

A LARGE SILESAURID SPECIMEN FROM PETRIFIED FOREST NATIONAL PARK, U.S.A., WITH COMMENTS ON LARGE BODY SIZES IN LATEST TRIASSIC ORNITHODIRANS

ADAM D. MARSH¹

¹Department of Science and Resource Management, Petrified Forest National Park, Petrified Forest, AZ 86028, U.S.A., adam_marsh@nps.gov.

ABSTRACT — Compared to other regions of Pangea, what is now western North America is not known for preserving larger-bodied dinosauriforms from the Triassic Period, partly because sauropodomorphs were apparently climatically excluded from the region until the Early Jurassic. However, the presence of the *Liliensternus*-sized coelophysoid *Gojirasaurus quayi* in the middle Norian of New Mexico suggests that increased sampling will recover larger-sized silesaurids and theropods in the Chinle Formation and Dockum Group. This contribution describes a relatively large silesaurid from the Petrified Forest Member of the Chinle Formation at Petrified Forest National Park, Arizona, U.S.A., second only in estimated size to a Middle Triassic form from Tanzania. This site also preserves a large-bodied coelophysoid comparable in size to other specimens from the same or correlated strata from Arizona and New Mexico. These specimens add more support to the decoupling of an increase in body size of theropod dinosaurs with the end-Triassic mass extinction and suggests that silesaurids may have undergone a similar increase in body size prior to that biotic event.

Keywords: Upper Triassic; Chinle Formation; Silesauridae; Coelophysoidea.

INTRODUCTION

Silesaurids are a lineage of dinosauriform archosaurs that originated in the Middle Triassic of Africa (Nesbitt et al., 2010; Peacock et al., 2013; Barrett et al., 2015), were well-represented in the Carnian of South America (Agnolín et al., 2022; Mestriner et al., 2023; Müller and García, 2023; Müller, 2024; Paes Neto et al., 2025), North America (Lovelace et al., 2025), and Europe (Dzik, 2003), and persisted well into the Norian prior to the end-Triassic mass extinction in Africa (Kammerer et al., 2012), South America (Ferigolo and Langer, 2007; Agnolín and Rozadilla, 2019), North America (Chatterjee, 1984; Irmis et al., 2007a; Stocker, 2013; Martz and Small, 2019; Marsh and Parker, 2020; Tolchard et al., 2025), and possibly Europe (Fraser et al., 2002; Baron et al., 2017). As the closest evo-

lutionary relatives to dinosaurs (if not being dinosaurs themselves; Cabreira et al., 2016; Norman et al., 2022; Fonseca et al., 2024), silesaurids are important for understanding the acquisition of ‘dinosaurian’ characteristics during the relatively swift radiation of archosaurs following the end-Permian mass extinction (Bernardi et al., 2015; Foth, 2016), including bone growth and ontogenetic trajectories (Fostowicz-Frelik and Sulej, 2010; Griffin and Nesbitt, 2016a, 2016b; Barta et al., 2022) and body sizes through the Triassic (Griffin and Nesbitt, 2020; Pradelli et al., 2022).

Some Late Triassic theropod and sauropodomorph dinosaurs grew to relatively large body sizes, including *Gojirasaurus quayi* (estimated femur length = 435 mm; Griffin, 2019) from New Mexico, U.S.A., *Liliensternus liliensterni* (femur length = 435 mm; Huene, 1934; Benson

et al., 2014) and *Plateosaurus trossingensis* (femur length = 652 mm; Schaeffer, 2024) from Germany, and *Kholumolumo ellenbergerorum* (femur length = 755 mm; de Fabregues and Allain, 2020) from Lesotho. While silesaurids did not reach these same large body sizes by the end of the Triassic, some recovered individuals (e.g., NHMUK R16303, estimated femur length = 346 mm) are considerably larger than members of other populations found in other parts of the world (Piechowski et al., 2014; Martz and Small, 2019; Nesbitt et al., 2020). Unlike other parts of Pangea, what is now western North America lacked a diverse assemblage of sauropodomorph dinosaurs owing to climatic exclusion through the Late Triassic (Whiteside et al., 2011, 2015; Lovelace et al., 2025), and silesaurids and theropods were relatively uncommon members of the terrestrial assemblages known from the Dockum Group and Chinle Formation in Texas, New Mexico, Colorado, and Arizona (Hunt et al., 1998; Parker et al., 2005; Nesbitt et al., 2007; Irmis et al., 2007b). However, with increased sampling and the use of apomorphy-based identifications of fragmentary remains, researchers are reporting an increasing number of ornithomirans from these strata (Irmis et al., 2007a; Martz et al., 2013; Lessner et al., 2017; Marsh and Parker, 2020). Here I describe the proximal end of a large silesaurid femur from the Petrified Forest Member of the Chinle Formation at Petrified Forest National Park (Fig. 1). A large proximal end of a coelophysoid femur was collected from the same site, supporting the hypothesis that at least in western North America theropod dinosaurs and their closest dinosauriform relatives may have been increasing in body size through a drying and warming climate (Nordt et al., 2015) prior to the end-Triassic mass extinction (Griffin, 2019; Griffin and Nesbitt, 2020).

MATERIALS AND METHODS

PEFO 44473 and PEFO 55555 were collected as float at PFV 477 (Fig. 1) in Petrified Forest National Park under NPS Scientific Research and Collection Permit PEFO-2017-SCI-0003. Initial preparation was undertaken with a wet toothbrush. PEFO 55555 underwent additional mechanical preparation using an HW-10 air scribe operating at 45 psi. No adhesives or consolidants were applied to either specimen. Both specimens were photographed with a Nikon D90 digital camera and AF-S NIKKOR 24–85 mm aspherical lens and were laser scanned using an Artec Space Spider, automatic rotating stage, and Artec Studio (v. 16.0.8.2). 3D surface meshes PEFO 44473 and PEFO 55555 are available to download for non-commercial use at Morphosource.org (media ID 000680445 and 000680452, respectively). Linear measurements (the maximum femur length and maximum width of the proximal end of the femur) of PEFO specimens observed for this study were made using Pittsburgh 0–200 mm digital calipers. These measurements were taken for other taxa from the literature, primarily from Griffin and Nesbitt (2016a, 2016b) and Müller and Garcia (2023), descriptions of taxa with complete femora (e.g., Stocker, 2013; Langer and Ferigolo, 2013; Martz and Small, 2019; Ezcurra et al., 2020; Müller, 2024; Tolchard et al., 2025), and estimated lengths from regression analyses (e.g., Barrett et al., 2015; Griffin, 2019), or were provided to the author via email (e.g., R. Piechowski, pers. comm.; Piechowski et al., 2014). The assembled dataset is available for download at <https://doi.org/10.6084/m9.figshare.28844009.v1>.

Institutional Abbreviations — **CAP-PA/UFSM**, Centro de Apoio à Pesquisa Paleontológica da Quarta Colônia da Universidade Federal de Santa Maria, São João do Polêsine, Rio Grande do Sul, Brazil; **CRILAR-Pv**, Centro Regional de Investigaciones y Transferencia São João do Polêsine Tecnológica de Lat Rioja, Paleontología de Vertebrados, Anillaco, La Rioja, Argentina; **DMNH**, Denver Museum of Nature and Science, Denver, Colorado, U.S.A.; **GR**, Ruth Hall Museum of Paleontology, Ghost Ranch, New Mexico, U.S.A.; **HMN**, Musuem für Naturkunde, Humboldt Universität, Berlin, Germany; **MCN**, Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil; **MCP**, Museu de Ciências e Tecnologia PUCS, Port Alegre, Brazil; **MNHN**, Museum d'Histoire Naturelle de Marrakech, Argana Basin Collection, Marrakech, Morocco; **NHMUK PV**, Natural History Museum, London, Palaeontology Vertebrates, London, United Kingdom; **NMMNH**, New Mexico Museum of Natural History and Science, Albuquerque, New Mexico, U.S.A.; **NMT**, National Museum of Tanzania, Dar es Salaam, Tanzania; **PEFO**, Petrified Forest National Park, Petrified Forest, Arizona, U.S.A.; **SAM-PK**, Iziko South African Museum, Cape Town, South Africa; **TMM**, Texas Vertebrate Paleontology Collections, The University of Texas at Austin, Austin, Texas, U.S.A.; **UCM**, University of Colorado Boulder, Museum of Natural History, Boulder, Colorado, U.S.A.; **UCMP**, University of California Museum of Paleontology, Berkeley, California, U.S.A.; **UFSM**, Laboratório de Estratigrafia e Paleobiologia, Universidade Federal de Santa Maria, Brazil; **ZPAL**, Institute of Paleobiology of the Polish Academy of Sciences, Warsaw, Poland.

SYSTEMATIC PALEONTOLOGY

ARCHOSAURIA Cope, 1869 *sensu* Sereno, 2005

AVEMETATARSALIA Benton, 1999 *sensu* Nesbitt et al., 2017

ORNITHODIRA Gauthier, 1986 *sensu* Nesbitt et al., 2017

SILESAURIDAE Nesbitt et al., 2010

Fig. 2

Voucher specimen. — PEFO 55555, the proximal end of a left femur.

Rationale for identification. — The proximal ends of silesaurid femora have three features unique to the clade, all of which are found on PEFO 55555: posteromedial tuber reduced, forming a triangular shape of the femoral head in proximal view (Fig. 2E); sharp ridge-like dorsolateral trochanter on the anterolateral surface (Fig. 2A; shared with skeletally immature dinosaurs like coelophysoids); and ventral notch on the ventromedial margin of the femoral head (Fig. 2C). Some research groups have hypothesized that silesaurids may represent the earliest-diverging ornithischian dinosaurs and are the only unambiguous Triassic members of that clade (Langer and Ferigolo, 2013; Cabreira et al., 2016; Baron, 2017; Müller and Garcia, 2020; Norman et al., 2022; Fonseca et al., 2024), however, speculating on those hypothesized relationships is outside the scope of this contribution (but see a review by Lovegrove et al., 2024).

Locality, stratigraphy, and age. — PFV 477 (The Corner). This site was discovered in 2017 by term paleontologist

Charles ‘Chuck’ Beightol IV and intern Emily Lessner as part of a three-year inventory of newly acquired park lands. As its informal locality name implies, PFV 477 occurs in the southeast corner of the former Paulsell Ranch (Fig. 1), for which every other square mile section was acquired by PEFO in 2011. The site occurs in the Petrified Forest Member of the Chinle Formation. The Petrified Forest Member in that area of the park lacks marker beds like the Flattops sandstones, Painted Desert sandstones, or Black Forest bed that can be used to establish vertical position in the member elsewhere in the park (Martz and Parker, 2010; Martz et al., 2012). Regardless, the presence of a pseudopalatine phytosaur at PFV 477 (see below) places the site in the Revueltian holochronozone, as would be expected from most sites in the Petrified Forest Member at the park (Martz and Parker, 2017).

Fauna. — In addition to the proximal end of a silesaurid femur described here (PEFO 55555), the site PFV 477 also preserves gastropod shells (PEFO 54980), disarticulated unionid mussel valves (PEFO 54981), metoposaur intercentra (PEFO 54982), a drepanosauromorph femur (PEFO 54979), a pseudopalatine leptosuchomorph phytosaur skull and partial skeleton (PEFO 56056), a paramedian osteoderm from the aetosaur *Typothorax coccinarum* (PEFO 56057), paracrocodylomorph teeth (PEFO 43451), and the proximal end of a coelophysoid neotheropod femur (PEFO 44473; Fig. 3; Marsh and Parker, 2020: fig. 10m–o).

DESCRIPTION

PEFO 55555 preserves a thick coat

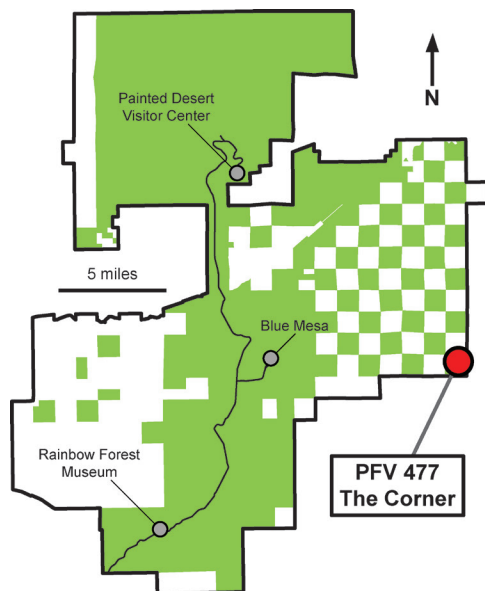


FIGURE 1. Outline showing the authorized boundary of Petrified Forest National Park and the location of fossil locality PFV 477 (The Corner). Green areas are those that are owned by the park.

of mineralization across most of its external surface, making interpretations of any faint muscle scars nearly impossible (e.g., the ‘medial ridge’ present on the posterior surface of NHMUK R16303 and NMT RB159; Barrett et al., 2015; Piechowski and Tałanda, 2020). However, the major structures present on the proximal ends of silesaurid femora are more easily observed. As is expected in silesaurids, the posteromedial tuber is highly reduced (Fig. 2E), even more so than the rounded posteromedial tuber in some silesaurids like *Asilisaurus kongwe* (NMT RB159; Nesbitt et al., 2020), *Gamatavus antiquus* (UFSM 11348b; Pretto et al., 2023), and NHMUK R16303 (Barrett et al., 2015). Instead, the proximal outline of PEFO 55555 resembles a blocky triangle like that of *Silesaurus opolensis* (ZPAL Ab III/361/23; Dzik, 2003), *Eucoelophysis baldwini*

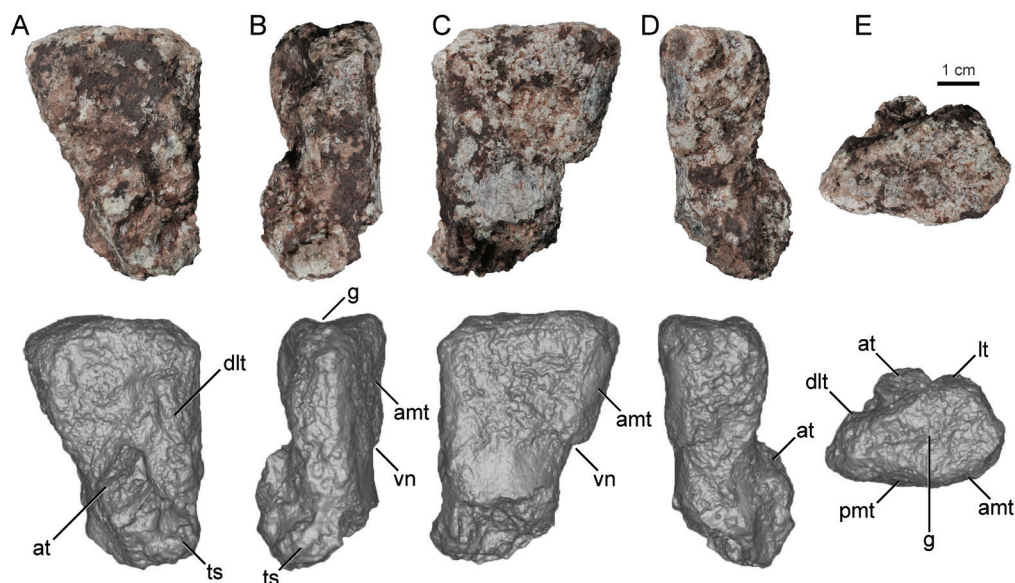


FIGURE 2. Proximal end of left silesaurid femur, PEFO 55555, from PFV 477 in anterior (A), lateral (B), posterior (C), medial (D), and proximal view (E) in photographs (upper) and surface mesh images (lower). **Abbreviations:** at, anterior trochanter; amt, anteromedial tuber; dlt, dorsolateral trochanter; g, groove; lt, lateral tuber; pmt, posteromedial tuber; ts, trochanteric shelf; vn, ventral notch.

(NMMNH P-22298; Sullivan and Lucas, 1999), the Hayden Quarry silesaurid (GR 195; Irmis et al., 2007a), and *Amanasaurus nesbitti* (CAPP/UFMS 0374; Müller and Garcia, 2023). A longitudinal groove is present on the proximal surface (Fig. 2B, 2E), that likely represents an attachment surface for cartilaginous tissue in archosaurs (Tsai et al., 2018); this feature is variably present in ornithomirans (Griffin, 2018) but is present in all known silesaurid specimens. PEFO 55555 lacks a prominent ligament sulcus between the anteromedial and posteromedial tubera found in *Lewisuchus admixtus* (CRILAR-Pv 552; Ezcurra et al., 2019), *Sacisaurus agudoensis* (MCN PV10014; Langer and Ferigolo, 2013), early-diverging sauropodomorphs (e.g., *Saturnalia tupiniquim*, MCP 3944-PV; Langer, 2003) and ornithischians (e.g., *Eocursor parvus*, SAM-PK-K8025; But-

ler, 2009), and neotheropods (e.g., *Coelophysoidea* indet., PEFO 44473, Fig. 3B–C; *Dilophosaurus wetherilli*, UCMP 37302; Marsh and Rowe, 2020). The dorsolateral trochanter is relatively proximodistally short and is situated medial to the lateralmost edge of the element in anterior view (Fig. 2A). This differs from some silesaurids like *Lewisuchus admixtus* (CRILAR-Pv 552), *Sacisaurus agudoensis* (MCN PV 10014), and *Diodorus scytobrachion* (MNHM-ARG 37; Kammerer et al., 2012) in which the structure occurs nearly on the lateral margin of the femoral head in anterior view. The anterior trochanter is a triangular structure that is not separated proximally from the shaft of the femur (Fig. 2D) like that of *Eucoelophysis baldwini* (NMMNH P-22298), *Kwanasaurus williamparkeri* (DMNH EPV.34579; Martz and Small, 2019), *Amanasaurus nes-*

bitti (CAPPA/UFSM0374), and UFSM 11579L (Mestriner et al., 2023). PEFO 55555 has a prominent trochanteric shelf that originates from the base of the anterior trochanter and wraps laterally around the anterolateral surface of the femur (Fig. 2A). Some silesaurid femora entirely lack a trochanteric shelf (*Sacisaurus agudoensis*, MCN PV 10014; *Diodorus scytobrachion*, MNHM-ARG 37; *Gondwanax paraisensis*, CAPPA/UFSM 0416, Müller and Garcia, 2023; *Gamatavus antiquus*, UFSM 11348b; TMM 31100-185 and TMM 31100-1309, Tolchard et al., 2025), some have a subtle swelling in this region (*Eucoelophysis baldwini*, NMMNH P-22298; most specimens of *Kwanasaurus williamparkeri*, e.g., DMNH EPV.34579), and others have a more robust structure similar to what is present on PEFO 55555 (e.g., *Lewisuchus admixtus*, CRILAR-Pv 552; *Asilisaurus kongwe*, NMT RB159; one specimen of *Kwanasaurus williamparkeri*, DMNH EPV.125924; some specimens of *Silesaurus opolensis*, e.g., ZPAL Ab III/361/21, Piechowski et al., 2014; TMM 31100-1304, Tolchard et al., 2025). The ventral notch is most apparent in posterior view (Fig. 2C), and it is accentuated by the relatively pronounced anteromedial tuber that can be observed in lateral view (Fig. 2B).

DISCUSSION

The presence of both a relatively large-bodied silesaurid (Fig. 2) and coelophysoid (Fig. 3) from the same locality in the Chinle Formation provides an opportunity to discuss ontogeny and the distribution of larger body sizes in these lineages throughout their evolution. As has been extensively documented in both Silesauridae and Coelophysoidea, body

size and the degree of ossifications on the femur (e.g., the presence/absence of a trochanteric shelf) are not reliable indicators of ontogenetic status/skeletal maturity owing to the high degree of variation in growth among these animals (Fostowicz-Frelik and Sulej, 2010; Piechowski et al., 2014; Griffin and Nesbitt, 2016a, 2016b; Griffin, 2018; Griffin et al., 2021; Barta et al., 2022; Tolchard et al., 2025). Unfortunately, the fragmentary nature of PEFO 44473 and PEFO 55555 precludes the chance to perform osteohistological sampling to better interpret the skeletal maturity of these individuals, but their relatively large sizes is important when compared to closely related taxa in the Triassic Period and later.

To compare the body sizes of these specimens with other silesaurids and coelophysoids, I log-transformed and plotted the maximum femur length and the maximum width of the proximal end of the femur for specimens with complete femora (Fig. 4), similar to the data visualized by Müller and Garcia (2023: fig. 3g). Most of the specimens of *Asilisaurus kongwe* and *Silesaurus opolensis* grouped together (Fig. 4A), with specimens of *Asilisaurus kongwe*, *Lewisuchus admixtus*, and *Sacisaurus agudoensis* representing the smaller individuals and specimens of *Kwanasaurus williamparkeri* and *Silesaurus opolensis* representing the larger individuals. Plotted on the linear regression line (Fig. 4A; $R^2 = 0.89$), PEFO 55555 is between the largest specimen of *Silesaurus opolensis* and NHMUK R16303 (a specimen whose total length was estimated from another regression; Barrett et al., 2015). Interestingly, with a maximum proximal width of 43.77 mm, PEFO 55555 is actually smaller than another proximal end of a silesaurid from a nearby locality at Petrified Forest, PEFO 44460 (maximum proximal width

= 44.68 mm), which lacks a trochanteric shelf (Marsh and Parker, 2020: fig. 5a–c). Among the coelophysoids, the sampled populations of *Coelophysis bauri* and *Megapnosaurus rhodesiensis* were interspersed with one another along the linear regression line (Fig. 4B; $R^2 = 0.85$), with the Hayden Quarry coelophysoid and ‘*Syntarsus*’ *kayentakatae* being the two largest specimens contributing to the linear regression. The maximum proximal width of PEFO 44473 (Fig. 3) is 47.69 mm, which is larger than any of the sampled complete coelophysoid femora, but it is comparable in size with other proximal ends of femora, PEFO 33981 (maximum proximal width = 47.88 mm; Marsh and Parker, 2020: fig. 14a–c) and PEFO 33983 (maximum proximal width = 46.32 mm; Marsh and Parker, 2020: fig. 15a–b), and it is slightly smaller than the partial femora from PEFO 21373/UCMP 129618 (maximum proximal widths = 49.52 mm and 49.76 mm; Marsh and Parker, 2020: fig. 13b–d). Regardless, these are far smaller than the robust holotype specimen of *Gojirasaurus quayi* (UCM 47721), which preserves a tibia, metatarsal V, scapula, a neural arch, four presacral centra, and partial ribs. While lacking a femur, the

tibia of UCM 47721 was used to provide an estimated total femur length of 435 mm (Griffin, 2019; Fig. 4B). This is comparable in size to the holotype specimen of another large Triassic coelophysoid from Germany, *Liliensternus liliensterni* (HMN MB.R.2175, femur length = 424 mm; Benson et al., 2014) but smaller than the holotype specimen of *Dilophosaurus wetherilli* (UCMP 37302, femur length = 562 mm; Marsh and Rowe, 2020) from the Early Jurassic of the Navajo Nation.

All silesaurids and coelophysoids from the Petrified Forest Member, whether from the Hayden Quarry at Ghost Ranch, New Mexico or the localities at Petrified Forest National Park, Arizona, are of similar geologic age, between 213.53 ± 0.33 Ma (Rasmussen et al., 2022) and 211.9 ± 0.7 Ma (Irmis et al., 2011). Further, the large Bull Canyon Formation specimens (i.e., *Gojirasaurus quayi*; Griffin, 2019) are likely the same age as the Petrified Forest Member specimens (Marsh and Parker, 2020: p. 31) and are from the type Revueltian holochronozone strata (Martz and Parker, 2017). It would be tempting to hypothesize that these lineages became larger through the end of the Triassic Period, but relatively large-bodied silesaurids are known from the Middle-

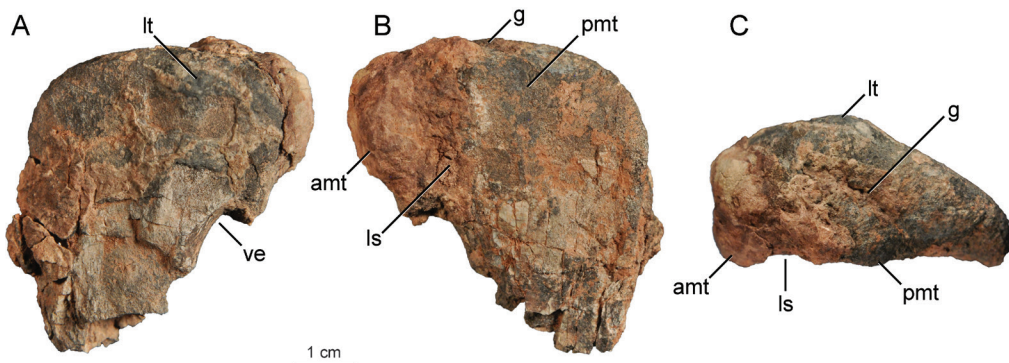


FIGURE 3. Proximal end of right coelophysoid femur, PEFO 44473, from PFV 477 in anterior (A), posterior (B), and proximal view (C). **Abbreviations:** **amt**, anteromedial tuber; **g**, groove; **ls**, ligament sulcus; **lt**, lateral tuber; **pmt**, posteromedial tuber; **ve**, ventral emargination.

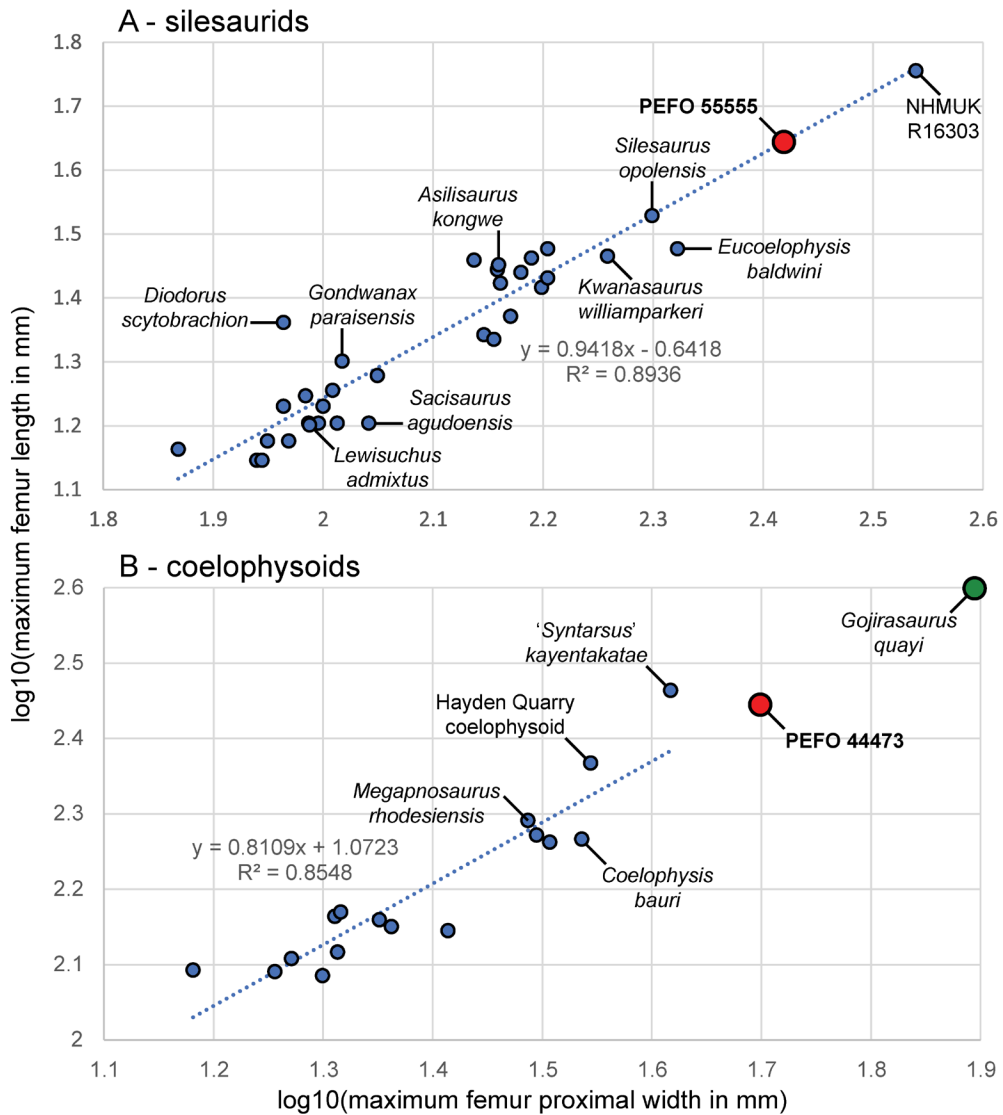


FIGURE 4. Scatter plots of log-transformed measurements of the maximum width of the proximal end of the femur and the total femur length of silesaurid (A, $n=35$) and coelophysoid taxa (B, $n=16$). Linear regressions are provided for all taxa sampled (blue dots) with PEFO 55555, PEFO 44473, and UCM 47721 (*Gojirasaurus quayi*) plotted along their respective lines. The largest specimens of some taxa are labelled (e.g., *Silesaurus opolensis*, *Kwanasaurus williamparkeri*, *Asilisaurus kongwe*, *Sacisaurus agudoensis*, *Lewisuchus admixtus*, *Coelophysis bauri*, *Megapnosaurus rhodesiensis*).

