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K-FELDSPAR SAND GRAIN ROUNDING IN EOLIAN AND SUBAQUEOUS TRANSPORTATION

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ABSTRACT

This project compares the rounding of K-feldspar grains in eolian and subaqueous conditions. It was hypothesized that K-feldspar grains in a subaqueous environment are cushioned by the surrounding water enough to prevent the rounding observed in eolian environments. The experiment was conducted by use of eolian and subaqueous simulations originally developed by Calvin Anderson for comparing muscovite flakes in these respective environments. The data showed significant rounding occurring in a few days in the eolian environment while the subaqueous environment experienced little to no change. The results of this project give a basis for determining the depositional environments of K-feldspar-rich sandstones.

KEYWORDS

K-feldspar rounding, subaqueous, sandstone, eolian

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Emma Henze is an undergraduate Geology major at Cedarville University.

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Abstract

This project compares the rounding of K-feldspar grains in eolian and subaqueous conditions. It was hypothesized that K-feldspar grains in a subaqueous environment are cushioned by the surrounding water enough to prevent the rounding observed in eolian environments. The experiment was conducted by use of eolian and subaqueous simulations originally developed by (Dr.) Calvin Anderson for comparing muscovite flakes in these respective environments. The data showed significant rounding occurring in a few days in the eolian environment while the subaqueous environment experienced little to no change. The results of this project give a basis for determining the depositional environments of K-feldspar-rich sandstones.

Materials and Methods

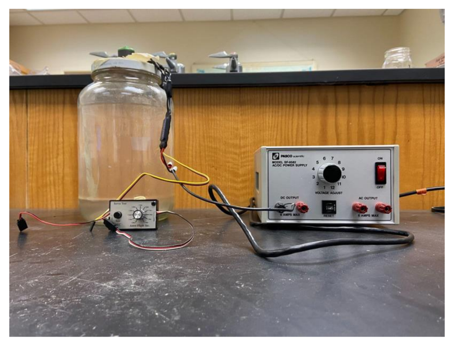
Obtaining the Sand

The first step in the research process was to produce K-feldspar-rich sand grains with the appropriate diameter and angularity. A sample of Pikes Peak granite collected near Colorado Springs, CO was crushed using a pneumatic hammer. Fragments were sent through sorting sieves until approximately 450g of sand with diameters between 250-420µm was obtained. To this, approximately 150g of angular, quartz-rich sand of the same diameter was combined to produce a total of 600g (3:1 ratio of quartz- and K-feldspar-rich sand) to use in this experiment.

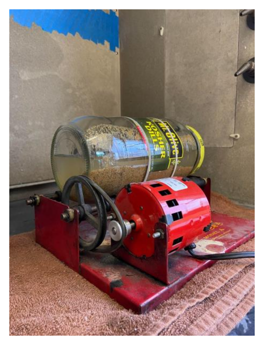
Setup

The combined sand was split into 3 glass jars. The first jar, about 2.4L in volume, contained approximately 550g sand submerged in water to simulate a subaqueous environment. The jar was placed sideways on a rock tumbler. The other two jars, about 4 liters in volume, each contained 25g of dry sand to simulate an eolian environment. A brushless 20 amp DC motor was attached along with a remote control airplane propeller inside of each lid. These were connected to a servo tester and electronic speed controller, and the entire setup was powered using an AC/DC power supply.

Crushing the Pikes Peak Granite.



The eolian set up.



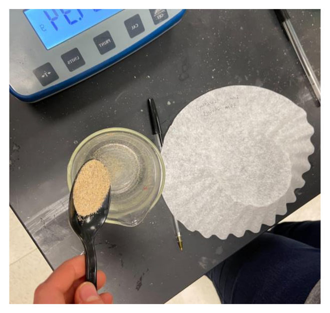
The subaqueous set up.

Sampling

Subaqueous and eolian simulations were run in sync throughout the entirety of this project. Samples were collected after running time doubled, beginning with 1 hr, 2 hrs, 4 hrs, etc. After the 16th hour of continuous running, samples were collected at 24 hrs, 2 days, 4 days, etc. 5g eolian samples and 10g subaqueous samples were collected, weighed, and stored in labeled coffee filters until microscope analysis.

