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A VISUAL PALEONTOLOGICAL INVENTORY OF UTAH'S NATIONAL PARK SERVICE AREAS

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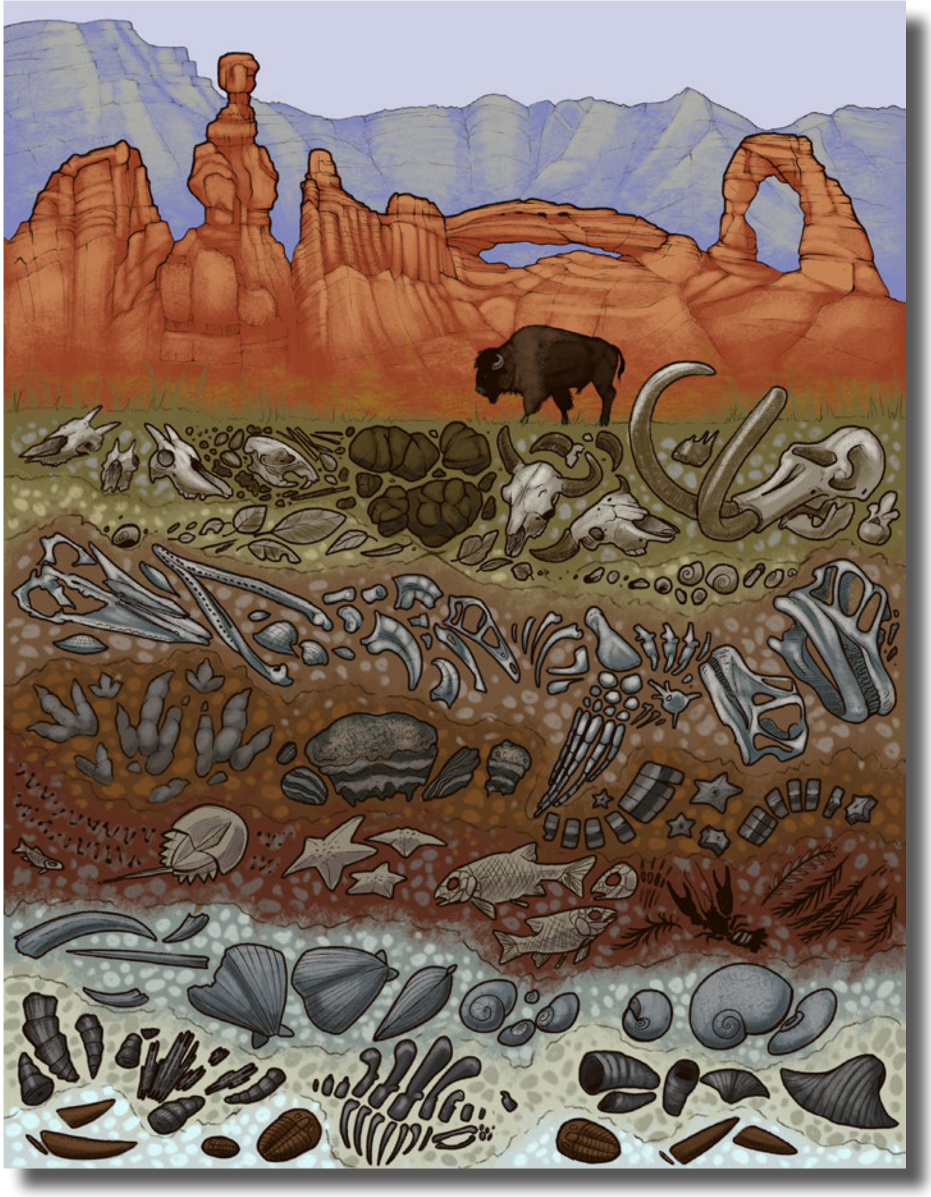

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Cover

An extant American bison strides atop an underlying sequence of Phanerozoic strata and fossils. These are arranged by geologic period (Cambrian, Permian, Early Triassic, Late Triassic, Jurassic, Cretaceous, Paleogene, and Quaternary) and from left (west) to right (east) in approximate accordance with their occurrence across the National Park Service areas of Utah. Iconic rock formations representing the "Mighty Five" national parks (Zion, Bryce Canyon, Capitol Reef, Canyonlands, and Arches National Parks) form the nearest skyline, and other landmarks (Powell Point to the west and the Henry Mountains to the east) form the horizon. Artwork by Benji Paysnoe, CAMBEN Creatives LLC, used with permission.

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A Visual Paleontological Inventory of Utah's National Park Service Areas

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ABSTRACT

The National Park Service (NPS) stewards 13 park units across the State of Utah, which is world-renowned for its stunning landscapes, complex geologic history, and globally significant fossil assemblages. Although most NPS areas in Utah are best known for their scenic landscapes, they all preserve geologic records with significant paleontological resources. The NPS Paleontology Program, through sustained partnership with such organizations as the Utah Geological Survey and the Utah Geological Association, has conducted years of field inventory and outreach to promote the stewardship, study, and education on paleontological resources within the NPS administered lands. The most comprehensive and publicly available literature reviews on fossils across Utah's NPS areas were completed more than a decade ago, and numerous field inventories and publications have since been completed. This document serves as a thorough update to those previous works by providing detailed and easily comprehensible biostratigraphic diagrams with accompanying descriptions for each NPS unit in Utah. By providing this resource, this document aims to support park managers, educators, and external partners in protecting, preserving, and educating the public on the diverse and scientifically significant paleontological resources across the NPS areas of Utah.

NATIONAL PARK SERVICE (NPS) ABBREVIATIONS

ARCH, Arches National Park; **BRCA**, Bryce Canyon National Park; **CANY**, Canyonlands National Park; **CARE**, Capitol Reef National Park; **CEBR**, Cedar Breaks National Monument; **DINO**, Dinosaur National Monument; **GLCA**, Glen Canyon National Recreation Area; **GOSP**, Golden Spike National Historical Park; **HOVE**, Hovenweep National Monument; **NABR**, Natural Bridges National Monument; **RABR**, Rainbow Bridge National Monument; **TICA**, Timpanogos Cave National Monument; **ZION**, Zion National Park.

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BACKGROUND

The State of Utah is home to 13 NPS areas: one national historical park (GOSP), one national recreation area (GLCA), six national monuments (CEBR, DINO, HOVE, NABR, RABR, TICA), and five national parks (ARCH, BRCA, CANY, CARE, ZION). These were collectively dubbed the "Mighty Five" national parks in a campaign by the Utah Office of Tourism Industry in the early 2010s) (Figure 1). The NPS also co-administers the Old Spanish National Historic Trail (NHT) alongside the Bureau of Land Management (BLM), which connects Los Angeles, California, with Santa Fe, New Mexico, and crosses through south-central Utah (90th Congress, 1968; 107th Congress, 2002). Several fossils were reported by the Macomb Expedition of 1859 in California, New Mexico, Colorado, and Utah, including the holotype of the sauropod *Dystrophaeus viaemalae* from the Tidwell Member of the Upper Jurassic Morrison Formation close to the trail near Moab, Utah (Newberry et al., 1876; Cope, 1877). Despite the occurrence of these important fossils, the fact the Old Spanish NHT spans across several states means that it falls beyond the scope of what is covered in this document.

Utah's NPS areas are renowned for their visually striking landscapes and unique geologic features, such as the eponymous rock arches of ARCH and the enigmatic hoodoos of BRCA, as well as their rich natural and cultural history. Historically, these areas were inhabited by diverse indigenous peoples who were displaced over the course of the 16th through 19th centuries with the arrival of Spanish explorers and Mormon pioneers. It was these collective communities who first experienced the wonder that these landscapes inspire in current and future generations.

The settlement of Euro-American communities across Utah in the 19th century paved the way for developments in the early 20th century, especially the establishment of these areas as federally protected national parks and monuments. Starting with President Theodore Roosevelt's designation of NABR in 1908 (Roosevelt, 1908), several presidents in the early 20th century invoked the Antiquities Act of 1906 (59th Congress, 1906) to protect these lands as national monuments (ZION, Taft, 1909; Wilson, 1918; RABR, Taft, 1910; DINO, Wilson, 1915; TICA, Harding, 1922; HOVE, Harding, 1923a; BRCA, Harding, 1923b; ARCH, Hoover, 1929; CARE, Roosevelt, 1937). Following the formal creation of the National Park Service through the Organic Act of 1916 (64th Congress, 1916), some of the previously established national monuments were re-designated as national parks through Acts of Congress (ARCH, 92nd Congress, 1971; BRCA, 68th Congress, 1924; 70th Congress, 1928; and ZION, 66th Congress, 1919). In the latter half of the 20th century, park units were established almost exclusively through Acts of Congress (CANY, 88th Congress, 1964; GOSP, 89th Congress, 1965; GLCA, 92nd Congress, 1972). By designating these lands under the stewardship of the NPS, the natural and cultural resources contained within fell under federal protection. Little known to legislators and the general public at the time of their establishment (with the notable exception of DINO), the paleontological resources contained within each and, as it turned out, every park unit in Utah fell within this purview.

Since the late 2010s, the "Mighty Five" national parks have hosted approximately 13.5 million visitors annually, and that number is expected to grow as time progresses (NPS, 2025a; Table 1). This naturally places strain on the management of people and visitors at these and other parks as growing visitation increases the likelihood of human-caused disturbance to paleontological and other natural resources (e.g., trampling, deliberate vandalization, and/or theft).

The recognition of the significance of paleontological resources in parks is a relatively recent development, and thus few parks have robust internal programs for managing and monitoring them. Therefore, management, research, and educating the public about park fossils is often done in collaboration with outside entities and through internships and short-term positions.

Most NPS areas with paleontological resources request support from the NPS Paleontology Program, which provides agency-wide support to at least 288 parks with fossil-related needs. Ideally, parks should develop programs outlined in the Paleontological Resources Preservation Act of 2009 (PRPA; 111th Congress, 2009) and NPS Management Policies (2006,

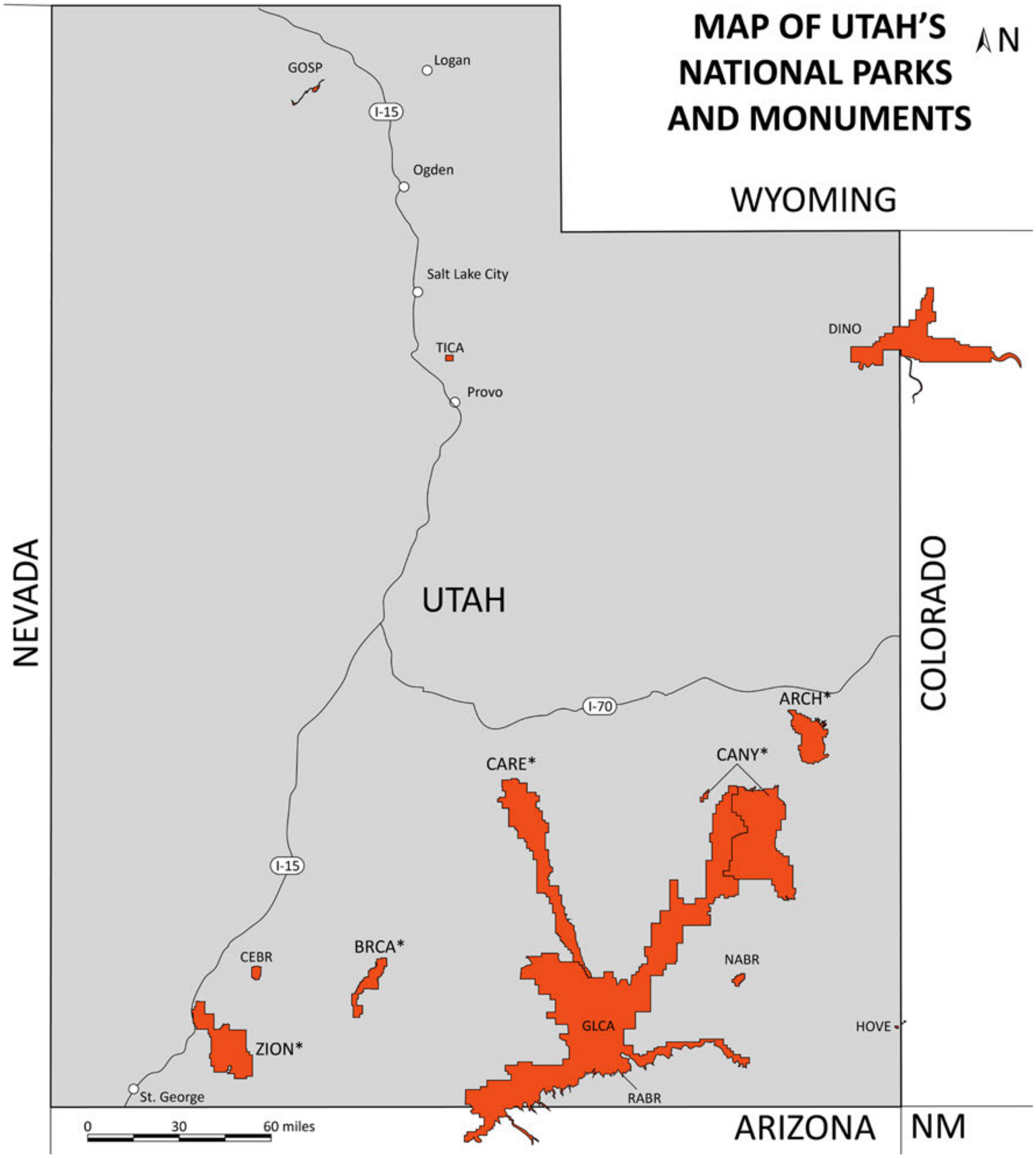

Figure 1. A map of Utah showing its 13 national parks and monuments managed by the NPS. The "Mighty Five" national parks are noted by an asterisk after their name (*). Scale bar equals 60 miles (about 96.5 km). Park unit boundaries adopted from data produced by the NPS Land Resources Division (https://www.arcgis.com/home/item.html?id=6f2f40e0b1c74b8ea886261fe8e0431f). See page 221 for NPS unit abbreviations.

Section 4.8.2.1). Utah's national parks and monuments display a strong and complex geological and paleontological history, mostly in the Mesozoic Era or "Age of Reptiles" (Figure 2), thanks to the state's geographic and physical features (e.g., the Grand Staircase geologic feature, which includes BRCA, CEBR, ZION, and GLCA), making them excellent places for research and outreach as resources permit.

Despite the overall lack of sustained paleontological programs across Utah's national parks, short-term field inventories have been coordinated by the NPS Paleontology Program through partnerships with professional

Table 1. Recent and record visitation numbers at Utah's NPS units. The "Mighty Five" national parks are noted by an asterisk after their name (*). Data available at https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=TICA (accessed April 21, 2025).

Park Unit	**Visitation in 2024**	**Highest Annual Visitation (Year)**
ARCH*	1,482,045	1,806,865 (2021)
BRCA*	2,498,075	2,679,478 (2018)
CANY*	818,492	911,594 (2021)
CARE*	1,422,490	1,422,490 (2024)
CEBR	722,834	909,199 (2017)
DINO	326,529	534,274 (1993)
GLCA	4,725,610	5,206,934 (2023)
GOSP	53,015	169,600 (1969)
HOVE	35,231	47,593 (1999)
NABR	83,760	151,504 (1993)
RABR	17,488	346,151 (1995)
TICA	114,034	226,600 (1974)
ZION*	4,946,592	5,039,835 (2021)
TOTAL (2024)	17,256,195	

paleontologists, collaboration with outside researchers, and recruitment of paleontology interns to help them protect, monitor, and study their fossils (ARCH, Swanson et al., 2005, Madsen et al., 2012; BRCA, Tran et al., 2024; CANY, DeBlieux et al., 2021, 2023, 2024; CARE, Kirkland et al., 2014a, 2020; GLCA, Kirkland et al., 2010; Milner et al., 2024; ZION, DeBlieux et al., 2005, 2006; Clites and Santucci, 2012). Literature reviews have also been published (Koch and Santucci, 2002; Tweet et al., 2009, 2012b through 2012l). However, these reports often contain sensitive locality information, which prohibits public dissemination in order to protect the vulnerable and nonrenewable fossils discussed within.

Despite this limitation, the NPS Paleontology Program has, over the last 23 years, published both sensitive and public versions of park-specific paleontological resource inventory reports and management plans to increase information accessibility and outreach impact (e.g., Varela et al., 2019; Kottkamp et al., 2020; Salcido et al., 2022). Public versions of these documents are easily searchable and are distributed openly to park staff and partner organizations. However, most of the NPS-produced field inventories in Utah predated this practice, as Utah and Colorado parks served as pilot programs for NPS Paleontology Program in the late 1990s through the early 2000s. Just two public paleontological resource inventory reports are currently available for NPS units in Utah (ARCH, Swanson et al., 2005; BRCA, Tran et al., 2024).

Other avenues used by the NPS Paleontology Program for promoting the integration of and education on paleontological resource management include the Park Paleontology Newsletter (e.g., Hunt-Foster, 2021; DeBlieux et al., 2022; Henderek, 2023; Tran, 2023a), the Parks Stewardship Forum (e.g., Santucci et al., 2024; Hunt-Foster, 2024), and the annual National Fossil Day (NFD) event hosted at several parks across the agency. A few Utah parks have been showcased through fossil logo artwork related to NFD, commissioned by the NPS Paleontology Program (BRCA, DINO, GLCA, ZION; Figure 3). Many NPS units in Utah are highlighted in, or are directly involved with these educational efforts, as they provide opportunities to showcase ongoing research and management projects (ARCH, BRCA, CARE, CANY, DINO, GLCA, ZION). Even so, these publications are often focused on current work, and full overviews of each park's paleontology and geology are beyond the scope of these materials.

These factors discussed above have prevented the public, park staff, and often potential researchers from receiving complete and accurate information on the complete scope of the fossils documented in each of Utah's national parks and monuments. Materials created by non-NPS agencies, especially the Utah Geological Survey (UGS), Utah Friends of Paleontology, and University of Utah Press have provided invaluable educational overviews of dinosaur fossils found across the state (Figure 4) (Gillette, 1999; DeCourten, 2013; Kirkland et al., 2024). By comparison, the most comprehensive overviews of paleontological resources with particular focus on NPS areas in Utah were included in previous editions of *Geology of Utah's Parks and Monuments*, produced by the Utah Geological Association

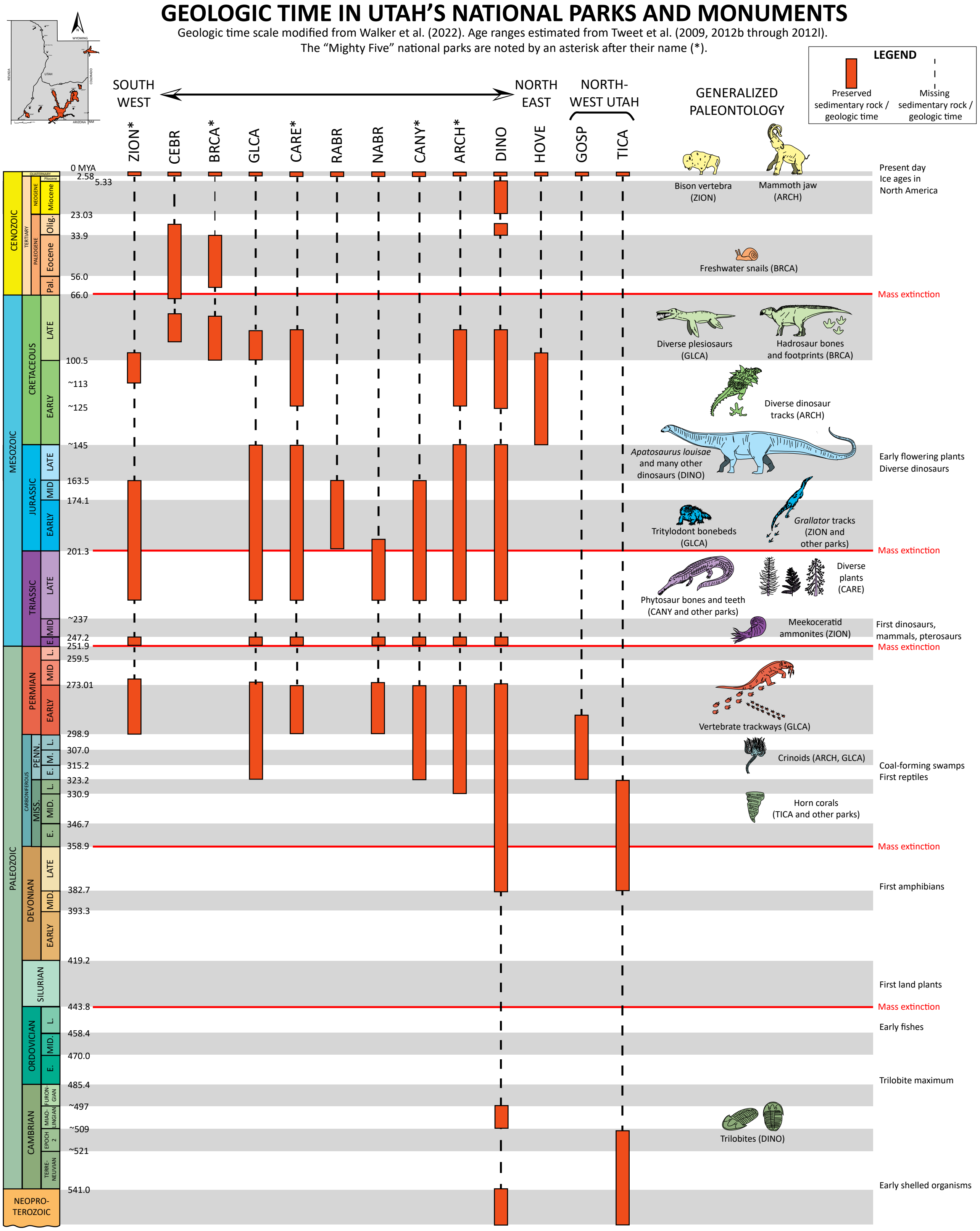

Figure 2. Utah national parks and monuments mapped against the geologic time scale. Time scale modified from Walker et al. (2022). Age estimates from Tweet et al. (2009, 2012b through 2012l).

Figure 3. National Fossil Day park logos (from left to right) for Bryce Canyon National Park (drafted for use in 2028), Dinosaur National Monument (drafted for use c. 2013), Glen Canyon National Recreation Area (2024), and Zion National Park (drafted for use in 2029), depicting fossil taxa and paleoenvironments documented at each park unit. Artwork by Studio105.

(UGA; Santucci, 2000, later expanded and updated into Santucci and Kirkland, 2010). However, more than a decade has passed since these materials were first published. In that time, several inventories, publications, conference abstracts, and outreach materials on fossils in Utah's NPS areas have been produced (e.g., Lockley et al., 2004; DeBlieux et al., 2006; Eaton, 2013; Martz et al., 2017; Bennett et al., 2023; Milner et al., 2023a, 2023b, 2024; Santucci et al., 2024; Tran et al., 2024). These advancements render the UGA reviews outdated. This document aims to serve as a comprehensive update to Santucci (2000) and Santucci and Kirkland (2010) by providing diagrams that compile all of the most recent and accurate data available on the paleontology and geology of each national park and monument in Utah.

METHODS

This work began after the Tut Tran created a biostratigraphic diagram for BRCA, first for the Society of Vertebrate Paleontology 83rd Annual Meeting (Tran, 2023b), and subsequently for the full BRCA Paleontological Resource Inventory (Tran et al., 2024). Vince Santucci requested that Tran make similar diagrams for all NPS units in Utah, as the parks and monuments throughout the state are known to produce many significant fossils (e.g., DINO, GLCA, ARCH, etc.). The impetus for this work was, in part, to serve as an update on previous reviews on paleontological resources in NPS areas in Utah, especially Santucci (2000) and Santucci and Kirkland (2010). More importantly, this document fills in a gap created by the exclusion of an updated chapter from the most recent edition of *Geology of Utah's Parks and Monuments* (Sprinkel et al., 2024), a volume which is widely distributed by the UGA and serves as an important source for geological education and outreach, due to constraints. This document allows UGA and NPS to provide an easily accessible avenue on park paleontological resources that, importantly, have been greatly expanded to include detailed and easily comprehensible biostratigraphic diagrams for each park.

The organisms represented in each park diagram are derived from NPS-produced inventories and field reports produced by partner researchers, especially the UGS. The inventory reports of Tweet et al. (2009, 2012b through 2012l) served as good overviews of NPS paleontological resources. More recent reports were added to this baseline.

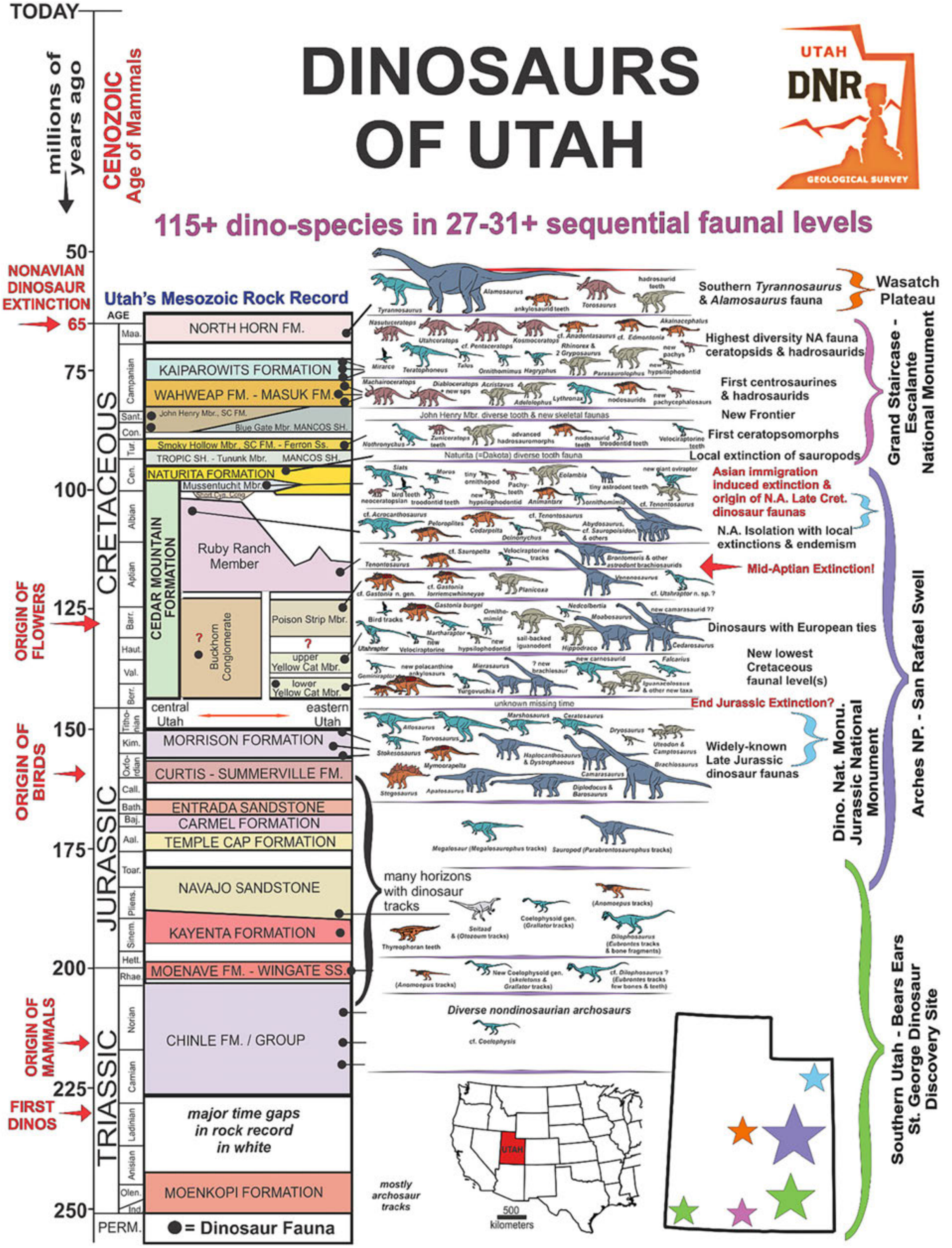

Figure 4. Dinosaurs of Utah mapped against the state's geologic formations and a geologic time scale. Adopted from Anatomical Record (2023).

The stratigraphic columns included in this document were modified from several UGA and UGS publications, especially existing stratigraphic columns and geologic maps (Doelling and Kuehne, 2007, 2013; Anderson et al., 2010; Biek et al., 2010, 2015; Constenius et al., 2011; Titus et al., 2016). The UGS maps cited have minor variations in their color designations for various geologic units. However, many of the Utah parks and monuments contain the same rock formations and/or units of roughly equivalent ages and depositional environments. For the sake of simplicity, and to promote understanding of the geologic time, formations, and fossils that many parks share in common, most colors have been made uniform across the park diagrams and paleogeographic maps. Nomenclature for certain stratigraphic units, such as the members of the Chinle Formation (ARCH, CANY, CARE, DINO, GLCA, NABR, ZION), the Wahweap Formation (BRCA), and the Mancos Group (ARCH, CARE, DINO) has been recently updated (Martz et al., 2017; Beveridge et al., 2022; Kirkland et al., 2025). These recent names have been applied to biostratigraphic diagrams where feasible. Appropriate citations are listed within each diagram and its accompanying text. Colors for the geologic time scale were adopted from the Geologic Time Scale v. 6.0 (Walker et al., 2022).

Fossil organisms recovered in NPS units are shown in their general stratigraphic context based on available data. Taxa that have been identified to the genus and/or species level are explicitly shown with those diagnoses; other identifications (e.g., Phytosauria indet.) are represented with a generalized individual of that taxon. Species that were described using type specimens originating from NPS lands are starred.

Body fossils are mostly represented by organisms drawn in the left-lateral view. Trace fossils (for which no representative body fossils have been documented) are displayed with a speculative reconstruction of a "possible track maker." The track maker is always walking toward the upper right-hand corner of each diagram. For example, the *Eubrontes* ichnogenus is common throughout NPS units containing the Kayenta and Navajo Sandstone formations. These footprints are represented with a walking *Dilophosaurus* as their "possible track maker." These reconstructions are included to help audiences visualize and understand the scope of biodiversity that trace fossils provide. Except in the case of ARCH, all taxa/ichnotaxa shown in these diagrams have been confirmed through available literature and archives to have been observed and/or collected at their respective parks. A comprehensive taxonomic list with citations, organized by park and geologic unit, is provided in the appendix of this document.

All biostratigraphic diagrams and paleogeographic maps throughout this paper were generated in Adobe Illustrator 2023. We provide a generalized geologic history of the Utah NPS units below to broadly synthesize the geologic time and environments preserved across these parks and monuments. Individual park units are presented in alphabetical order.

GENERALIZED GEOLOGIC HISTORY

This section elaborates upon the geologic time scale shown in Figure 2. Whereas there is great variation in the geologic and taxonomic nomenclature for formations and fossils across the State of Utah, NPS units share depositional environments, ecosystems, and fossils sufficiently to discuss geologic time on a grand scale. Here, we provide a review to help readers understand general patterns in geology and paleontology across all of Utah's national parks and monuments.

Figure 5 shows a generalized stratigraphic column for Utah's NPS areas, arranged from west to east. This figure provides a visual summary of all geology across the state's NPS units (excluding igneous and metamorphic rocks) and is modeled after the "Dinosaurs of Utah" diagram from the UGS (Figure 4). However, Figure 5 is more comprehensive in its temporal range as it also includes Paleozoic and Cenozoic strata. Formations (distinctive and mappable geologic units) are scaled loosely in this figure against geologic time, not actual thickness. Subdivided members of formations are excluded except in the case of the Late Triassic Chinle Formation and the Early Cretaceous Cedar Mountain Formation because both formations represent comparatively large stretches of geologic time (about 25 million years for the Chinle Formation, about 40 million years for the Cedar Mountain Formation).

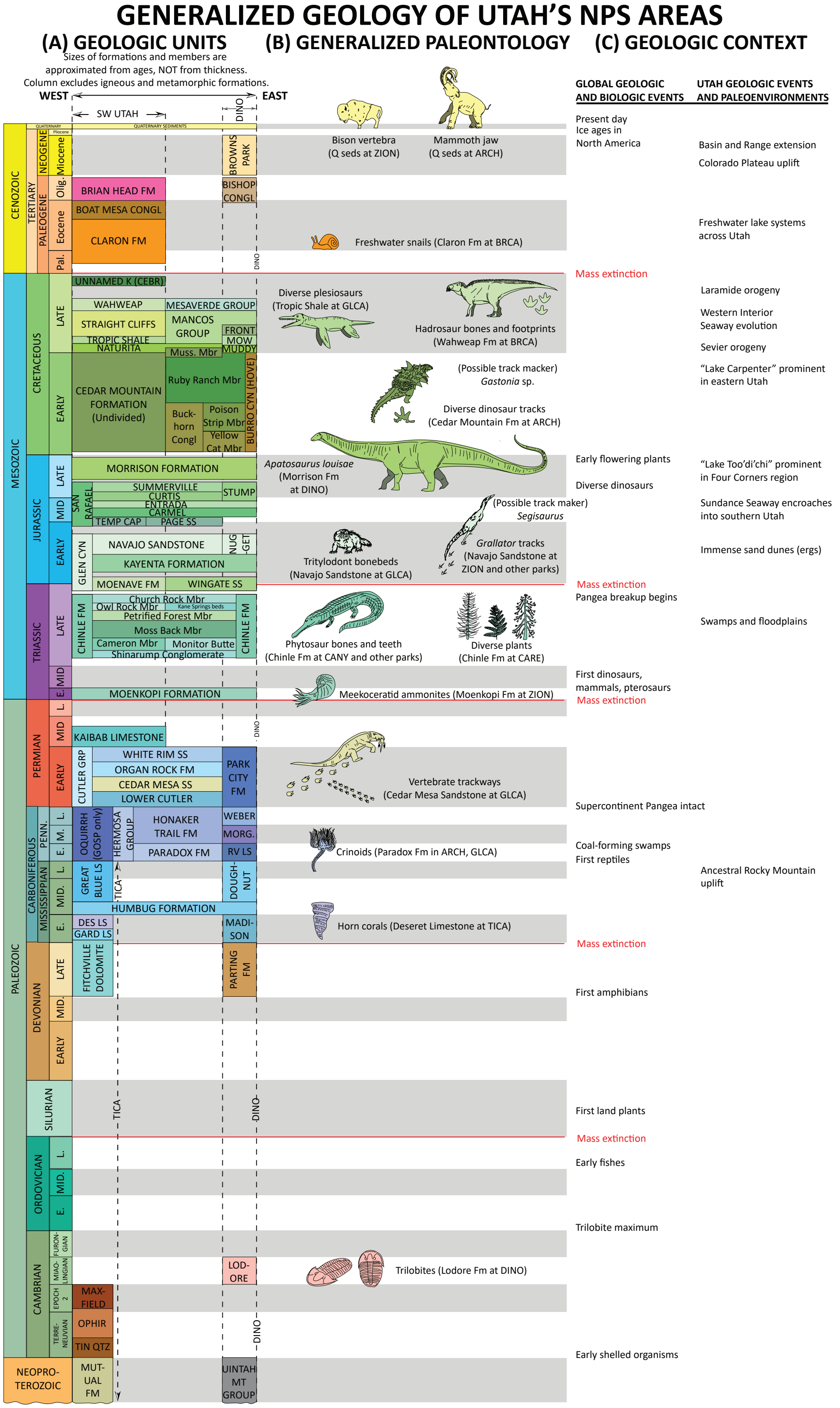

Figure 5. Generalized geology in Utah's NPS areas. (A) Geologic formations mapped against geologic time, (B) generalized paleontology, and (C) major global and regional geologic and biologic events. Ages for members of the Chinle and Cedar Mountain Formations were approximated from Martz et al. (2017), Joeckel et al. (2020), and Suarez et al. (2023).

The Neoproterozoic Era

The oldest strata recorded in any NPS area within Utah are of Neoproterozoic age. Such strata are only found in the Uinta Mountain Group at DINO (Evanoff, 1988) and the more recent Mutual Formation at TICA (Constenius et al., 2011). Neither have yet yielded fossils in the NPS areas, although the Uinta Mountain Group has yielded microfossils elsewhere in Utah (Nagy and Porter, 2005).

The Paleozoic Era

DINO and TICA are also the only NPS units in Utah to contain Cambrian-aged rocks. These are the Lodore Formation at DINO, and from oldest to youngest, the Tintic Quartzite, Ophir Formation, and Maxfield Limestone at TICA. Strata from the Cambrian Period record times during which most of western Utah was submerged in shallow seas (Blakey and Middleton, 2012; Figure 6A). The advance and retreat of oceanic boundaries and seaways surrounding and even submerging Utah is a constant theme across Paleozoic and Mesozoic Eras in Utah.

Ordovician and Silurian formations are not exposed (or absent) in NPS units in Utah; however, outcrops preserving these systems are prevalent along the western margin of the state, especially the Ordovician (Harris and Sheehan, 1997; Clark et al., 2023a). Notably, DINO records igneous dikes of Cambrian–Early Ordovician age (NPS Geologic Resources Division, 2006). The only park units to record Devonian time are DINO and TICA. At DINO, the Devonian is preserved within the newly reported Parting Formation between the underlying Lodore Formation (Cambrian) and overlying Madison Limestone (Mississippian) (Myrow et al., 2023a, 2023b; Figure 6B). The Fitchville Formation or Dolomite is the only Devonian unit at TICA; this unit spans the Late Devonian–Early Mississippian (Sandberg and Gutschick, 1979).

Several formations across Utah's NPS areas record the Carboniferous (Mississippian and Pennsylvanian) Period (Figure 7), as shallow seas persisted across what is now Utah, and this paleoenvironment is preserved as limestone in a few parks and monuments in the state. As with Cambrian and Devonian strata, sequences of Mississippian limestone are found at TICA (Mayo et al., 2024) and DINO (Evanoff, 1988).

The Paradox Basin in southeastern Utah (ARCH, CANY, CARE, GLCA, NABR) contains strata representing Pennsylvanian and Permian times. This is a key interval in the evolution of Utah paleoenvironments, as the complete formation of the supercontinent Pangea by the Early Permian (and subsequent dispersal from the Triassic into the Cretaceous) influenced regional basin deposition, tectonics, and climate (Figure 8).

The oldest of these strata fall within the Pennsylvanian Hermosa Group, which typically consists of the Paradox Formation and the overlying Honaker Trail Formation. Notably, the evaporite salts that were originally deposited in the marine Paradox Formation in the ARCH area were squeezed into the underlying domes and diapirs that directly influenced the erosion and formation of the iconic geology of that park. Within NPS areas, these units have been known to produce diverse invertebrates (Doelling, 2024).

The Early Permian Cutler Group overlies the Hermosa Group in the Paradox Basin. The oldest units in this group pertains to the Elephant Canyon-Halgaito Formations. The Elephant Canyon Formation is a carbonate laterally equivalent to the more clastic Halgaito Formation. The remaining units in the Cutler Group include, from oldest to youngest, the Cedar Mesa Sandstone, the Organ Rock Formation, and the White Rim Sandstone. These represent a sequence of nearshore marine, coastal sand dunes, and floodplains, influenced by the presence of a mountain range to the northeast (the Uncompahgre Highlands or Ancestral Rocky Mountains) and an ocean immediately to the west (Panthalassa), as eastern Utah sat along the west coast of Pangea (Condon, 1997; Huntoon et al., 2002; DiMichele et al., 2014; Figure 8). As the central and western parts of the state were completely submerged in open ocean, Early to Middle Permian outcrops in these areas often pertain to the marine Kaibab Limestone (CARE, ZION) (Huntoon et al., 2002). In northeastern Utah, the Permian Period is represented by the upper part of the eolian Weber Sandstone and the shallow marine Park City Formation at DINO (Gregson et al., 2024).

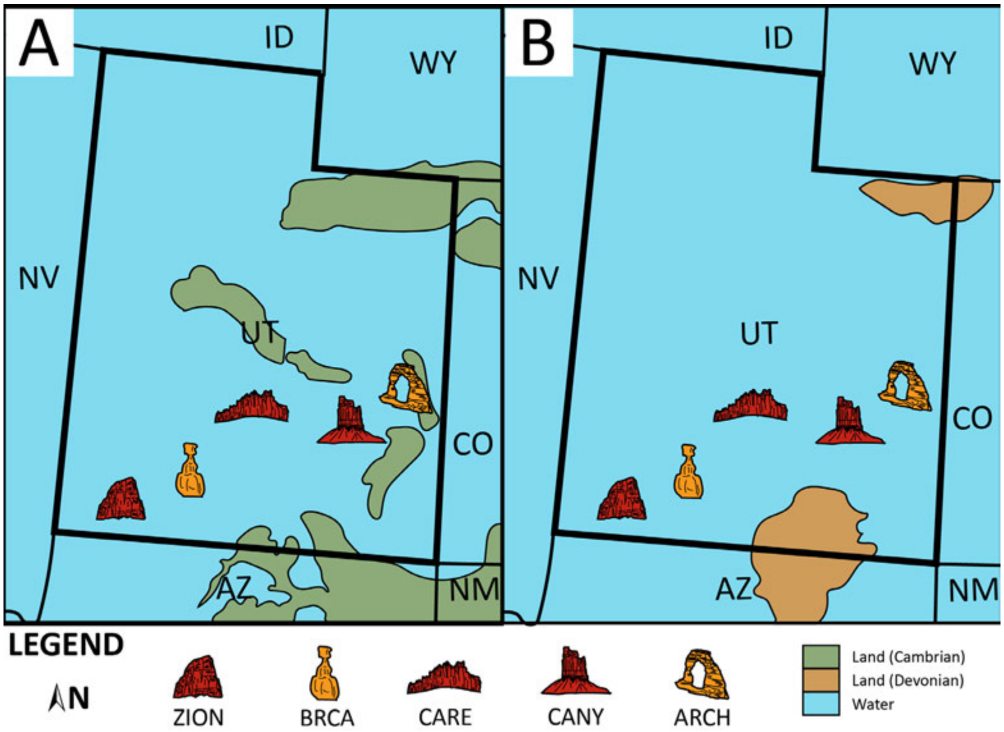

Figure 6. Utah's "Mighty Five" national parks mapped against a generalized reconstruction of the (A) Cambrian and (B) Devonian Periods. Modified from Blakey and Middleton (2012). Colors from Walker et al. (2022). See page 221 for NPS unit abbreviations.

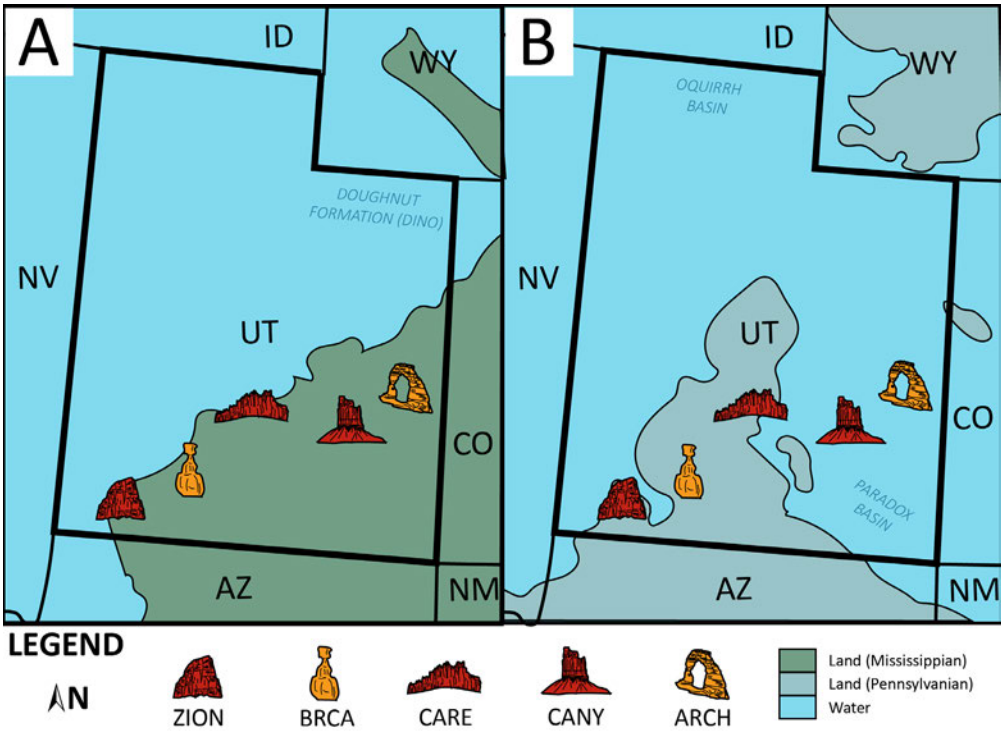

Figure 7. Utah's "Mighty Five" national parks mapped against a generalized reconstruction of the (A) Mississippian and (B) Pennsylvanian Periods. Modified from Lawton et al. (2021). Colors from Walker et al. (2022).