Triassic of Tanzania (NHMUK R16303, Barrett et al., 2015), and a large proximal end of a coelophysoid tibia was found in the early-middle Norian (Adamanian) Blue Mesa Member of the Chinle Formation at Petrified Forest National Park, U.S.A. (PEFO 43909, Marsh and Parker, 2020: fig. 12a–b), nearly 220 Ma in age. Further, Griffin (2019) and Griffin and Nesbitt (2020) have well demonstrated that at least theropod body sizes were increasing in western North America prior to the end-Triassic mass extinction.

PEFO 44473 and PEFO 55555 are good examples of how increased sampling can provide important data points for reconstructing the growth and body size of Triassic taxa. With the 2011 acquisition of neighboring former ranchlands, PEFO paleontologists are able to sample another several hundred acres of Petrified Forest Member badlands, resulting in a dramatic increase in the number of known dinosauiromorphs from the Chinle Formation at Petrified Forest National Park (Marsh and Parker, 2020). The interval of time in western North America during which the Petrified Forest Member and correlated strata were deposited was characterized by an overall drying and warming as the North American plate was moving northward into a more arid climate belt (Nordt et al., 2015; Whiteside et al., 2015; Byers et al., 2020). It is likely that the ontogenetic plasticity and higher metabolic rates (Griffin and Nesbitt, 2016b, 2020; Barta et al., 2020; Chapelle et al., 2021; Olsen et al., 2022; Wiemann et al., 2022) allowed dinosaurs to better adapt to changing environmental conditions through the latest Triassic and the end-Triassic mass extinction event but perhaps silesaurids lacked this ecological flexibility.

ACKNOWLEDGEMENTS

Thanks to Chuck Beightol and Emily Lessner for their hard work surveying the former Paulsell Ranch at PEFO and to Ben Kligman, Alexander Beyl, and Bryan Gee for later collection efforts at PFV 477. I thank Rafał Piechowski for sharing measurements of femora of *Silesaurus opolensis*. I appreciate Matt Smith and Debbie Wagner for helping me catalogue these specimens while our collections database was inaccessible. Thanks to Chris Griffin and Benn Breeden for helpful reviews. This is Petrified Forest National Park Paleontological Contribution No. 89. The conclusions presented here are those of the author and do not represent the views of the United States Government.

REFERENCES

- Agnolín, F. L., and S. Rozadilla. 2019. Phylogenetic reassessment of *Pisanosaurus mertii* Casamiquela, 1967, a basal dinosauriform from the Late Triassic of Argentina. *Journal of Systematic Palaeontology* 16: 853–879.
- Agnolín, F. L., Egli, F. B., Ezcurra, M. D., Langer, M. C., and Novas, F. 2022. New specimens provide insights into the anatomy of the dinosauriform *Lewisuchus admixtus* Romer, 1972 from the upper Triassic levels of the Chañares Formation, NW Argentina. *The Anatomical Record* 305: 1119–1146.
- Baron, M. G. 2017. *Pisanosaurus mertii* and the Triassic ornithischian crisis: could phylogeny offer a solution? *Historical Biology* 31: 967–981.

- Baron, M. G., Norman, D. B., and P. M. Barrett. 2017. A new hypothesis of dinosaur relationships and early dinosaur evolution. *Nature* 543: 501–506.
- Barrett, P. M., Nesbit, S. J., and B. R. Peacock. 2015. A large-bodied silesaurid from the Lifua Member of the Manda beds (Middle Triassic) of Tanzania and its implications for body-size evolution in Dinosauromorpha. *Gondwana Research* 27: 925–931.
- Barta, D. E., Griffin, C. T., and M. A. Norell. 2022. Osteohistology of a Triassic dinosaur population reveals highly variable growth trajectories typified early dinosaur ontogeny. *Scientific Reports* 12: 17321.
- Benson, R. B. J., Campione, N. E., Carrano, M. T., Mannion, P. D., Sullivan, C., Upchurch, P., and D. C. Evans. 2014. Rates of dinosaur body mass evolution indicate 170 million years of sustained ecological innovation on the avian stem lineage. *PLoS Biology* 12: e1001853.
- Benton, M. J. 1999. *Scleromochlus taylori* and the origin of dinosaurs and pterosaurs. *Philosophical Transactions of the Royal Society of London* 354: 1423–1446.
- Bernardi, M., Klein, H., Petti, F. M., and M. D. Ezcurra. 2015. The origin and early radiation of archosauriforms: integrating the skeletal and footprint record. *PLoS ONE* 10: e0128449.
- Butler, R. J. 2009. The anatomy of the basal ornithischian dinosaur *Eocursor parvus* from the lower Elliott Formation (Late Triassic) of South Africa. *Zoological Journal of the Linnean Society* 160: 648–684.
- Byers, B. A., DeSoto, L., Chaney, D., Ash, S. R., Byers, A. B., Byers, J. B., and M. Stoffel. 2020. Fire-scarred fossil tree from the Late Triassic shows a pre-fire drought signal. *Scientific Reports* 10: 20104.
- Cabreira, S. F., Kellner, A. W. A., Dias-da-Silva, S., da Silva, L. R., Bronzati, M., Marsola, J. C. A., Müller, R. T., Bittencourt, J. S., Batista, B. J., Raugust, T., Carrilho, R., Brodt, A., and M. C. Langer. 2016. A unique Late Triassic dinosauriform assemblage reveals dinosaur ancestral anatomy and diet. *Current Biology* 26: 3090–3095.
- Chatterjee, S. 1984. A new ornithischian dinosaur from the Triassic of North America. *Naturwissenschaften* 71: 630–631.
- Chapelle, K. E. J., Botha, J., and J. N. Choiniere. 2021. Extreme growth plasticity in the early branching sauropodomorph dinosaur *Massospondylus carinatus*. *Biology Letters* 17: 20200843.
- Cope, E. D. 1869. Synopsis of the extinct Batrachia, Reptilia and Aves of North America. *Transactions of the American Philosophical Society* 14: 1–252.
- Dzik, J. 2003. A beaked herbivorous archosaur with dinosaur affinities from the early Late Triassic of Poland. *Journal of Vertebrate Paleontology* 23: 556–574.
- Ezcurra, M. D., Nesbitt, S. J., Fiorelli, L. E., and J. B. Desojo. 2020. New specimen sheds light on the anatomy and taxonomy of the early Late Triassic

- dinosauriforms from the Chañares Formation, NW Argentina. *The Anatomical Record* 303: 1393–1438.
- Febrègues, C. P. d., and R. Allain. 2019. *Kholumolumo ellenbergerorum*, gen. et sp. nov., a new early sauropodomorph from the lower Elliot Formation (Upper Triassic) of Maphutseng, Lesotho. *Journal of Vertebrate Paleontology* 39: e1732996.
- Ferigolo, J., and M. C. Langer. 2007. A Late Triassic dinosauriform from south Brazil and the origin of the ornithischian predentary bone. *Historical Biology* 19: 23–33.
- Fonseca, A. O., Reid, I. J., Venner, A., Duncan, R. J., Garcia, M. S., and R. T. Müller. 2024. A comprehensive phylogenetic analysis on early ornithischian evolution. *Journal of Systematic Palaeontology* 22: 2346577.
- Fostowicz-Frelik, Ł., and T. Sulej. 2010. Bone histology of *Silesaurus opolensis* Dzik, 2003 from the Late Triassic of Poland. *Lethaia* 43: 137–148.
- Foth, C., Ezcurra, M. D., Sookia, R. B., Brusatte, S. L., and R. J. Butler. 2016. Unappreciated diversification of stem archosaurs during the Middle Triassic predated the dominance of dinosaurs. *BMC Ecology and Evolution*: 16: 188.
- Fraser, N. C., Padian, K., Walkden, G. M., and A. L. M. Davis. 2002. Basal dinosauriform remains from Britain and the diagnosis of the Dinosauria. *Palaeontology* 45: 79–95.
- Gauthier, J. A. 1986. Saurischian monophyly and the origin of birds. *Memiors of the California Academy of Sciences* 8: 1–55.
- Griffin, C. T. 2018. Developmental patterns and variation among early theropods. *Journal of Anatomy* 232: 604–640.
- Griffin, C. T. 2019. Large neotheropods from the Upper Triassic of North America and the early evolution of large theropod body sizes. *Journal of Paleontology* 93: 1010–1030.
- Griffin, C. T., and S. J. Nesbitt. 2016a. The femoral ontogeny and long bone histology of the Middle Triassic (?Late Anisian) dinosauriform *Asilisaurus kongwe* and implications for the growth of early dinosaurs. *Journal of Vertebrate Paleontology* 36: e1111224.
- Griffin, C. T., and S. J. Nesbitt. 2016b. Anomalous high variation in postnatal development is ancestral for dinosaurs but lost in birds. *Proceedings of the National Academy of Sciences* 113: 14757–14762.
- Griffin, C. T., and S. J. Nesbitt. 2020. Does maximum body size of theropods increase across the Triassic-Jurassic boundary? Integrating ontogeny, phylogeny, and body size. *The Anatomical Record* 303: 1158–1169.
- Griffin, C. T., Stocker, M. R., Colleary, C., Stefanic, C. M., Lessner, E. J., Riegler, M., Formoso, K., Koeller, K., and S. J. Nesbitt. 2021. Assessing ontogenetic maturity in extinct saurian reptiles. *Biological Reviews* 96: 470–525.
- Huene, F. v. 1934. Ein neuer Coelurosaurier in der thüringischen Trias. *Palaeontologische Zeitschrift* 16: 145–170.

- Hunt, A. P., Lucas, S. G., Heckert, A. B., Sullivan, R., M., and M. G. Lockley. 1998. Late Triassic dinosaurs from the western United States. *Geobios* 31: 511–531.
- Irmis, R. B., Nesbitt, S. J., Padian, K., Smith, N. D., Turner, A. H., Woody, D., and A. Downs. 2007a. A Late Triassic dinosauromorph assemblage from New Mexico and the rise of dinosaurs. *Science* 317: 358–361.
- Irmis, R. B., Parker, W. G., Nesbitt, S. J., and J. Liu. 2007b. Early ornithischian dinosaurs: the Triassic record. *Historical Biology* 19: 3–22.
- Irmis, R. B., Mundil, R., Martz, J. W., and W. G. Parker. 2011. High-resolution U-Pb ages from the Upper Triassic Chinle Formation (New Mexico, USA) supports a diachronous rise of dinosaurs. *Earth and Planetary Science Letters* 309: 258–267.
- Kammerer, C. F., Nesbitt, S. J., and N. H. Shubin. 2012. The first silesaurid dinosauriform from the Late Triassic of Morocco. *Acta Palaeontologica Polonica* 57: 277–284.
- Langer, M. C. 2003. The pelvic and hindlimb anatomy of the stem-sauropodomorph *Saturnalia tupiniquim* (Late Triassic, Brazil). *PaleoBios* 23: 1–40.
- Langer, M. C., and J. Ferigolo. 2013. The Late Triassic dinosauromorph *Sacisaurus agudoensis* (Caturrita Formation; Rio Grande do Sul, Brazil): anatomy and affinities. Geological Society, London, Special Publications 379: 353–392.
- Lessner, E. J., Parker, W. G., Marsh, A. D., Nesbitt, S. J., Irmis, R. B., and B. D. Mueller. 2017. New insights into Late Triassic dinosauromorph-bearing assemblages from Texas using apomorphy-based identifications. *PaleoBios* 35: 4ht19712.
- Lovegrove, J., Upchurch, P., and P. M. Barrett. 2024. Untangling the tree or unraveling the consensus? Recent developments in the quest to resolve the broad-scale relationships within Dinosauria. *Journal of Systematic Palaeontology* 22: 2345333.
- Lovelace, D. M., Kufner, A. M., Fitch, A. J., Rogers, K. C., Schmitz, M., Schwartz, D. M., LeClair-Diaz, A., St. Clair, L., Mann, J., and R. Teran. 2025. Rethinking dinosaur origins: oldest known equatorial dinosaur-bearing assemblage (mid-late Carnian Popo Agie FM, Wyoming, USA). *Zoological Journal of the Linnean Society* 203: zlae153.
- Marsh, A. D., and W. G. Parker. 2020. New dinosauromorph specimens from Petrified Forest National Park and a global biostratigraphic review of Triassic dinosauromorph body fossils. *PaleoBios* 37: 01w536hs.
- Marsh, A. D., and T. B. Rowe. 2020. A comprehensive anatomical and phylogenetic evaluation of *Dilophosaurus wetherilli* (Dinosauria, Theropoda) with descriptions of new specimens from the Kayenta Formation of northern Arizona. *Journal of Paleontology* 94 (Memoir 78): 1–103.
- Martz, J. W., and W. G. Parker. 2010. Revised lithostratigraphy of the Sonsela Member (Chinle Formation, Upper

- Triassic) in the southern part of Petrified Forest National Park, Arizona. *PLoS ONE* 5: e9329.
- Martz, J. W., and W. G. Parker. 2017. Revised formulation of the Late Triassic Land Vertebrate “Faunachrons” of western North America: recommendations for codifying nascent systems of vertebrate biochronology: pp. 39–124 in K. E. Zeigler, W. G. Parker (eds.), *Terrestrial Depositional Systems: Deciphering Complexities Through Multiple Stratigraphic Methods*. Elsevier, Amsterdam, Netherlands.
- Martz, J. W., and B. J. Small. 2019. Non-dinosaurian dinosauiromorphs from the Chinle Formation (Upper Triassic) of the Eagle Basin, northern Colorado: *Dromomeron romeri* (Lagerpetidae) and a new taxon, *Kwanasaurus williamsparkeri* (Silesauridae). *PeerJ* 7: e7551.
- Martz, J. W., Parker, W. G., Skinner, L., Raucci, J. J., Umhoefer P., and R. C. Blakey. 2012. Geologic map of Petrified Forest National Park, Arizona. Arizona Geological Survey Contributed Map, CR-12-A: 1 map sheet, 1:50,000 map scale, 18 p.
- Martz, J. W., Mueller, B. D., Nesbitt, S. J., Stocker, M. R., Parker, W. G., Atanassov, M., Fraser, N., Weinbaum, J., and J. R. Leane. 2013. A taxonomic and biostratigraphic re-evaluation of the Post Quarry vertebrate assemblage from the Cooper Canyon Formation (Dockum Group, Upper Triassic) of southern Garza County, western Texas. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh* 103: 1–26.
- Mestriner, G., Marsola, J. C. A., Nesbitt, S. J., Da Rosa, A. A. S., and M. C. Langer. 2023. Anatomy and phylogenetic affinities of a new silesaurid assemblage from the Carnian beds of south Brazil. *Journal of Vertebrate Paleontology* 43: e2232426.
- Müller, R. T. 2024. A new “silesaurid” from the oldest dinosauiromorph-bearing beds of South America provides insights into the early evolution of bird-line archosaurs. *Gondwana Research* 137: 13–28.
- Müller, R. T., and M. S. Garcia. 2020. A paraphyletic ‘Silesauridae’ as an alternative hypothesis for the initial radiation of ornithischian dinosaurs. *Biology Letters* 16: 20200417.
- Müller, R. T., and M. S. Garcia. 2023. A new silesaurid from Carnian beds of Brazil fills a gap in the radiation of avian line archosaurs. *Scientific Reports* 13: 4981.
- Nesbitt, S. J., Irmis, R. B., and W. G. Parker. 2007. A critical re-evaluation of the Late Triassic dinosaur taxa of North America. *Journal of Systematic Palaeontology* 5: 209–243.
- Nesbitt, S. J., Sidor, C. A., Irmis, R. B., Angielczyk, K. D., Smith, R. M. H., and L. A. Tsuji. 2010. Ecologically distinct dinosaurian sister group shows early diversification of Ornithodira. *Nature* 464: 95–98.
- Nesbitt, S. J., Butler, R. J., Ezcurra, M. D., Barrett, P. M., Stocker, M. R., Angielczyk, K. D., Smith, R. M. H., Sidor, C. A., Niedźwiedzki, G., Seenikov, A. G., and A. J. Charig. 2017. The earliest bird-line archosaurs and the assembly

- of the dinosaurian body plan. *Nature* 544: 484–487.
- Nesbitt, S. J., Langer, M. C., and M. D. Ezcurra. 2020. The anatomy of *Asilisaurus kongwe*, a dinosauriform from the Lifua Member of the Manda Beds (~Middle Triassic) of Africa. *The Anatomical Record* 303: 813–873.
- Nordt, L., Atchley, S., and S. Dworkin. 2015. Collapse of the Late Triassic megamonsoon in western equatorial Pangea, present-day American Southwest. *Geological Society of America Bulletin* 127: 1798–1815.
- Norman, D. B., Baron, M. G., Garcia, M. S., and R. T. Müller. 2022. Taxonomic, palaeobiological and evolutionary implications of a phylogenetic hypothesis for Ornithischia (Archosauria: Dinosauria). *Zoological Journal of the Linnean Society* 196: 1273–1309.
- Olsen, P. E., Sha, J., Fang, Y., Chang, C., Whiteside, J. H., Kinney, S., Sues, H.-D., Kennt, D. V., Schaller, M., and V. Vajda. 2022. Arctic ice and the ecological rise of the dinosaurs. *Science Advances* 8: eabo6342.
- Paes Neto, V. D., Pretto, F. A., Martinnella, A. G., Battista, F., Garcia, M., Muller, R. T., Schmitt, M. R., Melo, T. P., Francischini, H., Schultz, C. L., Pinheiro, F., Soares, M. B., and A. W. Kellner. 2025. Continuous presence of dinosauromorphs in South America throughout the Middle to the Late Triassic. *Scientific Reports* 15: 18498.
- Parker, W. G., Irmis, R. B., Nesbitt, S. J., Martz, J. W., and L. S. Browne. 2005. The Late Triassic pseudosuchian *Reueltosaurus callenderi* and its implications for the diversity of early ornithischian dinosaurs. *Proceedings of the Royal Society, Biological Sciences* 272: 963–969.
- Peacock, B. R., Sidor, C. A., Nesbitt, S. J., Smith, R. M. H., Steyer, J. S., and K. D. Angielczyk. 2013. A new silesaurid from the upper Ntawere Formation of Zambia (Middle Triassic) demonstrates the rapid diversification of Silesauridae (Avemetatarsalia, Dinosauriformes). *Journal of Vertebrate Paleontology* 33: 1127–1137.
- Piechowski, R., Tałanda, M., and J. Dzik. 2014. Skeletal variation and ontogeny of the Late Triassic dinosauriform *Silesaurus opolensis*. *Journal of Vertebrate Paleontology* 34: 1383–1393.
- Piechowski, R., and M. Tałanda. 2020. The locomotor musculature and posture of the early dinosauriform *Silesaurus opolensis* provides a new look into the evolution of Dinosauroomorpha. *Journal of Anatomy* 236: 1044–1100.
- Pradelli, L. A., Leardi, J. M., and M. D. Ezcurra. 2022. Body size disparity of the archosauromorph reptiles during the first 90 million years of their evolution. *Ameghiniana* 59: 47–77.
- Pretto, F. A., Müller, R. T., Moro, D., Garcia, M. S., Neto, V. D. P., and A. A. S. Da Rosa. 2023. The oldest South American silesaurid: new remains from the Middle Triassic (Pinheiros-Chiniquá Sequence, *Dinodontosaurus* Assemblage Zone) increase the time range of silesaurid fossil record in southern Brazil. *Journal of South American Earth Science* 120: 104039.

- Rasmussen, C., Mundil, R., Irmis, R. B., Giesler, D., Gehrels, G. E., Olsen, P. E., Kent, D. V., Lepre, C., Kinney, S. T., Geissman, J. W., and W. G. Parker. 2020. U-Pb zircon geochronology and depositional age models for the Upper Triassic Chinle Formation (Petrified Forest National Park, Arizona): implications for Late Triassic paleoecological and paleoenvironmental change. *Geological Society of America Bulletin* 133: 539–558.
- Schaeffer, J. 2024. Osteological redescription of the holotype of *Plateosaurus trossingensis* (Dinosauria: Sauropodomorpha) from the Upper Triassic of SW Germany and its phylogenetic implications. *Journal of Systematic Palaeontology* 22: 2335387.
- Sereno, P. C. 2005. The logical basis of phylogenetic taxonomy. *Systematic Biology* 54: 595–619.
- Stocker, M. R. 2013. Contextualizing vertebrate faunal dynamics: new perspectives from the Triassic and Eocene of western North America [Ph.D. dissertation]. The University of Texas at Austin, Austin, Texas. 297 p.
- Sullivan, R. M., and S. G. Lucas. 1999. *Eucoelophysis baldwini*, a new theropod dinosaur from the Upper Triassic of New Mexico, and the status of the original types of *Coelophysis*. *Journal of Vertebrate Paleontology* 19: 81–90.
- Tolchard, F. B., Perkins, B. W., and S. J. Nesbitt. 2025. Silesaurid (Archosauria: Dinosauriformes) remains from the base of the Dockum Group (Late Triassic: Otischalkian) of Texas provide new insights to the North American record of dinosauriformes. *The Anatomical Record* (early online).
- Tsai, H. P., Middleton, K. M., Hutchinson, J. R., and C. M. Holliday. 2018. Hip joint articular soft tissues of non-dinosaurian Dinosauromorpha and early Dinosauria: evolutionary and biomechanical implications for Saurischia. *Journal of Vertebrate Paleontology* 38: e1427593.
- Whiteside, J. H., Grogan, D. S., Olsen, P. E., and D. V. Kent. 2011. Climatically driven biogeographic provinces of Late Triassic tropical Pangea. *Proceedings of the National Academy of Sciences* 108: 8972–8977.
- Whiteside, J. H., Lindström, S., Irmis, R. B., Glasspool, I. J., Schaller, M. F., Dunlavey, M., Nesbitt, S. J., Smith, N. D., and A. H. Turner. 2015. Extreme ecosystem instability suppressed tropical dinosaur dominance for 30 million years. *Proceedings of the National Academy of Sciences* 112: 7909–7913.
- Wiemann, J., Menendez, I., Crawford, J. M., Fabbri, M., Gauthier, J. A., Hull, P. M., Norell, M. A., and D. E. G. Briggs. 2022. Fossil biomolecules reveal an avian metabolism in the ancestral dinosaur. *Nature* 606: 522–526.

*Recieved 7 January 2025;
Accepted 26 April 2025*

A 2025 BIRD CHECKLIST FOR PETRIFIED FOREST NATIONAL PARK

DYLAN SCHNEIDER¹ and HARRISON JONES²

¹Department of Science and Resource Management, Petrified Forest National Park, Petrified Forest, AZ 86028, U.S.A., dylan_schneider@nps.gov; ²The Institute for Bird Populations, Petaluma, CA 94953, U.S.A., hjones@birdpop.org

ABSTRACT — We produce a new 2025 bird species list for Petrified Forest National Park, updating the previous list from 2005. The new list is built upon historical bird lists and utilizes new survey data. There are now 258 species recorded in the park, with 217 species verified in the past 20 years. Significantly, the Yellow-billed Cuckoo (*Coccyzus americanus*), a federally threatened species, has been documented for the first time since 1985.

Keywords: Birds; Aves; Species list; Survey.

INTRODUCTION

This paper is an update to the 2005 van Riper and Lamow (USGS report) bird list for Petrified Forest National Park (PEFO). It complements the 1959 (Stephenson), 1963 (NPS data), 1984 (Johnson), and 2005 (van Riper and Lamow) lists, documenting changes across time in bird species' presence. Our list compiles all birds that have been observed in the park but highlights the bird species that have been observed in the last 20 years across multiple field surveys and studies. We also update species to current naming standards and list them in taxonomic order following the American Ornithological Society's 7th edition checklist, 65th supplement (Chesser et al., 2024).

BACKGROUND

Petrified Forest National Park was established in 1906 as a National Monument, changing to National Park status in 1962. Since 1906 the park has had one boundary reduction and several additions. The largest addition occurred

in 2004, when 506 km² were added, increasing the park from 379 km² to 884 km². However, as of 2024, large areas of land inside this designated boundary are still privately owned or belong to the Arizona State Land Trust, resulting in ~575 km² of National Park Service (NPS) owned land. Significantly, this acquisition has added several seeps, active water wells, earthen stock ponds, and ~22 km of riparian habitat along the Puerco River (compared to ~2 km prior to 2004). The park varies in elevation from ~1580 m to ~1890 m and consists of shortgrass prairie intermixed with shrubland, badlands, small pockets of pinyon (*Pinus* spp.) and juniper (*Juniperus* spp.) woodland, and riparian forest with cottonwood (*Populus* spp.), coyote willow (*Salix exigua*), tamarisk (*Tamarix* spp.), and Russian olive (*Elaeagnus angustifolia*).

METHODS

To compile the 2025 list (258 species), we started with the 2005 (van Riper and Lamow) list (234 species) and compared that to the historical 1998 (Ban-

ger) surveys, and the 1984 (Johnson: 207 species), 1963 (NPS data: 180 species), and 1959 (Johnson: 131 species) lists for the park. We then added data from newer surveys and data sets from the past 20 years including: 2007–2018 Southern Colorado Plateau Network (SCPN) habitat-specific monitoring surveys in grassland-shrubland (Ploughe and Jones, 2024), 2022, 2023 and 2024 SCPN park-wide point-count monitoring data (Ploughe and Jones, 2025), 2016–2024 window strike mortalities at park structures, 2023 Yellow-billed Cuckoo surveys (Albert et al., 2024), PEFO biology department photography database records, PEFO museum collections, and observation reports from iNaturalist (iNaturalist.org) and eBird (Sullivan et al., 2009) records. We used any sighting from 2005–2025 to confirm recent presence in the park. Several species were observed on older reports that were not included on the 2005 list. These species were reviewed and included on a case-by-case basis contingent upon the plausibility of the sighting (i.e., frequency of observations in northeast Arizona and north of the Mogollon Rim, difficulty of field identification) and documentation of the sighting (i.e., photo documentation, documentation on record with the Arizona Bird Committee). Historical reports and lists were reviewed for plausibility, documentation, and photo evidence prior to inclusion in the checklist. We removed several unusual historical species with no hard evidence or later sightings including all unconfirmed sightings.

