WeCSIP: Analyzing stable isotopes in precipitation to create a preliminary local meteoric water line for Grand Junction, Colorado

Myah Baker

Geochemical analysis of meteoric water can give insight into several different atmospheric processes such as Rayleigh fractionation and distillation. By using isotopic ratios of $\delta^{18}O$ and $\delta^{2}H$ in meteoric water, precipitation samples can be 'fingerprinted' to find their vapor source. For each sample, isotopic data is plotted against the global meteoric water line (GMWL) and analyzed to determine the general latitude, elevation, and climate associated with the sample's vapor source. Grand Junction is a semi-arid location seasonally affected by monsoons in Western Colorado, which is located in the northeast region of the Colorado Plateau. Using precipitation data collected from 2020-2021 from multiple sources in the Grand Valley, a preliminary trendline called the local meteoric water line (LMWL) was created. By using statistical analysis and data manipulation in Excel, this trendline will allow for better understanding of vapor sources of meteoric water in the Grand Valley. This trendline will differ from the GMWL, and may be comparable to other LMWL in areas with similar latitudes and climate classifications.

ARC-GIS DATABASE FOR THE CRETACEOUS WILLIAMS FORK FORMATION IN COAL AND PLATEAU CREEK CANYONS

Kristopher Maurer

The Cretaceous Williams Fork Formation in Coal and Plateau Creek Canyon has very little information that is openly available and there is no central database to access geologic data. The purpose of this research project is to compile existing geologic data such as stratigraphic sections, paleocurrent vectors, mineralogic information, and petrophysical data into a geospatial information system (GIS) for future access.

The location of Coal and Plateau Creek Canyon is northeast of Grand Junction and upper Cretaceous rocks contain fluvial records of the regression of the Western Interior Seaway. During the late Cretaceous through the Eocene Laramide orogeny the Williams Fork Formation deposited by a combination of braided to meandering channels. The project will compile hyperlinks to the original studies which include a series of graduate theses completed at University of Colorado and Oklahoma.

There will be 3D maps of the outcrops with interactive popup points to highlight the main datasets. This database will provide an organized view and easy access to geologic data which will help any future research in the Williams Fork Formation or oil and gas exploration.

USING ZIRCON U-PB GEOCHRONOLOGY OF ANCIENT RIVER DEPOSITS TO RECONSTRUCT THE PALEOGEOGRAPHY OF WESTERN COLORADO DURING THE PLEISTOCENE AND MIOCENE PERIODS

Amanda A Hicks

Reconstructing ancient landscapes is difficult in areas that have undergone widespread erosion such as western Colorado. Detrital zircon (DZ) U-Pb geochronology of ancient river deposits, however, can be used to reconstruct the paleogeography of ancient landscapes by determining sediment provenance of samples. This study uses eight samples three of which

represent modern river sediment (Colorado, Gunnison, Uncompahgre rivers) and five of which represent ancient rivers (Grand Mesa, Columbine Pass, Cactus Park, Gateway) spanning ~1 to 16 Ma. The modern and ancient river DZ data will be divided into specific age ranges that represent different geologic provinces and volcanic events, and similarities and differences in the age populations will be evaluated. The evaluating will be done using visual modelling techniques such as kernel density estimations (KDEs), multi-dimensional scaling (MDS) plots, and cumulative distribution functions (CDFs). DZ U-Pb geochronology allows changes in watersheds and exhumation of the landscapes of western Colorado to be inferred, despite widespread late Cenozoic erosion.

MAGNETIC SURVEY OF THE GLADE PARK AREA IN UNCOMPAHGRE PLATEAU, WESTERN COLORADO, USA

Daniel Arinze

Previous work on the Uncompahgre Plateau area, in Western Colorado indicates the presence of magnetic anomalies. Hector A. Casillas (2004) conducted a study on the Uncompahgre uplift using gravity and aeromagnetic surveys, and results indicate that mafic intrusions are possible sources for gravity and magnetic anomalies in the Glade Park area. This is a plausible suspicion because titanomagnetite minerals present in basalts and gabbro (mafic rocks) can be magnetized. The purpose of this study is to more precisely map magnetic anomalies in the Glade Park area and to investigate further whether or not mafic intrusions are the source of the magnetic anomalies. Magnetic surveys were initiated in the Glade Park area in Fall, 2021 and will continue through Spring, 2022. The surveys will test Casillas' suspicion of possible mafic intrusions at depth and will provide a better understanding of the geology and structure in the Uncompahgre Plateau area.

