# A CONDOR FROM THE UPPER PLIOCENE OF KANSAS

By HARRISON B. TORDOFF

Until recently, vulture remains were absent from the collection of several hundred fossil avian bones collected over the past twenty years by Claude W. Hibbard and his associates in Kansas. This gap in the otherwise fairly complete Rexroad avifauna of the Upper Pliocene was filled in the summer of 1958, when Hibbard's party found a tarsometatarsus in nearly perfect condition. The bone is that of an undescribed American vulture which was larger than a modern King Vulture (*Sarcoramphus papa*) but smaller than a California Condor (*Gymnogyps californianus*). The fossil and Recent species of the Cathartidae are well known through the careful work of Loye Miller, Hildegarde Howard, and Harvey I. Fisher, whose researches provide a sound basis for study of this new vulture.

The Rexroad species appears to parallel *Teratornis merriami* in some respects. Nevertheless, it clearly belongs to the Cathartidae rather than to the Teratornithidae because it has the following distinctively cathartid characteristics (Miller and Howard, 1938: 169): Facet for metatarsal I faces posterolaterally rather than posteriorly as in Teratornithidae; intercotylar tuberosity high and conspicuous, not low and rounded; hypotarsal block not as symmetrically quadrangular as in Teratornithidae and separated from head of tarsometatarsus by a narrow groove, rather than by a broad, smooth depression; excavation of shaft on anterior face below head deep and sharply vaulted proximally, instead of blending into head as in Teratornithidae (*Cathartes,* however, resembles the Teratornithidae in this respect, rather than its relatives in the Cathartidae).

Although the Rexroad tarsometatarsus is certainly cathartid, it differs from other known genera of the family at least as much as they differ from each other. For this reason it is here assigned to a new genus and species.

## **Pliogyps** new genus

*Type.*—*Pliogyps fisheri* new species.

*Diagnosis.*—Agrees with Cathartidae and differs from Teratornithidae as described above. Differs from other cathartid genera in relatively huge trochlea for digit III; proximal articular surface of tarsometatarsus large and shaft thick in comparison to length of bone; general form of tarsometatarsus columnar, with symmetrical lateral flaring both proximally and distally; shaft less deeply and extensively excavated anteriorly than in *Cathartes, Coragyps, Sarcoramphus, Vultur,* or *Gymnogyps,* resembling *Breagyps* in this respect except that excavation is relatively narrower in *Breagyps*; hypotarsus merges distally into shaft by means of a broad, rounded ridge in contrast to narrower ridge in other cathartids (some specimens of *Breagyps* approach *Pliogyps* in this regard); groove of trochlea for digit III ends anteroproximally in shallow but distinct pit—this is variable in other vultures at hand but only some *Cathartes* equal the condition in *Pliogyps.*

*Discussion.*—*Phasmagyps* Wetmore (1927) from the Oligocene of Colorado is known only from part of a tibiotarsus. It seems to be closest to *Coragyps* and thus is not related on a generic level to *Pliogyps.*

*Palaeogyps* Wetmore (1927), also from the Colorado Oligocene, is known from the lower part of a tibiotarsus (type) and the proximal third of an associated tarsometatarsus. Wetmore considered it to be a small condor; it is somewhat smaller than *Pliogyps* and shows differences which are certainly of generic value. In *Palaeogyps,* the hypotarsus is narrow and long (equal in length to the width of the shaft at the level of the distal end of the hypotarsus); in *Pliogyps* the hypotarsus is broad and short (only half as long as the width of the shaft at this level). The posterior surface of the hypotarsus is divided by a ridge in *Pliogyps* and is undivided in *Palaeogyps.* The proximal articular surfaces of *Palaeogyps* differ considerably from those of *Pliogyps* in shape and size.

Although the foregoing do not constitute a complete list of differences, they suffice to preclude close relationship between *Palaeogyps* and *Pliogyps*.

*Cathartidarum* Winge (1888) is known from a Pleistocene humerus from Brazil. It was about the size of *Coragyps* and seems to have been related to *Sarcoramphus* (Miller, 1931:71).

