Young C C; 1964, On a New Pterosaurian from Sinkiang, China, Vertebrate Palasiatica, vol.8 pp.221-225

ON A NEW PTEROSAURIAN FROM SINKIANG, CHINA

YOUNG CHUNG-CHIEN

(Institute of Vertebrate Palaeontology and Palaeoanthropology, Academia Sinica)

INTRODUCTION

In the summer of 1963 an interesting collection was made by Mr. C. M. Wei of the Palaeontological Division, Institute of Science, Bureau of Petroleum of Sinkiang. The whole collection was sent to the Institute of Vertebrate Palaeontology and Palaeoanthropology for identification. This shows the first confirmation of a Pterosauria in China. All the remains are classified in the sub-order Pterodactyloidea (generally) and will be described in the present paper. As the field data on the occurrence of this find are unavailable, except for the attached illustrations and a few oral quotes given by A. L. Sun and H. T. Chao, I prefer to restrict the present paper to the Palaeontological study only. The geological condition will be given later, when new information is forthcoming.

DESCRIPTION

Order Pterosauria Owen 1840

Suborder *Dsungaripteroidea* suborder nov**. Family *Dsungaripteridae*** Fam. nov.

With the diagnosis of the type genus *Dsungaripterus.*

Dsungaripterus gen. nov.

With the diagnosis of the type species *Dsungaripterus weii.*

Dsungaripterus weii sp. nov.

Type Anterior part of the skull and lower jaws; two neck vertebrae, thirteen consecutive vertebrae including three posterior "Notarium", three posterior dorsal vertebrae and seven sacral vertebrae, seven consecutive caudal vertebrae, two isolated distal caudal vertebrae; the proximal end of the left humerus, probably a left ulna, the distal part of both wing-metacarpals, both first digits, of the fourth finger and three following digits of the left side of the same; nearly complete pelvic girdle with both sides and both femora articulating with the sacrum in almost natural position and proximal part of the left tibia. All these specimens are associated with one individual. In addition a few fragmentary and internal moulds of some long bones are provisionally mounted to the panel reconstruction of the named specimens and a few unused ones are considered as also belonging to this individual. Field number 960. Catalogue number of the Institute V.2776.

Referred specimens Proximal and distal ends of humerus and probably ulna, a distal part of a femur and much damaged pelvic girdle and some other fragments. Field number the same as the type. They were found from the same site. Catalogue number V.2777.

Horizon and locality Upper part of Lower Cretaceous (CR 3/1, as labelled) from Urho, near the mouth of the Chiangmuho (Paiyangho), N. W. border of Dsungari Basin, Sinkiang.

Diagnosis Rather large pterodactyloid. Anterior part of the skull laterally compressed, sharply pointed and bending upwards. With well developed median crest above the nasal and preorbital opening. Prenasal opening length of the snout longer than prenasal and preorbital openings. Both are apparently completely confluent. Lower jaws firmly connected by

symphysis. Also sharply pointed with the tip of the symphysis bending upwards. Teeth with backward curving point. They are well separated except the posterior ones of the upper jaw. Upper jaw teeth probably twelve and lower jaw teeth eleven in number. The anterior teeth of the lower jaw are small and tend to be reduced. "Notarium" present. Sacrum composed of seven vertebrae. Fourth metacarpal very long. The four flight fingers considerably long. The total width of the wings presumably between three and three and half meters and nearly four times that of the length of the animal. Pelvic girdle of typical pterodactyloid construction. Femur comparatively long, longer than half of the first flight finger. It is anterio-posteriorly curved. Tibia must be longer than the femur and is straight.

Skull and lower jaws

Skull Only the anterior part of the skull is preserved. In both sides of the skull, part of the border of the nasal and preorbital openings can be clearly traced. The posterior border is broken but is probably close to the break. The two openings are apparently confluent. There is a distinct obliquely oriented furrow on both sides which clearly marks the line between the premaxilla and the maxilla. The tip of the anterior end is truncated. The premaxillary part is sharply compressed. Looking from the side the pointed part of the skull forms a very weak upward curve. About 45mm in front of the nasal and preorbital opening there is a well developed and strong crest. The well-marked notch suggests that the crest must extend backwards some distance. Its height remains unknown. At the posterior part of the fracture of both sides there is no trace of the jugal. On the ventral side of the skull the whole part is formed by the premaxilla and the maxilla. But it is possible that the internal nasal opening may be at or very near to the broken part, now filled by plaster. There is a distinct median ridge and a lateral furrow at each side which can be traced up to the very tip of the skull.

The presence of the supra-preorbital crest is only found in *Pterodactylus kochi* Wagner described by Plieninger (1901-1902) and we have reasons to assume that the posterior part of the skull of our form may be rather similarly constructed as the named form. In assuming this idea, the length of the skull posterior to the nasal and preorbital opening should be shorter than the part before this opening.

Preserved length, 275mm; Estimated length 285mm; length from the tip to the anterior border of the preorbital opening, 190mm; Height of the skull anterior to the crest, 35mm; the same at the posterior part of the preorbital opening, 22mm; Breadth of the skull near the anterior fracture, 4mm; near the anterior border of the preorbital opening 47mm; near the posterior fracture 82mm.