SUMMARY

The 2025 bird list revision (Appendices 1 & 2) includes 258 species, 24 more than the 2005 van Riper and Lamow

list. This includes changes such as the Myrtle Warbler (*Setophaga [coronata] coronata*) and the Audubon's Warbler (*Setophaga [coronata] auduboni*) being combined into the Yellow-rumped Warbler (*Setophaga coronata*) and including the Chihuahuan Meadowlark (*Sturnella lilianae*) which was recently split from the Eastern Meadowlark (*Sturnella magna*). In the last 20 years 217 species have been observed. Thirty species have also had their breeding status confirmed, or evidence found to assume probable breeding in the park. Significant sightings include the Yellow-billed Cuckoo (*Coccyzus americanus*) and the Canyon Wren (*Catherpes mexicanus*), both of which have been found multiple times in the last 20 years. These are two birds van Riper and Lamow (2005) indicated had not been observed between 1985–2005. The Yellow-billed Cuckoo (distinct western population) is now listed as federally threatened (USFWS). Surveys are underway to determine more about their presence and behavior in the park. The park may contain expanding breeding populations of arid land-associated species from southern Arizona that are moving northward in response to climate change, such as Greater Roadrunner (*Geococcyx californianus*), Gambel's Quail (*Callipepla gambelii*), White-winged Dove (*Zenaida asiatica*), and Crissal Thrasher (*Toxostoma crissale*). Other desert-associated species such as Curve-billed Thrasher (*Toxostoma curvirostre*), Bell's Vireo (*Vireo bellii*), and Lesser Night-hawk (*Chordeiles acutipennis*) are present in the greater landscape surrounding the park (records from Woodruff and Holbrook, Arizona, respectively) and should be potentially considered future breeders within the park. The breeding status of many species at Petrified Forest National Park is uncertain due to lack

of observations and survey data from late May–June. In particular, a more complete understanding of the breeding status of Brewer’s Sparrow (*Spizella breweri*) and Cassin’s Sparrow (*Peucaea cassinii*), both rapidly declining species, is needed for the park. Records of overwintering grassland birds, especially Lapland Longspur (*Calcarius lapponicus*, which has not been observed in PEFO but has photographic records from Holbrook), Chestnut-collared Longspur (*C. ornatus*), and Grasshopper Sparrow (*Ammodramus savannarum*), may be under-represented due to a lack of observations in appropriate habitat. A larger temporal (winter months, breeding season) and spatial (areas away from visitor centers) coverage of bird observations will provide a more complete picture of the bird community utilizing the varied habitats within the park.

ACKNOWLEDGEMENTS

We thank everyone who has participated in bird surveys in the park, especially Andy Bridges, Anita Allen, Southern Colorado Plateau Network field crews, and the Institute for Bird Populations for their help with Yellow-billed Cuckoo surveys, and former PEFO staff, interns and volunteers. We thank the reviewers for their thoughtful edits.

REFERENCES

- Albert, S., H. Jones, W. DeMott, and D. Schneider. 2024. Yellow-billed Cuckoo surveys at Petrified Forest National Park: Final report for the 2023 field season. Science Report NPS/SR – 2024/153. National Park Service, Fort Collins, Colorado. <https://doi.org/10.36967/2304871>.
- Bangert, R. K. 1998. 1998 PEFO Bird survey. Unpublished NPS Report.
- Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, B. E. Hernández-Baños, R. A. Jiménez, Oscar Johnson, A. W. Kratter, N. A. Mason, P. C. Rasmussen, and J. V. Remsen, Jr. 2024. Check-list of North American Birds (online). American Ornithological Society. <https://check-list.americanornithology.org/taxa/>
- eBird. <https://ebird.org>. Accessed on January, 2025.
- iNaturalist. Petrified Forest National Park Natural History Observations <https://www.inaturalist.org/projects/petrified-forest-national-park-natural-history-observations>. Accessed on November, 2024.
- Johnson, G. E.. 1984. Bird List: Petrified Forest National Park. Unpublished NPS Report.
- NPS Report. 1963. A Checklist of Birds of Petrified Forest National Park. Unpublished NPS Report.
- Ploughe, L. W. and H. H. Jones. 2024. SCPN Habitat-based bird community monitoring data 2007–2018. National Park Service. Fort Collins CO. <https://doi.org/10.57830/2302328>.
- Ploughe, L. W. and H. H. Jones. 2025. SCPN landbird monitoring 2022–2024 data package. National Park Service. Fort Collins CO (in submission, publication March 2025).
- Stephenson, A. N. undated (pre-1959).

Checklist of Birds of Petrified Forest National Monument, Arizona. Unpublished NPS Report.

Stephenson, A. N., 1959. A Checklist of Birds of Petrified Forest National Monument, Arizona. Unpublished NPS Report.

Sullivan, B. L., C. L. Wood, M. J. Iliff, R. E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. *Biological Conservation* 142: 2282–2292.

USFWS <https://www.fws.gov/species/yellow-billed-cuckoo-coccyzus-americanus>. Accessed on February 2025.

Van Riper III, C., and M. Lamow. 2005. A 2005 Bird Checklist for Petrified Forest National Park. Southwest Biological Science Center, USGS OFR no. 22.

Received 25 February 2025;

Accepted 11 April 2025

APPENDIX 1. The following codes were utilized to characterize bird list data:

Park Status

P PRESENT: species present in the park.

P* RECENTLY PRESENT: species observed in the last 20 years.

Abundance

A ABUNDANT: easily seen daily in relatively large numbers in appropriate season and habitat.

C COMMON: easily seen daily in appropriate season and habitat but not in large numbers.

UC UNCOMMON: likely to be seen weekly or monthly in appropriate season or habitat, may be locally common.

R RARE: present, but usually only seen a few times per year.

O OCCASIONAL: occasionally or sporadically seen, but not observed in the park every year.

UK UNKNOWN: abundance unknown.

Resident Status

b BREEDER: species that reproduces or probably reproduces in the park; b^y - present in the park year-round; b^s - present during the summer breeding season (March–August), not year-round.

r RESIDENT: a significant population is maintained in the park for more than two months each year, but it is not known to breed there.

m	MIGRATORY: species that occur in the park approximately two months or less each year (usually spring and fall), and do not breed there.	RE	RESIDENTIAL: park housing areas containing planted trees and shrubs (e.g., cottonwoods [<i>Populus</i> spp.], Russian olive [<i>Elaeagnus angustifolia</i>]) that act as 'migrant traps' for many bird species in the largely treeless landscape of the park.
v	VAGRANT: park is outside of the species' usual range.		
u	UNKNOWN: residency status in the park is unknown.	RW	RIPARIAN WOODLAND: Restricted to a narrow belt along major rivers and washes in the park. The vegetation has a dominant overstory of cottonwoods (<i>Populus</i> spp.) and/or tamarisk (<i>Tamarix</i> spp.) and may include Coyote willow (<i>Salix exigua</i>).
Habitat Types			
If more than one habitat type is listed, the habitat in which the species breeds or is observed most often is listed first.			
AH	ALL HABITATS: seen in all habitat types.	ST	STRUCTURES: human non-residential structures in the park including bridges, barns, and corrals.
GS	GRASSLAND SHRUBLAND: sem-iarid shortgrass prairie, a grassland containing shrubs such as sagebrush (<i>Artemisia</i> spp.), saltbush (<i>Atriplex</i> spp.), winterfat (<i>Krascheninnikovia lanata</i>), snakeweed (<i>Gutierrezia sarothrae</i>), Mormon tea (<i>Ephedra</i> sp.), rabbitbrush (<i>Eriocameria nauseosa</i>), greasewood (<i>Sarcobatus vermiculatus</i>), yucca (<i>Yucca</i> spp.), and cacti (Cactaceae).	UN	UNKNOWN: habitat type is unknown.
Breeding Status			
		*	CONFIRMED BREEDING: presence of an active nest, fledglings, food, and/or nesting material carried by adults.
		[*]	PROBABLY BREEDING: not confirmed, but breeding is likely based on behavior and timing of observations in the park from late May–June.
JW	JUNIPER WOODLAND: Juniper woodland such as the juniper-cliffrose association on the Painted Desert Rim, and pinyon-juniper woodland on Chinde Mesa.		
OW	OPEN WATER: open water present; sewage ponds.		
RC	ROCKS/CLIFFS: exposed sedimentary rock mesa tops and sheer rock outcroppings provide nesting sites for many species.		

APPENDIX 2. Updated species list of birds at Petrified Forest National Park. See Appendix 1 for abbreviations.

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
GEESE, DUCKS						
Greater White-fronted Goose	<i>Anser albifrons</i>	P*	O	m	OW	
Canada Goose	<i>Branta canadensis</i>	P	O	m	OW	
Wood Duck	<i>Aix sponsa</i>	P*	O	m	OW	
Blue-winged Teal	<i>Spatula discors</i>	P*	O	m	OW	
Cinnamon Teal	<i>Spatula cyanoptera</i>	P*	O	m	OW	
Northern Thoveler	<i>Spatula clypeata</i>	P*	O	m	OW	
Gadwall	<i>Mareca strepera</i>	P*	O	m	OW	
American Wigeon	<i>Mareca americana</i>	P*	O	m	OW	
Mallard	<i>Anas platyrhynchos</i>	P*	R	m	OW	
Northern Pintail	<i>Anas acuta</i>	P	O	m	OW	
Green-winged Teal	<i>Anas crecca</i>	P*	O	m	OW	
Canvasback	<i>Aythya valisineria</i>	P*	O	m	OW	
Redhead	<i>Aythya americana</i>	P*	O	m	OW	
Ring-necked Duck	<i>Aythya collaris</i>	P*	O	m	OW	
Lesser Scaup	<i>Aythya affinis</i>	P*	O	m	OW	
Bufflehead	<i>Bucephala albeola</i>	P*	O	m	OW	
Common Goldeneye	<i>Bucephala clangula</i>	P*	O	m	OW	
Hooded Merganser	<i>Lophodytes cucullatus</i>	P*	O	m	OW	
Common Merganser	<i>Mergus merganser</i>	P*	O	m	OW	
Ruddy Duck	<i>Oxyura jamaicensis</i>	P*	O	m	OW	
QUAIL						
Scaled Quail	<i>Callipepla squamata</i>	P*	C	b ^y	GS	*
Gambel's Quail	<i>Callipepla gambelii</i>	P*	R	u	RE, GS	[*]
GREBES						
Least Grebe	<i>Tachybaptus dominicus</i>	P	O	v	OW	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	P*	R	m	OW	
Eared Grebe	<i>Podiceps nigricollis</i>	P	O	m	OW	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Western Grebe	<i>Aechmophorus occidentalis</i>	P	O	m	OW	
PIGEONS, DOVES						
Rock Pigeon	<i>Columba livia</i>	P*	UC	b ^y	RE, ST	[*]
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	P*	R	u	RE	
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	P*	C	b ^y	RE	[*]
Inca Dove	<i>Columbina inca</i>	P	O	v	UN	
White-winged Dove	<i>Zenaida asiatica</i>	P*	R	b ^y	RE	[*]
Mourning Dove	<i>Zenaida macroura</i>	P*	C	b ^y	AH	*
CUCKOOS						
Greater Roadrunner	<i>Geococcyx californianus</i>	P*	UC	b ^y	RW, RE	[*]
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	P*	UK	u	RW	
NIGHTHAWKS, NIGHTJARS						
Common Nighthawk	<i>Chordeiles minor</i>	P*	C	b ^s	AH	*
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	P*	O	u	AH	
SWIFTS, HUMMINGBIRDS						
Vaux's Swift	<i>Chaetura vauxi</i>	P	O	v	AH	
White-throated Swift	<i>Aeronautes saxatalis</i>	P*	O	m	AH	
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	P*	UC	b ^s	RE, RW, JW	[*]
Anna's Hummingbird	<i>Calypte anna</i>	P*	O	v	RE	
Calliope Hummingbird	<i>Selasphorus calliope</i>	P*	O	m	RE	
Rufous Hummingbird	<i>Selasphorus rufus</i>	P*	C	m	RE, RW	
Allen's Hummingbird	<i>Selasphorus sasin</i>	P	O	v	RE	
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>	P*	C	m	AH	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
RAILS, COOTS						
Virginia Rail	<i>Rallus limicola</i>	P	O	m	OW, RW	*
Sora Rail	<i>Porzana carolina</i>	P	O	m	OW, RW	
American Coot	<i>Fulica americana</i>	P*	O	m	OW	
PLOVERS, AVOCETS, SANDPIPERS, PHALAROPES						
American Avocet	<i>Recurvirostra americana</i>	P*	C	b ^y	OW	*
American Golden Plover	<i>Pluvialis dominica</i>	P*	O	v	OW	
Killdeer	<i>Charadrius vociferus</i>	P*	C	b ^y	OW, RW	*
Semipalmated Plover	<i>Charadrius semipalmatus</i>	P*	O	m	OW	
Mountain Plover	<i>Anarhynchus montanus</i>	P	O	m	GS	
Upland Sandpiper	<i>Bartramia longicauda</i>	P	O	v	GS	
Whimbrel	<i>Numenius phaeopus</i>	P	O	v	GS, RW	
Long-billed Curlew	<i>Numenius americanus</i>	P*	O	m	GS, OW	
Stilt Sandpiper	<i>Calidris himantopus</i>	P*	O	m	OW	
Baird's Sandpiper	<i>Calidris bairdii</i>	P*	O	m	OW	
Least Sandpiper	<i>Calidris minutilla</i>	P*	O	m	OW	
Pectoral Sandpiper	<i>Calidris melanotos</i>	P	O	m	OW	
Western Sandpiper	<i>Calidris mauri</i>	P*	O	m	OW	
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	P*	O	m	OW	
Wilson's Snipe	<i>Gallinago delicata</i>	P*	R	m	OW, RW	
Spotted Sandpiper	<i>Actitis macularius</i>	P*	O	m	OW	
Solitary Sandpiper	<i>Tringa solitaria</i>	P*	O	m	OW	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Lesser Yellowlegs	<i>Tringa flavipes</i>	P	O	m	OW	
Willet	<i>Tringa semipalmata</i>	P	O	m	OW	
Greater Yellowlegs	<i>Tringa melanoleuca</i>	P*	O	m	OW	
Wilson's Phalarope	<i>Phalaropus tricolor</i>	P*	O	m	OW	
Red-necked Phalarope	<i>Phalaropus lobatus</i>	P*	O	m	OW	
GULLS						
Franklin's Gull	<i>Leucophaeus pipixcan</i>	P*	O	m	OW	
Ring-billed Gull	<i>Larus delawarensis</i>	P*	O	m	OW	
Herring Gull	<i>Larus smithsonianus</i>	P	O	v	OW	
PELICANS						
American White Pelican	<i>Pelecanus erythrorhynchos</i>	P	O	m	OW	
HERONS, BITTERNS						
American Bittern	<i>Botaurus lentiginosus</i>	P	O	m	OW	
Snowy Egret	<i>Egretta thula</i>	P*	O	m	OW, RW	
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	P	O	m	OW, RW	
Green Heron	<i>Butorides virescens</i>	P*	O	m	OW, RW	
Great Egret	<i>Ardea alba</i>	P*	O	m	OW, RW	
Western Cattle Egret	<i>Ardea ibis</i>	P*	O	m	OW, RW	
Great Blue Heron	<i>Ardea herodias</i>	P*	O	m	OW, RW	
IBIS						
White-faced Ibis	<i>Plegadis chihi</i>	P*	R	m	OW	
VULTURES, HAWKS, EAGLES						
Turkey Vulture	<i>Cathartes aura</i>	P*	C	b ^s	AH	[*]
Osprey	<i>Pandion haliaetus</i>	P	O	v	AH	
Golden Eagle	<i>Aquila chrysaetos</i>	P*	UC	b ^y	RC, GS	[*]
Northern Harrier	<i>Circus hudsonius</i>	P*	C	r	GS	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Bald eagle	<i>Haliaeetus leucocephalus</i>	P	O	v	AH	
Sharp-shinned Hawk	<i>Accipiter striatus</i>	P*	R	b ^s	RW	
Cooper's Hawk	<i>Astur cooperii</i>	P*	UC	b ^s	RW, RE	
Swainson's Hawk	<i>Buteo swainsoni</i>	P*	UC	b ^s	GS	[*]
Red-tailed Hawk (Western)	<i>Buteo jamaicensis</i>	P*	C	b ^y	AH	[*]
Rough-legged Hawk	<i>Buteo lagopus</i>	P	O	r	AH	
Ferruginous Hawk	<i>Buteo regalis</i>	P*	O	r	AH	
OWLS						
American Barn Owl	<i>Tyto furcata</i>	P*	UC	b ^y	ST, RC, GS	[*]
Western Screech Owl	<i>Megascops kennicottii</i>	P*	O	b ^y	RW	
Great-horned Owl	<i>Bubo virginianus</i>	P*	UC	b ^y	RW, RE, RC	*
Burrowing Owl	<i>Athene cunicularia</i>	P*	UC	b ^s	GS	*
Long-eared Owl	<i>Asio otus</i>	P	O	b ^y	RW	
Short-eared Owl	<i>Asio flammeus</i>	P	O	v	GS, RC	
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	P*	R	r	JW, RE	
KINGFISHERS						
Belted Kingfisher	<i>Megaceryle alcyon</i>	P*	O	m	RW, OW	
WOODPECKERS						
Lewis's Woodpecker	<i>Melanerpes lewis</i>	P*	O	m	JW, RE	
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	P*	O	v	RW, RE	
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	P*	O	m	RW, RE	
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	P*	O	v	RW, RE	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	P*	O	m	RW, RE	
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	P*	O	v	RW, RE	
Downy Woodpecker	<i>Dryobates pubescens</i>	P	O	v	RW, RE	
Ladder-backed Woodpecker	<i>Dryobates scalaris</i>	P	O	v	RW, RE	
Hairy Woodpecker	<i>Dryobates villosus</i>	P*	O	v	RW, RE	
Northern (Red-shafted) Flicker	<i>Colaptes auratus</i>	P*	C	by	RW, RE	*
FALCONS						
American Kestrel	<i>Falco sparverius</i>	P*	C	b ^y	RC, GS	*
Merlin	<i>Falco columbarius</i>	P*	R	r	AH	
Prairie Falcon	<i>Falco mexicanus</i>	P*	UC	b ^y	RC, GS	*
FLYCATCHERS						
Northern Beardless Tyrannulet	<i>Camptostoma imberbe</i>	P	O	v	UN	
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	P*	C	b ^s	RW, GS	[*]
Cassin's Kingbird	<i>Tyrannus vociferans</i>	P*	UC	b ^s	RW, RE	*
Western Kingbird	<i>Tyrannus verticalis</i>	P*	C	bs	RW, RE	*
Olive-sided Flycatcher	<i>Contopus cooperi</i>	P*	UC	m	RW	
Western Wood Pewee	<i>Contopus sordidulus</i>	P*	UC	m	RW, JW	
Willow Flycatcher	<i>Empidonax traillii</i>	P*	R	m	RW, RE	
Hammond's Flycatcher	<i>Empidonax hammondii</i>	P*	O	m	RW	
Gray Flycatcher	<i>Empidonax wrightii</i>	P*	UC	m	RW, RE, JW	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Dusky Flycatcher	<i>Empidonax oberholseri</i>	P*	R	m	RW, RE	
Western Flycatcher	<i>Empidonax difficilis</i>	P*	UC	m	RW, JW	
Black Phoebe	<i>Sayornis nigricans</i>	P*	R	m	RW, OW	
Say's Phoebe	<i>Sayornis saya</i>	P*	C	b ^y	RW, GS, RC	*
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	P*	O	v	GS, RE, RW	
VIREOS						
Gray Vireo	<i>Vireo vicinior</i>	P*	UC	m	RW, JW	
Cassin's Vireo	<i>Vireo cassinii</i>	P*	UC	m	RW, RE	
Plumbeous Vireo	<i>Vireo plumbeus</i>	P*	R	m	RW, RE	
Warbling Vireo	<i>Vireo gilvus</i>	P*	R	m	RW	
SHRIKES						
Loggerhead Shrike	<i>Lanius ludovicianus</i>	P*	A	b ^y	GS, RW, JW	*
JAYS, CROWS						
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	P*	O	m	JW, RW	
Steller's Jay	<i>Cyanocitta stelleri</i>	P*	O	m	JW, RE	
Woodhouse's Scrub Jay	<i>Aphelocoma woodhousii</i>	P*	R	m	JW, RE	
Clark's Nutcracker	<i>Nucifraga columbiana</i>	P	O	v	JW, RW	
Black-billed Magpie	<i>Pica hudsonia</i>	P*	O	v	JW, RW	
American Crow	<i>Corvus brachyrhynchos</i>	P*	R	b ^y	AH	[*]
Common Raven	<i>Corvus corax</i>	P*	C	b ^y	AH	*
TITMICE, BUSHTITS						
Mountain Chickadee	<i>Poecile gambeli</i>	P*	O	r	JW, RE	
Bridled Titmouse	<i>Baeolophus wollweberi</i>	P*	O	v	RW	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Juniper Titmouse	<i>Baeolophus ridgwayi</i>	P*	O	r	JW, RW	
Bushtit	<i>Psaltiriparus minimus</i>	P*	C	b ^y	RW, JW	*
LARKS						
Horned Lark	<i>Eremophila alpestris</i>	P*	A	b ^y	GS	*
SWALLOWS						
Bank Swallow	<i>Riparia riparia</i>	P*	O	m	RW	
Tree Swallow	<i>Tachycineta bicolor</i>	P*	O	m	RW	
Violet-green Swallow	<i>Tachycineta thalassina</i>	P*	C	m	AH	
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	P*	UC	m	RW	
Purple Martin	<i>Progne subis</i>	P	O	m	UN	
Barn Swallow	<i>Hirundo rustica</i>	P*	UC	b ^s	RW, RE, GS	*
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	P*	C	b ^s	ST, RC, HS	*
KINGLETS						
Ruby-crowned Kinglet	<i>Corthylio calendula</i>	P*	C	m	RE, RW, JW	
Golden-crowned Kinglet	<i>Regulus satrapa</i>	P*	O	m	RE	
WAXWINGS						
Bohemian Waxwing	<i>Bombycilla garrulus</i>	P	O	v	RE	
Cedar Waxwing	<i>Bombycilla cedrorum</i>	P*	R	m	RE, RW	
SILKY FLYCATCHERS						
Phainopepla	<i>Phainopepla nitens</i>	P*	O	v	JW, RE	
NUTHATCHES						
Red-breasted Nuthatch	<i>Sitta canadensis</i>	P*	R	m	JW, RW, RE	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
White-breasted Nuthatch	<i>Sitta carolinensis</i>	P*	O	r	RW, RE, JW	
Pygmy Nuthatch	<i>Sitta pygmaea</i>	P*	O	v	JW, RW, RE	
CREEPERS						
Brown Creeper	<i>Certhia americana</i>	P*	O	m	JW, RE, RW	
GNATCATCHERS						
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	P*	UC	m	RW, RE	
WRENS						
Rock Wren	<i>Salpinctes obsoletus</i>	P*	A	b ^y	RC	*
Canyon Wren	<i>Catherpes mexicanus</i>	P*	R	b ^s	RC	[*]
Bewick's Wren	<i>Thryomanes bewickii</i>	P*	R	r	RW, RE	
Northern House Wren	<i>Troglodytes aedon</i>	P*	UC	b ^s	RW, RE	[*]
Pacific Wren	<i>Troglodytes pacificus</i>	P*	O	v	RW, RE	
Marsh Wren	<i>Cistothorus palustris</i>	P*	O	m	OW, RW	
MOCKINGBIRDS, THRASHERS						
Gray Catbird	<i>Dumetella carolinensis</i>	P	O	v	JW, RE	
Curve-billed Thrasher	<i>Toxostoma curvirostre</i>	P*	O	v	RW	
Brown Thrasher	<i>Toxostoma rufum</i>	P	O	v	RE, RW	
Bendire's Thrasher	<i>Toxostoma bendirei</i>	P*	R	b ^s	RW, JW	[*]
Crissal Thrasher	<i>Toxostoma crissale</i>	P*	UC	b ^y	RW	[*]
Sage Thrasher	<i>Oreoscoptes montanus</i>	P*	UC	b ^y	GS	*
Northern Mockingbird	<i>Mimus polyglottos</i>	P*	C	b ^s	JW, GS, RW	[*]

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
STARLINGS						
European Starling	<i>Sturnus vulgaris</i>	P*	C	b ^y	RE, RW	[*]
BLUEBIRDS, THRUSHES						
Western Bluebird	<i>Sialia mexicana</i>	P*	R	r	GS, RE	
Mountain Bluebird	<i>Sialia currucoides</i>	P*	R	r	JW, RE, GS	
Townsend's Solitaire	<i>Myadestes townsendi</i>	P*	UC	r	JW, RE	
Swainson's Thrush	<i>Catharus ustulatus</i>	P*	O	m	RW	
Hermit Thrush	<i>Catharus guttatus</i>	P*	UC	m	RW, RE	
American Robin	<i>Turdus migratorius</i>	P*	C	r	RE, JW	
Varied Thrush	<i>Ixoreus naevius</i>	P*	O	v	RW, RE	
OLD WORLD SPARROWS						
House Sparrow	<i>Passer domesticus</i>	P*	C	b ^y	RE	*
PIPITS						
American Pipit	<i>Anthus rubescens</i>	P*	R	m	GS, OW	
FINCHES						
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	P*	O	m	RE, RW	
House Finch	<i>Haemorhous mexicanus</i>	P*	A	b ^y	RW, RE, GS	*
Cassin's Finch	<i>Haemorhous cassinii</i>	P*	R	m	RW, RE	
Pine Siskin	<i>Spinus pinus</i>	P*	R	m	RE, RW	
Lesser Goldfinch	<i>Spinus psaltria</i>	P*	UC	b ^s	RW, RE	[*]
American Goldfinch	<i>Spinus tristis</i>	P*	O	r	RE, RW	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
TOWHEES, SPARROWS						
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	P	O	m	GS	
Cassin's Sparrow	<i>Peucaea cassinii</i>	P*	O	b ^s	GS	[*]
Grasshopper Sparrow	<i>Ammodramus sava-</i> <i>narum</i>	P*	O	m	GS	
Black-throated Sparrow	<i>Amphispiza bilineata</i>	P*	A	b ^s	GS	*
Lark Sparrow	<i>Chondestes grammacus</i>	P*	UC	b ^s	RW, GS	*
Lark Bunting	<i>Calamospiza melanocorys</i>	P*	R	m	GS	
Chipping Sparrow	<i>Spizella passerina</i>	P*	UC	m	GS	
Black-chinned Sparrow	<i>Spizella atrogularis</i>	P*	O	m	RE, JW	
Brewer's Sparrow	<i>Spizella breweri</i>	P*	C	b ^s	GS	[*]
Fox Sparrow	<i>Passerella iliaca</i>	P*	O	m	RW, GS	
American Tree Sparrow	<i>Spizelloides arborea</i>	P	O	v	RW, GS	
Dark-eyed Junco	<i>Junco hyemalis</i>	P*	C	r	GS, RW	
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	P*	C	r	RW, GS, RE	
Harris's Sparrow	<i>Zonotrichia querula</i>	P*	O	v	GS, RE	
White-throated Sparrow	<i>Zonotrichia albicollis</i>	P*	O	m	GS	
Sagebrush Sparrow	<i>Artemisiospiza nevadensis</i>	P*	C	r	GS	
Vesper Sparrow	<i>Pooecetes gramineus</i>	P*	R	m	GS	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	P*	O	m	GS	
Song Sparrow	<i>Melospiza melodia</i>	P*	R	r	RW, GS	
Lincoln's Sparrow	<i>Melospiza lincolni</i>	P*	R	m	RW, GS	
Canyon Towhee	<i>Melospiza fusca</i>	P*	R	r	GS	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>	P*	O	m	GS, JW	
Green-tailed Towhee	<i>Pipilo chlorurus</i>	P*	UC	m	RW, JW	
Spotted Towhee	<i>Pipilo maculatus</i>	P*	R	m	RW	[*]
BLACKBIRDS, ORIOLES						
Yellow-breasted Chat	<i>Icteria virens</i>	P*	O	m	RW, RE	
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	P*	O	m	RE, RW, OW	
Chihuahuan Meadowlark	<i>Sturnella lilianae</i>	P*	C	b ^s	GS	*
Western Meadowlark	<i>Sturnella neglecta</i>	P*	C	b ^y	GS	*
Hooded Oriole	<i>Icterus cucullatus</i>	P*	O	v	RE	
Bullock's Oriole	<i>Icterus bullockii</i>	P*	C	b ^s	RE	*
Baltimore Oriole	<i>Icterus galbula</i>	P*	O	v	RW, RE	
Scott's Oriole	<i>Icterus parisorum</i>	P*	O	m	JW, RE	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	P*	O	m	RW, GS	
Brown-headed Cowbird	<i>Molothrus ater</i>	P*	UC	b ^s	RW, GS	*
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	P*	R	m	GS, RE	
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	P*	C	b ^s	RE	*
WOOD WARBLERS						
Ovenbird	<i>Seiurus aurocapilla</i>	P*	O	v	RW, RE	
Northern Waterthrush	<i>Parkesia noveboracensis</i>	P*	O	v	RW, RE	
Black and White Warbler	<i>Mniotilta varia</i>	P*	O	v	RW, RE	
Orange-crowned Warbler	<i>Leiothlypis celata</i>	P*	C	m	RW, RE	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Lucy's Warbler	<i>Leiothlypis luciae</i>	P*	O	m	RW, RE	
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	P*	O	m	RW, RE	
Virginia's Warbler	<i>Leiothlypis virginiae</i>	P*	R	m	RW, RE, JW	
MacGillivray's Warbler	<i>Geothlypis tolmiei</i>	P*	C	m	RW, RE, JW	
Common Yellowthroat	<i>Geothlypis trichas</i>	P*	R	m	RW, RE	
American Redstart	<i>Setophaga ruticilla</i>	P	O	v	RW, RE	
Northern Parula	<i>Setophaga americana</i>	P*	O	v	RW, RE	
Magnolia Warbler	<i>Setophaga magnolia</i>	P*	O	v	RW, RE	
Yellow Warbler	<i>Setophaga petechia</i>	P*	UC	m	RW, RE	
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>	P*	O	v	RW, RE	
Black-throated Blue Warbler	<i>Setophaga caerulescens</i>	P	O	v	RE, RW	
Palm Warbler	<i>Setophaga palmarum</i>	P	O	v	UN	
Yellow-rumped Warbler	<i>Setophaga coronata</i>	P*	C	m	RW, RE, JW	
Grace's Warbler	<i>Setophaga graciae</i>	P	O	v	JW, RW, RE	
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>	P*	UC	m	RW, RE	
Townsend's Warbler	<i>Setophaga townsendi</i>	P*	R	m	RW, RE, JW	
Hermit Warbler	<i>Setophaga occidentalis</i>	P*	O	m	RW, RE, JW	
Wilson's Warbler	<i>Cardellina pusilla</i>	P*	UC	m	RW, RE	