Another fossil vulture requiring consideration is *Sarcoramphus kernense* (Miller, 1931), from the middle Pliocene of California. This species is represented by the distal part of a humerus which differs from that of the modern King Vulture in being larger, more robust, and relatively shorter. Although the humerus of *Pliogyps* is unknown, it also can be confidently assumed to have been larger and relatively more robust than in *S. papa*.

As discussed later, *Pliogyps* is suggestive of *Teratornis merriami* in proportions of the tarsometatarsus. If one assumes that the humerus would have the same relationship to the length of the tarsometatarsus in *Pliogyps* as it does in *Teratornis,* then a simple calculation shows that the transverse diameter of the distal end of the humerus in *Pliogyps* might be approximately 42 mm., whereas it is 38.7 mm. in *S. kernense*. If the assumption is made that tarsal length in *S. kernense* would have the same relationship to humeral size as occurs in *S. papa,* then the computed tarsal length of *kernense* is 111 mm. versus 94 mm. in *Pliogyps*. Finally, if it is assumed that *S. kernense* has the proportions of *T. merriami,* then the computed length of tarsometatarsus for *kernense* is 89 mm., as compared to 94 mm. in *Pliogyps*. These computations prove nothing. They do, however, provide some additional basis for my admittedly subjective opinion that the humerus of *S. kernense* and the bone here described as *Pliogyps* do not represent the same species.

Both *Sarcoramphus kernense* and *Pliogyps* are from the Pliocene, which fact perhaps increases the possibility that they might be conspecific. However, *Pliogyps,* apart from size, is as different from *S. papa* as from any other cathartid. There is no doubt that it is generically distinct from *Sarcoramphus,* and it seems probable that the humerus would also show distinctive generic characteristics, although Fisher (1944:294) states that there are only slight generic differences between cathartids in the distal portion of the humerus. If associated material is ever found which proves *S. kernense* and *Pliogyps* to be identical, then *kernense* must be transferred from *Sarcoramphus* to *Pliogyps* on the basis of the distinctive characteristics of the tarsometatarsus.

*Vultur fossilis* (=*Sarcoramphus fossilis* Moreno and Mercerat, 1891:27, pl. 18), from the Pleistocene of Argentina, is thought by Fisher (1944:294) to be conspecific with *Vultur gryphus*, which it equals in size. *Vultur patruus* (Lönnberg, 1902) is based on a tarsometatarsus and femur from the Pliocene of Bolivia. It, too, Fisher thinks may be conspecific with *Vultur gryphus*; it is certainly larger than *Pliogyps* (*V. patruus,* tarsometatarsus, 118 mm. in length; *Pliogyps,* 94 mm.) although smaller than average *gryphus* (tarsus, 130 mm.). In any event, *fossilis* and *patruus* belong in *Vultur* and therefore are not closely related to *Pliogyps*.

### **Pliogyps fisheri** new species

*Type*.—Right tarsometatarsus, lacking trochlea for digit IV; edges of articular surfaces slightly worn; otherwise in excellent condition. Fully mineralized, light brown in color, trochleae pale tan. University of Michigan Museum of Paleontology no. 38319, from upper Pliocene, Rexroad formation, Rexroad fauna, Locality 3, Rexroad Ranch, W ½, SW ¼ Sec. 22, T33S, R29W, Meade County, Kansas. Collected on July 25, 1958, by Claude W. Hibbard and party.

*Diagnosis*.—Same as generic diagnosis. In size, tarsometatarsus larger than *Coragyps* and *Cathartes*; smaller than *Vultur, Breagyps,* and *Gymnogyps*; approximately the same length as *Sarco-*