There are twelve teeth or alveoli preserved in the left side and eleven in the right side. Judging from the posterior extension of the nasal and preorbital opening and comparing with the lower teeth, it seems that there are no more teeth posterior to the last preserved one or at most one or two teeth lost. The preserved posterior part of our specimen seems to be overlapped by the jugal. If so, the number of the upper teeth should be 12 or at most 14. There are no teeth in the anterior part of the jaw, which is about 130mm long. With the exception of the last five teeth at the posterior part, all the others are rather widely spaced. The widely spaced teeth are sub-equal in size. The last one of the spaced teeth of both side are well preserved. They are short crowned and with weakly posterior pointing tips and almost smooth surface. The last five teeth are more closely situated and clearly behind the last tooth of the lower tooth row, and probably not functional. The small tooth of the left side (the one before the last alveolus) shows that those teeth are bi-cuspid. It is difficult to assume how they function with the lower teeth, unless the lower jaw can be moved anterio-posteriorly. Length of the whole preserved upper tooth row is about 153mm.

Lower jaw The two lower jaws are firmly connected by the part of the symphysis which is about 187mm long. It is marked by a longitudinal weak ridge. On the ventral side, both jaws are fully co-ossified. The both lower jaws converge anteriorly in order to form a sharp point; the very sharp tip of the specimen is unfortunately broken. Looking from the lateral side (the left side is better preserved) the lower border of the posterior part of the jaw behind the seventh tooth, counting from the anterior end, is perfectly straight. But from there the lower jaw bends conspicuously upwards in accordance with the nature of the upper jaw, but much stronger. There are two fragments apparently belonging to the posterior part of the lower jaws, one (the larger one) to the left side and the other to the right side. They are much smaller in height when compared with the anterior part of the lower jaw. So, the general shape of the lower jaw is either like that of *Pteranodon* or like that of *Ornithodesmus* (Hooley, 1913, pl. 37, fig. 5). The latter possibility is more probable as the two fragments show more consistency in height. The dental foramen is apparently absent as in the case of the two genera. The two lower jaws diverge only gradually posteriorly about 25 degrees. At the posterior end of the symphysis there is a weak fossa facing posteriorly. Behind the tooth row the upper edge of the lower jaw is distinctly ridged, especially strong in the two fragments. In ventral view there is a distinct shelf at the median posterior part of the symphysis. The surface is weakly but distinctly marked by rugged ornamentation, especially strong in the ventral side at the posterior part of the symphysis (the same can be seen on the upper jaw but is rather indistinct). Such development suggests strongly that the beak of the animal may be reinforced by a horny sheath.

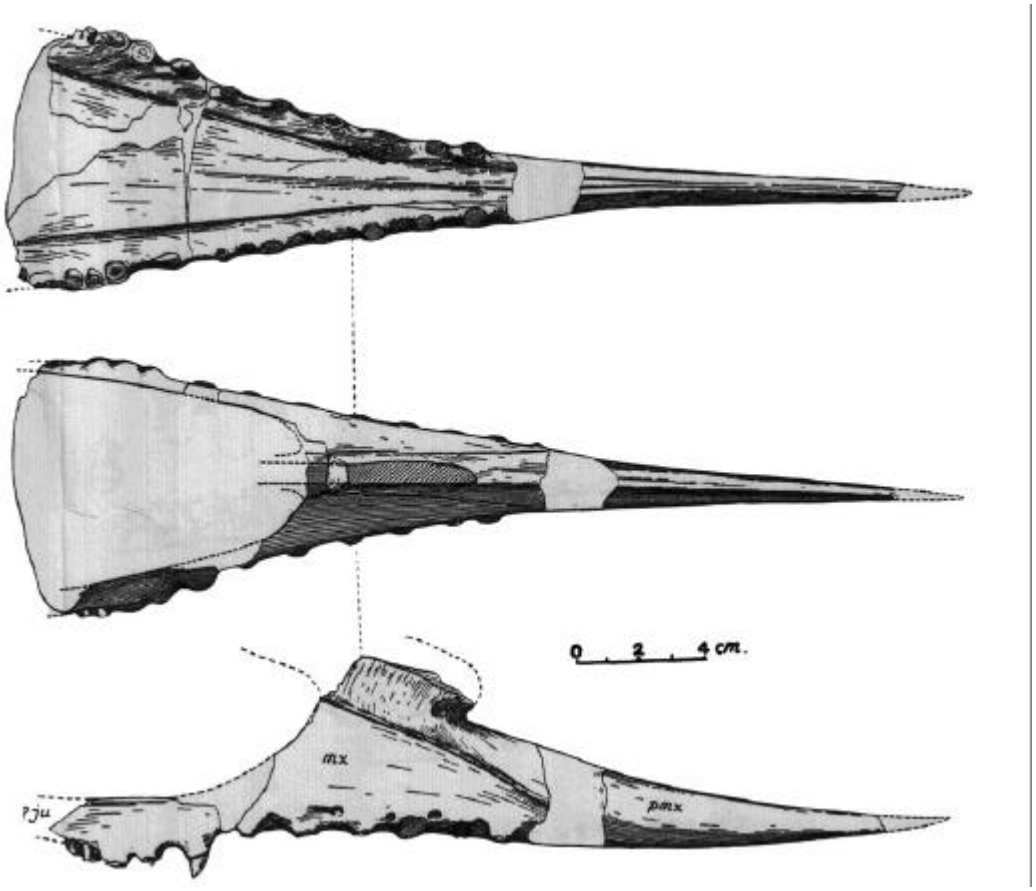

Fig 1. *Dsungeripterus weii*. Gen. et sp. Nov. Anterior part of the skull ventral, dorsal and right side views. ½ nat. size. Abbreviations; ju. Jugal; mx., maxilla; pmx., premaxilla.

