White Sands National Monument, New Mexico stereopairs and USTopo maps

White Sands National Monument is part of the National Park system and is a spectacular location of white gypsum sands that cover 275 square miles of the Tularosa Basin in southern New Mexico. The National Monument is located near the White Sands Missile Range, and is periodically closed due to missile testing, so beware! The site is located about 80 km south of the "Trinity" plutonium nuclear bomb test in 1945. The lower part of the Tularosa basin contains pools and groundwater discharge zones, which precipitate selenite crystals when the water evaporates in this arid landscape (mean annual precipitation is only about 10 inches/year). Later, these crystals are entrained within winds to form the spectacular gypsum dunes in the National Monument.

**USTopo Maps:**

<table>
<thead>
<tr>
<th></th>
<th>Heart of the Sands NE</th>
<th>Lost River</th>
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<tbody>
<tr>
<td>Heart of the Sands SW</td>
<td>Heart of the Sands</td>
<td>Garton Lake</td>
</tr>
<tr>
<td>Lake Lucero</td>
<td>Lake Lucero NE</td>
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</tbody>
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**Stereophotos**

Taken 11/13/1994, sequential stereophotos ARS940048378512, 111, 10, and 09. Cropped and enlarged.

**Location map** (From Ewing and Kocurek, 2010), showing some of the main geomorphic features at White Sands NM.

**Bibliography**

Topographic Profile from Google Earth across the San Andres Mountains (west), Tularosa Basin, to the Sacramento Mountains (east)

Stereopair questions:
1. What is the name of the feature at A? How does this location relate to the gypsum sand supply for the White Sands? (2)

2. What dune types are located at B? (1)

3. Based on the dune types, in which compass direction is the dominant dune-forming wind? (1)

4. What are the darker tone featureless areas at C? (1)

5. How does the density of dune coverage differ between locations C and D? What can you infer about the thickness of the sand cover there? (2)

6. How has the dune spacing changed at E relative to D? (1)

7. What are the dune types at F? Do the arms/horns point in the same or opposite direction to the dunes at B? (2)
8. What can you infer about the vegetation cover at F compared to B? (1)

9. What is the feature at G? (1)

10. What is the feature at H, and how does it relate to G? What eventually happens to the feature at H? (3)

11. What are the features at I? (1)

12. Which dune types have the longest arms/horns in White Sands? (1)

13. Locate Lake Lucero on the topo maps. How does it relate topographically and as a sediment supply to the sand dunes located to its northeast? What type of dunes are forming to its northeast? (2)

14. What is the elevation of Lake Lucero? What is the elevation of the flat area supporting the dunes to the NE of Lake Lucero? (2)

15. What are the dark spots and linear features on the alluvial fan to the southwest of the southern arm of Lake Lucero? (2)
Dune migration. Image modified from Figure 10 of Ewing and Kocurek (2010), shows a single dune (from LIDAR data) in 2007, and the location of its crest in previous years, as determined from aerial photographs.

16. What type of dune is shown in the figure above? (1)

17. Indicate with an arrow drawn on the figure above the primary dune-forming wind direction. (1)

18. Indicate with "SF" the location of the slipface on the dune. (1)
19. Draw a generalized topographic profile along the dune axis (2):

20. How fast did the horn of the dune migrate between 1985 and 2007 in meters per year? Show your calculations. (2)

21. How fast did the central dune migrate between 1985 and 2007 in meters per year? Show your calculations. (2)
22. Based on your knowledge of dunes from both lecture and today’s lab, please write a paragraph (3-5 sentences) explaining the process (the big geologic picture) that led to the formation of the dunes in White Sands.