above it developed a system of evenly spaced vertical joints.
5. The far more erodible shale tends to be scoured out from under the sandstone by headward stream erosion.
6. As the shale is removed, the fractured sandstone eventually gives way and slides down the steep shale slope. Except at Musselman Arch …
7. … where one tenacious slab of sandstone remains completely unsupported by shale.
8. The effects of salt motion…
9. ….are perhaps most apparent in the Needles District.
10. But here, because it is closer to the center of the Monument Uplift, the resistant White Rim Sandstone is completely eroded as is much of the underlying Organ Rock Formation ….
11. … such that the Cedar Mesa Sandstone is largely exposed with a few interfingering beds of Organ Rock Formation.
12. This gives outcrops in the area a distinct red and white striped appearance.
13. Against the blue sky of southern Utah, what could be more American?
14. Anyway, getting back to the salt story, the Needles District is named for the pointed columns formed from intersecting vertical joint systems.
15. The dominant joint system here runs parallel to the salt grabens and was no doubt formed by tensional stresses produced as these rocks slid toward the Colorado River over the plastic salt deposits below.
16. The second set of joints cuts across the first and is probably related to stress associated with the Monument Uplift and/or unseen salt anticlines below.
17. Weathering and erosion widen the joints …
18. … leaving progressively smaller remnants of the rock between the joints. Most of the erosion occurs along the principle joint system, forming long, vertical slabs of rock called “fins”.
19. In time, the secondary joint systems are eroded and enlarged as well…
20. … converting the fins into as series of columns.
21. Weaker rock regions do not always occur along the joint systems. During the conversion of sediment to rock, the distribution of sand-cementing minerals may be uneven, which results in differential erosion. Caves form where erosion rates are greatest. In time, caves enlarge and sometimes penetrate to the other side of the fin to form arches.
22. Although Canyonlands has only about 30 natural arches compared to 300-or-so in nearby Arches National Park, those in Canyonlands tend to have more have more complex shapes due to the variability of the Cedar Mesa Sandstone they occur in and the greater complexity of the joint systems in Canyonlands. Angel Arch and …
23. … the towering Druid Arch formed from the weathering and erosion of massive fins of Cedar Mesa sandstone. Both are in the Needles District.
24. Also in the Needles District is the rare horizontal arch known as Paul Bunyan’s Potty. It is one Canyonlands’ few attractions that is not related to the action of the Paradox salt deposits.
25. Horizontal arches begin as potholes which form on calcite-cemented sandstone, where standing water accelerates the dissolution of calcite producing bigger potholes, which hold more water and therefore cause even more erosion.
26. Paul Bunyan’s Potty is formed within the particularly lime-rich Navajo Sandstone.
27. As seen from the air, it is easy to see how this arch is just an overgrown pothole that eroded a weak spot in a hard layer of sandstone down to a much more erodible layer below.
28. From the right angle it really does look like a giant toilet seat.
29. But mostly what one sees in the Needles District are thousands of needles.
30. Chester Park is a large desert meadow surrounded by a sea of needles. Open areas like this form where there is an unusually high concentration of closely-spaced, intersecting joints.
31. Because of differential erosion, the needles have variable widths and therefore technically qualify as hoodoos.
32. The landforms of the Canyonlands may not be of the enormous scale of the Grand Canyon, …
33. … but the abundance …
34. … and variety of landforms in Canyonlands …
35. …put it in a class of its own.
36. West of the Needles District across the Colorado River lies the Maze District.
37. Easily the most remote and inaccessible area in the park (if not the entire U.S.), the Maze is a perplexing jumble of canyons that has been described as a "30 square mile puzzle in sandstone".
38. The Maze’s thousands of nooks and crannies made it a perfect hide out for outlaws of the old west.
39. Butch, Sundance and the rest of their gang used it for years to evade capture.
40. Seen from above, the Maze, albeit intricate, is not without structure. Basically it is a network of closely spaced drainages that flow towards the Green River. Late Cenozoic uplift of the Colorado Plateau increased the gravitational potential energy of these streams, which enhanced their ability to down-cut through the relatively erodible rocks of the region.
41. Because Maze strata tilt away from the Colorado River, they did not slide toward the Colorado like their counterparts in the Needles District. So salt grabens and vertical joint systems are virtually absent in the Maze.
42. If you crave solitude and are ready for some serious backcountry travel and hiking, the Maze may be just what you're looking for.
43. Canyonlands’ rivers not only separate the park’s three districts, but they constitute a forth district of their own.
44. Of greatest geologic interest here are the entrenched meanders which superimpose the features of two different types of rivers. First, the steep sided canyons here are indicative of streams that down-cut rapidly because they have a lot of energy relative to the load of sediment they have to carry. Second, the meandering pattern is characteristic of streams whose sediment load is equal to the streams ability to carry it.
45. Meandering patterns are generally found where streams flow across broad, flat floodplains. The fact that the two patterns are found together indicates that the Green and Colorado Rivers probably meandered across a broad floodplain before the uplift of the Colorado Plateau, …
46. … but after uplift they aggressively down-cut into their meandering channels.
47. One of the more dramatic places to see entrenched meanders is at the confluence of the Green and Colorado Rivers, where it is obvious from whence the two rivers derive their names.