Volcanic Ash in Lincoln County, Kansas

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Abstract

This report outlines the analysis of Pearlette volcanic ash in Lincoln County Kansas. Both field and lab methods were used to compile this report. Fort Hays State University alumni Dr. Ron Whitmer allowed use of his property on which the ash is found. Auguring was utilized as the main form of field work which allowed mapping of the subsurface ash layer. The ash was analyzed by UMKC using their scanning electron microscope (SEM). At Fort Hays, the SEM reports were compared to thin sections of the ash using plane and cross polarized light in petrographic microscopes.
The ash is comprised of mainly amorphous glass which was determined using both SEM and petrographic microscopes. Using Kansas Geological Survey literature, it can be determined that the ash is approximately 2 million years old and came from the Yellowstone area during an eruption (Carey). Even though Kansas is not volcanically active, this ash is used for different economical reasons and the origin and extent of these ash beds is important to better understanding the geology of the region.

Introduction

This is a study of the extent, composition, and origin of a volcanic ash bed in Lincoln County, Kansas. The Kansas Geological Survey released a report in 1952 compiling the known ash beds in the state of Kansas and general overview of their use and origins (Carey). This is the last report that goes over all the Kansas ash beds. The reports that have been published since focus on the economic portions of the ash. The ash has been determined to be from the Yellowstone region based on the composition and timing. This bed is a known ash quarry, but the extent and continuity was unknown. The origin was roughly hypothesized but questions have been posed that question the validity of the previously accepted origin. The ash can also be sieved to be compared to other ash beds and how economical the ash is to be quarried (Landes). Using a sieve size comparison, the bed can be verified as the one referenced in the study. The ash should exhibit the same size particles as the study and should be continuous under the ground cover.

Methods

Data collection in the field utilized hand auguring into the ash bed vertically from above. This allowed the beds to be found where there is no outcrop. The beds were measured at the depths from the surface to create a geologic cross section.

Lab work included creating thin sections of the ash to see the composition in a petrographic microscope. A sieve was utilized to produce ash size percentages to compare to previous literature.

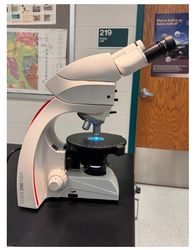
The ash was also analyzed by UMKC with their scanning election microscope (SEM) to get exact percentages of the chemical composition.

Analysis

Hand Auguring

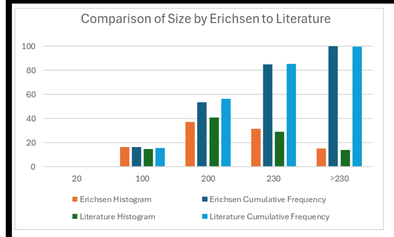
Scanning Electron Microscope Tescan Vega 3 LMU

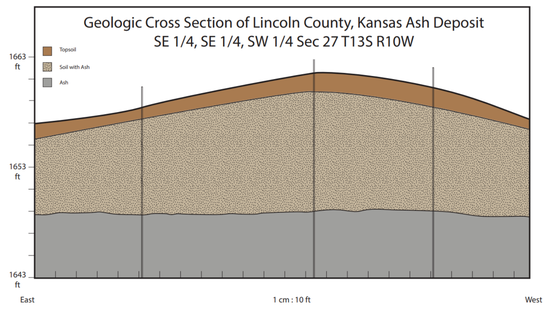
Sieve

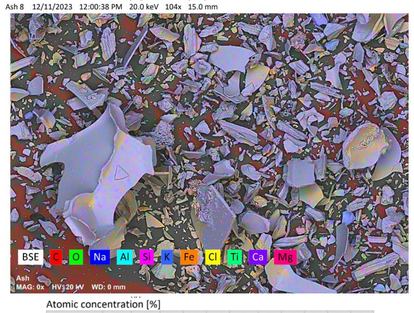


Petrographic Microscope

Results

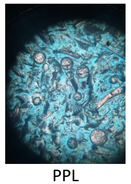






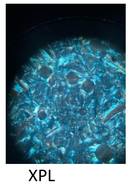
Atomic concentration [%]

Spectrum	C	O	Na	Mg	Al	Si	Cl	K	Ca	Ti	Fe
Ash 1	14.81	65.63	0.87	0.01	2.99	13.32	0.05	1.83	0.13	0.03	0.33
Ash 2	16.26	64.90	1.01	0.00	2.86	12.75	0.04	1.70	0.13	0.03	0.30
Mean	**15.54**	**65.27**	**0.94**	**0.00**	**2.93**	**13.04**	**0.04**	**1.77**	**0.13**	**0.03**	**0.32**
Sigma	**1.03**	**0.52**	**0.10**	**0.00**	**0.09**	**0.40**	**0.00**	**0.09**	**0.00**	**0.00**	**0.02**
SigmaMean	**0.73**	**0.36**	**0.07**	**0.00**	**0.07**	**0.28**	**0.00**	**0.06**	**0.00**	**0.00**	**0.02**

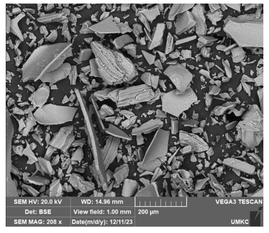


PPL

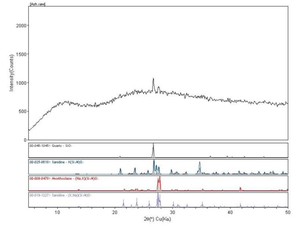
Amorphous glass is extinct on the right side under crossed polars



XPL



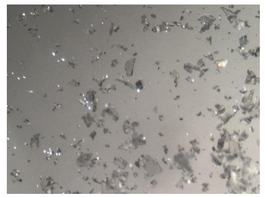
Scanning electron microscope (SEM) picture showing micron scale against ash grains



XRD Results of the ash showing a composition curve

Conclusion

The ash was confirmed to be continuous while hand auguring into the bed from the ground cover above. The ash is continuous under the property until the elevation dips below approximately 1643 ft. It can be confirmed to be from the Yellowstone National Park area due to the ash being mainly amorphous glass with no phenocrysts or other inclusions. Other ash deposits around Kansas potentially come from different areas in the United States such as the Capulin area in New Mexico and various eruptions by Yellowstone. Carey, Frye, Plummer, and Swineford dated various samples using fission track dating. The ash in Lincoln County, Kansas is true Pearlette ash and therefore is dated from 2.0 million years to 1.8 million years ago. This study affirms the ash was classified correct in 1956 and the ash beds have a large extent under the property. The ash is not nearly as fine as some of the others in the state of Kansas but still contains a large amount that is finer than .046 mm which is used in textiles and various soap products.



References

Carey, J., Frye, J., Plummer, N., and Swineford, A., 2005, Kansas Volcanic Ash Resources: KGS, https://www.kgs.ku.edu/Publications/Bulletins/96/03_intro.html (accessed April 2024).

Landes, K., 2015, Volcanic Ash Resources of Kansas: KGS, https://www.kgs.ku.edu/Publications/Bulletins/14/index.html (accessed April 2024).

Acknowledgments

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