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Magnetic Inclusions in Plagioclase Influence Magnetic Properties of the Laramie Anorthosite Complex, Wyoming

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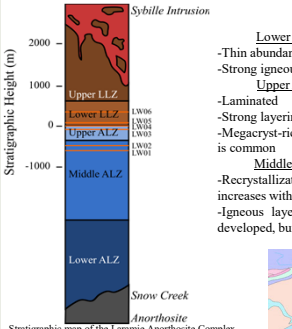
INTRODUCTION

- The Laramie Anorthosite Complex, in SE Wyoming, is a Proterozoic body of feldspar-rich igneous rock that overlaps the estimated age of when Earth's inner core may have formed and may be one of the very few reliable sources of geomagnetic record of that age.



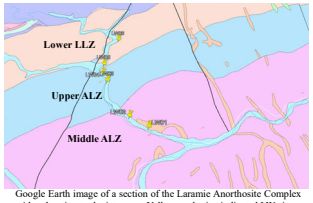
Lower LLZ
-Thin abundant layering
-Strong igneous layering

Upper ALZ
-Laminated
-Strong layering
-Megacryst-rich layering is common

Middle ALZ
-Recrystallization increases with depth
-Igneous layering poorly developed, but common

Stratigraphic map of the Laramie Anorthosite Complex divided into zones based on laminated layers and mineral abundance (Scoates et al. 2010). Stratigraphic locations of LW sample sites are labeled by the horizontal orange lines.

- Magnetite is commonly used to provide clues to Earth's geomagnetic intensity.



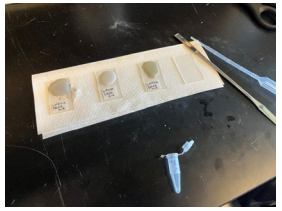
Google Earth image of a section of the Laramie Anorthosite Complex with coloration to depict zones. Yellow push pins indicated LW site locations.

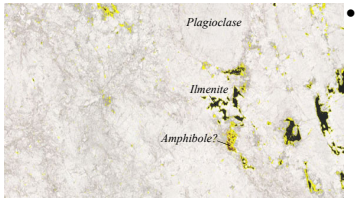
- Set out to determine whether dispersed iron oxide particles or iron oxide inclusions can explain geomagnetic intensity variations in LAC.

METHODOLOGY

- Large plagioclase feldspar crystals isolated from crushed sample, powdered, and transferred to a slide

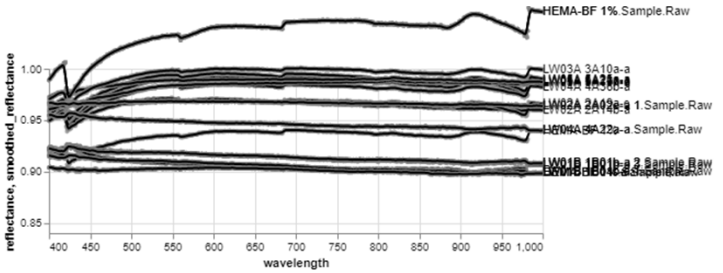
- Slides placed in a UV-Vis spectrophotometer device for reflectance analysis.



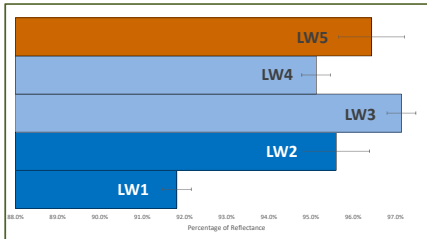


- Isolated the ilmenite and high relief minerals present in each image.
- Examined the relationship between the mineral's color, size, and additional properties.

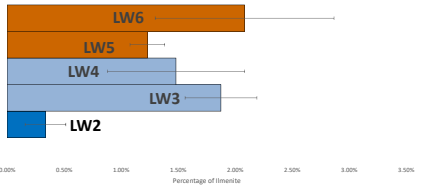
RESULTS



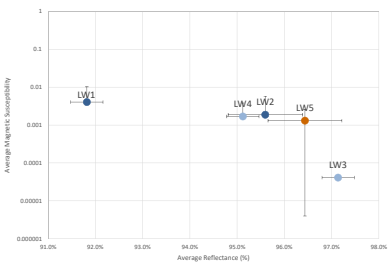
The graph above demonstrates spectra reflectance results of powdered samples. The y-axis is the percentage of reflectance. The x-axis expresses wavelength.



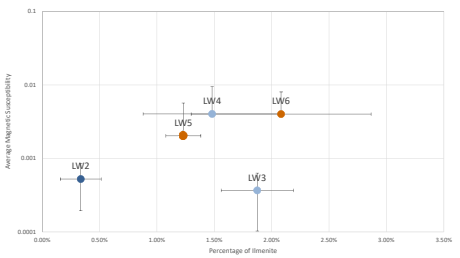
Average percentage of reflectance based on site. The x-axis is the percentage of reflectance. LW1 exhibits the lowest reflectance.



Percentage of ilmenite based on site. The x-axis is the percentage of ilmenite. LW2 has the lowest percentage of ilmenite. LW6 has the highest percentage of ilmenite.



Average reflectance compared to average magnetic susceptibility based on site. The x-axis is the percentage of reflectance. The y-axis expresses magnetic susceptibility. Site LW1 demonstrates the lowest reflectance and highest magnetic susceptibility. Site LW3 has the highest reflectance and lowest magnetic susceptibility.



Percentage of ilmenite compared to average magnetic susceptibility based on site. The x-axis is the percentage of ilmenite. The y-axis is the magnetic susceptibility. Site LW2 has the lowest ilmenite percentage and a relatively low magnetic susceptibility. Site LW6 contains the highest percentage of ilmenite and the most magnetic susceptibility.

DISCUSSION

- Magnetic susceptibility in these samples may be heavily influenced by magnetite inclusions found inside large plagioclase grains.
- There is a moderate trend to suggest that dispersed iron oxides also influencing magnetic susceptibility.
- Snow Creek Anorthosite, lower ALZ, upper LLZ, and Sybille Intrusion layers not represented. Would we observe the same trends in these layers?
- The deepest core samples gathered from the LW sites had the darkest powder coloration. This may be a characteristic of the middle ALZ.

- Magnetic susceptibility is only a measure of how much a material will become magnetized in an applied magnetic field.
- These data do not directly explain changes in geomagnetic intensity. However, they present a possible explanation as to what influences the magnetic properties of the LAC rocks. Those properties are part of the process of interpreting geomagnetic intensity estimates.

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