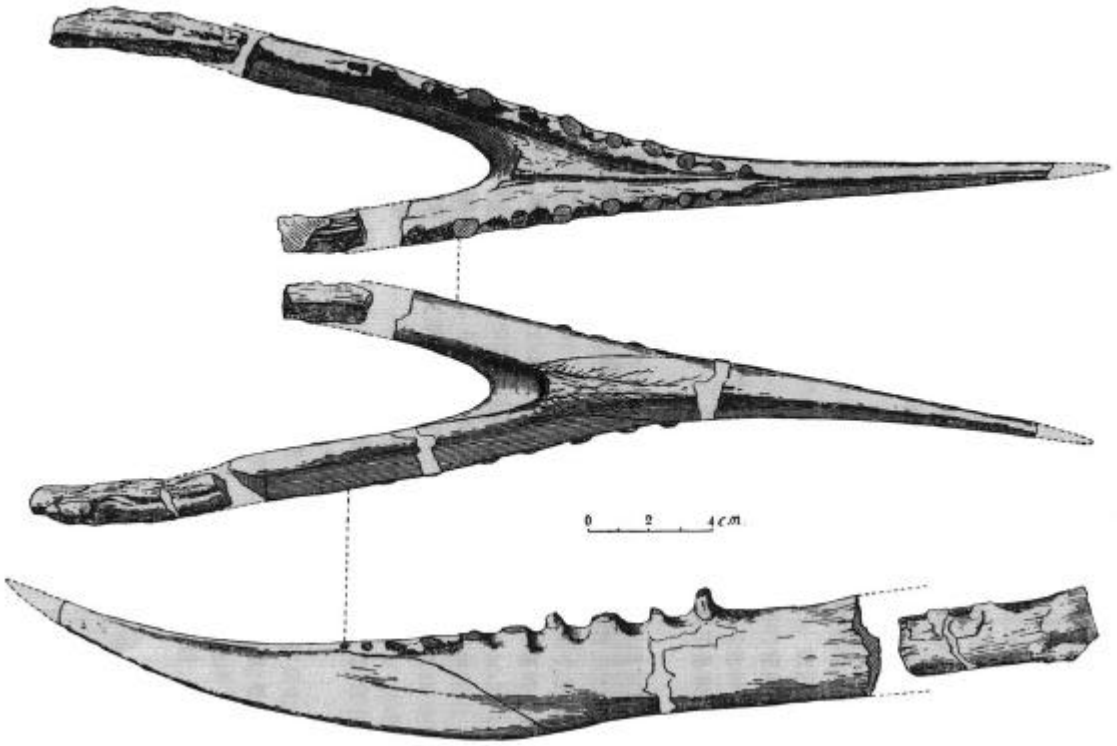

Fig. 2. *Dsungeripterus weii*. gen. et sp. nov. Lower jaw pair in dorsal, ventral and left side views. ½ natural size. This illustration has been reduced to fit on the page. In the original text it was rotated vertically and occupied a full page.

The lower teeth are observed in the left side by alveoli and broken teeth. In the right side the last two are broken. There are eleven teeth in the left side, representing the actual number of the dentition. They are also widely separated as in the case of the upper teeth, but the last two are more closely situated. Most of the teeth are lost or damaged. The better preserved ones, such as the seventh, counting from anterior end, of the right side, the seventh, ninth, and tenth of the left side show some part of the crown. The last named one is the best one with the tip only a little broken. It shows that the tooth is faintly striated with the tip bending somewhat medially and posteriorly. It is interesting that the anterior three teeth are decidedly reduced, especially the first one. The eighth tooth of both sides represents the largest one of the row. Length of the entire tooth row, 138mm. Preserved length of the left side 270mm. Height of the jaw behind the sixth tooth, 36mm. Height of the same behind the eighth tooth, 31mm. The same near the posterior breakage, 31mm. Height of the left broken one 21mm.

In both of the upper and lower teeth, with the exception of anterior two of the lower ones, the bone of the surroundings alveolus is considerably elevated by about three to six millimetres above the level of the upper border of the jaw. In addition, along the lateral border of both upper and lower jaws between each pair of teeth of the middle part of the row, there is a more or less distinct fossa developed. No trace of such feature in the anterior part and posterior part of the row. The function of such development is not clear, probably caused by the opposite tooth as in the case of the crocodiles.

Vertebrae

Neck vertebrae Only two neck vertebrae are preserved. The one illustrated in figure 3. A. represents a middle neck vertebra, probably the third or the fourth one after the atlas and epistropheus. It is actually formed by an internal mould, only the part of the anterior left corner being covered by real bone. The bone is extremely thin, scarcely exceeding one millimetre. The posterior part of the centrum and both postzygapophises are truncated. The ventral side of the centrum is also damaged. The dorsal spine is also broken. Nevertheless the feature of vertebra can be easily recognized. It is typically procoelous. The upper border of the centrum forms a curved sharp ridge. Above it there is an excavated triangular area with the neural canal well preserved. It is almost circular in outline and six millimetres in diameter.