APPENDIX 2. (continued)

Common name	Scientific name	Park status	Abundance	Residency	Habitat	Breeding status
Red-faced Warbler	<i>Cardellina rubrifrons</i>	P	O	v	RW, RE	
TANAGERS						
Hepatic Tanager	<i>Piranga flava</i>	P*	O	m	RE	
Summer Tanager	<i>Piranga rubra</i>	P*	O	m	RE, RW	
Western Tanager	<i>Piranga ludoviciana</i>	P*	UC	m	RW, RE	
CARDINALS						
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	P*	O	v	RE, RW	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	P*	UC	m	RW, RE	
Blue Grosbeak	<i>Passerina caerulea</i>	P*	C	b ^s	RW	*
Lazuli Bunting	<i>Passerina amoena</i>	P*	C	m	RW, RE	
Indigo Bunting	<i>Passerina cyanea</i>	P*	O	m	RW, RE	
Painted Bunting	<i>Passerina ciris</i>	P	O	v	RW, RE	

HISTORY, GENEALOGY AND ARCHAEOLOGY OF AN EARLY TWENTIETH CENTURY HOMESTEAD IN THE PUERCO RIVER BASIN OF NORTHEAST ARIZONA

WILLIAM G. PARKER¹ and JONATHAN G. HARDES¹

¹Department of Science and Resource Management, Petrified Forest National Park, Petrified Forest, AZ 86028, U.S.A.; william_parker@nps.gov; jonathan_hardes@nps.gov

ABSTRACT — Historical archaeological analysis of an early 20th Century homestead site within Petrified Forest National Park reveals key details of structures common during this time including sandstone foundations, concrete drinkers, and railroad tie fencing. A lack of metal cans on this particular site is noteworthy. Other artifacts present including cold cream jars, a nail polish bottle and fine china indicate a strong female presence, whereas doll parts and particular medicine bottles suggest the presence of children. Land and genealogical records show that this property was settled by George Zimmerman, a conductor with the Santa Fe Railroad. George was mainly stationed in Winslow, Arizona and the homestead was principally inhabited by his wife and young daughter, corroborating the archaeological evidence. After George's passing the rest of the family moved on. The family history demonstrates the struggles of early immigrant families and homesteaders. The collaboration of archaeological and genealogical work is a powerful tool that enriches our understanding of historical sites.

Keywords: archaeology; genealogy; Homestead Act; railroad; Petrified Forest.

INTRODUCTION

The Petrified Forest Expansion Act of 2004 authorized the National Park Service (NPS) to add 125,000 acres to protect abundant paleontological and archaeological resources outside of the original park boundary. In 2011 the NPS purchased the Paulsell and McCauley ranches that lie south of the Puerco River and east of Petrified Forest National Park. Subsequent archaeological inventory of the area in 2017 came across the remains of an early 20th Century homestead situated amongst sand dunes about 500 m south of the Puerco River and about 1.1 km east of the confluence between the Puerco River and Ninemile Wash. The site is also located only about 3.5 km east of the now defunct, but once bustling railroad stop of Adamana, a community of about 100 persons from

the early 1900s into the 1940s¹.

The site (PEFO01118) consists of six distinct features, the most prominent of which are the remains of a large rectangular stone foundation. Artifacts present at the site suggest an occupation period from the early 1900s and no later than the 1930s. A land records search turned up a homesteading patent (#658911) for a Mr. George Zimmerman of Winslow, Arizona issued on January 13th, 1919². The Homestead Act of 1862 allowed certain Americans the ability to claim 160 acres plots of public land for only a minimal filing fee. In return the homesteader had to continuously reside on the land for at least five years, construct a home on

¹ United States Federal Census Records, Adamana, Arizona, 1910, 1920, 1930.

² DOI BLM GLO Records. Accession Nr: 658911, January 13, 1919.

the property, and engage in ranching or farming.

A newspaper search discovered that Mr. Zimmerman had initially placed a homesteading claim on the parcel (Homestead Entry 26970) on March 19, 1915³. Newspaper records also show that Zimmerman constructed a ranch at the site, which he frequented periodically from 1915 until his death in 1918⁴. Although the homesteading claim was finalized in 1919, the surviving family members, a wife and daughter, only remained at least another 8 months after George's death before permanently leaving the site after the wife remarried⁵. The family eventually ended up in Oklahoma.

Still partially buried and well preserved, this site offers an opportunity to research and interpret an early 20th Century homestead and early ranching activities in the Puerco River Valley. Furthermore, the association of the site with specific individuals enhances the story that can be told about families who made a living in this area during the early days of Arizona statehood. This project demonstrates the crossroads between archaeological field investigations, historical records, and genealogical research.

LOCATION

PEFO01118 is located in the NW ¼ of Section 10, Township 18N, Range 24E. Exact coordinates for qualified researchers are available from the Department of Science and Resource Management at

³ The Holbrook News, Holbrook Arizona, February 15, 1918.

⁴ Winslow Daily Mail, Winslow, Arizona. January 30, 1915; August 20, 1915; August 27, 1915; February 11, 1916.

⁵ The Holbrook News, Holbrook Arizona, December 6, 1918.

Petrified Forest National Park. George Zimmerman had claim on the entire quarter section (160 acres). The site is located between Ninemile Wash and the Puerco River and about 0.5 mi east of Puerco Pueblo.

SITE FEATURES AND ARTIFACTS

The site is characterized by the preserved remains of an early 20th Century homestead located in a set of low dunes on a relatively flat plain south of the Puerco River. Six distinct features make up the site, the largest of which are the partially buried remains of the primary residential structure. The foundation of the dwelling, recorded as Feature 1, remains largely in place, with wall fall giving it some resemblance to a precontact pueblo rubble mound. Given its partially buried situation within a sand dune and the associated density of artifacts, the feature likely contains *in-situ*, buried cultural deposits. Future subsurface testing could help reveal the true depositional nature of the site.

The foundation, rectangular in shape, is unusually large at 36 ft along the long axis (Fig. 1). It is constructed of local, light tan sandstone, largely unshaped. Additional features include a square poured concrete 'drinker' (Feature 2), intended for use by horses and/or other livestock (Fig. 2), a section of fencing corner, constructed from railroad ties and containing hand-forged iron spikes and square nails and a concrete block dump consisting of several pieces in a concentrated pile. The blocks appear to have been made locally, as they comprise many larger pebbles and cobbles encased within the cement. The final recorded feature (Feature 6), consists of the remains of a probable privy. Not surprisingly, site artifact den-



FIGURE 1. Remains of the dry-laid sandstone foundation from the main house (Feature 1).

sity was found to be highest within this feature. Artifacts discovered in Feature 6 include numerous glass shards and ceramic sherds (both porcelain and stoneware), alongside numerous burnt metal fragments and an industrial ceramic sewage pipe, all within a slight depression in the ground.

The site is notable for the size and shape of Feature 1, for the presence of

fine porcelain, including Chinese and Chinese impression (Fig. 3), and for a lack of tin cans compared to multiple 'cowboy camps' in the area. This noticeably different artifact signature strongly suggests the presence of women and children. Female presence is indicated by the presence of ample crockery, imported porcelain, a nail polish bottle, and multiple cold cream jars (Fig. 3), and is

corroborated by the historical record of primarily female tenants.

Strong direct evidence for the presence of young children also exists, in the form of bisque doll parts, and the fragmentary remains of a 'Fletcher's Castoria' medicine bottle (Fig. 4). Fletcher's Castoria was originally patented in 1868 and known as Pitcher's Castoria, and was later purchased and renamed by Charles Henry Fletcher in 1871 (<https://sha.org/bottle/pdffiles/CastoriaHistory>). The product, which is still in use today and branded as Fletcher's Laxative, is intended as a natural and sensitive laxative for children. Additional artifactual evidence of note includes a local copper coin or token (Fig. 5), a small, surficial faunal assemblage (Fig. 6), kerosene lamp parts, a patented ink bottle, and multiple rifle and revolver shell casings.

The site represents a compelling example of an early homestead in the region and allows for a better understanding of this transitional period – pre-WWII, early 20th Century. There are other sites in the area that date to this period, but this one may be in the best condition and have some of the most diverse and informative artifacts. Based on cross-dating of artifacts, the site's occupation likely did not extend past the 1930's.

GENEALOGICAL RESEARCH

George Zimmermann (later Zimmerman) was born in Allegheny City, Pennsylvania, on September 24, 1876⁶, to German immigrant parents.

⁶ Marriage License No. 4141, Allegheny City, Pennsylvania, February 19, 1900.



FIGURE 2. Poured concrete stock tank or 'drinker' (Feature 2).



FIGURE 3. Female-related artifacts. **A)** Fragments of Chinese decorated porcelain. **B)** Nail polish bottle. Not pictured: cold cream jars and earthenware crockery. Scales = $\frac{1}{2}$ inch.

Allegheny City was commonly referred to as 'Deutschtown' for its prominent German population. The municipality was annexed by the city of Pittsburgh in 1907 and is now part of the city's North Shore neighborhood, located along the north banks of the Allegheny and Ohio rivers. On February 20th, 1900, Mr. Zimmerman married Annie Louise Schmidt (later Smith)⁷ who also was of German descent (Fig. 7), and German was the prominent language in the Zimmerman household (D. Pledger, pers. comm., 2024). Annie was born on January 6, 1880, in Sewickley, Pennsylvania⁸. The 1900 census shows George's profession as a store molder and Anna's as a roller in a cigar factory⁹. Within a couple of years, the couple had left western Pennsylvania, settled for a bit in Ohio where

their son Charles was born in 1902, and by 1908 settled in Sabinal, New Mexico¹⁰. By this time George had started working as a freight train conductor and in 1908 a daughter, Cecilia, was born¹¹. Sabinal is a small community on the west bank of the Rio Grande River. Both old U.S. Route 85 and the train tracks paralleled the river running north towards Albuquerque, about 69 km distant. The Zimmerman home was located about an eighth of a mile from the tracks and George was stationed mainly at San Marcial, about 57 km south of Sabinal.

On August 17, 1910, Cecilia, then almost two years old, wandered out to the tracks to see her father's train pass. This was a common ritual, and she would wave as he passed. However, on this day she ended up on the tracks and was struck and fatally injured by the Number

⁷ *ibid.*

⁸ *ibid.*

⁹ United States Federal Census 1900, Allegheny, Pennsylvania.

¹⁰ United States Federal Census 1910, Socorro, New Mexico.

¹¹ *ibid.*

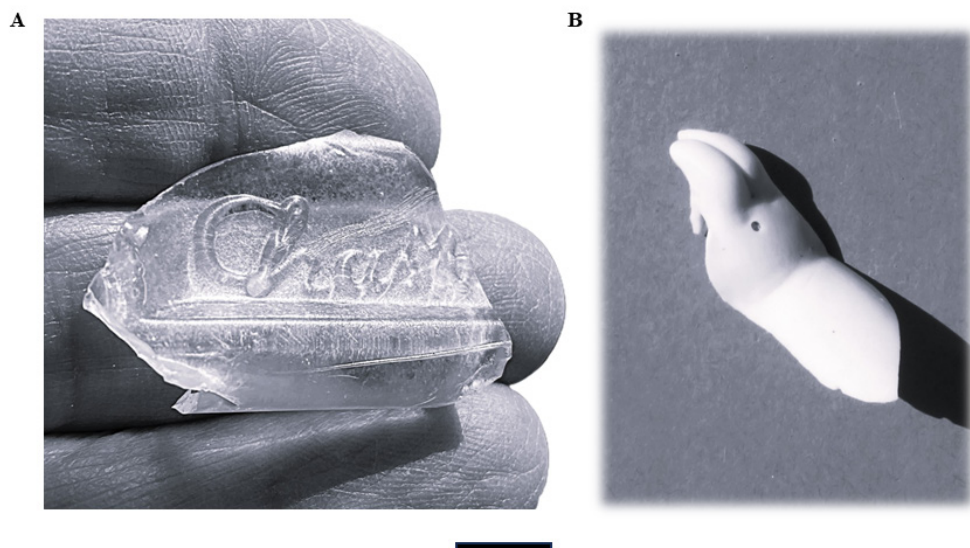


FIGURE 4. Child-related artifacts. **A)** Side panel fragment of a colorless glass 'Chas. H. Fletcher' 'Castoria' medicine bottle, manufactured by the Pierce Glass Co., Port Allegany, Pennsylvania. **B)** Fragment of a bisque porcelain doll arm/hand. Scale = $\frac{1}{2}$ inch.



FIGURE 5. Local copper coin/token. Side 1: "WATTS & LATHROP / HOLBROOK, / ARIZ.", Side 2: "GOOD FOR / 12 $\frac{1}{2}$ ¢ / CENTS / IN TRADE." (date range: 1912-1917). Scale = $\frac{1}{2}$ inch.

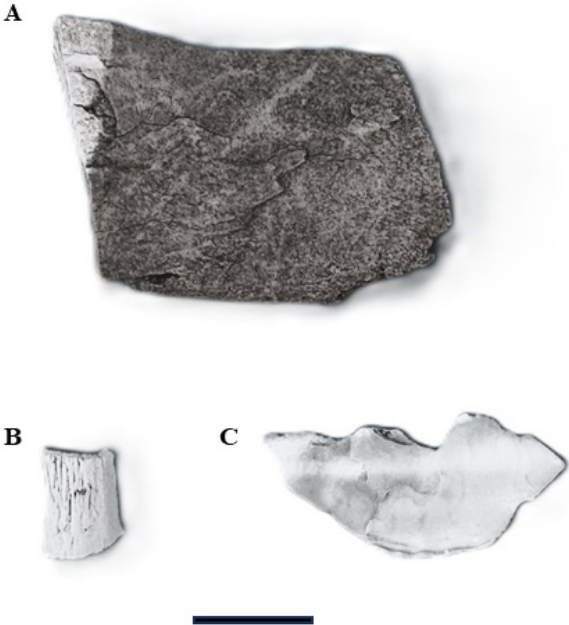


FIGURE 6. Faunal remains. A. saw-cut domestic cattle long bone, B. domestic cattle tooth enamel, C. freshwater mussel shell fragment. Scale = 1/2 inch

Series D. No. 4141	<u>George Zimmerman</u> born in <u>Allegheny City, Pa.</u> on the	
	<u>24</u> day of <u>Sept</u> A. D. 18 <u>76</u> , residing at <u>1615 Madison St. Allegheny Pa.</u>	
	occupation <u>Painter</u> ☒ not related by blood	
	or marriage to the person whom he desires to marry	
	has <u>not</u> been married before and the marriage was dissolved by	
	<u>Annie L. Schmidt</u> born in <u>Scraper, Pa.</u> on the	
	<u>6</u> day of <u>Jan'y</u> A. D. 18 <u>80</u> , residing at <u>635 Preble Ave. Allegheny Pa.</u>	
	occupation <u></u> has <u>not</u> been married before	
	and the marriage was dissolved by	
	Marriage License issued <u>Feb'y 19</u> 19 <u>00</u>	
Consent of <u>Adam F. Schmidt</u> residing at <u>635 Preble Ave. Allegheny Pa.</u>		
Consent of <u></u> residing at <u></u>		
Consent of <u></u> <u>Feb'y 19</u> 19 <u>00</u> ; Married <u>Feb'y 20</u> 19 <u>00</u>		
By <u>Rev. G. W. Koenig</u> Duplicate certificate returned <u>March 15</u> 19 <u>00</u>		

FIGURE 7. 1876 marriage license for George Zimmerman and Annie Schmidt from Allegheny City, Pennsylvania.

816 passenger train, that could not stop in time. She was taken north to Belen for treatment but did not survive and is buried in the cemetery in San Marcial (now a ghost town)¹². Tragically this was not the first loss of a child for the Zimmerman's as some records suggest the loss of a second child in infancy, a daughter named Annette, also in 1910¹³. Shortly after Cecilia's death the family moved to Winslow, Arizona where George had taken another position working for the Santa Fe Railroad, and on November 6, 1910, another daughter, Anna Margaret, is born¹⁴.

After this, public records are sparse, but a May 1914 Navajo County voter registration record showed the family still living in Winslow and George still employed as a train conductor¹⁵. That record provides some vital statistics: George was 37 years of age and of average build, 5' 10" and 160 pounds, whereas Anna was more petite at 5' 2", and 116 pounds¹⁶. Unfortunately, tragedy struck the family a few more times. In late 1914 George's father became seriously ill and passed away in early December¹⁷. A little over a month later the Zimmermans lost another child. On January 9th, 1915, 12-year-old Charles unexpectedly died at their home of diphtheria (Fig. 8) and is buried in the Winslow city cemetery¹⁸.

¹² Albuquerque Morning Journal, Albuquerque New Mexico, August 17, 1910.

¹³ Charles Zimmerman, Find A Grave© Index, 1600s–Current.

¹⁴ Arizona Territorial Board of Health Original Certificate of Birth, Co. Register No. 339.

¹⁵ Navajo County Voter Registration, May 11, 1914

¹⁶ *ibid*.

¹⁷ Winslow Daily Mail, Winslow Arizona, December 5, 1914.

¹⁸ Charles Zimmerman. Arizona State Board of Health – Original Death Certificate.

Heavily grieving, the family applied for the homesteading claim near Adamana and George spent the last week of January in 1915 building the new ranch. He filed his entry (No. 026970) on the 19th of March¹⁹. Anna and Anna Margaret moved there a few months later and it became their primary residence, while George still mainly lived and worked out of Winslow. *Winslow Daily Mail* notices from 1915 and 1916 show him visiting the ranch often, and in July of 1916 he registered to vote in Apache County with his profession listed as a rancher, presumably ending his long career with the railroad²⁰.

On February 15th, 1918, *The Holbrook News* published that George filed his notice of intention to make the required 'Three-year Proof' to establish his claim to the homestead site. The appointment was scheduled for March 19th, 1918, in Holbrook²¹. Unfortunately, a few weeks later tragedy struck once again. On February 28th Sheriff Lee Newman of Holbrook arrived at the ranch and put George under arrest, purportedly for attacking his wife and neighbors²². He was examined by the local doctor and ordered to the sanitarium in Phoenix, where he was moved a few days later. It was noted that Zimmerman had been in poor health and that the tragedies of losing his children had contributed greatly²³. George never left the Arizona State Hospital and passed away on April 28th, 1918, of dementia with 'insanity' listed as a contributor²⁴.

¹⁹ The Holbrook News, Holbrook Arizona, February 15, 1918.

²⁰ Apache County Voter Registration, July 21, 1916.

²¹ The Holbrook News, February 15, 1918.

²² The Holbrook News, March 1, 1918.

²³ Winslow Daily Mail, March 1, 1918.

²⁴ George Zimmerman. Arizona State Board of Health Original Death Certificate.

He was buried in the Winslow Cemetery close to Charles²⁵.

It is not clear how long Anna and Anna Margaret stayed at the homestead, but there is a final Notice to Creditors in *The Holbrook News* dated December 27, 1918²⁶ and a final Government Lands Office record on January 13th, 1919, deeding the homestead to the family²⁷.

Anna married Homer Alvin Ricketts on October 15, 1918²⁸ with whom she later had two more children. Originally, they resided at the homestead in Adamana where Anna had briefly served as the postmistress²⁹ (December 20, 1917 – October 8, 2018), but by mid-1919, with Anna Margaret, first moved to Arkansas³⁰ and finally settled in Perkins, Oklahoma³¹. Unfortunately, tragedy struck one final time and on May 19, 1933, Anna Margaret died at the age of 22 from injuries suffered in a fire, leaving behind a two-year-old daughter³² who was adopted by Anna and Homer. Anna passed away on April 20, 1958, in Perkins, Oklahoma at the age of 78³³.

By the 1940s, ownership of the homestead parcel was passed to Edwin H. Olsen who owned a curio shop and residence located on the east side of the main

park road in Section 4. After the Olsens left the area in the 1960s the parcel was acquired by Patton Paulsell, and the quarter section was the 'Dead River Pasture' of his large ranch located mainly to the east. The Paulsells passed away in 1985 and 1986 and deeded the property to the University of Arizona. The Hatch Family from Winslow purchased the ranch from the University in 1994 and eventually sold it, including the old Zimmerman parcel, to the National Park Service in 2011 (Chorover and Kulka, 2024).

DISCUSSION

PEFO01118 (Zimmerman Homestead), is an excellent example of an early 20th Century homestead, and represents a unique opportunity to develop a greater understanding of the early 1900s settlement of the Puerco River Valley by ranchers and railroad workers and how it interacted with the early Petrified Forest National Monument, which would have been just to the south and west. During the period the Zimmermans resided at Adamana the proprietor of the nearby Forest Hotel, Chester Campbell, would have also served as the monument custodian. The townsite was rapidly expanding as the gateway to the Petrified Forest, with the hotel and a store³⁴, and by the 1930s had a population of over 100 people³⁵. Such a site would have been attractive to a railroad man looking to resettle. The wealth of artifacts and good preservation provides this site with very high potential for historical and archaeological research.

Artifacts recovered from the site during

²⁵ George Zimmerman, Find A Grave© Index, 1600s–Current.

²⁶ The Holbrook News, December 27, 1918.

²⁷ DOI BLM GLO Records. Accession Nr: 658911, January 13, 1919.

²⁸ Stillwater News-Press, Stillwater Oklahoma February 5, 1951.

²⁹ The Daily Oklahoman, Oklahoma City, Oklahoma, April 21, 1958.

³⁰ United States Federal Census 1920, Black Rock Arkansas.

³¹ United States Federal Census 1930, Perkins Oklahoma.

³² Perkins Journal, Perkins Oklahoma, May 25, 1933

³³ Anna L. Ricketts, Find A Grave© Index, 1600s–Current.

³⁴ St. Johns Herald and Apache News, St. Johns, Arizona, February 19, 1914

³⁵ United States Federal Census 1930, Apache County, Arizona

FILL OUT ALL BLANKS
AGE should be stated EXACTLY. PHYSICIANS should state CAUSE OF DEATH in plain terms, that it may be properly classified. If any item can not be obtained insert word "unknown." Make every effort possible to secure this information. Incorrect certification will be returned for correction.

PLACE OF DEATH			ARIZONA STATE BOARD OF HEALTH	
BUREAU OF VITAL STATISTICS			State Index No. 209	
County	Navajo		ORIGINAL CERTIFICATE OF DEATH	
District	Winslow		County Registered No. 2	
Town	Winslow		Local Registrar's No.	
Or City	Winslow		No.	
(If death occurred in a Hospital or Institution, give its NAME in stead of street and number.)				
FULL NAME <u>Charles Zimmerman</u>				
PERSONAL AND STATISTICAL PARTICULARS			MEDICAL CERTIFICATE OF DEATH	
SEX	Color or Race	SINGLE	DATE OF DEATH	
Male	White	MARRIED	Jan 7 1915	
	Black	WIDOWED	(Month) (Day) (Year)	
	Chinese	or DIVORCED		
DATE OF BIRTH			I hereby certify, that I attended deceased from Dec. 31, 1914 to Jan 5, 1915; that I last saw him alive on Jan 5, 1915 and that death occurred on the date stated above at 11:30 P.M. The DISEASE or INJURY causing Death was as follows:	
AGE	12 yrs. 0 mos. 13 days		Septicemia	
OCCUPATION			(Duration) yrs. mos. 5 days	
(a) Trade, profession or particular kind of work			Was disease contracted in Arizona? 7-5	
(b) General nature of industry, business, or establishment in which employed or (employer)			If not, where?	
BIRTHPLACE (State or country)			CONTRIBUTORY	
Ohio			(Duration) yrs. mos. days	
NAME OF FATHER			(Signed) <u>Franklin A. Parr</u>	
BIRTHPLACE OF FATHER			J. 14 1915 (Address) Winslow, Ariz.	
Penn			In deaths from VIOLENT CAUSES state: (1) MEANS OF INJURY, and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.	
MAIDEN NAME OF MOTHER			LENGTH OF RESIDENCE	
Anna Maria Schmidt			At place of death yrs. mos. ds. In Arizona yrs. mos. ds.	
BIRTHPLACE OF MOTHER			Former or Usual Residence	
Penn			Filed Feb 5 1915 W. A. Parr	
THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE			Filed 2-8 1915 J. M. Carr	
(Informant)			Local Registrar	
(Address)			County Registrar	
PLACE OF BURIAL OR REMOVAL				
Winslow				
DATE OF BURIAL OR REMOVAL				
Jan 7 1915				
UNDERTAKER				
W. A. Parr, Winslow Ariz				

FIGURE 8. 1915 Death certificate for Charles Zimmerman from the Arizona State Board of Health.

initial investigations suggested a strong female presence as well as the presence of children. This is supported by genealogical research as well as published newspaper articles which showed that Zimmerman's wife and daughter spent long periods at the homestead while he was still working in Winslow. This history was fleshed out even more by contacting a living descendent who was able to furnish more information as well as a photograph of the family (Fig. 9). Ordinarily, sites such as these are simply recorded as part of a Section 110 survey for National Historic Preservation Act documentation and then monitored periodically for their condition. Combining

the genealogical and historical research 'breathes new life' into the site by identifying the residents and adding their story into the documentation. It also serves as a test for the inferences made from just the artifacts.

The Homestead Act of 1862 provided opportunities for families, especially poor immigrant families, to move west and to obtain good parcels of land. Because of his railroad job George Zimmerman was able to 'follow the tracks' west, settling in New Mexico, and then in Arizona where he was finally able to place a claim on a parcel near Adamana. He constructed a house and ranch, and his wife and daughter were able to live

there while he worked. Unfortunately, like too many families during this time, tragedy seemed to follow wherever they went. They lost a young daughter in Pennsylvania, and then another in New Mexico. Records suggest that after each of these events the family moved to another area. In Winslow, Arizona they lost their son to diphtheria, a common childhood illness kept in check today by vaccinations. After that event they settled in Adamana, but even that time was brief and bracketed by another loss, this time of George, purportedly from the grief of losing three children. George lived a hard life as evidenced from the apparent loss of fingers seen in the family photograph (Fig. 9) and deeply cared for his family, but eventually this hard life and mental illness took its final toll. Eventually Anna remarried and moved to Oklahoma, but even there she lost her last remaining child in a fire. Her apparent resilience in

losing four children and a husband within a decade is astounding. Fortunately, she had a granddaughter to care for and later two more children with her new husband. Many people today would find it hard to relate to the struggles of these homesteading families, just looking for a better and more stable life. Premature death or severe illness and injuries were common, and the majority of families were affected by these events, sometimes numerous episodes in one family such as the Zimmermans. PEFO01118 is a site that goes beyond a simple debris assemblage on the landscape. It represents the real struggles early homesteaders faced on a regular basis.