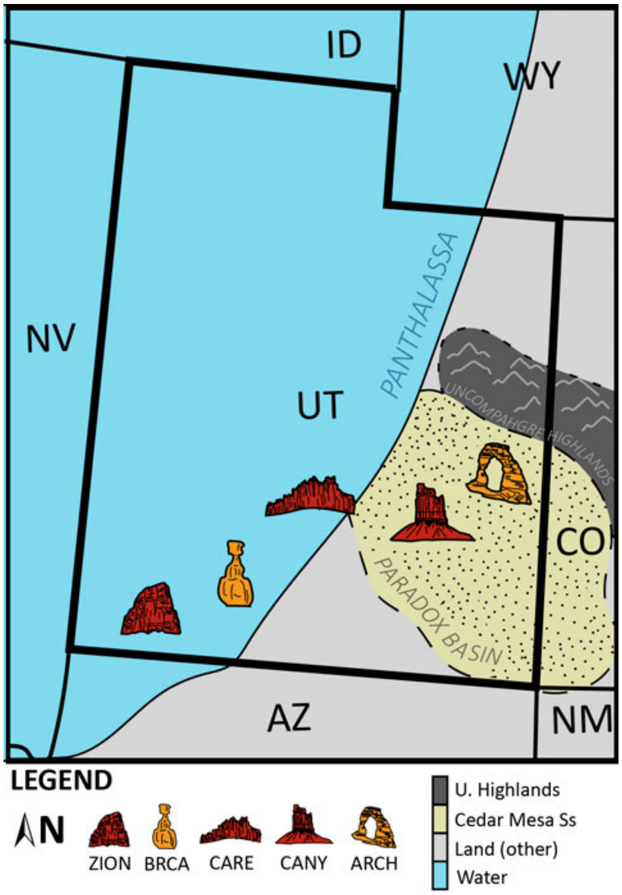

Figure 8. Utah's "Mighty Five" national parks mapped against a generalized reconstruction of the Permian Cutler Group (Paradox Basin). Modified from Condon (1997) and Huntoon et al. (2002). See page 221 for NPS unit abbreviations.

Many of the best and most recently discovered vertebrate body fossils and traces from the Cutler Group have been recovered from the BLM-administered Bears Ears National Monument, close to a few NPS units with similar outcrops (ARCH, CANY, GLCA, NABR) (Huttenlocker et al., 2018; Gay et al., 2020). The paleontology of the Cutler Group provides important insights into faunas and ecosystems leading up to the Permian–Triassic mass extinction (about 252 Ma), which wiped out an estimated 95% of life on Earth at the time. Recent and ongoing fieldwork by the UGS at CANY and GLCA has underscored the paleontological potential for the Cutler Group in Utah's NPS areas (DeBlieux et al., 2023; see the CANY section of this document).

The Mesozoic Era

The Triassic Period (c. 252 to 201 Ma)

Seven out of 13 national park units in Utah preserve some part of the Triassic Period. This period is recorded by the Early–early Middle Triassic Moenkopi Formation and the Late Triassic Chinle Formation. Both formations are usually divisible into multiple members that tend to be limited to small areas (e.g., Stewart et al., 1972a, 1972b). Therefore, the member-level stratigraphy varies widely across Utah and neighboring states. Despite this complexity, the NPS exposures are important outcrops for study because they record the recovery and rapid diversification of vertebrates (including the first dinosaurs and mammals) and other organisms after the Permian–Triassic mass extinction.

The Moenkopi Formation and its members are interpreted mostly as coastal plains as the paleoshoreline remained relatively close to its position during the Permian (Blakey and Ranney, 2008; Riggs et al., 2020; Figure 9A). Occasional fluctuations of sea level resulted in carbonate and/or evaporite beds interspersed with more terrestrial fluvial sediments. Its paleontology is consistent with this interpretation, as various members preserve assemblages of marine invertebrates (meekoceratid ammonites, crinoids, and bivalves in the Timpoweap/Sinbad/Virgin Limestone Members) and swim tracks of vertebrates at CARE (the Torrey Member) (Peabody, 1956; Mickelson et al., 2006a). Lockley et al. (1998) also reported multiple ichnotaxa within the Moenkopi Formation of GLCA. Ongoing fieldwork by the UGS has revealed that the Torrey Member at CANY is of particularly high importance because of the abundance of vertebrate and invertebrate traces documented in that unit there (DeBlieux et al., 2023).

The Chinle Formation, which lies unconformably above the Moenkopi Formation, records several paleoenvironments. These range from braided and meandering rivers to swamps and floodplains. The deposition of the sediments comprising the Chinle was dominated by southeast–northwest-trending river systems in Western North America (Riggs et al., 1996, 2020; Figure 9B). Historically, this formation has been much better studied in Arizona and New Mexico than in Utah, and the

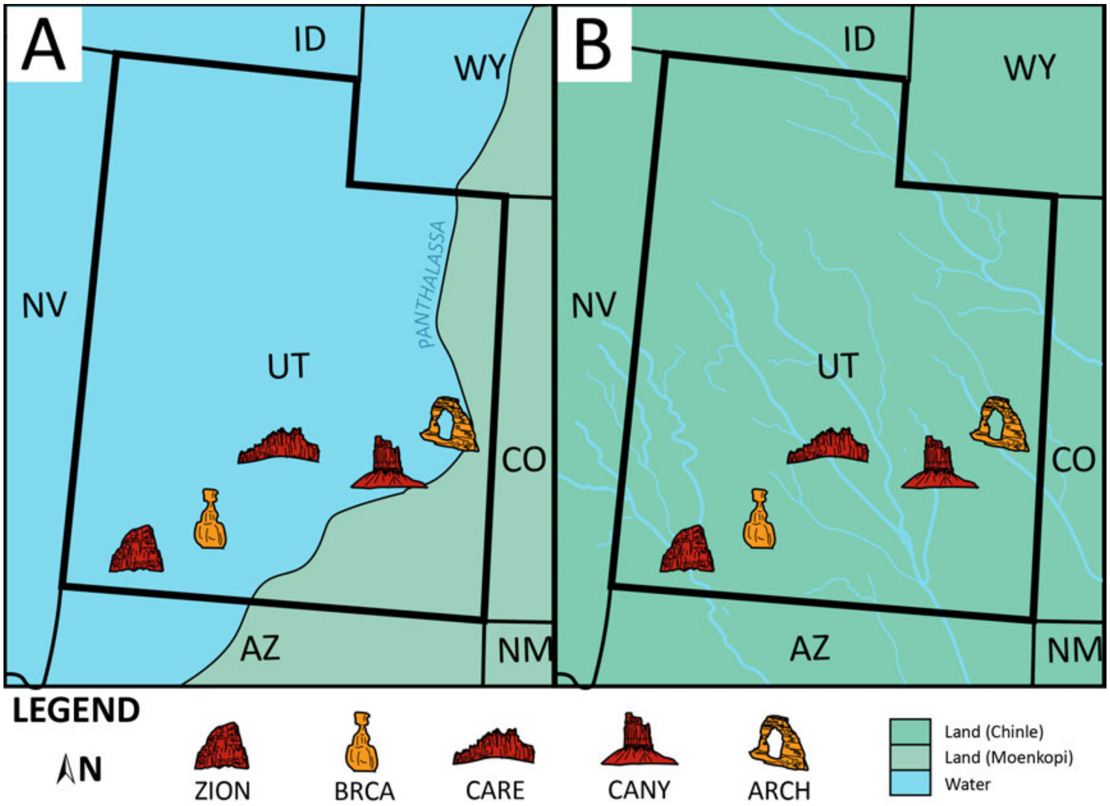

Figure 9. Utah's "Mighty Five" national parks mapped against the (A) the Early Triassic Moenkopi Formation and (B) the Late Triassic Chinle Formation. Modified from Riggs et al. (2020); Figures 7A and 7C from Riggs et al. (1996). See page 221 for NPS unit abbreviations.

nomenclature of its members varies across (and within) all three study areas. In southern Utah, the Chinle contains the following members, from oldest to youngest: the Shinarump Member/mottled strata, the Monitor Butte Member (= Cameron Member at ZION), Moss Back Member, Petrified Forest Member, Owl Rock Member (= Kane Springs beds at ARCH and CANY), and the Church Rock Member at the top (Martz et al., 2017). These members vary greatly in thickness and extent of exposure across southern Utah's NPS areas, though the sequence at CARE is considered the most complete among them (Martz et al., 2017). The Chinle is also exposed at DINO in the northeast corner of the state. The Chinle Formation is overlain by the Moenave Formation in the west (ZION) and the Wingate Sandstone in the central and east parts of the state (ARCH, CANY, CARE, DINO, GLCA, NABR, and ZION).

The fluvial, floodplain, and swamp environments preserved in the Chinle Formation are reflected in the diverse fossil animal and plant assemblages, which have been consistently found in national parks and monuments where the formation is observed. Among the most famous areas containing the Chinle are Petrified Forest National Park in Arizona and Ghost Ranch in New Mexico. Both areas are renowned for yielding benchmark specimens of diverse fossils for the Late Triassic record in North America. By comparison, Chinle exposures in Utah have not been as well-sampled as in Arizona and New Mexico with preliminary fieldwork undertaken in ARCH, CARE, GLCA, and ZION (Lockley et al., 1998, 2014; DeBlieux et al., 2005, 2006; Swanson et al., 2005; Santucci and Kirkland, 2010; Madsen et al., 2012; Kirkland et al., 2014a; Martz et al., 2015, 2017; DeBlieux et al., 2021, 2023; Milner et al., 2024). Therefore, the Chinle in Utah's NPS and other public lands provide a frontier for understanding how life recovered after the Permian–Triassic extinction event, especially with regard to the evolution and diversification of the earliest dinosaurs and mammals.

The Jurassic Period (c. 201 to 145 Ma)

The Jurassic Period is recorded in several NPS units across Utah; furthermore, some of the best Late Triassic–Early Jurassic continental strata are well preserved in these areas. Many of the sandstone units that were originally deposited during the Jurassic have since weathered into the iconic red rocks, arches, and canyons for which most of Utah's national parks and monuments are famous today.

The Late Triassic–Early Jurassic transition is recorded in a series of sandstone formations belonging to the Glen Canyon Group across most of Utah. The oldest of these formations are the Moenave Formation (ZION) and the approximately age-equivalent Wingate Sandstone (southeastern Utah parks and GLCA). These formations preserve the boundary between the Triassic and Jurassic Periods, which is exemplified by the transition of vertebrate tracks within each formation. Throughout central and eastern Utah, the lower Wingate Sandstone preserves typical Late Triassic tracks, whereas the middle to upper parts of the formation preserve typical Early Jurassic tracks (Milner et al., 2024). In southwestern Utah, the Triassic–Jurassic boundary has been identified within the Dinosaur Canyon Member of the Moenave Formation (Suarez et al., 2017, 2023).

In St. George, southwest of ZION, the Moenave Formation is famous for producing the spectacular St. George Dinosaur Discovery Site at Johnson Farm (SGDS), which is replete with dinosaur tracks and other vertebrate traces, invertebrate traces, and the body fossils of plants, invertebrates, fishes, and dinosaurs that lived in and around the so-called Lake Whitmore (Milner and Kirkland, 2006; Kirkland et al., 2014b). By contrast, the Wingate Sandstone represents an extensive sand sea (erg). The emergence and disappearance of vast sand dune fields is a common theme throughout the Jurassic sequence in Utah, and the Wingate is the oldest.

The Moenave Formation and Wingate Sandstone are overlain by the Early Jurassic Kayenta Formation, deposited by rivers and floodplains. Dinosaur and other vertebrate trace fossils become even more common in the Kayenta, especially those of functionally tridactyl theropod dinosaurs. The Kayenta Formation has also yielded body fossils of various vertebrates, but these are mostly found in fine-grained rocks in northern Arizona; in Utah the Kayenta Formation is coarser-grained, and Kayenta fossils in Utah parks and monuments are comprised almost entirely of footprints with some rare exceptions.

The upper part of the Glen Canyon Group is another erg interval known as the Navajo Sandstone, as seen at GLCA and all of the "Mighty Five" except for BRCA (Figure 10A). In the north, for example at DINO, there is the partially equivalent Nugget Sandstone. The Navajo–Nugget erg system is the largest known from North America, but despite this seemingly inhospitable environment, vertebrate trace fossils and even stromatolites are well-documented in the national parks of Utah (see Bennett et al., 2023; Milner et al., 2023b, 2024). Significant fossils are known from oasis settings (Lockley et al., 1998, 2004; Santucci and Kirkland, 2010; Milner et al., 2023a, 2023b, 2024) and interdunes (Loope et al., 2004; Bennett et al., 2023; Milner et al., 2024), where moisture was sheltered.

The sedimentary sequence overlying the Navajo Sandstone (= Nugget Sandstone at DINO) is classified as the Middle Jurassic San Rafael Group, named for the San Rafael Swell geologic feature in central Utah (Gilluly and Reeside, 1928). These formations are tied to the transgression and regression of the Sundance seaway, which during the Middle Jurassic Epoch covered much of central Canada and reached as far south as Wyoming and south-central Utah (Hintze and Kowallis, 2021; Figure 10B). The expansions and retractions of the Sundance seaway in this region produced the sequence of alternating terrestrial sandstone and marine limestone that comprises the San Rafael Group (Peterson, 1994; Wilcox and Currie, 2008). These include the Temple Cap Formation, the Carmel Formation and its alternating terrestrial and intertidal members, the eolian Entrada Formation, and the marine Curtis Formation (Gilluly and Reeside, 1928). The Curtis Formation is named for the Curtis sea, which refers to the south-

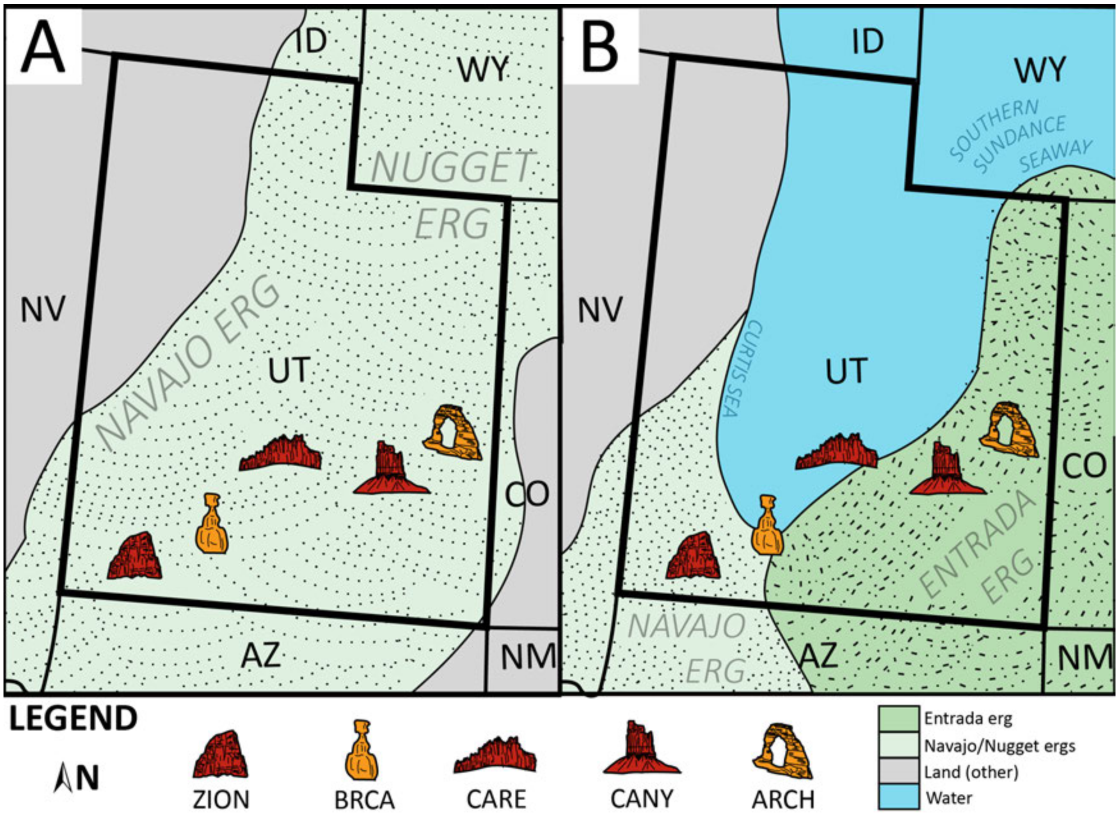

Figure 10. Utah's "Mighty Five" national parks mapped against (A) the Early Jurassic Navajo and Nugget ergs and (B) part of the Middle–Late Jurassic San Rafael Group. Paleogeography for (A) modified from Bryant and Miall (2010) and Bryant et al. (2016); (B) modified from Ejembi et al. (2021). See page 221 for NPS unit abbreviations.

ernmost extent of the Sundance seaway in the Middle Jurassic in south-central Utah. More northerly deposits (e.g., DINO) of the Sundance seaway near the end of the Middle Jurassic are known as the Stump Formation. The northward retreat of the seaway following the deposition of the Curtis and Stump Formations led to the deposition of the Summerville Formation, the uppermost unit in the San Rafael Group (Peterson, 1994; Wilcox and Currie, 2008).

The youngest Jurassic formation documented in Utah is the Morrison Formation. Following the retreat of the Sundance seaway, Utah became increasingly humid, hosting a suite of fluvial floodplain, swamp, and lacustrine environments. A major lake in the Morrison depositional system was the alkaline-saline "Lake T'oo'dichi'" in the Four Corners region (Turner and Fishman, 1991; Figure 11A). The Brushy Basin Member of the Morrison Formation is particularly famous for producing a high diversity of dinosaurs and other fossils from the latest Jurassic of Utah and other western states. DINO is especially renowned for the abundance and preservation quality of fossils at a single locality in this formation.

The Cretaceous Period (c. 145 to 66 Ma)

The Cretaceous Period is separated into two epochs: the Early Cretaceous (about 145 to 100.5 Ma) and the Late Cretaceous (about 100.5 to 66 Ma). In Utah, the Early Cretaceous is recorded almost entirely by the Cedar Mountain Formation (Figure 11B). From oldest to youngest, its members include the Buckhorn Conglomerate, Yellow Cat, Poison Strip, Ruby Ranch, and Mussentuchit Members. These units preserve highly diverse dinosaur faunas that are of major global significance. This significance is due in part to the fact that the Cedar Mountain provides a primary dataset for paleontologists to understand life in the Early Cretaceous Epoch, a period of global climate change and major biotic in-

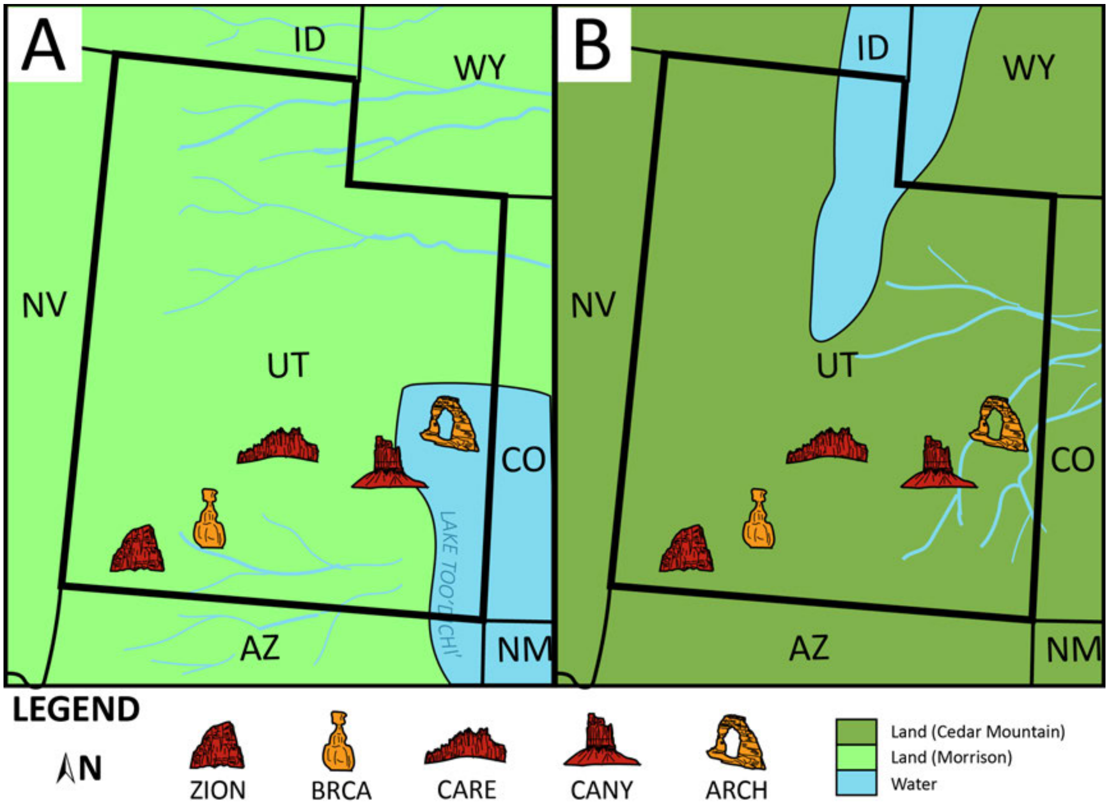

Figure 11. Utah's "Mighty Five" national parks mapped against the (A) Late Jurassic Morrison Formation and (B) Early Cretaceous Cedar Mountain Formation. Paleogeography for (A) modified from Turner and Peterson (2004, Figure 9); (B) modified from Elder and Kirkland (1993, Figure 5C). See page 221 for NPS unit abbreviations.

terchanges between what is now Asia, North America, and Europe (Kirkland et al., 1999, 2024). This formation is best exposed in east-central Utah (ARCH, CARE, DINO). Along the border with Colorado, strata roughly equivalent in age are known as the Burro Canyon Formation (HOVE) (Kirkland et al., 2020b). In the Uinta Mountains and Uinta Basin, the Muddy Formation unconformably overlies the Cedar Mountain Formation (Sprinkel et al., 2012; Sprinkel, 2024).

The Late Cretaceous of southern Utah is dominated by varying amounts of marine influence from the Western Interior seaway (Figure 12). The western margin of this epicontinental sea fluctuated during this time. As a result, environments across Utah ranged from open ocean to swamps to floodplain or river environments, depending on proximity to the shoreline. The oldest unit in the Late Cretaceous sequence in Utah is the coastal Naturita Formation (formerly the Dakota Formation or Group, changed after Carpenter [2014]). The deposition of this unit preceded the westward encroachment of the seaway (Figure 12A). The Naturita Formation has been identified across many of Utah's NPS units; however, outcrops at DINO previously referred to as the Dakota have been reassigned to the Early Cretaceous Muddy Formation based on radiometric dating (Sprinkel et al., 2012) and regional stratigraphic work (Sprinkel, 2024). Marine invertebrates, especially oysters, are common wherever these formations outcrop in NPS areas (Santucci and Kirkland, 2010).

The subsequent expansion of the seaway deposited what are known as the Tropic Shale in the southwest (BRCA, GLCA), and the Mancos Group in the east (ARCH, CARE, DINO; Figure 12B; Kirkland et al., 2025). The Mowry Shale represents the earliest part of this marine deposition at DINO and is partially equivalent to the Tropic Shale and Tununk Shale of the Man-

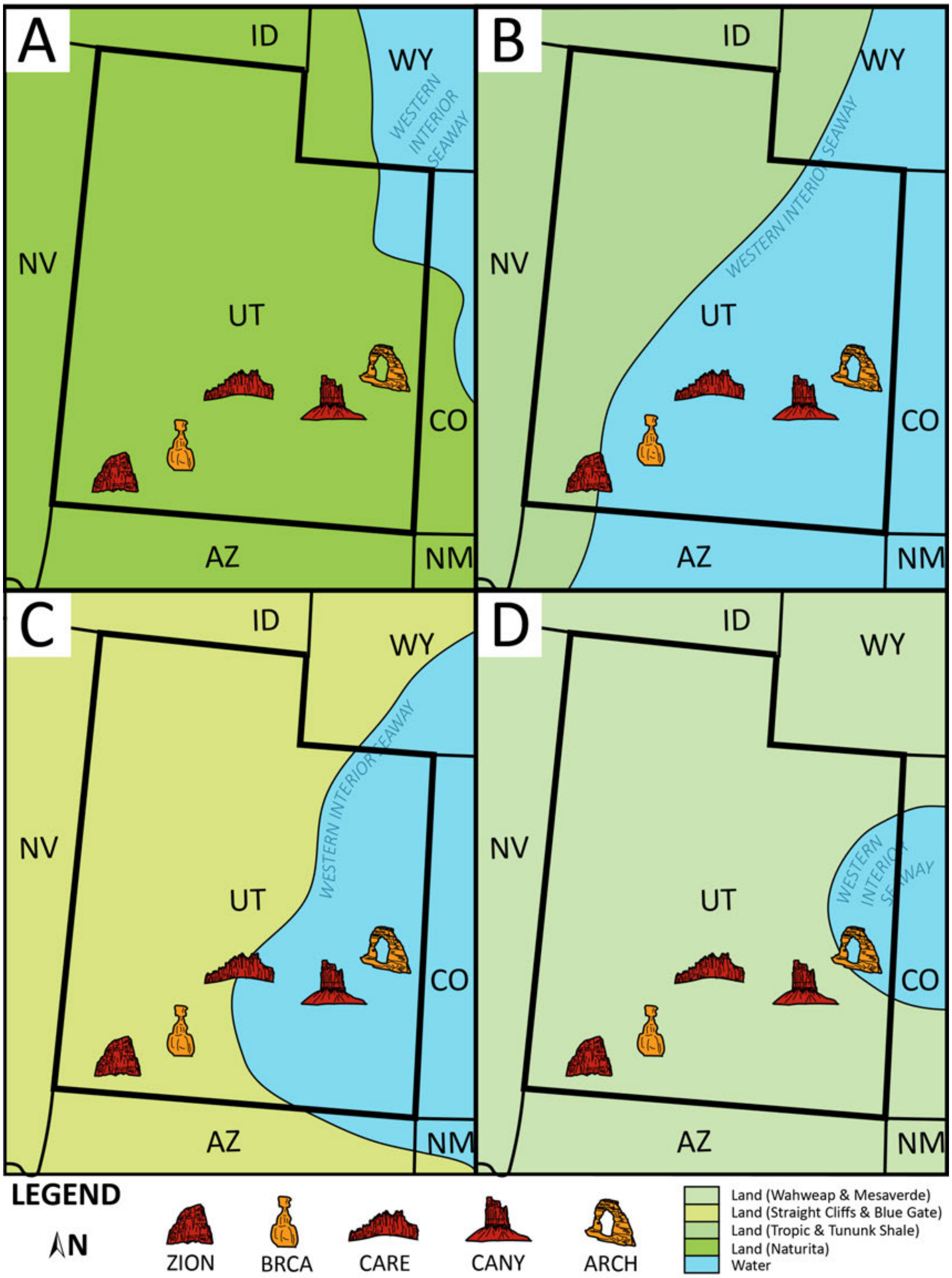

Figure 12. Utah's "Mighty Five" national parks mapped against the shoreline of the Late Cretaceous Western Interior seaway, during deposition of (A) the Cenomanian Naturita Formation; (B) the Turonian Tropic and Tununk Shales of the Mancos Group; (C) the Santonian Straight Cliffs Formation and the Ferron Formation and Blue Gate Shale of the Mancos Group; and (D) the Campanian Wahweap and Mesaverde Formations. Western Interior seaway shoreline for (A), (C), and (D) modified from Roberts and Kirschbaum (1995); (B) modified from Elder and Kirkland (1993). Formation colors adopted from Biek et al. (2015). See page 221 for NPS unit abbreviations.

cos Group to the southwest (Elder and Kirkland, 1993; Slattery et al., 2016; Kirkland et al., 2025; Figure 12B). Ammonites, bivalves, fishes, and sharks are common within these units. After about 94 Ma, the shoreline of the Western Interior seaway began to retreat eastward, exposing more land in which dinosaurs and other terrestrial organisms could flourish. Among Utah's NPS units, terrestrial Late Cretaceous environments are best recorded in the Straight Cliffs and Wahweap Formations (BRCA, CEBR; Figures 12C and 12D). Terrestrial strata of approximately equivalent age in central Utah fall within the Mesaverde Group (CARE). Eastern Utah remained submerged in the Western Interior seaway for most of the remaining Late Cretaceous Epoch. As a result, the Blue Gate Shale of the Mancos Group is the predominant youngest Cretaceous unit in that region (ARCH, DINO; Kirkland et al., 2025). However, some terrestrial Late Cretaceous units are found within this sequence, namely in the Ferron Formation and Juana Lopez Formation of the Mancos Group (ARCH, CARE; Kirkland et al., 2025) and the Frontier Formation (DINO). These strata are partially equivalent in age to the Straight Cliffs Formation at BRCA and CEBR (Seymour and Fielding, 2013). Multiple younger Late Cretaceous units are exposed throughout the state (e.g., Kaiparowits, Canaan Peak, Price River, Neslen, North Horn Formations; Hintze and Kowallis, 2021). However, these units are not recorded within the NPS areas of Utah, and their fossil biota are excluded from this document as a result.

The Cenozoic Era

The Paleogene and Neogene Periods (c. 66 to 2.6 Ma)

Although Paleogene and Neogene strata are not well-documented in most of Utah's NPS areas, these periods contain key, large-scale tectonic and volcanic events that directly pertain to Utah's modern landscape. These events include the mountain building of the Laramide orogeny (about 80 to 50 Ma, i.e., the formation of the Rocky Mountains, Tindall et al., 2010), Miocene volcanism (e.g., the Marysvale volcanic field north of BRCA, Davis and Pollock, 2024), and Basin and Range extension (about 15 to 5 Ma, Davis and Pollock, 2024). Laramide tectonism contributed to the uplift of the Colorado Plateau throughout the first part of the Cenozoic Era, exposing the Paleozoic and Mesozoic strata for which many of the NPS areas in Utah are world-renowned.

Despite an eventful tectonic history, relatively few sedimentary rocks are recorded from Paleogene or Neogene within the NPS units of Utah. Major exceptions are the stunning rocks of the Claron Formation, which comprises the iconic hoodoos and rock fins at BRCA and CEBR. These sediments were deposited in what is now known as Lake Claron from about 60 to 40 Ma (Figure 13). However, the depositional interpretation of this formation remains in flux. Although the upper white member is a limestone, indicative of lacustrine conditions, the lower more iconic pink member is a blend of conglomerate and calcareous sandstone, suggesting a more fluvial influence (Eaton et al., 2018). Notably, the pink member of the Claron Formation has produced diverse ichnofossils pertaining to insect burrows and pupae (Bown et al., 1995). The BRCA and CEBR region also preserves the Late Eocene Boat Mesa Conglomerate, the Oligocene Brian Head Formation, and basaltic lava flows from the Miocene Epoch (Tweet et al., 2012c, 2012f; Biek et al., 2015). Relatively complete fossil remains are exceedingly rare within these units at BRCA and CEBR, although significant discoveries have been made in the Claron and Brian Head Formations surrounding these parks. Dixie National Forest north of BRCA has produced informative charophytes, ostracods, and the only vertebrates yet recorded from the Claron Formation (Eaton et al., 2018; Sanjuan et al., 2020; Antonietto et al., 2022). The rarity of fossils and virtually total absence of macrovertebrates is in spite of the partial age equivalence between the Claron Formation and the Green River Formation in the Uinta Basin near DINO, which is known to produce impressively complete plants, molluscs, fishes, reptiles, birds, mammals, insects, other arthropods (spiders, scorpions), and stromatolites from lacustrine deposits (Figure 13). Tracks of birds and mammals have also been recorded in some parts of the Green River Formation, especially in central Utah.

DINO is the only other NPS unit in the state to contain Neogene formations, namely the Bishop Con-

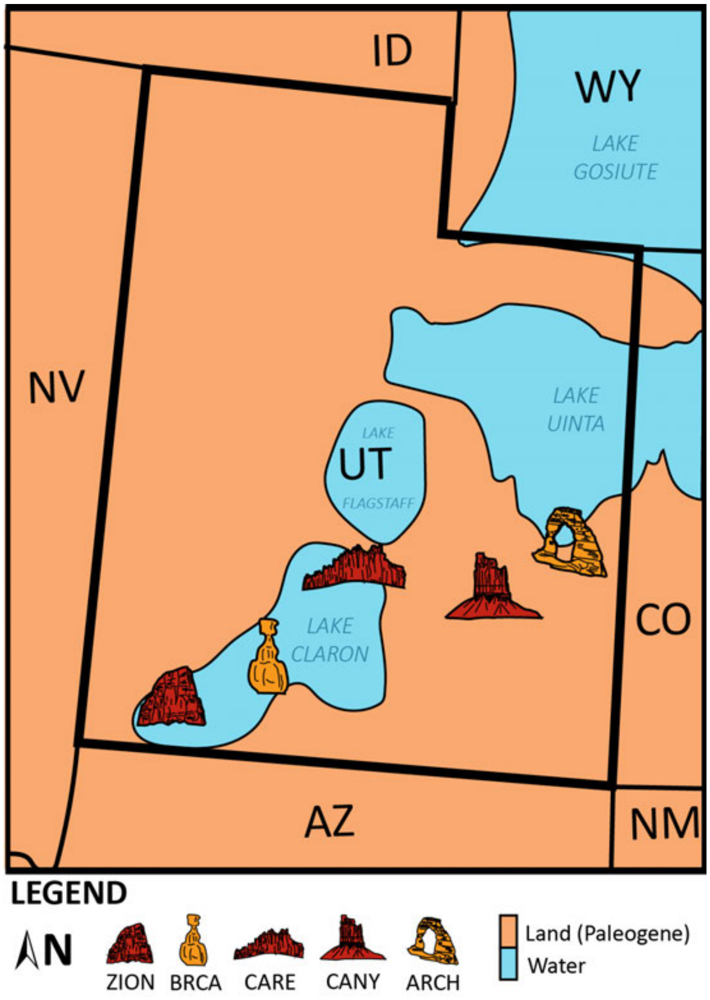

Figure 13. Utah's "Mighty Five" national parks mapped against the shallow lakes of the Paleogene Period. Paleogeography modified from Dickinson et al. (1988) and Davis et al. (2009). See page 221 for NPS unit abbreviations.

glomerate and the Browns Park Formation. No fossils have been reported from either the Bishop or Browns Park within DINO; however, vertebrate body fossils and trackways have been documented in these units elsewhere (Honey and Izett, 1988; Lockley and Milner, 2014).

The Quaternary Period (c. 2.6 Ma to Present)

Quaternary-aged sediments deposited during and after the last ice ages in the Pleistocene Epoch are present across all NPS units. The sediments vary in characteristics as a result of differences in regional geology, underlying strata, and depositional processes. This period is recorded in packrat middens, which have been reported in almost every NPS unit in Utah. Desert packrats (*Neotoma* sp.) gathers twigs, conifer needles, and other loose plant detritus, and even animal bones when constructing their middens. The packrats also urinate on these structures throughout their construction and residence. The urine is often so depleted in water that it rapidly crystallizes, preserving the middens (Tweet et al., 2012a). As a result, middens record key insights into taxonomic diversity and climatic conditions at the time they were constructed, and Quaternary-focused paleontologists can sample them to understand past plant and animal diversity and obtain radiocarbon dates. Packrat middens from several NPS units in Utah have provided data in such studies (Agenbroad and Mead, 1989; Tweet et al., 2012a).

BIOSTRATIGRAPHIC DIAGRAMS

Arches National Park
(ARCH)

Similar to most of the other large NPS units in southern Utah, ARCH's stratigraphic record preserves a large span of geologic time stretching back into the latter Paleozoic Era (Pennsylvanian) (Figure 14). One of the most striking aspects of the fossil record at ARCH is the abundance and quality of dinosaur footprints in the Ruby Ranch Member of the Cedar Mountain Formation (Early Cretaceous). These represents theropods (including dromaeosaurs, and other small [cf. *Carmelopodus* sp.] and large [cf. *Irenesauripus* sp.] unidentified morphotypes), sauropods, ornithopods, ankylosaurs, and even some enigmatic feeding traces (Lockley et al., 2004; Swanson et al., 2005; Madsen et al., 2012; Martin et al., 2014). Footprint localities at ARCH are comparable in age and ichnotaxa to the nearby Mill Canyon Tracksite, which is managed by the BLM (see Lockley et al., 2014a). Other than DINO, ARCH may preserve the best record of life in the Cedar Mountain out of any NPS unit in Utah.

Just three sources provide the bulk of the knowledge of fossils at ARCH (Figure 15): (1) an initial paleontolog-

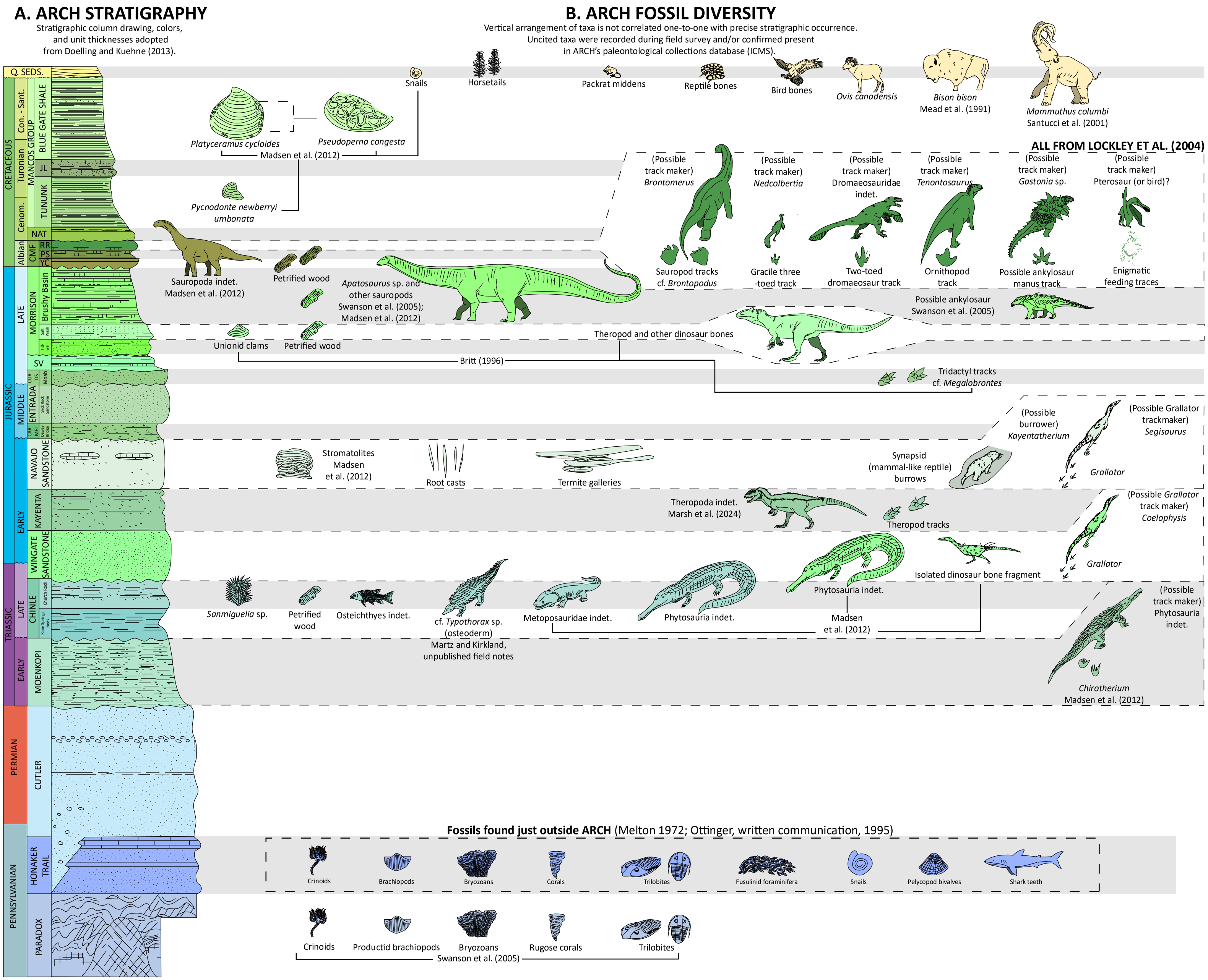

Figure 14. Biostratigraphic diagram for Arches National Park (ARCH). (A) Stratigraphy of ARCH, modified from Doelling and Kuehne (2013); (B) Fossil diversity of ARCH. Abbreviations: (geologic time) Cenom., Cenomanian; Con., Coniacian; Sant., Santonian; (stratigraphy) SV, Summerville Formation; CMF, Cedar Mountain Formation; YC, Yellow Cat Member; PS, Poison Strip Member; RR, Ruby Ranch Member; NAT, Naturita Formation; JL, Juana Lopez Formation (from Kirkland et al., 2025); Q. SEDS. Quaternary sediments.

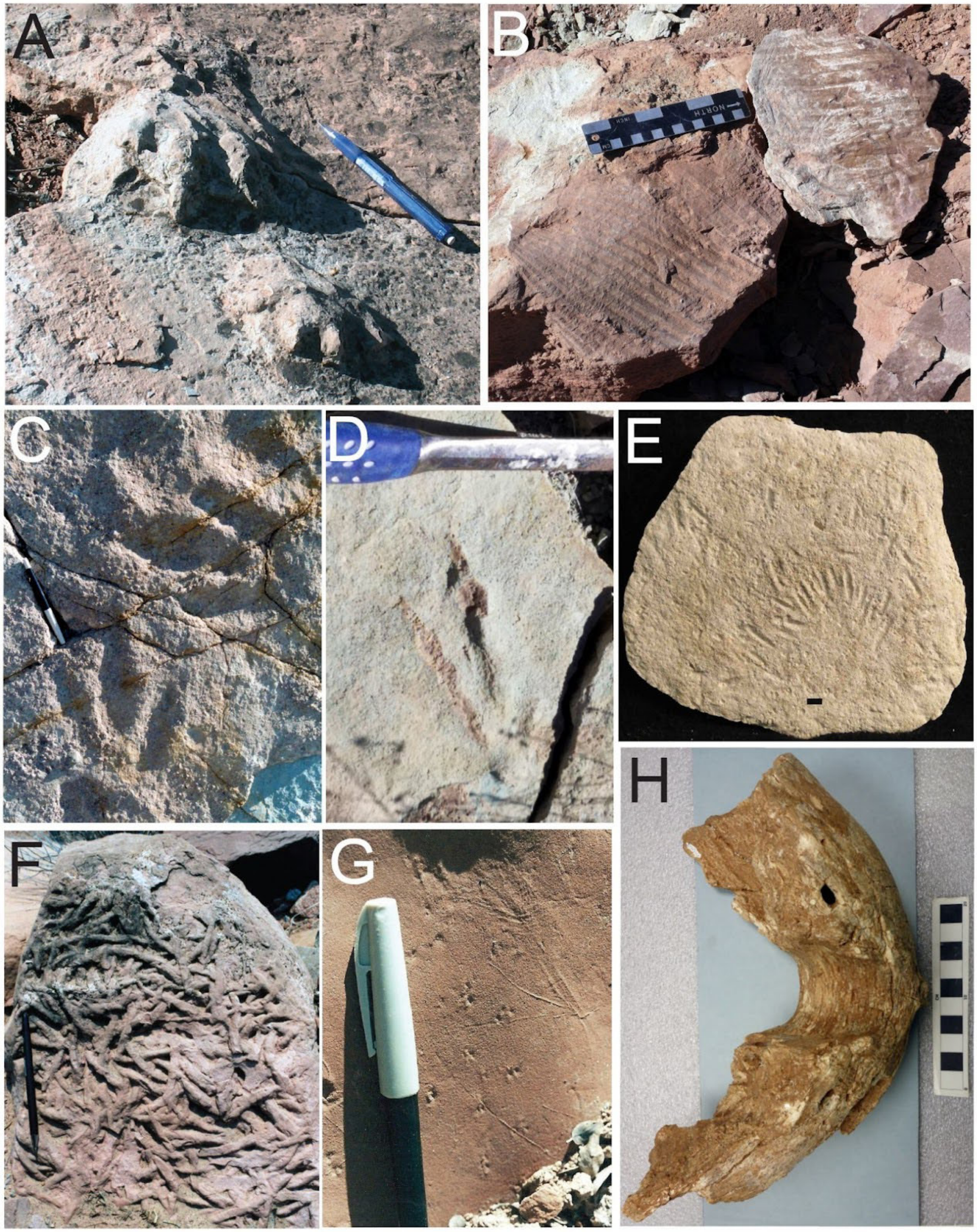

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Figure 15 is on the previous page. Fossils from ARCH. (A) *Chirotherium* natural cast manus/pes set from the Moenkopi Formation (locality ARCH66t). (B) Leaves of *Sanmiguelia* cf. *S. lewisii* from the Chinle Formation (locality ARCH41p). (C) Pair of theropod tracks from the Ruby Ranch Member, Cedar Mountain Formation (locality ARCH7t; pen for scale). (D) Dromaeosaurid track from locality ARCH7t. (E) Replica (UCM 199.78) of undescribed vertebrate feeding traces from ARCH7t. Scale = 1 cm. (F) Unidentified, branching invertebrate burrows from the Chinle Formation. Pen for scale. (G) Unidentified arthropod trackway from the Chinle Formation that was originally identified as *Octopodichnus* by Swanson et al. (2005, Figure 6H). (H) *Mammuthus columbi* from a cave deposit within ARCH. Scale = 10 cm. A through C modified from Madsen et al. (2012).

ical survey in 2000 by Brooke Swanson and colleagues (Swanson et al., 2005); (2) a detailed paleontological survey of the Mesozoic fossils at ARCH conducted by the UGS and NPS in 2011 (Madsen et al., 2012); and (3) a literature summary as part of the Northern Colorado Plateau Network in 2012 (Tweet et al., 2012b). These sources include some information on fieldwork conducted in ARCH by Brooks Britt (c.1996), George Engelmann (c. 1990), and Jim Kirkland (c. 2000). Aside from the significant trace fossils discovered in the Cedar Mountain Formation (Lockley et al., 2004), important finds at ARCH include vertebrate fossils in the Chinle Formation and Wingate Sandstone, as well as the first dinosaur fossils recorded in the Kayenta Formation within Utah (Madsen et al., 2012; Marsh et al., 2024). This fragmentary material has been diagnosed as indeterminate theropod remains (Marsh et al., 2024). Additional specimens and further study will be necessary to expand our knowledge of important dinosaur body fossils within this unit.

Fossils from the Pennsylvanian Paradox Formation were encountered during the 2005 Swanson survey, but were not recorded as an official locality, despite being the only known record of specimens from that formation at ARCH (Swanson et al., 2005). Similarly, several invertebrates and cladodont and brachydont sharks have been recorded in the Pennsylvanian Honaker Trail Formation immediately outside ARCH (Figure 14; Melton, 1972; L. Ottinger [deceased], written communication, 1995). Although no localities within this unit have yet been documented inside the park itself, exposures of the Honaker Trail at ARCH, along with the proximity of the localities of Melton (1972) and Ottinger (written communication, 1995) to said exposures, were sufficient cause to include these taxa in Figure 14.

