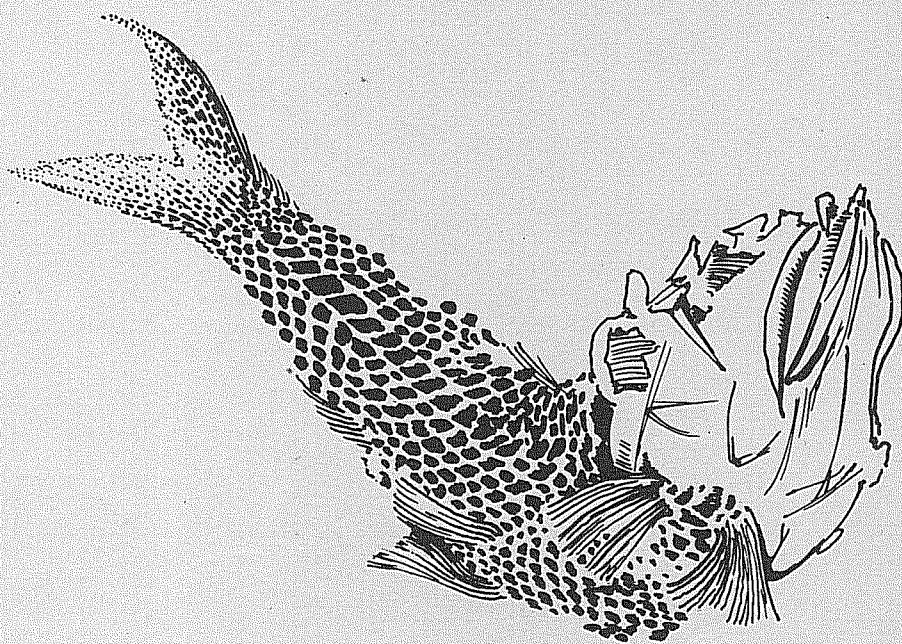




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KEVIN PADIAN (1)

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Note of a new specimen of pterosaur (Reptilia: Pterosauria)  
from the Norian (Upper Triassic) of Endenna, Italy

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SUMMARY.- A partial wing of a rhamphorhynchoid pterosaur, found in marine strata of the "Calcare di Zorzino", is proportionally larger than any specimen previously found from the Norian horizons of northern Italy. Its wing span was between 150 and 160 cm. A specific designation is not given here because no features of the preserved material are diagnostic. This specimen indicates that pterosaurs of considerable size were already present in the Upper Triassic, contemporaneous with the smaller forms Eudimorphodon ranzii and Peteinosaurus zambellii.

RIASSUNTO.- L'ala incompleta di uno pterosauro ranforincoide, trovata nei sedimenti marini del "Calcare di Zorzino", è proporzionalmente più grande di quella degli esemplari trovati precedentemente negli orizzonti del Norico dell'Italia settentrionale. L'apertura d'ali di questo ranforincoide è circa 150 - 160 cm. Qui non ne viene fatta una classificazione specifica perchè le caratteristiche del materiale preservato non bastano per una sufficiente diagnosi. Questo esemplare dimostra che nel Triassico superiore, contemporaneamente alle forme piccole di Eudimorphodon ranzii e di Peteinosaurus zambellii, erano già presenti pterosauri di taglia rilevante.

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In 1978 a local collector of fossils, Sr. Claudio ALBERGONI, found three pterosaurian wing bones, one of them incomplete, in a slab of calcareous laminite from the Val Bruciata in Endenna, near Bergamo, Italy. He subsequently donated these remains to the collections of the Museo Civico di Scienze Naturali in Bergamo, where they were given the collection number 4562. It is my pleasure to thank Mr. Rocco Zambelli for his permission to prepare a short note of the specimen, and Dr. Rupert Wild of the Staatliches Museum für Naturkunde Stuttgart for his cooperation and helpful advice. My study was supported by a grant from the National Science Foundation (U.S.), DEB-780211.