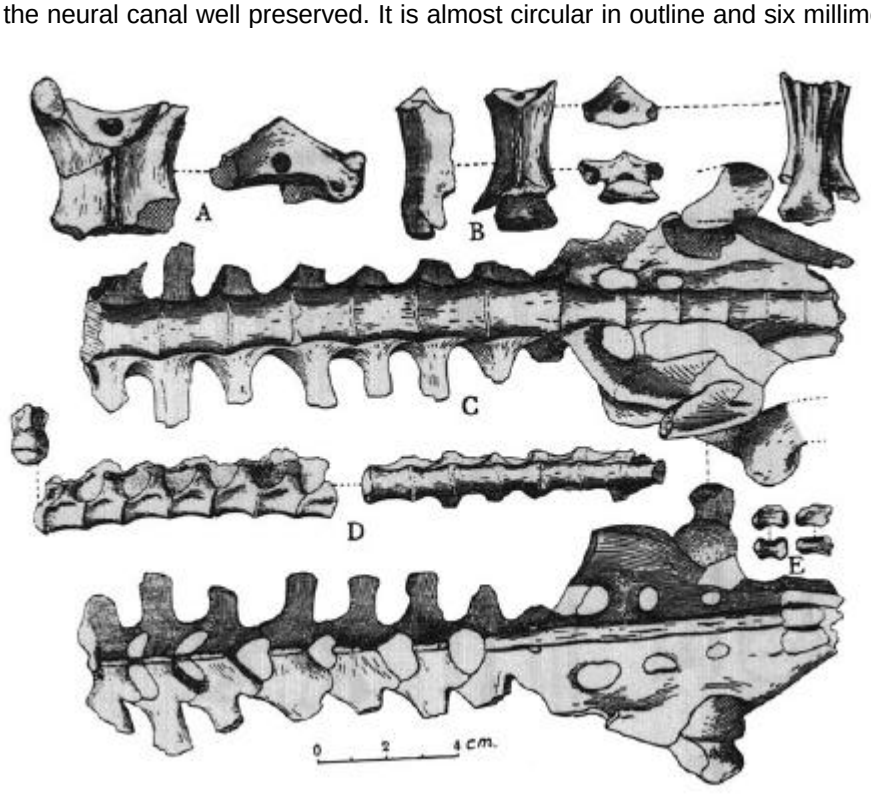

Fig. 3. Dsungeripterus weii. gen. et sp. nov. A. Neck vertebra in dorsal and anterior views; B. Posterior neck vertebra in dorsal, lateral, ventral, anterior and posterior views; C. Sacral vertebrae and the posterior presacral vertebrae in ventral and dorsal views (cf. fig. 6, A); D. Consecutive caudal vertebrae in left side and ventral views with anterior aspect of the first one; E. Two posterior caudal vertebrae in lateral and ventral views. All ½ nat. size.

The prezygapophysis is well preserved in the left side. Its articular surface is large, supported by strong process, and facing almost direct upwards. Behind this the whole vertebra constricts moderately and then expands again posteriorly.

In posterior view the part above the neural canal forms a weakly excavated surface. The broken part of the dorsal spine shows that the root of the spine occupies the whole length of the upper part of the vertebra. Median preserved length, 37mm; anterior breadth, 46mm; breadth at the middle constriction, 31mm; length of the base of the dorsal spine, 27mm.

The second neck vertebra represents probably the last or the one before the last vertebra (Fig. 3, B). It is also mainly formed by a mould with only a few parts covered by real bone. The bone is very thin, much less than one millimetre. The vertebra is better preserved, especially the ventral side, both ends and the left postzygapophysis. Both of the prezygapophysis, the right postzygapophysis as well as the dorsal spine are broken. It is much smaller and slenderer than the preceding vertebra. The postzygapophysis is also weaker. The main part of the centrum is narrow and weakly constricted. All the general features agree, however, with the other vertebra and it undoubtedly belongs to the neck region of the column. In ventral view the anterior part is marked by a prominent anterior longitudinal ridge while the posterior part by a deep and broad furrow. The general characters of this vertebra agree with the neck vertebra of *Ornithodesmus* described by Hooley (1913) but the latter differs from that of ours in a number of distinct features, such as the broader anterior part, evident flatness of the ventral side, etc. Total length, 42mm; breadth at the minimum constriction, 15.5mm; height at the same point, 13mm; posterior width at postzygapophysis, 20mm; diameter of the anterior neural canal, 4.2mm.

"Notarium" (Fig. 3, C. Fig. 6, A.) That the present form is armed with the fused or co-ossified anterior dorsal vertebrae, the so called "notarium" is proved by the last three vertebrae which are cemented firmly together and still sticking to the following dorsal ones and the sacrum. They are certainly the posterior part of the notarium. Since there are no vertebrae preserved between the last described neck vertebra and these three ones, we are not sure about the vertebral number of the notarium. judging from the restoration of *Pteranodon* by Eaton and the complete absence of the facet for the scapula at the lateral side of the fused dorsal spine, we would assume that there must be at least eight vertebrae in this form as in the case of the named genus and not like that of *Ornithodesmus* with only six vertebrae of the notarium, (Hooley, 1913, Pl. 38, Fig. 5).