Bryce Canyon National Park (BRCA)

In contrast to the rest of Utah's "Mighty Five" national parks, BRCA's fossil record is unique in being entirely younger than about 100 Ma. Instead, BRCA preserves a mostly uninterrupted record of marine and terrestrial environments during the Late Cretaceous Epoch (about 100.5 to 77 Ma), and the lake system environment of the Claron Formation (about 60 to 40 Ma), which forms the park's iconic hoodoo landscapes. Whereas some other Utah parks do preserve Late Cretaceous rocks, most do not record terrestrial ecosystems. CARE, CEBR, and GLCA are exceptions, but their terrestrial Cretaceous rocks have not been as well-documented as those at BRCA. Therefore, BRCA likely possesses the best Late Cretaceous terrestrial record of any NPS unit in Utah. The park's stratigraphy and fossil diversity are most comparable to the Late Cretaceous record in the neighboring Grand Staircase-Escalante National Monument (GSENM), which is famous for producing numerous new species of dinosaurs and other organisms (Figure 16).

The fossils found at BRCA were mostly inventoried by Jeffrey Eaton, Professor Emeritus of Geosciences at Weber State University, from 1988 until 2013. During that time, Eaton and many colleagues and students discovered diverse vertebrates (fishes, sharks, frogs, salamanders, lizards, turtles, neosuchians, mammals, and dinosaurs) in the Late Cretaceous Straight Cliffs and Wahweap Formations, including some holotypes (Figure 17, starred; Eaton, 2013; Kirkland et al., 2013; Nydam, 2013). Eaton also ventured into the Claron Formation to find invertebrate traces, gastropods, and plants within the final years of that inventory. Several of the specimens that Eaton collected have been described

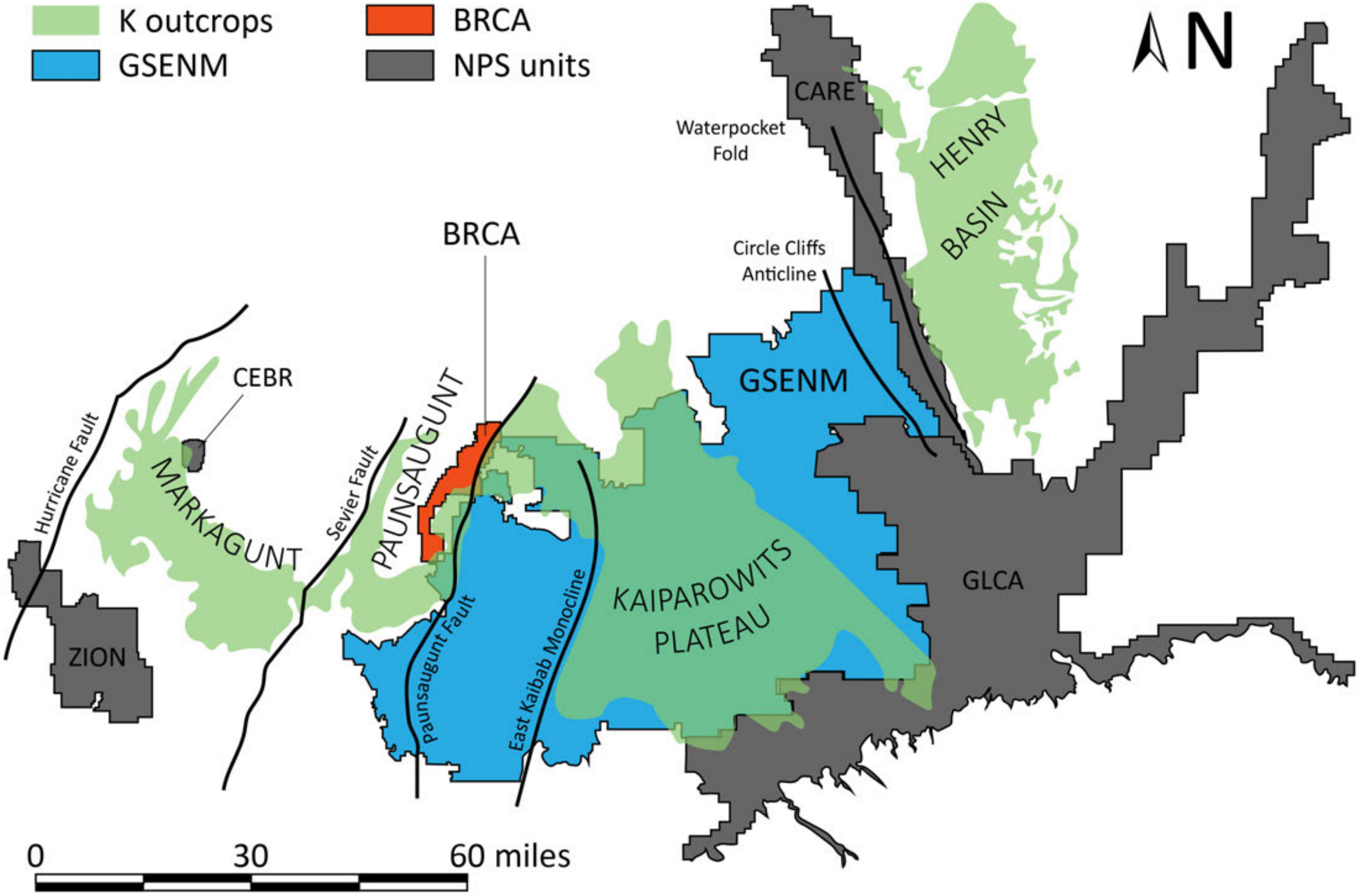


Figure 16. Generalized map of Cretaceous outcrops in southern Utah. Modified from Titus et al. (2016, Figure 2). See page 221 for NPS unit abbreviations.

in the scientific literature (Eaton, 2002, 2013; Brinkman et al., 2013; Gardner and Demar, 2013; Gardner et al., 2013; Gates et al., 2013; Irmis et al., 2013; Kirkland et al., 2013; Nydam, 2013; Roček et al., 2013). Fossils that BRCA staff found since 2022 have been consistent with what Eaton found but include many that were previously unknown, such as the first recorded instance of dinosaur footprints in the park's 100-year history (Figure 18). Data compiled in the 2022–2023 field season, along with legacy data collected by Eaton and other scientists, were used to complete a comprehensive Paleontological Resource Inventory for BRCA (Tran et al., 2024). Park staff continued fieldwork into 2024. New discoveries include the first localities documented in the Naturita Formation at BRCA, the first identifiable vertebrate fossil in the park's Tropic Shale (an isolated fragmentary protostegid coastal), and a possible tyrannosauroid in the Straight Cliffs Formation based on an isolated metatarsal fragment (Figure 19). Park staff have also collected newly documented fossils in the Claron Formation in the park, including gastropods, invertebrate ichnofossils, and leaf impressions (Figure 20). These new data will expand the park's knowledge to draft a Paleontological Resources Management Plan, which will help the park preserve its fossils and their scientific and educational value for generations to come.

The geology and fossil diversity at BRCA as displayed on Figure 17 highlights the research and educational potential of the park's fossils. For example, although Eaton and colleagues fleshed out the diversity

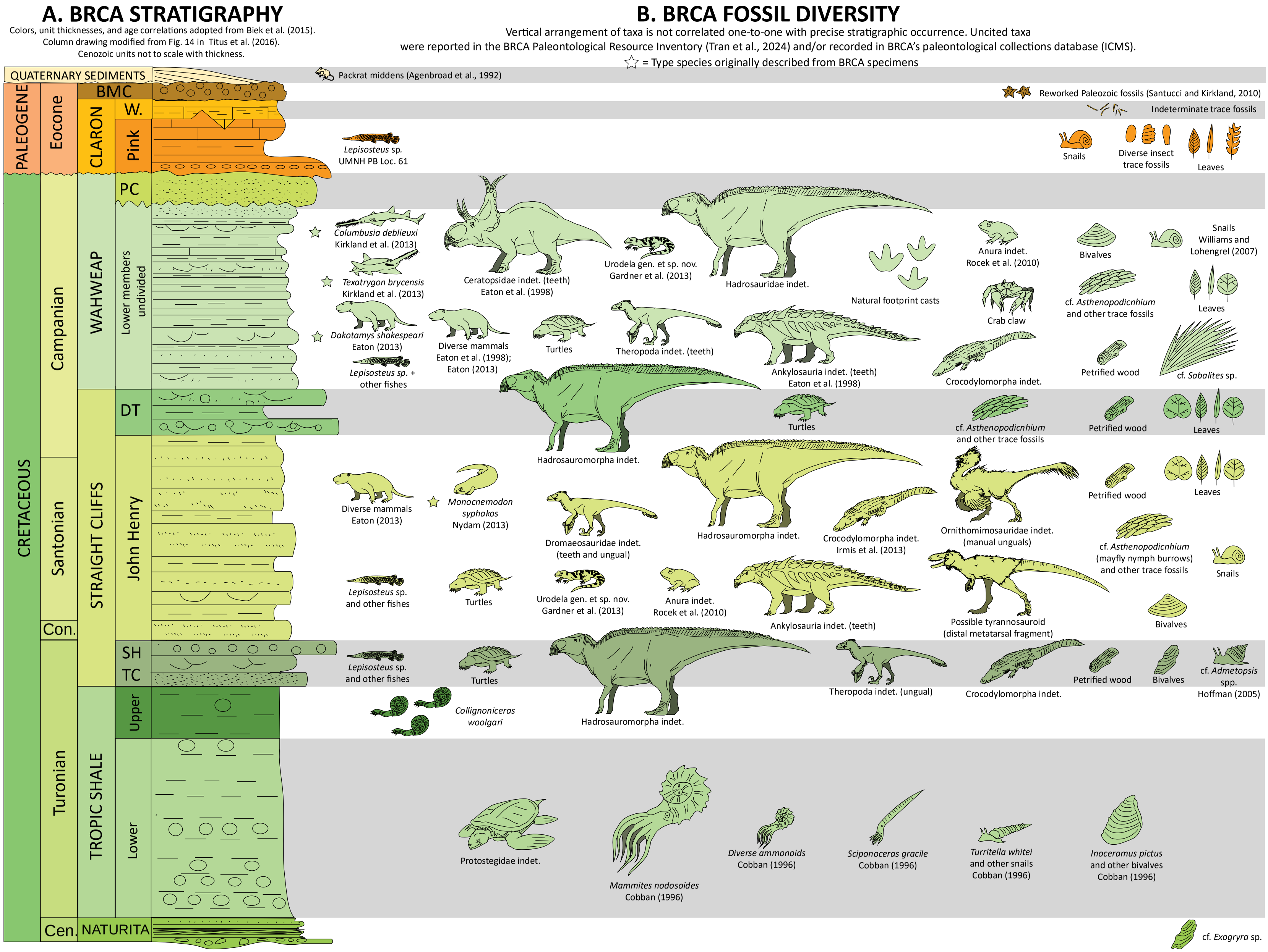


Figure 17. Biostratigraphic diagram for Bryce Canyon National Park (BRCA). (A) Stratigraphy of BRCA, adopted from Biek et al. (2015) and Titus et al. (2016) (B) Fossil diversity of BRCA. Abbreviations: (geologic time) Con., Coniacian; PAL., Paleogene; Pal., Paleocene; (stratigraphy) NAT., Naturita Formation; TC, Tibbet Canyon Member, Straight Cliffs Formation; SH, Smoky Hollow Member, Straight Cliffs Formation; DT, Drip Tank Member, Straight Cliffs Formation; PC, Partner Canyon Member, Wahweap Formation (Eaton, 1991; Beveridge et al., 2022); W, White member, Claron Formation; BMC, Boat Mesa Conglomerate.

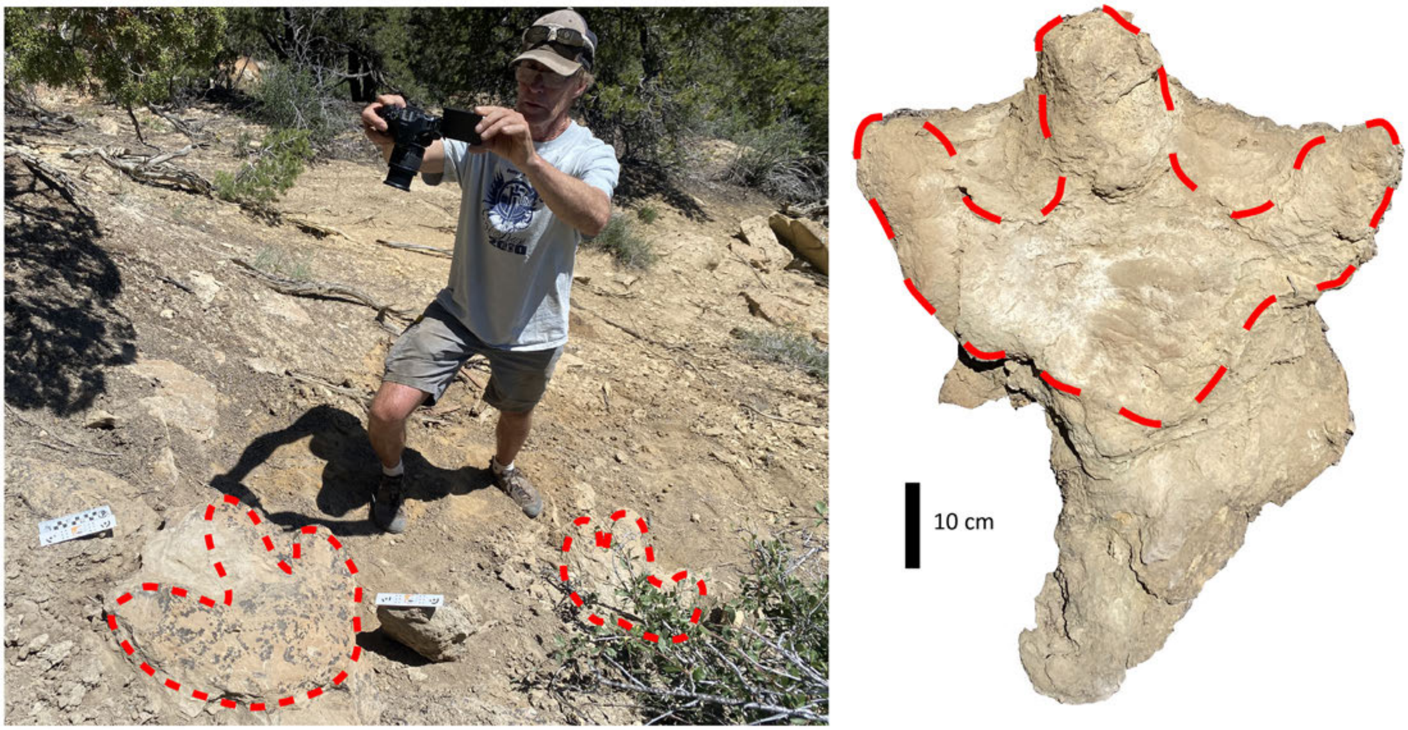


Figure 18. The first dinosaur footprints recorded at BRCA, occurring in the Wahweap Formation. Don DeBlieux photogrammetry scanning two cf. *Caririchnium* hadrosaur footprints (left); a close-up photograph of a third footprint (right). Scale bar = 10 cm. Figure modified from Tran (2023b) and Tran et al. (2024).

of microfossils in the Straight Cliffs Formation, paleontologists still have not yet formally described plant or dinosaur fossils from that unit. Although ceratopsomorph and tyrannosauroid teeth have recently been confirmed from the Straight Cliffs Formation outside of BRCA (McCuen and Zanno, 2023), diagnostic postcranial material pertaining to these taxa have yet to be formally described. Similarly, the Wahweap Formation in GSENM is well-known for producing multiple named dinosaur and other vertebrate taxa (Eaton et al., 1999; Kirkland and DeBlieux, 2010; Gates et al., 2011; Loewen et al., 2013; Gates et al., 2014; Lund et al., 2016). Several of the type localities for these taxa have been tightly chronostratigraphically constrained (Beveridge et al., 2022). Likewise, outcrops of the Claron Formation at Sweetwater Creek north of BRCA have recently produced ostracods (Antonietto et al., 2022), charophytes (Sanjuan and Eaton, 2016; Sanjuan et al., 2020), and the only vertebrate fossils yet documented in this unit (Eaton et al., 2018). Furthermore, the Sweetwater section has been measured and divided into distinct depositional units (Antonietto et al., 2022). Given this regional context, BRCA is likely the NPS area with the best potential to contribute to understanding of Utah's Late Cretaceous and Paleogene terrestrial ecosystems.

Canyonlands National Park (CANY)

CANY, like the other "Mighty Five" national parks, is not broadly known for its paleontological resources, despite possessing a mostly uninterrupted geologic record of Pennsylvanian–Middle Jurassic strata (Szymanksi et al., 2024). Although a number of paleontological studies have documented fossils in and around CANY throughout its history (McKnight, 1940; Hasi-

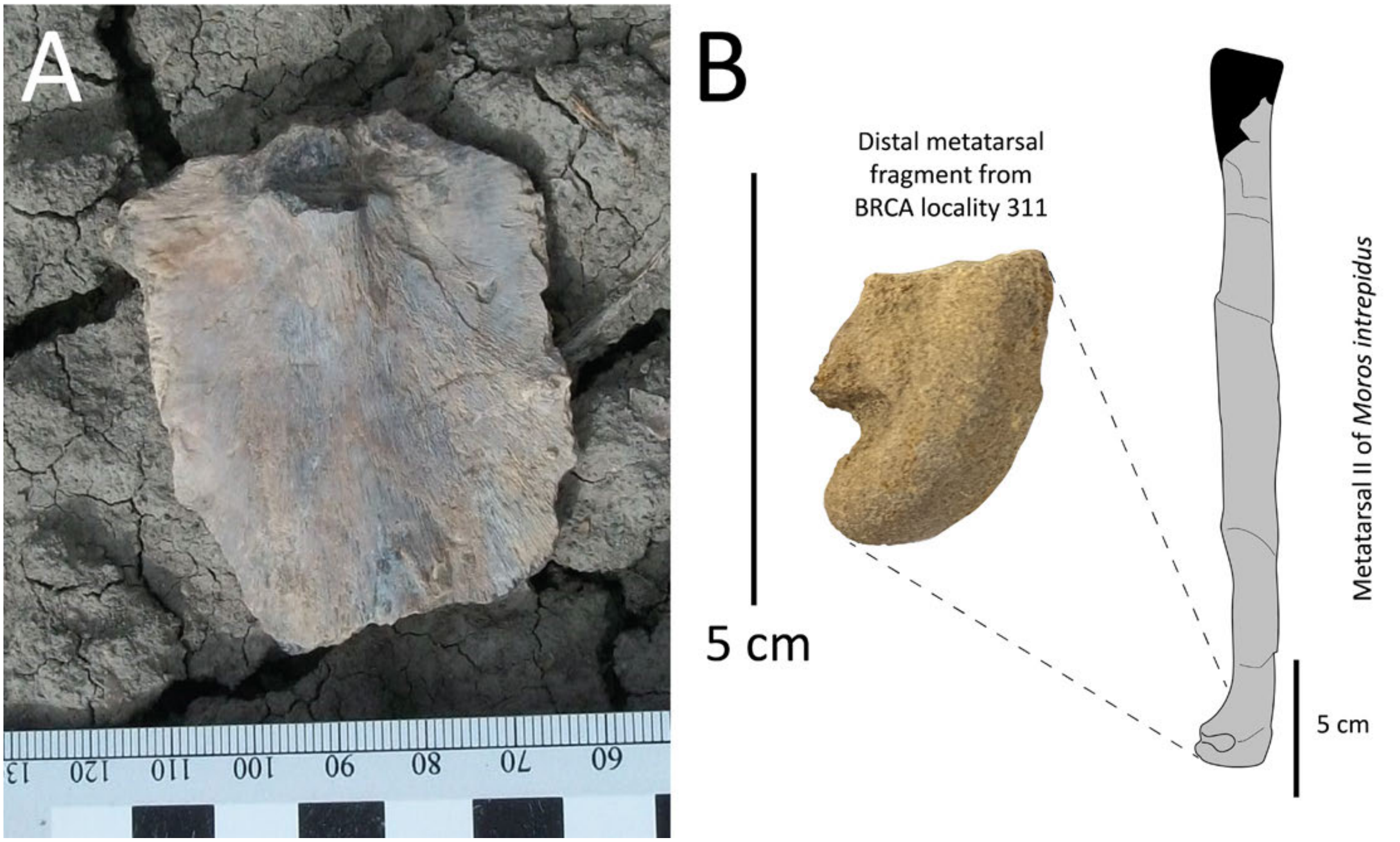


Figure 19. Close-up photographs of (A) an indeterminate protostegid turtle from the Tropic Shale and (B) an isolated distal metatarsal fragment, possibly referable to a tyrannosauroid, from the Straight Cliffs Formation of BRCA, with a drawing of metatarsal II of *Moros intrepidus* (Zanno et al., 2019, Figure 1J) for comparison. Scale bar in (A) in mm, scale bars in (B) = 5 cm.

otis and Mitchell, 1989; Hasiotis, 1993; Sumida et al., 1999a), no paleontological resource preservation program was established in light of these works.

A new period of paleontological inventory and research began in 2020, when the UGS obtained funding for the first phase of field paleontological resource inventory. Since that project began, the UGS has recovered several significant fossils across the Permian–Jurassic strata of CANY (Figure 21). These include vertebrate body fossils in the Permian Cedar Mesa Sandstone, abundant track sites in the Early–Middle Triassic Moenkopi Formation (Figure 22), vertebrates (chondrichthyans, phytosaurs, aetosaurs, and metoposaurs) in the Late Triassic Chinle Formation (Figure 23), and dinosaur tracks in the Late–Early Jurassic Wingate Sandstone, and Early–Middle Jurassic Kayenta Formation, and Navajo Sandstone (DeBlieux et al., 2021, 2023, 2024). Abundant and newly discovered traces pertaining to chirotheriid-type swim tracks in the Torrey Member of the Moenkopi Formation are of particular scientific interest (DeBlieux et al., 2021, 2023; Figure 22). These discoveries, along with ongoing work in the same formations at GLCA (DeBlieux et al., 2023; Milner et al., 2023a, 2023b, 2024), expand our understanding of the Permian–Jurassic ecosystems of the Paradox Basin of southeastern Utah.

Capitol Reef National Park (CARE)

At first glance, the fossil record at CARE appears rather sparse compared to Utah's other "Mighty Five" national parks (Figure 24). Like those parks (except BRCA), CARE's geologic record stretches from the Permian Period into the lower part of the Late Creta-

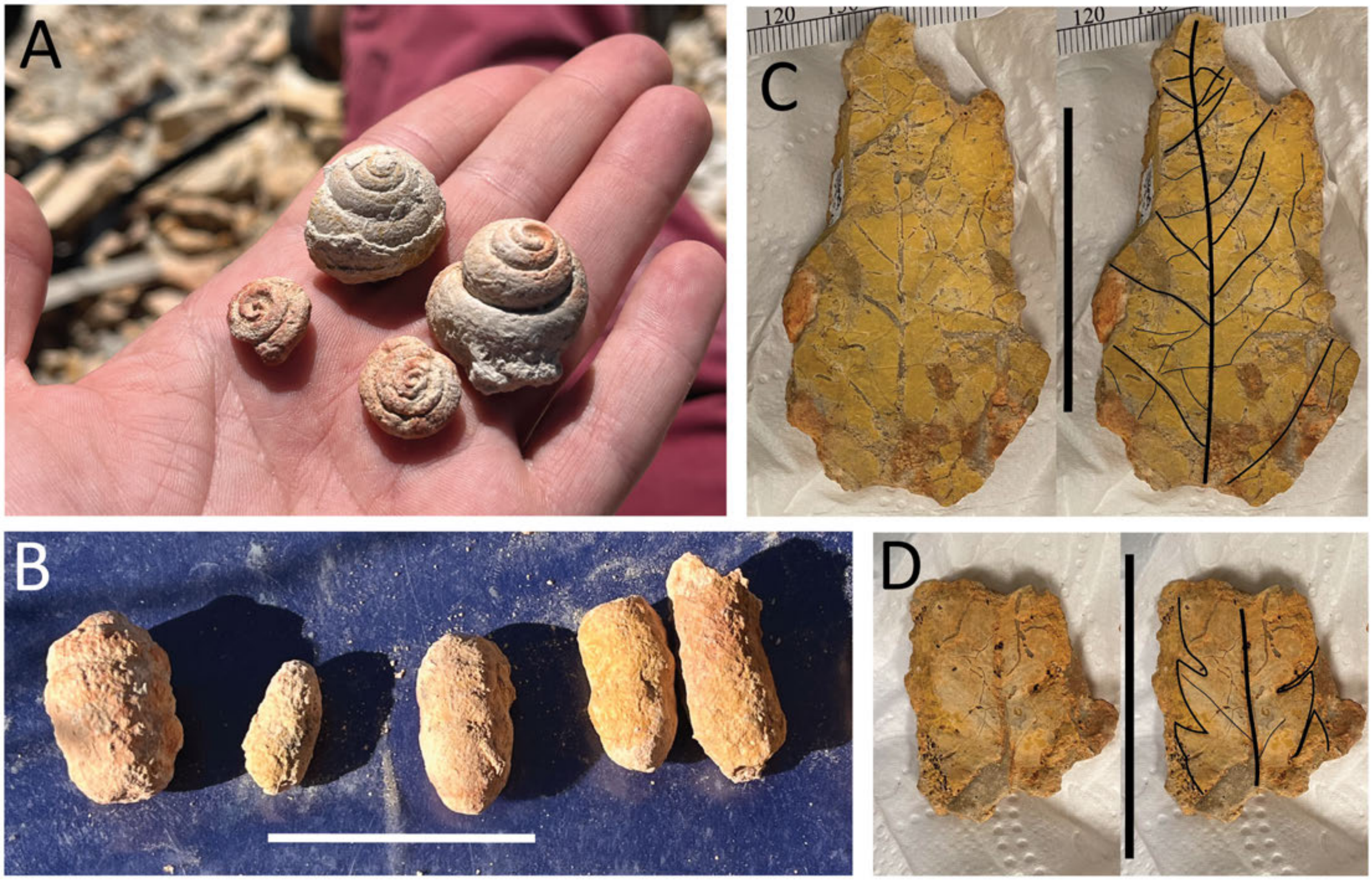


Figure 20. Fossils from the hoodoo-forming pink member of the Claron Formation at BRCA. (A) Gastropods, cf. *Viviparus*; (B) ichnofossils cf. *Eatonichnus* and *Parowanichnus* isp.; (C through D) leaf impressions with primary and secondary venation and leaf edges traced over. Scale bars = 5 cm. Photographs courtesy of Alexandra Bonham.

ceous Epoch, including some marine and terrestrial formations. Within this large span of time (more than 200 million years), an important paleontological record from the Triassic Moenkopi and Chinle Formations is documented at CARE. Notably, CARE possesses the most complete sequence of Chinle members when compared to any other NPS unit in Utah, and overall, within the state (Kirkland et al., 2014a; Martz et al., 2017).

Triassic paleontology has been a notable feature at CARE for much of its history. Significant vertebrate and invertebrate traces in the Moenkopi Formation at CARE were known as early as the 1940s (Peabody, 1956), and a single horsetail specimen identified as *Equisetum* was recovered from the park (Mickelson et al., 2006a). Similarly, plants in the Chinle Formation were also known and reported for many decades (Berry, 1927; Ash, 1975a, 1982, 1987, 1993, 2001, 2004; Dubiel, 1987; Kirkland et al., 2014a; Figure 25). The diversity of these fossils is displayed in the attached diagram (Figure 24).

Vertebrate body fossils have been underrepresented in CARE's fossil record until relatively recently. Park staff had known of some bone fragments throughout the park for decades; however, concerted research effort would not begin until the UGS became involved in the 2010s. To date, the UGS and colleagues have conducted two surveys at CARE (Kirkland et al., 2014a, 2020). The first focused on the geology and paleontology of the Chinle Formation (Kirkland et al., 2014a), whereas the second examined exposures of the Morrison and Cedar Mountain Formations (Kirkland et al., 2020a). Through

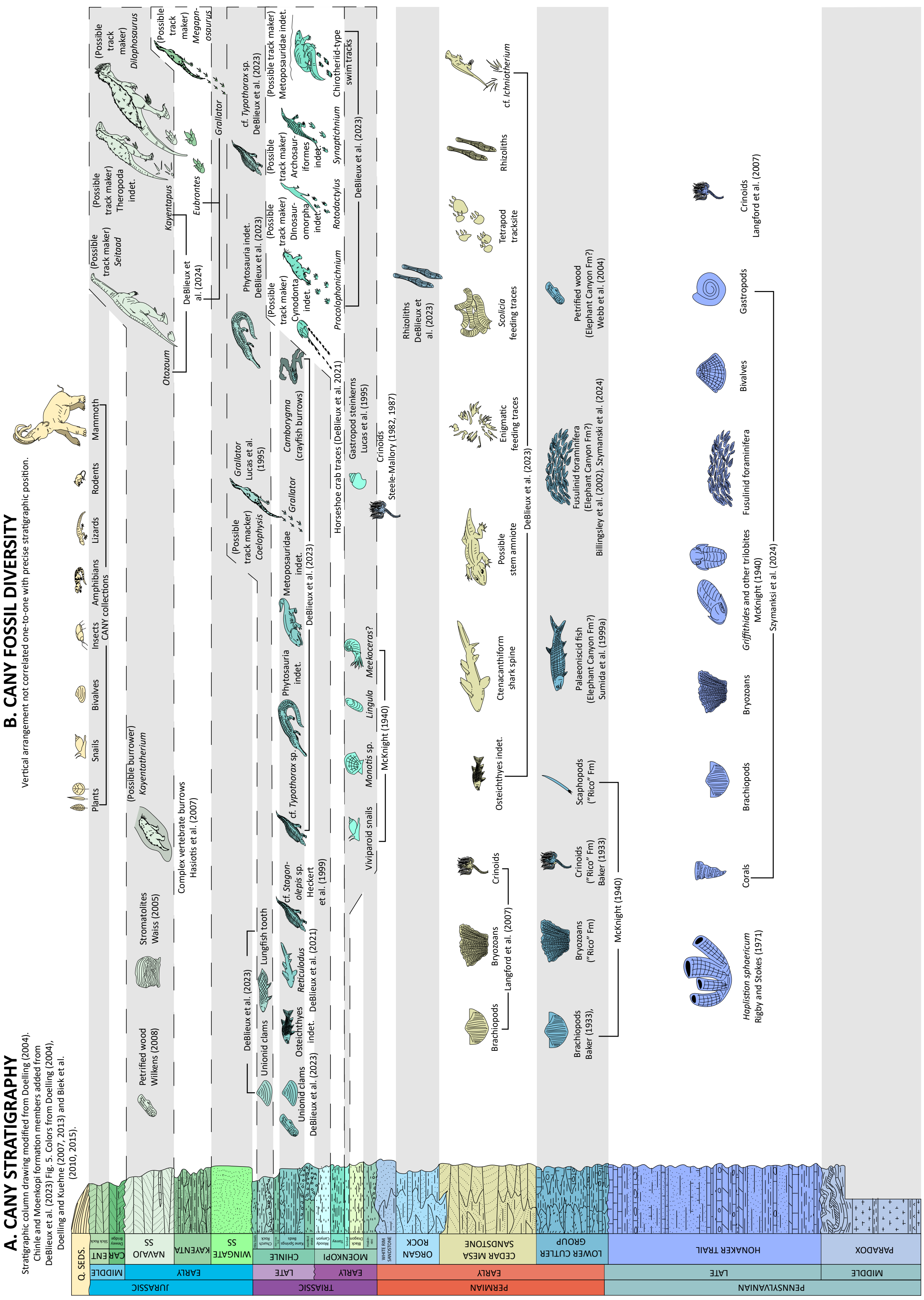


Figure 21. Biostratigraphic diagram for Canyonlands National Park (CANY). (A) Stratigraphy of CANY, modified from Doelling (2004); (B) Fossil diversity of CANY. Abbreviations: (geologic time) M., Middle Triassic; (stratigraphy) SS, sandstone; CAR, Carmel Formation; ENT, Entrada Sandstone; Q. SEDS., Quaternary sediments.

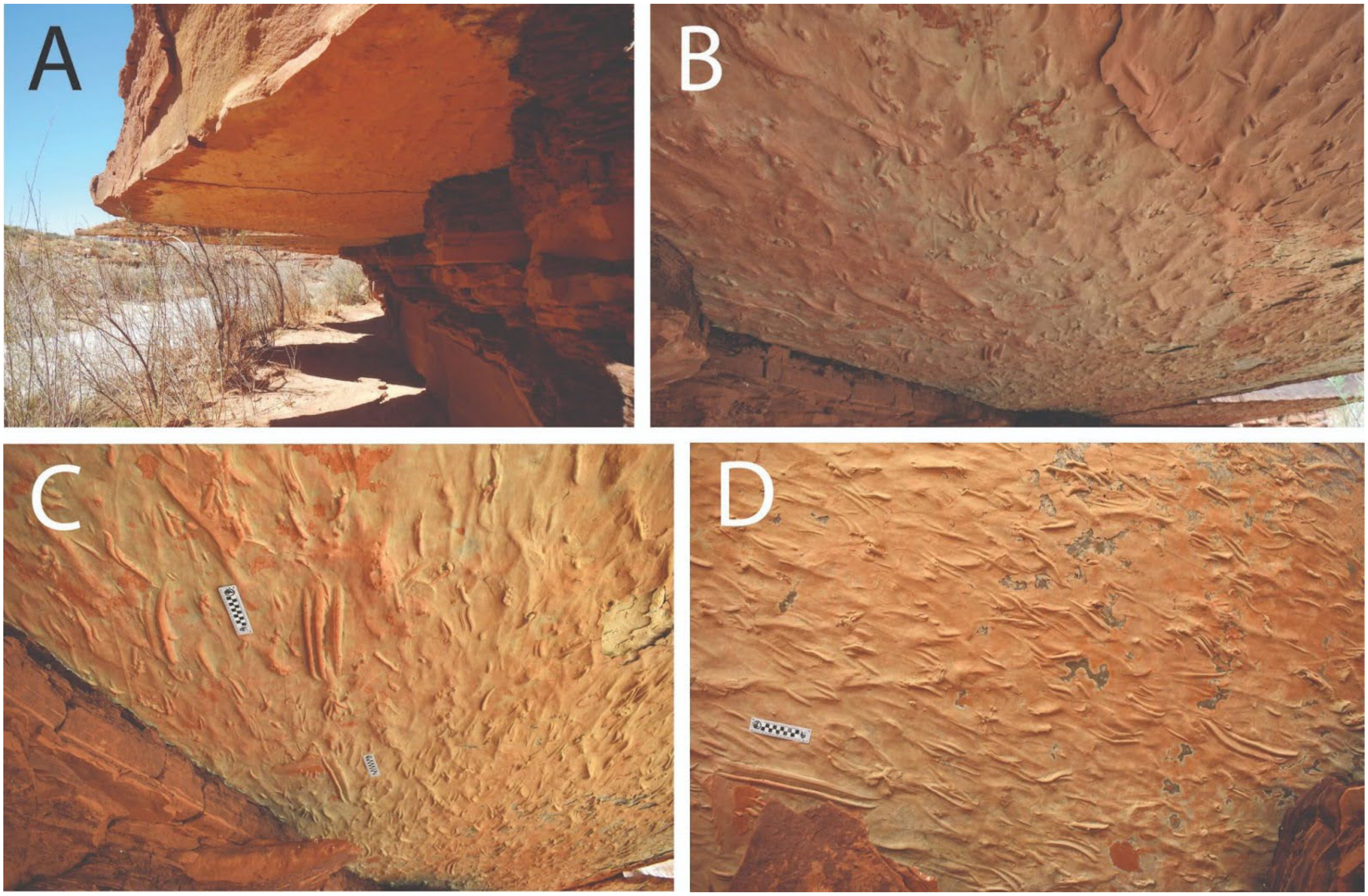


Figure 22. (A) Overview and (B through D) close-up photographs of locality Sa2273, the "Sistine Trample," a chirotheriid-type swim track locality in the Torrey Member of the Moenkopi Formation at CANY. From DeBlieux et al., 2023).

those studies, the UGS determined that the Chinle is by far the most fossiliferous and paleontologically important unit in the park.

Cedar Breaks National Monument (CEBR)

CEBR, which sits along the western edge of the Markagunt Plateau, is much like BRCA of the Paunsaugunt Plateau in that it is best known for its exposures of the brilliant pink hoodoo-forming Claron Formation. However, they differ greatly in the extent of paleontological research conducted in each park unit. Whereas BRCA has hosted decades of intensive study in its Late Cretaceous and Paleogene strata, CEBR has few fossil resources reported within its boundaries. This is in spite of the fact that CEBR also contains some of the same Cretaceous units as BRCA, namely the Straight Cliffs and Wahweap Formations (Figure 26).

There are just two reports of paleontological resources likely originating from CEBR. The first is provided by Gregory (1950). Gregory defers to Reeside in listing the gastropods *Bulinus*, *Helix spatiosa*, and *Planorbis utahensis*, the trace fossil *Celliforma spirifer*, and some possible leaf impressions from the top of the Wasatch Formation in Jericho Canyon (Gregory, 1950). It is important to note that (1) Jericho Canyon does lie within CEBR, and (2) "Wasatch" in this literature refers to what is now recognized as the pink member of the Claron Formation. However, no locality information

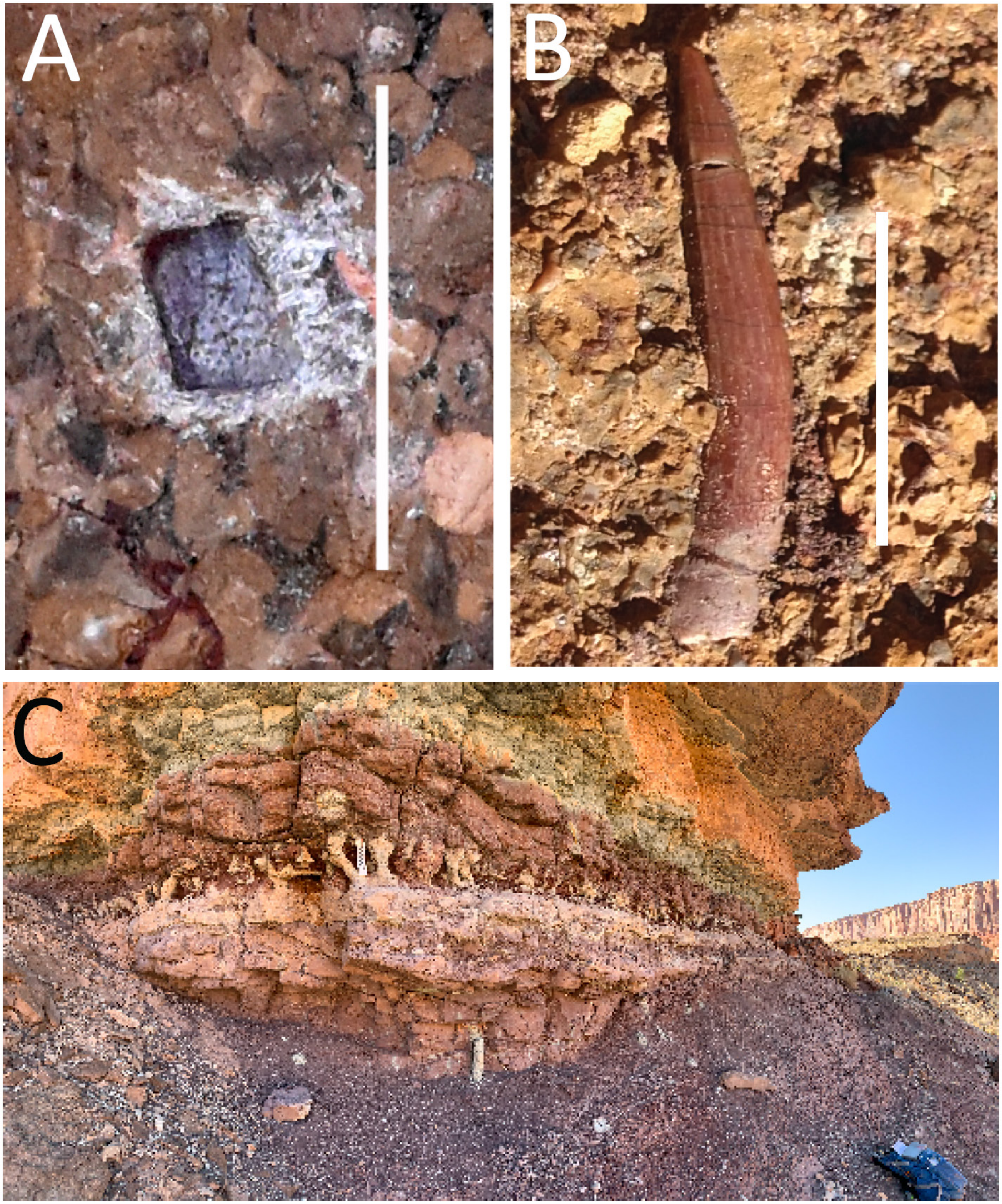


Figure 23. Fossils from the Triassic Chinle Formation at CANY. (A) *Reticulodus* chondrichthyan tooth. (B) Metoposaur tooth. (C) "Crayfish" burrows (cf. *Camborygma*) in the Owl Rock Member of the Chinle Formation at CANY (photograph courtesy of David Slauf). Scale bars = 1 cm.

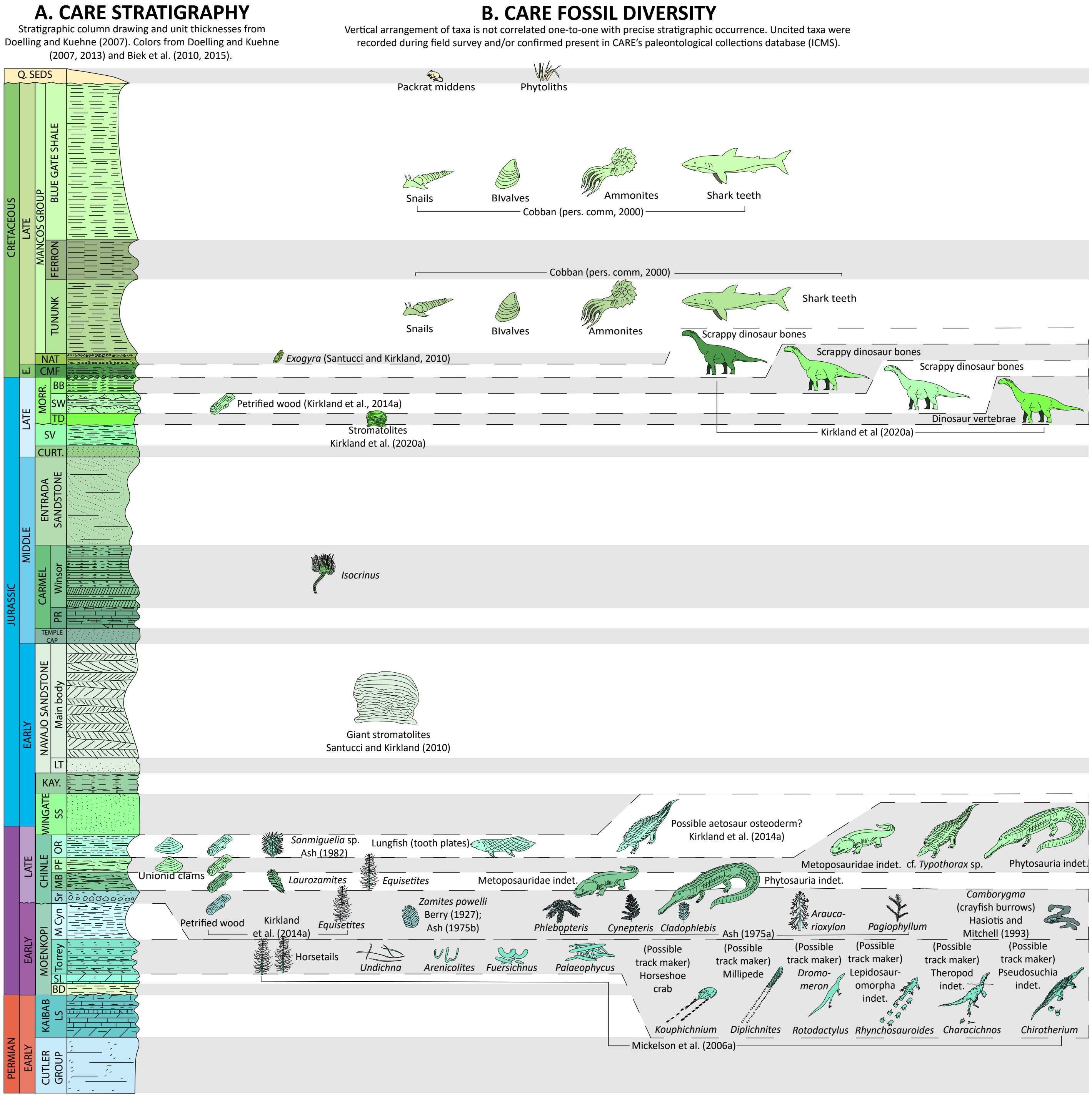


Figure 24. Biostratigraphic diagram for Capitol Reef National Park (CARE). (A) Stratigraphy of CARE. Modified from Doelling and Kuehne (2007). (B) Fossil diversity of CARE. Abbreviations: (stratigraphy, ascending) LS, limestone; BD, Black Dragon Member; SL, Sinbad Limestone Member; M Cyn, Moody Canyon Member; Sr, Shinarump Conglomerate; MB, Monitor Butte Member; PF, Petrified Forest Member; OR, Owl Rock Member; SS, sandstone; KAY., Kayenta Formation; LT, Lower tongue of the Navajo Sandstone; PR, Paria River Member; CURT., Curtis Formation; SV, Summerville Formation; TD, Tidwell Member; SW, Salt Wash Member; BB, Brushy Basin Member; CMF, Cedar Mountain Formation; NAT, Naturita Formation; Q. SEDS, Quaternary sediments.

