

Perseverance Dune: Characteristics & Comparison with Lake Michigan Dunes

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Abstract

The artificial Perseverance Dune and the surrounding area served as a unique location to study the movement of sand from an artificial dune. This study focused on analyzing the sand found on Perseverance Dune and comparing it to sand found in Prince parking lot and on a Lake Michigan dune so as to better understand the Perseverance Dune system. Using equipment such as a sieve, sand traps, a sand corer, microscopes, and magnets, our team was able to gain a better perspective on Perseverance Dune. It was determined that Perseverance Dune had a higher quartz content than the Lake Michigan dune, and a smaller grain size than the sand from Prince parking lot and the Lake Michigan dune. Our team also found that the depth of Perseverance Dune correlated with the location. We were also able to determine through multiple findings that sand is leaving the Perseverance Dune area.

Introduction

Lake Michigan dunes come in a variety of shapes and sizes, and their behavior and movement is impacted by these factors [1]. While most dunes in Michigan are created naturally, Perseverance Dune was artificially created in August of 2020 at Calvin University. Our study sought to determine how similar Perseverance Dune is to Lake Michigan dunes in terms of grain size and composition as well as to investigate the depth of sand on Perseverance Dune and sand leaving the dune area.

Study Objectives

- To compare sand minerology of Perseverance Dune and Lake Michigan dunes
- To compare grain-size of Perseverance Dune with grain-size of Lake Michigan dunes
- To measure Perseverance Dune depth along a line from the top of the dune to the bottom
- To discover whether and how sand is leaving the Perseverance Dune area

Study Area

Our study area was Perseverance Dune on the campus of Calvin University in Grand Rapids, MI (Figure 1). The dune is human-made and was created in August 2020. The dune is surrounded by grass and is placed on a hill that faces north.



Figure 1: Perseverance Dune viewed from the bottom of the slope

Methods

We collected sand samples for analysis from fourteen different sites on Perseverance Dune (Figure 2). Samples were also collected from the parking lot south of the dune, and a Lake Michigan dune.

For each sample, we did grain-size analysis with dry sieving using a Ro-Tap Sieve Shaker with sizes 1000 μm , 500 μm , 250 μm , 210 μm , 180 μm , 63 μm , and >63 μm . The samples were analyzed using a microscope to determine the minerology of the sand (specifically the quartz content). A magnet was used to draw out the magnetite and we determined its percentage.

Sand depth was measured using a sand corer at each of the sites depicted in Figure 2.

