Magnetic survey of magnetic anomalies in the Ryan Park-Pinon Mesa area, northwestern Uncompahgre Plateau, Colorado and Utah.

Emilio Topete

Abstract

The Ryan Park-Pinon Mesa area of the northwestern Uncompahgre Plateau is represented by two magnetic anomalies. These anomalies have not been the primary focus of previous geophysical surveys despite intense silicification in the Wingate Formation and metalliferous minerals, which are suggestive of hydrothermal activity. This study aims to identify the potential location and depth of a magnetic anomaly(s) using portable magnetometer data acquisition. The investigation seeks to explain the magnetic anomalies and to evaluate their potential relationship to the observed hydrothermal activity. Drawing from previous studies on the Uncompahgre Plateau and nearby La Sal Mountains, hypotheses regarding the origin of the magnetic anomalies are explored. One scenario is that the La Sal Mountains were the source of a magmatic intrusion in the Ryan Park-Pinon Mesa area. Through detailed fieldwork using a proton magnetometer and ArcGIS data analysis, the study will infer the location and potentially the properties of the subsurface magnetic anomaly(s). The project's outcomes are expected to provide valuable insights into the geological and geophysical features of the Ryan Park-Pinon Mesa area and will contribute to a deeper understanding of regional tectonic processes and hydrothermal influences. The findings may also facilitate future research in similar geological settings.

STRUCTURAL AND HYDROTHERMAL FEATURES OF RYAN PARK, NORTHWESTERN UNCOMPAHGRE PLATEAU, COLORADO

Addison Early

Abstract

This study aims to shed light on the geologic structures of Ryan Park and the structural evolution of the northwestern edge of the Uncompahgre Plateau. The northwestern edge of the Uncompahgre Plateau has a very complicated geologic history, leading to many different interpretations of its sedimentary stratigraphy, tectonics, structural development, and topographic evolution. The study area is located in western Colorado and eastern Utah on the Uncompahgre Plateau, specifically the Ryan Park area, which includes the Ryan Park fault zone. The methods used to interpret the structural geology of Ryan Park include gathering orientation data of the exposed outcropped formations, measuring joint and fracture orientations, and analyzing the data using stereonet plots to identify trends within the deformation. Sedimentary units present in the study area include the Triassic Chinle Formation and the Jurassic Wingate Formation, Kayenta and Entrada Formations. This study indicates that there has been a right lateral movement of the Ryan Park fault zone. The northwestern section of Ryan Park was subject to hydrothermal alteration, identified by the presence of silicification of segments of the Wingate Sandstone.

Ryan Park-Pinon Mesa Hydrothermal Fluorite Deposits

Mackina Chamberlain

Abstract

The Ryan Park- Pinon Mesa research area on the Colorado-Utah border houses Cenozoic mineral deposits that are indicators of hydrothermal activity. The minerals of interest in the study area are ore minerals, including fluorite, which is the most useful in analyzing hydrothermal fluids. The mineralization is structurally controlled as it is found along joints and veins or as a breccia matrix along the faults. Fluorite mineralization commonly occurs within hydrothermal veins and can hold information regarding the origin and temperature of hydrothermal fluids. Measurement of REE concentrations in fluorite mineralization can help determine the source of the deposits and hydrothermal fluids and tie them to a magma source. Using REE fluorite data normalized to chondrite or post-Archean Australian shale (PAAS) values identifies patterns of REE enrichment or depletion. Positive Eu or Ce anomalies can provide information regarding the mineralization processes and give insight about the causative intrusion. REE patterns can also help distinguish different types of mineralization. Analyzing REE data in fluorite can help identify the origin of the hydrothermal fluids and provide a timeline of the geological evolution of the Ryan Park- Pinon Mesa area.

REVIEW OF SELECTED CRITCAL MINERALS: COPPER AND TIN

Hunter Stewart

Global demand for mineral resources has dramatically increased in the last 50 years. This demand grew from 26.7 billion tons in 1970, to about 100 billion tons in 2017, and is expected to reach about 185 billion tons by 2050. The critical mineral list screening methodology provided a framework for the development of the first U.S. critical minerals list. Copper is one of the USA leading manufacturing minerals while other critical minerals such as tin imported from other countries. The amount of available minerals can affect future production and advancement of technology.

MAPPING AND CHARACTERIZATION OF MASS WASTING SITES ALONG THE COLORADO RIVER BLUFFS, GRAND VALLEY, WESTERN COLORADO

Ethan Freeburger

Abstract

Mass wasting events are one of the most widespread disasters that cause serious losses to various aspects of life. In understanding the factors that lead to these events, humans can plan to find the safest and most efficient use of land to avoid risks and dangers from landslides. This is especially important in areas such as Grand Junction, Colorado, where the Colorado river runs directly through major population centers and whose banks are very susceptible to mass wasting events. The purpose of this research project is to create an inventory of active and recently active mass wasting sites along the Colorado River bluffs using a combination of satellite imagery and field descriptions. The collected data will then be visually shown on two color-coded maps, one for activity and the other for characteristics. Through the data that was collected, it can be determined that the majority of the slides in the Grand Valley consist of semi-active slides. The mass wasting events are caused and accelerated by the brittle nature of the Mancos Shale, river cutting from the Colorado River, and human induced factors such as irrigation. This project gives an understanding of the types of mass wasting that occur along the Colorado bluffs and what their characteristics are. This information can be used for tasks such as hazard assessments of the area, where to plan for possible destruction of property/river blockages and be used to understand where to develop buildings.