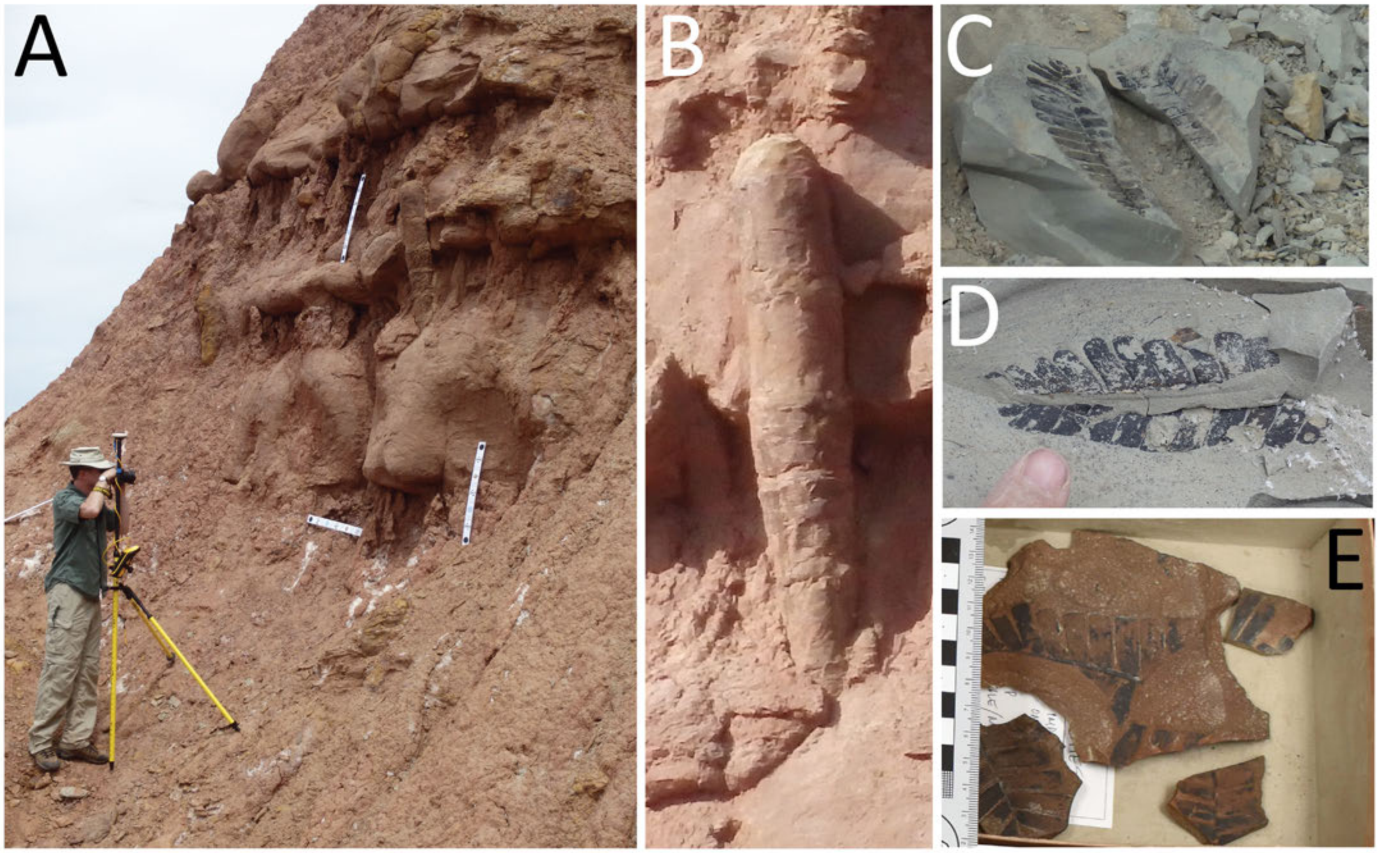


Figure 25. Fossil plants from the Monitor Butte Member of the Chinle Formation at CARE. (A) Jack Wood (NPS Geologic Resources Division) collecting photogrammetric data on in situ *Equisetites* locality Wn0151 (Kirkland et al., 2014a). (B) Close-up photograph of an *Equisetites* stem, locality Wn0151. *Laurozamites powelli* specimens from (C and D) locality Wn0160, and (E) locality Ga1463 (Kirkland et al., 2014a). Scale bar in (E) in cm. Photographs courtesy of Jim Kirkland and Vince Santucci.

is provided, nor are there sufficient specimens in the CEBR collections to corroborate this description. Mentions of fish fossils from the Claron at CEBR citing personal communication with Jeffrey Eaton (Santucci and Kirkland, 2010; Tweet et al., 2012f) were made in error. To date, Eaton has never conducted any paleontological survey in the monument (Weber State University, verbal communication, 2024). The second report of fossil resources in CEBR is on the pollen and macrofossil plant samples of Alpine Pond (Anderson et al., 1999), from about the past 3000 years.

Despite an overall paucity of fossils, CEBR does preserve strata that are not present in BRCA's geologic record. These include, namely, the late Eocene–Early Oligocene Brian Head Formation, which is known for producing diverse vertebrates including mammals, turtles, and other reptiles, as well as charophytes (Eaton et al., 1999b; Cook et al., 2014; Sanjuan et al., 2017). Importantly, an ash bed at the base of the formation at CEBR was radiometrically dated to 35.77 ± 0.28 Ma (Biek et al., 2015). The other major unit at CEBR that is not seen at BRCA is what has been referred to as the "Cretaceous beds on the Markagunt" by Biek et al. (2015, map unit "Km").

Past literature and maps listed the strata between the Wahweap and Claron Formations at CEBR as the Grand Castle Formation (Tweet et al., 2012f; Hatfield et al., 2024). However, the identification and definition of the Grand Castle and Cretaceous strata along the Markagunt Plateau more generally have been in flux. The Grand Castle was originally described with three informal members by Goldstrand and Mullett (1997). However, subsequent examination found that the lower

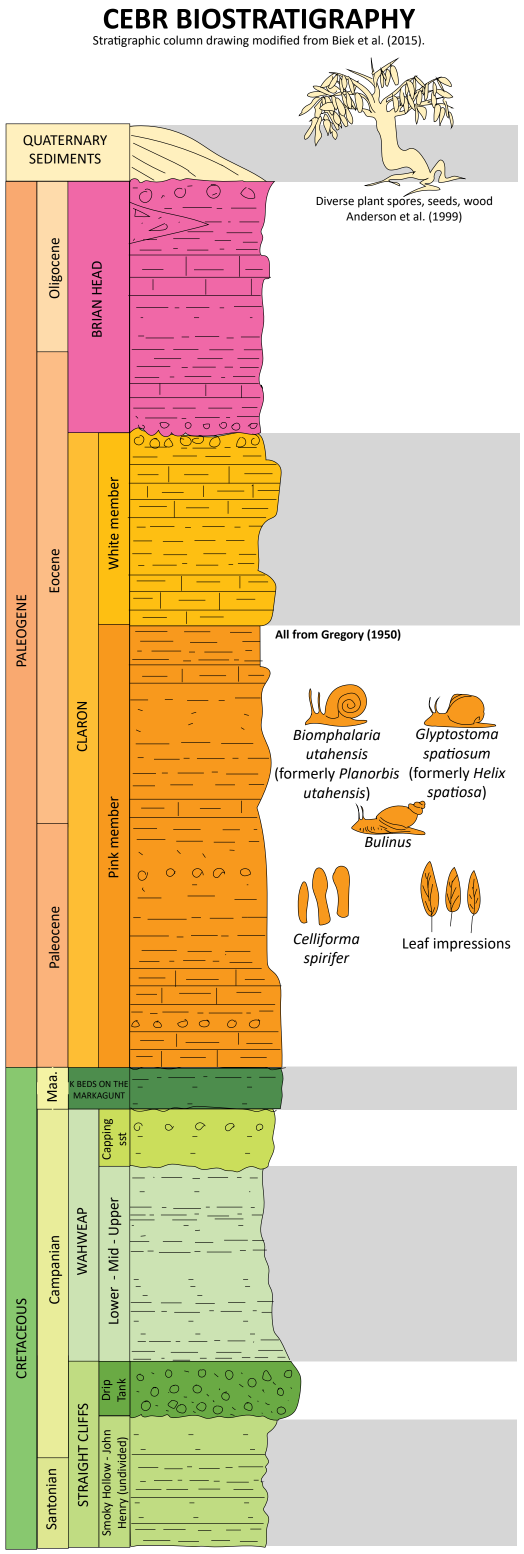


Figure 26. Biostratigraphic diagram for Cedar Breaks National Monument (CEBR). Stratigraphic column modified from Biek et al. (2015). Abbreviations: (geologic time) Maa., Masstrichtian; (stratigraphy) sst, sandstone.

and middle members were in fact the Drip Tank Member of the Straight Cliffs Formation and the capping sandstone member (now the Pardner Canyon Member, Beveridge et al., 2022) of the Wahweap Formation, respectively (Biek et al., 2015). As a result, Biek et al. (2015) redefined the Grand Castle, restricting it to just the uppermost conglomeratic member as described by Goldstrand and Mullett (1997).

The beds overlying the Pardner Canyon Member (Beveridge et al., 2022) of the Wahweap Formation and underlying the pink member of the Claron Formation at CEBR do not match the Grand Castle Formation of Biek et al. (2015), which is conglomeratic. By contrast, these beds consist of fine sandstone, resembling the base of the Claron. Palynomorphs recovered from this unit in the region range from Campanian to Maastrichtian in age; these beds may be referable to part of the Kaiparowits Formation (Biek et al., 2015). These factors led Biek et al. (2015) to map these strata as an informal unit, "Cretaceous beds on the Markagunt," at CEBR. We adhere to this nomenclature in Figure 26.

Although few fossils have been confirmed to originate from inside CEBR, the paleontology of the southwestern Utah region highlights the monument's potential for study and education. Multiple productive microfossil localities were recovered by Jeffrey Eaton in the Straight Cliffs and Wahweap Formations along the Markagunt and western Paunsaugunt Plateaus (see Titus et al., 2016). Vertebrate fossils that were at first thought to originate from the pink member of the Claron Formation were in fact float fossils from the overlying Brian Head Formation (Eaton et al., 2011, 2018). These discoveries, along with the numerous fossils known from equivalent strata in the BRCA and GSENM regions to the east, underscore the potential for CEBR's strata to yield fossils that can enhance understanding of Late Cretaceous and Paleogene ecosystems in southern Utah.

Dinosaur National Monument (DINO)

DINO is most famous for its world-renowned quarry wall (the Carnegie Quarry; Figures 27 and 28A through 28G), originally discovered by Earl Douglass in 1909. Excavation over several decades by multiple research groups (Carnegie Museum of Natural History, Smithsonian Museum of Natural History, and University of Utah) would ultimately reveal numerous fossils of dinosaurs and other organisms in the Brushy Basin Member of the Late Jurassic Morrison Formation. The significance of the Carnegie Quarry led DINO to be designated by President Woodrow Wilson as a protected monument in 1915 (Wilson, 1915), predating the establishment of the NPS in 1916. Fossils from the Carnegie Quarry and elsewhere in the Morrison at DINO paint a fully fleshed ecosystem occupied by diverse plants, invertebrates, fishes, amphibians, turtles, crocodylomorphs, mammals, and especially dinosaurs near the end of the Jurassic Period, about 150 Ma. Several holotypes are included in this group of fossils, such as that for the iconic sauropod *Apatosaurus louisiae*. Figure 27 shows at least one representative from each major taxonomic group of organisms recovered from the Brushy Basin Member at DINO; however, the faunal list for this unit in the monument is extensive and goes beyond what is shown here (Foster, 2003). A full list of taxa is provided in the appendix of this document.

At least 10 dinosaur taxa have been recorded within the Carnegie Quarry alone (Foster, 2003; Carpenter, 2013). These are the sauropods *Apatosaurus, Barosaurus, Camarasaurus* (Figure 28B), *Diplodocus*, and the newly described dicraeosaurid *Athenar* (Whitlock et al., 2025), the ornithischians *Stegosaurus* (Figure 28F), *Camptosaurus*, and *Dryosaurus*, and the theropods *Allosaurus*, *Ceratosaurus*, and *Torvosaurus*. Foster (2003) reported a possible *Haplocanthosaurus*; however, Carpenter (2013) proposes that this may instead be a juvenile *Diplodocus*. We defer to the latter source as more recent (Figure 27). The animals range in age from juveniles to adults, providing a wealth of information on the life histories of these Late Jurassic dinosaurs.

Although we have visually segregated organisms based on their presence in the Carnegie Quarry, viewers should note that dinosaurs and other animals shown in the quarry have in fact been found elsewhere at DINO, but not vice-versa. For example, the theropod *Marshosaurus* has been found within DINO but not in the Carnegie Quarry. *Apatosaurus*, on the other hand, has been recovered from multiple localities across the monument (Foster, 2003).

DINO's significant fossils extend beyond the iconic Morrison Formation. In fact, DINO preserves the greatest extent of geologic time of any Utah national park or monument, as its rock record stretches as far back as the Neoproterozoic Era and includes Cenozoic rocks of Oligocene and Miocene age, younger than the Paleocene–Eocene Claron Formation of BRCA and CEBR. Like the Morrison, some of these units have produced holotype specimens from DINO (starred), including the titanosauriform sauropod *Abydosaurus mcintoshi* (Chure et al., 2010; Figure 28G), which was originally reported from the Cedar Mountain Formation at DINO. Holmes (2017) posited that this type locality occurs at the base of the Naturita Formation; however, more recent chronostratigraphic and geochemical study confirms that this locality is indeed within the Cedar Mountain Formation (Lee et al., 2021).

Holotypes have also been described from DINO's Paleozoic rocks (e.g., *Amplexus zaphrentiformis* White 1876; Figure 29). Most of the knowledge on DINO's Paleozoic fossils comes from surveys in the mid-20th century (Untermann and Untermann, 1949a, 1949b, 1954). However, ongoing study in the Monument's Cambrian Lodore Formation and other Paleozoic rocks (Davis, 2010), including the newly identified Devonian Parting Formation (Myrow et al., 2023a, 2023b) seeks to understand life in Utah before the Age of Dinosaurs.

It is important to note that DINO is currently the only NPS unit in Utah with a permanently employed Park Paleontologist or equivalent staff member for much of its history. This staffing, along with the fact that paleontological resources are inherent to the spirit and identity of DINO, makes it much easier than at other parks for personnel of all disciplines to keep fossils at the forefront of management decisions and interpretive strategies.

Glen Canyon National Recreation Area (GLCA)

GLCA contains an immense fossil record represented by more than 700 localities and 40,000 museum spec-

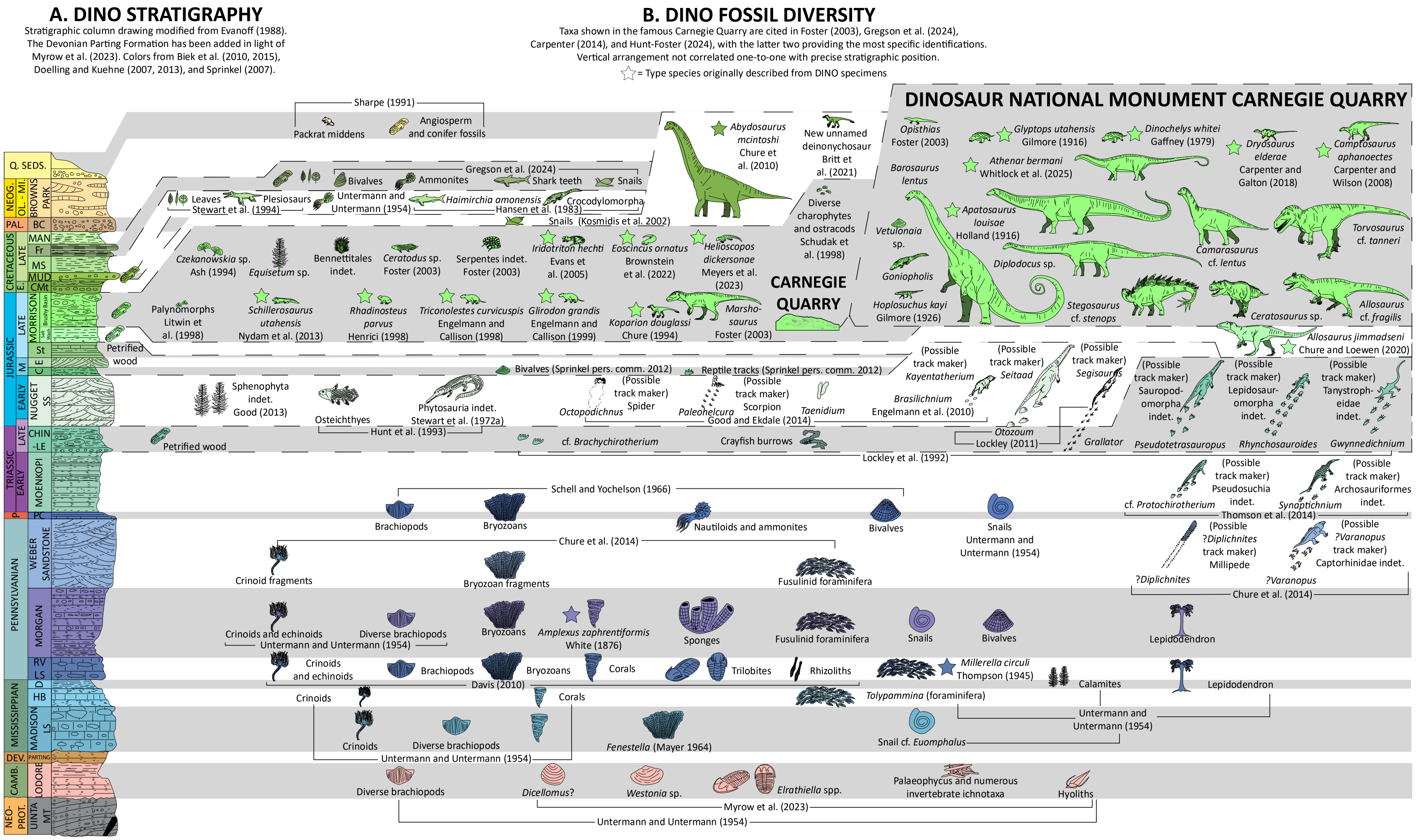


Figure 27. Biostratigraphic diagram for Dinosaur National Monument (DINO). (A) Stratigraphy of DINO, modified from Evanoff (1988). (B) Fossil diversity of DINO. Abbreviations: (geologic time) NEOPROT., Neoproterozoic; P, Permian; MID., Middle Jurassic; E., Early Cretaceous; PAL., Paleogene; OL., Oligocene, MI., Miocene; (stratigraphy) UINTA MT, Uinta Mountain Group; LS, Madison Limestone; HB, Humbug Formation; D, Doughnut Formation; RV LS, Round Valley Limestone; PC, Park City Formation; SS, Nugget Sandstone; C, Carmel Formation; E, Entrada Sandstone; St, Stump Formation; CMt, Cedar Mountain Formation; MUD, Muddy Formation; MS, Mowry Shale; Fr, Frontier Formation, MAN, Mancos Group (of Kirkland et al., 2025); BC, Bishop Conglomerate; Q. SEDS., Quaternary sediments.

Figure 28. Overview of key vertebrate fossils and the Carnegie Quarry at DINO. (A) Overview of the Quarry Exhibit Hall. (B) Skull of *Camarasaurus* cf. *lentus* in the Carnegie Quarry. (C) Overview of the Carnegie Quarry wall. (D) DINO 16488, the holotype of *Abydosaurus mcintoshi* (Chure et al., 2010) (E) DINO 11541, the holotype of *Allosaurus jimmadseni* (Chure et al., 2020). (A) and (B) courtesy of TT; (C) courtesy of Ken Carpenter; (D) and (E) courtesy of ReBecca Hunt-Foster.

Figure 29. Holotype specimen of the horn coral *Amplexus zaphrentiformis* (White, 1876), originally collected from the Morgan Formation in Lodore Canyon at DINO by John Wesley Powell (photograph courtesy of Vince Santucci).

imens. The fact that it continues to produce fossils of high scientific importance, especially those that illuminate vertebrate ecosystems and behavior in the first half of the Mesozoic Era, underscores GLCA's importance as a paleontological park. It rivals even DINO in its breadth and abundance of significant material (Figure 30). For these reasons, GLCA was selected as the prototype paleontological resource monitoring park in 2009. The pilot project to establish this monitoring program was undertaken as a partnership between the NPS Paleontology Program and the UGS (Kirkland et al., 2010).

GLCA is a real "Walking with Dinosaurs" experience in that it possesses a wealth of well-studied and protected vertebrate tracksites stretching as far back as the Permian Period. The GLCA is best known to science for producing many footprints of dinosaurs and other animals from the Late Triassic and Early Jurassic Epochs, especially in the Chinle Formation, Wingate Sandstone (Figure 31), Kayenta Formation, and Navajo Sandstone. Hundreds of localities have revealed footprints and associated traces of several types of dinosaurs (theropods, sauropodomorphs, ornithischians), pseudosuchians, and synapsids (Lockley et al., 1998, 2014b; Milner et al., 2023b, 2024; Figure 32). A notable

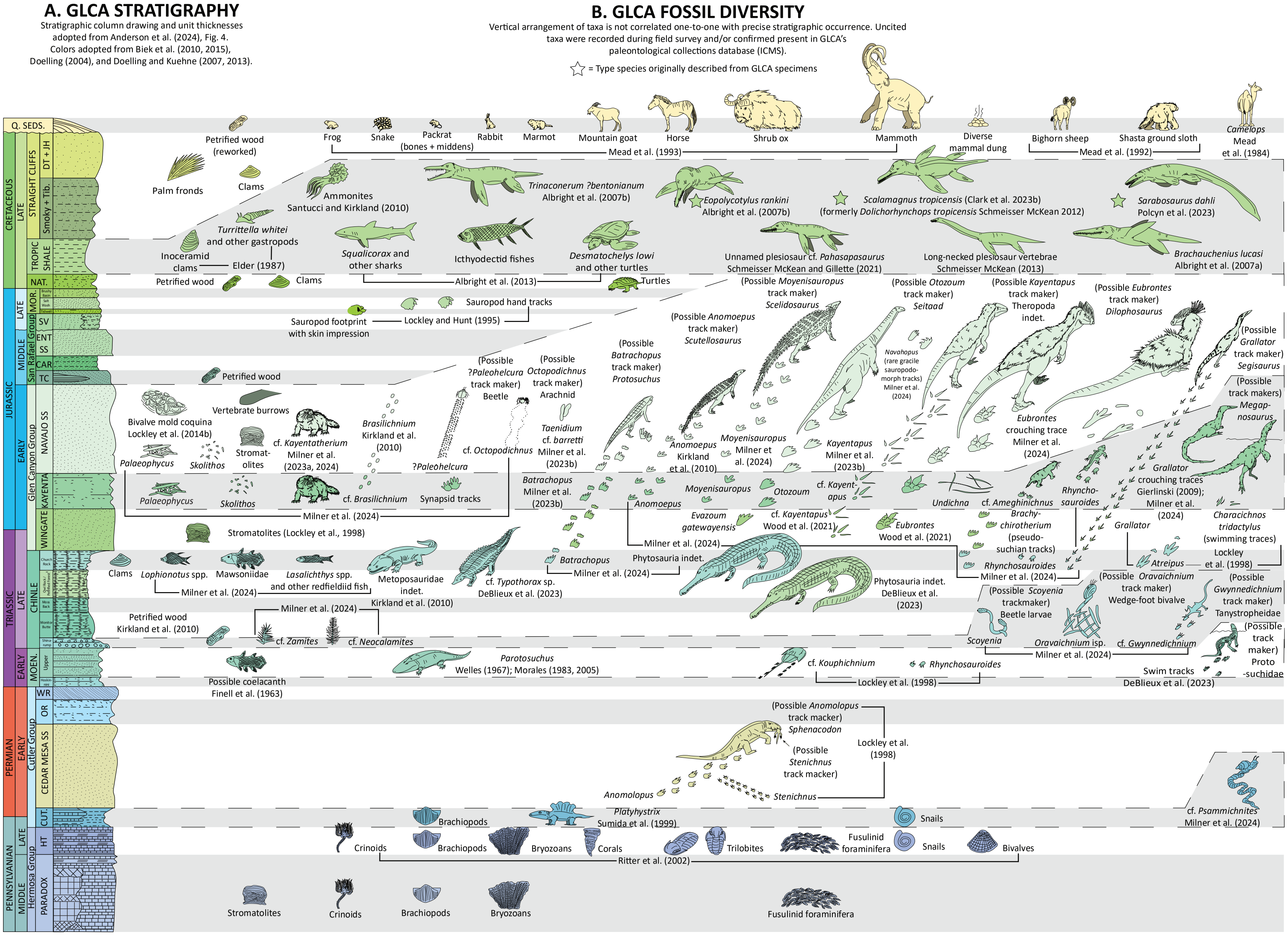


Figure 30. Biostratigraphic diagram for Glen Canyon National Recreation Area (GLCA). (A) Stratigraphy of GLCA, adopted from Anderson et al. (2024); (B) Fossil diversity of GLCA. Abbreviations: (geologic time) (stratigraphy) HT, Honaker Trail Formation; CUT., Cutler Formation; SS, sandstone; OR, Organ Rock Formation; WR, White Rim Sandstone; MOEN., Moenkopi Formation; TC, Temple Cap Formation; CAR, Carmel Formation; ENT SS, Entrada Sandstone; SV, Summerville Formation; MOR., Morrison Formation; NAT., Naturita Formation; Smoky + Tib., Smoky Hollow and Tibbet Canyon Members, undivided; DT + JH; Drip Tank and John Henry Members, undivided.

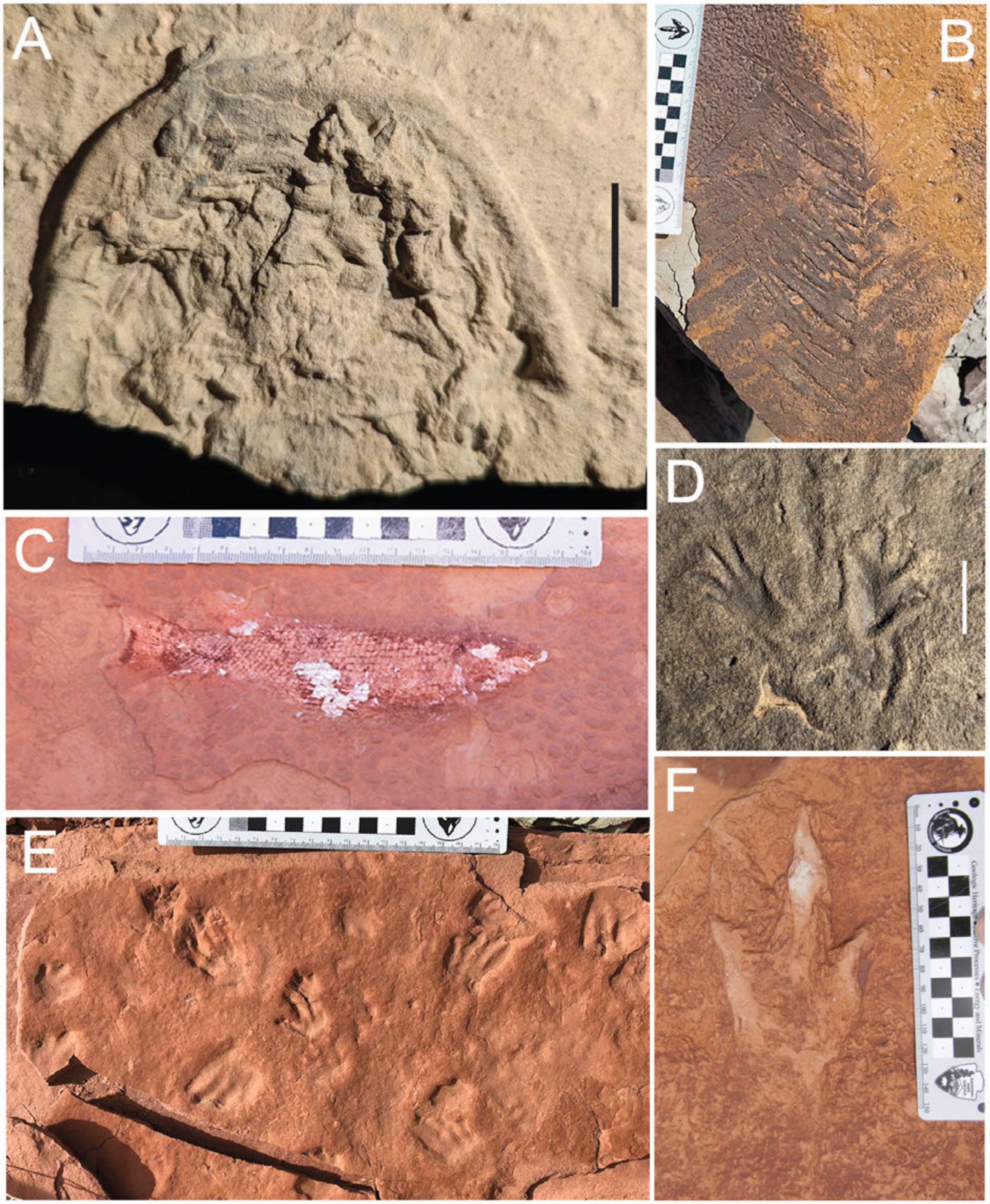


Figure 31. Triassic fossils from GLCA. (A) Horseshoe crab resting trace with associated *Kouphichnium* traces (GLCA 23838, UCM 140-5) from Moenkopi Formation. Scale = 2 cm. (B) Bennettitales (cf. *Zamites*) from Shinarump Member, Chinle Formation. (C) Redfieldiidae fish in right lateral view from Church Rock Member, Chinle Formation. (D) cf. *Gwyneddichnium* (GLCA 25204, UCM 98261) from the Shinarump Member, Chinle Formation. Scale = 1 cm. (E) *Batrachopus* tracks from Church Rock Member, Chinle Formation. (F) *Grallator* natural cast from lower Wingate Sandstone. Scale for B, C, E, and F in cm. Photographs B, C, and E courtesy Andre Delgalvis.

Permian trackway has been cleverly dubbed "Permian Murder" because it possibly shows a predator snatching up a smaller vertebrate mid-stride (Lockley et al., 1998). Although already well-known, vertebrate trace localities at GLCA continue to provide new insights into paleoenvironments and species diversity in the Early–Middle Jurassic of southern Utah (Milner et al., 2023a, 2023b, 2024).

A new group of important localities at the Kayenta–Navajo transition were discovered in early 2023 thanks to the low water level of Lake Powell at the time. These localities bore multiple vertebrate-bearing horizons, namely tritylodontid synapsids (Milner et al., 2023a, 2024; Figure 32C). This is an important discovery because vertebrate body fossils in the Kayenta Formation of Utah and the Navajo Sandstone overall are exceedingly rare. Only one set of body fossils has been identified from the Kayenta in Utah (a fragmentary theropod from ARCH; Marsh et al., 2024). Similarly, just two vertebrate taxa have been named from the Navajo Sandstone: the sauropodomorph *Seitaad* in Utah (Sertich and Loewen, 2010) and the small theropod *Segisaurus* in Arizona (Camp, 1936; Carrano et al., 2005). Because of this context, the recently discovered bonebeds are a new priority for fieldwork and protection at GLCA.

GLCA also has the best record of Late Cretaceous marine vertebrates of any NPS unit in Utah, and likely the entire NPS. Paleontologists, the late David Gillette and Janet Gillette, led several expeditions into the Tropic Shale in the park during their tenure at the Museum of Northern Arizona in Flagstaff, Arizona. Their efforts revealed several significant specimens of short-necked plesiosaurs, including a well-preserved skull of the pliosaur *Brachauchenius lucasi* (Albright et al., 2007a; Figure 33) and the holotypes of the polycotylids *Eopolycotylus rankini* (Albright et al., 2007b) and *Scalamagnus tropicensis* (Clark et al., 2023b, originally *Dolichorhynchops tropicensis* Schmeisser McKean, 2012) (Figure 30). GLCA also produced the oldest known mosasaur in North America, *Sarabosaurus dahli* (starred; Polcyn et al., 2023). Other fossils in the Tropic Shale at GLCA include sea turtles, fishes, sharks, ammonites, gastropods, and bivalves (Albright et al., 2013).

GLCA is also notable for its Quaternary (Pleistocene–Holocene) fossil resources. Whereas most NPS units in Utah have some record of this period in the form of packrat middens, which frequently capture scrappy plant and animal remains, GLCA stands out because its cave resources have preserved the most abundant and diverse mammal dung specimens yet found in any park unit in Utah. Much of this dung was recovered from the aptly named Bechan Cave, as "Bechan" translates to "big feces" in the Navajo language (Davis et al., 1984; Mead et al., 1984; Tweet et al., 2009; Hunt et al., 2012; Figure 34). Most animals identified from Pleistocene-age dung at GLCA are also represented by some skeletal remains (Mead et al., 1993) and hair (Davis et al., 1984). However, a few, namely bighorn sheep, bison, North American camel (*Camelops*), and Shasta ground sloth (*Nothrotheriops shastensis*) have been identified exclusively by their droppings (Mead et al., 1984). They are depicted in the "possible trace maker" pose as a result.

The late Martin Lockley, Professor Emeritus at University of Colorado, Denver, served as one of the primary stewards of paleontological research at GLCA, generating decades' worth of fieldwork and knowledge on the numerous vertebrate trace fossils in the park. His friends and colleagues, especially paleontologists at the SGDS and the UGS, carry on his legacy of study and resource stewardship at GLCA.

Golden Spike National Historical Park (GOSP)

GOSP was established in 1957 to commemorate the location of the joining of the westward Central Pacific railroad and the eastward Union Pacific railroad in 1869, signified with an eponymous golden rail spike. This union formed the first transcontinental railroad in the United States. This historical significance greatly overshadows the park's paleontological resources. Whereas they are limited in geologic scope and taxonomic breadth, they do represent a diverse Paleozoic ecosystem.

Although GOSP contains fewer than 3000 acres, the park does contain small outcrops of the lower limestone member of the Pennsylvanian Oquirrh Group. The only confirmed record of fossils from this unit in the park was provided by Arvid Aase (Park Paleontologist, Fos-

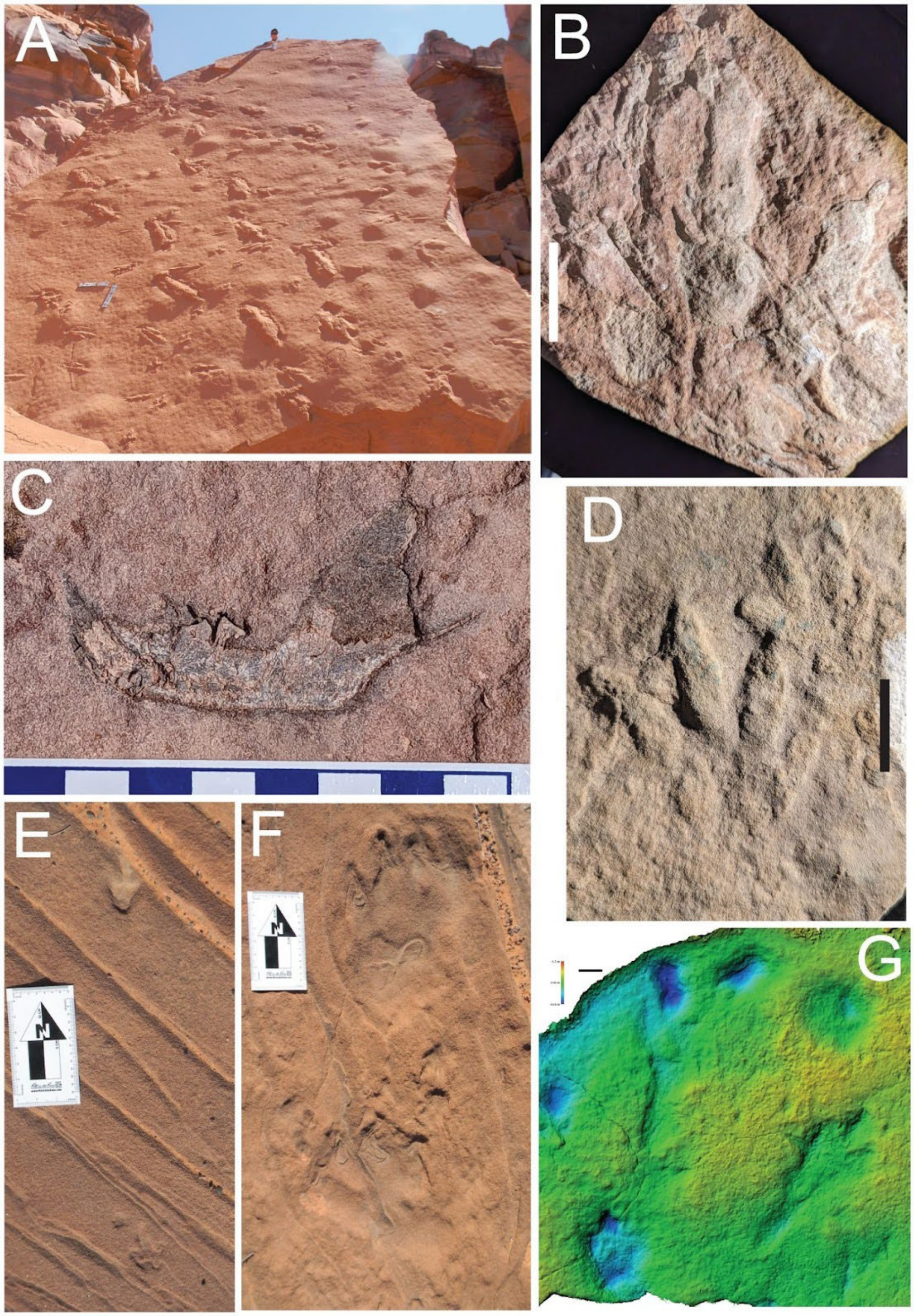


Figure 32. Jurassic fossils from GLCA. (A) Little Cave Cove Tracksite main block from mid-part of the Wingate Sandstone. Note, man's head at the top of the block. (B) *Kayentapus* (GLCA 23976, UCM 183.63) natural cast from the Kayenta Formation. (C) Tritylodontid mandible from the uppermost Kayenta Formation. (D) *Batrachopus* manus-pes set (GLCA 23891, UCM 180.33) from the Kayenta Formation. Scale = 2 cm. (E) *Grallator* and (F) *Otozoum* footprints at the Crossing of the Fathers Tracksite, Navajo Sandstone. (G) Photogrammetric model of a *Eubrontes* crouching trace with possible manus impressions from the lower Navajo Sandstone (modified from Milner et al., 2024, Figure 17E). Scale = 10 cm. Scale for C, E, and F in cm.

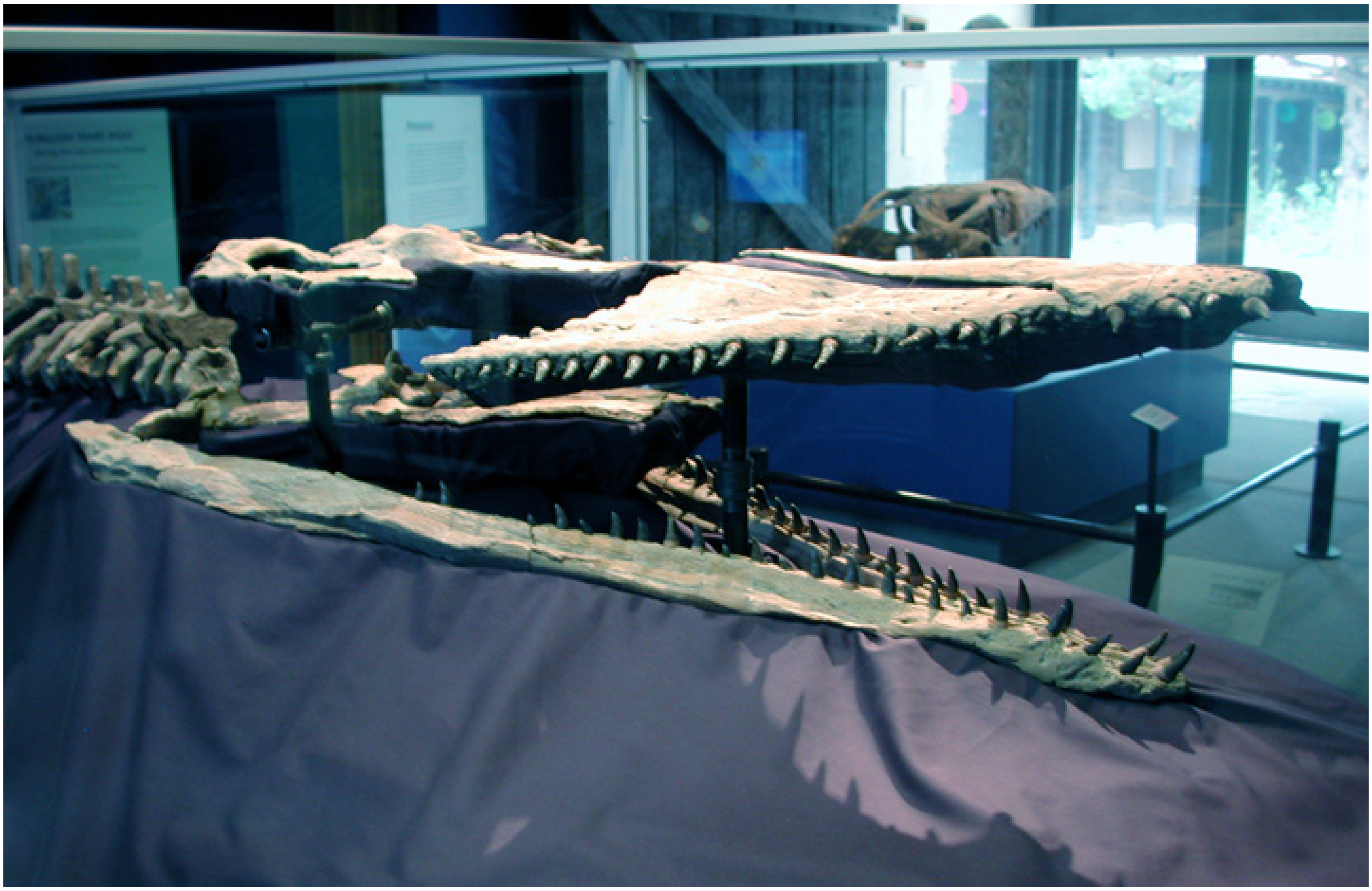


Figure 33. Skull of the pliosaur, *Brachauchenius lucasi* (specimen MNA V9433), from the Tropic Shale of GLCA (photograph courtesy of Vince Santucci).

sil Butte National Monument, Wyoming) c. 2007–2008. Aase's survey returned diverse fossils, including sponges, corals, bryozoans, brachiopods, crinoids, trilobites, and phosphatic fish and shark fossils (Figure 35). None of the fossils that Aase reported were collected (Tweet et al., 2012h). No paleontological inventory has since been conducted at GOSP, likely due in part to Aase's assessment that fossils in the park are too obscure from the public eye to be threatened by many visitors.

Hovenweep National Monument (HOVE)

HOVE, a set of six small park units in southeastern Utah and southwestern Colorado, was established in 1923 primarily to preserve the significant cultural resources there.

A paleontological resource inventory and field assessment was completed at HOVE in April 2024 (Shaffer et al., 2024). This work found that only two Mesozoic geologic units are preserved in the monument: the Early Cretaceous Burro Canyon Formation and Late Cretaceous Naturita Formation (Figure 36). Previously, HOVE was considered to contain strata pertaining to the Brushy Basin Member of the Morrison Formation (NPS, 2004). The April 2024 field assessment reclassified these strata as the younger Yellow Cat Member of the Burro Canyon Formation, a unit generally lacking substantial fossil resources in southeastern Utah. Furthermore, much of the rest of HOVE is covered by Qua-

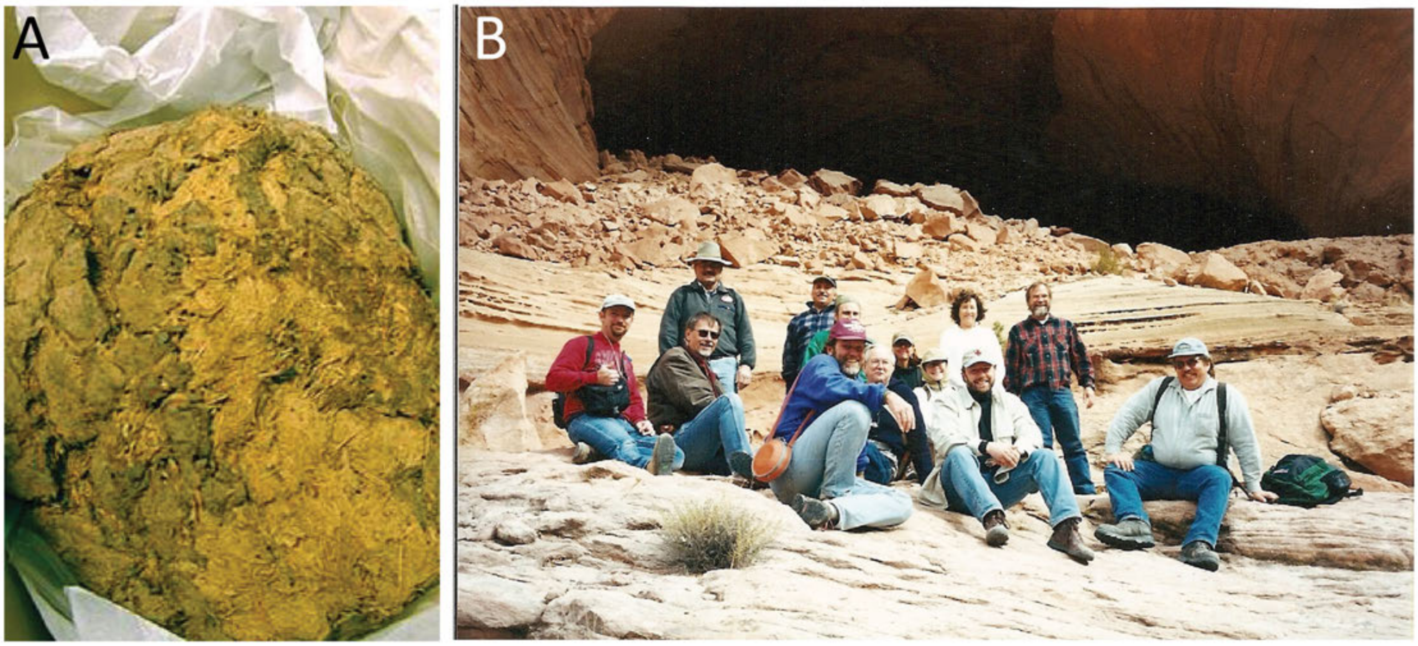


Figure 34. Bechan Cave at GLCA. (A) Pleistocene mammoth dung and (B) Glen Canyon NRA Paleontological Resource Scoping Field Trip in November 2000 at Bechan Cave. Personnel in (B) (front row): Alan Titus, Ron Blakey, Norm Henderson, Vincent Santucci, Jim Kirkland; (back row): the late Larry Agenbroad, the late Dave Gillette, Steve Hasiotis, Greg McDonald, Kris Thompson, Pat Monaco, Debra Mickelson, and Ken Cole. Photographs courtesy of Vince Santucci.