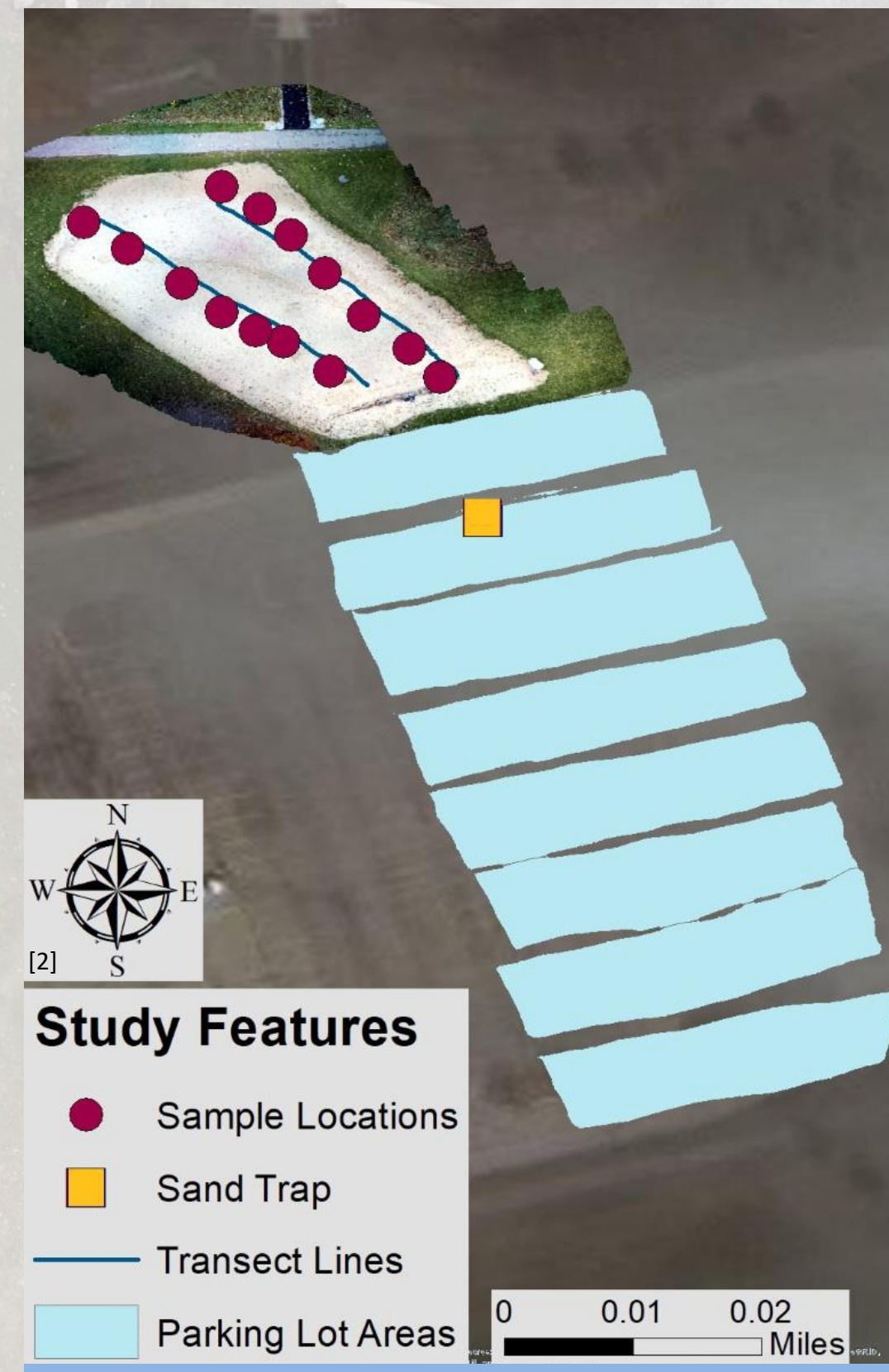


Figure 2: Map of Perseverance Dune sample collection and sand trap sites

Results

The grain size of Perseverance Dune sand is mostly between 250 and 180 micrometers. The grain size in Prince parking lot is more varied but tends to have larger grains (Figure 3). While there is some magnetite and other types of sediment and minerals, over 98% of the sand on Perseverance Dune is quartz.

The depth of Perseverance Dune peaks upslope from the dune center and is shallower at the north and south edges of the dune (Figure 4).

There is evidence that Perseverance Dune sand is leaving the dune area through wind (Figure 5), human transport (Figure 6), and water erosion.