DETRITAL SANIDINE ^{40}AR/^{39}AR GEOCHRONOLOGY OF WESTERN COLORADO: EXPLORING PROVENANCE AND DEPOSITIONAL AGES OF MIOCENE RIVERS

Sherri Randall

Detrital sanidine (DS) $^{40}Ar/^{39}Ar$ dating of paleoriver deposits provide insight on evolution of landscapes during periods of time dominated by erosion. This study uses DS dating to determine the provenance and maximum depositional ages of three Miocene fluvial deposits of Western Colorado. Samples from the inferred ancestral Colorado River (CRSS) and a volcanic river-gravel (GMVG) were collected from beneath the basalt cap of Grand Mesa. The third sample was collected from the Columbine Pass gravel pit (COLP) along the crest of the Uncompahgre Plateau. The youngest DS ages show the river deposits are mid- to late Miocene in age (13.410±0.037 Ma – CRSS; 10.822±0.015 Ma – GMVG; 16.101±0.052 Ma – COLP). DS analyses also provide insight on the provenance of individual grains. Many of the DS ages correlate with explosive volcanism in the San Juan Mountains. However, DS ages younger than 23 Ma probably originated from volcanic fields such as Basin and Range and Yellowstone hotspot track. By correlating age and K/Ca of DS with those of tuffs from known volcanic fields, we will test the hypothesis that a significant number of the grains originated from distant volcanic sources. In summary, DS $^{40}Ar/^{39}Ar$ data are critical for improving paleogeographic, paleoenvironmental, and paleoclimate reconstructions.

Using cosmogenic ^{3}He nuclide dating to constrain slip rates of the Mead Slope Fault at Lake Mead, Arizona

Jean Thomas Marso

Determining slip rates on active faults is an essential part of fault hazard assessment. This study uses the accumulation of stable, cosmogenic ^{3}He in olivine and pyroxene to date alluvial fan surfaces that constrain recent slip activity. The Mead Slope fault is an active late Quaternary fault located directly below Fortification Hill along the shore of Lake Mead in Arizona. The fault offsets Pleistocene-aged alluvial fan surfaces with large basalt boulders on the surface. Several surfaces on primarily two alluvial fans were sampled for cosmogenic dating. Helium-3 exposure ages of the Qo and Qi3-4 are 620-880 ka and 80-147 ka respectively. The Qo alluvial fan surface shows displacement of at least 80 meters. The Qi3-4 surface shows left lateral offset of 5-6 meters. Exposure dates along the fault surface are also used to constrain timing of fault movement by looking for the difference in the oldest and youngest surfaces ruptured. Constraining the slip rate and movement of this fault is essential to characterize the hazard potential of the fault and potential Dangers to Las Vegas and the Hoover Dam.

ANALYSIS OF GEOMORPHIC CHANGE IN LADDER CANYON, COLORADO FOLLOWING 2021 FLASH FLOOD EVENT

Kyle Karren

Flash flooding occurs in headwater bedrock canyons throughout the Colorado Plateau and are often caused by late summer monsoon rains characteristic of the southwest United States. High intensity rainstorms can deliver large amounts of precipitation to small steep watersheds, resulting in runoff that is quickly delivered to confined bedrock canyons. These high discharge floods can drastically alter a channel's morphology in a short amount of time as large quantities of water and debris are flushed through predominantly dry ephemeral channels. A large flash flood was produced on the evening of July 25th, 2021 in Ladder Canyon, located on the Uncompahgre Plateau in Mesa County, Colorado. The flood event caused incision through a coarse point-bar and heavily damaged a popular hiking trail. This study uses pre- and post-flood aerial photo analysis and field surveys to characterize morphological changes caused by the flood. Dominant controls on sediment transport and deposition within the study reach are identified to better understand bedrock channel dynamics and impacts of the 2021 flood.