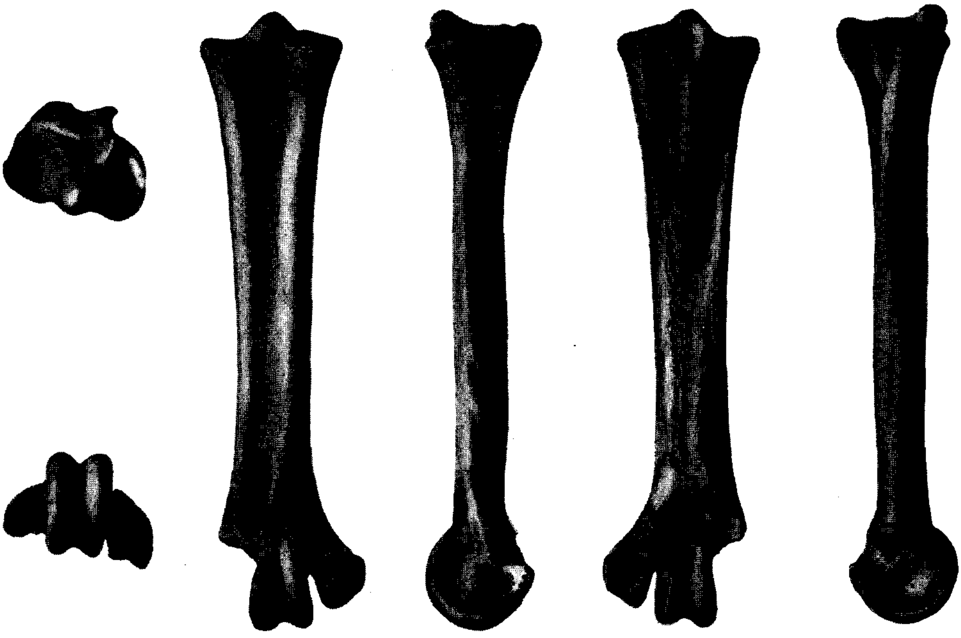

Fig. 1. Tarsometatarsus of *Pliogyps fisheri*, type, University of Michigan Museum of Paleontology no. 38319: upper left, proximal end; lower left, distal end; left to right, anterior, medial, posterior, and lateral views. Seven-eighths natural size.

*ramphus papa* but considerably more robust; somewhat larger than *Palaeogyps*; considerably larger than *Phasmagyps*.

*Pliogyps fisheri* is named for Harvey I. Fisher, in recognition of his definitive studies of the functional anatomy of the New World vultures.

*Discussion.*—The detailed studies of vultures by Loye Miller, Fisher, and Howard provide a basis for judging the adaptations of *Pliogyps fisheri*. Although it seems not to be closely related to any cathartid heretofore known, it is nevertheless a "condor,"—a relatively heavy-bodied bird, poorly adapted for rapid walking or running, and powerful in flight. Evidence for an essentially graviportal hind limb is provided by the thick columnar shaft of the tarsometatarsus, the relatively shallow excavations on the anterior face of the shaft and on each side of the hypotarsus, the nearly symmetrical flaring of the shaft both proximally and distally, the large proximal articular surfaces, and the extremely large trochlea for digit III. The total effect of the tarsus of *Pliogyps fisheri* is that of a symmetrically constructed support designed to bear considerable weight. A numerical evaluation of the sturdy proportions of the bone can be seen in table 1, where measurements and ratios of this bone are given for various cathartiform birds. *Pliogyps* is distinctive in this assemblage in the following ways:

1. In transverse diameter of the head in relation to total length of the tarsometatarsus, *Pliogyps* is equalled or exceeded only by *Teratornis* and *Breagyps*. In sagittal diameter of the head in relation to length, *Teratornis* and *Cathartornis* are the only genera which are greater than *Pliogyps*.

2. The transverse diameter of the shaft in *Pliogyps* is greater in relation to tarsal length than in any other vulture.

3. In sagittal diameter of shaft divided by total length, *Pliogyps* is exceeded only by the two teratorns and *Breagyps*.

4. The various ratios involving the dimensions of the trochlea for digit III show that *Pliogyps* has relatively the largest trochlea of any vulture studied and that this trochlea is narrower transversely in relation to the sagittal diameter.