Although the last three vertebrae of the notarium are starting to fuse together both at the centrums and the neural spines, they look flimsy as in the case of both *Pteranodon* and *Ornithodesmus.* Only part of the centra are co-ossified and there is no sharp junction. The upper part of the neural spine is totally fused but the space between them is rather large forming a conspicuous hole. There is no actual "supra-neural plate formed in our form, at least in the posterior part of the notarium. Whether these features should be interpreted as the specific characters or as the incipient stage of their fusion or as a juvenile development is unclear. The three vertebrae are subequal in length. Total length measured from the ventral side, 51 mm; Length of each anterio-posteriorly, 16.5; 18; 18mm. The diapophysis is short and directs more upwards. They all show damage terminally. The partly fused neural spines are very low only about 12 millimetres above the anterior of the neural canal. There is no distal thickening or a very slight thickening. Certainly there is no supra-neural plate developed in our form. It is also not sure how the distal part of the scapula articulates with the notarium, although the restoration is essentially copied from that of *Pteranodon.* It is probable that the articulation may be somewhat like that of *Ornithodesmus.* In any way the notarium of our form seems to differ quite remarkably from the both named genera. The number of vertebrae is likely to be the same as that of *Pteranodon* but with no supra-neural plate. The articulation may be the same as that of *Ornithodesmus,* but the number of vertebrae is most probably much less. In addition, as noted above, the notarium of our form seems to be distinguished by a lesser degree of co-ossification and the absence of the band-like fusion of the dorsal spines.

The other presacral vertebrae (Fig. 3, C, Fig. 6, A.) After the notarium and before the sacrum there are only three vertebrae still connected firmly in natural position.

Total length measured ventrally, 52mm. Length of each anterio-posteriorly, 17, 17 and 19mm respectively. The diapophysis is very short with the rather small facet for the articulation with the rib. The dorsal spines are widely separated and comparatively higher (13.5mm in the anterior one). The postzygapophysis of the last dorsal vertebra is almost in fusion stage with the first sacral vertebra. In all the general features and the number of the vertebrae posterior to the notarium are essentially comparable with those of *Pteranodon.*

Sacral vertebrae (Fig. 3, C, Fig. 6, **A.)** There are seven firmly fused sacral vertebrae representing the last section of the vertebral complex with the both pelvic girdles and both femora in nearly natural position. The first sacral vertebra is also in a rather fused state with the last dorsal vertebra, both by the centrums and the pre and post-zygapophysis. It is the largest one among the sacrals. Ventral length of the centrum is 21mm. Total height anteriorly, 46mm. The dorsal spine is well separated from the last dorsal vertebra but apparently fused (slightly broken there) with the following spines. Then the size of the following vertebrae decreases considerably backwards. The last one is somewhat damaged, being the smallest. Ventral length anterio-posteriorly, 18, 16, 15, 13, 12 and 11mm respectively. The dorsal spines are fused together and form a continuous band but the separation of them can still be recognizable. The sacral ribs are short and strong. They decrease also in size posteriorly. The intersacral holes are large and decreasing considerably posteriorly.

The last ones are apparently obliterated and concealed behind the ilium. On the whole, the structure of the sacral vertebrae is very similar to that of *Pteranodon,* but differs from the same in some details such as the shape of the holes formed by the transversal processes, etc.

Caudal vertebrae (Fig. 3, D and E) There are seven caudal vertebrae still in consecutive series and two isolated ones. The former cannot be fitted well with the last sacral as the posterior part is damaged. But judged by the size it is very probably that this series is immediately in connection with the sacrum or nearly so (at most one vertebra is missing). It is of special interest to note that the first vertebra is opistho-coelous in nature. It is rather distinctly projecting in the anterior end. Looking from the anterior end there is a weak horizontal ridge. The first vertebra is the strongest with the ventral length 11mm without the anterior projection and the anterior breadth, 11mm. Then the following ones increase in length and decrease in breadth backwards in a very slight manner. The spina dorsal is damaged in most of them but the diapophyses are better preserved and direct upwards. The two isolated vertebrae represent undoubtedly the terminal part of the tail (Fig. 3, E). One or two may be missing between the consecutive series and the two and one or two missing posterior to these two vertebrae. The anterior ends of these two vertebrae are also projecting, proving once more that the caudal vertebrae are opistho-coelous. Length, 9mm.

With the exception of the sacrum which composed of seven, the number of the other parts of the column is not known. In the following reconstruction we assume that the probable number of the vertebral column may be as follows: neck, 9; dorsal 11-12; sacrum, 7 and caudal, 12-14. It is about the same as those of *Pteranodon,* but the tail of our form may be relatively longer.

Anterior limb

No sure scapula and other elements of the pectoral girdle are present, although some of the internal cores may be the former one.

