Geology Happenings

The Past is Key to the Present

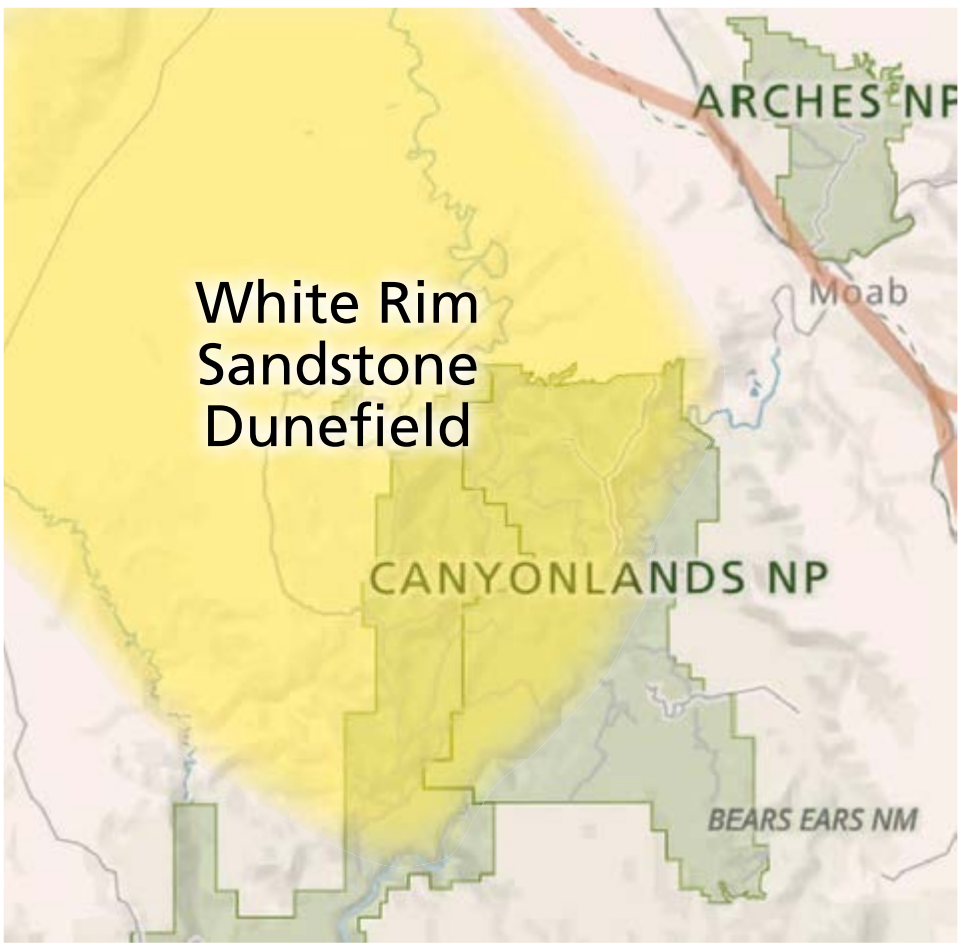
by Allyson Mathis

There's an oft-repeated dictum in geology: *the present is key to the past*. This means that geologists use observations of current geologic processes and features to interpret the ancient geologic past. For example, water currents that leave ripples in sand today are the same as those that made ripple marks preserved in stone. Similar interpretations are made for other geologic phenomena. Modern volcanic eruptions are used to understand volcanic rocks and the movement of sand in coastal areas provide insight into marine sandstones. Paleontologists even study what happens to cow carcasses left in floodplains in order to better understand how fossils are preserved.

The flipside of this principle is that *the past is key to the present*. In other words, the geologic history of an area determines its modern features, landscapes, and landforms. Ancient geologic events also dictate what types of rocks are present in any given area, as well as what fossils they may contain. The geologic past also determines what geologic hazards are present and if there are any mineral or oil and gas resources. Just like with human history: the past must be understood in order to understand the present.

Simply put, Moab is Moab because of events that happened in the geologic past, sometimes hundreds of millions of years ago or more. Arches and Canyonlands national parks are also what they are because of their particular geologic histories.

The defining features of canyon country, including its cliffs and canyons, rock domes and spires, and alcoves and arches, all depend on the ancient geologic history of how the rock layers (*formations* to geologists) were formed, and what has happened to them since then. Most of the rocks exposed near Moab are sedimentary rocks deposited near sea level. Today, the area stands at least 4,000 feet higher. This high elevation, combined with the Green and Colorado rivers incising into the landscape, is responsible for how these rock layers have been carved into such spectacular scenery.



Salt Valley in Arches National Park was formed by collapse of the overlying rock layers after salt dissolution.

The oldest part of Moab's geologic story is the deposition of the rock layers. Most of the rock layers exposed in southeastern Utah are Mesozoic in age (e.g., between about 252 and 66 million years old); e.g., from the Age of the Dinosaurs. The Moab area is particularly rich in dinosaur fossils because many of Moab's rock layers were deposited in terrestrial environments where dinosaurs lived.

One important rock type (*halite* or salt) is not exposed anywhere on the surface but plays a profound role in shaping the landscape. Great thickness of salt were deposited about 310 million years ago in a hypersaline sea centered on what is now the Moab area. Salt can flow plastically under the confining pressure of overlying rocks. Because it is less dense, it flows upward. Near the surface where the salt encounters groundwater, it dissolves causing the overlying layers to collapse to form elongated valley-like basins. Both the Moab Valley and Salt Valley in Arches National Park are in such collapsed features.

Ancient geography also impacts modern geography. For example, the White Rim Sandstone was deposited in coastal sand dunes. The edge of those dunes was near where the Colorado River is today. They also didn't extend northeast towards Moab. Therefore, the White Rim Sandstone that forms the broad bench in Canyonlands National Park isn't present in Moab.

One of the most impactful events in southeastern Utah's geologic history was the geologic uplift that mostly occurred between 70 and 40 million years ago. It occurred during a tectonic event that impacted the entire intermountain west and pushed up the Rocky Mountains. This uplift fundamentally changed in the region's geologic environment—from a low area where sediments were largely being deposited to one that experiences net erosion.

The White Rim Sandstone in Canyonlands National Park

The development of southeastern Utah's deep canyons happened more recently. Prior to the Colorado River extending to the Gulf of California in the last six million years, the rivers in the area did not flow to sea level. They were like the rivers that flow into the Great Salt Lake; they can only downcut to the elevation of the lake (e.g., their *base level*). However, once the Colorado River reached the gulf, its base level fell and the rivers began slicing into the landscape, progressively upstream. These waves of incision only reached southeastern Utah within the last few million years.

A dinosaur bone in the Morrison Formation.

These are only a few examples of how the geologic past and the present are connected in the Moab area. Our human perspectives just don't serve us well when contemplating geologic timescales, but the geologic past is as relevant today as human history is to current events. As William Faulkner wrote, "The past is never dead. It's not even past." We see that this is true in every view we take of the surrounding canyonlands.

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