SEM Topology of Enamel

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# SEM Topology of Enamel

## Tami Wallin

### Background

The topology of the enamel is an important topic to study how, on a microscopic level, the surface of the tusk is rough or smooth so that the correct restoration material and method are applied to the tusk. The method of study to find this information will be the SEM; which with the back scattered electrons will tell me the topography and chemical composition on the surface of the mastodon tusk fragment that will be tested, shown in the image below.

![SEM Image](image1.png)

SEM has better spacial resolution than optical microscopes do with the measuring tool provided by the program and the ability to clearly focus to the limits of detection in this case to a magnification of 1000 the roughness of the surface can be give measurements on how rough the topology.

### Importance

The topology of the enamel is an important topic to study how, on a microscopic level, the surface of the tusk is rough or smooth. This is important for it will determine the type of restoration material to use on the surface of the tusk. The topology of the enamel will be studied using scanning electron microscopy (SEM) on small pieces of the mastodon provided to the course by the recreation team. The topology of the enamel fragments will depend on the removal of the previous restoration practices done on the tusk, such as the shellac and lacquer that was applied on the tusk in the 1930s, may change the surface of the enamel and introduce some discrepancies.

### Scanning Electron Microscopy (SEM)

- The topology of the enamel was studied using the SEM, which scans a focused electron beam over the surface of the sample to create an image.
- The electrons from the beam interact with the sample to produce various signals that are then used in creating the image that obtains information about the surface topology and composition.

![SEM Diagram](image2.png)

- The electrons in the beam will pass through a set of condenser lenses and then through a computer operated scanning coil, after which the beam will reach the sample.
- The scanning coil controls the pattern in which the area of the sample is scanned so that the beam can analyze different parts of the enamel sample.
- The SEM then collects the electrons that are scattered off the surface of the sample (Granger II).

### Parameters/theory behind instrument

- Depending on the interaction between the sample and the electron beam, the electron scattering coming off of the sample can be in several different categories. Back-scattered electrons result from elastic scattering on the surface of the sample, which can be used to create a chemical composition and topographical information (Granger II). The emission of the secondary electron results in the emission of the auger electrons and the characteristic x-rays (Granger II).
- Sample Preparations for samples used in the SEM are: must be solid and can be any thickness with 5 to 10 cm on the edge (Granger II).
- Sample must also be conducting, which if the sample is non-conducting it is smothered in some type of metal, and the magnification will depend on the filament being used in the electron gun.

### Data and Analyst

The two SEM images provided are from two different sites on the tusk at different magnifications on the same piece of tusk, the top images is at a magnification of 300 at a site looked at the top of the tusk and the bottom is located at the side of the tusk.

![Top Image](image3.png)

- The image at the side shows the image obtained when having the right parameters side.
- This image is at 50 magnification of the region where the two other images where taken.

### Conclusion

The result of the SEM scans of the topology of the enamel research determine the restoration materials needed and the techniques to be used to restore the mastodon tusk. This minimizes the time and materials spent on trying to figure out what would be needed to restore the mastodon tusk saving time and money.

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### References