The specimen was collected from the Middle Norian horizons of the Val Bruciata, near the highest levels of the formations known as the "Calcare di Zorzino," some meters below their boundary with the argillites of the Riva di Solto. It comes from a group of fossiliferous strata dated on the basis of ammonites, and which also contain fish and (more rarely) crustaceans. These horizons are in a position similar to those of Cene, ten kilometers distant, from which the two recently discovered genera of Late Triassic pterosaurs, Eudimorphodon ranzii Zambelli 1973 and Peteinosaurus zambellii Wild 1978, were recovered.

Three of the four phalanges of the wing-finger (Digit IV) are preserved, the distal two in their entirety, and the second lacking an indeterminate length at the distal end (Figure 1). Because the preserved end of this bone has a concave joint surface, it must be the proximal end; therefore, the bone is the second wing-phalanx, since the proximal end of the first wing-phalanx has a characteristic hinge-like shape which articulates with the wing metacarpal. The dimensions of all three bones are provided in Table One.

While there is a certain allometric growth component in the

TABLE ONE

Dimensions of specimen No. 4562,  
Museo Civico di Scienze Naturali, Bergamo.

	<u>length</u>	<u>width of proximal end</u>	<u>median width of shaft</u>	<u>width of distal end</u>
wph 2	123 (inc.)	13	6	(est. 11)
wph 3	135	10	4	7
wph 4	109	6	1	1

All measurements in millimeters.

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skeletons of pterosaurs (Wellnhofer 1970, 1978; Mateer 1976, MS.), the proportions and forms of the long bones, particularly those of the wing, are highly consistent within species and are often diagnostic (Padian, unpublished data; Wild, pers. comm.). Although the present specimen is incomplete, its proportions can be compared to those of other pterosaurs. Such comparisons often allow precise taxonomic placement, but that is not possible here for reasons given below. Some idea of the wingspan, however, can be had from the preserved portion, and this will be treated in turn.

The third and fourth wing phalanges are complete, but the proportions of these two bones are neither species-specific nor highly consistent within single species, mainly because the size of the fourth wing-phalanx is so variable. The proportions of the second and third wing-phalanges are better indicators of systematic position, but unfortunately here the distal end of the second phalanx is missing. As preserved, the ratio wph 2 / wph 3 is 0.91 in this specimen. There is no sign of the characteristic broadening

towards the distal (incomplete) end, which is seen clearly in the third wing-phalanx. Therefore the length of wph 2 must have been somewhat longer, and its ratio to wph 3 somewhat greater than 0.91. This would remove it from the range of ratios seen in Peteinosaurus, Eudimorphodon, and Dimorphodon (see Table Two). It is not certain just how much larger this phalanx may have been, but an additional 10 to 50 mm would be the approximate range of the missing distal end, as shown in Table Two. Figure Two summarizes these comparisons: the possible expected lengths of wph 2, based on other pterosaurian taxa, are drawn to scale. In Dorygnathus bantensis, for example, the second and third wing-phalanges are approximately equal. If the same proportion applied to the Endenna wing, an estimated 12 mm would be missing from the distal end; and so forth.

It appears that the Endenna wing differs from the two other genera of pterosaurs from these strata in both absolute size and proportion: it is twice as large as the type specimen of Eudimorphodon and three times larger than Peteinosaurus. However, the allometric consequences of size increase in these two genera cannot be predicted with certainty, and no features characterize the preserved material from Endenna as either belonging to one of these taxa or forming a new and distinct taxon. Nor can the Endenna wing be referred with any confidence to a Jurassic genus of rhamphorhynchoid, for while its size may be consistent with specimens of Dimorphodon, Dorygnathus mistelgauensis (Wild 1971), or Campylognathoides zitteli, it is also noteworthy that the distributions of pterosaurian genera are highly endemic. They are not long-lived and are geographically restricted to small areas. Isolated bones or fragments found in distant places or in questionable horizons have, in the past, often been referred to well-known genera such as Rhamphorhynchus or Pterodactylus, but these assignments have never been based on diagnostic characters and are of little

TABLE TWO  
Relationships of second and third wing-phalanges in some rhamphorhynchoid pterosaurs.

