

*Buteo conterminus* from the early Pliocene of Nebraska is larger than *Spizaetus schultzi*, has the facet for metatarsal I more proximally situated, the outer ridge of the external trochlea less extended posteriorly, and the trochleae less arched (Wetmore 1923).

*Buteo typhoius* from the Upper Miocene of Nebraska (Wetmore 1923) has a more distinct anterior groove on the face of the shaft, the shaft thicker antero-posteriorly, and the external trochlea larger and more blunted posteriorly than in *Spizaetus schultzi*.

*Buteo fluviaticus* (Miller and Sibley, Condor 44:39-40, 1942) from the Oligocene of Colorado has the shaft of the tarsometatarsus wider above the trochleae, the middle trochlea larger, and the trochleae less strongly arched than in *S. schultzi*.

*Buteo antecursor* (Wetmore, Bull. Mus. Comp. Zool. 75:297-311, 1933) from the Upper Oligocene of Wyoming has a less elongate tarsometatarsus than *Spizaetus schultzi*, and *B. ales* (Wetmore, Ann. Carnegie Mus. 16:403-408, 1926) from the lower Miocene of Nebraska is smaller and has the trochleae less arched.

This is the second record of *Spizaetus* from the Central Great Plains and the oldest reported occurrence of the genus. The other record from this region and the next oldest occurrence is *S. tanneri* from the Blancan of Nebraska (Martin, Condor 73:248-250, 1971). North American fossil species of *Spizaetus* fall into 2 groups: large massive forms which seem similar to *Aquila* (*S. tanneri*, *S. willetti*, and *S. pliogryps*), and smaller more lightly built forms (*S. schultzi* and *S. grinnelli*).

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**The bony stapes in the Upupidae and Phoeniculidae: evidence for common ancestry.**—Krause (Die Columella der Vögel, Berlin, R. Friedländer and Sohn, 1901) examined the form of the avian bony stapes in a number of groups, but no comprehensive study has yet been achieved. As I reported earlier (Feduccia, Auk 91:427-429, 1974), most of the nonpasserine orders, and the entire "oscine" passerine assemblage of birds possess a bony stapes resembling the primitive reptilian condition, with a flat footplate, and a straight bony shaft. This type of stapes (Fig. 1) no doubt represents the retention of the primitive condition. Both the New and Old World suboscines possess a characteristic derived morphology of the bony stapes, and this I interpreted (op. cit.) as evidence for common ancestry of the Old and New World groups. In the examination of the coraciiform families (to be presented in detail later) I discovered that the Hoopoe (Upupidae: *Upupa epops*) and the wood-hoopoes (Phoeniculidae: *Phoeniculus purpureus* and *Rhinopomastus cyanomelas*) also possess a common derived morphology of the bony stapes which is found in no other of the more than 1000 species I have examined. This type of stapes (Fig. 1) is characterized by a flat bony footplate, but with a short but wide shaft that bifurcates into 2 processes. There is a long, laterally directed thin process, and a shorter, broad process, both of which connect to the tympanic membrane via extracolumellar ligaments, and no doubt function in a complex lever system.

The possession of this bizarre type of stapes in both the Upupidae and Phoeniculidae I interpret as a strong indication of monophyly of the 2 groups that points *a fortiori* to

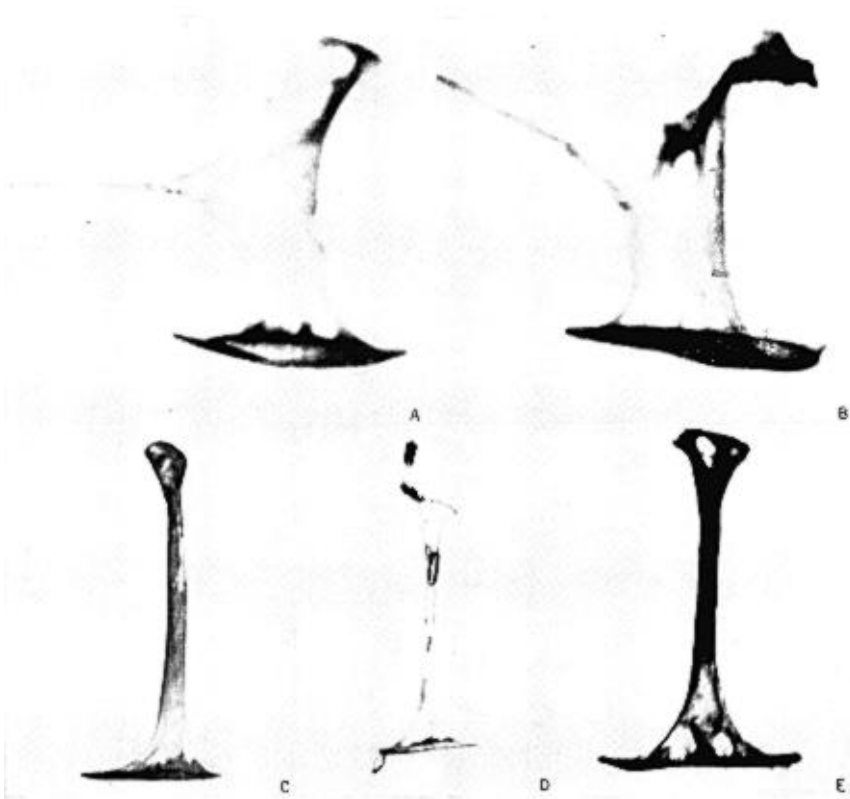


FIG. 1. Alizarin-stained stapes of A, *Upupa epops* (Upupidae); B, *Phoeniculus purpureus* (Phoeniculidae); C, *Leptosomus discolor* (Leptosomatidae); D, *Coracias noevia* (Coraciidae); and E, *Berenicornis albocristatus* (Bucerotidae). The stapes of *Phoeniculus* is slightly damaged. C, D, and E represent the primitive condition for birds; *Colius* has a similar stapes. All approximately  $\times 10-30$ .

their uniqueness. Because of this very unusual common character, and because there are few "good" characters to ally them with the other members of the Coraciiformes, I suggest that they are best treated as 2 families within an order Upupiformes, as Stresemann (*Aves. In Handbuch der Zoologie*, vol. 7, No. 2, W. deGruyter, Berlin, 1927-34) suggested, but that the hornbills (Bucerotidae) not be included within the order until evidence for evolutionary affinity can be aptly demonstrated. Whether or not the woodhoopoes and Hoopoe are considered as separate families or subfamilies of a Upupidae is a matter of arbitrary decision.

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