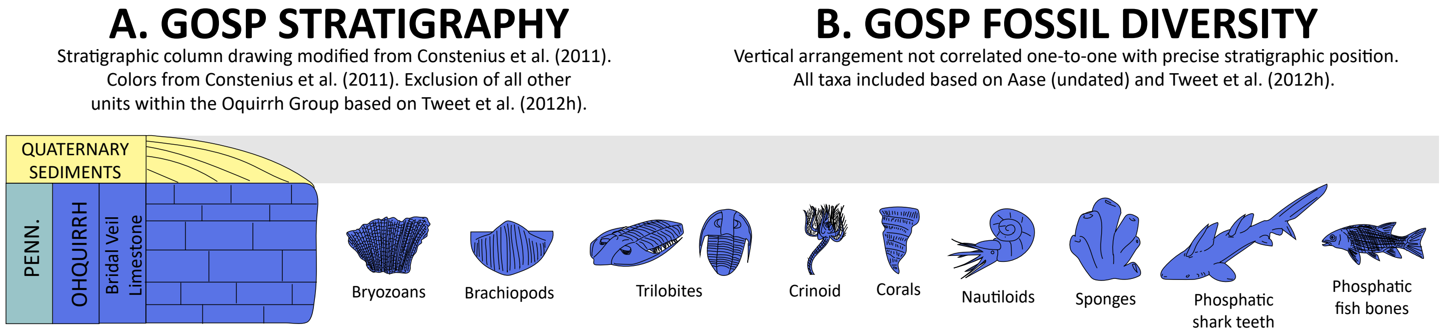


Figure 35. Biostratigraphic diagram for Golden Spike National Historical Park (GOSP). (A) Stratigraphy of GOSP, modified from Constenius et al. (2011). (B) Fossil diversity of GOSP.

ternary sediments considered unlikely to produce significant paleontological resources.

Scant paleontological resources were observed by Austin Shaffer and Vince Santucci in sandstone beds of the Naturita Formation at HOVE. These include invertebrate trace fossils, possible root traces, and fossil plant fragments; however, these fossils are poorly preserved and of infrequent occurrence (Figure 37).

Natural Bridges National Monument (NABR)

NABR is a small park unit east of GLCA and south of CANY. Very few fossils have been documented in

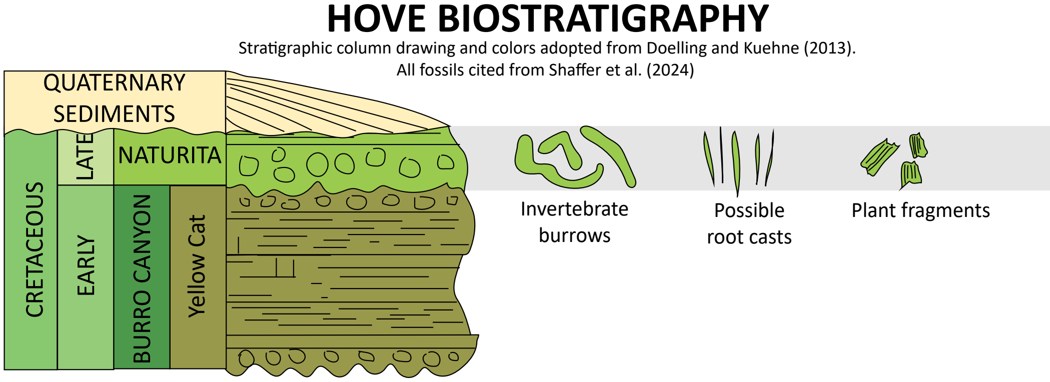


Figure 36. Biostratigraphic diagram for Hovenweep National Monument (HOVE). Stratigraphic column and colors modified from Doelling and Kuehne (2013); all taxa from Shaffer et al. (2024).

NABR to date (Figure 38). Whereas the vast majority of the monument overlies the Permian Cedar Mesa Sandstone, which forms the eponymous natural bridges, some outcrops of overlying Early–early Middle Triassic Moenkopi Formation and Late Triassic Chinle Formation do occur. However, very few fossil resources have been recorded in these units. To date, a handful of root casts and other trace fossils have been noted from the Cedar Mesa Sandstone, reworked fragments of petrified wood from the Chinle Formation, and packrat middens and bones of the rare but significant Harrington's mountain goat (Mead et al., 1987) represent the Quaternary at NABR. Given that the Cedar Mesa has proven to be highly fossiliferous in other park units (CANY, GLCA) and in Bears Ears National Monument to the southeast, one should expect that this unit at NABR may produce similarly significant fossils of vertebrates, invertebrates, and trackways that point to life before the largest known mass extinction event in the fossil record at the end of the Permian Period.

Rainbow Bridge National Monument (RABR)

RABR is a tiny park unit that sits along one of the southeast edges of the much larger and more famous GLCA. Neighboring GLCA is well-known for having numerous vertebrate trace fossil localities in Permian, Triassic, and Jurassic formations (see the GLCA section of this document). In contrast, RABR has just one recorded fossil occurrence: a theropod tracksite in the Early Jurassic Kayenta Formation (Lockley et al., 1998; Figures 39 and 40). Future work will be necessary to determine whether the better exposed Navajo Sandstone, which comprises the eponymous Rainbow Bridge, includes paleontological resources inside RABR.

Timpanogos Cave National Monument (TICA)

TICA was originally established to protect 5600 feet of caves in the Mississippian Deseret Limestone (Figure 41). Whereas a handful of invertebrate fossils have been collected from this unit (R. Horrocks, NPS, personal communication, 2001; Santucci et al., 2001; Figures 42A and 42B), the best study of paleontological resources at TICA was provided by George (1999). In that study, George sampled packrat middens from several localities within the Monument in order to identify mammal remains. This survey returned diverse fossilized mammals (Figures 42C and 42D) and even snake and bird remains, all of extant species. Small mammals (rodents, hares, mustelids) represented the majority of the collected material, and bighorn sheep comprised the largest proportion of macromammal specimens. The still-extant status of the taxa observed led George to conclude that the middens were likely of Holocene age, and that the diversity recorded within is consistent with the modern ecosystem in the American Fork region (George, 1999). To date, this study remains the only systematic survey for paleontological resources at TICA.

Because George (1999) focused on the mammal taxa in the study, he did not assign the snake and bird fossils to alpha taxa. These materials are fragmentary and include a single snake mandible and a few bird bones of "relatively large size" (George, 1999). We represent

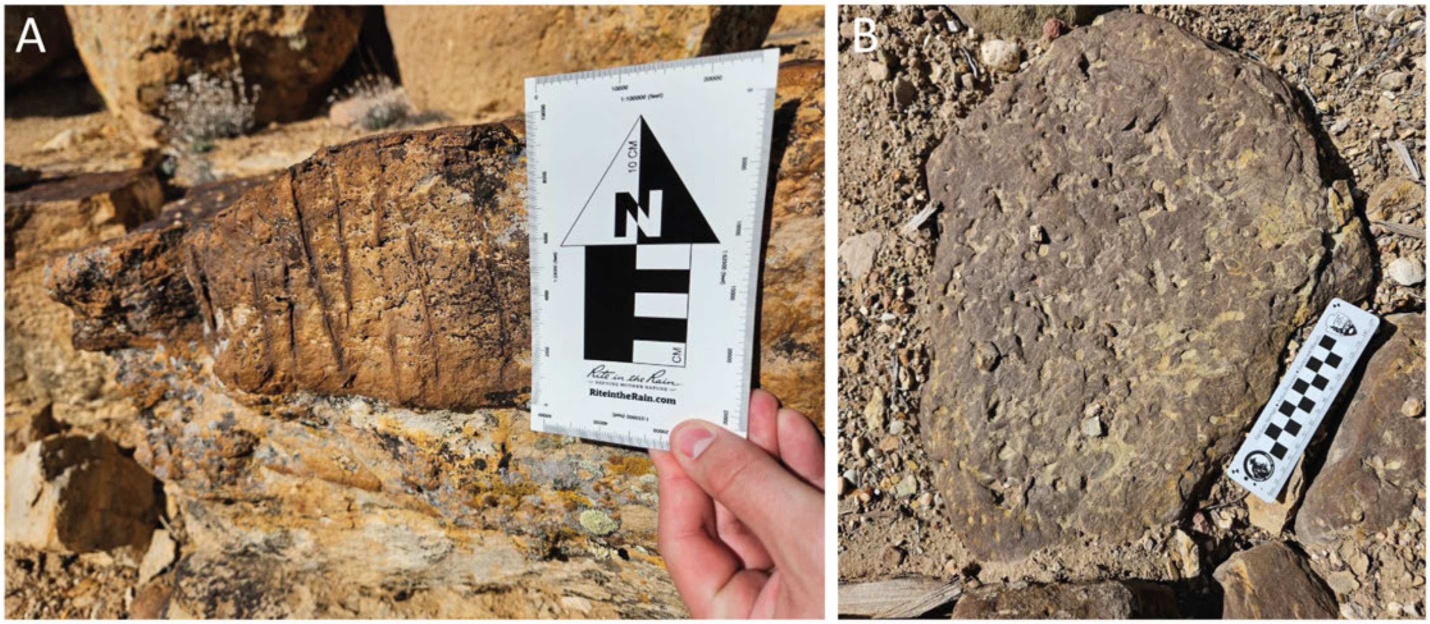


Figure 37. Paleontological resources from the Late Cretaceous Naturita Formation at HOVE. (A) Possible root casts and (B) invertebrate burrows. Photographs courtesy of Austin Shaffer (Shaffer et al., 2024).

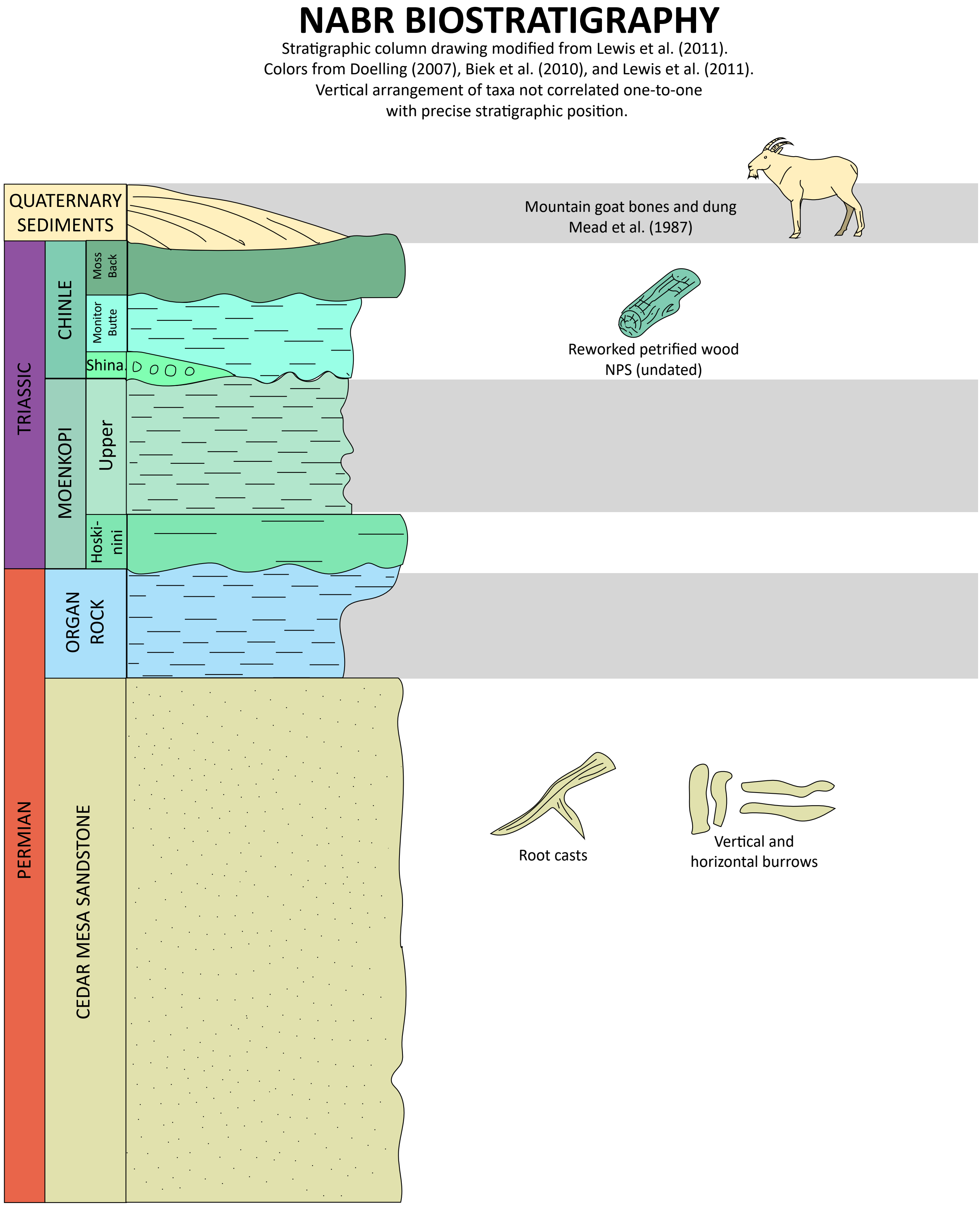
these as a gopher snake and a golden eagle, respectively, because these taxa are well-known to inhabit Utah for at least part of the year. Santucci and Kirkland (2010) reported a bison skeleton collected at TICA based on a report from monument cave resource specialist Rod Horrocks (NPS, written communication, 1999).

Zion National Park (ZION)

The geology and paleontology of ZION is consistent with those of the other large NPS units in Utah (ARCH, CANY, CARE, GLCA). The best overall information on ZION fossils was obtained during an inventory conducted by the UGS (DeBlieux et al., 2005). Much of what they found is consistent with many southern Utah NPS units (e.g., ARCH, CANY, GLCA), especially in the fossils of the Chinle Formation and the overlying Early and Middle Jurassic formations at ZION (Figure 43). As in other parks, these units at ZION have produced abundant petrified logs and scrappy vertebrate remains (usually metoposaurs, aetosaurs, and phytosaurs) in the Chinle Formation and footprints across the Moenave (equivalent to the Wingate Sandstone at ARCH, CANY, and GLCA) and Kayenta Formations and the overlying Navajo Sandstone. Vertebrate traces at ZION and other Utah parks include the theropod footprint taxa *Eubrontes* and *Grallator* as well as four-toed footprints that may have been made by small non-mammalian synapsids (Smith and Santucci, 2001; DeBlieux et al., 2006; Mickelson et al., 2006b; Figure 44).

The Late Triassic Chinle Formation at ZION has proven to be fossiliferous, as revealed through the UGS field inventory in 2005. An important discovery during the 2005 UGS survey was a tooth of a herbivorous reptile named *Revueltosaurus* (Heckert et al., 2006). Similarities between the teeth of *Revueltosaurus* and those of ornithischian dinosaurs led paleontologists to classify this animal into that larger group (Hunt and Lucas, 1994). However, with the discovery of more complete specimens in Arizona, *Revueltosaurus* was later found to be a pseudosuchian archosaur closer to crocodylians than to birds and dinosaurs (Parker et al., 2005, 2021; Irmis et al., 2007).

Paleontological work is ongoing at ZION thanks to the efforts of Physical Scientist, Robyn Henderek. In 2023, Henderek hired Scientists-in-the-Parks intern Conner Bennett to help manage collections and con-



NABR BIOSTRATIGRAPHY

Stratigraphic column drawing modified from Lewis et al. (2011).
Colors from Doelling (2007), Biek et al. (2010), and Lewis et al. (2011).
Vertical arrangement of taxa not correlated one-to-one
with precise stratigraphic position.

Figure 38. Biostratigraphic diagram for Natural Bridges National Monument (NABR). Abbreviations: Shina., Shinarump Member, Chinle Formation.

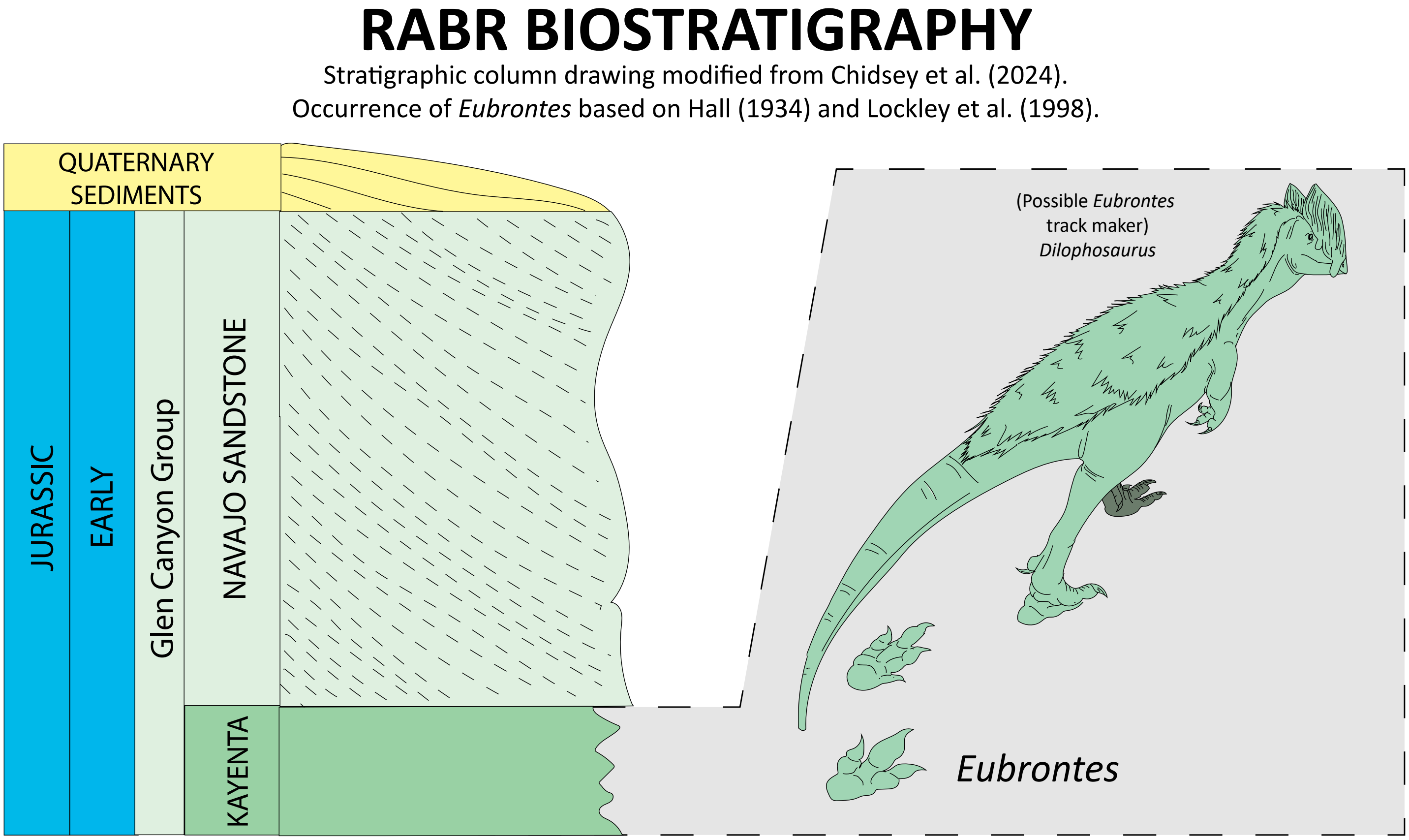


Figure 39. Biostratigraphic diagram for Rainbow Bridge National Monument (RABR). Stratigraphic column for RABR modified from Chidsey et al. (2024).

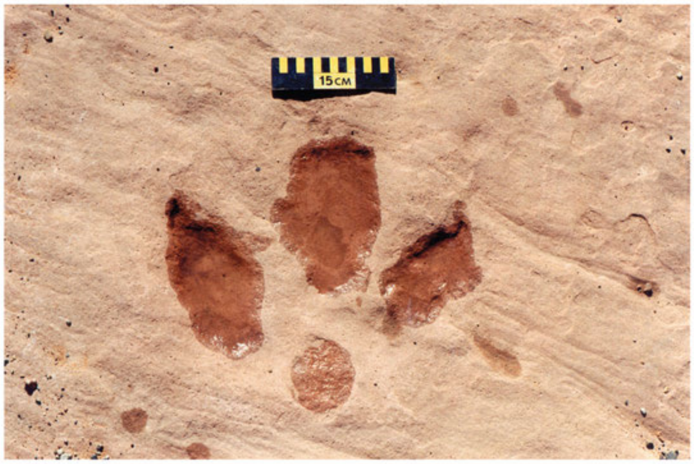


Figure 40. Close-up photograph of a single *Eubrontes* track at RABR, the only fossil thus far documented in the monument (from Chidsey et al., 2010, Figure 5).

duct fieldwork. During his internship, Bennett discovered the first recorded coelacanth specimen from ZION (a disarticulated partial skull) in the Whitmore Point Member of the Moenave Formation. Coelacanths from this geological unit have been recorded elsewhere, especially at SGDS (Milner and Kirkland, 2006; Harris and Milner, 2015). Paleontological outreach efforts are also being conducted at ZION. Bennett and Henderek organized the first National Fossil Day event in the park, and Henderek commissioned paleoartist Brian Engh to decorate the newly installed electric buses at ZION with reconstructions of vertebrates from the Navajo

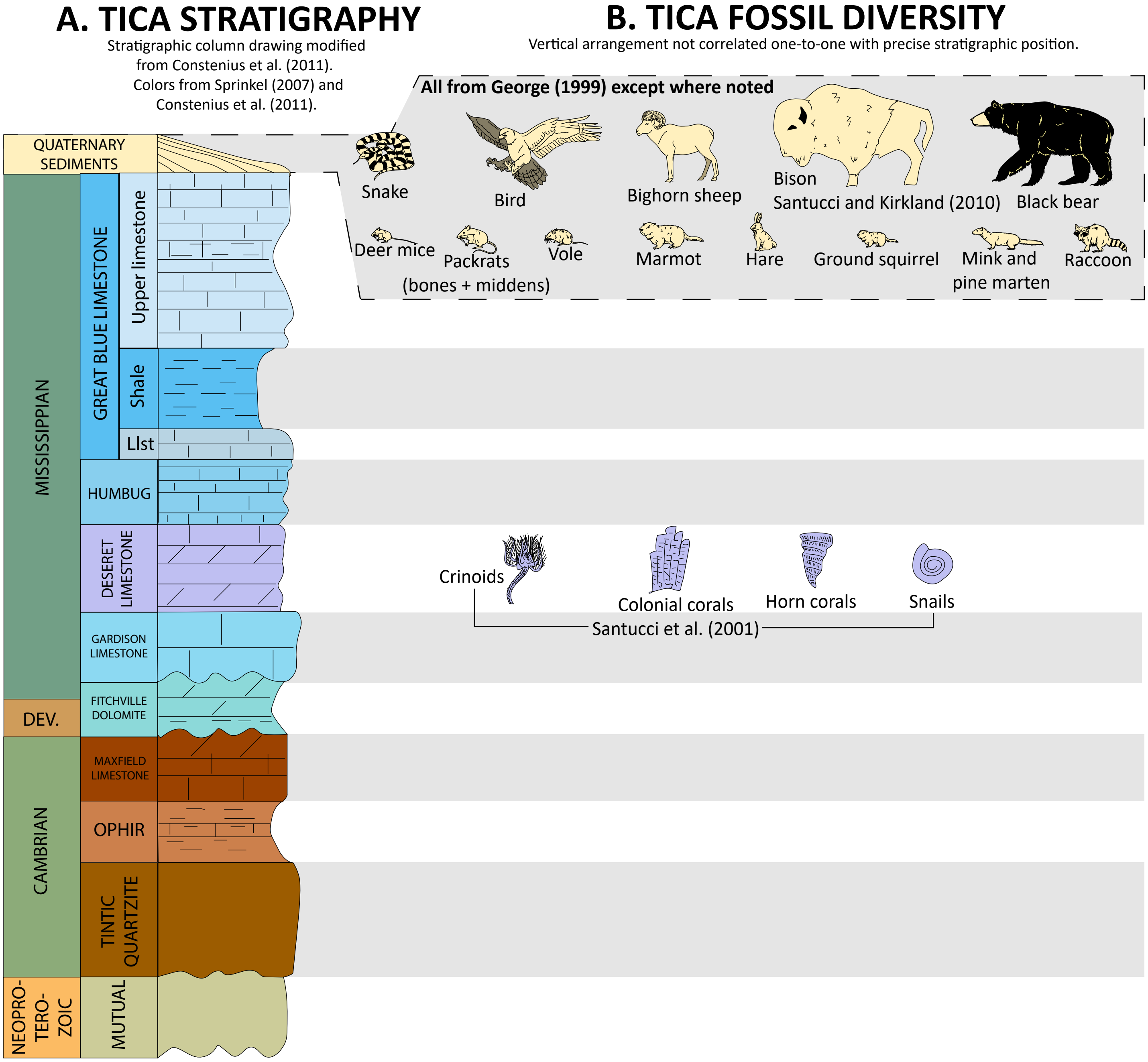


Figure 41. Biostratigraphic diagram for Timpanogos Cave National Monument (TICA). (A) Stratigraphy of TICA, modified from Constenius et al. (2011). (B) Fossil diversity of TICA. Abbreviations: Llst, Lower limestone member, Great Blue Limestone.

Sandstone (Henderek, 2023; Figure 45). Recent collaborative field survey between ZION and the SGDS documented a large scorpion tracksite (cf. *Paleohelcura*) in the Navajo in the park (Milner, SGDS, personal observations). In the summer of 2025, ZION opened a new temporary exhibit on the flora, fauna, and paleoenvironment of the Triassic-Jurassic transition within the park, driven by the research of Celina Suarez (University of Arkansas) and collaboration with SDGS and UGS (NPS, 2025b).

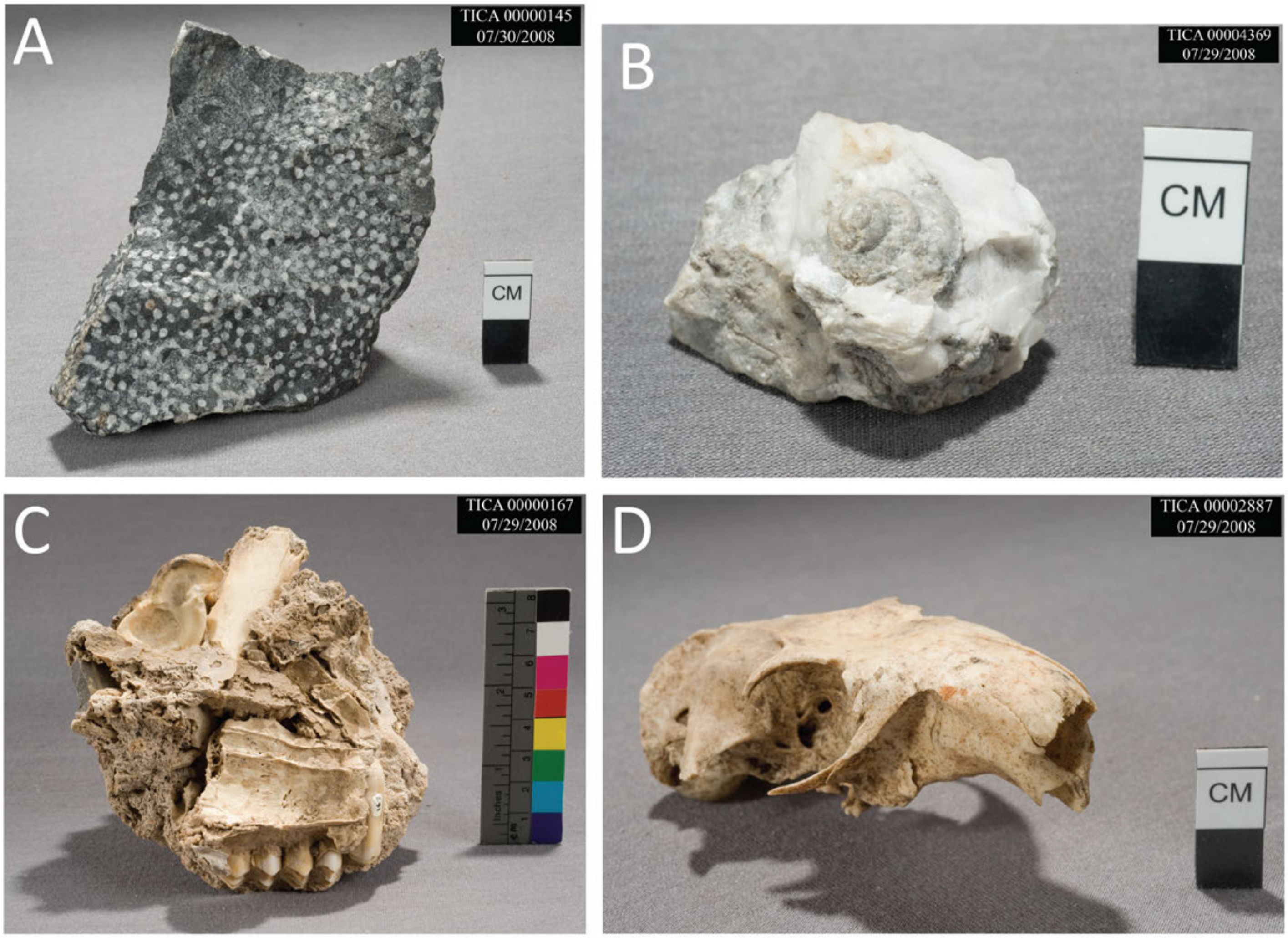


Figure 42. Overview of fossils recovered from TICA. Fossils include (A) coral and (B) gastropod, likely from the Deseret Limestone, and (C) miscellaneous bones and (D) a rodent skull from Quaternary cave deposits at TICA. Photographs courtesy of Camille McKinney, TICA (Tweet et al., 2012k, Figures 4 through 7).

CONCLUSIONS AND FUTURE WORK

The biostratigraphic diagrams for the 13 NPS units in Utah showcase the full extent of the complex geologic history, diverse paleoenvironments, and fossil taxa and ichnotaxa that are preserved in these parks and monuments. Together, these parks and monuments record most of Utah's geologic history, especially in the Paleozoic and Mesozoic Eras. We hope that, by showing all data and work conducted in each park through 2024, these diagrams can serve as a launch board for future research and interpretation. Studies through partnerships like that between the NPS Paleontology Program and the UGS should investigate the gaps in knowledge for Utah's geological record. The NPS areas of Utah provide opportunities for this work because most preserve fossiliferous strata with high potential to reveal insights into key intervals of deep time. Examples of these types of studies are already underway, with the recent discovery of new fossil localities in the Chinle Formation, Wingate Sandstone, Kayenta Formation, and Navajo Sandstone at GLCA (Milner et al., 2024), the Moenkopi and Chinle Formations at CANY (DeBlieux et al., 2021, 2023, 2024), and in the Late Cretaceous and Paleogene strata at BRCA (Tran et al., 2024). These projects are sig-

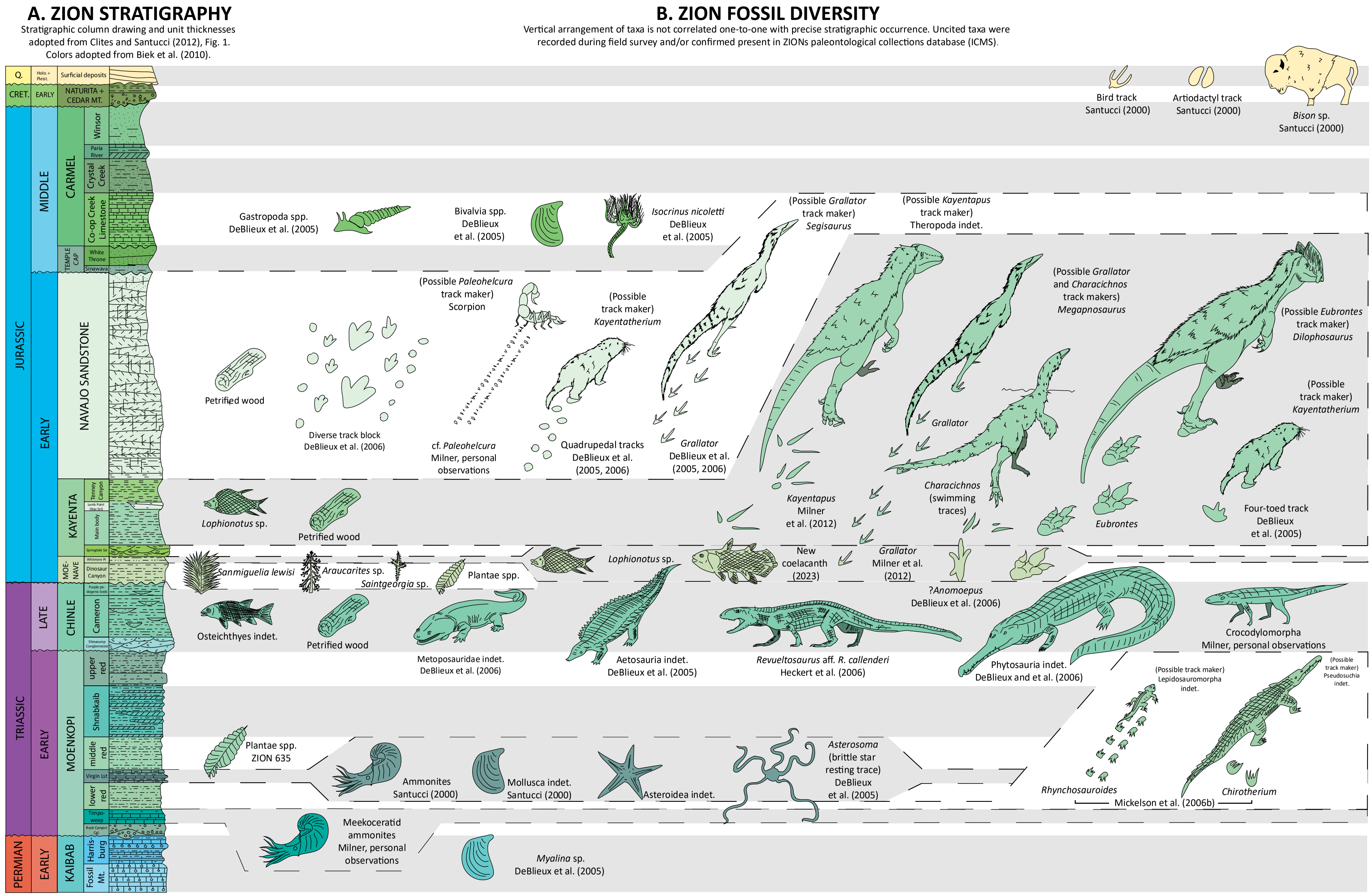


Figure 43. Biostratigraphic diagram for Zion National Park (ZION). (A) Stratigraphy of ZION, modified from Biek et al. (2003, 2010). (B) Fossil diversity of ZION. Abbreviations: (geologic time) CRET., Cretaceous; Holo., Holocene; Pleist., Pleistocene; Q., Quaternary sediments; (geology) Cgl., conglomerate; Lst, limestone; Sst, sandstone; Nav Sst, Navajo Sandstone; Mt., mountain; Pt., point.

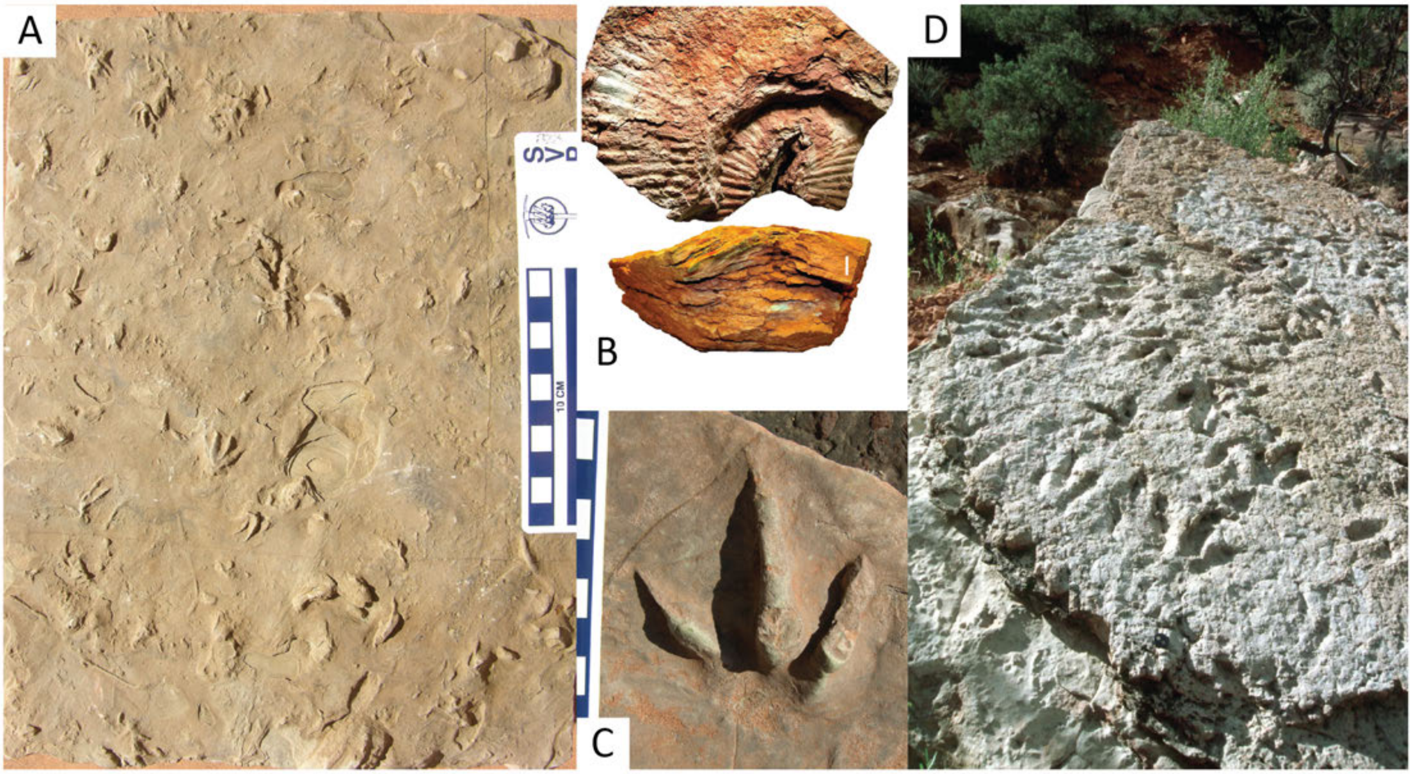


Figure 44. Key fossils from the Triassic–Jurassic of Zion National Park (ZION). (A) A swim track block from the Moenkopi Formation in the Kolob Canyon area; (B) specimen of *Sanmiguelia lewisi* from the uppermost Whitmore Point Member, Moenave Formation (modified from Ash et al., 2014); (C) tridactyl theropod track (DeBlieux et al., 2006); and (D) *Eubrontes* at the Subway Tracksite in the Kayenta Formation (DeBlieux et al., 2006). Photographs A through C courtesy of Andrew Milner; photograph D courtesy of Don DeBlieux).

nificant because they both aid in identifying and managing the resource and they contribute to the overall knowledge of the paleoenvironments and biodiversity recorded in regionally significant geologic formations. The results of these and future research projects may be made more accessible through expanded interpretation and outreach programming.

It is important to reiterate that it is the duty of the NPS and the Department of Interior to preserve, research, and conduct outreach on its paleontological resources for the enjoyment and education of future generations of the public. This is mandated through multiple laws, regulations, and policies, especially the Organic Act of 1916 (64th Congress, 1916), the Paleontological Resources Preservation Act of 2009 (PRPA; 111th Congress, 2009), and NPS Management Policies (2006, Section 4.8.2.1). Ongoing collaboration between the NPS (the NPS Paleontology Program and staff at individual parks) and outside organizations (the UGS, the SDGS, and other researchers) has been vital to fulfilling this responsibility, as exemplified through the inventories, research, and outreach discussed throughout this document. This cooperation ensures that the public continues to benefit scientifically and educationally from the paleontological resources already discussed and yet to be discovered within these iconic and scenic landscapes.

This document is not the intended final iteration of this project. We encourage individual parks, NPS regional offices, and cooperating partner organizations to incorporate the included visuals into easily accessible and engaging interpretive materials such as interactive

Figure 45. ZION's fleet of electric buses adorned with reconstructions of the Navajo Sandstone and its faunas by paleoartist Brian Engh. Modified from Henderek (2023).

and comparative website map applications. Such products would serve as an educational and scientific tool to help the public, NPS staff, and researchers quickly and easily understand the temporal and taxonomic diversity of paleontological resources thus far documented in the national parks and monuments of Utah.

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We would like to thank paleoartist Benji Paysnoe of CAMBEN Creatives LLC for illustrating the cover art for this document. Thank you for bringing our concept to life, combining the parks' temporal and taxonomic diversity with their iconic modern features.

Finally, we extend our appreciation to the countless current and former interns, staff, volunteers, researchers, and partners who have contributed to the preservation of and education on paleontological resources in Utah's NPS areas. This work would not have been possible without the foundation of data, stewardship, and outreach produced by these dedicated individuals.

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APPENDIX

TAXONOMIC LIST OF FOSSILS IN THE NATIONAL PARK SERVICE AREAS IN UTAH

Background

Although the diagrams are comprehensive in biostratigraphic extent, they do not completely capture the full taxonomic diversity that has been recorded within the NPS areas in Utah. For example, Eaton (2013) figured and described numerous multituberculates and other mammals to the genus level within the Straight Cliffs and Wahweap Formations at BRCA. However, these genera are summarized visually as a singular mammal individual (except *Dakotamys shakespeari,* Eaton, 2013) in Figure 17. This approach of depicting multiple taxa with a single representative individual was used across all diagrams to mitigate visual noise and promote the ease of comprehension. In order to ensure completeness of data, we include this appendix of all known fossil taxa and associated references from the NPS areas in Utah, listed by park and geologic formation. This appendix is modeled after the taxonomic list of Titus et al. (2016). Type species originally described from fossils first documented in these parks are indicated with asterisks (*). Because these are based on the literature, some taxonomy and identifications are inevitably outdated.

