

OBSERVATIONS ON FOSSIL BIRDS DESCRIBED FROM  
THE MIOCENE OF MARYLAND.<sup>1</sup>

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AMONG the many Selachian and Cetacean fossils found in the cliffs bordering Chesapeake Bay in Calvert County, Maryland, there have been a few fragments of fossil birds, a number surprisingly small when the scrutiny to which these deposits have been subjected during the past sixty years is considered. Sometime ago the type of *Puffinus conradi* Marsh, and other avian types of similar nature from the Academy of Natural Sciences in Philadelphia, were sent to the U. S. National Museum that they might be cast in plaster. The writer took advantage of this opportunity to make a careful study of these type specimens in connection with two other fragments of recent acquisition. The results have proved of sufficient interest to warrant assembling for publication.

***Puffinus* sp.**

The distal third of a right ulna associated with the type of *Puffinus conradi* Marsh (see Amer. Journ. Sci., ser. 2, vol. 49, March, 1870, p. 213), which Marsh considered as from a smaller individual, comes in reality from a species of shearwater of decidedly smaller size than *conradi*, probably a bird of the dimensions of the modern *Puffinus puffinus*. The specimen, therefore, indicates a second species of the genus from the Miocene of Maryland, that may not be given a specific designation until further material is available. The fossil bears the same number, Acad. Nat. Sci. Cat. No. 13,360, as the type of *P. conradi* and was collected by T. A. Conrad. It is probably the lower extremity of a "right radius" exhibited, with the type of *conradi*, by Dr. Leidy, at a meeting of the Academy of Natural Sciences on June 5, 1866.<sup>2</sup>

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<sup>2</sup> See Proc. Acad. Nat. Sci. Philadelphia, 1866, p. 237.<sup>1</sup> Published with permission of the Secretary of the Smithsonian Institution.

***Puffinus conradi* Marsh**

*Puffinus conradi*, O. C. Marsh, Amer. Journ. Sci., ser. 2, vol. 49, March 1870, p. 212.

The type material upon which this species was based (Acad. Nat. Sci. Cat. No. 13,360) consisted of the distal two-fifths of a left humerus, and the distal third of a right ulna. Examination of the latter fragment shows that it belonged to another species, (see p. —), so that the broken humerus remains as the type of the species. The specimen is marked "Miocene, Maryland, T. A. Conrad," without further indication as to its source. The bone is brownish in color, is well fossilized, and in detail may be described as follows: Shaft obliquely flattened, so that it is elliptical in outline; ectepicondylar process thin, triangular in general outline with the upper margin somewhat irregular, flattened, projecting toward the front, in appearance like the tooth of a saw, lower margin forming an abrupt angle with rest of bone, upper with a more rounded slope into shaft; height 5 mm. and breadth at base about the same, with one pit on the posterior face and two on the anterior surface for tendinal insertion; depression for brachialis inferior elliptical, deeply sunk, with steeply sloping walls and a rounded bottom, sharply delimited on all margins but especially marked on the inner side, where the bone is raised to form a broad flattened insertion for the pronator brevis; entepicondylar process slight, merging into shaft at level of lower edge of ectepicondylar process; radial condyle thin, flattened, with upper margin especially compressed, descending at nearly a right angle to base of shaft, deeply impressed on external, posterior face for the insertion of the supinator brevis and the extensor digitorum communis, separated from the base of the shaft on its anterior external margin by a distinct groove; ulnar condyle small, externally rounded, but with anterior, inner face flattened; a broad depression above its posterior face that forms an excavation in the outer, posterior surface of the radial condyle; a second excavation below its anterior face; inter-trochlear sulcus broad, open, but distinct; separated by another depression from a slight flattened ridge internal to it at the base of the entepicondylar process. The transverse diameter at the

distal end is 13.4 mm., transverse diameter of shaft at upper end 7.1 mm.

In the original description Marsh placed *conradi* in *Puffinus* through its resemblance to the black-tailed (or cinereus) shear-water *Puffinus cinereus* (Gmelin), at that time known as *Puffinus cinereus*. Careful comparison of the fossil with the modern species at hand shows that *conradi* is very similar in size and form to *Puffinus gravis* (O'Reilly),<sup>1</sup> from which it may be distinguished only by careful comparison. Comparison has been made with three skeletons of *P. gravis*. The shaft in the fossil is the same in size as in the modern bird but the ectepicondylar process in *conradi* is shorter and has a broader base, the radial condyle is a trifle smaller, less rounded, (more angular) without a distinct projecting hook on the upper, anterior end (present in *gravis*). The entepicondylar region in addition is less developed, and is not extended upward on the shaft beyond the level of the lower margin of the ectepicondylar process. At first glance the differences noted might be attributed merely to variation among individuals of one species but on close scrutiny the more sharply sculptured processes and graceful form of the fossil are distinctive. *Puffinus kuhlii borealis*, of slightly larger size, differs from *conradi* and *gravis* in the shallower, broader impression of the insertion of the brachialis inferior.

