Glacial Resource Analysis – Castner Glacier, Alaska

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Abstract

Glaciers cover much of the 49th U.S. state of Alaska. While many of these are deep blues, just as many are “rock” glaciers which means the glacier is covered in sediment. This sediment can be transported many miles through the mountain ranges. With the current climate melting these glaciers they are receding. Sediment and rock samples can now be safely collected from different locations where glaciers have released sediment that was locked in the ice for an untold number of years. Much of the USGS data comes from the 1940’s through 1960’s due to the size and remoteness of Alaska. Much of the Alaska Range remains capped in ice but the sediment being dropped by these glaciers give a new look into the rocks trapped beneath the ice. These rocks can be analyzed against the geological maps to see how far Castner Glacier transported sediment and analyzed to see if the geological map was correctly labeled in a remote part of the state.

Introduction

A resource analysis of Castner Glacier can validate the fact that the glacier was truly only ever 13 miles long (Nielsen). Using geological maps, it is shown the glacier only touches certain mountains. With the glacier being near the Denali Fault, there are many types of rocks that are within close proximity of Castner Glacier but not directly in contact with the ice. If the Glacier once extended past the 13 miles, some rocks would be present in its moraines that currently are not adjacent to the glacier. Besides geological maps, no specialized geological research has been done on the rocks concerning their composition. Since many of these maps are old, questions can be raised since the glacier has since retreated and released rocks from within the ice. This study will be used to check the geological map and check the rocks with the compositions provided within the previously accepted extent of the glacier.

Methods

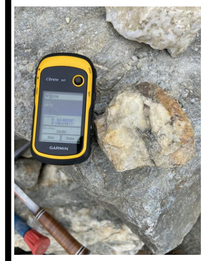
All samples were collected by hand and marked using a handheld GPS unit. The samples were rocks from the glacier and outwash plain that ranged from a size of 1 inch to 10 inches. The rocks were classified using geological procedure for hand samples. Select samples were turned into thin sections to see microscopical differences.

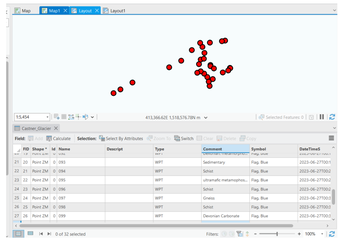

Ice Cave


Collapsed Ice Cave

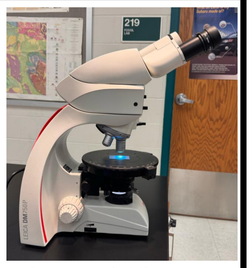

Glacier Terminus

Analysis


Handheld GPS

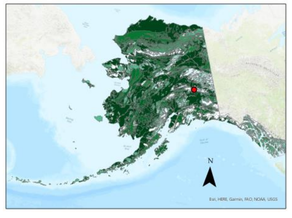

ArcGIS Pro


Hand Samples

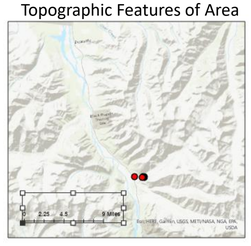

Petrographic Microscope

Results

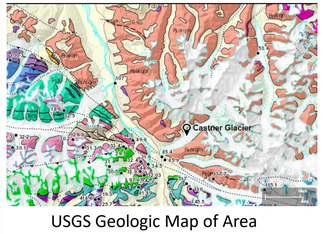
State of Alaska with Area Marked



Topographic Features of Area

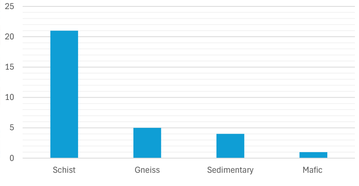


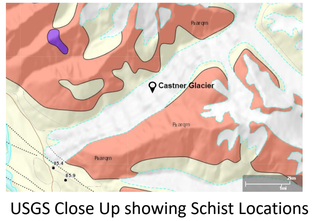
Icefield Map (White Area)



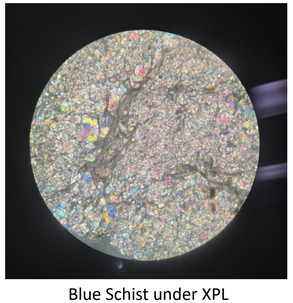
USGS Geologic Map of Area

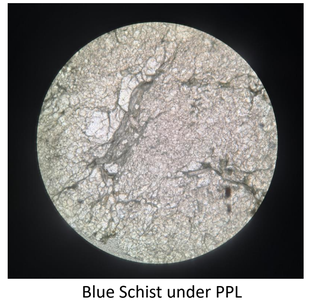
Samples Collected by Erichsen

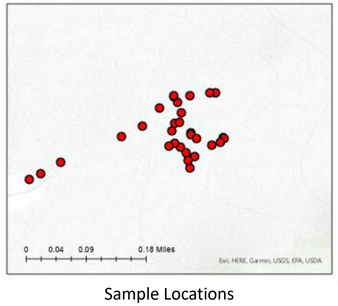




USGS Close Up showing Schist Locations


Blue Schist under XPL


Blue Schist under PPL



Sample Locations

Conclusion

Castner Glacier’s outwash plain, moraines, and till all exhibit the metamorphic, sedimentary, and rare igneous nature of what the USGS claims the rocks should be. The rocks expected to be in the vicinity are pelitic quartzose schist, felsic granitic rocks, augen gneiss and orthogneiss, mafic and ultramafic, and fine grained metasedimentary (Wilson). All the samples fall loosely into these categories. The gneiss actually exhibits more micaceous qualities than what one would find in augen and orthogneiss. The mafic rock is a piece of metamorphosed basalt. Based on the collected hand samples an argument could be raised on the previous classification of gneiss’ surrounding Castner Glacier. The majority of rocks around the glacier are rocks displaying a schistose quality. This is in line with the what would be expected from the geological maps. Some of the schist is definitely a higher grade and could be considered gneiss. The banding is evident. Big quartz veins are also evident with some hand samples being almost completely quartz. This could be evidence of gneisses being broken along the mineral planes of banding. This separates the rocks and then the banding would no longer be seen. With no evidence of banding in broken hand samples, the samples could be classified incorrectly. This study found more gneiss than what the current map suggests. The previous accepted length of the glacier is correct since all rocks found were those with origins adjacent to the known mass of the glacier.


Folded Gneiss


Micaceous Gneiss


Micaceous Gneiss

References

Nielsen, L.E., and Post, A.S., 2017, The Castner Glacier Region, Alaska: Journal of Glaciology: Cambridge Core, https://www.cambridge.org/core/journals/journal-of-glaciology/article/castner-glacier-region-alaska/9B5BD62F68AD949292B0F356D0C52200 (accessed April 2024).

Wilson, F.H., Hults, C.P., Mull, C.G, and Karl, S.M, comps., 2015, Geologic map of Alaska: U.S. Geological Survey Scientific Investigations Map 3340, pamphlet 196 p., 2 sheets, scale 1:1,584,000, http://dx.doi.org/10.3133/sim3340.

Acknowledgments

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