Arches National Park (ARCH)

Paradox Formation, Pennsylvanian (ARCH)
Anthozoa
    Rugosa
        Gen. et sp. indet. (*in* Swanson et al., 2005)
Bryozoa
        Gen. et sp. indet. (*in* Swanson et al., 2005)
Brachiopoda
    Productida
        Gen. et sp. indet. (*in* Swanson et al., 2005)
Echinodermata
    Crinoidea
        Gen. et sp. indet. (*in* Swanson et al., 2005)
Arthropoda
    Trilobita
        Gen. et sp. indet. (*in* Swanson et al., 2005)

Moenkopi Formation, Early Triassic (ARCH)
Pseudosuchia
        Chirotherium isp. (*in* Madsen et al., 2012)

Church Rock Member, Chinle Formation, Late Triassic (ARCH)
Plantae
    Sanmiguelia sp. (*in* Madsen et al., 2012)
    Gen. et sp. indet. (*in* Madsen et al., 2012)
Amphibia

- Metoposauridae
  - Gen. et sp. indet. (*in* Madsen et al., 2012)

Pseudosuchia
- Aetosauria
  - cf. *Typothorax* sp. (*in* Martz and Kirkland, unpublished field notes)
- Phytosauria
  - Gen. et sp. indet. (*in* Madsen et al., 2012)

Wingate Sandstone, Late Triassic–Early Jurassic (ARCH)

Pseudosuchia
- Phytosauria
  - Gen. et sp. indet. (*in* Madsen et al., 2012)

Dinosauria
  - *Grallator* isp. (*in* Madsen et al., 2012)
  - Gen. et sp. indet. (*in* Madsen et al., 2012)

Kayenta Formation, Early Jurassic (ARCH)

Dinosauria
- Theropoda
  - Gen. et sp. indet. (*in* Marsh et al., 2024)
  - Theropod tracks (*in* Madsen et al., 2012)

Navajo Sandstone, Early Jurassic (ARCH)

Theropoda
- *Grallator* isp. (*in* Madsen et al., 2012)

Curtis Formation, Late Jurassic (ARCH)

Theropoda
- cf. *Megalobrontes* isp. (*in* Britt, 1996)

Salt Wash Member, Morrison Formation, Late Jurassic (ARCH)

Plantae
- Gen. et sp. indet. (*in* Britt, 1996)

Mollusca
- Bivalvia
  - Unionidae
    - Gen. et sp. indet. (*in* Britt, 1996)

Dinosauria
- Theropoda
  - Gen. et sp. indet. (*in* Britt, 1996)

Brushy Basin Member, Morrison Formation, Late Jurassic (ARCH)

Plantae
- Gen. et sp. indet. (*in* Swanson et al., 2005)

Dinosauria
- Ornithischia
  - Ankylosauria
    - Gen. et sp. indet. (*in* Swanson et al., 2005)

- Saurischia
  - Sauropoda
    - *Apatosaurus* sp. (*in* Swanson et al., 2005; Madsen et al., 2012)

Yellow Cat Member, Cedar Mountain Formation, Early Cretaceous (ARCH)

- Plantae
  - Gen. et sp. indet. (*in* Madsen et al., 2012)
- Dinosauria
  - Saurischia
    - Sauropoda
      - Gen. et sp. indet. (*in* Madsen et al., 2012)

Poison Strip Member, Cedar Mountain Formation, Early Cretaceous (ARCH)

- Plantae
  - Gen. et sp. indet. (*in* Madsen et al., 2012)

Ruby Ranch Member, Cedar Mountain Formation, Early Cretaceous (ARCH)

- Dinosauria
  - Saurischia
    - Sauropoda
      - cf. *Brontopodus* isp. (*in* Madsen et al., 2012)
    - Theropoda
      - Ornithomimosauria
        - Gen. et sp. indet. (*in* Madsen et al., 2012)
      - Deinonychosauria
        - Gen. et sp. indet. (*in* Madsen et al., 2012)
  - Ornithischia
    - Ornithopoda
      - Gen. et sp. indet. (*in* Madsen et al., 2012)
    - Ankylosauria
      - Gen. et sp. indet. (*in* Madsen et al., 2012)

Tununk Shale, Mancos Group, Late Cretaceous (ARCH)

- Mollusca
  - Bivalvia
    - *Pycnodonte newberryi umbonata* (*in* Madsen et al., 2012)

Blue Gate Shale, Mancos Group, Late Cretaceous (ARCH)

- Mollusca
  - Bivalvia
    - *Platyceramus cycloides* (*in* Madsen et al., 2012)
    - *Pseudoperna congesta* (*in* Madsen et al., 2012)

Eocene (Reworked) (ARCH)

- Mollusca
  - Bivalvia
    - *Plesielliptio* sp. (*in* Oviatt, 1988)
    - Gen. et sp. indet. (*in* Oviatt, 1988)

- Gastropoda
  - *Biomphalaria* sp. (*in* Oviatt, 1988)
  - cf. *Biomphalaria* sp. (*in* Oviatt, 1988)
  - *Drepanotrema*? sp. (*in* Oviatt, 1988)
  - *Goniobasis tenera* (*in* Oviatt, 1988)
  - *Goniobasis* cf. *G. tenera* (*in* Oviatt, 1988)
  - *Physa* sp. (*in* Oviatt, 1988)
  - Planorbidae gen. et sp. indet. (*in* Oviatt, 1988)

Quaternary Sediments (ARCH)

- Plantae
  - Rhizoliths (*in* Oviatt, 1988)
  - Polypodiophyta
    - Equisetales
      - *Equisetum* sp. (*in* Nittmann, 1993)
  - Gymnospermae
    - Cupressaceae
      - *Juniperus osteosperma* (*in* Sharpe, 1991; Smith and Betancourt, 1998)
      - *Juniperus* sp. (*in* Nittmann, 1993)
    - Pinaceae
      - *Picea pungens* (*in* Smith and Betancourt, 1998)
      - *Pinus edulis* (*in* Smith and Betancourt, 1998)
      - *Pinus flexilis* (*in* Sharpe, 1991)
      - cf. *Pinus* sp. (*in* Sharpe, 1991)
      - *Pseudotsuga menziesii* (*in* Sharpe, 1991; Smith and Betancourt, 1998)
  - Angiospermae
    - Nyctaginaceae
      - *Abronia* sp. (*in* Sharpe, 1991)
    - Rosaceae
      - *Amelanchier utahensis* (*in* Sharpe, 1991)
      - *Cercocarpus* cf. *C. montanus* (*in* Sharpe, 1991)
      - *Coleogyne ramosissima* (*in* Sharpe, 1991)
      - cf. *Rosa* sp. (*in* Sharpe, 1991)
    - Boraginaceae
      - *Amsinckia* sp./*Cryptantha* sp. (*in* Sharpe, 1991)
      - *Cryptantha* cf. *C. cinerea* (*in* Sharpe, 1991)
      - cf. *Cryptantha* sp. (*in* Sharpe, 1991)
      - *Lithospermum* cf. *L. incisum* (*in* Sharpe, 1991)
      - *Tiquilia* sp. (*in* Sharpe, 1991)
      - Gen. et sp. indet. (*in* Sharpe, 1991)
    - Papaveraceae
      - *Argemone* sp. (*in* Sharpe, 1991)
    - Asteraceae
      - *Artemisia* sp. (*in* Sharpe, 1991)
      - *Artemisia* sp./*Chrysothamnus* sp. (*in* Sharpe, 1991)
      - cf. *Chrysopsis* sp. (*in* Sharpe, 1991)
      - *Chrysothamnus* sp. (*in* Sharpe, 1991)
      - cf. *Chrysothamnus* sp. (*in* Sharpe, 1991)

- *Cirsium* sp. (*in* Sharpe, 1991)
- cf. *Cirsium* sp. (*in* Sharpe, 1991)
- *Gutierrezia* cf. *G. microcephala* (*in* Sharpe, 1991)
- *Gutierrezia* cf. *G. sarothrae* (*in* Sharpe, 1991)
- *Gutierrezia* sp. (*in* Sharpe, 1991)
- Gen. et sp. indet. (*in* Sharpe, 1991)

Fabaceae
- *Astragalus* sp. (*in* Sharpe, 1991)
- Gen. et sp. indet. (*in* Sharpe, 1991)

Amaranthaceae
- *Atriplex* sp. (*in* Sharpe, 1991)
- *Chenopodium* sp. (*in* Sharpe, 1991)
- *Krashcheninnikovia lanata*/*Ceratoides lanata* (*in* Sharpe, 1991)
- Cheno-Am pollen (*in* Nittmann, 1993)
- Chenopodiaceae gen. et sp. indet. (*in* Sharpe, 1991)

Poaceae
- *Bouteloua* sp. (*in* Sharpe, 1991)
- *Heteropogon* sp. (*in* Sharpe, 1991)
- *Stipa hymenoides* (*in* Sharpe, 1991)
- Gen. et sp. indet. (*in* Sharpe, 1991)

Cyperaceae
- *Carex* sp. (*in* Nittmann, 1993)

Santalaceae
- *Comandra umbellata* (*in* Sharpe, 1991)

Cornaceae
- *Cornus sericea* (*in* Sharpe, 1991)

Brassicaceae
- *Dithyrea wislizenii* (*in* Sharpe, 1991)
- *Dyssodia acerosa* (*in* Sharpe, 1991)
- *Lepidium* sp. (*in* Sharpe, 1991)

Oleaceae
- cf. *Fraxinus anomala* (*in* Sharpe, 1991)

Loasaceae
- *Mentzelia* sp. (*in* Sharpe, 1991)

Cactaceae
- *Opuntia polyacantha* (*in* Sharpe, 1991)
- *Opuntia* sp. (*in* Sharpe, 1991; Nittmann, 1993)
- Gen. et sp. indet. (*in* Sharpe, 1991)

Apiaceae
- *Osmorhiza depauperata* (*in* Sharpe, 1991)

Salicaceae
- *Populus* sp. (*in* Sharpe, 1991)

Anacardiaceae
- *Rhus aromatica* (*in* Sharpe, 1991)
- *Rhus trilobata* (*in* Smith and Betancourt, 1998)

Grossulariaceae
- *Ribes montigenum* (*in* Sharpe, 1991)

Malvaceae

      - *Sphaeralcea* sp. (*in* Sharpe, 1991)
    - Asparagaceae
      - *Yucca* cf. *Y. angustissima* (*in* Sharpe, 1991)
      - *Yucca* sp. (*in* Sharpe, 1991)
    - Polemoniaceae
      - Gen. et sp. indet. (*in* Sharpe, 1991)
- Mollusca
  - Bivalvia
    - *Pisidium* cf. *P. variable* (*in* Nittmann, 1993)
    - *Pisidium* cf. *P. walkeri* (*in* Nittmann, 1993)
    - *Pisidium* sp. (*in* Nittmann, 1993)
  - Gastropoda
    - *Deroceras laeve* (*in* Nittmann, 1993)
    - *Discus whitneyi* (formerly *D. cronkhitei*) (*in* Nittmann, 1993)
    - *Euconulus fulvus* (*in* Nittmann, 1993)
    - *Galba bulimoides* (formerly *Fossaria* (*Bakerilymnaea*) *bulimoides*) (*in* Nittmann, 1993)
    - *Galba dalli* (formerly *Fossaria* (*Bakerilymnaea*) *dalli* (*in* Nittmann, 1993)
    - *Galba* cf. *G. obrussa* (formerly *Fossaria obrussa*) (*in* Nittmann, 1993)
    - *Galba* sp. (formerly *Fossaria* sp.) (*in* Nittmann, 1993)
    - *Gastrocopta pellucida* (*in* Nittmann, 1993)
    - *Gastrocopta* sp. (*in* Nittmann, 1993)
    - *Hawaiia miniscula* (*in* Nittmann, 1993)
    - *Nesovitrea hammonis electrina* (*in* Nittmann, 1993)
    - *Oxyloma* sp. (*in* Nittmann, 1993)
    - *Physella* sp. (*in* Nittmann, 1993)
    - *Pupilla blandi* (*in* Nittmann, 1993)
    - *Pupilla muscorum* (*in* Nittmann, 1993)
    - *Pupilla* sp. (*in* Nittmann, 1993)
    - *Pupoides hordaceous* (*in* Nittmann, 1993)
    - *Vallonia* cf. *V. gracilicosta* (*in* Nittmann, 1993)
    - *Vallonia cyclophorella* (*in* Nittmann, 1993)
    - *Vallonia* sp. (*in* Nittmann, 1993)
    - cf. *Zonitoides arboreus* (*in* Nittmann, 1993)
    - Succineidae gen. et sp. *in*det. (in Nittmann, 1993)
    - Gen. et sp. indet. (*in* Madsen et al., 2012)
  - Arthropoda
    - Ostracoda
      - Gen. et sp. indet. (*in* Oviatt, 1988; Nittmann, 1993)
- Reptilia
      - Gen. et sp. indet. (*in* Sharpe, 1991; Nittmann, 1993)
- Aves
      - Gen. et sp. indet. (*in* Nittmann, 1993)
- Mammalia
      - Gen. et sp. indet. (*in* Nittmann, 1993)
  - Rodentia
      - *Neotoma* sp. middens (*in* Tweet et al., 2012a)
  - Proboscidea
      - *Mammuthus columbi* (*in* Santucci et al., 2001; Swanson et al., 2005)

- Artiodactyla
    - *Bison bison* (*in* Mead et al., 1991)
    - *Ovis canadensis* (*in* Mead et al., 1991)
- Diatomista
    - Gen. et sp. indet. (*in* Oviatt, 1988)

Bryce Canyon National Park (BRCA)

Naturita Formation (Dakota Formation in older references), Late Cretaceous (BRCA)

- Mollusca
    - Bivalvia
        - cf. *Exogyra* sp. (*in* this paper)

Tropic Shale, Late Cretaceous (BRCA)

- Mollusca
    - Cephalopoda
        - Ammonoidea
            - *Allocrioceras annulatum* (*in* Cobban, 1996)
            - *Baculites gracilis* (*in* Reeside, 1937)
            - *Baculites yokoyamai* (*in* Cobban, 1996)
            - *Baculites* sp. (*in* Tran et al., 2024)
            - *Burroceras irregulare* (*in* Cobban, 1996)
            - *Collignoniceras woollgari* (*in* Tran et al., 2024)
            - *Euomphaloceras septemseriatum* (*in* Cobban, 1996)
            - *Mammites nodosoides* (*in* Cobban, 1996)
            - *Metoicoceras geslisianum* (*in* Cobban, 1996)
            - *Prionocyclus hyatti* (*in* Cobban, 1996)
            - *Sciponoceras gracile* (*in* Cobban, 1996)
    - Bivalvia
        - *Anomia* sp. (*in* Reeside, 1939)
        - *Corbicula* (*Cyrena*) *securis* (*in* Reeside, 1939)
        - *Corbicula* (*Cyrena*) *sequilateralis* (*in* Reeside, 1939)
        - *Exogyra columbella* (*in* Reeside, 1939)
        - *Inoceramus pictus* (*in* Cobban, 1996)
        - *Inoceramus* sp. (*in* Cobban, 1996)
        - *Ostrea prudentia* (*in* Reeside, 1937)
        - *Ostrea soleniscus* (*in* Reeside, 1939)
        - *Parvilucina juvensis* (formerly *Nymphalucina juvensis*) (*in* Cobban, 1996)
        - *Phelopteria* sp. (*in* Tran et al., 2024)
        - *Psilomya meeki* (*in* Cobban, 1996)
        - *Pycnodonte newberryi* (*in* Cobban. 1996)
        - *Volsella* sp. (*in* Reeside, 1939)
    - Gastropoda
        - *Euspira* sp. (*in* Cobban, 1996)
        - *Neritina bellulata* (*in* Reeside, 1937)
        - *Neritina incompta* (*in* Cobban, 1996)
        - *Perissoptera prolabiata* (*in* Cobban, 1996)

    - *Turritella whitei* (*in* Cobban, 1996)
    - *Viviparus* sp. (*in* Cobban, 1996)
- Testudines
  - Protostegidae
    - Gen. et sp. indet. (this paper)

Smoky Hollow Member, Straight Cliffs Formation, Late Cretaceous (BRCA)

- Plantae
  - Angiospermae
    - Gen. et sp. indet. (*in* Tran et al., 2024)
- Mollusca
  - Bivalvia
    - Gen. et sp. indet. (*in* Tran et al., 2024)
  - Gastropoda
    - *Admetopsis* spp. (*in* Hoffman, 2005)
- Actinopterygii
  - Lepisosteiformes
    - *Lepisosteus* sp. (*in* Tran et al., 2024)
- Crocodylomorpha
    - Gen. et sp. indet. (*in* Tran et al., 2024)
- Dinosauria
  - Hadrosauromorpha
    - Gen. et sp. indet. (*in* Santucci and Kirkland, 2010; Tran et al., 2024)
  - Theropoda
    - Gen. et sp. indet. (*in* Tran et al., 2024)
- Testudines
    - Gen. et sp. indet. (*in* Tran et al., 2024)

John Henry Member, Straight Cliffs Formation, Late Cretaceous (BRCA)

- Plantae
  - Angiospermae
    - cf. *Cercidiphyllum* sp. (*in* Tran et al., 2024)
    - cf. *Saliciphyllum* sp. (*in* Tran et al., 2024)
    - Menispermaceae indet. (*in* Tran et al., 2024)
- Mollusca
  - Bivalvia
    - *Corbula* sp. (*in* Tran et al., 2024)
  - Gastropoda
    - Gen. et sp. indet. (*in* Tran et al., 2024)
- Elasmobranchii
  - *Brachyrhizodus* sp. (*in* Williamson et al., 2011)
- Actinopterygii
  - Teleostei
        - Gen. et sp. indet. type O (*in* Brinkman et al., 2013)
    - Acanthomorpha
        - Gen. et sp. indet. (*in* Brinkman et al., 2013)

    - Hiodontidae
            - Gen. et sp. indet. (*in* Brinkman et al., 2013)
  - Lepisosteiformes
            - *Lepisosteus* sp. (*in* Brinkman et al., 2013)
  - Ostariophysi
    - Otophysi
            - Gen. et sp. indet. (*in* Brinkman et al., 2013)
  - Pycnodontiformes
    - *Micropycnodon* sp. (*in* Brinkman et al., 2013)
    - *Paralbula* sp. (*in* Brinkman et al., 2013)
- Amphibia
  - Allocaudata
    - Albanerpedontidae
      - Gen. et sp. indet. (*in* Gardner and DeMar, 2013)
      - cf. *Albanerpeton nexuosum* (*in* Gardner and DeMar, 2013)
  - Anura
      - *Scotiophryne pustulosa* (*in* Roček et al., 2010, 2013; Gardner and Demar, 2013)
  - Urodela
    - Batrachosauroididae
      - *Opisthotriton* sp. (*in* Gardner et al., 2013)
    - Family incertae sedis
      - Gen. et sp. nov. (*in* Gardner et al., 2013)
    - Scapherpedontidae
      - *Scapherpeton* sp. (*in* Gardner et al., 2013)
    - Sirenidae
      - *Habrosaurus* sp. (*in* Gardner et al., 2013)
      - Gen. et sp. indet. (*in* Roček et al., 2010; Gardner and DeMar, 2013)
- Crocodylomorpha
      - Gen. et sp. indet. (*in* Tran et al., 2024)
  - Eusuchia
      - Gen. et sp. indet. (*in* Irmis et al., 2013)
  - Mesoeucrocodylia
      - Gen. et sp. indet. (*in* Irmis et al., 2013)
  - Neosuchia
      - Gen. et sp. indet. (*in* Irmis et al., 2013)
  - Unnamed clade of Atoposauridae + Eusuchia
      - Gen. et sp. indet. (*in* Irmis et al., 2013)
- Dinosauria
  - Hadrosauromorpha
    - Gen. et sp. indet. (*in* Santucci and Kirkland, 2010; Gates et al., 2013; Tran et al., 2024)
  - Theropoda
    - Dromaeosauridae
      - Gen. et sp. indet. (*in* Tran et al., 2024)
    - Ornithomimosauria
      - Gen. et sp. indet. (*in* this paper)
    - Tyrannosauroidea
      - Gen. et sp. indet. (*in* this paper)
- Testudines

- *Adocus* sp. (*in* Tran et al., 2024)
- *Aspideretoides* sp. (*in* Tran et al., 2024)

Baenidae
- *Neurankylus* sp. (*in* Tran et al., 2024)
- *Naomichelys* sp. (*in* Eaton, 1999)
- Gen. et sp. indet. (*in* Tran et al., 2024)

Trionychidae
- Gen. et sp. indet. (*in* Tran et al., 2024)

Squamata
- Autarchoglossa
  - Morphotype D (*in* Nydam, 2013)
- Ophidia
  - *Coniophis* sp. (*in* Nydam, 2013)
- Platynota
  - cf. *Colpodontosaurus* sp. (*in* Nydam, 2013)
  - Morphotype B (*in* Nydam, 2013)
  - Morphotype C (*in* Nydam, 2013)
- Scincomorpha
  - *Monocnemodon syphakos** (*in* Nydam, 2013)
  - Gen. et sp. indet. (*in* Nydam, 2013)

Mammalia
- Multituberculata
  - Cimolodontidae
    - *Cedaromys* sp. cf. *C. hutchisoni* (*in* Eaton, 2013)
    - *Cimolodon similis* (*in* Eaton, 2013)
    - *Cimolodon* sp. cf. *C. foxi* (*in* Eaton, 2013)
    - *Cimolodon* sp. cf. *C. similis* (*in* Eaton, 2013)
  - Cimolomyidae
    - *Cimolomys* sp. B (*in* Eaton, 2002, 2013)
    - ?*Cimolomys* sp. A (*in* Eaton, 2013)
  - Neoplagiaulacidae
    - *Mesodma* sp. (*in* Eaton, 2013)
    - *Mesodma* sp. cf. *M. minor* (*in* Eaton, 2013)
- Marsupalia
  - "Didelphomorpha"
    - *Apistodon* sp. cf. *A. exiguus* (*in* Eaton, 2013)
    - Gen. et sp. indet. (*in* Eaton, 2013)
  - "Alphadontidae"
    - ?*Varalphadon* sp. (*in* Eaton, 2013)
  - Didelphidae
    - Gen. et sp. indet. (*in* Eaton, 2013)
  - Stagodontidae
    - *Eodelphis* sp. (*in* Eaton, 2013)
  - Pediomydiae
    - ?*Leptalestes* sp. (*in* Eaton, 2013)
    - Gen. et sp. indet. (*in* Eaton, 2013)
- Triconodonta
  - cf. *Alticonodon* sp. (*in* Eaton, 2013)

    Gen. et sp. indet. (*in* Eaton, 2013)
  Trechnotheria
    ?*Spalacotheridium* sp. (*in* Eaton, 2013)
    Symmetrodontoides sp. (*in* Eaton, 2013)

Drip Tank Member, Straight Cliffs Formation, Late Cretaceous (BRCA)

Crocodylomorpha
  Gen. et sp. indet. (*in* Tran et al., 2024)
Dinosauria
  Hadrosauromorpha
    Gen. et sp. indet. (*in* Gates et al., 2013; Tran et al., 2024)

Wahweap Formation, Late Cretaceous (BRCA)

Plantae
  Angiospermae
    cf. *Sabalites* (*in* Tran et al., 2024)
Arthropoda
  Crustacea
    Ostracoda
        Gen. et sp. indet. (*in* Meyers and Knauss, 2021)
    Xanthidae
        Gen. et sp. indet. (*in* Milner, written communications)
    Paguiroidea
        Gen. et sp. indet. (*in* Milner, written communications)
Mollusca
  Bivalvia
    Gen et sp. indet. (*in* Tran et al., 2024)
  Gastropoda
    Physa sp. (*in* Tran et al., 2024)
    Reesidella sp. (*in* Tran et al., 2024)
    Viviparus sp. (*in* Tran et al., 2024)
Elasmobranchii
  Chiloscyllium missouriense (*in* Kirkland et al., 2013)
  *Columbusia deblieuxi** (*in* Kirkland et al., 2013)
  Cristomylus cifellii (*in* Kirkland et al., 2013)
  Lonchidion sp. (*in* Kirkland et al., 2013)
  *Texatrygon brycensis** (*in* Kirkland et al., 2013)
Actinopterygii
    Amiidae
        Amia sp. (*in* Tran et al., 2013)
  Lepisosteiformes
        Lepidotes sp. (*in* Brinkman et al., 2013)
        Lepisosteus sp. (*in* Brinkman et al., 2013)
  Otophysi
        Gen. et sp. indet. (*in* Brinkman et al., 2013)
  Pycnodontiformes
        Micropycnodon sp. (*in* Brinkman et al., 2013)
        Paralbula sp. (*in* Brinkman et al., 2013)

  - Teleostei
    - Acanthomorpha
      - Gen. et sp. indet. (*in* Brinkman et al., 2013)
- Amphibia
  - Allocaudata
    - Albanerpedontidae
      - Gen. et sp. indet. (*in* Gardner and DeMar, 2013)
  - Anura
      - *Scotiophryne pustulosa* (*in* Roček et al., 2010, 2013; Gardner and Demar, 2013)
      - Morphotype 1 (*in* Roček et al., 2013; Gardner et al., 2016)
    - Family incertae sedis
      - *Nezpercius dodsoni* (*in* Gardner and DeMar, 2013)
  - Urodela
    - Scapherpedontidae
      - *Scapherpeton tectum* (*in* Gardner and DeMar, 2013)
      - *Scapherpeton* sp. (*in* Gardner and DeMar, 2013)
- Crocodylomorpha
      - Gen. et sp. indet. (*in* Tran et al., 2024)
- Dinosauria
  - Ankylosauridae
      - Gen et sp. indet. (*in* Eaton et al., 1998)
  - Hadrosauridae
      - Gen. et sp. indet. (*in* Tran et al., 2024)
      - Hadrosaurid pes tracks (*in* Tran et al., 2024)
  - Theropoda
      - Gen. et sp. indet (*in* Eaton et al., 1998)
  - Ceratopsidae
      - Gen. et sp. indet. (*in* Eaton et al., 1998; Tran et al., 2024)
- Testudines
  - Adocidae
    - *Adocus* sp. (*in* Meyers and Knauss, 2021)
  - Baenidae
    - Gen. et sp. indet. (*in* Tran et al., 2024)
    - *Neurankylus* sp. (*in* Tran et al., 2024)
  - Chelydridae
    - Gen. et sp. indet. (*in* Tran et al., 2024)
    - *Compsemys* sp. (*in* Eaton et al., 1998)
    - *Bothremys* sp. (*in* Tran et al., 2024)
    - *Naomichelys* sp. (*in* Tran et al., 2024)
  - Trionychidae
    - Gen. et sp. indet. (*in* Tran et al., 2024)
    - *Aspideretoides* sp. (*in* Tran et al., 2024)
- Squamata
    - *Chamops segnis* (*in* Eaton et al., 1998)
    - *Contogenys* sp. (*in* Eaton et al., 1998)
- Mammalia
  - Multituberculata
    - Cimolodonta

    - Family incertae sedis
      - ?*Paracimexomys* sp. (*in* Eaton, 2013)
    - Cimolodontidae
      - *Cedaromys* sp. cf. *C. hutchisoni* (*in* Eaton, 2013)
  - Cimolomyidae
    - *Cimolomys* sp. (*in* Eaton, 2013)
  - Family incertae sedis
    - *Dakotamys shakespeari** (*in* Eaton, 2013; originally referred to the John Henry Member, Straight Cliffs Formation)
- Neoplagiaulacidae
    - *Mesodma* sp. cf. *M. formosa* (*in* Eaton, 2013)
    - *Mesodma* sp. cf. *M. minor* (*in* Eaton, 2013)
- Marsupalia
  - Pediomydiae
    - Gen. et sp. indet. (*in* Eaton, 2013)
    - *Varalphadon* sp. cf. *V. creber* (*in* Eaton, 2013)

Pink Member, Claron Formation, Paleogene (BRCA)

- Arthropoda
  - Insecta
    - Hymenoptera
      - *Celliforma* isp. (*in* Davis et al., 2015; Tran et al., 2024)
    - Coleoptera
      - *Eatonichnus claronensis* (*in* Davis et al., 2015; Tran et al., 2024)
      - *Eatonichnus utahensis* (*in* Davis et al., 2015; Tran et al., 2024)
      - *Parowanichnus* isp. (*in* Davis et al., 2015; Tran et al., 2024)
- Angiospermae
    - *Celtis* sp. (*in* Tran et al., 2024)
    - Gen. et sp. indet. (*in* Tran et al., 2024)
- Mollusca
  - Bivalvia
    - Unionidae indet.
  - Gastropoda (*in* Tran et al., 2024)
    - *Physa pleromatis* (*in* Tran et al., 2024)
    - cf. *Physa* sp. (*in* Tran et al., 2024)
    - cf. *Viviparus* sp. (*in* Tran et al., 2024)
- Actinopterygii
  - Lepisosteiformes
      - *Lepisosteus* sp. (*in* Tran et al., 2024)

White Member, Claron Formation, Paleogene (BRCA)

Indeterminate trace fossils (*in* this paper)

Boat Mesa Conglomerate, Paleogene (BRCA)

Paleozoic invertebrates (reworked) (*in* Santucci and Kirkland, 2010)

Quaternary Sediments (BRCA)

Plantae

  - Gymnospermae
    - Pinopsida
        - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
      - Cupressaceae
        - *Juniperus osteosperma* (*in* Agenbroad et al., 1992)
        - *Juniperus scopulorum* (*in* Agenbroad et al., 1992)
        - *Juniperus* sp. (*in* Agenbroad et al., 1992)
      - Pinaceae
        - *Pinus edulis* (*in* Agenbroad et al., 1992)
        - *Pinus ponderosa* (*in* Agenbroad et al., 1992)
  - Angiospermae
    - Eudicotidae
      - Caryophyllales
        - Cactaceae
          - *Echinocereus* sp. (*in* Agenbroad et al., 1992)
      - Fagales
        - Fagaceae
          - *Quercus gambelli* (*in* Agenbroad et al., 1992)
          - *Quercus sp.* (*in* Agenbroad et al., 1992)
      - Ranunculales
        - Berberidaceae
          - *Berberis repens* (*in* Agenbroad et al., 1992)

      - Sapindales
        - Anacardiaceae
          - *Rhus trilobata* (*in* Agenbroad et al., 1992)
    - Monocotidae
      - Poales
        - Poaceae
          - *Oryzopsis hymenoides* (*in* Agenbroad et al., 1992)
- Insecta
  - Coleoptera
    - Buprestidae
      - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
    - Carabidae
      - *Rhadine* sp. (*in* Agenbroad et al., 1992)
    - Chrysomelidae
      - *Altica* sp. (*in* Agenbroad et al., 1992)
    - Cleridae
      - *Cymatodera latifasciata* (*in* Agenbroad et al., 1992)
    - Curculionidae
      - *Sapotes* sp. (*in* Agenbroad et al., 1992)
      - *Ophryastes* sp. (*in* Agenbroad et al., 1992)
    - Elateridae
      - *Esthesopus parcus* (*in* Agenbroad et al., 1992)
      - *Melanotus* sp. (*in* Agenbroad et al., 1992)
    - Latridiidae
      - Gen. et sp. indet. (*in* Agenbroad et al., 1992)

        - Mycetophaginae
            - *Litargus* sp. (*in* Agenbroad et al., 1992)
        - Ptinidae
            - *Niptus* cf. *ventriculus* (*in* Agenbroad et al., 1992)
            - *Niptus* spp. (*in* Agenbroad et al., 1992)
            - *Ptinus* sp. (*in* Agenbroad et al., 1992)
        - Scarabaeidae
            - *Aphodius* sp. (*in* Agenbroad et al., 1992)
            - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
        - Staphylinidae
            - *Pselaptrichus* sp. (*in* Agenbroad et al., 1992)
            - *Quedius* sp. (*in* Agenbroad et al., 1992)
        - Tenebrionidae
            - Gen et sp. indet. (*in* Agenbroad et al., 1992)
            - *Coniontis* sp. (*in* Agenbroad et al., 1992)
            - *Eleodes* spp. (*in* Agenbroad et al., 1992)
            - *Entrodes* sp. (*in* Agenbroad et al., 1992)
            - cf. *Metaponium* sp. (*in* Agenbroad et al., 1992)
    - Diptera
            - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
    - Hemiptera
        - Lygaeidae
            - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
    - Hymenoptera
        - Apoidea
            - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
        - Formicidae
            - *Camponotus* sp. (*in* Agenbroad et al., 1992)
            - *Formica* sp. (*in* Agenbroad et al., 1992)
            - *Pheidole* sp. (*in* Agenbroad et al., 1992)
            - *Pogonomyrmex* sp. (*in* Agenbroad et al., 1992)
    - Orthoptera
        - Acrididae
            - Gen. et sp. indet. (*in* Agenbroad et al., 1992)
- Mammalia
    - Rodentia
        - *Neotoma* sp. (*in* Agenbroad et al., 1992)

Canyonlands National Park (CANY)

Honaker Trail Formation, Late Pennsylvanian (CANY)

- Porifera
    - *Haplistion sphaericum* (*in* Rigby and Stokes, 1971)
- Anthozoa
    - Rugosa
        - Gen. et sp. indet. (*in* Szymanski et al., 2024)
- Arthropoda
    - Trilobita

Proetida
Griffithides sp. (*in* McKnight 1940; Szymanski et al., 2024)
Brachiopoda
Gen. et sp. indet. (*in* Szymanski et al., 2024)
Bryozoa
Gen. et sp. indet. (*in* Szymanski et al., 2024)
Foraminifera
Fusulinida
Gen. et sp. indet. (*in* Szymanski et al., 2024)
Echinodermata
Crinoidea
Gen. et sp. indet. (*in* Langford et al., 2007)
Mollusca
Bivalvia
Gen. et sp. indet. (*in* Szymanski et al., 2024)
Gastropoda
Gen. et sp. indet. (*in* Szymanski et al., 2024)

Lower Cutler Group, Late Pennsylvanian–Early Permian (CANY)
Brachiopoda
Gen. et sp. indet. (*in* Baker, 1933; McKnight, 1940)
Bryozoa
Gen. et sp. indet. (*in* McKnight, 1940)
Echinodermata
Crinoidea
Gen. et sp. indet. (*in* Baker, 1933; McKnight, 1940)
Foraminifera
Fusulinida
Gen. et sp. indet. (*in* Billingsley et al., 2002; Szymanski et al., 2024)
Mollusca
Scaphopoda
Gen. et sp. indet. (*in* McKnight, 1940)
Actinopterygii
Palaeonisciformes
Palaeoniscidae
Gen. et sp. indet. (*in* Sumida et al., 1999a)
Plantae
Gen. et sp. indet. (*in* Webb et al., 2004)

Cedar Mesa Sandstone, Early Permian (CANY)
Brachiopoda
Gen. et sp. indet. (*in* Langford et al., 2007)
Bryozoa
Gen. et sp. indet. (*in* Langford et al., 2007)
Echinodermata?
Scolicia isp. (*in* DeBlieux et al., 2023)
Crinoidea
Gen. et sp. indet. (*in* Langford et al., 2007)

- Chondrichthyes
  - Ctenacanthiformes
      - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Osteichthyes
      - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Tetrapoda
      - Gen. et sp. indet. (*in* DeBlieux et al., 2023; Huttenlocker, University of Southern California, written communication)
      - cf. *Ichniotherium* isp. (*in* DeBlieux et al., 2023)

Organ Rock Formation, Early Permian (CANY)

- Plantae
  - Rhizoliths (*in* DeBlieux et al., 2023)

White Rim Sandstone, Early Permian (CANY)

- Echinodermata
  - Crinoidea
    - Gen. et sp. indet. (*in* Steele-Mallory, 1982; Steele, 1987)

Sinbad Member, Moenkopi Formation, Early Triassic (CANY)

- Brachiopoda
      - *Lingula* sp. (*in* McKnight, 1940)
- Mollusca
  - Cephalopoda
    - Ammonoidea
      - ?*Meekoceras* sp. (*in* McKnight, 1940)
  - Bivalvia
      - *Monotis* sp. (*in* McKnight, 1940)
  - Gastropoda
      - Viviparoidea
        - Gen. et sp. indet. (*in* McKnight, 1940)
    - Family incertae sedis
        - Gen. et sp. indet. (*in* Lucas et al., 1993)

Torrey Member, Moenkopi Formation, Early Triassic (CANY)

- Arthropoda
  - Xiphosura
    - cf. *Kouphichnium* isp. (*in* DeBlieux et al., 2023)
- Actinopteriygii
    - *Undichna* isp. (*in* DeBlieux et al., 2023)
- Tetrapoda
  - Temnospondyli
      - "Chirotheriid-type" swim tracks (*in* DeBlieux et al., 2023)
  - Reptilia
      - *Procolophonichnium* isp. (*in* DeBlieux et al., 2023)
    - Archosauromorpha
      - *Synaptichnium* isp. (*in* DeBlieux et al., 2023)
      - *Rotodactylus* isp. (*in* DeBlieux et al., 2023)

Kane Springs beds, Chinle Formation, Late Triassic (CANY)

- Arthropoda
  - *Camborygma* isp. (*in* DeBlieux et al., 2023)
- Bivalvia
  - Unionidae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Plantae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Chondrichthyes
  - Hyobodontiformes
    - *Reticulodus* sp. (*in* DeBlieux et al., 2021)
- Actinopterygii
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Amphibia
  - Metoposauridae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Pseudosuchia
  - Aetosauria
    - cf. *Stagonolepis* sp. (*in* Heckert et al., 1999)
    - cf. *Typothorax* sp. (*in* DeBlieux et al., 2023)
  - Phytosauria
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Dinosauria
  - Theropoda
    - *Grallator* isp. (*in* DeBlieux et al., 2023)

Church Rock Member, Chinle Formation, Late Triassic (CANY)

- Bivalvia
  - Unionidae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Sarcopterygii
  - Dipnoi
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Pseudosuchia
  - Aetosauria
    - cf. *Typothorax* sp. (*in* DeBlieux et al., 2023)
  - Phytosauria
    - Gen. et sp. indet. (*in* DeBlieux et al., 2023)
- Dinosauria
  - Theropoda
    - *Grallator* isp. (*in* Lucas et al., 1993)

Wingate Sandstone, Late Triassic–Early Jurassic (CANY)

- Dinosauria
  - Theropoda
    - *Grallator* isp. (*in* DeBlieux et al., 2024)

Kayenta Formation, Early Jurassic (CANY)

- Dinosauria
  - Theropoda
    - *Eubrontes* isp. (*in* DeBlieux et al., 2024)
    - *Grallator* isp. (*in* DeBlieux et al., 2024)

Navajo Sandstone, Early Jurassic (CANY)

- Stromatolites
  - Gen. et sp. indet. (*in* Waiss, 2005)
- Plantae
  - Gen. et sp. indet. (*in* Wilkens, 2008)
- Chordata
  - Gen. et sp. indet. (*in* Hasiotis et al., 2007)
- Dinosauria
  - Theropoda
    - *Eubrontes* isp. (*in* DeBlieux et al., 2024)
    - *Kayentapus* isp. (*in* DeBlieux et al., 2024)
  - Sauropodomorpha
    - *Otozoum* isp. (*in* DeBlieux et al., 2024)

Quaternary Sediments (CANY)

- Plantae
  - Gymnospermae
    - Cupressaceae
      - *Juniperus communis* (*in* Coats et al., 2008)
      - *Juniperus osteosperma* (*in* Coats et al., 2008)
      - *Juniperus scopulorum* (*in* Coats et al., 2008)
      - *Juniperus* sp. (*in* Reheis et al., 2005)
    - Pinopsida
      - *Picea pungens* (*in* Coats et al., 2008)
      - *Picea* sp. (*in* Reheis et al., 2005)
      - *Pinus edulis* (*in* Coats et al., 2008)
      - *Pinus edulis* var. *fallax* (*in* Coats et al., 2008)
      - *Pinus flexilis* (*in* Coats et al., 2008)
      - *Pinus* sp. (*in* Reheis et al., 2005)
      - *Pseudotsuga menziesii* (*in* Coats et al., 2008)
    - Ephedraceae
      - *Ephedra torreyana* (*in* Coats et al., 2008)
      - *Ephedra* sp. (*in* Reheisa et al., 2005; Coats et al., 2008)
  - Angiospermae
    - Asteraceae
      - *Ambrosia acanthicarpa* (*in* Coats et al., 2008)
      - *Artemisia* sp. (*in* Reheis et al., 2005)
      - *Chrysothamnus* sp. (*in* Coats et al., 2008)
      - *Cirsium vulgare* (*in* Coats et al., 2008)
      - *Gutierrezia sarothrae* (*in* Coats et al., 2008)
      - *Hilaria jamesii* (*in* Coats et al., 2008)

- Low-spine Asteraceae pollen (*in* Reheis et al., 2005)
- Fabaceae
    - *Astragalus* sp. (*in* Coats et al., 2008)
- Berberidaceae
    - *Berberis fremontii* (*in* Coats et al., 2008)
- Cannabaceae
    - *Celtis reticulata* (*in* Coats et al., 2008)
- Rosaceae
    - *Cercocarpus intricatus* (*in* Coats et al., 2008)
    - *Coleogyne ramosissima* (*in* Coats et al., 2008)
    - *Rosa* sp. (*in* Coats et al., 2008)
- Amaranthaceae
    - *Corispermum villosum* (*in* Coats et al., 2008)
    - *Krascheninnikovia lanata/Ceratoides lanata* (*in* Coats et al., 2008)
    - Cheno-Am pollen (*in* Reheis et al., 2005)
- Boraginaceae
    - *Cryptantha flava* (*in* Coats et al., 2008)
    - *Lithospermum incisum* (*in* Coats et al., 2008)
- Euphorbiaceae
    - *Euphorbia* sp. (*in* Coats et al., 2008)
- Oleaceae
    - *Fraxinus anomala* (*in* Coats et al., 2008)
- Brassicaceae
    - *Lepidium montanum* (*in* Coats et al., 2008)
    - Gen. et sp. indet. (*in* Reheis et al., 2005)
- Cactaceae
    - *Opuntia* sp. (*in* Reheis et al., 2005; Coats et al., 2008)
- Poaceae
    - *Oryzopsis hymenoides* (*in* Coats et al., 2008)
    - *Stipa comata* (*in* Coats et al., 2008)
    - Gen. et sp. indet. (*in* Reheis et al., 2005)
- Plantaginaceae
    - *Penstemon* sp. (*in* Coats et al., 2008)
- Fagaceae
    - *Quercus gambelii* (*in* Coats et al., 2008)
- Rhamnaceae
    - *Frangula betulifolia* (formerly *Rhamnus betulifolia*) (*in* Coats et al., 2008)
- Anacardiaceae
    - *Rhus trilobata* (*in* Coats et al., 2008)
- Sarcobataceae
    - *Sarcobatus* sp. (*in* Reheis et al., 2005)
- Elaeagnaceae
    - *Shepherdia rotundifolia* (*in* Coats et al., 2008)
- Malvaceae
    - *Sphaeralcea* sp. (*in* Reheis et al., 2005)
- Capriofoliaceae
    - *Symphoricarpos* sp. (*in* Coats et al., 2008)
- Asparagaceae

- *Yucca angustissima* (*in* Coats et al., 2008)
- Tubuliflorae
  - Gen. et sp. indet. (*in* Reheis et al., 2005)
- Mollusca
  - Bivalvia
    - *Pisidium casertanum* (*in* Nittmann, 1993)
    - *Pisidium nitidum* (*in* Nittmann, 1993)
    - *Pisidium walkeri* (*in* Nittmann, 1993)
  - Gastropoda
    - *Discus cronkhitei* (*in* Nittmann, 1993)
    - *Euconulus fulvus* (*in* Nittmann, 1993)
    - *Galba dalli* (formerly *Fossaria* (*Bakerilymnaea*) *dalli*) (*in* Nittmann, 1993)
    - *Galba* sp. (formerly *Fossaria*) (*in* Nittmann, 1993)
    - *Gyraulus circumstriatus* (*in* Nittmann, 1993)
    - *Hawaiia miniscula* (*in* Nittmann, 1993)
    - *Oreohelix* sp. (*in* Nittmann, 1993)
    - *Oxyloma* sp. (*in* Nittmann, 1993)
    - *Pupilla muscorum* (*in* Nittmann, 1993)
    - *Vallonia cyclophorella* (*in* Nittmann, 1993)
    - *Vallonia gracilicosta* (*in* Nittmann, 1993)
    - *Vertigo* sp.? (*in* Nittmann, 1993)
    - *Zonitoides arboreus* (*in* Nittmann, 1993)
    - Succineidae gen. et sp. indet. (*in* Nittmann, 1993)
- Arthropoda
  - Insecta
    - Coleoptera
      - *Amara* sp. (*in* Elias et al., 1992)
      - *Eleodes* spp. (*in* Elias et al., 1992)
      - *Niptus* sp. (*in* Elias et al., 1992)
      - *Pachybrachis* sp. (*in* Elias et al., 1992)
      - Chrysomelidae gen. et sp. indet. (*in* Elias et al., 1992)
      - Dermestidae gen. et sp. indet. (*in* Elias et al., 1992)
      - Elateridae gen. et sp. indet. (*in* Elias et al., 1992)
      - Scarabaeidae gen. et sp. indet. (*in* Elias et al., 1992)
      - Tenebrionidae gen. et sp. indet. (*in* Elias et al., 1992)
      - Gen. et sp. indet. (*in* Elias et al., 1992)
    - Hymenoptera
      - *Formica* sp. (*in* Elias et al., 1992)
    - Lepidoptera
      - Gen. et sp. indet. (*in* Elias et al., 1992)
- Amphibia
  - Anura
    - *Spea hammondii* (formerly *Scaphiopus hammondii*) (*in* CANY museum records)
- Squamata
  - Iguania
    - cf. *Sceloporus* sp. (*in* CANY museum records)
    - Phrynosomatidae gen. et sp. indet. (*in* CANY museum records)
- Aves

        Gen. et sp. indet. (*in* CANY museum records)
Mammalia
    Rodentia
        Dipodomys sp. (*in* CANY museum records)
        Neotoma cinerea (*in* CANY museum records)
        Neotoma sp. (*in* CANY museum records)
        Neotoma sp. middens (*in* Tweet et al., 2012a)
        Peromyscus sp. (*in* CANY museum records)
        Microtinae gen. et sp. indet. (*in* CANY museum records)
        Muridae gen. et sp. indet. (*in* CANY museum records)
        Gen. et sp. indet. (*in* Tweet et al., 2012d)
    Proboscidea
        Mammuthus sp. (*in* Tweet et al., 2012d; CANY museum records)

Capitol Reef National Park (CARE)

Torrey Member, Moenkopi Formation, Early Triassic (CARE)

Plantae
    Equisetales
            Gen. et sp. indet. (*in* Mickelson et al., 2006a)
Annelida
            Arenicolites isp. (*in* Mickelson et al., 2006a)
Arthropoda
            Diplichnites isp. (*in* Mickelson et al., 2006a)
            Fuersichnus isp. (*in* Mickelson et al., 2006a)
            Koupichnium isp. (*in* Mickelson et al., 2006a)
            Palaeophycus isp. (*in* Mickelson et al., 2006a)
Actinopterygii
            Undichna isp. (*in* Mickelson et al., 2006a)
Tetrapoda
            Characichnos isp. (*in* Mickelson et al., 2006a)

    Reptilia
        Lepidosauromorpha
            Rhynchosauroides isp. (*in* Mickelson et al., 2006a)
        Archosauromorpha
            Rotodactylus isp. (*in* Mickelson et al., 2006a)
        Pseudosuchia
            Chirotherium isp. (*in* Mickelson et al., 2006a)

Shinarump Member, Chinle Formation, Late Triassic (CARE)

Plantae
    Tracheophyta
        Bennettitales
            Zamites powellii (*in* Berry, 1927; Ash, 1975b)
        Pinopsida