*Puffinus conradi* appears so closely allied to the modern *P. gravis* that it may be considered as a Miocene ancestor of the stock that has produced that species.

#### **Fulmarus sp.**

Among specimens collected by William Palmer is a portion of the shaft of a left humerus that comes from a species of fulmar. The bone in question is marked "S. Chesapeake Beach, Maryland, July, 1908, Wm. Palmer. From yellow stratum above." Though its assignment to this yellow stratum might indicate a more recent origin, since some of the higher zones in these deposits are Pleistocene, the bone in question, which is well fossilized, has

<sup>1</sup> For the purpose of this paper the genus *Puffinus* is considered in a broad sense without regard to recent proposals for its division (by Mathews and Iredale, Austr. Av. Rec., Vol. 2, 1913-1914, pp. 12, 20, 110, Ibis, 1915, pp. 582-604, and Oberholser, Auk, 1917, pp. 471-475).

the dark coloration usual to Miocene fossils from these beds and is probably from a Miocene formation. This fossil includes that part of the shaft between the nutrient foramen and the lower half of the crista superior. In size and structure it agrees perfectly with modern *Fulmarus glacialis* (Linnaeus), and must be closely allied to that species. It may be noted that in *Fulmarus* the nutrient foramen is at a higher elevation on the shaft than in *Puffinus*, a distinction that makes possible the generic allocation of Palmer's specimen. Specifically the fossil cannot be distinguished from *glacialis* on the basis of this fragmentary bone.

***Moris loxostyla* (Cope).**

*Sula loxostyla* Cope, Trans. Amer. Phil. Soc., N. S., Vol. 14, December, 1870, p. 236, fig. 53. (Miocene, Calvert County, Maryland, type specimen a left coracoid.)

*Sula atlantica* Shufeldt, Trans. Conn. Acad. Arts Sci., Vol. 19, February, 1915, p. 62, Pl. 15, fig. 123. (Miocene, New Jersey, type specimen a left coracoid.)

The location of the type of *Sula loxostyla* Cope, a left coracoid, is not at present known so that for information regarding it we must turn to the original description and the figure accompanying it. Through the kindness of Dr. Richard S. Lull, of the Peabody Museum, Yale University, I have before me a plaster cast of the type of *Sula atlantica* Shufeldt, which I have examined in the collections at New Haven, said to have been collected by J. Leidy in the Miocene of New Jersey. In size the type of *atlantica*, which is also a left coracoid, is so similar to the dimensions ascribed to *loxostyla*, and the description written by Cope fits it so closely, that after careful review, and some hesitation, I am forced to consider the two as identical, and to cite *atlantica* in the synonymy of the present species. So similar are the two in fact that except that it is more broken at the extremities Cope's figure might well have been drawn from the Yale specimen.

In the collections of the Division of Palaeontology, U. S. National Museum, there is the distal end of a right humerus, (No. 8863) taken by Mr. N. H. Boss from the Miocene of the Calvert Cliffs in Calvert County, Maryland, in September, 1918, that I have identified as *loxostyla* from the fact that it represents a

gannet of the same size and relative proportions. In the same collections there is the upper half of the shaft of a right humerus (without the head) collected by the late William Palmer, along the shore south of Chesapeake Beach, Maryland, where it had probably been washed from the same deposits that seems also to belong to the present species.

Though the species that comprise the family Sulidae have long been considered congeneric, the naked throat and scutal covering of the toes in the gannets, first pointed out by Mathews,<sup>1</sup> are external structural characters that easily warrant their generic separation from the boobies (genus *Sula*). As shown by Oberholser<sup>2</sup> the correct name for the Gannets is *Moris* of Leach, 1816<sup>3</sup> since this is not preoccupied by the previous *Morus* Vieillot<sup>4</sup> 1816, or *Morum* Bolten, 1798. Though Leach, in his list published some time after August 30, 1816 (the date of the preface), in all probability intended to use *Morus* Vieillot, a name proposed in April of that year, his emendation, if such it is, must be accepted as valid and so must be used in place of *Subita* erected by Mathews for this group.

External differences between *Moris* and *Sula* are reflected to more or less degree in the skeleton. In the coracoid the lower anterior face is broad and plane toward the inner side in *Moris*, while it is narrower and more rounded in *Sula*. On this criterion *loxostyla*, belongs in the genus *Moris*. The distal end of the humerus also presents characters of difference between the two genera, as in *Moris* the radial condyle is relatively slender and elongated, with a pronounced excavation on the inner side on the upper, anterior end so that it appears flexed at this point. In addition the articular surface for the pronator muscles is plane and considerably elongated. In *Sula* the radial condyle is broader, shorter, and rounder, without a pronounced inward flexure of the upper end, while the prominence for the insertion of the pronator is short and irregular. In the points mentioned the National Museum specimen agrees with *Moris*. Following is a description of the lower end of the humerus in this bone.

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<sup>1</sup> Austr. Av. Rec., Vol. 2, Oct. 23, 1913, p. 55.