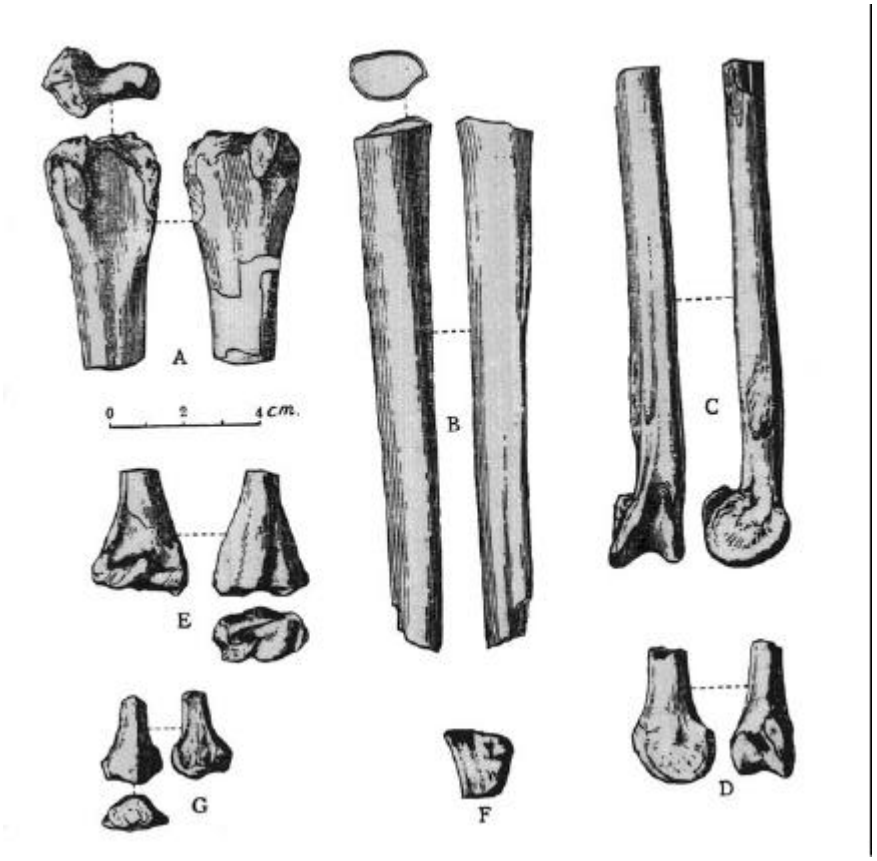

Fig.4. *Dsungeripterus weii*. gen. st sp. nov. Anterior limbs (A-B, E-G) and the wing- metacarpals (C and D) in different views. For setails see text. All ½ nat. size.

Humerus (Fig. 4, A, F.) The humerus is only represented by the proximal part of the left one. The proximal end is much worn and damaged so that the exact shape is rather obscure. Nevertheless, the cresta medialis and the condyle for the articulation to the glenoid surface of the scapula are observable and they two are rather closely situated. The deltoid crest is also damaged but it is well formed and not so strongly as the spiral curved one of *Ornithodesmus.* It is also more highly situated. Distally the shaft narrows gradually towards the distal end and looks rather straight. The preserved end

may be quite near to the minimum constriction of the shaft. Preserved proximal breadth 31mm; breadth near the breakage, 16mm; preserved length, 62mm; estimated length, 125mm.

There is a distal part of a right humerus (V.2777) in a good state of preservation (Fig. 4, E.). It is too small for the present individual. Distal breadth, 23mm. It fits with the small pelvic girdles in association with the larger animal. Preserved length, 31mm. Breadth at the breakage, 10mm. The distal end the bone narrows in a rather sudden way upwards, exact like that of *Ornithodesmus.* It agrees almost in every detail with that of the named form, only the anterior border is straighter and the circular foremen on shaft is less distinct. The trochlea for the radius and the valley for the ulnar ridge are clearly visible.

Two other fragments of the upper part of long bone may represent the humerus of the other individual (V.2777) but they are too poorly preserved for a detailed description. The shape of part of the deltoid crest is detectable. These bones are much smaller than left humerus described above.

The ulna is represented by part of the shaft near the proximal end (Fig. 4, B). The proximal end is unfortunately broken. Preserved length is 132mm. It is strongly convex in the dorsal side and nearly flat in the ventral side. It is apparently the left side. The proximal broken end is rather expanded showing that it must be close to the upper end. The bone narrows gradually distally without the distal expansion, showing that at least one half of the remaining part is missing. The total length of the bone should be nearly 300mm.

The other ulna may be represented by the part of the core with also one side convex and other side flat.

There are two small fragments represented, probably the proximal and the distal part of an ulna (Fig. 4, F, G.). They are small and probably belong to the left side (clearer in the proximal one). The real surface of the proximal is broken. Breadth is 18mm. The distal part is better preserved though in a worn state. Breadth is 15mm.

No remains of the carpals are present in our collection. The pteroid bone is doubtfully presented.

Wing-metacarpal[1] (Fig. 4, C, D.) This interesting bone is only represented by the distal part with the articulator end well-preserved. The one with only a small part of the shaft preserved (Length 35mm; distal breadth, 16mm) is considered to belong to the left side and the other (preserved length 129mm; distal breadth 19mm) the right side. The better preserved right one shows that the shaft is perfectly straight. Breadth near the breakage, 12mm and the thickness at the same point, 10.5mm. Both the dorsal and ventral sides are rather flat, so that the cross section of the shaft looks rather square in outline. The distal condylar part in articulation with the first wing-finger is sharply differentiated. There is a weak prominent and rough surface developed in posterior side about 30mm above the distal end in the right one. In the left one, this surface is immediately broken above the damaged bone. This surface is clearly for the attachment of the wing. Since both the wing-metacarpals are broken, the length of this bone is unknown. But I have the impression that this bone must be rather when considering the better preserved right one. An estimation of the length may reach 300mm, about the same length as that of the ulna.