        - *Araucarioxylon* sp. (*in* Ash, 1975a)
        - *Pagiophyllum* sp. (*in* Ash, 1975a)
    - Polypodiopsida
        - *Cladophlebis* sp. (*in* Ash, 1975a)
        - *Cynepteris* sp. (*in* Ash, 1975a)
        - *Equisetites* sp. (*in* Kirkland et al., 2014a)
        - *Phlebopteris* sp. (*in* Ash, 1975a)
- Arthropoda
    - *Camborygma* isp. (*in* Hasiotis and Mitchell, 1993)

Monitor Butte Member, Chinle Formation, Late Triassic (CARE)

- Plantae
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
    - Bennettitales
        - *Laurozamites* sp. (*in* Kirkland et al., 2014a)
    - Polypodiopsida
        - *Equisetites* sp. (*in* Kirkland et al., 2014a)
- Temnospondyli
    - Metoposauridae
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Pseudosuchia
    - Phytosauria
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)

Petrified Forest Member, Chinle Formation, Late Triassic (CARE)

- Plantae
    - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Bivalvia
    - Unionidae
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Temnospondyli
    - Metoposauridae
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Pseudosuchia
    - Aetosauria
        - cf. *Typothorax* sp. (*in* Kirkland et al., 2014a)
    - Phytosauria
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)

Owl Rock Member, Chinle Formation, Late Triassic (CARE)

- Plantae
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
        - *Sanmiguelia* sp. (*in* Ash, 1982)
- Sarcopterygii
    - Dipnoi
        - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Pseudosuchia
    - Aetosauria

Gen. et sp. indet. (*in* Kirkland et al., 2014a)

Navajo Sandstone, Early Jurassic (CARE)

Stromatolites (*in* Eisenberg, 2003; Santucci and Kirkland, 2010)

Winsor Member, Carmel Formation, Middle Jurassic (CARE)

- Echinodermata
  - Crinoidea
    - *Isocrinus* sp. (*in* Tweet et al., 2012e)

Tidwell Member, Morrison Formation, Late Jurassic (CARE)

- Stromatolites (*in* Kirkland et al., 2020a)
- Reptilia
  - Dinosauria
    - Gen. et sp. indet. (*in* Kirkland et al., 2020a)

Salt Wash Member, Morrison Formation, Late Jurassic (CARE)

- Plantae
    - Gen. et sp. indet. (*in* Kirkland et al., 2014a)
- Dinosauria
    - Gen. et sp. indet. (*in* Kirkland et al., 2020a)

Brushy Basin Member, Morrison Formation, Late Jurassic (CARE)

- Dinosauria
    - Gen. et sp. indet. (*in* Kirkland et al., 2020a)

Cedar Mountain Formation, Early Cretaceous (CARE)

- Dinosauria
    - Gen. et sp. indet. (*in* Kirkland et al., 2020a)

Naturita Formation (Dakota Formation in older references), Late Cretaceous (CARE)

- Mollusca
  - Bivalvia
    - cf. *Exogyra* sp. (*in* Santucci and Kirkland, 2010a)

Tununk Shale, Mancos Group, Late Cretaceous (CARE)

- Mollusca
  - Bivalvia
    - Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
  - Cephalopoda
    - Ammonoidea
        - Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
- Mollusca
  - Gastropoda
    - Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
- Chondrichthyes

Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)

Blue Gate Shale, Mancos Group, Late Cretaceous (CARE)

Mollusca
  Bivalvia
      Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
  Cephalopoda
    Ammonoidea
      Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
  Gastropoda
      Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)
Chondrichthyes
      Gen. et sp. indet. (*in* Cobban, U.S. Geological Survey, written communication)

Quaternary Sediments (CARE)

Plantae
  Rhizoliths (*in* Oviatt, 1988)
  Polypodiophyta
    Equisetales
      Equisetum sp. (*in* Nittmann, 1993)
Gymnospermae
    Cupressaceae
      Juniperus osteosperma (*in* Cole et al., 1997; Cole and Murray, 1999)
      Juniperus scopulorum (*in* Cole and Murray, 1999)
      Juniperus sp. (*in* Cole et al., 1997; Cole and Murray, 1999)
    Pinaceae
      Abies sp. (*in* Cole and Murray, 1999)
      Picea sp. (*in* Cole and Murray, 1999)
      Pinus edulis (*in* Cole et al., 1997)
      Pinus flexilis (*in* Cole and Murray, 1999)
      Pinus sp. (*in* Cole and Murray, 1999)
      Pinus spp. (*in* Cole et al., 1997)
      Pseudotsuga menziesii (*in* Cole and Murray, 1999)
      Pseudotsuga sp. (*in* Cole and Murray, 1999)
    Ephedraceae
      Ephedra sp. (*in* Cole and Murray, 1999)
      Ephedra spp. (*in* Cole et al., 1997)
  Angiospermae
    Amaranthaceae
      Amaranthus sp. (*in* Cole et al., 1997)
      cf. *Amaranthus* sp. (*in* Cole et al., 1997)
      Atriplex spp. (*in* Cole et al., 1997)
      Krascheninnikovia lanata/*Ceratoides lanata* (*in* Cole et al., 1997)
      Cheno-Am (*in* Cole and Murray, 1999)
      "Chenopodiaceae" gen. et sp. indet. (*in* Cole et al., 1997)
    Asteraceae
      Ambrosia sp. (*in* Cole et al., 1997; Cole and Murray, 1999)

- *Artemisia* sect. *Tridentatae* (*in* Cole et al., 1997)
- *Artemisia* sp. (*in* Cole et al., 1997; Cole and Murray, 1999)
- *Heterotheca* sp. (*in* Cole et al., 1997)

Fabaceae
- cf. *Amorpha* sp. (*in* Cole and Murray, 1999)

Rhamnaceae
- *Ceanothus* sp./*Rhamnus* sp. (*in* Cole and Murray, 1999)

Rosaceae
- *Cercocarpus intricatus* (*in* Cole and Murray, 1999)
- *Cercocarpus* sp. (*in* Cole et al., 1997; Cole and Murray, 1999)
- *Cowania mexicana* (*in* Cole et al., 1997)
- Gen. et sp. indet. (*in* Cole et al., 1997)

Cleomaceae
- cf. *Cleome* sp. (*in* Cole and Murray, 1999)

Boraginaceae
- *Cryptantha* spp. (*in* Cole et al., 1997)
- *Phacelia* sp. (*in* Cole et al., 1997)

Euphorbiaceae
- *Euphorbia* sp. (*in* Cole et al., 1997)

Oleaceae
- *Fraxinus* sp. (*in* Cole and Murray, 1999)
- cf. *Fraxinus anomala* (*in* Cole and Murray, 1999)

Poaceae
- *Hilaria* sp. (*in* Cole et al., 1997)
- *Oryzopsis* sp. (*in* Cole and Murray, 1999)
- *Sporobolus* spp. (*in* Cole et al., 1997)
- *Stipa hymenoides* (*in* Cole et al., 1997)
- *Stipa* sp. (*in* Cole et al., 1997)

Juglandaceae
- *Juglans* sp. (*in* Cole and Murray, 1999)

Brassicaceae
- *Lepidium densiflorum* (*in* Cole et al., 1997)

Cactaceae
- *Opuntia polyacantha* (*in* Cole et al., 1997)
- *Opuntia* sp. (*in* Cole et al., 1997; Cole and Murray 1999)
- *Pediocactus* sp./*Echinocereus* sp. (*in* Cole et al., 1997)

Betulaceae
- *Ostrya knowltoni* (*in* Cole and Murray, 1999)
- Gen. et sp. indet. (*in* Cole and Murray, 1999)

Salicaceae
- *Populus* sp. (*in* Cole and Murray, 1999)
- *Salix* sp. (*in* Cole and Murray, 1999)

Fagaceae
- *Quercus* sp. (*in* Cole and Murray, 1999)

Adoxaceae
- *Sambucus* sp. (*in* Cole and Murray, 1999)

Sarcobataceae
- *Sarcobatus* sp. (*in* Cole et al., 1997)

        Elaeagnaceae
            Shepherdia rotundifolia (*in* Cole et al., 1997)
        Malvaceae
            Sphaeralcea coccinea (*in* Cole et al., 1997)
            Sphaeralcea sp. (*in* Cole et al., 1997)
        Asparagaceae
            Yucca angustissima (*in* Cole et al., 1997)
            Yucca cf. *Y. angustissima* (*in* Cole and Murray, 1999)
        Compositae
            Gen. et sp. indet. (*in* Cole et al., 1997; Cole and Murray, 1999)
        Cruciferae
            Gen. et sp. indet. (*in* Cole and Murray, 1999)
        Gramineae
            Gen. et sp. indet. (*in* Cole et al., 1997; Cole and Murray, 1999)
        Labiatae
            Gen. et sp. indet. (*in* Cole and Murray, 1999)
        Leguminosae
            Gen. et sp. indet. (*in* Cole and Murray, 1999)
        Onagraceae
            Gen. et sp. indet. (*in* Cole et al., 1997)
        Polygonaceae
            Gen. et sp. indet. (*in* Cole and Murray, 1999)
Mammalia
    Rodentia
            Neotoma sp. middens (*in* Tweet et al., 2012a)
    Other
        Undetermined fungal spores (*in* Cole et al., 1997; Cole and Murray 1999)

Cedar Breaks National Monument (CEBR)

Pink Member, Claron Formation, Paleogene (CEBR)

Plantae
    Angiospermae
        Gen. et sp. indet. (*in* Gregory, 1950)
Insecta
    Hymenoptera
        Celliforma spirifer (*in* Gregory, 1950)
Mollusca
Gastropoda
        Bulinus sp. (*in* Gregory, 1950)
        Glyptostoma spatiosum (formerly *Helix spatiosa*) (*in* Gregory, 1950)
        Biomphalaria utahensis (formerly *Planorbis utahensis*) (*in* Gregory, 1950)

Quaternary Sediments (CEBR)

Chlorophyta
    Pediastrum sp. (*in* Anderson et al., 1999)
Plantae

- Gymnospermae
  - Ephedraceae
    - *Ephedra* sp. (*in* Anderson et al., 1999)
  - Pinaceae
    - *Abies lasiocarpa* (*in* Anderson et al., 1999)
    - *Abies* sp. (*in* Anderson et al., 1999)
    - *Picea engelmannii* (*in* Anderson et al., 1999)
    - *Picea* sp. (*in* Anderson et al., 1999)
    - *Pinus* sp. (*in* Anderson et al., 1999)
    - *Pinus* (*Strobus*) sp. (*in* Anderson et al., 1999)
    - *Pinus* (*Pinus*) sp. (*in* Anderson et al., 1999)
  - Cupressaceae
    - Gen. et sp. indet. (*in* Anderson et al., 1999)
- Angiospermae
  - Fagaceae
    - *Quercus* sp. (*in* Anderson et al., 1999)
  - Asteraceae
    - *Artemisia* sp. (*in* Anderson et al., 1999)
    - *Ambrosia* sp. (*in* Anderson et al., 1999)
    - Gen. et sp. indet. (*in* Anderson et al., 1999)
  - Poaceae
    - Gen. et sp. indet. (*in* Anderson et al., 1999)
  - Cyperaceae
    - Gen. et sp. indet. (*in* Anderson et al., 1999)

Mollusca
- Gen. et sp. indet. (*in* Sharpe, 1993)

Dinosaur National Monument (DINO)

Lodore Formation, Middle Cambrian (DINO)

Invertebrate traces
- *Bergaueria* isp. (*in* Myrow et al., 2023a)
- *Diplocraterion* isp. (*in* Myrow et al., 2023a)
- *Monocraterion* isp. (*in* Myrow et al., 2023a)
- *Rusophycus* isp. (*in* Myrow et al., 2023a)
- *Cruziana* isp. (*in* Myrow et al., 2023a)
- *Arenicolites* isp. (*in* Myrow et al., 2023a)
- cf. *Palaeophycus* isp. (*in* Untermann and Untermann, 1954)
- *Skolithos* isp. (*in* Myrow et al., 2023a)
- *Teichichnus* isp. (*in* Myrow et al., 2023a)

Brachiopoda
- Billingsellida
  - *Billingsella*-like shells (*in* Untermann and Untermann, 1954)
- Obolidae
  - *Dicellomus* sp.? (*in* Myrow et al., 2023a)
  - *Westonia* sp. (*in* Myrow et al., 2023a)
  - cf. *Westonia ella* (*in* Myrow et al., 2023a)

        Gen. et sp. indet. aff. *Lingulepis* (*in* Myrow et al., 2023a)
Arthropoda
    Trilobita
        Elrathiella decora? (*in* Myrow et al., 2023a)
        Elrathiella cf. *E. domensa* (*in* Myrow et al., 2023a)
        Elrathiella cf. *E. rectangularia* (*in* Myrow et al., 2023a)
        Elrathiella sp. nov. 1 (*in* Myrow et al., 2023a)
        Elrathiella sp. nov. 2 (*in* Myrow et al., 2023a)
Hyolitha
    Hyolithes sp. (*in* Untermann and Untermann, 1954)
    Gen. et sp. indet. (*in* Myrow et al., 2023a)
Incertae sedis
    Hyolithes-like form "having heavy concentric rings resembles *Tentaculites*" (*in* Untermann and Untermann, 1954)

Parting Formation, Late Devonian (DINO)

    "Bioturbation" (*in* Myrow et al., 2023a)

Madison Limestone, Early–Middle Mississippian (DINO)

Anthozoa
    Rugosa
        cf. *Lithostrotion* sp. (*in* Untermann and Untermann, 1954)
        cf. *Neozaphrentis* sp. (*in* Untermann and Untermann, 1954)
    Tabulata
        cf. *Favosites* sp. (*in* Untermann and Untermann, 1954)
        Syringopora surcularia (*in* Mayer, 1964)
        cf. *Syringopora* sp. (*in* Untermann and Untermann, 1954)
Brachiopoda
        cf. *Schuchertella* sp. (*in* Untermann and Untermann, 1954)
Bryozoa
        Fenestella cf. *F. rudis* (*in* Mayer, 1964)
        Fenestella cf. *F. serratula* (*in* Mayer, 1964)
Mollusca
    Gastropoda
        cf. *Euomphalus* sp. (*in* Untermann and Untermann, 1954)
Arthropoda
    Trilobita
        Gen. et sp. indet. (*in* Untermann and Untermann, 1949a)
Echinodermata
    Crinoidea
        Gen. et sp. indet. (*in* Untermann and Untermann, 1954 [as Deseret Limestone])

Humbug Formation, Middle Mississippian (DINO)

Anthozoa
    Rugosa
        Gen. et sp. indet. (*in* Untermann and Untermann, 1954)
Echinodermata
    Crinoidea

- Gen. et sp. indet. (*in* Untermann and Untermann, 1954)

Doughnut Formation, Middle–Late Mississippian (DINO)

- Plantae
    - Polypodiopsida
        - *Calamites* sp. (*in* Untermann and Untermann, 1954)
        - *Lepidodendron* sp. (*in* Untermann and Untermann, 1954)
- Arthropoda
    - Ostracoda
        - Gen. et sp. indet. (*in* Untermann and Untermann, 1954)
- Foraminifera
    - *Tolypammina* sp. (*in* Untermann and Untermann, 1954)

Round Valley Limestone, Early Pennsylvanian (DINO)

(Belden Formation of Thompson, 1945; Morrow or lower member of the Morgan Limestone of Untermann and Untermann, 1949b, 1954 [beds 69 to 104 in 1949b, per thickness in 1954])

- Algae
    - Gen. et sp. indet. (*in* Davis, 2010)
    - *Asphaltina* sp. (*in* Davis, 2010)
    - *Stacheoides* sp. (*in* Davis, 2010)
- Anthozoa
    - Rugosa
        - "'Zaphrentoid' cup corals of the *Ratiphyllum* type" (typo for unknown genus) (*in* Untermann and Untermann, 1949b, 1954)
        - Gen. et sp. indet. (*in* Davis, 2010)
- Bryozoa
    - Rhomboporoid forms (*in* Untermann and Untermann, 1949b)
    - Stenoporoid forms (*in* Untermann and Untermann, 1949b)
    - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b; Davis, 2010)
- Brachiopoda
        - *Composita subtilita* (*in* Untermann and Untermann, 1954)
        - *Composita* cf. *C. subtilita* (*in* Untermann and Untermann, 1949b)
        - *Dictyoclostus* sp. (*in* Untermann and Untermann, 1949b)
        - *Echinoconchus* sp. (*in* Untermann and Untermann, 1949b)
        - *Marginifera haydenensis*? (*in* Untermann and Untermann, 1954)
        - *Neospirifer* cf. *N. cameratus* (*in* Untermann and Untermann, 1954)
        - *Neospirifer* sp. (*in* Untermann and Untermann, 1949b)
        - *Spirifer occidentalis* (*in* Untermann and Untermann, 1954)
        - *Spirifer rockymontanus* (*in* Untermann and Untermann, 1949b)
        - *Spirifer* cf. *S. rockymontanus* (*in* Untermann and Untermann, 1954)
        - *Spirifer* sp. (*in* Untermann and Untermann, 1949b)
        - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b; Davis, 2010)
    - Productida undetermined (*in* Untermann and Untermann, 1949b)
- Mollusca
    - Bivalvia
        - Gen. et sp. indet. (*in* Davis, 2010)

- Gastropoda
    - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b; Davis, 2010)

Arthropoda
- Ostracoda
    - Gen. et sp. indet. (*in* Davis, 2010)
- Trilobita
    - Gen. et sp. indet. (*in* Davis, 2010)

Echinodermata
- Undetermined ossicles (*in* Untermann and Untermann, 1949b)
- Echinoidea
    - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b; Davis, 2010)
- Crinoidea
    - Gen. et sp. indet. (*in* Davis, 2010)

Foraminifera
- *Climacammina* sp.? (*in* Untermann and Untermann, 1949b)
- *Endothyra* sp. (*in* Untermann and Untermann, 1949b, 1954; Davis, 2010)
- *Endothyra sp.?* (*in* Untermann and Untermann, 1949b)
- *Eostaffella* sp. (*in* Davis, 2010)
- *Millerella circuli** (*in* Thompson, 1945)
- *Millerella* cf. *M. marblensis* (*in* Thompson, 1945)
- *Millerella* sp. (*in* Untermann and Untermann, 1949b, 1954)
- *Millerella* sp. (evolute) (*in* Untermann and Untermann, 1949b, 1954)
- *Millerella* sp. indet. (*in* Thompson, 1945)
- *Paleonubecularia* sp. (*in* Davis, 2010)
- *Planoendothyra* sp. (*in* Davis, 2010)
- *Pseudoglomospira* sp. (*in* Davis, 2010)
- *Trepeilopsis* sp. (*in* Untermann and Untermann, 1949b, 1954)
- *Trepeilopsis* sp.? (*in* Untermann and Untermann, 1949b)
- "Calcitornellids" (*in* Untermann and Untermann, 1949b)
- "Tolypamminids" (*in* Untermann and Untermann, 1949b)

Morgan Formation, Middle Pennsylvanian (DINO)

Taxa from White, 1876 ("Lower Aubrey Group") are placed here based on Sando (1965) attributing the type material of *Amplexus zaphrentiformis* to the Morgan Formation, but it is possible that some pertain to the Round Valley Limestone.

- Tubular burrows (*in* Fryberger, 1979)

Algae
- "Peculiar form" (*in* Untermann and Untermann, 1949b)
- Gen. et sp. indet.? (*in* Untermann and Untermann, 1949b)

Porifera
- *Chaetetes milleporaceus* (*in* White, 1876)
- *Chaetetes milleporaceus*? (*in* Untermann and Untermann, 1949b)
- *Chaetetes* cf. *C. milleporaceus* (*in* Untermann and Untermann, 1954)
- Gen. et sp. indet. (spicules) (*in* Untermann and Untermann, 1949b, 1954)

Anthozoa
- Rugosa
    - *Amplexus zaphrentiformis** (*in* White, 1876; *Barytichisma zaphrentiforme* of Sando, 1965)
- Tabulata

        Acervularia sp.? (*in* White, 1876)
Bryozoa
    Archimedes sp.? (*in* White, 1876)
    Fenestella sp.? (*in* White, 1876)
    Prismopora sp. (*in* Untermann and Untermann, 1954)
    Rhombopora-like form (*in* Untermann and Untermann, 1949b)
    Stenopora-like form (*in* Untermann and Untermann, 1949b)
    Gen. et sp. indet. (*in* Untermann and Untermann, 1949b)
Brachiopoda
    Chonetes platynota (*in* White, 1876)
    Composita subtilita (*in* White, 1876, as *Spirigera*; Untermann and Untermann, 1954)
    Composita subtilita? (*in* Untermann and Untermann, 1949b)
    Composita cf. *C. elongata* (*in* Untermann and Untermann, 1954)
    Composita cf. *C. ovata* (*in* Untermann and Untermann, 1954)
    Composita cf. *C. subtilita* (*in* Untermann and Untermann, 1949b, 1954)
    Dictyoclostus coloradoensis (*in* Untermann and Untermann, 1954)
    Dictyoclostus cf. *D. coloradoensis* (*in* Untermann and Untermann, 1954)
    Dictyoclostus sp. (*in* Untermann and Untermann, 1949b)
    Dictyoclostus sp. (small) (*in* Untermann and Untermann, 1949b, 1954)
    Dielasma boyoidens? (*in* Untermann and Untermann, 1954)
    Echinoconchus semipunctatus (*in* Untermann and Untermann, 1954)
    Echinoconchus sp. (*in* Untermann and Untermann, 1949b)
    Hemipronites crinistria (*in* White, 1876)
    Hystriculina aff. *H. wabashensis* (*in* Sando, 1965)
    Inflatia sp.? (*in* Sando, 1965)
    Juresania sp. (*in* Untermann and Untermann, 1954)
    Linoproductus sp. (*in* Untermann and Untermann, 1954)
    Linoproductus sp.? (*in* Untermann and Untermann, 1949b)
    Neospirifer dunbari (*in* Untermann and Untermann, 1954)
    Neospirifer cf. *N. cameratus* (*in* Untermann and Untermann, 1954)
    Neospirifer cf. *N. dunbari* (*in* Untermann and Untermann, 1949b, 1954)
    Productus costatus? (*in* White, 1876)
    Productus costatus var. (*in* White, 1876)
    Productus longispinus? (*in* White, 1876)
    Productus muricatus? (*in* White, 1876)
    Spirifer rockymontanus (*in* White, 1876; Untermann and Untermann, 1949b)
    Spirifer rockymontanus? (*in* Untermann and Untermann, 1954)
    Spirifer cf. *S. occidentalis* (*in* Untermann and Untermann, 1954)
    Spirifer cf. *S. rockymontanus* (*in* Untermann and Untermann, 1954)
    Gen. et sp. indet. (*in* Untermann and Untermann, 1949b)
Arthropoda
    Ostracoda
        Gen. et sp. indet. (*in* Untermann and Untermann, 1949b)
    Trilobita
        ?*Phillipsia* sp. (*in* White, 1876)
Echinodermata
        Gen. et sp. indet. (*in* Untermann and Untermann, 1949b, 1954)
    Crinoidea

    - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b, 1954)
  - Echinoidea
    - Gen. et sp. indet. (*in* Untermann and Untermann, 1949b)
- Conodonta
  - *Adetognathus* sp. (*in* Broadhead and Driese, 1994)
  - *Hindeodus* sp. (*in* Broadhead and Driese, 1994)
  - *Idiognathus* sp. (*in* Broadhead and Driese, 1994)
  - ?*Idiognathus* sp. (*in* Broadhead and Driese, 1994)
  - ?*Idioprionodus* sp. (*in* Broadhead and Driese, 1994)
- Foraminifera
  - *Ammodiscus* sp. or *Cornuspira* sp. (*in* Untermann and Untermann, 1954)
  - *Bradyina* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Calcitornella*-like form (*in* Untermann and Untermann, 1949b)
  - *Climacammina* spp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Deckerella goessi*? (*in* Untermann and Untermann, 1949b, 1954)
  - *Endothyra* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Endothyra* sp.? (*in* Untermann and Untermann, 1954)
  - *Eoschubertella* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Eoschubertella* or *Fusulinella* (*in* Untermann and Untermann, 1949b)
  - *Fusulina curta*? (*in* Untermann and Untermann, 1949b, 1954)
  - *Fusulina pristina*? (*in* Untermann and Untermann, 1954)
  - *Fusulina* aff. *F. leeri* (*in* Untermann and Untermann, 1949b, 1954)
  - *Fusulina* aff. *F. rockymontana* (*in* Untermann and Untermann, 1949b, 1954)
  - *Fusulina* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Fusulinella gephyraea* (*in* Untermann and Untermann, 1949b)
  - *Fusulinella* cf. *F. haywardi* (*in* Untermann and Untermann, 1949b, 1954)
  - *Fusulinella* sp. (*in* Untermann and Untermann, 1954)
  - *Fusulinella* sp.? (*in* Untermann and Untermann, 1949b)
  - *Millerella* sp. (*in* Untermann and Untermann, 1954)
  - *Ozawainella* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Pseudostaffella* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Pseudostaffella* sp.? (*in* Untermann and Untermann, 1949b, 1954)
  - *Spiroplectammina* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Tetrataxis* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Wedekindellina euthysepta* (*in* Untermann and Untermann, 1949b)
  - *Wedekindellina matura* (*in* Untermann and Untermann, 1954)
  - *Wedekindellina perforata* (*in* Untermann and Untermann, 1949b, 1954)
  - *Wedekindellina* aff. *W. magna* (*in* Untermann and Untermann, 1949b, 1954)
  - *Wedekindellina* sp. (*in* Untermann and Untermann, 1949b, 1954)
  - *Wedekindellina*? sp. (*in* Untermann and Untermann, 1949b)
  - *Wedekindellina* sp. or possibly *Fusulina* sp., minute (*in* Untermann and Untermann, 1949b)
  - "Calcitornellids" (*in* Untermann and Untermann, 1949b)
  - Fusulinida (minute form) (*in* Untermann and Untermann, 1949b)
  - Textulariidae gen. et sp. indet. (*in* Untermann and Untermann, 1949b)

Weber Sandstone, Middle Pennsylvanian–Early Permian (DINO)

- Root traces or invertebrate burrows (*in* Driese, 1985)
- Tubular burrows (*in* Bissell, 1964)

- Algae
  - ?Gen. et sp. indet. (*in* Bissell, 1964)
- Bryozoa
  - Gen. et sp. indet. (*in* Bissell, 1964; Chure et al., 2014)
- Arthropoda
  - ?*Diplichnites* isp. (*in* Chure et al., 2014)
- Echinodermata
  - Crinoidea
    - Gen. et sp. indet. (*in* Bissell, 1964; Chure et al., 2014)
- Reptilia
  - Captorhinomorpha?
    - ?*Varanopus* isp. (*in* Chure et al., 2014)
- Foraminifera
  - Fusulinida
    - *Schwagerina* sp. (*in* Bissell, 1964)
    - Gen. et sp. indet. (*in* Chure et al., 2014)

Park City Formation, Permian (DINO)

- Spindle-shaped borings in shells (*in* Schell and Yochelson, 1966)
- Bryozoa
  - Fenestrate bryozoans (*in* Schell and Yochelson, 1966)
  - Small ramose bryozoans (*in* Schell and Yochelson, 1966)
- Brachiopoda
  - *Beecheria* cf. *B. bovidens* (*in* Schell and Yochelson, 1966)
  - *Composita* sp. (*in* Schell and Yochelson, 1966)
  - *Spiriferina* cf. *S. pulchra* (*in* Schell and Yochelson, 1966)
- Mollusca
  - Bivalvia
    - *Aviculopecten* sp. indet. (*in* Schell and Yochelson, 1966)
    - *Myalina* (*Myalinella*) cf. *M.* (*M.*) *meeki* (*in* Schell and Yochelson, 1966)
    - *Nuculana* (*Leda*) cf. *N. bellistriata* (*in* Untermann and Untermann, 1954)
    - ?*Permophorus* sp. indet. (*in* Schell and Yochelson, 1966)
    - *Polidevcia* sp. (*in* Schell and Yochelson, 1966)
    - *Schizodus* sp. (*in* Schell and Yochelson, 1966)
    - *Yoldia* cf. *Y. mcchespeyana* (*in* Untermann and Untermann, 1954)
    - ?Parallelodont bivalve, indet. (*in* Schell and Yochelson, 1966)
  - Cephalopoda
    - Ammonoidea
      - cf. *Pseudogastrioceras* sp. (*in* Schell and Yochelson, 1966)
      - Gen. et sp. indet. (*in* Schell and Yochelson, 1966)
    - Nautiloidea
      - Gen. et sp. indet. (*in* Schell and Yochelson, 1966)
  - Gastropoda
    - *Naticopsis* (*Naticopsis*) sp. indet. (*in* Schell and Yochelson, 1966)
    - Bellerophontoidea indet. (*in* Schell and Yochelson, 1966)
    - Bellerophontid similar to *Bucanopsis* sp. (*in* Untermann and Untermann, 1954)
    - Murchisoniidae indet. (*in* Schell and Yochelson, 1966)
    - ?Pleurotomariacea indet. (*in* Schell and Yochelson, 1966)

- Scaphopoda
    - *Plagioglypta canna* (*in* Untermann and Untermann, 1954)

Moenkopi Formation, Early Triassic (DINO)

- Archosauria
        - *Synaptichnium* isp. (*in* Thomson et al., 2014)
    - Archosauriformes
        - cf. *Protochirotherium* isp. (*in* Thomson et al., 2014)

Chinle Formation, Late Triassic (DINO)

- Plantae
    - Petrified wood (*in* Untermann and Untermann, 1949a, 1954; Erickson, 2007)
    - Root traces (*in* Erickson, 2007)
- Invertebrata
    - Invertebrate burrows (*in* Erickson, 2007)
- Arthropoda (traces)
    - *Acripes* isp. (*in* Hartung et al., 2021)
    - *Isopodichnus* isp. (*in* Lockley et al., 1992a; Hartung et al., 2021)
    - *Kouphichnium* isp. (*in* Lockley et al., 1992a)
    - *Scoyenia gracilis* (*in* Lockley et al., 1992a)
    - Crayfish burrows (*in* Erickson, 2007)
- Lepidosauromorpha
            - *Rhynchosauroides* isp. (*in* Lockley et al., 1992a)
    - Tanystropheidae
            - *Gwynnedichnium* isp. (*in* Lockley et al., 1992a)
- Dinosauria
    - Theropoda
        - "*Agialopus* isp." (*in* Lockley et al., 1992a)
    - Sauropodomorpha
        - *Pseudotetrasauropus* isp. (*in* Lockley et al., 1992a)
- Pseudosuchia
        - ?*Chirotherium* isp. (*in* Lockley et al., 1992a)
        - *Brachychirotherium* isp. (*in* Lockley et al., 1992a)
    - Phytosauria
        - ?*Apatopus* isp. (*in* Lockley et al., 1992a)

Nugget Sandstone, Late Triassic–Early Jurassic (DINO)

- Plantae
    - Sphenophyta
        - Gen. et sp. indet. (*in* Good, 2013)
- Arthropoda (traces)
        - *Octopodichnus* isp. (*in* Good and Ekdale, 2014)
        - *Paleohelcura* isp. (*in* Good and Ekdale, 2014)
        - *Taenidium* isp. (*in* Good and Ekdale, 2014)
- Osteichthyes
        - Gen. et sp. indet. (*in* Hunt et al., 1993)
- Mammaliamorpha

- *Brasilichnium* isp. (*in* Engelmann et al., 2010; Good and Ekdale, 2014)

Dinosauria
- Sauropodomorpha
  - *Otozoum* isp. (*in* Lockley, 2011)
- Theropoda
  - *Grallator* isp. (*in* Lockley, 2011)

Pseudosuchia
- Phytosauria
  - Gen. et sp. indet. (*in* Stewart et al., 1972a; Hunt et al., 1993)

Carmel Formation, Middle Jurassic (DINO)

Bivalvia
- Gen. et sp. indet. (D.A. Sprinkel, Utah Geological Survey [retired], written communication, 2012)

Reptilia
- Gen. et sp. indet. (D.A. Sprinkel, Utah Geological Survey [retired], written communication, 2012)

Salt Wash Member, Morrison Formation, Late Jurassic (DINO)

Plantae
- Gen. et sp. indet.

Dinosauria
- Theropoda
  - *Allosaurus jimmadseni** (*in* Chure and Loewen, 2020)

Brushy Basin Member, Morrison Formation, Late Jurassic (DINO)

Algae

Charophyta
- Characeae
  - *Aclistochara bransoni* (*in* Schudak et al., 1998)
  - *Aclistochara latisulcata* (*in* Schudak et al., 1998)
  - *Alistochara madleri* (*in* Schudak et al., 1998)
  - *Aclistochara miniscula*? (*in* Schudak et al., 1998)
  - *Aclistochara obovata* (*in* Schudak et al., 1998)
  - *Latochara latitruncata* (*in* Schudak et al., 1998)
  - *Latochara* sp. (*in* Schudak et al., 1998)
  - *Peckisphaera verticillata* (*in* Schudak et al., 1998)
  - *Porochara arguta* (*in* Schudak et al., 1998)
  - *Porochara kimmeridgensis* (*in* Schudak et al., 1998)
- Clavatoraceae
  - *Echinochara* sp. (*in* Schudak et al., 1998)

Plantae
- Polypodiophyta
  - Equisetales
    - *Equisetum* sp. (*in* Schudak et al., 1998)
- Pteridophyta
  - Umkomasiaceae
    - *Pteruchipollenites microsaccus* (*in* Ash, 1994; Litwin et al., 1998)
  - Osmundaceae
    - *Todisporites minor* (*in* Ash, 1994; Litwin et al., 1998)

- Bennettitales
  - Family incertae sedis
    - Gen. et sp. indet. (*in* Ash, 1994)
- Pinophyta
  - Araucariaceae
    - *Callialasporites trilobatus* (*in* Ash, 1994; Litwin et al., 1998)
    - *Callialasporites* cf. *C. rugularus* (*in* Ash, 1994; Litwin et al., 1998)
  - Podocarpaceae
    - *Microcachrydites antarcticus* (*in* Ash, 1994; Litwin et al., 1998)
    - *Parvisaccites* sp. (*in* Ash, 1994; Litwin et al., 1998)
    - *Rugubivesiculites* sp. (*in* Ash, 1994; Litwin et al., 1998)
- Ginkgophyta
  - Czekanowskiaceae
    - *Czekanowskia* sp. (*in* Ash, 1994)

Mollusca
- Bivalvia
  - Unionidae
    - *Vetulonaia* sp. (*in* Carpenter, 2013)
    - Gen. et sp. indet. (*in* Good, 2004)

Arthropoda
- Ostracoda
  - Cyprididae
    - *Candona* sp. (*in* Schudak et al., 1998)
  - Limnocytheridae
    - *Bisulcocypris pahasapensis* (*in* Schudak et al., 1998)
    - *Helmdachia petersoni* (*in* Schudak et al., 1998)
  - Family incertae sedis
    - *Cetacella* sp. (*in* Schudak et al., 1998)
- Spinicaudata
  - Cyzicidae
    - *Lioestheria* sp. (*in* Lucas and Kirkland, 1998)

Actinopterygii
- Amiiformes
  - Gen. et sp. indet. (*in* Foster, 2003)

Sarcopterygii
- Dipnoi
  - *Ceratodus* sp. (*in* Foster, 2003)

Amphibia
- Anura
  - Alytidae
    - *Enneabatrachus* sp. (*in* Foster, 2003)
    - Gen. et sp. indet. (*in* Foster, 2003)
  - Family incertae sedis
    - *Rhadinosteus parvus** (*in* Henrici, 1998)
- Caudata
    - *Iridotriton hechti** (*in* Evans et al., 2005)
    - Gen. et sp. indet. (*in* Foster, 2003)

Reptilia

  - Choristodera
      - *Cteniogenys* sp. (*in* Foster, 2003)
  - Rhynchocephalia
    - Opisthodontia
      - *Opisthias* sp. (*in* Foster, 2003)
      - *Theretairus* sp. (*in* Foster, 2003)
  - Crocodylomorpha
    - Goniopholidae
      - *Goniopholis* sp. (*in* Foster, 2003)
      - *Eutretauranosuchus* sp. (*in* Foster, 2003)
    - Protosuchidae
      - *Hoplosuchus kayi** (*in* Gilmore, 1926)
  - Dinosauria
    - Saurischia
      - Theropoda
        - *Allosaurus* cf. *fragilis* (*in* Foster, 2003; Carpenter, 2013)
        - *Ceratosaurus* sp. (*in* Foster, 2003; Carpenter, 2013)
        - *Koparion douglassi** (*in* Chure, 1994)
        - *Marshosaurus* (*in* Foster, 2003)
        - *Torvosaurus* cf. *tanneri* (*in* Foster, 2003; Carpenter, 2013)
      - Sauropoda
        - *Apatosaurus louisae** (*in* Holland, 1916)
        - *Athenar bermani** (*in* Whitlock et al., 2025)
        - *Barosaurus lentus* (*in* Foster, 2003; Carpenter, 2013)
        - *Camarasaurus lentus* (*in* Foster, 2003; Carpenter, 2013)
        - *Diplodocus* sp. (*in* Foster, 2003; Carpenter, 2013)
      - Ornithischia
        - *Camptosaurus aphanoectes** (*in* Carpenter and Wilson, 2008)
        - *Dryosaurus elderae** (*in* Carpenter and Galton, 2018)
        - *Stegosaurus* sp. (*in* Carpenter, 2013
  - Squamata
    - *Eoscincus ornatus** (*in* Brownstein et al., 2022)
    - *Helioscopus dickersonae** (*in* Meyer et al., 2023)
    - *Schillerosaurus utahensis** (*in* Nydam et al., 2013; formerly *Schillera utahensis, in* Evans and Chure, 1999)
  - Serpentes
    - Gen. et sp. indet. (*in* Foster, 2003)
  - Testudines
    - *Dinochelys whitei** (*in* Gaffney, 1979)
    - *Glyptops utahensis** (*in* Gilmore, 1916)
- Mammaliaformes
      - *Docodon* sp. (*in* Foster, 2003)
  - Mammalia
    - Dryolestida
      - *Dryolestes* sp. (*in* Foster, 2003)
      - *Euthlastus* sp. (*in* Foster, 2003)
      - Eutriconodonta
      - *Priacodon* sp. (*in* Foster, 2003)
      - *Triconolestes* sp. (*in* Foster, 2003)

- Multituberculata
  - *Glirodon grandis** (*in* Engelmann and Callison, 1999)
- Family incertae sedis
  - Gen. et sp. indet. (*in* Foster, 2003)

Cedar Mountain Formation, Early Cretaceous (DINO)

- Arthropoda
  - Ostracoda
    - Gen. et sp. indet. (*in* Kosmidis et al., 2002)
- Mollusca
  - Gastropoda
    - Gen. et sp. indet. (*in* Kosmidis et al., 2002)
- Dinosauria
  - Theropoda
    - Deinonychosauria
      - Gen. et sp. nov. (*in* Britt et al., 2021)
  - Sauropoda
    - *Abydosaurus mcintoshi** (*in* Chure et al., 2010)

Mowry Shale, Late Cretaceous (DINO)

- Plantae
  - Angiospermae
    - Gen. et sp. indet. (*in* Stewart et al., 1994)
- Mollusca
  - Cephalopoda
    - Ammonoidea
      - Gen. et sp. indet. (*in* Untermann and Untermann, 1954)
- Chondrichthyes
  - *Haimirchia amonensis* (*in* Hansen et al., 1983)
- Actinopterygii
  - Aulopiformes
    - Enchodontidae
      - *Enchodus* sp. (*in* Stewart et al., 1994)
    - Alepisauroidei
      - Gen. et sp. indet. (*in* Stewart et al., 1994)
  - Ichthyodectiformes
    - Gen. et sp. indet. (*in* Stewart et al., 1994)
  - Sphenocephaliformes
    - Sphenocephalidae
      - Gen. et sp. indet. (*in* Stewart et al., 1994)
- Reptilia
  - Plesiosauria
    - Gen. et sp. indet. (*in* Stewart et al., 1994)
- Crocodylomorpha
  - Gen. et sp. indet. (*in* Hansen et al., 1983; Stewart et al., 1994)

Frontier Formation, Late Cretaceous (DINO)

- Plantae

- Unidentified leaves (*in* Untermann and Untermann, 1954)
- Petrified wood (*in* Gregson et al., 2024)

- Gymnospermae
  - Pinopsida
    - *Brachyphyllum* sp. (*in* Untermann and Untermann, 1954)

- Invertebrata
  - Invertebrate burrows (*in* Gregson et al., 1954)
- Mollusca
  - Ammonoidea
    - *Prionotropis* sp. (*in* Untermann and Untermann, 1954)
    - *Scaphites* sp. (*in* Untermann and Untermann, 1954)
    - Gen. et sp. indet. (*in* Gregson et al., 2024)
  - Bivalvia
    - *Inoceramus* sp. (*in* Untermann and Untermann, 1954)
    - Gen. et sp. indet. (*in* Gregson et al., 2024)
  - Gastropoda
    - *Viviparus* sp. (*in* Untermann and Untermann, 1954)
    - Gen. et sp. indet. (*in* Gregson et al., 2024)
- Chondrichthyes
  - Gen. et sp. indet. (*in* Untermann and Untermann, 1954; Gregson et al., 2024)

Quaternary Sediments (DINO)

- Plantae
  - Gymnospermae
    - Cupressaceae
      - *Juniperus communis* (*in* Sharpe, 1991)
      - *Juniperus osteosperma* (*in* Sharpe, 1991)
      - *Juniperus scopulorum* (*in* Sharpe, 1991)
      - *Juniperus* cf. *J. scopulorum* (*in* Sharpe, 1991)
      - *Juniperus* sp. (*in* Sharpe, 1991)
    - Pinaceae
      - *Picea pungens* (*in* Sharpe, 1991)
      - *Pinus flexilis* (*in* Sharpe, 1991)
      - *Pseudotsuga menziesii* (*in* Sharpe, 1991)
      - Gen. et sp. indet. (*in* Sharpe, 1991)
  - Angiospermae
    - Asteraceae
      - *Artemisia ludoviciana* (*in* Sharpe, 1991)
      - *Artemisia tridentata* (*in* Sharpe, 1991)
      - cf. *Aster* sp. (*in* Sharpe, 1991)
      - *Cirsium* sp. (*in* Sharpe, 1991)
      - *Gutierrezia* sp. (*in* Sharpe, 1991)
      - *Helianthus* sp. (*in* Sharpe, 1991)
      - Gen. et sp. indet. (*in* Sharpe, 1991)
    - Amaranthaceae
      - *Atriplex confertifolia* (*in* Sharpe, 1991)
      - *Chenopodium* sp. (*in* Sharpe, 1991)
    - Rhamnaceae

        Ceanothus sp. (*in* Sharpe, 1991)
        Rhamnus sp. (*in* Sharpe, 1991)
    Rosaceae
        Cercocarpus intricatus (*in* Sharpe, 1991)
        Rosa sp. (*in* Sharpe, 1991)
    Cactaceae
        cf. *Echinocereus* sp. (*in* Sharpe, 1991)
        Mammillaria sp. (*in* Sharpe, 1991)
        Opuntia polyacantha (*in* Sharpe, 1991)
        Opuntia sp. (*in* Sharpe, 1991)
        cf. *Pediocactus* sp. (*in* Sharpe, 1991)
        Gen. et sp. indet. (*in* Sharpe, 1991)
    Brassicaceae
        Lepidium sp. (*in* Sharpe, 1991)
    Boraginaceae
        Amsinckia sp./*Cryptantha* sp. (*in* Sharpe, 1991)
        Lithospermum sp. (*in* Sharpe, 1991)
        Gen. et sp. indet. (*in* Sharpe, 1991)
    Anacardiaceae
        Rhus sp. (*in* Sharpe, 1991)
    Poaceae
        Stipa hymenoides (*in* Sharpe, 1991)
        Gen. et sp. indet. (*in* Sharpe, 1991)
    Caprifoliaceae
        Symphoricarpos sp. (*in* Sharpe, 1991)
    Fabaceae
        Gen. et sp. indet. (*in* Sharpe, 1991)
Mammalia
  Rodentia
    Neotoma sp. middens (*in* Tweet et al., 2012a)
    Neotoma sp. (*in* Sharpe, 1991)

Glen Canyon National Recreation Area (GLCA)

Paradox Formation, Middle Pennsylvanian (GLCA)

Brachiopoda
  Derbyia cf. *D. crassa* (*in* Lewis and Campbell, 1965)
  Mesolobus mesolobus (*in* Lewis and Campbell, 1965)
  Chonetina flemingi (*in* Lewis and Campbell, 1965)
  Hustedia mormoni (*in* Lewis and Campbell, 1965)
  Neospirifer cf. *cameratus* (*in* Lewis and Campbell, 1965)
  Neospirifer cf. *N. kansasensis* (*in* Lewis and Campbell, 1965)
  Enteletes sp. (*in* Lewis and Campbell, 1965)
  Nubeculara sp. (*in* Lewis and Campbell, 1965)
  Antiguatonia hermosanus (*in* Lewis and Campbell, 1965)
  Composita subtilita (*in* Lewis and Campbell, 1965)
Bryozoa