Precise interpretation of these ratios is difficult. The extreme development of trochlea III would be expected in a strongly cursorial bird, as an adaptation parallel to that seen in ostriches and modern horses. It is inconceivable to me, however, that the short, robust, columnar tarsus belonged to a bird adept at running. Instead, the conclusion that *Pliogyps fisheri* was very heavy-bodied, short-legged, and consequently awkward on the ground seems inescapable. The large articular surfaces probably served primarily to support great weight. Digit III was probably very stout although perhaps not particularly long. Koford (1953:30) noted that the deepest part of the footprint of California Condors was made by the distal third of digit III. This is proof of the importance of this digit and its trochlea in supporting body weight.

Table 1

Measurements and Ratios of the Tarsometatarsus of Vultures

Measurements

| Species and no. specimens | Total length | Proximal width | Distal width | Distance proximal end to tibialis insertion |
|---|---|---|---|---|
| *Palaeogyps prodromus* (type) | ........ | 19.5 | ........ | 17.3 |
| *Cathartes aura* (3) | 68.0 | 14.4 | 15.3 | 10.3 |
| *Coragyps atratus* (2) | 81.5 | 15.1 | 16.8 | 12.0 |
| *Sarcoramphus papa* (2) | 98.5 | 20.8 | 23.5 | 16.0 |
| *Breagyps clarki* (10) | 120.1 | 27.6 | 29.4 | 22.0 |
| *Gymnogyps amplus* (10) | 125.0 | 27.4 | 31.2 | 21.7 |
| *Pliogyps fisheri* (1) | 94.0 | 21.9 | ........ | 14.5 |
| **Teratornis merriami* (over 25) | 138.0 | 32.5 | 33.0 | 25.3 |

| Species and no. specimens | Least transverse diam. shaft | Sagittal diam., middle of shaft | Transverse diam., trochlea III | Sagittal diam., trochlea III | Greatest sagittal diam. of head |
|---|---|---|---|---|---|
| *Palaeogyps prodromus* (type) | ........ | ........ | ........ | ........ | ........ |
| *Cathartes aura* (3) | 7.4 | 4.8 | 5.7 | 8.6 | 11.2 |
| *Coragyps atratus* (2) | 6.7 | 5.4 | 6.7 | 9.8 | 11.6 |
| *Sarcoramphus papa* (2) | 10.8 | 6.8 | 8.8 | 11.7 | 14.8 |
| *Breagyps clarki* (10) | 12.6 | 10.1 | 11.9 | 17.3 | 21.4 |
| *Gymnogyps amplus* (10) | 14.2 | 9.5 | 12.0 | 16.4 | 20.3 |
| *Pliogyps fisheri* (1) | 11.4 | 7.7 | 9.6 | 15.2 | 17.0 |
| **Teratornis merriami* (over 25) | 14.3 | 12.3 | 12.7 | 20.5 | 27.4 |

Ratios

| Species | Trans. diam. head/ total length | Sagittal diam. head/ total length | Trans. diam. shaft/ total length | Sagittal diam. shaft/ total length | Trans. diam. trochlea III/ total length | Sagittal diam. trochlea III/ total length | Trans. diam. trochlea III/ sagittal diam. trochlea III |
|---|---|---|---|---|---|---|---|
| *Cathartes aura* | .212 | .165 | .109 | .071 | .084 | .126 | .663 |
| *Coragyps atratus* | .185 | .142 | .082 | .066 | .082 | .120 | .684 |
| *Sarcoramphus papa* | .211 | .150 | .110 | .069 | .089 | .119 | .752 |
| *Breagyps clarki* | .230 | .178 | .105 | .084 | .099 | .144 | .688 |
| *Gymnogyps amplus* | .219 | .162 | .114 | .076 | .096 | .131 | .732 |
| *Pliogyps fisheri* | .234 | .181 | .122 | .082 | .102 | .162 | .632 |
| **Teratornis merriami* | .236 | .195 | .102 | .088 | .091 | .143 | .635 |
| **Cathartornis gracilis* (type) | .224 | .188 | .085 | .087 | .090 | .146 | .613 |

* Measurements and ratios from Fisher (1945:738).

