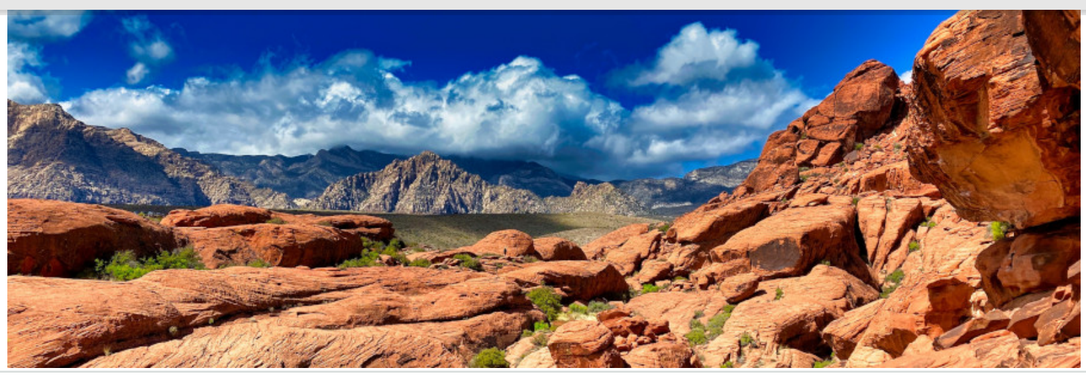

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7-3 - GLACIAL MAPPING IN THE ARID PIONEER MOUNTAINS, MONTANA: ASSESSING PALEO-ELAS DURING THE LAST GLACIAL MAXIMUM

Tuesday, 15 March 2022
8:30 AM - 6:00 PM
UNLV Student Union - SU Ballroom A/B

Booth No. 12

Abstract

Abstract:

Although temperature and precipitation both control ice behavior, it is often challenging to untangle their respective roles in now-vanished glaciers and ice sheets. Here, we study alpine glaciation in a dry region of western North America in order to assess glacier behavior in a precipitation-starved mountain range once proximal to the Laurentide Ice Sheet. This project focuses on using field mapping and equilibrium line altitude calculations in the Pioneer Mountains of southwest Montana to understand the glacial response to Last Glacial Maximum cooling in an arid continental locale.

In order to better visualize glacial features remotely, we created digital elevation models and orthophotos of our study locations. The high-resolution aerial imagery allowed us to identify glacial landforms. Our detailed geomorphic mapping provides context for interpreting cosmogenic exposure ages of the glacial boulders, and improved analysis of the glacial extent and retreat timing.

The project focuses on three glacial valleys: Birch, Canyon, and Dingley Creek. In order to reconstruct the past dimensions of these glaciers, we used several tools for determining the equilibrium line altitude (ELA); including using a polygon-area calculation with Google Earth and the GlaRe paleo-glacier reconstruction software. Comparisons were made using the AABR (area-altitude balance ratio) and the AAR (accumulation area ratio) method. For example, in Canyon Creek, the reconstructed paleo-ELA using AABR was 2550 vs 2580 m, while AAR was 2590 vs 2585 m, for Google Earth and GlaRe respectively. We found that the AABR method produced more consistent ELAs between valleys. The average AABR for all three glacial valleys was 2570m (Google Earth) compared to 2585 m (GlaRe). The difference between the GlaRe AABR and AAR methods was minor (~40 m) with the AABR method generally higher.

Our ELA calculations using local SNOTEL stations for the Pioneer Mountains put the modern ELA at about 4300 m, and a ΔELA of ~1700 m based on the average reconstructed paleo-ELAs. Using a summer atmospheric lapse rate of -6.3˚C/km, and assuming no change in precipitation, a temperature depression of 10-11°C is required to reproduce the Pioneer glaciers.

Geological Society of America Abstracts with Programs. Vol. 54, No. 2, 2022
doi: 10.1130/abs/2022CD-374335

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