ACKNOWLEDGEMENTS

Thank you to Dr. David Pledger, the grandson of Anna Margaret Zimmerman,



FIGURE 9. Photograph of (l-r) Anna, Anna Margaret, and George Zimmerman possibly at the homestead site around 1917. Courtesy of David Pledger.

who supplied additional information on the family and provided permission to tell these stories. David Purcell provided important comments during the review process. Original site recordation was conducted by the 2017 archaeology field crew, including Cody Dalpra, ELK, RLJ, and CRN.

REFERENCES

Chorover, G., and E. Kulka, 2024. Determination of eligibility for Paulsell Ranch Structures, Petrified Forest National Park. Unpublished Report by the Heritage Conservation Program and School of Landscape Architecture and Planning, University of Arizona. Tucson, 26p + Appendices.

<https://glassbottlemarks.com/fletchers-castoria-pitchers-castoria/>, accessed 14 November 2024.

<https://sha.org/bottle/pdffiles/Castorica-History.pdf>.

Recieved 2 December 2024; Accepted 4 March 2025

REX KITTRELL BRUTON, JR.: DOCUMENTING AND RESTORING A CHILD'S HISTORICAL GRAVESITE AT PETRIFIED FOREST NATIONAL PARK

MAXWELL FORTON¹

¹Department of Anthropology, Binghamton University, Binghamton, NY 13902;
mforton1@binghamton.edu

"It is terribly important that the 'small things forgotten' be remembered. For in the seemingly little and insignificant things that accumulate to create a lifetime, the essence of our existence is captured. We must remember these bits and pieces, and we must use them in new and imaginative ways so that a different appreciation for what life is today, and was in the past, can be achieved."

Deetz (1977: p. 161).

This quote from historical archaeologist James Deetz, reflects on the humanity preserved in the seemingly inconsequential objects of everyday life. Archaeologists at Petrified Forest National Park (PEFO) document the detritus of daily life of over 13,000 years of human history. After recording the thousandth lithic flake, ceramic sherd, or tin can, it can be easy to lose sight of the people and stories tied to the park's artifacts. However, there are certain places in the park where that human connection is very tangible, spaces where the barrier between past and present is at its thinnest, especially those that tie descendent communities to the landscape. One such place is the grave of the infant Rex Kittrell Bruton, Jr.

In December 2021, segments of the PEFO boundary fence were replaced near the historic railroad community of Adamana, portions of which fall within the park boundary. A crew member working on this fencing project informed the park's resource management staff of a gravesite near the project area. Government Lands Office maps as well as the USGS Adamana quadrangle topographic

map show the presence of a grave near the historic townsite, but the exact spot had never been located by park staff. Once the spot was reported, staff worked quickly to determine if the fencing project would have any adverse effect on its condition. The following is a summary of the discovery of the grave of Rex Kittrell Bruton, Jr. and subsequent research into the story of his brief life. In keeping with the National Park Service's historic preservation mission, park staff conducted a preservation project to restore Rex's grave and honor his memory.

DISCOVERY OF THE GRAVESITE

The gravesite was first officially documented on December 16, 2021. Adamana has no known formal cemetery, and there is only one other known historic period gravesite within PEFO, that of John Samuel Reniker. Rex's grave is located within a partially collapsed rectangular enclosure constructed from rough-hewn juniper posts linked together with sheep fencing. The grave itself consists of a small white marble headstone and plinth.



FIGURE 1. The Rex Kittrell Bruton, Jr. gravesite as it appeared on December 16, 2021 (photo by Maxwell Forton/NPS).

The enclosed space measures approximately 5 x 6 ft., with the fence on the east side being largely collapsed (Fig. 1).

Initial investigation found the gravesite to be in poor condition. The internal metal dowels securing the headstone to the plinth had been removed, resulting in the headstone toppling forward onto its face (Fig. 2). Vegetation was growing around the toppled grave, further obscuring the inscription on the headstone. When the headstone was flipped over, the inscription was fortunately still legible, reading: "Rex Kittrell Jr. / Son of / Rex & Helen / Bruton / Born & Died / Dec. 25, 1918." Above the inscription, framed in an oval, is a carved floral motif. The only major damage to the headstone is a scar from a high caliber bullet striking the surface next to the 'S' in 'Son'. Beyond the gunshot damage, the white marble was stained brown from the extended time

spent lying in the dirt (Fig. 3).

A brief survey of the surrounding area revealed no other graves or other associated features. The grave's distance from park boundary meant there would be no impact from the fencing project and no further mitigation was required. However, the poor condition of the gravesite and mystery of the child's identity compelled the park resource staff to conduct further archival research and begin planning a restoration project.

THE FAMILY OF REX KITTRELL BRUTON, JR.

Reginald 'Rex' Kittrell Bruton, Jr. was born at 8:00 PM on Christmas night, 1918 in Adamana, Arizona (Fig. 4). He shared his birthday with his father Reginald Kittrell Bruton, Sr., who was born on December 25, 1897, in Grifton North



FIGURE 2. The Rex Kittrell Bruton, Jr. headstone found toppled off its plinth (photo by Maxwell Forton/NPS).



FIGURE 3. The original condition of the headstone, with a bullet scar observed above the 'S' in 'Son' (photo by Maxwell Forton/NPS).

PLACE OF BIRTH
County of Navajo
District of _____
Town of Adamana
or _____
City of _____ (No. _____ St. _____ Ward _____)

ARIZONA STATE BOARD OF HEALTH
BUREAU OF VITAL STATISTICS
State Index No. 399
Co. Register No. _____
Local Registrar's No. _____

ORIGINAL CERTIFICATE OF BIRTH

FULL NAME OF CHILD Rex Bruton Jr.
If child is not named, make Supplemental Report on blank obtainable from local registrar.

Sex of Child Male { Twin, Triplet or other _____ } and { Number in order of birth _____ } Legitt. mate? Yes Date of Birth Dec 25 1918
(Month) (Day) (Yr.)

FATHER
Full Name Reginald Kittrell Bruton
Residence Adamana, Ariz.
Color or Race White Age at last Birthday 25 (Years)
Birthplace W. C.
Occupation Telegraph operator

MOTHER
Full Maiden Name Helin Kosta
Residence Adamana, Ariz.
Color or Race White Age at last Birthday 18 (Years)
Birthplace Iowa
Occupation Housewife

Number of child of this mother... 1... Number of children, of this mother, now living... 1... Were precautions taken against *Opthalmia neonatorum*? _____

CERTIFICATE OF ATTENDING PHYSICIAN OR MIDWIFE*
I hereby certify that I attended the birth of above child; and that it occurred on Dec 25 1918, at 8:00 P.M.
{ *When there is no attending phys- }
{ clan or midwife, then the householder }
{ should make this return. }
(Signature) Greg S. Smith
(Attending physician, midwife, householder.)
Given or christian name added from a supplemental report _____ Address _____

925-1225-821
COUNTY REGISTRAR.

Filed Jan 13 1919 W. B. Cross
LOCAL REGISTRAR.
A True Copy W. B. Cross
COUNTY REGISTRAR.

FIGURE 4. The original birth record for Rex Kittrell Bruton, Jr.

Carolina^{1,2}. At the time of his son's birth, Reginald was a telegraph operator in Adamana, but earlier that year had been living in Gallup, New Mexico³. Rex's mother, Helen Edna (Kosta) Bruton, was 18 years old at the time, born in Iowa on April 21, 1901⁴. Although Reginald, Sr. was also called 'Rex,' in this contribution the father will be referred to as Reginald and the son as Rex.

Helen and Reginald were only six months married at the time of their son's birth. On June 20, 1918, they were wed in Holbrook, Arizona by Justice A. M. Boyer, with Anna Zimmerman and Olive Clark serving as witnesses⁵. Their marriage was announced in *The Holbrook News*, where Helen's surname was erroneously spelled as "Costa"⁶. The exact circumstances that brought Helen and Reginald to Adamana are unclear. Adamana was an isolated community founded in 1896 as a coal and watering station for the Santa Fe Railroad. In time, the community grew around supporting the growing interest of tourists arriving by train to visit the Petrified Forest (Lubick 1996; Wild 1987). However, Adamana remained a small community forever linked to the comings and goings of passengers and freight on the Santa Fe.

Reginald likely came West as part of his work as a telegraph operator for the railroads, having no known familial connections in the Southwest. Reginald was

raised in Lenoir County, North Carolina by his parents James and Sallie Bruton, along with his older sister Geneva and younger brother Ashton. His father James worked as a barrister clerk⁷, until his death 1903 which forced the family to move in with Sallie's brother⁸. In 1917, Reginald was living in Washington, D.C., working for Western Union⁹, but by the next year, he was living in Gallup, New Mexico.

Helen was raised in Tama, Iowa by her grandparents John and Barbara Chaloupek, both immigrants from Austria who ran a general store¹⁰. Helen's parents John and Anna J. Kosta were alive, but living in Elko, Nevada, where John worked as a telegraph operator¹¹. Little is known of her upbringing in rural Iowa, but census records indicate she was a high school graduate¹². While Reginald likely came to the Southwest looking for work, Helen may have arrived in Adamana at the invitation of family. Around 1920, her mother (Anna) was the railroad station agent in Adamana^{13,14}. When exactly Anna moved to Adamana is unclear, but it was likely after the death of her

¹WWI Draft Registration Card for Reginald Kittrell Bruton, 1918.

²WWII Draft Registration Card For Reginald Kittrell Bruton.

³Affidavit for Marriage License, Navajo County, Arizona.

⁴Helen Kosta, U.S. Social Security Death Index, 1935–2014.

⁵Arizona County Marriage Records, 1865–1972. Helen E. Kosta.

⁶Local Paragraphs. *The Holbrook News*, June 21, 1916.

⁷1910 United States Federal Census, Lenoir County, North Carolina.

⁸1910 United States Federal Census, Carteret County, North Carolina.

⁹WWI Draft Registration Card for Reginald Kittrell Bruton, 1918.

¹⁰1910 United States Federal Census, Tama County, Iowa.

¹¹1910 United States Federal Census, Elko County, Nevada.

¹²1940 United States Federal Census, Los Angeles County, California.

¹³Local Notes from Adamana. *The Holbrook News*, May 6, 1921.

¹⁴1920 United States Federal Census Records, Apache County, Arizona.

husband in 1918^{15,16}. Anna was an active member of her community, being registered to vote in 1920 as a Democrat¹⁷ and being noted for owning a Dodge automobile, which she frequently drove into Holbrook with her friends¹⁸.

Regardless of what circumstances brought Helen and Reginald together, their child Reginald 'Rex,' Jr. was born on Christmas Day, 1918. Signing the birth certificate as the attending midwife

¹⁵John L. Kosta, Iowa Cemetery Records, 1662–1999.

¹⁶1920 United States Federal Census Records, Apache County, Arizona.

¹⁷Arizona Voter Registrations 1866–1955, A.J. Kosta, 1920.

¹⁸Adamana Notes. *The Holbrook News*, December 3, 1920.

was Lucy (Smith) Shumway, who of note was the first Anglo child born in the community of Snowflake to the south of Adamana¹⁹. Where exactly Rex's birth took place is unknown, but the residence of Helen's mother Anna Kosta seems likely.

At 8:30 PM, Rex died only half an hour after birth. His death certificate states his cause of death as premature birth (Fig. 5). There is no mention of the child's death in the local Holbrook newspaper or records of any type of funeral service that may have been held for baby Rex. At some unknown date, he was buried on the edge of town and a tombstone erected for him.

¹⁹Death Takes Lucy Shumway. *The Arizona Republic*, November 16, 1951.

FILL OUT ALL BLANKS. AGE should be stated EXACTLY. PHYSICIANS should state CAUSE OF DEATH in Plain terms, that it may be properly classified. If any item can not be obtained insert word "unknown." Make every effort possible to secure this information. Incorrect certificates will be returned, for correction.

PLACE OF DEATH		ARIZONA STATE BOARD OF HEALTH	
BUREAU OF VITAL STATISTICS		State Index No. 530	
County <u>Havapo</u>	District	County Registered No.	
Town <u>Adamana</u>	Or City	Local Registrar's No.	
No. _____ St. _____		(If death occurred in a Hospital or Institution, give its NAME instead of street and number.)	
FULL NAME <u>Reginald Bruton Jr.</u>			
PERSONAL AND STATISTICAL PARTICULARS		MEDICAL CERTIFICATE OF DEATH	
SEX <u>Male</u>	Color or Race <u>White</u>	DATE OF DEATH <u>Dec. 25 1918</u>	
	Indian <u>Black</u> Chinese <u>Mexican</u>	(Month) (Day) (Year)	
	SINGLE MARRIED WIDOWED or DIVORCED	I hereby certify, that I attended deceased from <u>birth</u>	
DATE OF BIRTH <u>Dec 25 1918</u>		1918 to <u>Dec 25 1918</u> ; that I last saw him alive	
(Month) (Day) (Year)		on <u>Dec 25 1918</u> , and that death occurred on the date	
AGE _____	If less than 1 day _____	stated above at <u>8:30 P.M.</u> The DISEASE or INJURY causing	
yrs. mos. days hrs. or min.		Death was as follows: <u>Prematurity</u>	
OCCUPATION		(Duration) _____ yrs. mos. days	
(a) Trade, profession or particular kind of work		Was disease contracted in Arizona?	
(b) General nature of industry, business, or establishment in which employed or (employer)		If not, where?	
BIRTHPLACE (State or country) <u>Adamana, Ariz.</u>		CONTRIBUTORY _____	
NAME OF FATHER <u>Reginald H. Bruton</u>		(Duration) _____ yrs. mos. days	
BIRTHPLACE OF FATHER (State or country) <u>U.C.</u>		(Signed) <u>Lucy S. Smith M.D.</u>	
MAIDEN NAME OF MOTHER <u>Helen Kosta</u>		<u>12/26 1918</u> (Address) <u>Holbrook, Ariz.</u>	
BIRTHPLACE OF MOTHER (State or country) <u>Iowa</u>		*In death from VIOLENT CAUSES state (1) MEANS OF INJURY, and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.	
THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE		LENGTH OF RESIDENCE _____	
(Informant) <u>Reginald H. Bruton</u>		At place of death _____ yrs. mos. ds. In Arizona _____ yrs. mos. ds.	
(Address) <u>Adamana, Ariz.</u>		Former or Usual Residence _____	
PLACE OF BURIAL OR REMOVAL	DATE OF BURIAL OR REMOVAL <u>19</u>	Filed _____	
UNDERTAKER	ADDRESS	Filed <u>4/12 1919</u> <u>W.B. Davis</u> Local Registrar	
		Filed <u>4/14 1919</u> <u>Lucy Shumway</u> County Registrar	

FIGURE 5. The original death record for Rex Kittrell Bruton, Jr.

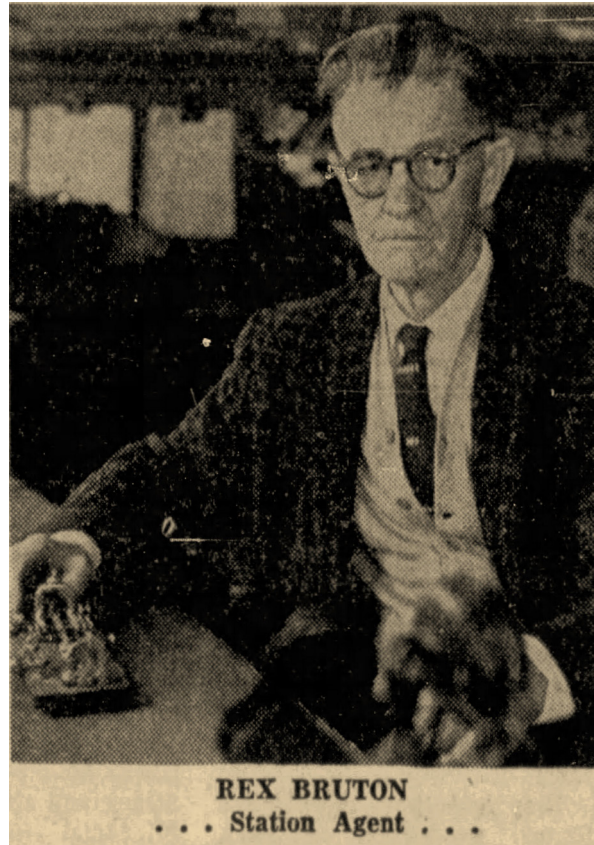


FIGURE 6. Reginald (Rex) Bruton, Sr. later in life working as a telegraph operator in North Carolina.

Undoubtedly the grief experienced by the death of Rex Kittrell, Jr. was only compounded by the fact that it was also Christmas Day and the shared birthday of his father. The family did not linger in Adamana for long, with both Reginald and Helen listed as living with family in Des Moines in 1920²⁰, where a daughter, Barbara Helen Bruton, was born on January 10, 1920²¹. Curiously, Helen is also in the 1920 Census as still living with her mother Anna in Adamana and using her maiden name²². Given Barba-

ra's information the Adamana record is certainly an error. However, on December 24, 1920, Helen is noted in the Holbrook newspaper as visiting family in Adamana²³. Whether she stopped to visit her son's grave is unknown, but this is the last recorded mention of either Reginald or Helen being in Adamana.

Helen and Reginald would have a third child, Robert Ellis Bruton, born in 1922 in North Carolina²⁴. However, sometime in the 1920s, their marriage appears to have ended, although no formal record

²⁰1920 United States Federal Census, Polk County, Iowa.

²¹<https://www.findagrave.com/memorial/68553274/barbara-helen-warren>.

²²1920 United States Federal Census,

Apache County, Arizona.

²³Adamana Notes. *The Holbrook News*, December 24, 1920.

²⁴Record of Vital Statistics, Rowan County, North Carolina, page 98.

of divorce or separation can be found. Reginald remarried in 1931 to Agnes A. Watkinson in Manhattan, New York²⁵. He continued working for the railroads in Ohio²⁶, and was even pictured in a Raleigh, North Carolina newspaper in 1958 for his work as a ticket clerk-operator for the Seaboard Rail System²⁷ (Fig. 6). Reginald died on November 17, 1968, in Beaufort, North Carolina from a heart attack²⁸.

Helen, meanwhile, moved to California. Her mother, Anna, had departed Adamana in May 1921²⁹ and it appears Helen likely followed her there. In 1930, Helen was renting a room in Los Angeles and working as a waitress at a café³⁰. At this point, she still retained her married name of Bruton, but is curiously listed as being widowed, despite Reginald being alive in New York. This discrepancy suggests a difficult and fraught end to Helen and Reginald's marriage. The 1930 census also shows Robert and Barbara living in Los Angeles, but with a couple listed as "grandparents"³¹. By 1940, Helen was still living in Los Angeles, but she now bore the surname Sullivan and is listed as divorced³². Who Helen's departed

husband was is unknown, but that marriage produced another daughter, Saralicia, aged 7. Completing their household was Robert, who had rejoined his mother sometime between 1930 and 1940³³. Robert later served in World War Two as a crew member on a torpedo bomber and was killed in 1944 fighting in the Pacific³⁴. Having now lost two sons, Helen continued to live in southern California with her daughter Saralicia. In 1950, they were joined again by Anna³⁵. Helen died on September 27, 1979, in Orange County, California³⁶. Anna passed in 1969 in Los Angeles³⁷. Barbara died in Utah in 2009, and Saralicia passed away in 2017 in Lancaster, California³⁸. Interestingly throughout her life Helen had four children, and nearly 100 years separated the deaths of the first born and the youngest.

RESTORING THE REX KITTRELL BRUTON, JR. GRAVESITE

Rex's only mentions in the historic record are his death and birth certificate. For over a century, his grave stood largely forgotten. No other graves were added, and the area was mostly used for livestock grazing. At some point, a simple enclosure was put up around the grave, likely to protect it from damage

Angeles County, California.

³³1940 United States Federal Census, Los Angeles County, California.

³⁴United States Combat Navy Casualties, World War II, 1946, Volume 1.

³⁵1950 United States Federal Census, Los Angeles County, California.

³⁶Helen V. Sullivan, California U.S. Death Index 1940–1997.

³⁷Anna J. Kosta, California Death Index, 1940–1997.

³⁸<https://www.findagrave.com/memorial/175871599/saralicia-agnes-kessler>.

²⁵New York, New York Extracted Marriage Index 1866–1937, Certificate Number 26885.

²⁶WWII Draft Registration Card for Rex Kittrell Bruton

²⁷Mainline Rail Service Hurries Mail to North-south Points from Sanford. *The News and Observer*, March 23, 1958. Morning edition.

²⁸North Carolina State Board of Health Certificate of Death, Rex Kittrell Bruton.

²⁹Local Notes from Adamana, *The Holbrook News*, May 6, 1921.

³⁰1930 United States Federal Census, Los Angeles County, California.

³¹1930 United States Federal Census, Los Angeles County, California.

³²1940 United States Federal Census, Los



FIGURE 7. Park staff cleaning the headstone and repairing the plinth for the Rex Kittrell Bruton, Jr. gravesite (photo by Jonathan Hardes/NPS).

from cows and horses. Whether this was done before or after someone took a shot at Rex's headstone is unknown. The rediscovery of Rex's gravesite presented an opportunity for the park's resource staff to conduct a historic preservation project for a unique remnant of Adamana's history and ultimately restore some sense of dignity for a child that time had otherwise all but forgotten.

On November 28, 2022, park archaeology and museum staff conducted basic restoration of the Bruton gravesite. The headstone was thoroughly cleaned with water and soft, stiff-bristled brushes to remove a thick layer of adhered dirt (Fig. 7). The headstone was then reset on its base using copper support rods and a modern, weather-resistant adhe-

sive. This adhesive was applied in areas not visible with the headstone back in its original position (Fig. 8). The installation of the improved boundary fence in 2021 will help ensure no livestock enter the park and pose a potential threat to the gravesite. There are certain aspects of Rex and his families lives that remain a mystery and should be pursued by further archival research. In particular, it is unknown why Rex was buried in Adamana instead of in the main cemetery in nearby Holbrook as was common at the time.

James Deetz (1977) espoused the power of the "small things forgotten" for enriching our understanding of the human experience. Rex Kittrell Bruton, Jr.'s life was brief and his only trace on



FIGURE 8. The fully restored grave of Rex Kittrell Bruton, Jr. (photo by Jonathan Harges/NPS).

this world is a shot-up, broken tombstone. For archaeologists, though, it is through such small forgotten things that history may be best humanized. Through the rediscovery of this forgotten gravesite, park staff are able to write a more holistic and grounded narrative of life in Adamana. Rather than grand narratives of history, it is through the lives of individual families and moments of everyday life that the past is most tangibly realized. The restoration of Rex's grave not only ensures his continued remembrance, but also preserves a unique feature of the diverse cultural landscape of Petrified Forest National Park.

ACKNOWLEDGEMENTS

Thank you to the Petrified Forest Science and Resource Management staff for assisting with this project and to the Facility Management staff who reported the gravesite. Thank you to editors William Parker and Jonathan Harges, reviewer Emily Dale, and an anonymous reviewer for comments that improved the manuscript.

REFERENCES

- Deetz, J. 1996. *In Small Things Forgotten: An Archaeology of Early American Life*. Anchor Books/Doubleday, New York

Lubick G. M. 1996. *Petrified Forest National Park: A Wilderness Bound in Time*. The University of Arizona Press, Tucson.

Wild, P. 1987. Months of sorrow and renewal: John Muir in Arizona, 1905-1906. *Journal of the Southwest* 29(1): 20-40.

Recieved 8 January 2025; Accepted 22 May 2025

THE BIRDS OF PETRIFIED FOREST NATIONAL PARK ROCK IMAGERY

JONATHAN G. HARDES¹ and STEVEN D. BLYTHE²

¹Department of Science and Resource Management, Petrified Forest National Park, Petrified Forest, AZ 86028, U.S.A., jonathan_hardes@nps.gov; ²3916 North Potsdam Avenue, PMB 2797, Sioux Falls, SD 57104, U.S.A.

ABSTRACT — Petrified Forest National Park is a unit of the National Park Service in northeastern Arizona encompassing an impressive array of natural and cultural resources. Among the more notable of these resources is the Park's expansive archaeological record, a record that includes thousands of precontact rock imagery (i.e., rock art) motifs. Here we describe a sample of these motifs, focusing specifically on those glyphs depicting birds and evidence of birds. Included are discussions of how these images may correlate with the Park's current permanent, seasonal, and migrant bird species, along with those whose physical remains have been identified from archaeological faunal assemblages found in the Park and neighboring contemporary sites of the Little Colorado River Basin.

Keywords: birds; Little Colorado River; Ancestral Puebloan; rock imagery; zooarchaeology.

INTRODUCTION

If one is to assume the creation of rock imagery motifs was largely informed by firsthand observations made by the makers of the images, then birds appear to have been rather significant in the lives of Ancestral Puebloan peoples in what is now Petrified Forest National Park and the surrounding area. This is reinforced by the variety of bird species identified in the Park's zooarchaeological assemblages, along with those recovered from neighbouring areas of the Little Colorado River Basin (Diaz de Valdes and E. C. Adams, 2016; Gillespie, 1990; Hardes, 2024; Lange, 2020; Olsen and Wheeler, 1978; Strand and McKim, 1996; Szuter, 1991; Waters, 1993) (Fig. 1). Some birds were obtained for food, but many, if not most, were sought out for their feathers to be used in garments, blankets, and ceremonial objects, including prayer sticks (Tyler, 1979). The bones of larger species like eagles and cranes also provided the raw material necessary for the manufac-

ture of a variety of items, including tubular beads, whistles, and containers to house small items such as needles (Hardes, 2024; McKusick, 2001; Serjeantson, 2006). Here we provide an initial inventory and basic description of bird and bird-like petroglyphs from the Park, with the primary intent of contributing important baseline data to the archaeological literature of the region. While beyond the scope of this current report, it is our hope that future research focused on both ethnographic and current Tribal interpretations and classifications of these motifs, will find this data to be valuable.

This study intentionally replaces the term rock 'art' with rock 'imagery'. In no way is this shift in terminology driven by a lack of recognition of the great skill or artistry that surely went into creating many of these images, nor the symbolic importance of birds to the people who recreated them on stone, but rather a pointed attempt to remove unintended bias from our labels and subsequent interpretations. Despite what some may

believe, archaeologists do not possess knowledge of why petroglyphs were created, what the originators had in mind when creating them or what their overall purpose(s) may have been. Even with the ability to draw inferences from significant ethnographic studies, archaeologists do not know with any degree of certainty which motifs, if any, should be considered art or religious symbology, versus something more secular and simply observational in nature.

At the time of this synthesis, and with less than one quarter of the Park having been formally inventoried for archaeological resources, 87 sites include portrayals of birds on 350 individual rock imagery panels. A total of 935 individual petroglyph motifs representing birds or bird-like forms have been documented within the Park to date. As a regional, and largely contemporary point of reference, the Chaco Rock Art Reassessment Project taking place at Chaco Culture National Historical Park, some 180 km northeast of the study area, reports a total of 133 motifs as birds (Kolber, 2021: 58).

A number of researchers have written about the rock imagery of the Petrified Forest over the years (Bertsch, 1983; Bock, 1988; Burton, 2006; Dorn, et al., 1993; Groom, et al., 2019; Martynec, 1982; McCreery and Malotki, 1994). Thus far, however, none have examined these resources through a natural history or biological lens, comparing them to current observations, known extant species, while also addressing their potential correlation to skeletal evidence found in the area's zooarchaeological record.