ORIGIN OF A PALEOSOL AT THE CRETACEOUS-PALEOGENE BOUNDARY IN THE OHIO CREEK FORMATION, SHALE RIDGE AREA, PICEANCE BASIN

Ben Chamberlain

Abstract

A paleosol is a fossil soil that can preserve information about paleoclimates, paleoenvironments and the evolution of landscapes in the past. Paleosols often form during periods of landscape stability that can coincide with the formations of unconformities. The Cretaceous-Paleocene boundary is an important geologic unconformity, and it may be represented by a paleosol. To test this hypothesis, five samples of a possible paleosol were collected in the Shale Ridge area located west of DeBeque, Colorado from the top of the late Cretaceous Ohio Creek Member of the Williams Fork formation for study. The paleosol is overlain by the Paleocene Wasatch Formation. X-ray diffraction and x-ray fluorescence will be used to characterize the clay mineralogy and geochemistry of the paleosol samples to determine if vertical trends in the composition of the samples are consistent with late Cretaceous weathering. This analysis could reveal the paleoclimatic conditions during the time of paleosol formation and could help resolve controversies surrounding the stratigraphy of the Ohio Creek unit.

DETRITAL SANIDINE $^{40}AR/^{39}AR$ DATING OF THE WEST ELK RIVER GRAVELS OF THE BLACK CANYON OF THE GUNNISON, COLORADO: INSIGHTS ON POST-LARAMIDE PALEOGEOGRAPHY AND TECTONISM

Coral Copenhaver

Abstract

The post-Laramide paleogeography and tectonism of Western Colorado remain subjects of ongoing debate, fueled by the complex geological history of the region. This study focuses on elucidating the timing and causes of epeirogenic uplift in this area through comprehensive field studies and high precision detrital sanidine (DS) dating techniques applied to the West Elk River Gravels. The West Elk River Gravels, situated atop the Rocky Mountain Erosion Surface (RMES), provide a crucial geological boundary and a unique opportunity to investigate post-Laramide paleogeography.

Field observations and clast analysis reveal that the majority of clasts within the West Elk River Gravels are locally sourced, with a significant proportion likely originating from the nearby West Elk Volcano. Detrital sanidine (DS) dating results indicate a peak concentration of grains around 31 million years ago (Ma), consistent with the overall clast-based age distribution. Furthermore, the maximum depositional age (MDA) of approximately 29.2 Ma suggests that the West Elk River Gravels predate the Blue Mesa Tuff, aligning with the broader geological timeline of the region. The age determination of the West Elk River Gravels provides insights into significant shifts in paleogeography and drainage patterns from the time of their deposition to the deposition of the overlying Blue Mesa Tuff. These findings contribute to a better understanding of the dynamic geological evolution of western Colorado, highlighting the importance of continued investigation to unravel the intricate narratives shaping the landscape of this region and its broader implications for tectonic and environmental phenomena.

Evaluation of Petrophysical Heterogeneity within Fluvial Architectural Elements of the Cretaceous Burro Canyon Formation, Piceance Basin, Colorado

Liam Posovich

Abstract

This research focuses on refining reservoir characterization of fluvial bodies within the Lower Cretaceous Burro Canyon Formation at Deer Creek Canyon, Colorado by integrating high-resolution field data with advanced modeling techniques. Traditional field methods combined with unmanned aerial vehicle (UAV) photogrammetry captured detailed stratigraphic and architectural variations, facilitating the development of a comprehensive 3D model using the subsurface modeling software, Petrel. This model replicates observed geological features accurately and enhances the predictability and efficiency of reservoir management strategies by bridging empirical data collection with theoretical simulation. The study emphasizes the complexity of reservoir heterogeneity, underscoring the importance of incorporating both large and small-scale architectural elements to understand fluid flow behaviors within fluvial depositional systems. Utilizing detailed field measurements and advanced photogrammetric techniques, the research accurately models the spatial distribution of lithofacies and constructs a detailed geological framework that informs the distribution of petrophysical properties such as porosity and permeability. The research explores the challenges and necessity of fine-scale modeling in capturing the intrinsic heterogeneity of the formation, which traditional models often overlook. The detailed stratigraphic architecture obtained from the study provides a critical tool for predicting changes in reservoir properties and planning effective field development strategies. This integration of geological data with process-based modeling technology exemplifies a sophisticated approach to enhancing reservoir characterization, crucial for optimizing resource management in hydrocarbon extraction, groundwater management, and carbon sequestration.

Hydrogeological and geochemical analysis of a Grand Mesa alluvial fan near Whitewater, Mesa County, Colorado

KennaLee Worster

Abstract

Hydrogeologic and hydrogeochemical analyses were conducted to determine whether water associated with shallowly buried paleochannels features were acting as groundwater conduits. Hypothesized locations for the paleochannels in a terraced alluvial-fan remnant on the western flank of Grand Mesa were to be tested using a hydrogeologic mass-balance approach involving measurements of surface runoff versus groundwater seepage rates. Due to lack of flow a mass balance approach was not achievable and only still waters were able to be collected. Geochemical analyses included basic water parameters (pH, electric conductivity, and oxidation-reduction potential) and a comparison of surface runoff versus groundwater seepage parameters. Previous RGB and multispectral drone (sUAS) imagery yielded hypothesized locations of buried paleochannels, including several locations associated with apparent groundwater-sapping erosional features. Additional high-resolution RGB imagery is collected at one of the features, and the resulting 3D digital model allows for further examination of surface runoff versus groundwater seep pathways. By assimilating the entirety of the available data, including drone imagery, hydrogeology, and hydrogeochemistry, the hypothesis for the location of shallowly buried paleochannels acting as groundwater conduits was tested.