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THE SUPPOSED PLUMAGE OF THE EOCENE BIRD *DIATRYMA*

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Plumage, the unique possession of birds, dates back to at least the Upper Jurassic. It is so well developed in the *Archæopteryx* of that era that we may reasonably expect to find it considerably earlier, should there exist a deposit capable of preserving recognizable traces of it. According to Petronievics, the specimens of supposed *Archæopteryx* in the British and Berlin Museums represent different genera, not merely species as Dames had maintained. It appears that the Berlin specimen must take the name *Archæornis siemensii* (Dames), and in certain characters it is said to approach the carinate type, while the British Museum example shows more ratite features. As the genus *Archæopteryx* was based by Meyer (1861) on a feather, it appears to be somewhat hazardous to identify it with one or another of the well-preserved forms and, according to the facts given by Lydekker ('Cat. Fossil Birds,' p. 362), the British Museum specimen seems to be entitled to the name *Griphosaurus problematicus*.

In the light of these facts, and in consideration of all we know about Mesozoic birds, we have little ground for considering any Tertiary or modern bird primitive on account of its lacking the power of flight or possessing hair-like feathers. Even in the Cretaceous, certain birds were so far advanced that Shufeldt has not hesitated to refer one of them (*Graculavus lentus* Marsh) to the modern genus *Pedioecetes*, judging from the distal end of a tarso-metarsus. In the heading of his account (Trans. Conn. Acad., XIX, p. 25) he actually calls it *P. phasianellus* (L.), but the true purport of the observations below would be better indicated by calling it *Pedioecetes* (?) *lentus*. As Matthew and Granger indicate, it is hardly to be doubted that the discovery of the whole skeleton would compel us to recognize a perfectly distinct genus. Nevertheless, modernization and differentiation had gone far by the time we come to the Eocene and, as regards the feathers, there was probably no striking advance remaining to be made. The promise of the future was rather in the development of the voice and in arboreal and nest-building adaptations and developments. Even the mechanism for maintaining a high temperature must have been already perfected.

In the midst of this rather orderly and consistent development certain extraordinary types appear, both in the living and extinct faunas. They do not represent the expectations of orthogenesis and must be regarded as specially adapted forms, made, like the caricatures of the cartoonist, by exaggerating certain features to the point of grotesqueness. Such a bird is the *Diatryma* of the Wasatch, fully elucidated from a magnificent specimen by Matthew and Granger (Bull. Amer. Mus. Nat. Hist., XXXVII, pp. 307-326). Of the four species ascribed to *Diatryma*, only *D. steini* is known by the major part of the skeleton. The others are represented by very imperfect fragments of the feet. Nothing has been known of the plumage but, although the authors (p. 309) suggest that the bird is closest to *Cariama*, the very convincing restoration by Mr. Erwin S. Christman (Pl. xxxiii) shows hair-like plumage like that of a cassowary.

The vicinity of Roan Creek in western Colorado has long been known to palæontologists on account of the discovery of numerous fossil insects, ascribed to the Green River Eocene. It is a region of high mesas or hills, separated by gigantic valleys, which have not yet been accurately mapped, topographically or geologically. The enormous exposures are all in the Eocene, apparently Wasatch at the bottom of the valleys and Green River at the top. Before going there I was prepared to believe that the shales ascribed to the Green River were not really contemporaneous with the typical beds in Wyoming; but the longer one worked in them the closer seemed to be the resemblance to the genuine Green River deposit, and no hesitation remains in ascribing the whole series to a single epoch. Granting this, it is of course still true that horizons will have to be elucidated and will probably show marked differences in their contents. The good fossiliferous levels in the Roan Mountains are high up, but some distance below the tops of the mesas. In certain places they are indeed on top, but this occurs on spurs from the main elevations which have been worn down to a lower level. The fossil-bearing beds are known as the oil shales, and the hard gray rock will burst into flame when placed on a fire. At very numerous places assessment holes have been dug and, although it is doubtful whether the money thus invested will be recovered, the palæontologist finds most of his heavy work done for him and has only to pick up and split the shale upon the dumps. Now indeed is the golden time to collect fossils in this area, as in five years' time the exposed shales will have crumbled to dust and it is not probable that the digging of holes will continue indefinitely.