ENVIRONMENTAL SETTING

Petrified Forest National Park is situated in northeastern Arizona, near the

southern end of the Colorado Plateau. Largely characterized by semi-arid short-grass prairie, mesas and badlands, the area ranges in elevation between 1,600 m and 1,900 m (approximately 5,250 ft to 6,230 ft) above sea level. The Puerco River, an intermittent but substantial tributary of the Little Colorado River (itself a tributary of the Colorado River), flows through the Park from east to west. Many braided washes join the Puerco in and around the Park, defining much of its dry, monsoon-reliant drainage basin. This low-discharge river (averaging less than 70 ft³/sec.) originates along the Continental Divide in northwestern New Mexico before winding west into Arizona and ultimately joining the Little Colorado River slightly east of the town of Holbrook. In addition to intermittent waterways, a limited number of seeps and springs are known to occur on the Park landscape, providing local species and those passing through the area, access to precious freshwater. These areas, though largely ephemeral, provide essential refuge, nesting habitat, feeding grounds, and natural travel corridors for bird life.

The Petrified Forest area is generally considered to lie within the eastern margins of the Pacific Flyway, one of the four major North American migration routes for birds. The Pacific Flyway extends from arctic Alaska in the north to the Patagonian region of Chile and Argentina in the south, west to the Pacific coast and east into Arizona, Utah, Idaho, and Montana. Even with steeply declining numbers in many species of migratory birds, an estimated billion or more make this north-south journey annually (Olson, 2022). Their migratory timing is often predictable to a degree in which many locals know to the day when a species will likely show up in their area along the route. So, while semi-arid and

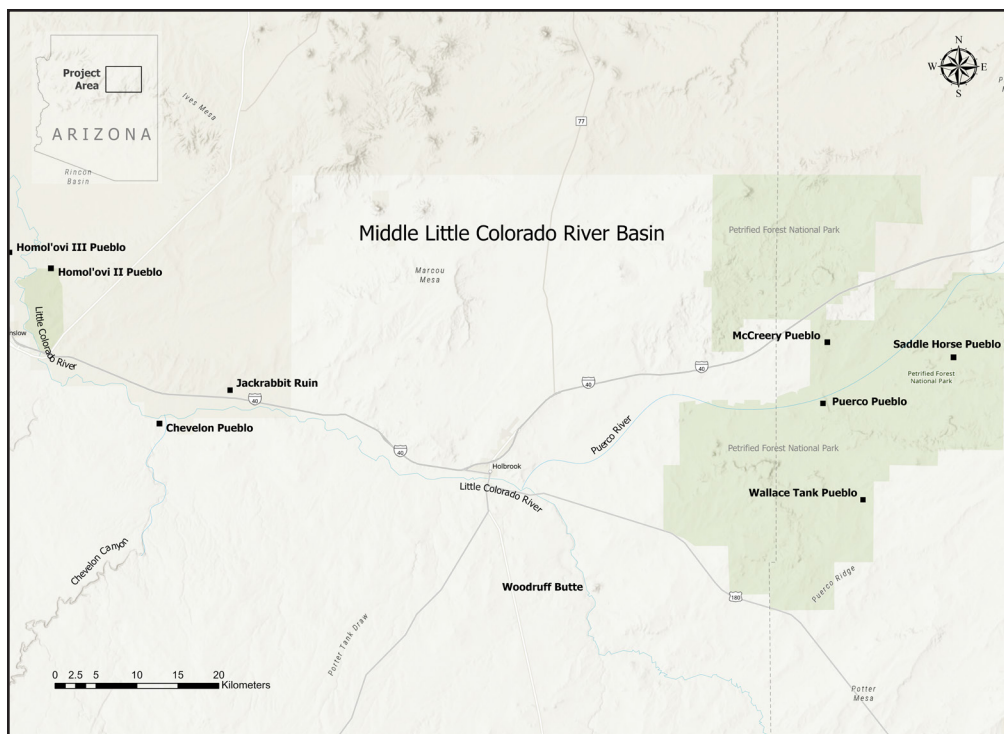


FIGURE 1. Select Ancestral Puebloan sites of Petrified Forest National Park and the greater Middle Little Colorado River Basin.

largely treeless, the study area experiences a notable influx of seasonal migrants. This was likely the case historically as well, particularly when the Puerco River flowed with more regularity and local playas remained full for longer periods of time.

METHODS

Avian motifs in the Park's rock imagery, while abundant, can be challenging to identify simply as birds, and often impossible to classify taxonomically. Many bird motifs are abstract or highly stylized, some are anthropomorphized, while others are missing legs, feet, heads, or other anatomical features. Missing features may be due to the maker's preference when creating the motif and/or a result of environmental factors, including ero-

sion and spalling and/or human-induced decay (Dorn, 2006; Groom et al., 2019). These factors significantly increase the difficulty of categorizing them to any substantial degree. The rock imagery motifs described here are grouped into broad classes, such as 'birds of prey' and 'shorebirds/wading birds,' but whenever possible conservatively assigned to family or genera. Only rock imagery motifs possessing multiple shared visual traits were assigned to groups as specific as 'macaw' or 'hummingbird.' To be classified as a 'bird' petroglyph, the individual motif must possess the following bird-like characters: they are bipedal, or walk on two legs, and are therefore represented as standing on two legs rather than the four legs seen in most mammal designs (Noble and Lynch, 1993). Sometimes feet are depicted at the end of the legs but not always. When feet are present, such

as in a number of the parrot, shorebird/wading bird and turkey motifs (Figs. 2, 3, & 6), they often reveal birds' digitigrade-style of walking, meaning when not in flight they move about on their toes (Noble and Lynch, 1993). There must be a representation of a tail, which in modern birds is composed almost entirely of feathers. This element may consist of one or more linear projections intended to portray feathers. In the case of at least one glyph, the tail appears to be represented by a knob-like element rather than linear projections (Fig. 3F). Perhaps the most important element in the identification of bird glyphs is the presence of a beak. Beaks can be long and slender, straight or highly curved and hook-like, and always without teeth. This is in stark contrast to the toothy depictions of katsina motifs found throughout the park's rock imagery. In the case of one hummingbird motif, there also appears to be a tongue protruding from the beak (Fig. 4). Despite their important evolutionary specialization for flight, other than those included in anthropomorphic bird motifs, depictions of their forelimbs, or wings, are very rare in this sample (Noble and Lynch, 1993). Representations of the main body are highly variable and not as diagnostic as the aforementioned elements.

The Park's rock imagery (almost entirely made up of petroglyphs rather than pictographs), has been recorded using a variety of tools, including standardized Park rock imagery-specific recording forms, global positioning system technology, high-resolution digital photography, timelapse photography and video (particularly with solar markers), and hand-drawn sketches. Though researchers and rock imagery enthusiasts have admired and studied the Petrified Forest National Park's rock imagery for well

over 100 years, the past several years have witnessed a marked uptick in the thorough recordation of this archaeological feature type within the Park's administrative boundary. It is important to reiterate that the use of the term rock "imagery" in this study instead of rock "art" is aimed at removing unintended bias from our language, and in no way a lack of recognition of the great skill or artistry involved in the creation of these enduring designs.

CLASSIFICATIONS

Parrots (macaws)

Despite not being local, native species to the Petrified Forest National Park area, parrots are the most common bird portrayed in the Park's rock imagery, and arguably the easiest to identify. Their relative abundance in the area's rock imagery may in fact be directly attributed to a noteworthiness in having seen firsthand one of these large and striking birds far from their native environment. With their distinctly long tails (usually depicted as one or two straight projections), measuring at least as long and often longer than the main part of the rounded or 'pot-bellied' body and a robust, curved beak, or a neck and head represented by a simple line ending in a candy cane-like hook (Figs. 2A, 2B, and 2I), they stand out from many other bird motifs portrayed in the area's rock imagery. Unlike what is reported from Chaco Canyon rock imagery (Kolber, 2021), Petrified Forest macaws are usually depicted as singular, stand-alone birds rather than in pairs, with one known exception (Fig. 2B).

The presence of parrot remains, specifically those belonging to Scarlet macaws (*Ara macao*), and to a lesser degree, Military macaws (*Ara militaris*)

and Thick-billed parrots (*Rhynchopsitta pachyrhynchos*), in the archaeological record of the Ancestral Pueblo region dates to 900–1,000 CE, and several hundred years earlier in the Hohokam area south of the Park (Hargrave, 1970; Whiteley, 2022:29). Though relatively common in the Park’s rock imagery (currently two dozen motifs are interpreted as macaws), and known from local precontact ceramic designs, skeletal remains of parrots have yet to be identified from Petrified Forest National Park archaeological faunal assemblages. Their absence from local zooarchaeological assemblages to this point is likely due to several factors, including limited prior excavations/sampling; prioritization of the collection and analysis of other kinds of archaeological items over faunal remains; a lack of available faunal identification proficien-

cy; possible misidentifications, among others. Images of parrots may attest to their former presence in the middle Little Colorado River drainage despite their physical remains not having yet been identified in any of the Ancestral Puebloan assemblages of the area.

Shorebirds/Wading Birds

Rock imagery depictions of shorebirds and wading birds in the Park are second in abundance only to macaws, with at least 10 petroglyph motifs conservatively fitting this category. With their long beaks, short tails in comparison to overall body size (or no tail at all), and long legs, frequently shown with prominent knobby joints, birds grouped in this class tend to be conspicuous compared to many other bird representations (Fig. 3). Wading bird motifs are sometimes also portrayed with

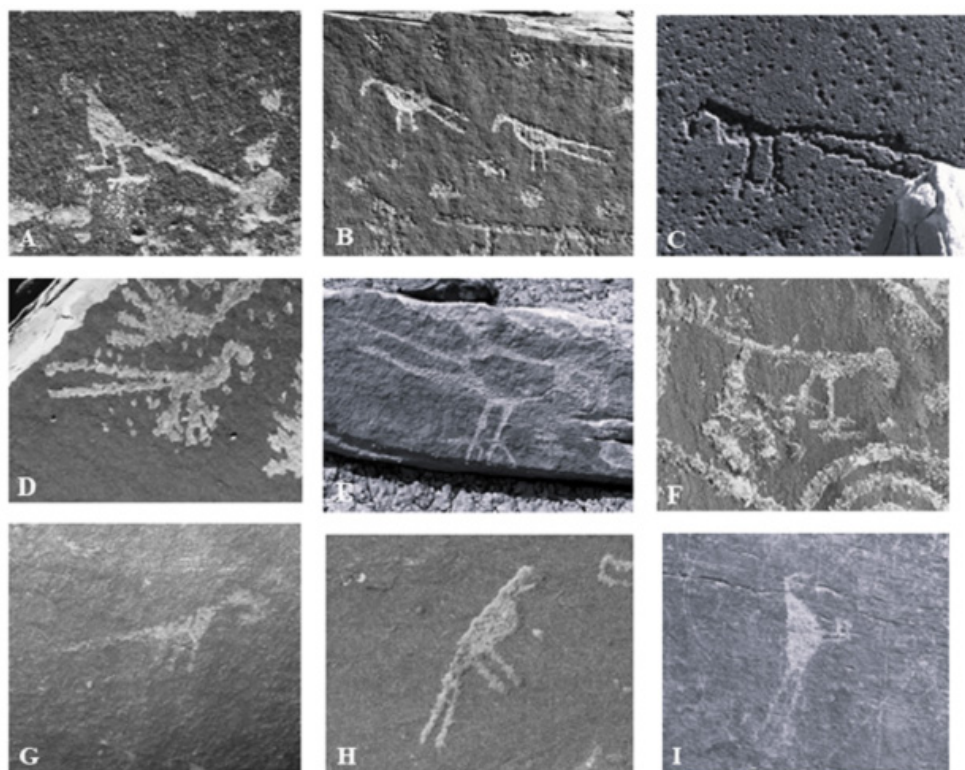


FIGURE 2. A sample of the two dozen macaw petroglyphs currently known from Petrified Forest National Park (photos by Steven Blythe/NPS)

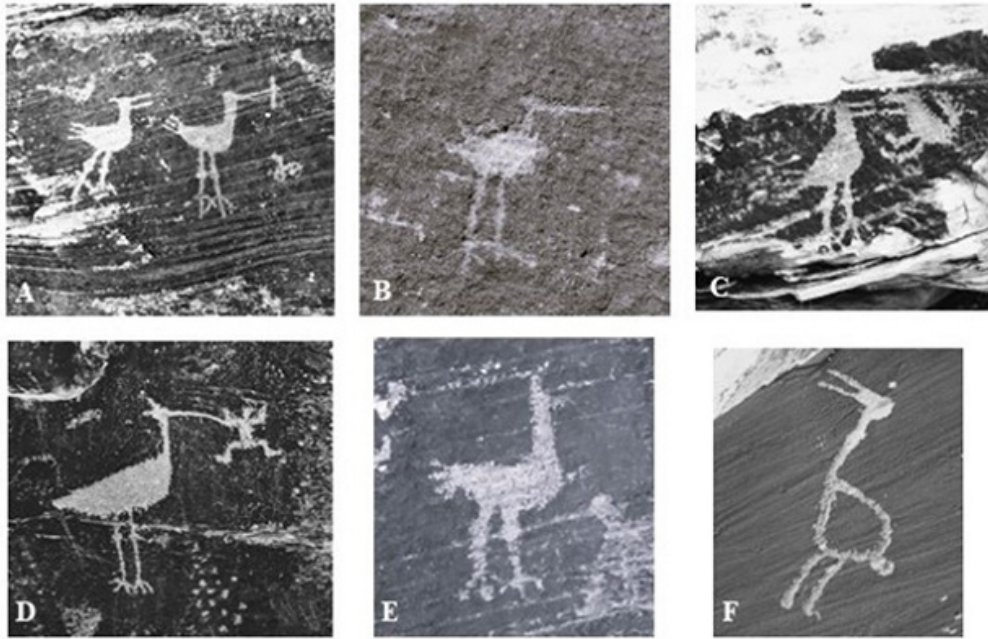


FIGURE 3. Shorebird and/or wading bird petroglyph motifs from Petrified Forest National Park (photos by Steven Blythe/NPS).

an object or prey item grasped in their beak (Figs. 3A & 3D).

Wading and shorebird species known to seasonally inhabit or migrate through the Park, include but are not limited to: White-faced ibis (*Plegadis chihi*), American avocet (*Recurvirostra americana*), Long-billed curlew (*Numenius americanus*), Virginia rail (*Rallus limicola*), Sora (*Porzana carolina*), American coot (*Fulica americana*), and a host of herons, egrets, plovers and sandpipers (Bridges, 2018). Of note, a pair of American avocets were observed successfully nesting and rearing a chick at a small, highly ephemeral playa near the south end of the Park in 2023. This was no small feat in an exceedingly arid environment nearly devoid of year-round surficial freshwater.

Though not included in the list of current avian residents or seasonal migrants, skeletal remains of Sandhill crane (*Grus canadensis*) are known from three of the Park's Ancestral Puebloan sites, reveal-

ing their presence in the area historically (Gillespie, 1990; Harges, 2024). It is important to note that bones of Sandhill crane and turkey, particularly when found in a fragmentary state, can be mistaken for one another. Hargrave and Emslie (1979) recognized the potential for this confusion and created a brief comparative osteology aid to assist with distinguishing the two species. Their publication, in conjunction with comparison to known osteological reference specimens, was employed to ensure accurate identification of the crane remains discussed here. The small tail-like knob depicted on the bird in Figure 3F may be a rendering of a feature seen in living Sandhill cranes, known as a 'bustle,' in which their slight tail is covered by drooping feathers. The long downturned bill depicted on the bird in Figure 3D is suggestive of a Whimbrel, White-faced ibis or perhaps a Long-billed curlew, with the ibis perhaps being the most likely to

have been present in the immediate area. In September 2024, Hardes observed firsthand a group of a dozen White-faced ibis and two dozen Cinnamon teal congregated in the Puerco River, only a few hundred meters from the glyph shown in Figure 3D. It is worth noting that the day before this observation was made the river had been completely dry.

In regard to the remains of large-bodied water birds identified in Ancestral Puebloan assemblages of the surrounding area, Diaz de Valdes and Adams (2016) identified both Great blue heron (*Ardea herodias*) and Green heron (*Butorides vivescens*) remains from Chevelon Pueblo, a late Ancestral Puebloan site located at the mouth Chevelon Canyon where a creek of the same name joins the Little Colorado River. The site, a component of the Homol'ovi cluster of seven villages, is located some 65 km west of Petrified Forest (Fig. 1). Its position near the confluence of perennial Chevelon Creek and the Little Colorado River likely accounts for the diversity of water birds identified from the site. Additionally, Szuter (1991) identified at least one Pelican from the faunal assemblage recovered from Homol'ovi II, another late Ancestral Puebloan settlement located along the Little Colorado River approximately 70 km west of Petrified Forest. Though conservatively identified as *Pelecanus* sp., given the location, the remains almost certainly belong to *Pelecanus erythrorhynchos*, the American white pelican, a relatively common species in the Interior West, particularly in grassland environments with freshwater nearby.

Hummingbirds

Six species of hummingbirds, including Allen's (*Selasphorus sasin*), Anna's (*Calypte anna*), Black-chinned (*Archilochus alexandri*), Broad-tailed (*Selaspho-*

rus platycercus), Calliope (*Selasphorus calliope*) and Rufous (*Selasphorus rufus*), occur as seasonal visitors to the Park (Bridges, 2018). At least three rock imagery depictions of what are thought to be hummingbirds are currently known (Fig. 4). Of some interest, is the high degree of stylistic variability between the individual motifs in this category. Not surprisingly, considering their diminutive size and low likelihood of preservation, no skeletal remains of hummingbirds are currently known from archaeological sites in the Park.

Ducks/Geese

While others may fit this category, only two petroglyph motifs were confidently grouped as ducks or geese (Fig. 5). These motifs are characterized by 'filled-in' bodies with smooth curving edges, superficially similar to the bird portions of the bird-headed anthropomorphs known from the region during the Basketmaker III era (Cole, 2009; Schaafsma and Young, 2007) and shown in Figure 10D (McCreery and Malotki, 1994).

More than a dozen types of ducks, including the American wigeon (*Mareca americana*), Ruddy duck (*Oxyura jamaicensis*), Northern pintail (*Anas acuta*), and Mallard (*Anas platyrhynchos*), three species of grebe, and two kinds of geese are known to migrate through the area today (Bridges, 2018). However, to date, the skeletal remains of just a single individual duck-like species, a Pied-billed grebe (*Podilymbus podiceps*), are known from Petrified Forest zooarchaeological assemblages (Gillespie, 1990; Hardes, 2024). To the west, at Homol'ovi II, Szuter (1991) also identified the remains of American coot (*Fulica americana*) and Canada goose (*Branta canadensis*). In archaeological deposits from Chevelon Pueblo, Diaz de Valdes and Adams

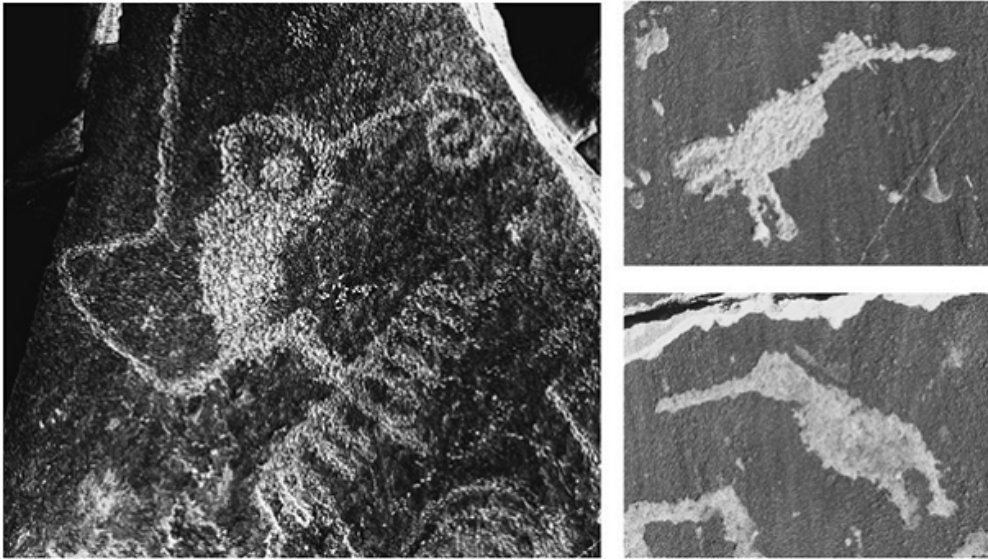


FIGURE 4. Hummingbird and potential hummingbird depictions in the rock imagery of Petrified Forest National Park (photos by Steven Blythe and Jonathan Harges/NPS)

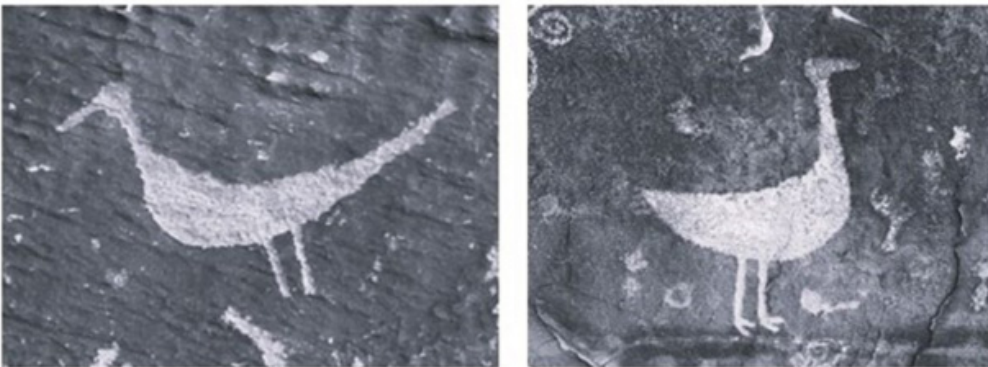


FIGURE 5. Petroglyphs from the study area likely depicting waterfowl (photos/NPS).

(2016) report a host of waterfowl species, including at least four species of ducks, American coot, and Sandpipers or Plovers.

Turkeys

Turkeys (*Meleagris gallopavo*) and macaws can be difficult to distinguish from one another in petroglyph form, despite bearing little resemblance to one another in life. McCreery and Malotki (2004:80) point this out in their popular Tapamveni volume. The Turkey's snood (a long fleshy flap that grows from the forehead and hangs over the beak of male turkeys),

depicted in rock imagery (Figure 6), can be easily mistaken for the large, curved bill of a macaw, and vice versa. Turkeys in the Park's rock imagery are generally identified by longer legs and a shorter tail, though these details are rarely consistent. Though no longer observed in Petrified Forest National Park, the archaeological record shows us that turkeys were once part of the local avifauna (Harges, 2024; Waters, 1993).

Petroglyph depictions of turkeys in the Petrified Forest area may come from observations of wild birds, domestic varieties, or both. And while their skeletal re-

mains are known from at least three sites in the Park, based on their work at Homol'ovi III, Senior and Pierce (1989:249) feel evidence for the bird's domestication does not come simply from the identification of osteological specimens, but more from detecting the presence of their eggshells, immature individuals, healed bone fractures, and turkey pen-like features (Hardes, 2024; Waters, 1993).

Roadrunners

The Greater roadrunner (*Geococcyx californianus*) is locally common in the Park and known to currently breed there, with regular sightings around the Park headquarters area (Bridges, 2018). Fossils of the species dating from the Holocene and Pleistocene are known from Arizona, strongly suggesting the roadrunner's presence throughout the time of known human occupation of the area (Larson, 1930). Petroglyphs representing roadrunners are generally identified by their long, erect tails, body positioning (creating a shallow V-shape from their

neck and back to their tail), and overall head and beak configuration (Fig. 7). Additional motifs may fit this classification, however, only two were identified with enough confidence to be included here (Fig. 7). To date, no roadrunner skeletal remains have been identified from the Park's archaeological faunal assemblages.

Birds of Prey

At least 19 species of birds of prey, including eagles, hawks, falcons, owls, and vultures are known to currently inhabit the Park for at least part of the year. Several of these species are also known from the zooarchaeological record, with identifications of Golden eagle (*Aquila chrysaetos*), Red-tailed hawk (*Buteo jamaicensis*), Prairie falcon (*Falco mexicanus*), Burrowing owl (*Athen cunicularia*) and Turkey vulture (*Cathartes aura*) having been made from the Park's Ancestral Puebloan faunal assemblages (Gillespie, 1990; Hardes, 2024; Waters, 1993). Though often overshadowed in

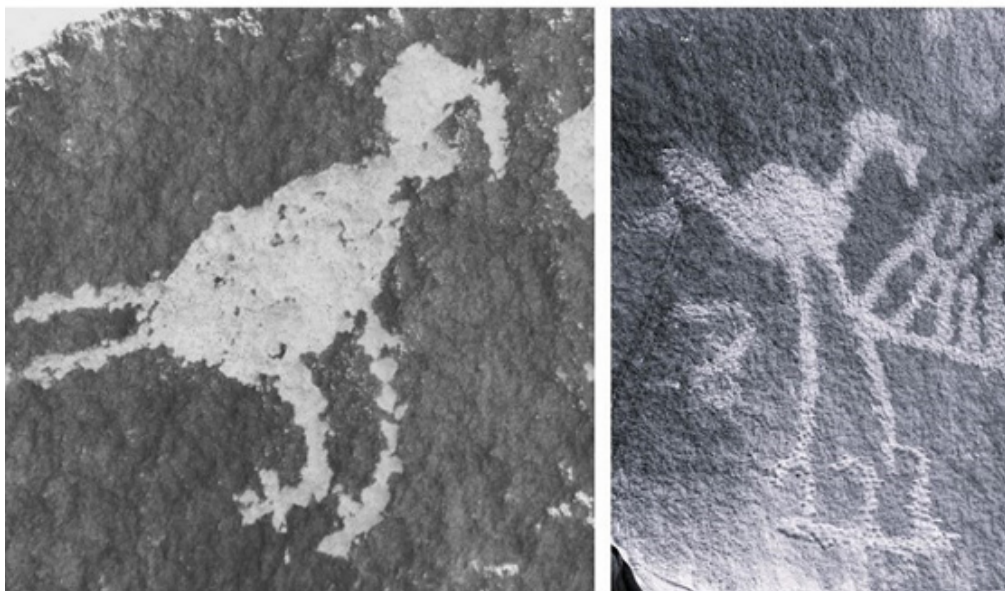


FIGURE 6. Two petroglyph motifs identified as turkeys from Petrified Forest National Park (photos by Steven Blythe and Jonathan Hardes/NPS)

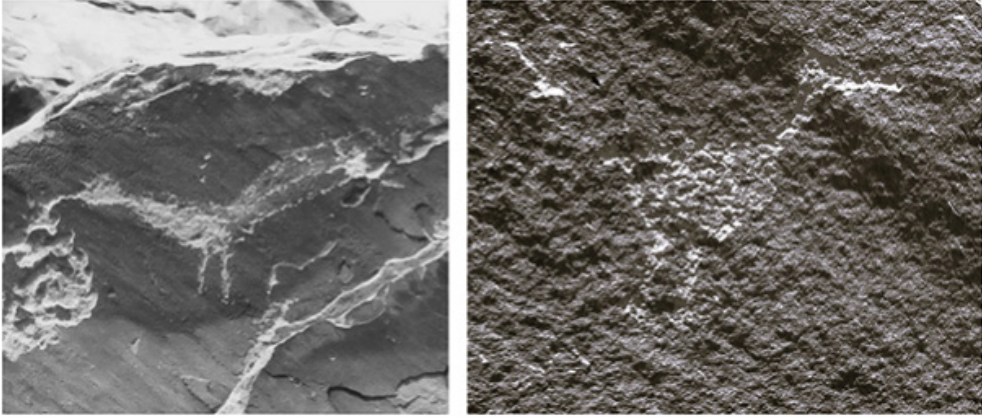


FIGURE 7. Two Petrified Forest petroglyph motifs identified as roadrunners (photos by Steven Blythe/NPS).

archaeological treatments by macaws and turkeys, raptors are relatively common in zooarchaeological assemblages of the American Southwest, sometimes even accounting for a sizeable percentage of the overall identified species, such is the case at Chaco Canyon (Bishop, 2019 and 2021).

