Sediment Composition and Texture of Exposed Reservoir Deposits in Lake Powell Tributary Canyons, Utah

Aditya Pandey[1], Dr. Brenda Bowen[2] Sam Bagge[3] | Department of Geology and Geophysics
1: Student, 2: Professor/Advisor, 3: Former Graduate Student Advisor

INTRODUCTION

Since the construction of Glen Canyon Dam in the 1960s, sediment carried by the Colorado River and its tributaries has been trapped in Lake Powell Reservoir. As water levels have dropped in recent years, large areas of these stored sediments are now exposed. This project focuses on describing and comparing the composition and grain texture of exposed reservoir sediment in three tributary canyons: Clearwater (D), Gypsum (C) and Dark (E) in southeastern Utah.

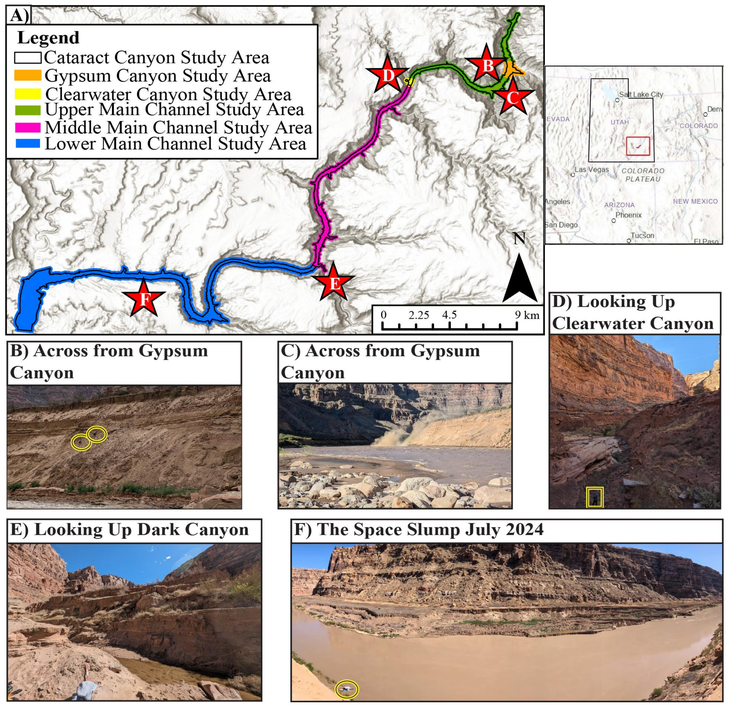

Figure 1: Field area map showing Gypsum, Clearwater and Dark Canyon study sites with representative photos.

METHODS

We collected 63 sediment samples across the three canyons. Laser Grain Size Analysis (LGSA) was used to measure grain size distribution, with results grouped into clay (<4 µm), silt (4-62.5 µm) and sand (>62.5 µm). Based on LGSA results, 20 fine grained samples interpreted to be reservoir deposits were selected for further analysis. These samples were analyzed using X-ray Fluorescence (XRF) to identify major elements and X-ray Diffraction (XRD) to determine mineral composition. Scanning Electron Microscopy (SEM) images were taken at 5, 20 and 100 µm to observe grain shape, angularity and surface texture.

ACKNOWLEDGMENT

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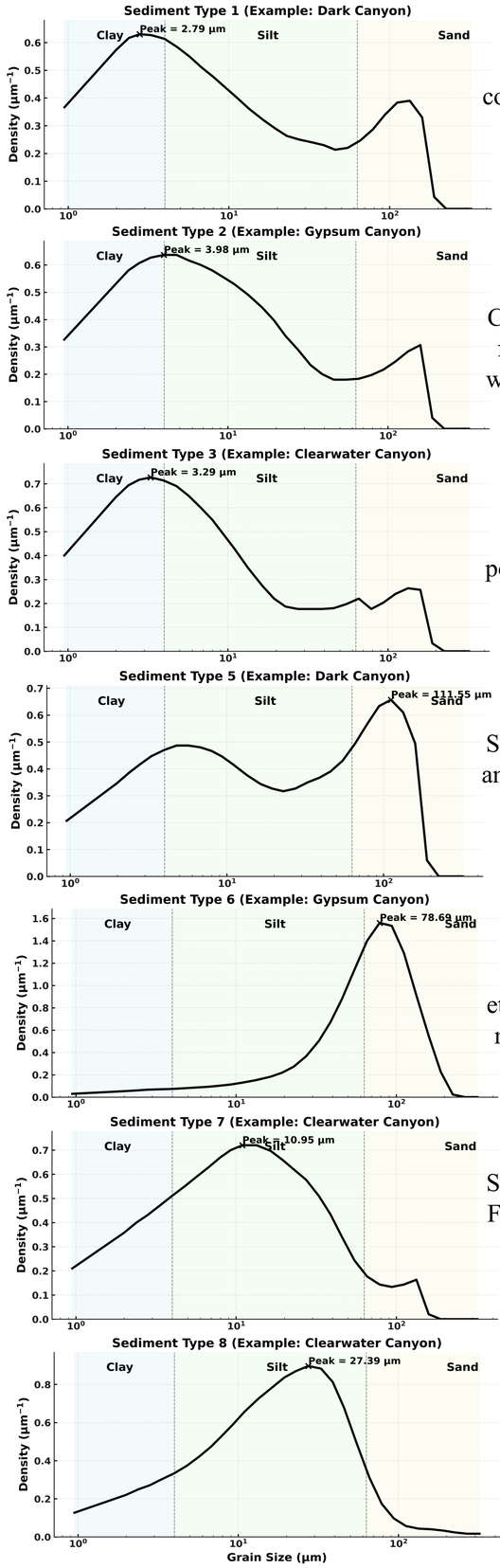
LASER GRAIN SIZE ANALYSIS