  - *Fenestella* sp. (*in* Lewis and Campbell, 1965)
  - *Rhombotrypella* sp. (formerly *Rhomboporella*) (*in* Lewis and Campbell, 1965)
- Echinodermata
  - Crinoidea
- Chlorophyta
  - Dasycladales
    - Diploporaceae
        - *Diplopora* sp. (*in* Lewis and Campbell, 1965)
- Cyanobacteria
  - Cyanophyceae
    - Oscillatoriales
        - *Girvanella* sp. (*in* Lewis and Campbell, 1965)
- Foraminifera
  - Fusulinida
    - Gen. et sp. indet. (*in* Nail, 1996)
    - Ozawainellidae
        - *Ozawaniella* sp.? (*in* Lewis and Campbell, 1965)
    - Schubertellidae
        - *Schubertella* sp. (*in* Lewis and Campbell, 1965)
    - Triticitidae
        - *Triticites* sp. (*in* Lewis and Campbell, 1965)
        - *Triticites* sp. aff. *T. confertus* (*in* Lewis and Campbell, 1965)
        - *Triticites kellyensis*? (*in* Lewis and Campbell, 1965)
    - Endothyrida
        - Bradyinidae
        - *Bradyina* sp. (*in* Lewis and Campbell, 1965)
    - Endothyridae
        - *Endothyra* or *Endothyranella* (*in* Lewis and Campbell, 1965)
    - Globivalvulinidae
        - *Globivalvulina* sp. (*in* Lewis and Campbell, 1965)
    - Palaeotextulariidae
        - *Climacammina* sp. (*in* Lewis and Campbell, 1965)
        - *Osagia* sp. (*in* Lewis and Campbell, 1965)
    - Miliolida
        - Gen. et sp. indet. (*in* Lewis and Campbell, 1965)
    - Calcivertellidae
        - *Treipeilopsis* sp. (*in* Lewis and Campbell, 1965)
        - *Treipeilopsis* sp.? (*in* Lewis and Campbell, 1965)
    - Glomospiroididae
        - *Plummerinella* sp. (*in* Lewis and Campbell, 1965)
- Rhizoliths (*in* Williams, 2009)

Honaker Trail Formation, Late Pennsylvanian (GLCA)

- Anthozoa
    - Gen. et sp. indet. (*in* Ritter et al., 2002)
- Brachiopoda
    - Gen. et sp. indet. (*in* Doelling, 1975; Ritter et al., 2002)
    - "Compositids" (*in* Doelling, 1975)

        "Productids" (*in* Doelling, 1975)
        "Rhynchonellids" (*in* Doelling, 1975)
        "Spirifers" (*in* Doelling, 1975)
Bryozoa
        Gen. et sp. indet. (*in* Ritter et al., 2002)
Echinodermata
    Crinoidea
        Gen. et sp. indet. (*in* Doelling, 1975; Ritter et al., 2002)
    Echinoidea
        Gen. et sp. indet. (*in* Doelling, 1975)
Foraminifera
    Fusulinida
        Gen. et sp. indet. (*in* Doelling, 1975; Ritter et al., 2002)
Mollusca
    Gastropoda
        Gen. et sp. indet. (*in* Ritter et al., 2002)
Stromatolites
        Gen. et sp. indet. (*in* Ritter et al., 2002)

Lower Cutler Group, Late Pennsylvanian–Early Permian (GLCA)

Brachiopoda
        Gen. et sp. indet. (*in* O'Sullivan, 1965)
Mollusca
    Gastropoda
        cf. *Psammichnites* isp. (*in* Milner et al., 2024)
Amphibia
    Temnospondyli
        Platyhystrix sp. (*in* Sumida et al., 1999b)

Cedar Mesa Sandstone, Early Permian (GLCA)

Synapsida
        "cf. *Anomalopus* isp." (*in* Lockley and Madsen, 1993; Lockley et al., 1998)
        Stenichnus isp. (*in* Lockley et al., 1998)

Upper Moenkopi Formation, Early Triassic (GLCA)

Arthropoda
    Xiphosura
        cf. *Kouphichnium* isp. (*in* Lockley et al., 1998)
Sarcopterygii
    Coelacanthiformes
        Gen. et sp. indet. (*in* Finell et al., 1963)
Amphibia
    Temnospondyli
        Parotosuchus sp. (*in* Welles, 1967; Morales 1983, 2005)
Reptilia
        Chirotheriid-type swim tracks (*in* DeBlieux et al., 2023)
    Lepidosauromorpha
        Rhynchosauroides isp. (*in* Lockley et al., 1998)

Shinarump Member, Chinle Formation, Late Triassic (GLCA)

- Plantae
        - Gen. et sp. indet. (*in* Kirkland et al., 2010)
    - Bennettitales
        - cf. *Zamites* (*in* Milner et al., 2024)
    - Equisetales
        - cf. *Neocalamites* sp. (*in* Milner et al., 2024)
- Arthropoda (trace)
    - *Scoyenia* isp. (*in* Milner et al., 2024)
- Mollusca (trace)
    - *Oravaichnium* isp. (*in* Milner et al., 2024)
- Reptilia
  - Tanystropheidae
    - cf. *Gwynnedichnium* isp. (*in* Milner et al., 2024)

Owl Rock/Petrified Forest Member, Chinle Formation, Late Triassic (GLCA)

- Phytosauria
  - Gen. et sp. indet. (*in* Milner et al., 2024)

Church Rock Member, Chinle Formation, Late Triassic (GLCA)

- Actinopterygii
  - Redfieldiformes
    - Redfieldiidae
        - *Lasalichthys stewarti* (*in* Milner et al., 2024)
        - *Lasalichthys* sp. (*in* Milner et al., 2024)
        - Gen. et sp. indet. (*in* Milner et al., 2024)
  - Semionotiformes
    - Semionotidae
        - *Lophionotus sanjuanensis* (*in* Milner et al., 2024)
        - *Lophionotus* sp. (*in* Milner et al., 2024)
        - Semionotidae indet. (*in* Milner et al., 2024)
- Sarcopterygii
  - Coelacanthiformes
    - Mawsoniidae
        - Gen. et sp. indet. (*in* Milner et al., 2024)
- Amphibia
  - Temnospondyli
    - Metoposauridae
        - Gen. et sp. indet. (*in* Kirkland et al., 2010)
- Archosauromorpha
  - Dinosauromorpha
        - *Atreipus* isp. (*in* Lockley et al., 1998)
    - Dinosauria
        - Saurischia
            - Theropoda
                - *Grallator* isp. (*in* Lockley et al., 1998)
  - Pseudosuchia

- Aetosauria
  - cf. *Typothorax* sp. (*in* DeBlieux et al., 2023)
  - *Brachychirotherium* isp. (*in* Milner et al., 2024)
- Phytosauria
  - Gen. et sp. indet. (*in* Milner et al., 2024)
- Crocodylomorpha
  - *Batrachopus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
- Lepidosauromorpha
  - *Rhynchosauroides* isp. (*in* Milner et al., 2024)

Wingate Sandstone, Late Triassic–Early Jurassic (GLCA)

- Cyanobacteria
  - Stromatolites (*in* Lockley et al., 1998)
- Archosauromorpha
  - Dinosauria
    - Saurischia
      - Sauropodomorpha
        - *Evazoum gatewayensis* (*in* Milner et al., 2024)
      - Theropoda
        - *Eubrontes* isp. (*in* Wood et al., 2021; Milner et al., 2024)
        - *Grallator* isp. (*in* Lockley et al., 1998)
        - *Kayentapus* isp. (*in* Wood et al., 2021; Milner et al., 2024)
  - Crocodylomorpha
    - *Batrachopus* isp. (*in* Milner et al., 2024)
  - Aetosauria
    - *Brachychirotherium* isp. (*in* Milner et al., 2024)

Kayenta Formation, Early Jurassic (GLCA)

- Invertebrate traces
  - *Palaeophycus* isp. (*in* Milner et al., 2024)
  - *Skolithos* isp. (*in* Milner et al., 2024)
- Actinopterygii
  - *Undichna* isp. (*in* Milner et al., 2024)
- Synapsida
  - Mammaliamorpha
    - cf. *Kayentatherium* sp. (*in* Milner et al., 2023a, 2024)
    - cf. *Ameghinichnus* isp. (*in* Milner et al., 2024)
    - cf. *Brasilichnium* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
    - Indet. tracks (*in* Milner et al., 2024)
- Archosauromorpha
  - Dinosauria
    - Saurischia
      - Sauropodomorpha
        - cf. *Otozoum* isp. (*in* Kirkland et al., 2010; Lockley et al., 2014b)
      - Theropoda
        - *Characichnos tridactylus* (*in* Lockley et al., 2014b; Milner et al., 2024)
        - *Characichnos* isp. (*in* Lockley et al., 2014b; Milner et al., 2024)
        - *Eubrontes* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)

        - *Grallator* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
        - cf. *Kayentapus* isp. (*in* Milner et al., 2024)
    - Ornithischia
        - *Anomoepus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
        - *Moyenisauropus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
  - Crocodylomorpha
    - *Batrachopus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
- Lepidosauromorpha
    - cf. *Rhynchosauroides* isp. (*in* Milner et al., 2024)

Navajo Sandstone, Early Jurassic (GLCA)

- Arthropoda (traces)
    - cf. *Octopodichnus* isp. (*in* Milner et al., 2024)
    - *Palaeophycus* isp. (*in* Milner et al., 2024)
    - ?*Paleohelcura* isp. (*in* Milner et al., 2024)
    - *Taenidium* cf. *barretti* (*in* Milner et al., 2023b, 2024)
- Mollusca
  - Bivalvia
    - Unionidae
      - Gen. et sp. indet. (*in* Lockley et al., 2014b)
- Archosauromorpha
  - Dinosauria
    - Saurischia
      - Sauropodomorpha
        - *Otozoum* isp. (*in* Kirkland et al., 2010; Lockley et al., 2014b; Milner et al., 2024)
        - *Navahopus* isp. (*in* Milner et al., 2024)
      - Theropoda
        - *Eubrontes* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
        - *Grallator* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2023b, 2024)
        - *Kayentapus* isp. (*in* Milner et al., 2023b, 2024)
    - Ornithischia
        - *Anomoepus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
        - *Moyenisauropus* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
  - Crocodylomorpha
    - *Batrachopus* isp. (*in* Milner et al., 2023b, 2024)
- Synapsida
  - Mammaliamorpha
    - cf. *Kayentatherium* sp. (*in* Milner et al., 2023a, 2024)
    - *Brasilichnium* isp. (*in* Lockley et al., 1998, 2014b; Milner et al., 2024)
    - Indet. tracks (*in* Milner et al., 2024)

Temple Cap Sandstone, Middle Jurassic (GLCA)

- Plantae
  - Petrified wood (*in* National Park Service, 1999 [= Page Sandstone of reference])

Entrada Sandstone, Middle Jurassic (GLCA)

- Archosauromorpha
  - Dinosauria

    - Saurischia
      - Theropoda
        - Unidentified theropod tracks previously attributed to the Navajo Sandstone (*in* Lockley et al., 2005)

Morrison Formation, Late Jurassic (GLCA)

- Arthropoda (traces)
  - Termite nests (*in* Engelmann, 1999)
- Archosauromorpha
  - Dinosauria
    - Dinosauria indet. (*in* Anderson et al., 2000)
    - Saurischia
      - Sauropoda
        - Unidentified sauropod track with skin impressions (*in* Lockley and Hunt, 1995)

Naturita Formation (Dakota Formation in older references), Late Cretaceous (GLCA)

- Plantae
    - Undetermined material (wood tissue, resin blebs) (*in* Peterson, 1969)
  - Chlorophyta
      - *Botryococcus* sp. (*in* Peterson, 1969)
  - Polypodiopsida
      - *Anemia* sp. (*in* Peterson, 1969)
      - *Appendicisporites* sp. (*in* Peterson, 1969)
      - *Cicatricosisporites* sp. (*in* Peterson, 1969)
      - *Gleichenia* sp. (*in* Peterson, 1969)
      - *Gleicheniidites* sp. (*in* Peterson, 1969)
      - Other fern spores (*in* Peterson, 1969)
  - Gymnospermae
    - Pinopsida
      - Conifer pollen (*in* Peterson, 1969)
  - Angiospermae
      - *Monosulcites* sp. (*in* Peterson, 1969)
      - *Retitricolpites* sp. (*in* Peterson, 1969)
      - *Tricolpopollenites* sp. (*in* Peterson, 1969)
      - Other monosulcate and tricolpate pollen (*in* Peterson, 1969)
- Mollusca
  - Cephalopoda
    - Ammonoidea
      - *Metoicoceras defordi* (*in* Peterson, 1969)
      - *Metoicoceras* cf. *M. whitei* (*in* Peterson, 1969)
  - Bivalvia
    - *Brachiodontes multilinigera* (*in* Peterson, 1969)
    - *Brachiodontes* sp. (*in* Peterson, 1969)
    - *Callistina* sp.? (*in* Peterson, 1969)
    - *Cardium* sp. (*in* Peterson, 1969)
    - *Corbicula* sp.? (*in* Peterson, 1969)
    - *Corbula* sp. (*in* Peterson, 1969)
    - *Exogyra levis* (*in* Peterson, 1969)

Exogyra olisiponensis (*in* Peterson, 1969)
Ostrea sp. (*in* Peterson, 1969)
Phelopteria sp. (*in* Peterson, 1969)
Pinna petrina (*in* Peterson, 1969)
Plicatula sp. (*in* Peterson, 1969)
Gastropoda
Gyrodes sp.? (*in* Peterson, 1969)
Testudines
Gen. et sp. indet. (*in* Peterson, 1969)

Tropic Shale, Late Cretaceous (GLCA)
Anthozoa
Platycyathus sp. (*in* Elder, 1987)
Trochocyathus sp.? (*in* Peterson, 1969)
Brachiopoda
Discinisca sp. (*in* Elder, 1987)
Mollusca
Ammonoidea
Allocrioceras annulatum (*in* Peterson, 1969)
Baculites sp. (*in* Peterson, 1969)
Baculites sp.? (*in* Peterson, 1969)
Collignoniceras woollgari (*in* Peterson, 1969)
Kanabiceras septemseriatum (*in* Peterson, 1969)
Kanabiceras sp.? (*in* Peterson, 1969)
Mammites sp. (*in* Peterson, 1969)
Metoicoceras whitei (*in* Peterson, 1969)
Metoicoceras sp. (*in* Peterson, 1969)
Neocardioceras sp.? (*in* Peterson, 1969)
Sciponoceras gracile (*in* Peterson, 1969)
Watinoceras sp.? (*in* Peterson, 1969)
Belemnoidea
Actinocamax sp. (*in* Peterson, 1969)
Bivalvia
Anomia sp. (*in* Peterson, 1969; Elder, 1987)
Astarte sp.? (*in* Elder, 1987)
Aucinella sp. (*in* Elder, 1987)
Botula sp.? (*in* Peterson, 1969)
Camptonectes platessa (*in* Peterson, 1969)
Camptonectes sp. (*in* Peterson, 1969)
Cardium cf. *C. pauperculum* (*in* Peterson, 1969)
Cardium sp. (*in* Peterson, 1969)
Corbicula sp.? (*in* Peterson, 1969)
Corbula kanabensis (*in* Peterson, 1969)
Corbula sp. (*in* Peterson, 1969; Elder, 1987)
Corbula sp.? (*in* Peterson, 1969)
Cymbophora sp. (*in* Elder, 1987)
Exogyra acroumbonata (*in* Elder, 1987)
Exogyra levis (*in* Peterson, 1969; Elder, 1987)

- *Exogyra olisiponensis* (*in* Peterson, 1969)
- *Exogyra* sp. (*in* Peterson, 1969)
- *Gervillia* sp. (*in* Elder, 1987)
- *Gryphaea newberryi* (*in* Peterson, 1969)
- *Gryphaeostrea* sp. (*in* Elder, 1987)
- *Inoceramus flavus flavus* (*in* Elder, 1987)
- *Inoceramus flavus pictoides* (*in* Elder, 1987)
- *Inoceramus labiatus* (*in* Peterson, 1969)
- *Inoceramus pictus gracilistriatus* (*in* Elder, 1987)
- *Inoceramus pictus pictus* (*in* Elder, 1987)
- *Inoceramus tenuistriatus* (*in* Elder, 1987)
- *Inoceramus* sp. (*in* Peterson, 1969; Elder, 1987)
- *Lima utahensis* (*in* Peterson, 1969)
- *Lima* sp. (*in* Elder, 1987)
- *Liopistha concentrica* (*in* Elder, 1987)
- *Liopistha elongatula* (*in* Elder, 1987)
- *Liopistha meeki* (*in* Elder, 1987)
- *Lucina subundata* (*in* Peterson, 1969)
- *Lucina* sp. (*in* Peterson, 1969; Elder, 1987)
- *Mytiloides* aff. *M. duplicostatus* (*in* Elder, 1987)
- *Mytiloides* aff. *M. submytiloides* (*in* Elder, 1987)
- *Mytiloides* n. sp. A (*in* Elder, 1987)
- *Mytiloides opalensis* (*in* Elder, 1987)
- *Nemodon* sp. (*in* Elder, 1987)
- *Ostrea* sp. (*in* Peterson, 1969)
- *Phelopteria* cf. *P. gastrodes* (*in* Peterson, 1969)
- *Phelopteria* sp. (*in* Peterson, 1969)
- *Phelopteria* sp. indet. (*in* Elder, 1987)
- *Pholadomya* sp. (*in* Elder, 1987)
- *Plesiopinna* sp. (*in* Elder, 1987)
- *Plicatula* sp. (*in* Elder, 1987)
- *Protocardia* sp. (*in* Elder, 1987)
- *Pseudoptera* sp. (*in* Elder, 1987)
- *Psilomya concentrica* (*in* Peterson, 1969)
- *Psilomya meeki* (*in* Peterson, 1969)
- *Pycnodonte newberryi* (*in* Elder, 1987)
- *Solemya obscura* (*in* Peterson, 1969; Elder, 1987)
- *Syncyclonema* sp. (*in* Elder, 1987)
- *Veniella mortoni* (*in* Peterson, 1969)
- *Yoldia*? sp. (*in* Peterson, 1969)
- Arcidae indet. (*in* Elder, 1987)
- Inoceramidae indet. (*in* Elder, 1987)
- Indet. oysters (including oyster spat) (*in* Elder, 1987)
- Infaunal bivalve indet. (*in* Elder, 1987)
- "Ligumen" [typo?] (*in* Elder, 1987)

Gastropoda

- *Anchura* sp. (*in* Elder, 1987)
- *Anisomyon* sp. (*in* Elder, 1987)

- *Arrhoges prolabiata* (*in* Peterson, 1969)
- *Cerithiopsis* sp. (*in* Elder, 1987)
- *Cerithium* sp. (*in* Peterson, 1969)
- *Cerithium* sp.? (*in* Peterson, 1969)
- *Cylichna* sp. (*in* Elder, 1987)
- *Drepanochilus ruida* (*in* Peterson, 1969; Elder, 1987)
- *Eunaticina textilis* (*in* Elder, 1987)
- *Euspira concinna* (*in* Elder, 1987)
- *Euspira* sp. (*in* Peterson, 1969)
- "*Mesostoma*" sp. (*in* Elder, 1987)
- *Perissoptera* sp. (*in* Elder, 1987)
- *Rostellites* sp.? (*in* Peterson, 1969)
- *Sigaretus* (*Eunaticina*?) *textilis* (*in* Peterson, 1969)
- *Turritella whitei* (*in* Peterson, 1969; Elder, 1987)
- *Turritella* sp. (*in* Elder, 1987)
- Gen. et sp. indet. (*in* Elder, 1987)

Scaphopoda
- Gen. et sp. indet. (*in* Elder, 1987)

Annelida
- *Hamulus* sp. (*in* Elder, 1987)
- *Serpula intrica* (*in* Peterson, 1969; Elder, 1987)
- *Serpula* sp. (*in* Elder, 1987)

Chondrichthyes
- *Cretolamna appendiculata* (*in* Albright et al., 2013)
- *Oxyrhina* cf. *O. angustidens* (*in* Peterson, 1969)
- *Ptychodus whipplei* (*in* Peterson, 1969)
- *Ptychodus* cf. *P. polygyrus* (*in* Peterson, 1969)
- *Ptychodus* sp. (*in* Peterson, 1969)
- *Scapanorhynchus raphiodon* (*in* Albright et al., 2013)
- *Scapanorhynchus subulatus* (*in* Peterson, 1969)
- *Squalicorax curvatus* (*in* Albright et al., 2013)
- Gen. et sp. indet. (*in* Peterson, 1969)

Actinopterygii
- Undetermined scales (*in* Peterson, 1969)
- Ichthyodectidae
  - *Gillicus arcuatus* (*in* Albright et al., 2013)
  - *Xiphactinus audax* (*in* Peterson, 1969)
- Pycnodontoidea
  - Pycnodontoid tooth (*in* Peterson, 1969)

Mosasauridae
- *Sarabosaurus dahli** (*in* Polcyn et al., 2023)

Plesiosauria
- Pliosauridae
  - *Brachauchenius lucasi* (*in* Albright et al., 2007a)
- Polycotylidae
  - *Eopolycotylus rankini** (*in* Albright et al., 2007b)
  - *Scalamagnus tropicensis** (*in* Clark et al., 2023b; formerly *Dolichorhynchops tropicensis, in* Schmeisser McKean, 2012)

        Trinacromerum ?*bentonianum* (*in* Albright et al., 2007b)
        Gen. et sp. nov., cf. *Palmulasaurus* (*in* Schmeisser McKean and Gillette, 2021)
- Testudines
        - *Desmatochelys lowi* (*in* Albright et al., 2013)
- Foraminifera
    - *Bulimina* sp. (*in* Peterson, 1969)
    - *Dentalina* sp.? (*in* Peterson, 1969)
    - *Frondicularia* sp. (*in* Peterson, 1969)
    - *Haplofragmoides* sp.? (*in* Peterson, 1969)
    - *Hedbergella* cf. *H. delrioensis* (*in* Peterson, 1969)
    - *Heterohelix moremani* (*in* Peterson, 1969)
    - *Marginulinopsis* sp.? (*in* Peterson, 1969)
    - *Planulina dakotensis* (*in* Peterson, 1969)
    - *Proteonina difflugiformis* (*in* Peterson, 1969)
    - ?*Ticinella aprica* (*in* Peterson, 1969)
    - Undetermined planktonic foraminifera (*in* Peterson, 1969)

Straight Cliffs Formation, Late Cretaceous (GLCA)

- Plantae
    - Angiospermae
        - *Geonomites*? sp. (*in* Peterson, 1969)
- Mollusca
    - Cephalopoda
        - Ammonoidea
            - *Placenticeras* sp. (*in* Peterson, 1969)
            - *Protexanites shoshonensis* (*in* Peterson, 1969)
    - Bivalvia
        - *Cardium* cf. *C. pauperculum* (*in* Peterson, 1969)
        - *Inoceramus howelli* (*in* Peterson, 1969)
        - *Inoceramus* (*Volviceramus*) *involutus* (*in* Peterson and Barnum, 1973)
        - *Inoceramus* cf. *I. stantoni* (*in* Peterson, 1969)
        - *Inoceramus* sp. (*in* Peterson, 1969)
        - *Ostrea* sp. (*in* Peterson, 1969)
    - Gastropoda
        - *Bellifusus* sp.? (*in* Peterson and Barnum, 1973)
        - *Gyrodes* cf. *G. conradi* (*in* Peterson, 1969)
        - *Gyrodes* cf. *G. depressus* (*in* Peterson, 1969)
        - *Gyrodes* sp. (*in* Peterson and Barnum, 1973)
        - *Helicaulax* sp.? (*in* Peterson and Barnum, 1973)
        - *Rostellites* sp.? (*in* Peterson, 1969)
- Annelida
        - *Serpula* sp. (*in* Peterson, 1969)
- Arthropoda (traces)
        - *Ophiomorpha* isp. (*in* Peterson, 1969)
- Chondrichthyes
        - *Ptychodus* sp. (*in* Peterson, 1969)

Quaternary Sediments (GLCA)

- Plantae
  - Gymnospermae
    - Cupressaceae
      - *Juniperus* sp. (*in* Davis et al., 1984)
      - *Juniperus communis* (*in* Davis et al., 1984)
    - Pinaceae
      - *Picea pungens* (*in* Davis et al., 1984)
  - Angiospermae
    - Asteraceae
      - *Artemisia* cf. *tridentata* (*in* Davis et al., 1984)
      - *Cirsium* sp. (*in* Davis et al., 1984)
      - cf. *Heleanthus* (*in* Davis et al., 1984)

    - Betulaceae
      - *Betula occidentalis* (*in* Davis et al., 1984)
    - Cactaceae
      - *Opuntia* sp. (*in* Davis et al., 1984)
      - *Opuntia polyacantha* (*in* Davis et al., 1984)
      - *Sclerocactus* sp. (*in* Davis et al., 1984)
    - Caprifoliaceae
      - *Sambucus* sp. (*in* Davis et al., 1984)
      - *Symphoricarpos* sp. (*in* Davis et al., 1984)
    - Chenopodiaceae
      - *Atriplex* sp. (*in* Davis et al., 1984)
      - *Atriplex* cf. *canescens* (*in* Davis et al., 1984)
      - *Atriplex* cf. *confertifolia* (*in* Davis et al., 1984)
      - *Chenopodium* sp. (*in* Davis et al., 1984)
      - *Corispermum* sp. (*in* Davis et al., 1984)
    - Cleomaceae
      - *Cleome* sp. (*in* Davis et al., 1984)
    - Cornaceae
      - *Cornus stolonifera* (*in* Davis et al., 1984)
    - Cyperaceae
      - *Carex* cf. *lenticularis* (*in* Davis et al., 1984)
      - *Carex* cf. *interior* (*in* Davis et al., 1984)
      - *Carex lasiocarpa* (*in* Davis et al., 1984)
      - *Scirpus* sp. (*in* Davis et al., 1984)
    - Fagaceae
      - *Quercus* sp. (*in* Davis et al., 1984)
    - Gramineae
      - Cf. *Agropyron* (*in* Davis et al., 1984)
    - Poaceae
      - *Oryzopsis hymenoides* (*in* Davis et al., 1984)
      - *Panicum* sp. (*in* Davis et al., 1984)
      - *Spartina gracilis* (*in* Davis et al., 1984)
      - *Sporobolus* sp. (*in* Davis et al., 1984)
    - Labiatae
      - cf. *Marrubium* sp. (*in* Davis et al., 1984)

- Leguminosae
  - cf. *Dalea* sp. (*in* Davis et al., 1984)
- Liliaceae
  - cf. *Smilacina* sp. (*in* Davis et al., 1984)
- Malvaceae
  - *Sphaeralcea* sp. (*in* Davis et al., 1984)
- Potamogetonaceae
  - *Potamogeton diversifolium* (*in* Davis et al., 1984)
- Rosaceae
  - *Amelanchier* sp. (*in* Davis et al., 1984)
  - *Purshia* sp. (*in* Davis et al., 1984)
  - *Rosa* sp. (*in* Davis et al., 1984)
  - *Rubus* sp. (*in* Davis et al., 1984)
- Saxifragaceae
  - *Ribes* sp. (*in* Davis et al., 1984)

Mollusca
- Bivalvia
  - *Pisidium casertanum* (*in* Kaufman et al., 2002)
  - *Pisidium nitidum* (*in* Kaufman et al., 2002)
  - *Pisidium subtruncatum* (*in* Kaufman et al., 2002)
  - *Pisidium walkeri* (*in* Kaufman et al., 2002)
  - *Pisidium* sp. (*in* Kaufman et al., 2002)
- Gastropoda
  - *Catinella* sp. (*in* Kaufman et al., 2002)
  - *Fossaria dalli* (*in* Kaufman et al., 2002)
  - *Gyraulus parvus* (*in* Kaufman et al., 2002)
  - *Vertigo ovata* (*in* Kaufman et al., 2002)

Arthropoda
- Ostracoda
  - *Cypridopsis okeechobei* (*in* Kaufman et al., 2002)
  - *Cypridopsis vidua* (*in* Kaufman et al., 2002)
  - *Darwinula stevensoni* (*in* Kaufman et al., 2002)
  - *Heterocypris incongruins* (*in* Kaufman et al., 2002)
  - *Hyocypris bradyi* (*in* Kaufman et al., 2002)
  - *Strandesia meadensis* (*in* Kaufman et al., 2002)

Amphibia
- Anura
  - *Scaphiopus intermontanus* (*in* Mead et al., 1993)
  - *Scaphiopus* cf. *bombifrons* (*in* Mead et al., 1993)

Reptilia
- Ophidia
  - *Crotalus* cf. *viridis* (*in* Mead et al., 1993)
  - *Pitulophis melanoleucus* (*in* Mead et al., 1993)

Mammalia
- Afrotheria
  - *Mammuthus columbi* (*in* Mead et al., 1984)

Artiodactyla
  - *Bison* sp. (*in* Mead and Agenbroad, 1992)

- *Euceratherium collinum* (*in* Mead et al., 1993)
- *Camelops* sp. (*in* Mead and Agenbroad, 1992)
- *Odocoileus* sp. (*in* Mead et al., 1984)
- *Oreamnos harringtoni* (*in* Mead et al., 1993)
- *Ovis canadensis* (*in* Mead and Agenbroad, 1992)

Perissodactyla
- *Equus* sp. (*in* Davis et al., 1984)

Lagomorpha
Brachylagus idahoensis (*in* Mead et al., 1993)
Sylvilagus sp. (*in* Mead and Agenbroad, 1992)

Rodentia
- *Lagurus curtatus* (*in* Mead et al., 1993)
- *Marmota flaviventris* (*in* Mead et al., 1993)
- *Microtus* sp. (*in* Mead et al., 1993)
- *Neotoma cinerea* (*in* Mead et al., 1993)
- *Spermophilus* sp. (*in* Mead et al., 1993)
- *Thomomys* sp. (*in* Mead et al., 1993)

Xenarthra
- *Nothrotheriops shastensis* (*in* Mead et al., 1984; Mead and Agenbroad, 1992)

Golden Spike National Historical Park (GOSP)

Bridal Veil Limestone, Oquirrh Group, Pennsylvanian (GOSP)

Porifera
- Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Anthozoa
- Rugosa
  - Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Arthropoda
- Trilobita
  - Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Brachiopoda
- Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Bryozoa
- Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Echinodermata
- Crinoidea
  - Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Mollusca
- Nautiloidea
  - Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Elasmobranchii
- Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Actinopterygii
- Teleostei
  - Gen. et sp. indet. (*in* Aase, undated; Tweet et al., 2012h)

Quaternary Sediments (GOSP)

- Plantae
  - Gymnospermae
    - Pinopsida
        - *Juniperus osteosperma* (*in* Rhode, 2000)
  - Angiospermae
    - Amaranthaceae
        - *Amaranthus* sp. (*in* Rhode, 2000)
        - *Chenopodium* sp. (*in* Rhode, 2000)
    - Papaveraceae
        - *Argemone* sp. (*in* Rhode, 2000)
    - Asteraceae
        - *Artemisia* sect. *Tridentatae* (*in* Rhode, 2000)
        - *Brickellia* sp. (*in* Rhode, 2000)
        - *Chrysothamnus* sp. (*in* Rhode, 2000)
        - *Gutierrezia* cf. *G. sarothrae* (*in* Rhode, 2000)
        - *Haplopappus* sp. (*in* Rhode, 2000)
        - *Tetradymia* sp. (*in* Rhode, 2000)
    - Gen. et sp. indet. (*in* Rhode, 2000)
    - Fabaceae
        - *Astragalus* sp. (*in* Rhode, 2000)
    - Poaceae
        - *Festuca* sp. (*in* Rhode, 2000)
        - Gen. et sp. indet. (*in* Rhode, 2000)
    - Rubiaceae
        - *Gallium* sp. (*in* Rhode, 2000)
    - Boraginaceae
        - *Lappula redowskii* (*in* Rhode, 2000)
    - Cyperaceae
        - *Scirpus* sp. (*in* Rhode, 2000)
    - Fabaceae
        - Gen. et sp. indet. (*in* Rhode, 2000)
- Mammalia
  - Rodentia
    - *Neotoma* sp. middens (*in* Tweet et al., 2012a)

Hovenweep National Monument (HOVE)

Naturita Formation (Dakota Formation in older references), Late Cretaceous (HOVE)

- Plantae
        - Gen. et sp. indet. (*in* Shaffer et al., 2024)

Natural Bridges National Monument (NABR)

Chinle Formation, Late Triassic (NABR)

- Plantae

Gen. et sp. indet. (*in* Santucci and Kirkland, 2010)

Quaternary Sediments (NANRA)

Plantae
- Gen. et sp. indet. (*in* Mead et al., 1987)
- Polypodiophyta
  - Equisetales
    - *Equisetum* sp. (*in* Mead et al., 1987)
- Gymnospermae
  - Pinopsida
    - *Juniperus* sp. (*in* Mead et al., 1987)
    - *Picea* sp./*Abies* sp./*Pseudotsuga* sp. (*in* Mead et al., 1987)
    - *Pinus flexilis*-type pollen (*in* Mead et al., 1987)
    - *Pinus* sp. (*in* Mead et al., 1987)
    - *Pseudotsuga* sp. (*in* Mead et al., 1987)
  - Ephedraceae
    - *Ephedra* sp. (*in* Mead et al., 1987)
- Angiospermae
  - Sapindaceae
    - *Acer* sp.? (*in* Mead et al., 1987)
  - Betulaceae
    - *Alnus* sp. (*in* Mead et al., 1987)
    - *Betula* sp. (*in* Mead et al., 1987; Mead and Agenbroad, 1992)
  - Asteraceae
    - *Antennaria sp./Cirsium* sp. (*in* Mead et al., 1987)
    - *Artemisia* sp. (*in* Mead et al., 1987)
    - High-spine Asteraceae pollen (*in* Mead et al., 1987)
    - Low-spine Asteraceae pollen (*in* Mead et al., 1987)
  - Nyctaginaceae
    - *Boerhavia* sp. (*in* Mead et al., 1987)
  - Poaceae
    - *Bromus* sp. (*in* Mead et al., 1987)
    - *Poa* sp. (*in* Mead et al., 1987)
    - Gen. et sp. indet. (*in* Mead et al., 1987)
  - Cyperaceae
    - *Carex* sp. (*in* Mead et al., 1987)
    - Gen. et sp. indet. (*in* Mead et al., 1987)
  - Rhamnaceae
    - *Ceanothus* sp./*Cercocarpus* sp. (*in* Mead et al., 1987)
    - *Rhamnus* sp. (*in* Mead et al., 1987)
  - Cannabaceae
    - *Celtis* sp. (*in* Mead et al., 1987)
  - Oleaceae
    - *Fraxinus* sp. (*in* Mead et al., 1987)
  - Juglandaceae
    - *Juglans* sp. (*in* Mead et al., 1987)
  - Cactaceae
    - *Opuntia* sp. (*in* Mead et al., 1987)

- Plantaginaceae
  - *Plantago* sp. (*in* Mead et al., 1987)
- Salicaceae
  - *Populus* sp. (*in* Mead et al., 1987)
- Fagaceae
  - *Quercus* sp. (*in* Mead et al., 1987)
- Polygonaceae
  - *Rumex* sp. (*in* Mead et al., 1987)
- Sarcobataceae
  - *Sarcobatus* sp. (*in* Mead et al., 1987)
- Malvaceae
  - *Sphaeralcea* sp. (*in* Mead et al., 1987)
- Amaranthaceae
  - Cheno-Am pollen (*in* Mead et al., 1987)
- Liguliflorae
  - Gen. et sp. indet. (*in* Mead et al., 1987)
- Rosaceae
  - Gen. et sp. indet. (*in* Mead et al., 1987)

Mammalia
- Rodentia
  - *Neotoma* sp. middens (*in* Tweet et al., 2012a)
- Artiodactyla
  - *Oreamnos harringtoni* (*in* Mead et al., 1987)

RAINBOW BRIDGE NATIONAL MONUMENT (RABR)

Kayenta Formation, Early Jurassic (RABR)
- *Eubrontes* isp. (*in* Hall, 1934; Lockley et al., 1998)

TIMPANOGOS CAVE NATIONAL MONUMENT (TICA)

Deseret Limestone, Mississippian (TICA)

Anthozoa
- Gen. et sp. indet. (*in* Santucci et al., 2001)
- Rugosa
  - Gen. et sp. indet. (*in* Santucci et al., 2001)

Echinodermata
- Crinoidea
  - Gen. et sp. indet. (*in* Santucci et al., 2001)

Mollusca
- Gastropoda
  - Gen. et sp. indet. (*in* Santucci et al., 2001)

Quaternary Sediments (TICA)

Reptilia
- Squamata

        Ophidia
                Gen. et sp. indet. (*in* George, 1999)
Aves
                Gen. et sp. indet. (*in* George, 1999)
Mammalia
    Rodentia
        Sciuridae
                Marmota flaviventris (*in* George, 1999)
                Spermophilus sp. (*in* George, 1999)
        Muridae
                Microtus sp. (*in* George, 1999)
                Neotoma cf. *cinerea* (*in* George, 1999)
                Neotoma sp. middens (*in* Tweet et al., 2012a)
                Peromyscus cf. *maniculatus* (*in* George, 1999)
    Lagomorpha
                Lepus americanus (*in* George, 1999)
    Carnivora
                Martes americana (*in* George, 1999)
                Mustela vison (*in* George, 1999)
                Procyon lotor (*in* George, 1999)
                Ursus americanus (*in* George, 1999)
    Artiodactyla
                Bison bison (*in* Santucci et al., 2001; Santucci and Kirkland, 2010)
                Ovis canadensis (*in* George, 1999)

ZION NATIONAL PARK (ZION)

Kaibab Limestone, Early Permian (ZION)

Mollusca
    Bivalvia
        Myalina sp. (*in* DeBlieux et al., 2005)

Lower Red Member, Moenkopi Formation, Early Triassic (ZION)

Lepidosauromorpha
    Rhynchosauroides isp. (*in* Mickelson et al., 2006b)
Pseudosuchia
    Chirotherium isp. (*in* Mickelson et al., 2006b)

Virgin Limestone Member, Moenkopi Formation, Early Triassic (ZION)

Mollusca
                Gen. et sp. indet. (*in* Santucci, 2000)
    Ammonoidea
        Meekoceratidae
                Gen. et sp. indet. (*in* Santucci, 2000)
Echinodermata
    Asterozoa
        Asteroidea

- Gen. et sp. indet. (*in* Santucci, 2000)
- Ophiuroidea
    - *Asterosoma* sp. (*in* DeBlieux et al., 2005)

Middle Red Member, Moenkopi Formation, Early Triassic (ZION)

- Plantae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2005)

Cameron Member, Chinle Formation, Late Triassic (ZION)

- Plantae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2005)
- Actinopterygii
    - Gen. et sp. indet. (*in* DeBlieux et al., 2005)
- Amphibia
    - Metoposauridae
        - Gen. et sp. indet. (*in* DeBlieux et al., 2005)
- Reptilia
    - Pseudosuchia
        - Crocodylomorpha
            - *Revueltosaurus* cf. *R. callendari* (*in* Heckert et al., 2006)
            - Gen. et sp. indet. (Milner, written observations)
        - Aetosauria
            - Gen. et sp. indet. (*in* DeBlieux et al., 2005)

        - Phytosauria
            - Gen. et sp. indet. (*in* DeBlieux et al., 2005)

Dinosaur Canyon Member, Moenave Formation, Late Triassic–Early Jurassic (ZION)

- Plantae
    - Gen. et sp. indet. (*in* DeBlieux et al., 2006)
    - Pinopsida
        - *Araucarites* sp.
        - *Saintgeorgia* sp.

Whitmore Point Member, Moenave Formation, Early Jurassic (ZION)

- Plantae
    - *Sanmiguelia lewisii* (*in* Ash et al., 2014)
- Actinopterygii
    - Semionotiformes
        - Semionotidae (*in* Hesse, 1935; Milner et al., 2012)
            - *Lophionotus* sp. (*in* Milner et al., 2012)
- Sarcopterygii
    - Coelacanthiformes
        - Gen. et sp. indet. (*in* C.J. Bennett, [former] National Park Service, Zion National Park, unpublished field notes, 2023)
- Dinosauria
    - Theropoda
        - *Eubrontes* isp. (*in* DeBlieux et al., 2006)

        Grallator isp. (*in* Milner et al., 2012)
        "?*Grallator* isp. or ?*Anomoepus* isp." (*in* DeBlieux et al., 2006)

Kayenta Formation, Early Jurassic (ZION)
Dinosauria
    Theropoda
        Characichnos isp.
        Eubrontes isp. (*in* DeBlieux et al., 2005, 2006)
        Grallator isp. (*in* DeBlieux et al., 2005, 2006)
        Kayentapus isp. (*in* Milner et al., 2012)
Synapsida
    Mammaliamorpha
        Brasilichnium isp. (*in* DeBlieux et al., 2005, 2006)

Navajo Sandstone, Early–Middle Jurassic (ZION)
Arthropoda
    Arachnida (trace)
        cf. *Paleohelcura* isp.
Dinosauria
    Theropoda
        Grallator isp. (*in* DeBlieux et al., 2005, 2006)
Synapsida
    Mammaliamorpha
        Gen. et sp. indet. (*in* DeBlieux et al., 2005, 2006)

Co-op Creek Limestone Member, Carmel Formation, Middle Jurassic (ZION)
Mollusca
    Bivalvia
        Gen. et sp. indet. (*in* DeBlieux et al., 2005)
    Gastropoda
        Gen. et sp. indet. (*in* DeBlieux et al., 2005)
Echinodermata
    Crinoidea
        Isocrinus nicoletti (*in* DeBlieux et al., 2005)

Cedar Mountain Formation–Naturita Formation undivided (late Early–early Late Cretaceous) (ZION)
Plantae
        Leaf impressions (*in* DeBlieux et al., 2005)
Mollusca
    Bivalvia
        Gen. et sp. indet. (*in* DeBlieux et al., 2005)

Straight Cliffs Formation (reworked) (Late Cretaceous) (ZION)
Mollusca
    Bivalvia
        Crassostrea soleniscus (*in* DeBlieux et al., 2005)

Quaternary Sediments (ZION)

- Plantae
      - Gen. et sp. indet. (*in* Hamilton, 1979; Hevly, 1979)
    - Pteridophyte spores (*in* Hevly, 1979)
  - Bryophyta
      - Gen. et sp. indet. (*in* Hevly, 1979)
  - Gymnospermae
    - Pinaceae
      - *Abies* sp. (*in* Hevly, 1979)
      - *Picea* sp. (*in* Hevly, 1979)
      - *Pinus* sp. (*in* Hamilton, 1979; Hevly, 1979)
      - *Pseudotsuga* sp. (*in* Hevly, 1979)
      - White pine pollen (*in* Hevly, 1979)
      - Yellow pine pollen (*in* Hevly, 1979)
    - Cupressaceae
      - *Juniperus* sp. (*in* Hevly, 1979)
  - Angiospermae
      - Riparian tree pollen (*in* Hevly, 1979)
    - Salvinaceae
      - *Azolla* sp. (*in* Hamilton, 1979)
    - Potamogetonaceae
      - *Potamogeton* sp. (*in* Hamilton, 1979; Hevly, 1979)
    - Fagaceae
      - *Quercus* sp. (*in* Hevly, 1979)
    - Typhaceae
      - *Typha* sp. (*in* Hevly, 1979)
    - Araceae
      - *Lemna* sp. (*in* Hevly, 1979)
    - Haloragaceae
      - *Myriophyllum* sp. (*in* Hevly, 1979)
    - Amaranthaceae
      - Cheno-Am pollen (*in* Hevly, 1979)
    - Compositae
      - Gen. et sp. indet. (*in* Hevly, 1979)
    - Cruciferae
      - Gen. et sp. indet. (*in* Hevly, 1979)
    - Cyperaceae
      - Gen. et sp. indet. (*in* Hevly, 1979)
    - Gramineae
      - Gen. et sp. indet. (*in* Hevly, 1979)
    - Umbelliferae
      - Gen. et sp. indet. (*in* Hevly, 1979)
- Mollusca
      - Gen. et sp. indet. (*in* Hamilton, 1979)
      - Mollusk burrows (*in* Hamilton, 1979)
  - Bivalvia
    - *Musculium partumeium* (*in* Hamilton, 1979)
    - *Pisidium* sp. (*in* Hamilton, 1979)
    - Mussel impression (*in* Hevly, 1979)

- Gastropoda
  - *Cochlicopa* (*Cionella*) *lubrica* (*in* Hamilton, 1979)
  - *Discus whitneyi* (formerly D. *cronkhitei*) (*in* Vanatta, 1921)
  - *Discus shimekii* (*in* Hamilton, 1979; Hevly 1979)
  - *Euconulus fulvus alaskensis* (*in* Hamilton, 1979)
  - *Gyraulus parvus* (*in* Hamilton, 1979)
  - *Heliosoma* sp. (*in* Hamilton, 1979)
  - *Lymnaea* (*Stagnicola*) *bulimoides* (*in* Hevly, 1979)
  - *Microphysula ingersollii* (*in* Hamilton, 1979)
  - *Oreohelix haydeni* var. *oquirrensis* (*in* Vanatta, 1921)
  - *Oreohelix strigosa* (*in* Hamilton, 1979)
  - *Oreohelix strigosa* var. *depressa* (*in* Vanatta, 1921)
  - *Physa* sp. (*in* Hamilton, 1979)
  - *Physa virgata* (*in* Hamilton, 1979)
  - *Planorbella tenuis* (*in* Hamilton, 1979)
  - *Polita indentata* (*in* Vanatta, 1921)
  - *Stagnicola* sp. (*in* Hamilton, 1979)
  - *Succinea avara* (*in* Vanatta, 1921; Hamilton, 1979)
  - *Vallonia perspectiva* (*in* Hamilton, 1979)

Nematomorpha
- Horsehair worm trail (*in* Hamilton, 1979)

Arthropoda
- Insecta
  - Ant tracks (*in* Hamilton, 1979)
  - Beetle tracks (*in* Hamilton, 1979)
  - Aquatic insect larva trails (*in* Hamilton, 1979)

Actinopterygii
- Gen. et sp. indet. (*in* Hamilton, 1979)

Aves
- Gen. et sp. indet. (*in* Hevly, 1979)
- Large bird track (*in* Hamilton, 1979)

Mammalia
- Rodentia
  - *Thomomys* sp. (*in* Hevly, 1979)
- Artiodactyla
  - *Bison* sp. (*in* Hamilton, 1979)
  - Camel? track (*in* Hamilton, 1979)
  - *Ovis canadensis* (*in* Hamilton, 1979)

Microfossils
- Diatomista
  - *Fragilaria vaucheriae* (*in* Hevly, 1979)
  - *Navicula* sp. (*in* Hevly, 1979)