

A HESPERORNITHIFORM LIMB BONE FROM THE BASAL GREENHORN FORMATION (LATE CRETACEOUS; MIDDLE CENOMANIAN) OF NORTH CENTRAL KANSAS

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The vast majority of bird remains from the Late Cretaceous of North America are members of the extinct Hesperornithiformes, a group of highly specialized, foot-propelled diving birds. The first known hesperornithiform bird (*Hesperornis regalis*) from North America was described by Marsh (1872) on the basis of a partial specimen that he discovered in 1871 in the Niobrara Chalk of western Kansas. Marsh (1876) described two other species of *Hesperornis* (*H. crassipes* and *H. gracilis*) as well as a member of a new family of hesperornithiform, *Baptornis advenus* (1877), from the Niobrara of Kansas. At about the same time, Seely (1876) described the oldest known hesperornithiform birds (*Enaliornis sedgwicki* and *E. barretti*) from the Late Cretaceous (Early Cenomanian) Cambridge Greensand of England. Williston (1898) summarized the original discoveries of toothed birds in Kansas reported by Marsh and discussed additional specimens subsequently acquired by the University of Kansas. More recently, Martin (1984) described *Parahesperornis alexi* from the upper Smoky Hill Chalk (Upper Santonian-Lower Campanian) of Kansas, and a Middle Cenomanian hesperornithiform fauna was described from Saskatchewan (Tokaryk et al. 1997; Cumbaa et al., 2006).

While the Hesperornithiformes have a global distribution from the Early Cenomanian (Galton and Martin, 2002) to the Maastrichtian (Hou, 1999; Dyke et al., 2006), all previously known hesperornithiform specimens from Kansas are Santonian to Early Campanian in age (Martin and Bonner, 1977). Although most hesperornithiform specimens from Kansas have little or no reliable contextual information, it appears that the oldest remains are from the Smoky Hill Chalk member of the Niobrara Chalk (Santonian). The oldest known North American hesperornithiform remains were reported by Tokaryk et al. (1997, see also Cumbaa et al., 2006) from Middle Cenomanian bone beds along the Carrot River near the Pasquia Hills in eastern Saskatchewan, Canada. A new genus, *Pasquiaornis*, belonging to the Baptornithidae has been described from these deposits and two species, *P. hardiei* and *P. tankei*, have been identified thus far (Tokaryk et al., 1997). Interestingly, none of the better known hesperornithiforms from lower latitudes have been found in these older deposits.

Here we describe a specimen belonging to a new taxon of hesperornithiform from the basal Lincoln Limestone member of the Greenhorn Formation (Cenomanian) of Kansas. This occurrence pushes back the fossil record of hesperornithiforms in the United States to a point comparable to the earliest known records from Canada. The specimen described here, FHSM VP-6318, was collected by R. Zakrzewski in 1979 while on a field trip with students (pers. comm., 2008) and is now housed in the Sternberg Museum in Fort Hays, Kansas (FHSM). While Martin (1983:313) mentioned the specimen as “an *Enaliornis*-like tarso-metatarsus from the Cenomanian, Greenhorn Formation, Kan-

sas, in the Sternberg Museum,” he did not cite or otherwise describe it. Tokaryk, et al. (1997, p. 174) and Rees and Lindgren (2005, p.1326) cited Martin’s remarks, but, other than a brief comparison of FHSM VP-6318 to *Pasquiaornis* (Tokaryk et al., 1997), no further information has been published. Therefore, this paper presents the first detailed description with figures of the specimen.

LOCALITY/STRATIGRAPHIC OCCURRENCE

FHSM VP-6318 was surface collected from the basal portion of the Lincoln Member of the Greenhorn Limestone on June 21, 1979 about 2.5 km east of the town of Fairport, Kansas in western Russell County, Kansas. The exact locality is on record at the Sternberg Museum of Natural History, Fort Hays State University, Hays, Kansas. Stratigraphically, the specimen had eroded from a limestone ledge less than 1 m above the contact of the Lincoln Member and the underlying Graneros Shale (Zakrzewski, pers. comm., 2008). The basal Lincoln Member is characterized by skeletal limestones composed of a well cemented matrix containing abundant inoceramid prisms, valves and fragments, as well as other invertebrates and vertebrate remains including numerous fish bones, scales, and teeth (Hattin, 1975; Liggett, et al., 2005). FHSM VP-6318 is considered to be upper Middle Cenomanian in age.

Liggett, et al. (2005) described a mixed marine and terrestrial fauna, including sharks, bony fish, a pliosaur (*Brachauchenius lucasi*), a lizard (*Coniasaurus* cf. *crassidens*) and the earliest known Kansas pterosaur, from a lag deposit at the contact between the Lincoln Member of the Greenhorn Limestone and the Graneros Shale at the same locality where FHSM VP-6318 was collected. Liggett, et al. (2005) noted that an ⁴⁰Argon/³⁹Argon analysis of the “X-bentonite” located about 1 m below this lag deposit and about 2 m below FHSM VP-6318 yielded a date of 95.53 ± 0.159 Ma, while Cumbaa, et al. (2006) reported an age of 95.17 ± 0.31 Ma from the bentonite lying directly on top of the Carrot River bonebed.

The lag deposit implies that the deposition of the faunal remains reported by Liggett, et al. (2005) and FHSM VP-6318 probably occurred in a near shore environment during the initial stages of the Greenhorn transgression (Hattin, 1975). Although it is difficult to chronostratigraphically compare the Russell County, Kansas locality with the sediments exposed along the Carrot River in Saskatchewan, in both situations the bird remains were collected in proximity to a regional stratigraphic marker called the X-bentonite, and the occurrence of *Ostrea beloiti* (Hattin, 1975; Cumbaa, et al. 2006), indicating that FHSM VP-6318 is of a similar age as *Pasquiaornis*. However, since FHSM VP-6318 was collected approximately 2 m above the X-bentonite and the Carrot River bonebed material is occurs 2 m below the X-bentonite, the Saskatchewan hesperornithid material remains the oldest yet discovered in North America and FHSM VP-6318 is the oldest in the United States.

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