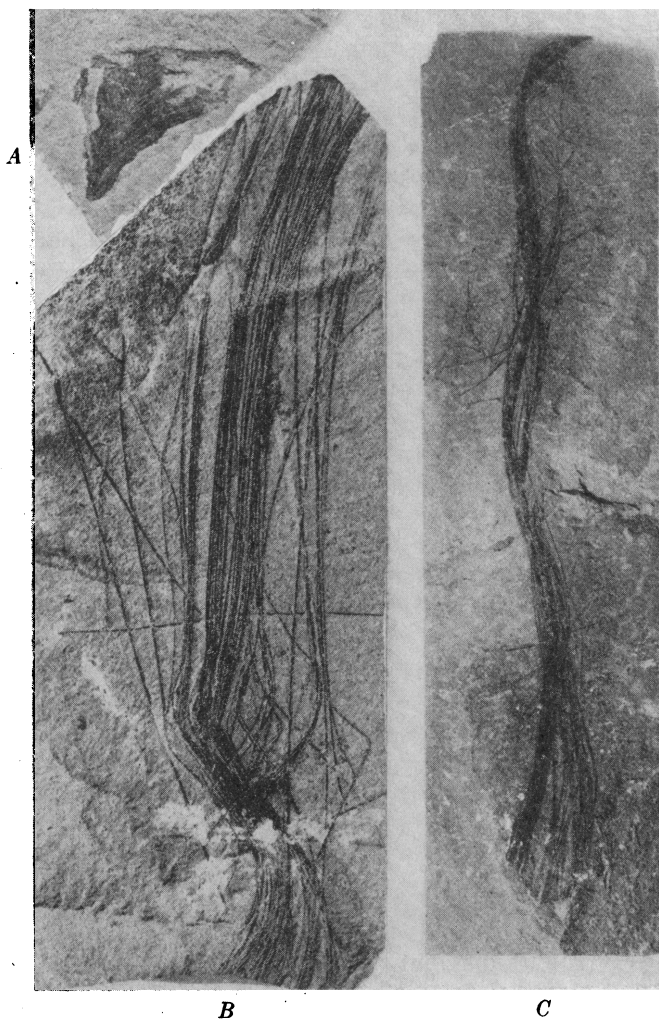


Fig. 1. Feathers from the Eocene.
A, Contour feather of unknown bird.
B, C, Plumage of *Diatryma (?) filifera*.

Passing up the old Ute trail above Seller's Ranch, a mile or more before reaching the Osborn cabin, there is a considerable excavation which we designated Station No. 1. The holes, blasted out in successive years, are like so many gigantic steps on the side of the mountain, the uppermost practically on the top. Later on it will be possible to describe

the fossil insects and plants taken from this location. Among other things, we found a typical contour feather of a bird, perhaps the oldest ordinary feather known (Fig. 1). At the lowest hole, which was in general unproductive, Mrs. Cockerell was so fortunate as to find long strands of plumage which look as if they might have come from the very *Diatryma* figured by Mr. Christman. Repeated study, with lens and microscope, shows that they are not vegetable fibres, nor are they mammalian hairs. They are not filoplumes, according to Chandler's ('A Study of the Structure of Feathers, with Reference to their Taxonomic Significance,' Univ. of Calif. Publ., Zoöl., 1916) definition, but are like the very slender simple feathers of the Casuariformes, particularly the cassowary. Chandler says of the cassowary:

The naked terminal portion of the feather, which sometimes constitutes three-fourths of the entire feather and reaches a length of over 20 cm., sometimes has the stiff bristle-like naked barbs present in decreasing numbers all the way to the tip, where there are only two or three per centimeter on each side, while in other cases, especially in shorter feathers, the naked shaft is produced as a very coarse, stiff bristle.

The fossil plumage now described had a length of fully 20 cm., probably much more. It was apparently very dark, appearing black upon the stone. It was soft and wavy, not bristly. All the filaments appear to be perfectly simple. The average filament has a diameter of about 65 μ ; but there also occur slender, pale brown ones only half as wide. The surface mottling resembles that in Chandler's figure of *Casuarinus*. In places the filaments are bent instead of curved. There is no resemblance to the plumage of *Cariama*, but, as compared with the cassowary, the plumage seems to have been even more filiform, more delicate and soft, less bristly.

Among the known Eocene birds, this could only have come from *Diatryma*. The horizon is considerably higher than any known for that genus and no doubt a different species, at least, is concerned. Until we know more about the matter, this plumage may be designated ***Diatryma*** (?) ***filifera***, new species.