Lab 04: Valley of Fire and Mass Wasting

The following questions relate to physical weathering features at Valley of Fire State Park, southern Nevada. Valley of Fire displays numerous interesting physical weathering and tectonic features such as joints, faults, arches, and fluvial erosion in the sedimentary sequence of the Muddy Mountains. These features are the result of differential weathering associated with joints and faults, and various bedrock types.

The Valley of Fire State Park is a frequent location for film sets. Captain Kirk fell to his death here in *Star Trek: Generations*, and scenes from Elvis Presley's 1964 classic movie *Viva Las Vegas* were filmed here.

This laboratory exercise uses aerial stereophotographs, topographic maps, geologic and structural maps, and orthophotographs. For additional understanding, view the area in Google Earth. **For your answers below, use complete, grammatically correct sentences in your answers. Failure to do so will result in point deductions.**

**Materials:**
- Six aerial photographic stereopairs of the main Valley of Fire area (listed below)
- Geologic and tectonic map of the Muddy and Northern Black Mountains by Bohannon (1983)
- Geologic and tectonic map of the Northern Muddy Mountain area by C. Longwell (1949)
- Figure 3 (Structural map) of Flodin and Aydin (2004)
- 7.5' Topographic Maps and orthophoto quadrangles: Piute Point, Valley of Fire West, Valley of Fire East, Echo Bay. These maps may be downloaded at the USGS store as USTopos.
- Transparencies and transparency markers or tracing paper.

**References for further study:**
1. Orient the location of the air photos with the Valley of Fire West topo quad. On which quarter (NE, SW, etc.) of the map is the stereopair located? (1)

2. What is the geomorphic term for Overton Ridge, the long linear ridge at "A"? What evidence can you cite to support this interpretation? (2)

3. What is the term for the erosional feature at "B" that cuts across Overton Ridge? (1)

4. "C" is the parking area for the White Domes trailhead. The trail continues to the south from the parking lot, on the same alignment as the road. Into what feature(s) will you be hiking through on the trail? (1)

5. What forms the long linear north-south feature at "D"? What type of bedrock is to the east of "D"? What can you infer about the type of bedrock to the west of "D"? (3)

6. What are the primary joint orientations at "E"? Use compass directions (NNE, E, W, etc.). Which of these joint patterns appears to be dominant? (2)

7. What can you infer about the lithology and orientation of the rocks at "F"? (2)

8. How do you explain the difference in weathering patterns of rocks at "F" compared to those at "E"? (2)
Pair #2 (Sandstone Vista north and Sandstone Vista south; Photos 11617-49 and -50; Valley of Fire West and East 7.5' Topographic and Orthophotographic Quadrangles)

9. Using a transparency or tracing paper, trace out the dominant joint directions in the main sandstone hills at Valley of Fire. Make sure to mark the corners of the air photograph on the transparency for reference. How would you describe the shape of the paths taken by the joints? (1)

10. Using a different color, trace the road across the sandstone mountains from the Visitor's Center (G) to the Rainbow Vista Overlook (H). Why does it take a 90° bend through the sandstone hills? This stretch of road through the hill was the scene of a famous car-race scene in *Viva Las Vegas*. (1)

11. How can you explain why the highest peak at (I) is higher than the surrounding sandstone? (2)

Pair #3 (Sandstone Vista south and Atlatl and Beehive Rock; Photos 11617-50 and -51; Valley of Fire West and East 7.5' Topographic and Orthophotographic Quadrangles).

12. Based on the weathering patterns, in what type of rock is Atlatl Rock formed? (1)

13. What kind of stream is Valley of Fire Wash at "J"? Into what water body does it immediately drain? Into what water body does it ultimately drain? (3)

14. The long sinuous east-west ridge at "K" marks the northern boundary of which Mountains? What formed the ridge? (2)
**Pair #4** (Fire Canyon Wash and Valley of Fire Wash; Photos 11627-200 and -201; Valley of Fire East 7.5’ Topographic and Orthophotographic Quadrangles)

15. What is the name of the feature at "L"? Given the different weathering characteristics on the relatively flat top and its sides, what can you infer about the geology of the top? (2)

16. Why does the path of the Fire Canyon Wash at "M" cut directly across the sandstone hills along a lineation parallel to the western margin of "L"? (2)

**Pair #5** (Valley of Fire Wash and Echo Bay; Photos 11627-201 and -202; Valley of Fire East 7.5’ Topographic and Orthophotographic Quadrangles)

17. How do you explain the difference in jointing and weathering patterns between the two rock units at "N" and "O"? Based on their difference in jointing patterns, what rock types can you infer based on the regional geology? (3)

**Pair #6** (Echo Bay and Echo Bay; Photos 11627-202 and -203; Valley of Fire East 7.5’ Topographic and Orthophotographic Quadrangle and Echo Bay 7.5’ Topo Quad)

18. How do the shades of color contrast for the stream channels of the active channel of Valley of Fire Wash, and the three stream channels at P, Q, and R? How are these three washes different from the Valley of Fire Wash? (3)

19. Compare the weathering patterns on the bedrock at “S” compared to the main Aztec sandstone at Valley Fire. How do they differ? What is the lithology of “S”. (3)
Mass Wasting

Leyden, NM Stereopairs and GoogleEarth (36.140303°, -106.043315°)

1. What are the features at A, B, and C? (1)

2. Into what type of larger geomorphic feature are they formed? (1)

3. How is the scarp at D different than those at A, B, and C? (2)

4. Based on the drainage patterns on the hill, in which direction does it slope? (1)

5. How does the slope of the surficial drainage help explain the slope characteristics on the west and east sides of the hill? (2)

6. What is the name of the river on the SE side of the hill? This same river flows south through Albuquerque, NM. (1)

7. At C, what caused the light toned “benches” within the otherwise irregular topography? (1)

8. What causes the darker colors on the cultural features at E? (1)