Despite their presence in local and regional faunal assemblages, thus far, only a single petroglyph from the Park is attributed to a raptor, in this case, likely an eagle or hawk (Fig. 8). It is worth noting that at least one researcher has argued for this motif to be identified as a macaw, however, the blunt, roundish body, short, fan-like tail featuring three projections, along with a shorter curved beak, suggest otherwise. The motif does not compare favourably to positively identified macaw motifs known from the Park (Fig. 2). In addition, the bird is perched atop a terraced structure of sorts. This type of motif is often interpreted as a stylized cloud or cloud terrace and bear resemblance to Hopi tablita or dance headdresses (Berrier and Willis, 2021; Schaafsma, 1980). It is possible the design may also represent a mesa or pueblo structure, either of which would be appropriate for depicting

an eagle or hawk tethered atop a domestic dwelling or perhaps in a topographic setting where such a species may have been viewed or even captured.

Passerines

A couple of hundred species of small residential and migratory birds are currently known from the Park, (Bridges, 2018). Common sightings include an array of finches, sparrows, thrashers, thrushes and warblers, among others. To date, no small passerines have been identified from the Park's archaeological assemblages. This is likely due to poor preservation of slight avian bones and historically inadequate sampling strategies, including the use of large gauge sifting screens (or not screening at all), that fail to capture small, fragmentary bones. Currently, only a single petroglyph is confidently assigned to this category (Fig. 9).

The bird depicted in Figure 9 appears to be crested and possess a squared-off tail, both which may be suggestive of a Steller's jay (*Cyanocitta stelleri*), a species that is sporadically present in the Park during migration (Bridges, 2018). Another possible candidate possess-

ing these features is the Phainopepla (*Phainopepla nitens*), an occasional visitor to the park (Bridges, 2018).

Anthropomorphic Birds

Highly stylized part human, part bird characters are widespread in the rock imagery of the American Southwest (McCreery and Malotki, 2004), including those found in Petrified Forest National Park, with at least a dozen of the Park's individual motifs fitting this category. Anthropomorphic motifs can vary widely in design and overall form (Fig. 10). Some possess what appear to be birds atop the heads of basic human forms (Fig. 10D), while others have a human head combined with the stylized body of a bird, including the tail feathers, and pronounced talons of an eagle or hawk (Fig. 10C). A common design seen in anthropomorphs are multiple vertical lines descending from horizontal limbs, likely intended to represent feathers (Fig. 10A, 10B, 10E, and 10F). The figure depicted in Figure 10A appears to be grasping an atlatl or possibly an atlatl dart or arrow.

Unclassified Birds

Due largely to conservative identifications and subsequent grouping, the majority of whole bird motifs were left as unclassified (Fig. 11). These motifs either lack the multiple features necessary to confidently classify them, are simply too abstract or basic in design, or are missing diagnostic features due to weathering or the features having been intentionally left blank by their makers.

Bird Tracks

Bird tracks are quite common in the Park's rock imagery, and ubiquitous in rock imagery throughout much of the American Southwest. They tend to be

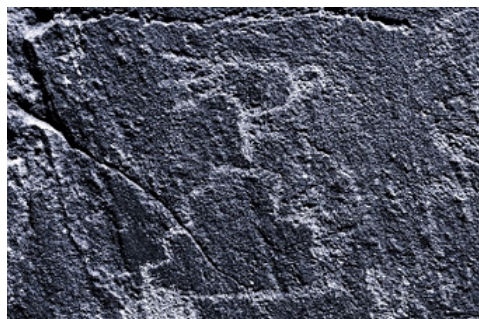


FIGURE 8. A Petrified Forest petroglyph depicting a raptor, likely a Golden eagle or Red-tailed hawk perched atop a terraced structure-like motif (photo by Steven Blythe/NPS)



FIGURE 9. A petroglyph from the study area possibly depicting a Steller's Jay (photo by Steven Blythe/NPS).

generalized in style as seen in Figure 12, and therefore no attempt was made to group them with a particular type of bird. It is important to note that some motifs assigned to the bird track category may also be interpreted by some as representations of stars or some other type of visually similar symbology.

DISCUSSION

About 6% or 60 individual motifs of the total 935 included in this study were grouped into a particular category, leav-

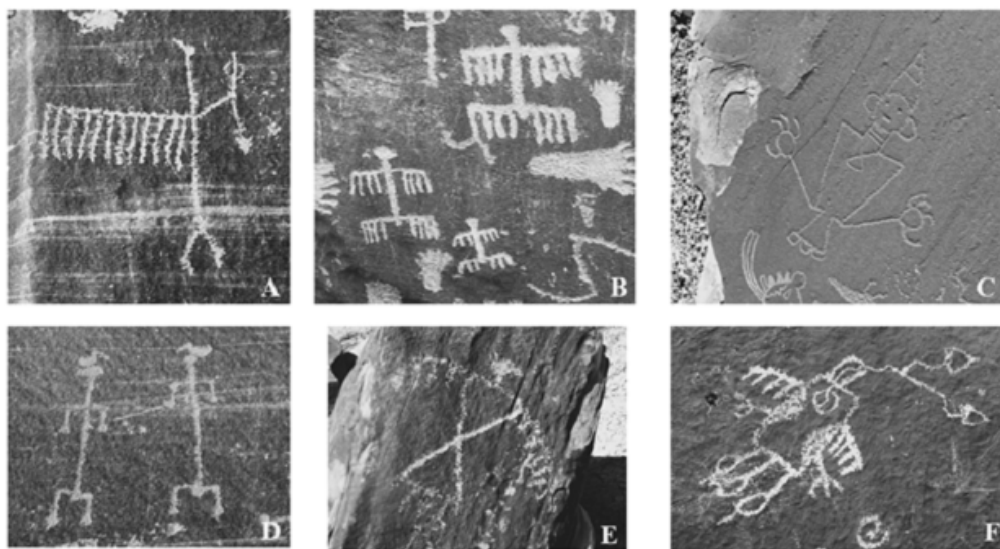


FIGURE 10. A sample of anthropomorphic bird petroglyphs from Petrified Forest National Park (photos by Steven Blythe/NPS and John Pitts, Rock Art Research Association).

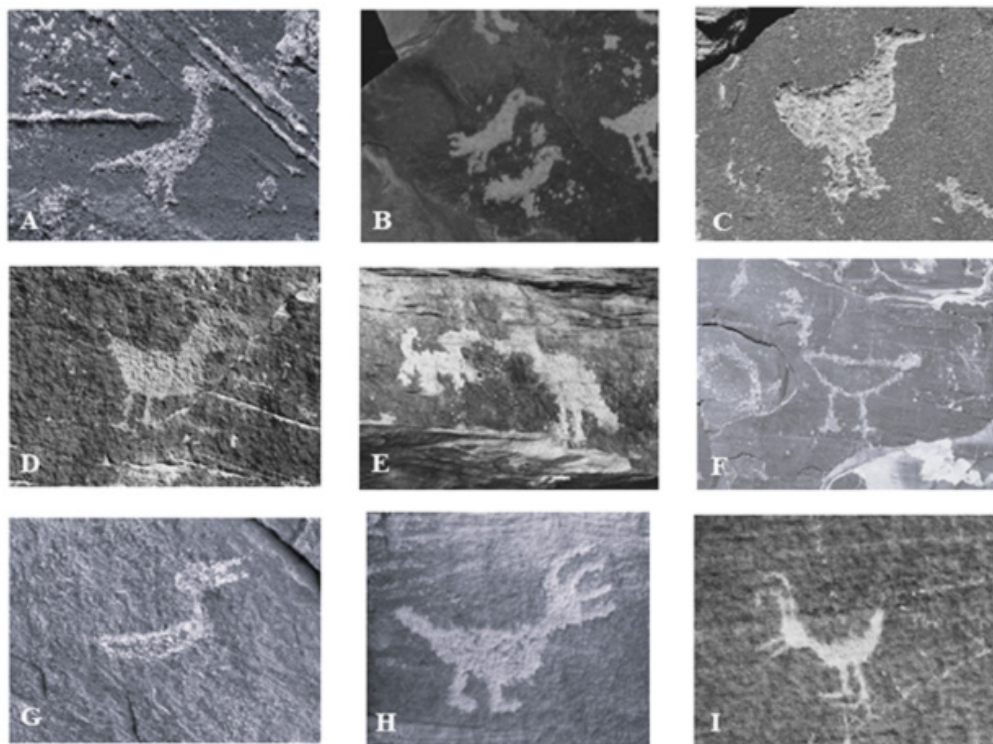


FIGURE 11. A sample of unclassified bird motifs from Petrified Forest rock imagery (photos by Steven Blythe/NPS and John Pitts, Rock Art Research Association).

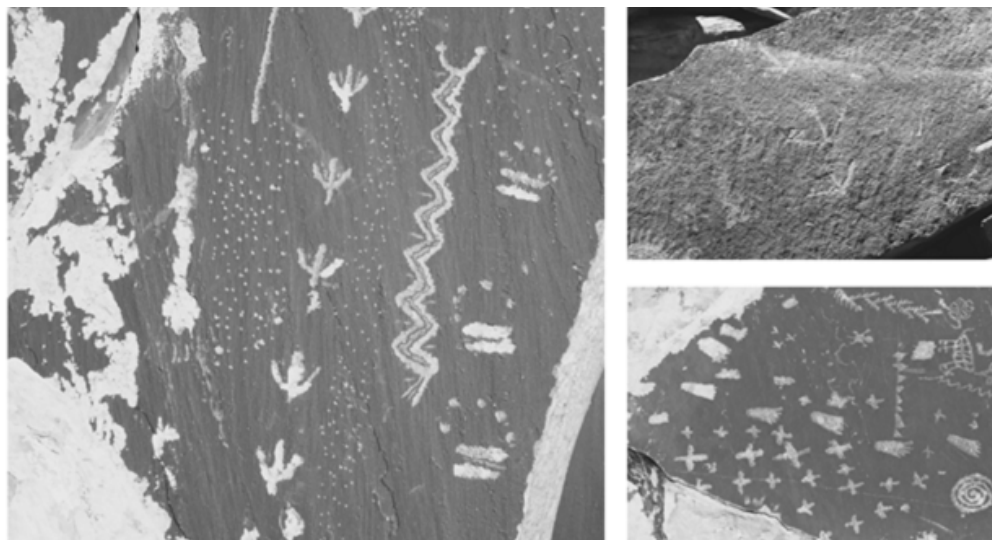


FIGURE 12. A sample of bird track petroglyphs from the study area (photos by Steven Blythe/NPS).

ing 94% that were identified simply as unclassified or tracks (Fig. 13). While macaws make up the most common bird identified from the Park's rock imagery, there has yet to be a single macaw bone recovered from its plentiful Ancestral Puebloan archaeological sites. The inverse appears to be true for birds of prey, with a range of these species known from Ancestral Puebloan assemblages, but only a single rock imagery depiction identified to date. It appears a variety of shorebirds and wading birds are included in the local rock imagery, while only a single species, the Sandhill crane, is currently known from its skeletal remains, though this species' bones are found in at least three of the Park's sites. Turkey remains have also been found in three of the Park's site assemblages and were clearly an important species during the Ancestral Puebloan, yet depictions of this bird are currently identified in just two rock imagery motifs. Ultimately, the current evidence reveals very little correlation between rock imagery depictions of types of birds and the physical remains of those specific birds from Park archaeo-

logical assemblages. Additional rock imagery birds will surely be rediscovered as archaeological inventory of the Park continues. An increased focus on the study of zooarchaeological assemblages in recent years will no doubt also lead to a greater diversity of bird species known from the Park's rich archaeological record.

The central intent of this paper is to begin introducing Petrified Forest National Park's rock imagery to a wider audience through a peer-reviewed report on a portion of these unique types of archaeological remains. Several careers could be spent studying and describing the park's rock imagery in its entirety. More robust studies in the future should incorporate the various systems of classifying birds used by the different Pueblo groups with the Western scientific perspectives used here. These diverse perspectives complement one another and are vital to a more holistic interpretation of these exceptional resources.

ACKNOWLEDGEMENTS

We thank the various Park archaeology staff members who have endured long hours in challenging conditions collecting the data on which much of this study rests. We are grateful to the constructive peer reviews that enhanced this final product. We especially acknowledge the native descendant communities whose ancestors created these lasting works and on whose lands we are fortunate to be able to work and conduct research.

REFERENCES

Berrier, M. and M. D. Willis. 2021. My Head’s in the Clouds: Early Evidence of Tablita Headdresses in Jornada Mogollon Rock Art. In *American Indian Rock Art*, Volume 47, Eds. D. A. Kaiser, M. Greer and J. D. Keyser. American Rock Art Research Association.

Bertsch, H. 1983. Petroglyphs of the Pet-

rified Forest. *Rock Art Papers*, 1, San Diego Museum Papers, San Diego, CA.

Bishop, K. J. 2019. *Ritual Practice, Ceremonial Organization, and the Value and Use of Birds in Prehispanic Chaco Canyon, New Mexico, 800–1150 CE*. Doctoral dissertation, University of California, Los Angeles.

Bishop, K. J. 2021. Birds in Chaco Canyon. *Revisiting Birds in the Southwest. Archaeology Southwest Magazine*, Vol. 35(1 & 2): 9–11

Bock, F. 1988. *Petrified Forest National Park Rock Art Survey Preliminary Report*. Report submitted to the Western Archaeological and Conservation Center, National Park Service, US Department of the Interior.

Bridges, A. E. 2018. *Checklist of 80 Common Birds of Petrified Forest National Park*. Unpublished report on file

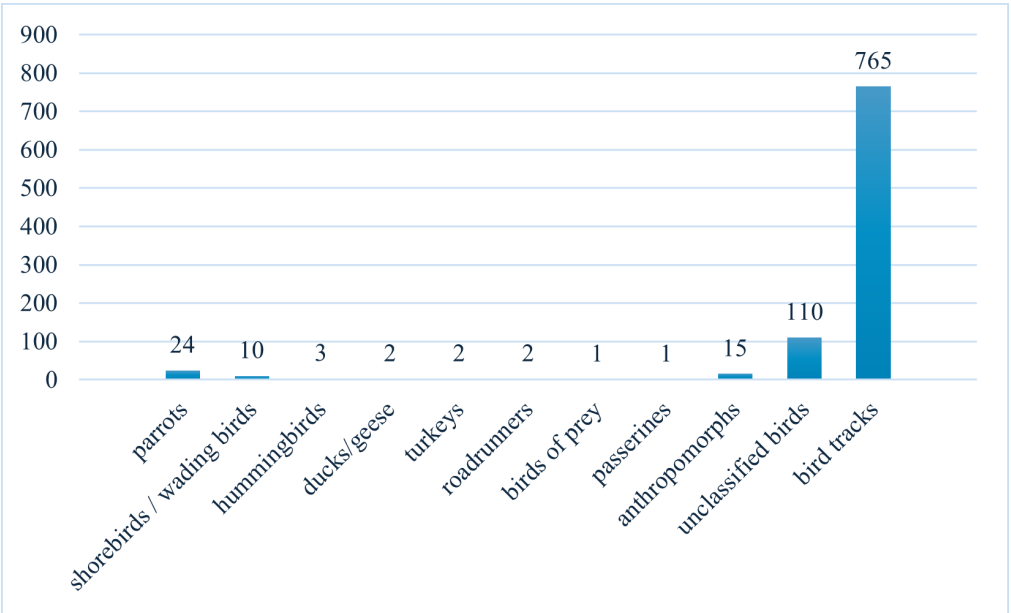


FIGURE 13. Frequency of bird motif types identified in Petrified Forest National Park rock imagery.

- at Petrified Forest National Park, Arizona.
- Burton, J. F. 2006. Late Pueblo iconography in Petrified Forest Rock Art: implications for the origin and development of the kachina cult. 1994 IRAC Proceedings, Rock Art-World Heritage: 261–272.
- Diaz de Valdes, R. and E. C. Adams. 2016. Faunal Remains from Chevelon. Arizona State Museum Archaeological Series 211: 225–250.
- Dorn, R. I. 2006. Petroglyphs in Petrified Forest National Park: role of rock coatings as agents of sustainability and as indicators of antiquity. Museum of Northern Arizona Bulletin 63: 52–63.
- Dorn, R. I., A. Jones, F. Bock and A. J. Bock. 1993. Preliminary data on radiocarbon dating petroglyphs at Petrified Forest National Park, Arizona. American Indian Rock Art 19: 31–39.
- Gillespie, W. B. 1990. Faunal Remains. Western Archeological and Conservation Center Publications in Anthropology 54: 205–230.
- Groom, K. M., N. V. Cervený, C. D. Allen, R. I. Dorn, and J. Theuer. 2019. Protecting stone heritage in the Painted Desert: employing the rock art stability index in the Petrified Forest National Park, Arizona. Heritage 2(3): 2111–2123.
- Harden, J. G. 2024. Pueblo Period archaeofauna of the Petrified Forest: a baseline synthesis. Lithodendron 1: 119–138.
- Hargrave, L. L. and S. D. Emslie. 1979. Osteological identification of Sandhill crane versus Turkey. American Antiquity 44(2): 295–299.
- Hargrave, L. L. 1970. Mexican macaws: comparative osteology and survey of remains from the Southwest. The Anthropological Papers of the University of Arizona 20: 1–67.
- Kolber, J. 2021. Birds in Chaco Canyon Rock Art. Archaeology Southwest Magazine 35(1 & 2): 58–59.
- Lange, R. C. 2020. Faunal remains of Homol’ovi II Pueblo. The Arizona Archaeologist 43: 411–448.
- Larson, M. L. 1930. Osteology of the California road-runner recent and Pleistocene. University of California Publications in Zoology 32(4): 1–112.
- Martynec, R. J. 1982. Archeology of Petrified Forest National Park: a rock art perspective. Western Archeological and Conservation Center, National Park Service, Tucson, Arizona.
- McCreery, P. and E. Malotki. 1994. Tapamveni: Rock Art Galleries of Petrified Forest and Beyond. Petrified Forest Museum Association, Petrified Forest, Arizona
- McKusick, C. R. 2001. Southwest birds of sacrifice. The Arizona Archaeologist 31: 1–208.
- Noble, P. S. and P. J. Lynch. 1993. Manual of ornithology: avian structure and function. Yale University Press, New Haven and London.
- Olsen, S. J. and R. P. Wheeler. 1978. Bones from Awatovi, northeastern Ar-

- izona. Papers of the Peabody Museum of Archaeology and Ethnology 70(2): 1–74.
- Olson, S. M. 2022. Pacific Flyway Data Book, 2022. U. S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Helena, Montana
- Schaafsma, P. 1980. Indian Rock Art of the Southwest. School of American Research, Santa Fe, University of New Mexico Press, Albuquerque.
- Senior, L. M. and L. J. Pierce. 1989. Turkeys and domestication in the Southwest: implications from Homol’ovi III. *Kiva* 54(3): 245–259.
- Serjeantson, D. 2006. Birds. Cambridge Manuals in Archaeology. Cambridge University Press, United Kingdom and New York.
- Strand, J. G. and R. McKim. 1996. Analysis of the Fauna from Homol’ovi II. *Arizona State Museum Archaeological Series* 185: 187–217.
- Szuter, C. R. 1991. Faunal Remains. *Anthropological Papers of the University of Arizona* 55: 103–111.
- Tyler, H. A. 1979. Pueblo Birds and Myths. University of Oklahoma Press, Norman.
- Waters, J. A. 1993. Faunal Remains. *Western Archeological Conservation Center Publications in Anthropology* 63: 73–82. Tucson.
- Whiteley, P. M. 2022. Puebloan parrots paradox. *Amerind Studies in Anthropology*, The University of Arizona Press, Tucson, pp. 29–57.
- Recieved 8 January 2024; Accepted 22 May 2025*

STAGNER'S GEOLOGIC RECONNAISSANCE OF NORTHERN ARIZONA, OCTOBER 14–22, 1940

WILLIAM G. PARKER¹ and JEFFREY W. MARTZ²

¹Department of Science and Resource Management, Petrified Forest National Park, Petrified Forest, AZ 86028, U.S.A., william_parker@nps.gov; ²The Museum of Texas Tech University, Lubbock, TX 79409, U.S.A.

ABSTRACT — In October of 1940 Petrified Forest National Monument Naturalist Howard Ralph Stagner conducted a weeklong geological reconnaissance trip looking at outcrops of the Chinle Formation throughout northern Arizona. During this trip he was surprised to find that a facies in the monument where fossil leaves had first been discovered was prevalent throughout these other exposures. He also noted that they also preserved leaf fossils and were in roughly the same stratigraphic position, in lower Chinle Formation strata assigned to the top of 'Division D,' equivalent to the Monitor Butte Member, Bluewater Creek Member, Cameron Member, and lower Blue Mesa Member in current usage. Stagner's report was included in the Superintendent's monthly report but was distributed no further. These findings are reproduced here for the first time with the addition of some figures and additional notes based on similar fieldwork conducted by the senior authors in northern Arizona and southern Utah, and confirm the presence of interbedded sandstones and mudstones within the lower Monitor Butte Member, Cameron Member, Bluewater Creek Member, and Blue Mesa Member of the Chinle Formation that were subjected to syndepositional deformation and are rich in leaf fossils and horsetail internal molds in growth position.

Keywords: Chinle Formation; Stratigraphy.

INTRODUCTION

In 1931 during a road construction project a bed of well-preserved fossil leaves was discovered in the Tepees area of then Petrified Forest National Monument, now Petrified Forest National Park (PEFO). Park naturalist Myrl Walker made the initial collections and was the first to realize that the lateral deposits of the same strata contained more plant fossils. Much of this material was initially described by Daugherty (1941) and was the subject of later studies by Ash (1969, 1970 a, b, 1973, 1991, 1999, 2010), Ash and Litwin (1982, 1996), Axsmith and Ash (2006), Axsmith (2009), and Watson and Ash (2006). The leaf bearing shale is capped in most exposures by a micaceous

ripple-laminated fine-grained sandstone that Park Naturalist Howard R. Stagner named the Newspaper Rock sandstone (Fig. 1; Stagner, 1941; Billingsley, 1985; Dubiel et al., 1999; Parker, 2006) later emended to Newspaper Rock Bed (Heckert and Lucas, 2002; Parker, 2006; Martz et al., 2012). The name derives from Newspaper Rock, a pair of boulders from this unit located northwest of the Tepees that bear numerous petroglyphs and whose ripple-lamination gives the appearance of wrinkled newsprint pages. The Newspaper Rock Bed represents an incised channel fill of a high-sinuosity river dominated by lateral accretion (Demko, 1995; Trendell et al., 2013). Throughout the area the sandstone unit and associated ribbons of the same li-

thology interfinger with the leaf-bearing mudstones in channel abandonment facies (Demko, 1995), resulting in complex heterolithic strata exposed near the main park road (Fig. 2). The Newspaper Rock Bed is capped by a zone of reddish mudstone that cuts through the leaf deposits and represents significant pedogenesis of the unit (Fig. 2; Trendell et al., 2013). Parker (2006) included all three of these interfingering facies in the Newspaper Rock Bed. The red paleosol extends laterally from the channel into surrounding overbank facies for several kilometers, forming a distinctive stratigraphic marker bed (Dubiel et al., 1999). To the east in Billings Gap and beyond to Blue Tank within PEFO there are as many as three of these pedogenic zones stratigraphically superimposed suggesting long periods of landscape stability during the deposition of the Newspaper Rock Bed.

Stagner spent a week in October of 1940 examining outcrops of the Chinle Formation throughout northern Arizona (Figure 3). He noted the presence of the Newspaper Rock Bed facies at many of these locations including the presence of well-preserved plant material and suggested that the facies was potentially a good stratigraphic marker for the Chinle Formation. Stagner (1941) describes the Newspaper Rock 'sandstone' and associated facies but did not discuss the regional exposures outside of PEFO in his report. Paleobotanist Sidney Ash visited some of these sites during his dissertation work and noticed the lithologic and stratigraphic similarities of the Newspaper Rock Bed and its fossil flora with exposures around Fort Wingate New Mexico (Ash, 1967, 1969). The senior authors examined correlative facies in northern Arizona in 2008–2009, and in southern Utah in subsequent years (Irmis et al., 2011 supp.; Martz et al., 2017).

In Stagner's report, the lettered divisions of the Chinle Formation were designated by Gregory (1917). These divisions are lettered in descending order and exclude the Shinarump Member and Mesa Redondo Member at the base the Chinle Formation as these were considered separate units at the time. In current terminology (Stewart et al., 1972), Division D corresponds to the Monitor Butte Member, Bluewater Creek Member, and Cameron Member (Lucas, 1993), Division C to the Blue Mesa Member, Sonse-la Member, and Petrified Forest Member (Lucas, 1993; Heckert and Lucas, 2002), Division B to the Owl Rock Member, and Division A to the Rock Point Member (Stewart et al., 1972). Irmis et al. (2011, supplemental) determined that some parts of Gregory's (1917) Division C (specifically the lower Blue Mesa Member type section at PEFO; Lucas, 1993) and Division D are correlative. This is significant as these correlative strata are the subject of Stagner's report. The facies relationships of these beds are complex and the proper nomenclature which should be applied to these beds locally within the Colorado Plateau has been contentious (e.g., Dubiel et al., 1993, 1999; Irmis et al., 2011, supplemental) and is by no means completely resolved. Our annotations are in brackets.

STAGNER'S REPORT

"The Chinle Formation was traced along the east side of the Defiance Uplift from Lupton, Arizona, via Window Rock and Ft. Defiance to Lukachukai, Arizona; around the north end of the uplift between Lukachukai and Round Rock; and down along the west side as far as Chinle and Nazlini. The formation was again picked up at Kayenta, Arizona, and

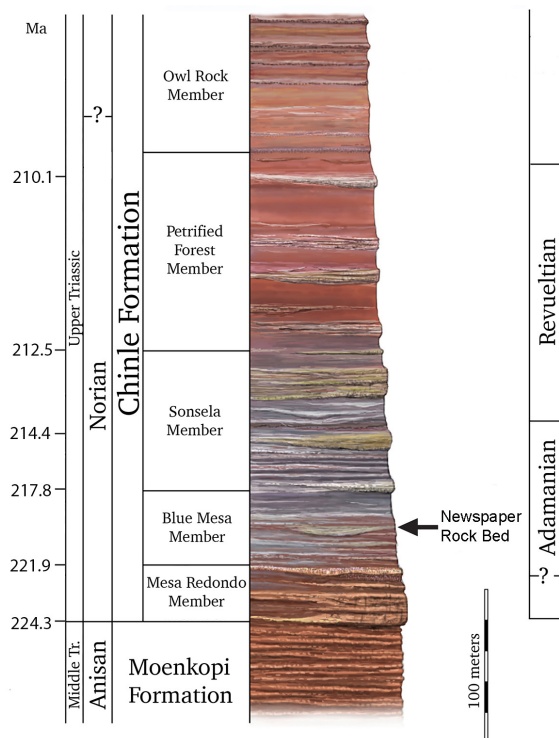


FIGURE 1. Stratigraphic position in the Chinle Formation of the Newspaper Rock Bed (A) and the location of the Tepees (B) at Petrified Forest National Park (PEFO). U-Pb ages based on Ramezani et al. (2014) and Rasmussen et al. (2020). Modified from Reyes et al. (2023).

examined at several localities to the north in Monument Valley and at Comb Ridge a few miles west of Bluff, Utah.”

“Throughout the area the Chinle is a valley-maker, cropping out in the usual broad valley between the bold Wingate, Jurassic sandstone cliffs on one side and the Shinarump-Coconino sandstone uplifts and low escarpments on the other side. In most places a considerable part of the Chinle section is covered with alluvium and terrace gravels, or is still deeply buried below the valley floor. At a number of points, however, it appears that detailed, nearly complete sections may be studied and accurately measured. The most favorable areas for such study are as follows: Between Window Rock and Ft. Defiance; between Greasewood and Lukachukai; about 15 miles west of Lukachukai; between Chinle and Nazli-

ni; and about 15 miles north of Kayenta, 3 miles north of El Capitan.”

