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## ***The Hayden Quarry, a new Upper Triassic fossil locality at Ghost Ranch, New Mexico***

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# THE HAYDEN QUARRY, A NEW UPPER TRIASSIC FOSSIL LOCALITY AT GHOST RANCH, NEW MEXICO

ALEX DOWNS

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**ABSTRACT.**—The Hayden quarry is a recently discovered fossil locality in the Upper Triassic Petrified Forest Formation at the Ghost Ranch Conference Center. The quarry is at a similar stratigraphic level to the nearby NMMNH Snyder quarry and produces a similar but less diverse fauna.

## INTRODUCTION

The Hayden quarry was discovered in June 2002 by a Ghost Ranch Conference Center hiking group led by retired U. S. Forest Service forester John Hayden. The quarry is located approximately 750 m south-southwest of the Ghost Ranch main gate along an escarpment bordering the west side of the Arroyo Seco (Canjilon Creek) floodplain. This is on the Ghost Ranch property, T24N, R4E, of the USGS Ghost Ranch Quadrangle in Rio Arriba County, New Mexico.

The Hayden quarry is stratigraphically high in the Upper Triassic Petrified Forest Formation of the Chinle Group (Painted Desert Member). The fossiliferous layer is in a widespread reduced layer that crops out in many places in the Ghost Ranch area. Although the Hayden quarry is faulted down relative to the other sites in the area it appears that the fossil-bearing, reduced layer correlates with the fossiliferous horizon at the New Mexico Museum of Natural History Snyder Quarry 4.3 km to the northwest (Lucas et al., 2003). Both sites produce very well preserved black bone and large amounts of carbonaceous, apparently charcoaled wood (Zeigler, 2003; Zeigler et al., 2003). This may also be the approximate horizon of the holotype locality of *Eucoelophysis baldwini* 3 km east-northeast near Orphan Mesa (Sullivan and Lucas, 1999). The Canjilon quarry located about 3.2 km north of the Hayden quarry is also in a reduced horizon at about the same stratigraphic level but produces white and gray bone of markedly poorer preservation (Hunt and Downs, 2000).

All fossils collected from the Hayden quarry are housed in the Ruth Hall Museum of Paleontology at the Ghost Ranch Conference Center (institutional abbreviation GR).

## FAUNA

The density of bone in the Hayden quarry is considerably less than at the nearby Snyder quarry and comparatively few person hours have been invested in excavation and preparation of fossils from the Hayden quarry. Nevertheless, a diverse vertebrate fauna typical of the Painted Desert Member of the Petrified Forest Formation in the Chama Basin has been discovered (Heckert et al. 2005).

All the known fauna of the Hayden quarry so far are tetrapods; no invertebrates or fish remains have been found as yet. Only a few fragmentary bones indicate the presence of a metoposaurid temnospondyl. These are one small incomplete centrum

(GR 172, cf. *Apachesaurus* sp.), 16.5 mm in length and 26 mm wide, and a chunk of conglomerate matrix and associated bone fragments (GR 173) that show the characteristic radial sculpting pattern of metoposaur pectoral girdle elements (Long and Murry, 1995). A small, nearly complete femur (GR 167) with an estimated restored length of 67 mm and smallest diameter of 7.5 mm together with an associated partial humerus (GR 168) are similar to the small armored diapsid *Vancleavea* (Long and Murry, 1995; Hunt et al. 2002).

Like many Petrified Forest Formation localities, the fauna of the Hayden quarry is dominated by phytosaurs. Except for a very fragmentary juvenile skull and a few shed teeth, cranial material is lacking, making generic identification difficult. However, the most common phytosaur in similar age quarries is *Pseudopalatus* (Heckert et al., 2005). No large adult phytosaurs are as yet known from the Hayden quarry; the largest individual is represented by a 30 cm fibula (GR 158), and the largest complete femur measures 25 cm.

Aetosaurs are the second most common fossils from the Hayden quarry. Several partial dorsal scutes are attributable to *Typothorax* sp. (J. Martz, personal commun., 2004). No cranial bones or teeth of aetosaurs have been discovered at the Hayden quarry yet. Postcranial elements are from both subadult and adult animals. One proximal caudal vertebra (GR 174) is from a large adult and has a height of 17 cm.

As at the Snyder quarry, two sizes of dinosaur are known from the Hayden quarry (Heckert et al., 2000). A small saurischian dinosaur (cf. *Caseosaurus* sp.) is represented by dorsal, sacral and caudal vertebrae, pelvic elements, three femora, one metatarsal, one pedal phalanx and one metacarpal. Although duplication of elements indicates a minimum of two individuals all these fossils were found in an area of about a square meter and are cataloged as GR 155. The animals are very small with a maximum femur length of 14 cm. A larger dinosaur proximal femur (GR 156) with a width across the head of 5 cm may be from a different taxon or perhaps an adult of the taxon represented by GR 155.