No confirmed finds of the other metacarpals, but some fragments of the rod-like internal cores may represent those bones.

Wing-phalanges (Fig. 5) The first wing-phalanx of both sides is well preserved. The second one is also complete and is considered to be the left side. The third one is indicated by both ends and the middle part and is reconstructed. It is also thought to belong to the left side. Both ends of the fourth one are damaged and this is probably also the left side. By the good preservation of all the wing-fingers we are able to get a fairly good idea about the structure of the anterior limb, especially the length of the wing. The length of the left first wing-finger 374; the right 377mm; the same of the second, 265mm. The estimated length of the third one, 202mm. The same of the fourth one, 150mm. The total length of the whole four fingers is 991 to 994mm or nearly one meter long.

The proximal end of the first wing-phalanx is considerably expanded and strong. The olecranon-like process is very prominent about 13mm long. The proximal breadth, 37mm. The articular surface is well separated by a sharp ridge for the division of the ulnar and radius facet. They fit quite nicely with the distal part of the wing-metacarpal. The bone is nearly straight and the distal end is only moderately expanded. Breadth 28mm of the left. The anterior foot-like extension of the right one is broken. The distal end is moderately convex. As showing by the breadth of the following phalanges the bone must also be very hollow. The shaft is rather flat about 14mm broad at the middle and 8mm thick. The longitudinal ridge along shaft seems to represent the ventral side and is only weakly developed.

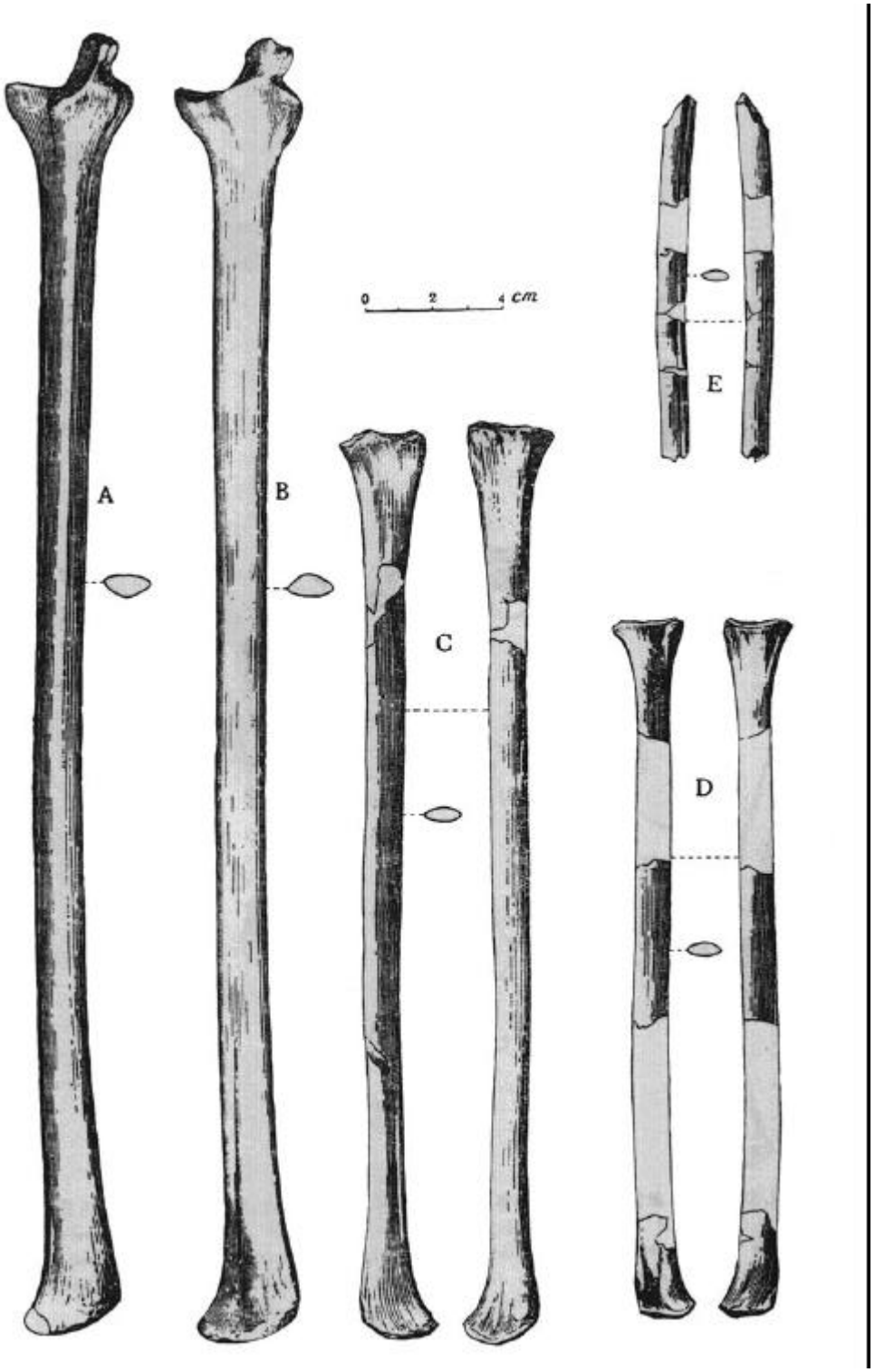

Fig. 5. *Dsungeripterus weii*. gen. et sp. nov. A. Right first wing-finger in ventral view; B. Left first wing-finger in dorsal view; C. Left second wing-finger in two views; D. Third left wing-finger in two views; E. Fourth left wing-finger in two views. All ½ nat. size.