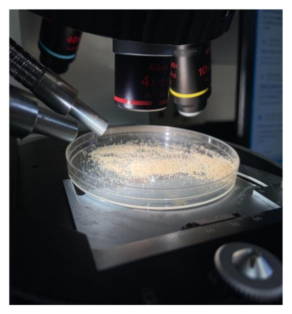
Analysis

After 4 days of continuous tumbling, the collected samples were observed under a microscope. 40 sand grains from each collected sample were observed in groups of 20, resulting in a total of 640 sand grains observed. Each grain was classified according to Powers' 1953 roundness scale with correlating numerical values from 1-6. These numbers were then inputted into excel and formatted into a box and whisker plot with time on the x axis and roundness on the y axis. A paired two sample for means t-test was done and showed the data to be statistically significant.



Measuring out samples.

Subaqueous and eolian samples.



Analyzing K-feldspar grains under the microscope.

Subaqueous | Eolian

1 hour

2 hours

4 hours

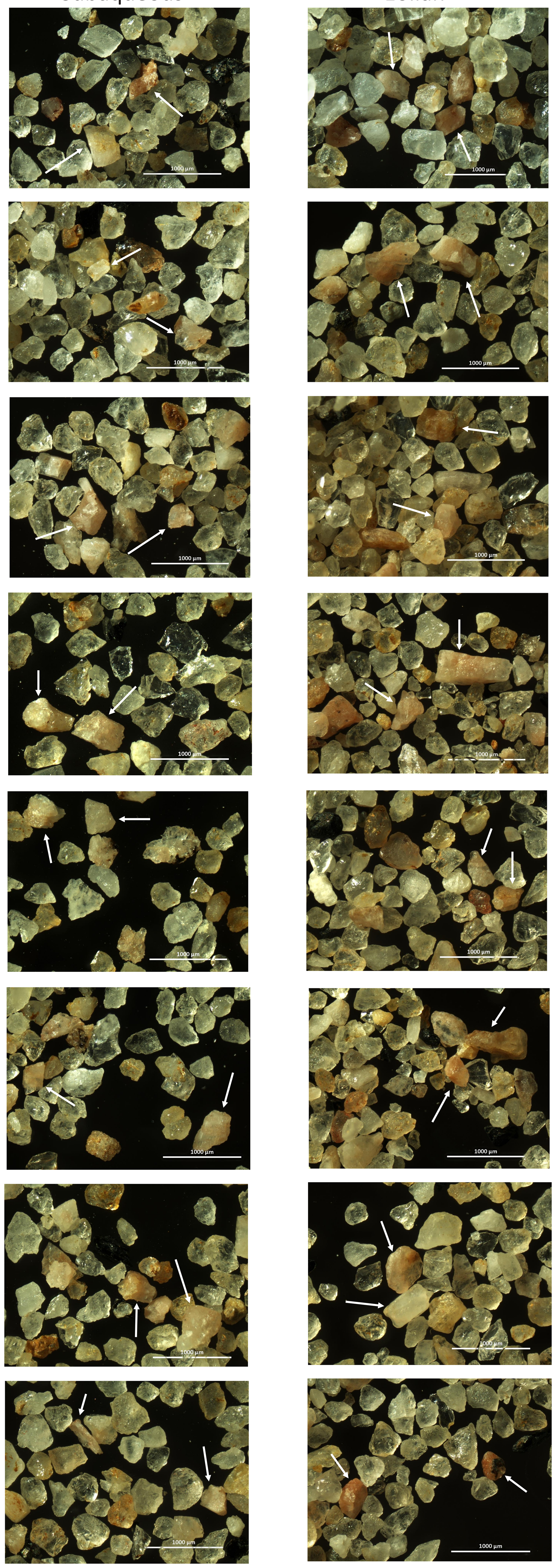
8 hours

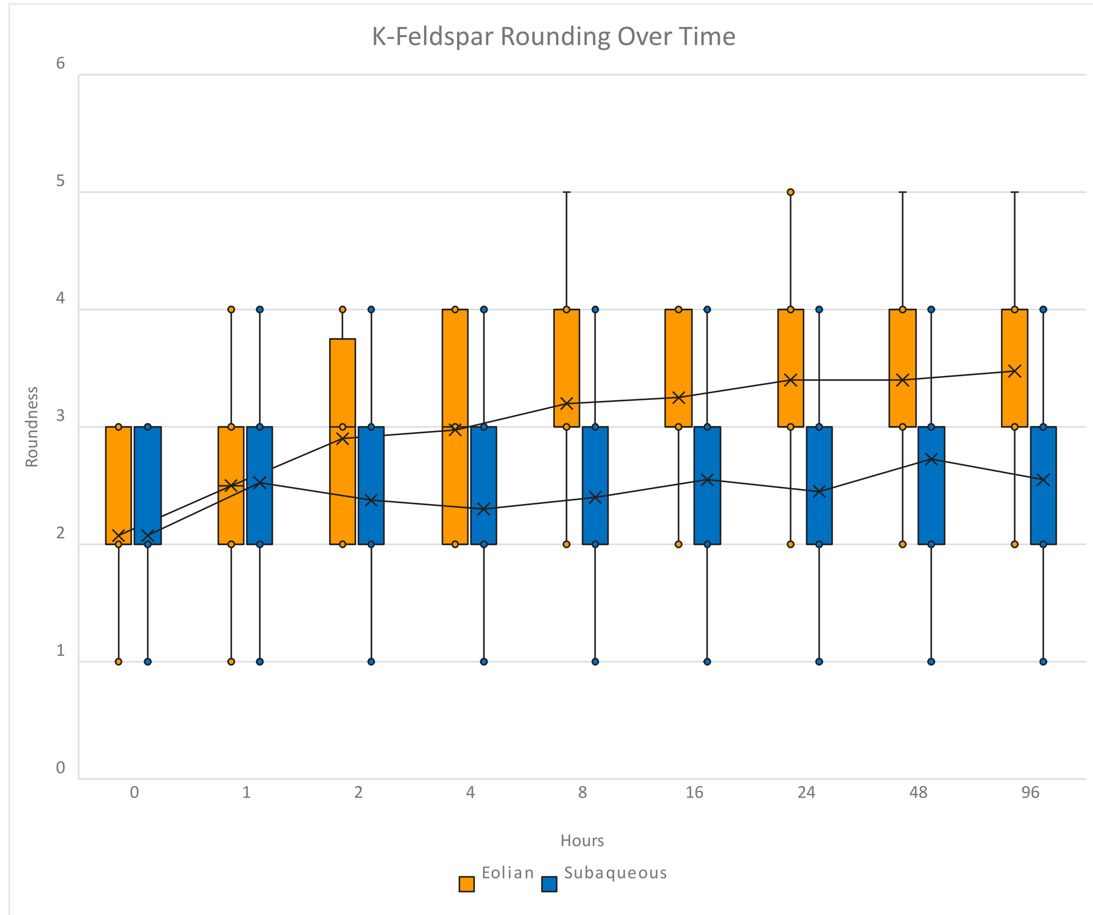
16 hours

24 hours

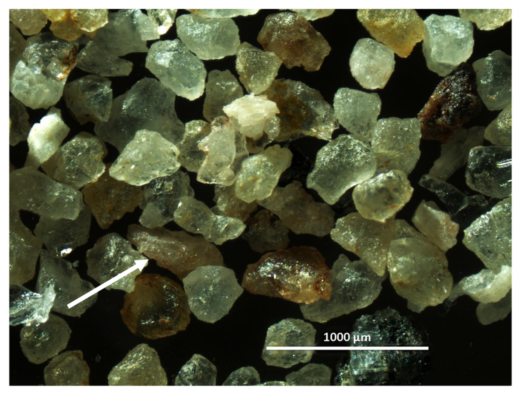
48 hours

96 hours

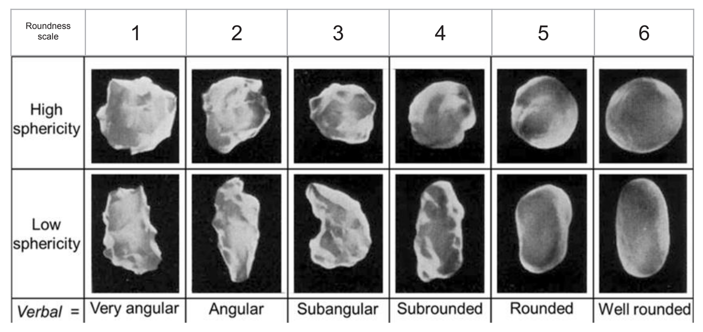




Box and whisker plot comparing K-feldspar rounding in eolian and subaqueous conditions. p value (0.000541) <0.05. Roundess scale: 1=very angular, 2=angular, 3=subangular, 4=subrounded, 5=rounded, 6=very rounded.



Original Sand



Powers roundness scale used for analysing the K-feldspar grains under the microscope. The numbers were our addition to quantify this.

Results

After 4 days of continuous tumbling, a significant amount of rounding occurred in the eolian environment with hardly any occurring in the subaqueous. This matched our hypothesis.

Conclusions

This project showed the rapidity with which K-feldspar grains are rounded in an eolian setting. It also showed that the subaqueous environment did not have significant rounding occurring within the testing timeline. Differences between the environments were seen after just 2 hours of motion. The results of this study can be used to help identify the depositional environment of sandstones containing K-feldspar.

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