“Around the Defiance uplift the Chinle crops out around the base of the rather abrupt anticlinal uplift with rather low dips decreasing away from the uplift. In many places the Chinle beds lie nearly flat. A considerable portion of the Chinle section appears to be faulted out between Lupton and St. Michaels, Arizona [this is incorrect, see Parker et al., 2013], but little evidence of faulting in the Chinle was observed in other areas. In the Kayenta-Monument Valley area all beds are nearly horizontal, but the massive, resistant Wingate sandstones, rising abruptly above the valley floor effectively covers the Chinle in most places. A nearly complete section was observed some 15 miles north of Kayenta, however, and it is believed that good sections can be found

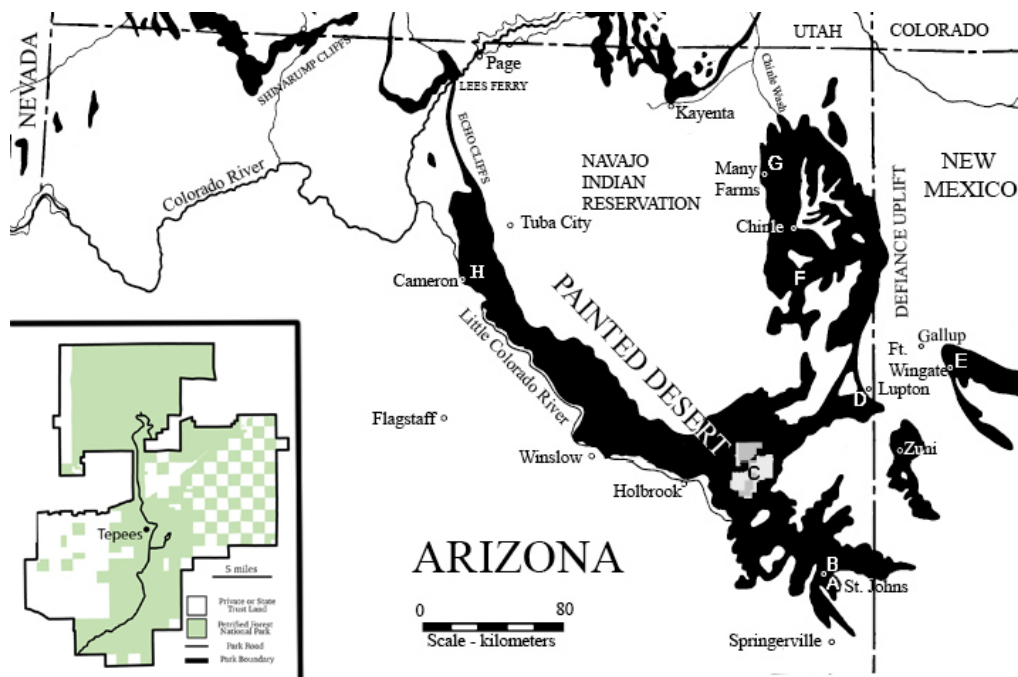


FIGURE 2. Map of Chinle Formation exposures in northeastern Arizona and northwestern New Mexico showing the locations of areas discussed in the text. A) Salido, Arizona; B) Blue Hills, St. Johns, Arizona; C) Petrified Forest National Park, Arizona; D) St. Michaels, Arizona; E) Fort Wingate, New Mexico; F) Nazlini, Arizona; G) Many Farms, Arizona; H) Cameron, Arizona. Modified from Parker (2005).

along Comb Ridge somewhat north of Bluff, Utah.”

“[Herbert E.] Gregory [1917], *Geology of Navaho Country*, separated the Chinle into four divisions, only the lower two, C and D, apparently represented in Petrified Forest National Monument [this is incorrect as Division B, the Owl Rock Member, is present at PEFO; e.g. Dubiel, (1993)]. The writer was particularly interested in examining the upper divisions, and found that all four divisions were quite clearly recognizable in most areas visited. The lower two divisions are not well exposed at any one locality, and are, in general nearly completely covered in the Kayenta-Monument Valley area. The line of separation of these lower two divisions are not clearly defined, and some doubt exists as to this boundary. It is believed, however, that the top of the

tentatively correlated Newspaper Rock Sandstone represents the top of Gregory’s division D” [this is what the senior authors determined independently as well (Martz and Parker, 2010)].

“Surprisingly, the fossil leaf shales, formally believed to be restricted to the Monument area, were found nearly everywhere a considerable part of the lower part of the Chinle was exposed. As in Petrified Forest, these leaf shales occur associated with a distinct sandstone – below it, or interfingering with it, and everywhere from 100 to 150 feet (estimated) from the base of the Chinle taken as the rather massive white sandstone beneath the exposed variocolored shales (Shinarump?). The leaf shales and tentatively correlated Newspaper Rock Sandstone were traced from St. Michaels to about ten miles north of Ft. Defiance.

The fossil member and associated sandstone are conspicuous back of the trading post at Greasewood, and from that point crop out almost continuously as far as Round Rock to the west. Good exposures of the same series occur between Chinle and the Headquarters building of Canyon De Chelly National Monument, and thence southward, with interruptions as far as Nazlini. Excellent impressions of leaves were found within half a mile of the trading post at Nazlini, and fragmentary material was found at several localities between St. Michaels and Ft. Defiance. It is quite probable that the leaf bed and associated Newspaper Rock sandstone will prove to be a dependable horizon marker in the Chinle throughout the northeast Arizona area, and possibly throughout the Chinle area."

"Contrary to all published reports, it appeared to this writer that certain beds in the Chinle are remarkably persistent. These are the bentonitic shales associated with the lenticular sandstones that contain the petrified wood. It is because of the cut-and-fill nature of the sandstone lenses that the Chinle has been described as exceedingly variable. It appears that within a thick stratum of bentonitic shale, itself quite persistent, there maybe up to a dozen sandstone stringers and lenses replacing locally the shale. Discounting the presence of the variable sandstone lenses, the bentonite appears as a remarkably persistent, relatively unchanged bed spreading for, perhaps, several hundred square miles."

"Petrified wood fragments were found wherever the lower two divisions of the Chinle are exposed, and on the north and west sides of the Defiance uplift several fair sized forests occur. However, in this brief reconnaissance, no logs were actually found in place, although the fragments could be traced upward to one

or several white, soft sandstone lenses [Sonsela Member]. It is believed as in Petrified Forest National Monument, that the wood occurs only in the variable sandstone lenses, and never in the fine, bentonitic shales. In color, the wood between Chinle and Nazlini resembles that of the Petrified Forest Monument, but farther north only black, gray and white wood was seen."

"No evidence of trees in place, indicating an in situ origin, was found" [we did find in-situ stumps in the lower part of the Blue Mesa Member at Cameron].

"The sections and fragments of petrified wood in various parts of the Defiance uplift area differ somewhat in character from the wood in Petrified Forest National Monument. No sections larger than 18" in diameter were found at Nazlini or farther north. In Petrified Forest the average size is from 2 to 5 feet in diameter, with some logs as large as 8 feet. At Nazlini a considerable amount of the wood is small, ranging down to stem-like pieces an inch or less in diameter. Material of this size is very rare in the Petrified Forest."

"At Nazlini the wood shows much rounding and irregular smooth grooving parallel to the grain of the wood, believed to be the result of water wear prior to petrification. The wood here is less solid, as a general rule, than in Petrified Forest, most of it showing irregular cavities, cracks, pits, and a honeycomb structure which may be the result of considerable decay of the wood before petrification."

"Of the sandstone lenses, none was found containing any considerable amount of the rather coarse pebbles and gravel so common in some of the sandstone lenses of the Petrified Forest. Even the Shinarump appeared to contain decidedly less pebble and gravel material than even the higher sandstones in the

Petrified Forest area. Furthermore, limestone beds, almost entirely absent from the lower divisions of the Chinle in the Petrified Forest, are common in division B [the Owl Rock Member] to the north, and also occur in divisions C and D of these areas. The general impression, too, is that the sandstone lenses make up a smaller part of the C and D sections in areas to the north.”

“In summary,

1. The combined sandstones of divisions C and D appear thickest to the south in the Petrified Forest area [possibly a typo as the areas discussed by Stagner are on or adjacent to the Navajo Nation, north of PEFO].
2. Gravel, pebbles and coarse sand are present in the sandstones of the Petrified Forest, and become less important to the north.
3. Limestones, rare in the Petrified Forest, increase in importance to the north.
4. The petrified wood shows more wear in northern areas.
5. The petrified wood decreases in average size to the north.
6. The bentonite shales (except for thickness, not checked) appear to be quite uniform in character and persistent in all areas.”

“The following tentative opinions are suggested, subject, of course, to the findings in more detailed field studies and laboratory examinations.

1. Chinle beds are the result of two separate, simultaneously acting agents of deposition.
 - a. Volcanic ash deposition, either aerial, fluvial or lacustrine – the former favored at this time.
 - b. Deposition of coarse material by streams in channels cut into the ash and on floodplains flooded by volcanic ash. Streams constantly

shifting laterally, and rising in the section as a result of the building up of the land surface by ash deposits [Both conclusions have been vindicated by subsequent depositional analysis of the Chinle Formation; e.g. Blakey and Gubitosa, 1983; Dubiel and Hasiotis, 2011).

2. Source of streams to south or southwest, and a general northward course of flow. (In general this checks McKee’s findings that certain invertebrates found in Chinle pebbles had an origin to the west and southwest of Petrified Forest.) [Also well supported by subsequent studies; e.g. Stewart et al., 1972; Riggs et al., 2016].
3. Trees transported from an area foreign to the area of Chinle deposition. It is suggested that the trees were carried by rivers, the larger logs were first deposited in the Petrified Forest area, and the smaller material floated to areas farther north.”

“Several partial sections were measured roughly, and samples collected for comparison with materials from the Chinle in Petrified Forest [unfortunately we lack these data and specimens]. Future work will consist of detailed field studies, the measuring of sections, collection of samples and study of the samples in the laboratory. The following localities should be studied in detail:

1. Detailed sections at short intervals entirely across the Petrified Forest National Monument from south to north.
2. Fort Defiance.
3. Between Lukachukai and Round Rock.
4. Between Chinle and Nazlini.
5. North of Kayenta.
6. Along the northern part of Comb Ridge.

7. Tuba City.
8. Near Lee's Ferry.
9. San Rafael Swell, Utah.
10. Zion Canyon, Utah.
11. Valley of Fire, Nevada.
12. Muddy Mountains, Nevada.

"The writer has plans to visit several areas where Upper Triassic formations crop out in New Mexico and western Texas, but no detailed work is planned in these areas. H. R. Stagner" [Stagner was transferred soon afterwards and it is unrecorded if he ever did any of this proposed work].

BIOGRAPHICAL INFORMATION

Howard Ralph Stagner (Sept. 10, 1907 Chillicothe, Missouri – Nov. 11, 1995 Wake, North Carolina) was the 2nd full time park naturalist at Petrified Forest National Monument. Stagner was transferred from Grand Tetons on June 30, 1938 to replace Myrl Walker who had been transferred to Zion in April. In 1940 he was promoted to Chief Naturalist and was the first director of the Petrified Forest Museum Association Board. One of Stagner's other projects was to mark all of the known paleontology localities in the park. He placed 4 x 4 wooden posts carved with the site number at each site. Many of these posts are still visible today. On April 3, 1941 Stagner was transferred to Mount Rainer, ending his stint at PEFO and terminating his geological investigations of the area. He was replaced by L. Floyd Keller. Stagner's report on the Newspaper Rock sandstone in PEFO was published in 1941 as part of Lyman Daugherty's *Upper Triassic Flora of Arizona* monograph. His larger study remained unpublished until now.

DISCUSSION

During our studies to map the park geology and determine the local stratigraphy, we visited several of the areas mentioned by Stagner in his report. We were interested in tracing out Gregory's (1917) four divisions of the Chinle Formation and were particularly interested in tracing the boundary between Divisions C and D, which Stagner correctly identified as the Newspaper Rock Bed. We observed a very similar facies in the same stratigraphic position (the Bluewater Creek Member and lower Blue Mesa Member) in many places including St. Johns (Fig. 3A–C), Nazlini, Fort Wingate (Fig. 4D), Many Farms (Fig. 3E), Cameron (Fig. 3F), and Sanders (Parker et al., 2013). These lower Chinle Formation facies have been interpreted as having formed in wetlands traversed by streams (Blakey and Gubitosa, 1983; Beer, 2005; Dubiel and Hasiotis, 2011). This early phase of Chinle deposition experienced higher mean annual precipitation compared to upper Chinle deposition (Prochnow et al., 2006; Atchley et al., 2013).

At all these places we observed the interfingering of the ripple-laminated fine grain sandstone and organic-rich leaf-bearing mudstones, with distinct red zones of pedogenesis. Where we were able to sample the mudstones we did discover preserved leaf material. Very notable was the syndepositional deformation of the bedding that occurs at all of these outcrops and which at its extreme forms a distinct, small-scale anticline at St. Johns (Figure 3B; Dubiel et al., 1993). This anticline is beveled at its top by horizontal beds of the Blue Mesa Member (Figure 3C; Green, 1956). Similarly contorted strata occur locally in the lower Monitor Butte Member of Utah (Stewart et al., 1972), for example at Capitol Reef Na-



FIGURE 3. Photos of lower Chinle Formation outcrops in Arizona that include the Newspaper Rock Bed facies. **A**, lower Blue Mesa Member beds at Salado, Arizona; **B**) anticlinal structure in the Bluewater Creek Member at the Blue Hills, St. Johns, Arizona. **C**) Horizontal beds of the upper Blue Mesa Member on top of the anticlinal structure in the underlying Bluewater Creek Member at the Blue Hills; **D**) lower Chinle exposures and contorted leaf beds at Fort Wingate, New Mexico; **E**) Leaf bearing beds in the Bluewater Creek Member at Many Farms, Arizona; **F**) lower Chinle Formation exposures near Cameron, Arizona.

tional Park, where the interbedded mudstones are also rich in leaf fossils (Kirkland et al., 2015; Martz et al., 2017). In all areas, ripple-laminated sandstones and other coarse-grained units interbedded with muddier leaf-bearing facies can be observed at astonishingly high angles of repose in multiple directions, in some cases being nearly vertical (Fig. 4A), and horsetail internal molds occur in vertical growth position (Fig. 4B; Dubiel, 1987; Kirkland et al., 2015). These features are so odd that Camp et al. (1947) thought that the St. Johns anticline represented strata of the Moenkopi Formation beveled by the Chinle Formation, representing a significant regional unconformity, and Hunt and Lucas (1989) and Lucas and Hayden (1989) argued the distorted beds were the product of Laramide deformation. However, Chinle strata both below and above the 'contorted strata' are undeformed (Figure 3C; Green, 1956; Dubiel et al., 1993; Kirkland et al., 2014), suggesting that this interval was subjected to Late Triassic syndepositional deformation which has been hypothesized to be related to slumping of blocks of sediment into deeper bodies of water

(Dubiel et al., 1993) or the movement of salts in the underlying Paleozoic strata (Olsen et al., 2016).

Our current understanding is that at PEFO the Newspaper Rock Bed divides the Blue Mesa Member of Woody (2006) into upper and lower units with the lower unit and the Newspaper Rock bed assignable to Gregory's Division D (Irmis et al., 2011; Parker et al., 2013). To the west in Arizona and north into southern Utah equivalent strata would be the Cameron Member and Monitor Butte Member (Lucas, 1993; Irmis et al., 2011; Martz et al., 2017), and to the east through Arizona and into New Mexico the equivalent would be the Bluewater Creek Member. The tops of all of these units have Newspaper Rock Bed-like facies and contain abundant leaf fossils and horsetail internal molds in growth position. At Salado, near St. Johns, these facies have a U-Pb age of <221.6 Ma (Ramezani et al., 2014) while the age of the Newspaper Rock Bed at PEFO is estimated to be about 220 Ma based on the most recent age model (Rasmussen et al., 2020). Both dates are early Norian.



FIGURE 4. **A)** Vertical strata in the Monitor Butte Member at Capital Reef National Park, Utah. **B)** *Equisetites* (horsetail) fossil preserved in life position in the Newspaper Rock Bed in the Tepees at Petrified Forest National Park, Arizona.

CONCLUSIONS

Unfortunately, Stagner's regional scale findings were only presented as an appendix in a Superintendent's Monthly Report, and therefore largely forgotten and never considered by future researchers. During the senior authors' work to clarify the overall PEFO stratigraphy we came across this document and acknowledged and verified Stagner's findings, which matched our own (Martz and Parker, 2011). It is important that these forgotten data are revived and finally published for availability to future researchers. Stagner's report is significant for three reasons. First, he correctly determined the stratigraphic position of the Newspaper Rock Bed in its regional context, contrary to most future studies that were utilized for decades. Second, he recognized an important facies widespread across the lower part of the Chinle Formation, discussed its potential as a marker bed, and showed that across its extent it is fossiliferous. Finally, he also correctly surmised the basic depositional pattern for the Chinle Formation in Arizona.

ACKNOWLEDGEMENTS

We thank the editor Jon Hardes and reviewer Randy Irmis for constructive comments that improved the manuscript. Permission for field work was provided by the Navajo National Department of Minerals and the Bureau of Land Management, Safford, AZ, office. Thanks to Steve Clarke for field assistance in the Chinle Valley. Blue Hills Environmental provided access to the St. Johns Arizona outcrop.

REFERENCES

- Ash, S. R. 1967. The Chinle (Upper Triassic) megafloora of the Zuni Mountains, New Mexico. New Mexico Geological Society Guidebook 18: 125–131.
- Ash, S. R. 1969. Ferns from the Chinle Formation (Upper Triassic) in the Fort Wingate area, New Mexico. United States Geological Survey Professional Paper, 613-D: 1–52.
- Ash, S. R. 1970a. *Dinophyton*, a problematic new plant genus from the Upper Triassic of the southwestern United States. *Palaeontology* 13: 122–124.
- Ash, S. R. 1970b. *Pagiophyllum simpsonii*, a new conifer from the Chinle Formation (Upper Triassic) of Arizona. *Journal of Paleontology* 44: 945–952.
- Ash, S. R. 1973. Two new Late Triassic plants from the Petrified Forest of Arizona. *Journal of Paleontology*, 47:46–53.
- Ash, S.R. 1991. A new pinnate cycad leaf from the Upper Triassic Chinle Formation of Arizona. *Botanical Gazette* 152: 123–131.
- Ash, S. R. 1999. An Upper Triassic *Sphenopteris* showing evidence of insect predation from Petrified Forest National Park, Arizona. *International Journal of Plant Sciences* 160: 208–215.
- Ash, S. R. 2010. Late Triassic ginkgoaleans of North America. Pp 173–185 in Gee, C. T. (ed.) *Plants in Mesozoic time: morphological innovations, phylogeny, ecosystems*. Indiana University Press.

- Ash, S. R., and R. J. Litwin. 1996. Two new species of the pinnate microsporephyll *Pramelreuthia* from the Upper Triassic of the southwestern United States. *American Journal of Botany* 83: 1091–1099.
- Ash, S. R., and R. J. Litwin. 1982. The Upper Triassic fern *Phlebopteris smithii* (Daugherty) Arnold and its spores. *Palynology* 6:203–219.
- Atchley, S. C., Nordt, L. C., Dworkin, S. I., Ramezani, J. R., Parker, W. G., Ash, S. R., and S. A. Bowring. 2013. A linkage among Pangean tectonism, cyclic alluviation, climate change, and biologic turnover in the Late Triassic: the record from the Chinle Formation, southwestern United States. *Journal of Sedimentary Research* 83: 1147–1161.
- Axsmith, B. J., and S. R. Ash. 2006. Two rare fossil cones from the Upper Triassic Chinle Formation in Petrified Forest National Park, Arizona, and New Mexico. *Museum of Northern Arizona Bulletin* 62: 82–94.
- Axsmith, B. J. 2009. A new *Cynepteris* from the Upper Triassic of Arizona: potential implications for the early diversification of schizaealean ferns. *International Journal of Plant Science*, 170:657–665.
- Beer, J. J. 2005. Sequence stratigraphy of fluvial and lacustrine deposits in the lower part of the Chinle Formation, south central Utah, United States: paleoclimatic and tectonic implications. Unpublished M.S. Thesis. University of Minnesota, Duluth. 169 pp.
- Billingsley, G. H. 1985. General stratigraphy of the Petrified Forest National Park, Arizona. *Museum of Northern Arizona Bulletin* 54: 3–8.
- Blakey, R. C. and R. Gubitosa. 1983. Late Triassic paleogeography and depositional history of the Chinle Formation, southern Utah and northern Arizona. Pp. 57–75 in Reynolds M. W., and E. D. Polly (eds.), *Mesozoic Paleogeography of west-central United States*. Rocky Mountain Section, S.E.P.M., Denver, CO.
- Daugherty, L. H. 1941. The Upper Triassic flora of Arizona. *Carnegie Institution of Washington Publication* 526: 1–108.
- Camp, C. L., Colbert, E. H., McKee, E. D., and S. P. Welles. 1947. A guide to the continental Triassic of northern Arizona. *Plateau* 20: 1–9.
- Demko, T. M. 1995. Taphonomy of fossil plants in Petrified Forest National Park, Arizona. *Mesa Southwest Museum Bulletin* 3: 37–52.
- Dubiel, R. F. 1993. Depositional setting of the Owl Rock Member of the Upper Triassic Chinle Formation, Petrified Forest National Park and vicinity, Arizona. *New Mexico Museum of Natural History and Science* 3: 117–121.
- Dubiel, R. F., and S. T. Hasiotis. 2011. Deposystems, paleosols, and climatic variability in a continental system: The Upper Triassic Chinle Formation Colorado, U.S.A. *SEPM Special Publication* 97.
- Dubiel, R. F., Ash, S. R., and S. T. Hasiotis. 1993. Syndepositional deformation in the Monitor Butte Member of the Chinle Formation at Fort Wingate, NM

- and St. Johns, AZ. New Mexico Museum of Natural History and Science 3: 27–29.
- Dubiel, R. F., Hasiotis, S. T., and T. M. Demko. 1999. Incised valley fills in the lower part of the Chinle Formation, Petrified Forest National Park, Arizona: complete measured sections and regional stratigraphic implications of Upper Triassic rocks. NPS Geologic Resource Division Technical Report NPS/NRGRD/GRDTR-99/03: 78–84.
- Green, T. E. 1956. Disturbed Chinle beds near St. Johns, Apache County, Arizona. Unpublished M.S. Thesis. The University of Texas, Austin, Texas. 71p.
- Gregory, H. E. 1917. Geology of the Navajo Country: a reconnaissance of parts of Arizona, New Mexico, and Utah. United States Geological Survey Professional Paper 93: 1–161.
- Heckert, A. B. and S. G. Lucas. 2002. Revised Upper Triassic stratigraphy of the Petrified Forest National Park, Arizona, U.S.A. New Mexico Museum of Natural History and Science Bulletin 21: 1–36.
- Hunt, A. P. and S. G. Lucas. 1989. Late Triassic vertebrate localities in New Mexico. Pp. 72–101 in Lucas, S. G., and A. P. Hunt (eds.) Dawn of the age of dinosaurs in the American southwest. New Mexico Museum of Natural History, Albuquerque.
- Irmis, R. B., Mundil, M., Martz, J. W., and W. G. Parker. 2011. High-resolution U-Pb ages from the Upper Triassic Chinle Formation (New Mexico, USA) support a diachronous rise of dinosaurs. *Earth and Planetary Science Letters* 309: 258–267.
- Kirkland, J. I., Martz, J. W., DeBlieux, D. D., Santucci, V. L., Madsen, S. K., and J. R. Wood. 2014. Paleontological resource inventory & monitoring Chinle and Cedar Mountain Formations, Capitol Reef National Park, Utah. Unpublished Report, State of Utah Department of Natural Resources, 123 p.
- Lucas, S. G. 1993. The Chinle Group: revised stratigraphy and biochronology of Upper Triassic nonmarine strata in the western United States. *Museum of Northern Arizona Bulletin* 59: 27–50.
- Lucas, S. G. and S. N. Hayden. 1989. Triassic stratigraphy of west-central New Mexico. *New Mexico Geological Society Guidebook* 40: 191–211.
- Martz, J. W., Parker, W. G., Skinner, L., Raucci, J. J., Umhoefer, P., and R. C. Blakey. 2012. Geologic Map of Petrified Forest National Park, Arizona. Arizona Geological Survey Contributed Map CR-12-A, 1 map sheet, 1:50,000 map scale, 18 p.
- Martz, J. W., Kirkland, J. I., Milner, A. R. C., Parker, W. G., and V. L. Santucci. 2017. Upper Triassic lithostratigraphy, depositional systems, and vertebrate paleontology across southern Utah. *Geology of the Intermountain West* 4: 99–108.
- Olsen, P. E., Parker, W. G., Kürschner, W., Huber, P., and J. Geissman. 2016. Implications of the stratigraphic results of the Colorado Plateau Coring Project (CPCP): salt vs. plate tectonics vs. eustasy in the Late Triassic Chinle Formation. *International Geological Conference Meeting Abstracts*, 35.

- Parker, W. G. 2005. Faunal review of the Upper Triassic Chinle Formation of Arizona. *Mesa Southwest Museum Bulletin* 11: 34–54.
- Parker, W. G. 2006. The stratigraphic distribution of major fossil localities in Petrified Forest National Park, Arizona. *Museum of Northern Arizona Bulletin* 62: 46–61.
- Parker, W. G., Martz, J. W., Zeigler, K. E., Semken, S., and J. M. Timmons. 2013. Winslow, AZ to Gallup, NM; Second day road log: from a corner in Winslow, Arizona, through Petrified Forest National Park, to the El Rancho Hotel in Gallup, New Mexico. *New Mexico Geological Society Guidebook* 64: 25–42.
- Prochnow, S. J., Nordt, L. C., Atchley, S. C., and M. R. Hudec. 2006. Multi-proxy paleosol evidence for Middle and Late Triassic climate trends in eastern Utah. *Palaeogeography, Palaeoclimatology, Palaeoecology* 232: 53–72.
- Ramezani, J., Fastovsky, D. E., and S. A. Bowring. 2014. Revised chronostratigraphy of the lower Chinle Formation strata in Arizona and New Mexico (USA): high-precision U-Pb geochronological constraints on the Late Triassic evolution of dinosaurs. *American Journal of Science* 314: 981–1008.
- Rasmussen, C., Mundil, R., Irmis, R. B., Geisler, D., Gehrels, G. E., Olsen, P. E., Kent, D. V., Lepre, C., Kinney, S. T., Geissman, J. W., and W. G. Parker. 2020. U-Pb zircon geochronology and depositional age models for the Upper Triassic Chinle Formation (Petrified Forest National Park, Arizona, USA): implications for Late Triassic paleoecological and paleoenvironmental change. *Geological Society of America Bulletin* 133: 539–558.
- Reyes, W. A., Parker, W. G., and A. B. Heckert. 2023. A new aetosaur (Archosauria: Pseudosuchia) from the upper Blue Mesa Member (Adamanian: Early-Middle Norian) of the Late Triassic Chinle Formation, northern Arizona, USA, and a review of the paratypothoracin *Tecovasuchus* across the southwestern USA. *Paleobios* 49: 1–15.
- Riggs, N. R., Oberling, Z. A., Howell, E. R., Parker, W. G., Barth, A. P., Cecil, M. R., and J. W. Martz. 2016. Sources of volcanic detritus in the basal Chinle Formation, southwestern Laurentia, and implications for the early Mesozoic magmatic arc. *Geosphere* 12: 439–463.
- Stewart, J. H., Poole, F. G., and R. F. Wilson. 1972. Stratigraphy and origin of the Chinle Formation and related Upper Triassic strata in the Colorado Plateau region. *United States Geological Survey Professional Paper* 690: 1–336.
- Stagner, H. R. 1941. Geology of the fossil leaf beds of the Petrified Forest National Monument, p. 9–21. In L. H. Daugherty. *The Upper Triassic Flora of Arizona*. Carnegie Institution of Washington Publication 526.
- Trendell, A. M., Atchley, S. C., and L. C. Nordt. 2013. Facies analysis of a probable large-fluvial-fan depositional system: the Upper Triassic Chinle Formation at Petrified Forest National Park, Arizona, U.S.A. *Journal of Sedimentary Research* 83:8 73–895.

Watson, J., and S. R. Ash. 2006. A rare bipinnate microsporophyll attributable to the cycadales, from the Late Triassic Chinle Formation, Petrified Forest National Park, Arizona. *Museum of Northern Arizona* 62: 95–105.

Woody, D. T. 2006. Revised stratigraphy of the lower Chinle Formation (Upper Triassic) of Petrified Forest National Park, Arizona. *Museum of Northern Arizona Bulletin* 62: 17–45.

*Recieved 16 March 2024; Accepted 2
June 2025*