SEM IMAGES

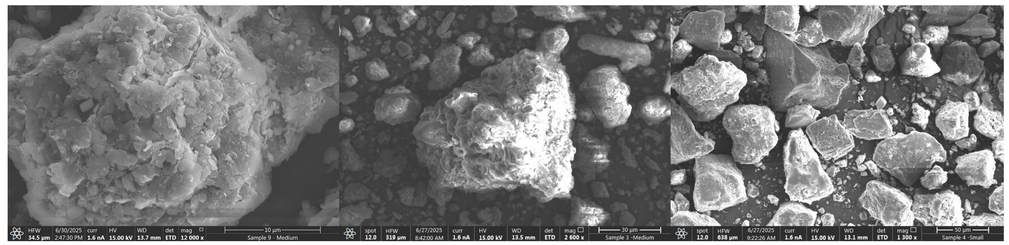


Figure 3: SEM images showing etched, layered and compacted grains reflecting varied energy.

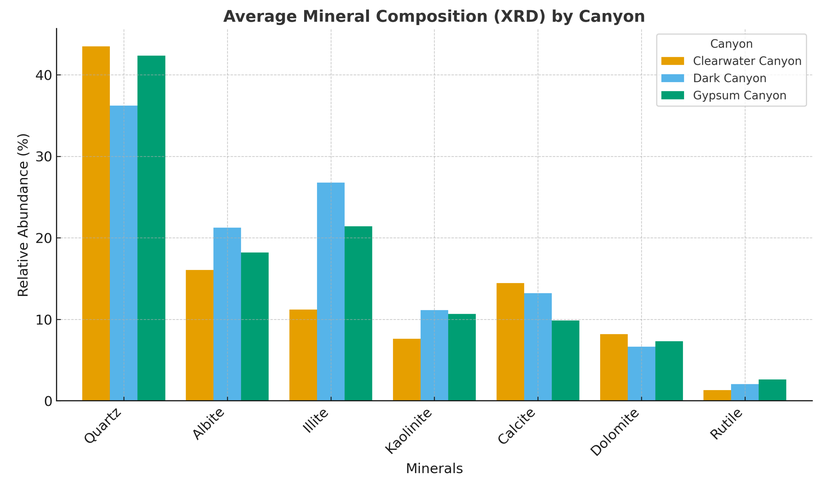


Figure 4: Mineralogy varies by canyon, with clays up to 40% influencing texture and stability.

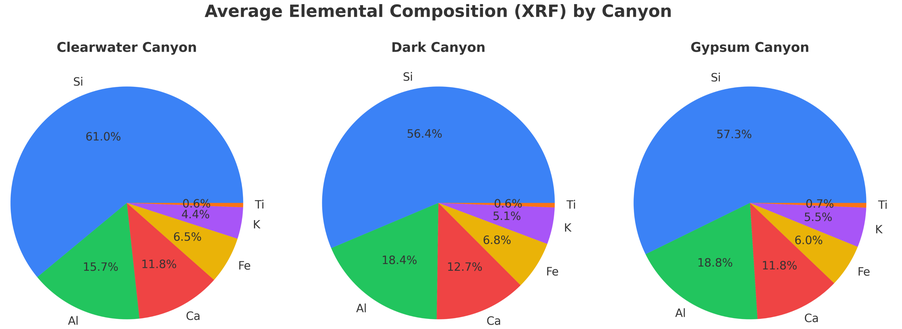


Figure 5: Elemental composition is similar across canyons, dominated by Si, Al and Ca.

RESULTS

The grain size results showed eight distinct sediment types based on grain size distribution patterns, including clay-rich, silt-rich, sand-rich and mixed type samples. These textural differences were observed both within and across canyons. XRF results showed similar overall chemical composition across sites, with high levels of Si, Al and Ca. XRD confirmed that common minerals including quartz, calcite and illite were present in most samples. SEM images revealed clear differences in grain shape and texture across sites. While overall chemistry is similar across canyons, the textures of the sediments are not, suggesting localized differences in depositional conditions across the reservoir. These patterns likely reflect varying depositional settings, with higher-energy fluvial input in Clearwater, finer lacustrine settling in Gypsum and alternating inflow and still-water conditions in Dark Canyon. These findings will inform ongoing analyses of slope stability and sediment failure mechanisms in exposed reservoir deposits.

References
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