We anticipate that collecting at the Hayden quarry in coming years will increase this diversity.

## ACKNOWLEDGMENTS

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Ranch January term 2004 collected and prepared many of the fossils. Finally I thank Spencer Lucas for locating the fossiliferous horizon. Andrew Heckert and Spencer Lucas provided helpful reviews of the manuscript.

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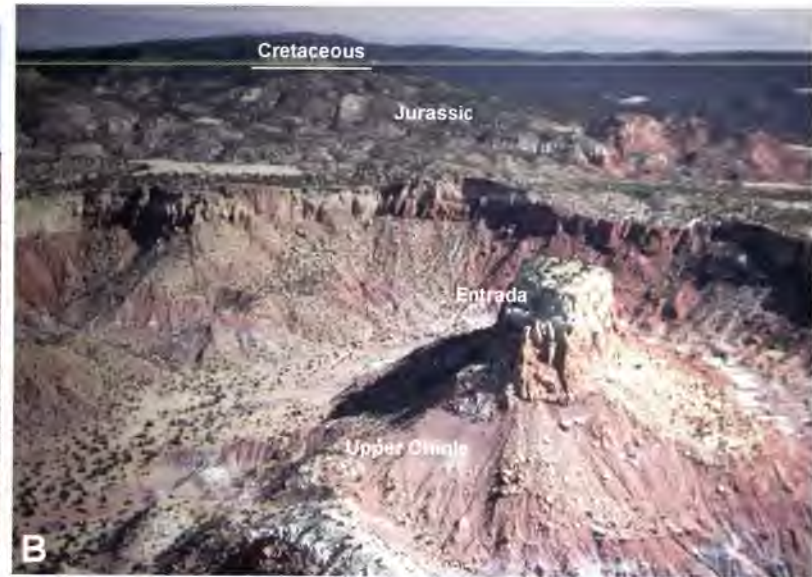


PLATE 14. Upper Triassic strata in the Chama Basin. A. Overview of Coyote Amphitheater, the only locale in the Chama Basin where the entire Chinle Group is exposed. The Shinarump Formation is not visible in this photograph, but is found in the walls of the deeply incised Coyote Canyon. The Chinle Group is capped by the Jurassic Entrada Sandstone and the steep slopes above the Entrada Sandstone are the Summerville-Bluff-Morrison formations. B. Aerial photography of Orphan Mesa, southeast of Ghost Ranch. The Upper Triassic Petrified Forest and Rock Point formations comprise the base and slopes of the mesa, with the Jurassic Entrada Sandstone capping it. In the distance, younger Jurassic and Cretaceous strata are visible. C. East wall of Abiquiu Dam, just south of the dam itself. The walls of this earthwork dam are the Upper Triassic Poleo Formation (Chinle Group), with thin deposits of the Salitral and Shinarump formations near the base of the walls. The Poleo Formation is thickest here at Abiquiu Dam. D. Rock Point Formation (Upper Triassic Chinle Group) exposed in a mesa along US 84, south of Ghost Ranch. The mesa is capped by the Jurassic Entrada Sandstone.



PLATE 15: PHOTOGRAPHIC STRATIGRAPHY OF THE CHAMA BASIN  
JURASSIC STRATIGRAPHY

PLATE 15. Jurassic stratigraphy in the Chama Basin. A, Far view of the cliffs of Mesa Alta that parallel Highway 96 between Coyote and Gallina, New Mexico. The striking gold cliffs are the Jurassic Entrada Sandstone, with the Todilto and Summerville-Bluff-Morrison formations creating the steep slopes above the Entrada. These mesas are capped by Cretaceous Burro Canyon-Dakota formations. B, Chimney Rock near Ghost Ranch. Red and gold cliffs are the Jurassic Entrada Sandstone, and the caprock is the Todilto Formation. C, Close-up view of the gypsum in the Todilto Formation just north of Ghost Ranch. The Entrada is visible beneath Todilto debris. Notice the Summerville Formation is infilling hummocky topography on the Todilto Formation. D, Upper part of the Jurassic section north of Ghost Ranch. Lower variegated slopes are the Summerville Formation, with the Bluff Sandstone creating cliffs locally. Summerville and Bluff formations are capped by the color banded Morrison Formation (Brushy Basin Member), which is famous in the Four Corners area for its dinosaur fossils.