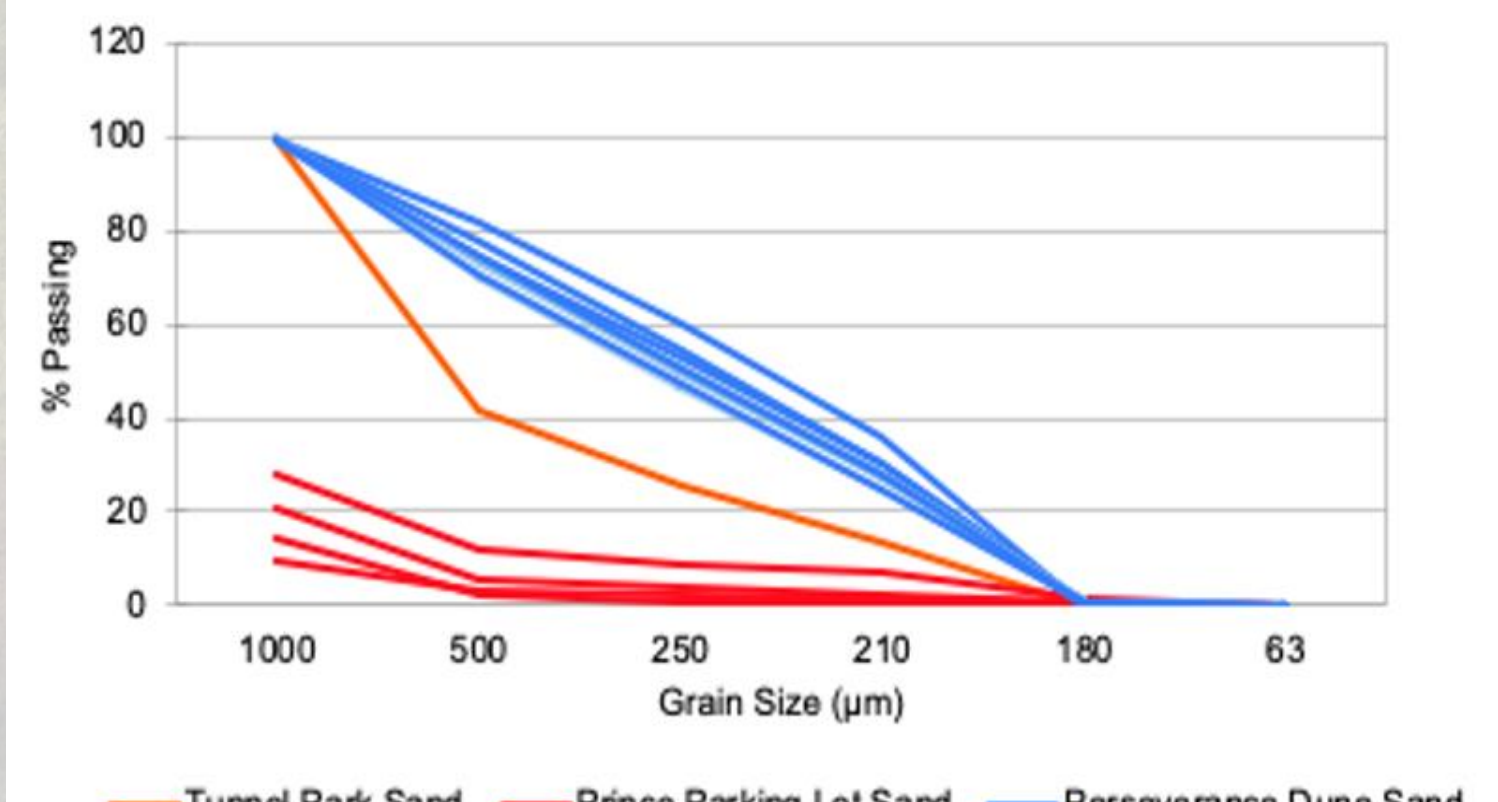


Figure 3: Grain sizes on Perseverance Dune



Figure 5: Sand captured on trap in parking lot

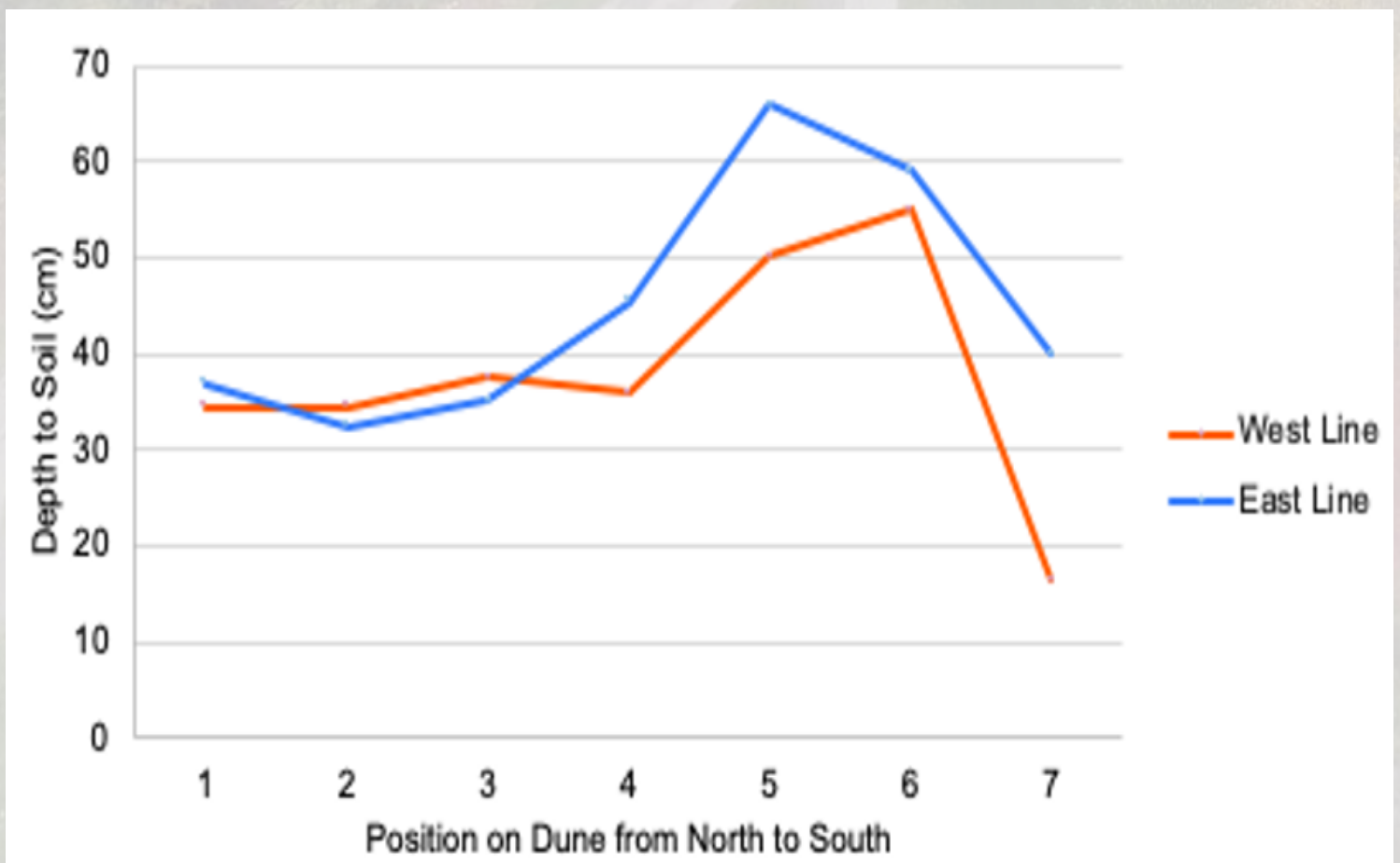


Figure 4: Depth of Perseverance Dune



Figure 6: Sandy footprint in the parking lot

Discussion

Results suggest that Perseverance Dune has an unusually high concentration of quartz (>98%) compared to Lake Michigan Dunes, which tend to be composed of 80-90% quartz. A small amount of magnetite was found in Perseverance Dune sand; magnetite also appears in some Lake Michigan dune sands [3].

Perseverance Dune sand seems to be smaller than sand on Lake Michigan dunes, which tend to have sand between 500 and 250 micrometers [4].

Perseverance Dune was supposed to be a consistent sand depth of 45 cm. But as can be seen in Figure 6, the dune varies in depth, possibly because of the fluvial feature at the north end of the dune (Figure 7).



Figure 7: Fluvial feature at north end of Perseverance Dune

Conclusions

While there is some magnetite and other types of sediment and minerals, most sand (>98%) on Perseverance Dune is quartz and tends to be finer than other sand studied in this project. Perseverance Dune is less deep at the edges, which may be evidence of sand leaving the dune. Sand is leaving Perseverance Dune with wind, water, and human transport and will likely continue to do so in the future

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Works Cited

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