<sup>2</sup> Auk, 1919, p. 417.

<sup>3</sup> Syst. Cat. Spec. Indig. Mamm. and Birds Brit. Mus., 1816, p. 35.

<sup>4</sup> Anal. Nouv. Meth. Orn. Elem., April, 1816, p. 63.

Shaft flattened on anterior face, impressed by broad area for the brachialis inferior, which is deepened on its inner side and shallow on the outer portion, bordered externally by a low, narrow, raised margin, and internally by an abrupt plate, that slopes up to merge in the pronator tubercle; internal face of lower end of shaft flattened, with a sharp rectangular union with both anterior and posterior planes of the bone; posterior face, gently curved for inner half, and then sloped in a flat surface that merges with the outer edge of the anterior face in a sharp, acute angle; pronator tubercle long and narrow (approximately 8.5 mm. in length) with the anterior end elevated, so that, viewed from the external side, it presents in outline a flattened isosceles triangle, with the upper end as the apex, which slopes away in a faintly concave line to right and left; ulnar tubercle relatively small, strongly protrudent anteriorly, irregularly globular, excavated under upper side so that it has a slight overhang above impression for the brachialis inferior, with a large, broad, olecranal depression behind; radial condyle compressed, elevated, curved inward at upper end, where the outer side is undercut, the upper margin of the process standing out boldly above the shaft, with its walls rising at a sharp angle from the base; sulcus anconeus lateralis a deeply impressed U-shaped groove, cutting posterior face of radial condyle; sulcus anconeus medius broad and shallow, well marked immediately above olecranal depression, disappearing beyond.

Pertinent measurements of this bone are as follows;

Breadth of bone across condyles 21.1 mm., transverse breadth of shaft at level of upper third of brachial depression 13.5 mm., vertical diameter of ulnar condyle 7.0 mm., vertical length of radial condyle 10.2 mm.

In the broken shaft collected by Palmer the line for the insertion of the deltoid is strong, and extends from its proximal end downward, without a break, verging constantly toward the center, to end just external to the median line of the bone. The upper portion of the internal, posterior face is plane. Proportionately the shaft seems somewhat more slender than in *Moris bassana*. It is possible that the fragment described may have formed part of the shaft of the bone secured by Mr. Boss, though they do not articulate as a small portion of bone that should form the necessary junction is missing.

The form of the condyles, the length of the attachment on the promotor tubercle, the relative position of ulnar and radial condyles with the form of the deltoid crest and the posterior face of the shaft, indicate the affinity of the present fragments with *Moris* and not with *Sula*.

In modern seas we find three species of gannets, *Moris bassana* (Linnaeus) of North Atlantic waters, *Moris serrator* (Gray) from Australia and New Zealand, and *Moris capensis* (Lichtenstein) from southern Africa. All are maritime species that breed near the seashore or on rocky islands and seek their food from the sea.

In the U. S. National Museum there is a good series of skeletons of *Moris bassana* and one of *Moris serrator*. *Morris capensis* from one skin that I have examined, loaned for the purpose by the American Museum of Natural History, and from published descriptions, is similar in size to *M. serrator*, from which it is distinguished by the entirely dark tail; in *serrator* the median rectrices alone are black, or brown.

The two gannets of the southern hemisphere are slightly smaller than *M. bassana*. The fossil form, *Moris loxostyla*, appears less in size than the two smaller, modern birds so that the four fall into three groups as regards their dimensions. The relative proportions of the four is indicated by the measurement of the transverse intercondylar diameter of the humerus. In eight specimens of *Moris bassana* this ranges from 23.7 to 24.3 mm., in one skeleton of *M. serrator* it is 22.5 mm., in one *M. capensis* (measured in the skin) 24.5 mm., while in *M. loxostyla* it is 21.0 mm.

Other sulids thus far described cause no confusion in the determination of *loxostyla*. *Sula arvernensis* Milne-Edwards,<sup>1</sup> from the Upper Oligocene of Gannat, France, based on a fossil pelvis, is larger than the modern gannet (*Moris bassana*), as is *Sula ronzonei* (Gervais),<sup>2</sup> said to come from the Oligocene of Ronzon, near Puy-en-Velay, France. *Sula pygmaea* Milne-Edwards<sup>3</sup> from the lower Miocene of France is smaller.

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<sup>1</sup> Rech. Anat. Pal. Ois. Foss. France, vol. I, 1867, p. 267, pl. 42, fig. 13, pl. 43, fig. 12.

<sup>2</sup> *Mergus ronzonei* Gervais, Mem. Acad. Sci. Montpellier, vol. I, 1851, p. 220, cf. Milne-Edwards, Rech. Anat. Pal. Ois. Foss. France, vol. I, 1867, p. 271, pl. 44, fig. 9.

<sup>3</sup> Bibl. Ec. Haut. Etudes. Sci. Nat. vol. 11, 1874, p. 8, pl. 2, fig. 2.