	ratio wph 2 wph 3	length wph 2	length wph 3	length of wph 2 based on wph 3 = 135	difference from preserved length of wph 2 = 123
<u>Peteinosaurus zambellii</u> <sup>a</sup>	.925	43	46.5	125	negligible
<u>Eudimorphodon ranzii</u> <sup>a</sup>	.90	63	67	122	negligible
<u>Dimorphodon macronyx</u> <sup>b</sup>	.90	124	139	122	negligible
<u>Dorygnathus banthensis</u> <sup>c</sup>	1.00	105.5	104	135	12
<u>Campylognathoides liasicus</u> <sup>d</sup>	1.14	108	95	154	31
<u>Campylognathoides zitteli</u> <sup>e</sup>	(1.27)	est. 210	165	171	48
<u>Rhamphorhynchus muensteri</u> <sup>f</sup>	1.08	114	106	146	23

<sup>a</sup> holotype (Wild 1978). <sup>b</sup> British Museum (Natural History) 41212. <sup>c</sup> BM(NH), undescribed. <sup>d</sup> Staatliches Museum für Naturkunde Stuttgart, No. 50.735. <sup>e</sup> holotype, Staatl. Mus. f. Nat. Stuttgart. <sup>f</sup> after Wellnhofer 1975, ex. 43.  
All measurements in millimeters.

value. It would be equally imprudent to assign the Endenna material to a known taxon solely on the basis of size. Finally, a new name is not given to this specimen at this time because there are no diagnostic characters present in the material as preserved. It must be remembered, however, that all Italian pterosaur remains have been recovered only within the past decade; it is hoped, therefore, that new material, capable of providing a sufficient taxonomic designation of this specimen, will eventually be unearthed, and for this reason such designation is postponed.

The wing span of the Endenna specimen is problematical. The preserved material, while incomplete, provides a minimum length for this segment of the wing, and comparison of these measurements with those of other rhamphorhynchoids (Padian, unpublished data) produces an estimate of between 150 and 160 cm for the total wing span. This is approximately the size of the largest known specimen of the Liassic genus Dimorphodon, which Owen reconstructed in 1870. As mentioned earlier, all the other pterosaur specimens from the Late Triassic of Italy are considerably smaller -- less than half this size.

The pterosaurs of the Italian Triassic have been noteworthy for many reasons. They have extended the known temporal range of pterosaurs into the Norian, nearly contemporaneous with the earliest occurrences of dinosaurs in terrestrial localities elsewhere. They have revealed highly derived and surprisingly unique features in this group, such as multi-cusped, polymorphic dentition, unicusped pterygoidal teeth, and sesamoid bones dorsal to the ultimate joint of each foreclaw (Wild 1978). And they have raised anew questions about the interrelationships of Mesozoic archosaurs and the origins of major taxonomic groups. The present find affirms that, in addition to the relatively small pterosaurs already known from the



Italian Triassic, there were pterosaurs of a size comparable to the largest known forms from the Liassic and later Jurassic horizons. This expands our understanding of the diversity of these animals and raises the possibility of an adaptive radiation at a very early stage in the history of pterosaurs, a group which remained highly successful for 130 million years.

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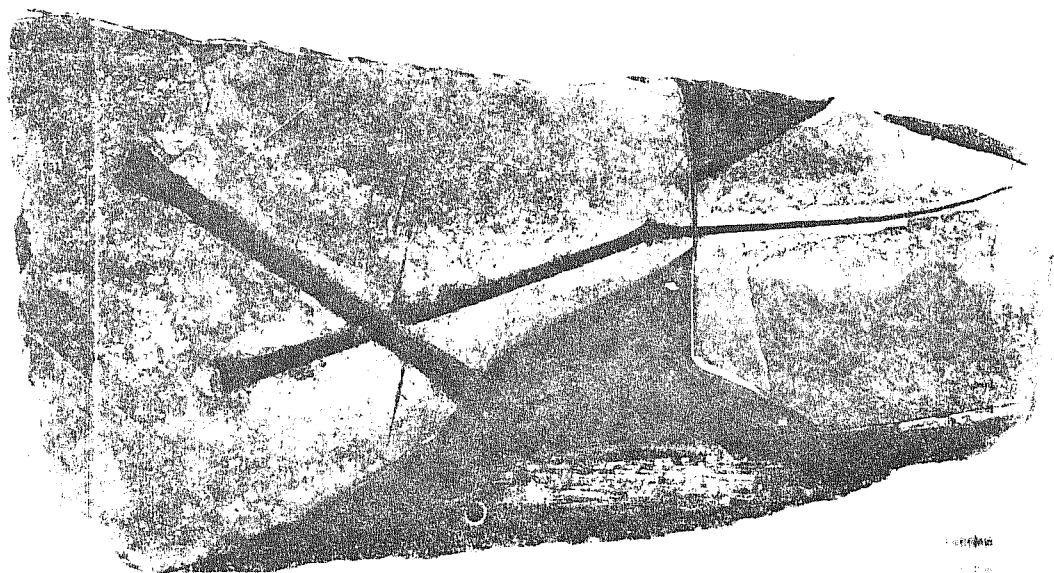