There is little likelihood that a vulture so poorly adapted for running was flightless, even though the hind limb, because of its shortness, also seems poorly adapted for launching the bird into the air. Probably takeoff from level ground was accomplished primarily by flapping of the wings, which must have been extremely powerful to lift the heavy body, perhaps accompanied by a few hops but not by a long run. Fisher (1945: 739) suggested a similar method of takeoff for *Teratornis*; the launching problem faced by *Pliogyps* probably was as difficult as in *Teratornis*.

In mountainous terrain, Recent condors regularly jump from elevated perches on cliffs and trees for takeoff. Often, however, they find their food in valleys or on level plains and must therefore be able to fly from level ground. Strong winds make it easier for these heavy birds to take off from the ground. Consequently, terrain and wind velocity are important factors in their distribution (Koford, 1953:53). Undoubtedly the extinct condors were affected by the same factors.

These conclusions indicate that *Pliogyps* might well have nested in mountainous terrain and foraged over the Great Plains, where flight would be aided by the steady winds. *Pliogyps* probably fed on the horses, camels, proboscideans, and other large plains-dwelling herbivores of the Rexroad fauna.

*Pliogyps fisheri* shows no close relationship to other vultures. Its extreme specializations make it unlikely that it was ancestral to any known Pleistocene or Recent vulture.

*Specimens examined.—Pliogyps fisheri,* 1; *Gymnogyps amplus,* 10; *G. californianus,* 2; *Breagyps clarki,* 10; *Sarcoramphus papa,* 2; *Coragyps atratus,* 2; *Cathartes aura,* 3; *Teratornis merriami,* 10; various Accipitridae.

*Acknowledgments.*—Dr. Hildegarde Howard, of the Los Angeles County Museum, generously loaned me tarsometatarsi of fossil vultures from the Pleistocene tar pits of California for comparative purposes. Dr. Herbert Friedmann, of the United States National Museum, loaned me specimens of the California Condor. William L. Brudon, of the University of Michigan Museum of Zoology, made the drawings reproduced here. Partial support for this study came from a Faculty Research Grant from the University of Michigan Horace H. Rackham School of Graduate Studies. Paul Slud, Peter Stettenheim, Robert W. Storer, and Alexander Wetmore gave me helpful advice. I am grateful to Claude W. Hibbard for permission to study this interesting fossil.

## SUMMARY

*Pliogyps fisheri* is described as a new genus and species of vulture of the Cathartidae from the Upper Pliocene of Kansas. Comparison of *Pliogyps* to fossil and Recent vultures indicates that it was a short-legged, heavy-bodied bird suggestive in proportions of the huge extinct teratorns. *Pliogyps* was probably clumsy on the ground but powerful in flight. Takeoff from level ground presumably was accomplished by vigorous flapping of the wings, perhaps accompanied by a few hops but not by a long run.

## LITERATURE CITED

Fisher, H. I.

1944. The skulls of cathartid vultures. Condor, 46:272–296.

1945. Locomotion in the fossil vulture *Teratornis*. Amer. Midl. Nat., 33:725–742.

Koford, C. B.

1953. The California condor. Res. Rept. No. 4, Nat. Audubon Soc., 154 pp.

Lönnberg, E.

1902. On some remains of a condor from Bolivia. Geol. Inst. Uppsala, 6:11 (original source not seen).

Miller, L.
1931. Bird remains from the Kern River Pliocene of California. Condor, 33:70–72.
Miller, L., and Howard, H.
1938. The status of the extinct condor-like birds of the Rancho La Brea Pleistocene. Univ. Calif. Los Angeles Publ. Biol. Sci., 1:169–176.
Moreno, F. P., and Mercerat, A.
1891. Catalogo de los pajaros fosiles de la Republica Argentina. Ann. Mus. La Plata, Paleont. Argentina, 1:71 pp., 21 pls.
Wetmore, A.
1927. Fossil birds from the Oligocene of Colorado. Proc. Colorado Mus. Nat. Hist., 7 (2):14 pp.
Winge, G. O. B.
1888. Fugle fra Knoglehuler i Brasilien. Copenhagen Univ., Zool. Mus., E Museo Lundii, 2(5):33–34 (original source not seen).

*Museum of Zoology, University of Michigan, Ann Arbor, Michigan, January 7, 1959.*