Introduction

The purpose of this project is to use non-destructive and minimally invasive methods of analysis to characterize the materials used in production of the lithic pieces in a collection at the Agnes Etherington Art Centre donated by Archibald E. Malloch (1844-1933). The aim of this project is to create a methodical approach to studying these archaeological objects and provide a thorough understanding of the evolution of these objects to the source community. This project will contribute to the understanding of the lithic pieces in this collection and will allow other scholars to further research the pieces. The aim of this project is to aid other scholars in their art historical, archaeological, and anthropological research in the provenance and techniques used in the production of ground stone tools.

Experimental

The basis of this research begins with a survey of 55 lithic objects in the collection with the associated name Archibald E. Malloch. The survey included photo documentation and a description of the stone material based on geological standards of description as well as typological features such as axe, google, cutting stone, etc. The equipment used in the photo documentation of these objects include the use of a Nikon D300s with a zoom lens of 16-55mm. Soft box flash lighting was used along with a light box. The photomicrographs were taken with the DINO-Lite digital microscope tethered to a laptop. The lighting used in the DINO-Lite microscope are LED bulbs. The photomicrographs were taken at 50x magnification, images were taken of the surface and of a break edge if one existed to show the variation in the worked surface and the body of the stone.

Following the survey of these lithic objects, X-ray fluorescence (XRF), a non-destructive surface analytical technique, was utilized to group the lithic objects based on the elements on the top surface of each object. The X-ray fluorescence instrument used is a Handheld Bruker Trace III XRF analyser. The settings used for the first round of a ray fluorescence spectrometry were operated with no filter, tube voltage, 80kv, tube current 60 micro amperes. Polarized Light Microscopy (PLM) was used to look at the crystal structure and lighting both the individual rock type from each tool. The sample preparation involved taking a small sample from an inconspicuous area such as a break edge or crack to get a representative image of the surface and the body of the rock. This will involve the use of a tungsten point and chisel to extract the samples and Bioplastic casting resin to create thick and thin cross sections of each sample.

Discussion

The large amount of calcium and iron present in most of the samples with trace amounts of manganese, potassium, silicon, chromium, and zirconium. The large amount of calcium and iron present in the samples could be due to the actual surface of the rock or the soiling deposits present on the rock. Further analysis such as SEM is needed to confirm this theory.

Photo documentation results from the survey include photographs, type of object, photomicrographs and macro descriptive features which can be found in the appendix. The survey is to show the reader of vast differences and similarities within the collection though the macroscopic and photomicrographs that are shown. UV fluorescence, infrared, and x-radiography of the stones were not possible as a part of this photo documentation survey due to the time constraints of the project.

XRF: The X-ray fluorescence done on all 55 lithics shows that there is mostly calcium and iron present in most of the samples with trace amounts of manganese, potassium, silicon, chromium, and zirconium. The large amount of calcium and iron present in the samples could be due to the actual surface of the rock or the soiling deposits present on the rock. Further analysis such as SEM is needed to confirm this theory.

PLM: Polarized Light Microscopy was done on MY8.24, MY8.31, and MY8.19 due to the similar chemical constituents under XRF as well as slightly different similar geological features through visual observation. The analysis of these thin sections is pending.

Conclusion

The normalized tables of the XRF results in tandem with the visual observations of the survey, along with the typological features shows little to no correlations between the data. There are no trends which exist between the visual observations of the stone type, function of the tool, and the chemical constituents of the stone type.

The information gathered from this research project will likely be used to inform provenance studies and further study into trade relations in pre-contact societies. The provenance of these objects can also help solidify the understanding of the context through the trade and use of these objects throughout history. Working with pre-contact indigenous material can also allow for conversations around the ethical responsibility of the conservator to contact the indigenous communities in the surrounding areas to discuss possible rehousing or simply allow this information to be accessible to interested parties which may include indigenous peoples.

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