Figure One. Partial pterosaur wing from Val Bruciata, Museo Civico di Scienze Naturali (Bergamo) No. 4562. Measurements are given in Table One.

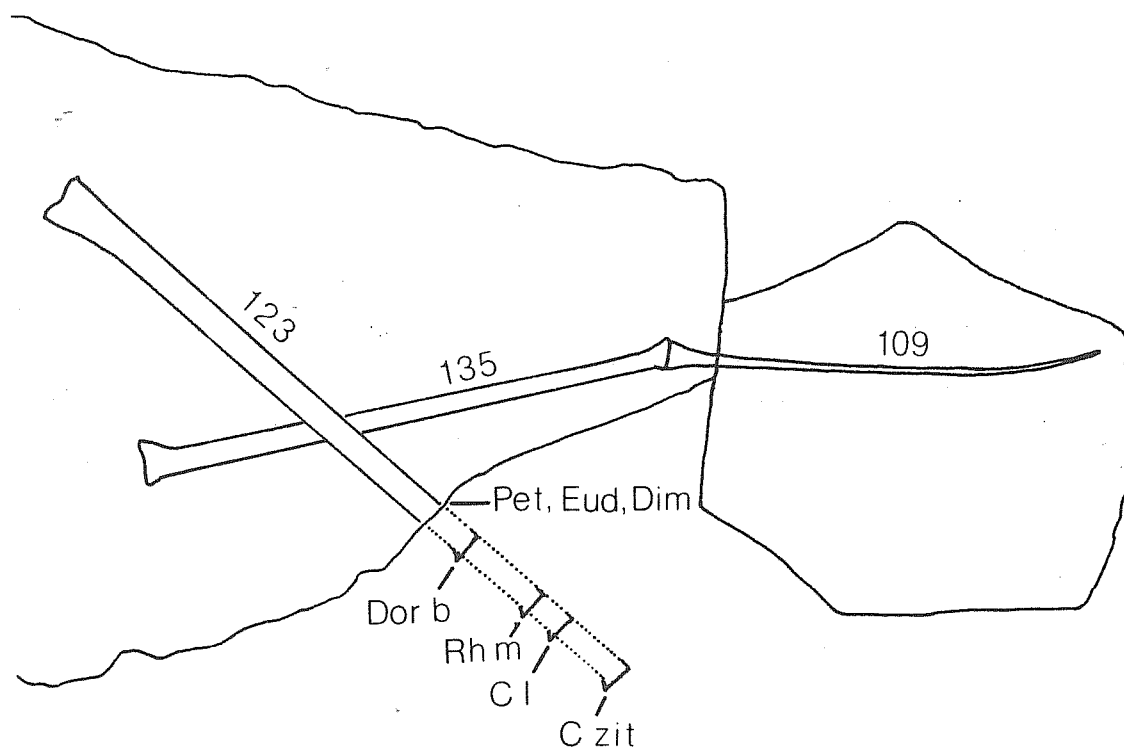


Figure Two. Expected complete lengths of second wing phalanx, based on various rhamphorhynchoid taxa. Measurements given in Table Two. For explanation, see text. Abbreviations: C l, Campylognathoides liasicus; C zit, Campylognathoides zitteli; Eud, Eudimorphodon; Dim, Dimorphodon; Dor b, Dorygnathus banthensis; Pet, Peteinosaurus; Rh m, Rhamphorhynchus muensteri.