The second wing-phalanx is complete. The proximal end is comparatively weakly expanded with a well excavated concaved surface and the distal end is also distinctly expanded with foot-like outline and convex end. The shaft is essentially the same structure as that of the first one but weaker. The longitudinal ridge is also well developed at the ventral side. Breadth of proximal end, 25mm; the same of the distal end, 21mm. Breadth at the middle of the shaft, 11mm; and thickness of the same 5.5mm.

The third wing-phalanx is partly reconstructed, but both the end and the middle part are in a good state of preservation. It appears to be that both segments belong to the same individual and even to the same side, since there are no other flat bones found in the collection. Both ends are also distinctly expanded with the proximal end concave and the distal end convex. The foot-like outline of the latter is only weakly indicated. Breadth of the proximal end, 20.5mm; That of the distal

end, 16.5mm. Breadth at the middle, 10.5mm and the thickness at the same point, 4.5mm. The weakly convex nature of the dorsal side is still recognizable but the longitudinal ridge disappears completely.

The fourth wing-phalanx is only represented by the middle part. The broader part appears to be the proximal end. The bone is more slender than that of the third one but the general structure is exactly the same. There is no distinct convex and flat side of the shaft but both are weakly convex with one side (apparently the dorsal side) slightly more convex than the other side. Along this side a rather distinct longitudinal groove can be observed along the posterior border of the proximal part becoming weaker distally. Breadth near the proximal breakage, 9mm; The same near the distal breakage, 8mm. Breadth at the middle 9mm and thickness at the same point, 4mm.

The well developed articulated surface between each two wing-phalanges suggests good mobility of the wings in all directions, even in a slight folding posture.

Pelvic girdle and posterior limb

Both the pelvic girdles (Fig. 6,) are articulated with the sacrum in an almost natural position. Unfortunately the anterior and posterior end of the ilium as well as the part of the pubis, the prepubis and the ischium of both sides are damaged, but the real shape of the pelvic girdle can be detected rather satisfactorily. We could get a fairly reliable idea about the construction of the pelvic girdle. All the elements of the pelvic girdle are strongly co-ossified and the suture between them are difficult to detect. However, the suture between the ilium and the pubis, the ilium and ischium and pubis and prepubis may be faintly observed. The other pair of pelvic bones found in isolation (V.2777) supplements the form of the type.

Ilium Both the anterior and the posterior ends of both ilia are broken. The left one is better preserved. The anterior end is extended with rather blunt ends like that of *Pteranodon* and *Nyctosaurus* and not like that of *Pterodactylus.* It ends some way above the anterior part of the second sacral vertebra. This part of the bone is almost straight and cuts posteriorly close to the upper border of the acetabulum. Directly behind the acetabulum, there is a considerable elevation forming a thick part with an upper smooth facet almost side by side with the dorsal spine of sixth sacral vertebra. The posterior projection behind this elevation is rather short as indicated by nearly complete tip of the right side of the paratype V.2777 (Fig. 6, C). The separation with the pubis and the ischium is not clear but it is probable that the ilium occupies at least one half of the border of acetabulum.

Pubis and prepubis The separation of the pubis with the ilium is not perfectly clear but it is very likely that the pubis borders the acetabulum too. In the right pelvic girdle, there is a rather clear line across the lower part of the acetabulum which seems to represent the boundary between the ilium and the pubis and the ischium. In addition the separation of the sacral rib and the pubis is rather clear, not only by suture but also by a distinct process at the very point in connection with the sacral rib. That this part of the pelvic girdle forms the proximal part of the pubis is evidenced by the fact that in all the four specimens, the pubic foramen is clearly seen in the inner side. It is rather high in location quite near to the root of the lower border of the anterior process of the ilium. This clearly indicates that the pubis is also included in the acetabulum. Distally the bone is damaged in all the available specimens, except the right side of the type. In this side the posterior edge of the pubis and prepubis is also damaged, but the anterior border is well preserved and ended distally by a truncated termination. The distal part of the bone represents certainly the prepubis. Just below the level of the acetabulum there is a faint suture-like line running anterior up to the very border of the bone. If this is not a fracture and really a suture, then the pubis and prepubis must be firmly connected or co-ossified.

Ischium The ischium is fused with the pubis and forms an expanded bone, convex moderately externally. It differs from the other pterosaurians by the total absence of the obturator foramen but instead a depression or fossa is developed at the proximal part of the inner side in all the four specimens.

Acetabulum The acetabulum is imperforated but its middle part is extremely thin as shown by the right one of V.2777. It is rather rounded square in outline with the anterio-posterior diameter slightly longer, 25mm of the left side of the type and 17mm in the right of V.2777. Breadth of the distal end of the right prepubis, 17mm.

Femur (Fig. 6, A.) The femur of both sides is well preserved and articulated with its acetabulum but somewhat displaced. Both femora should direct much more sidewards and posteriorly. The femur is a long and slender bone and distinctly curved -posteriorly. The condyle is well separated from the shaft by the long and obliquely directed neck. The articulated surface is moderately convex and smooth. It is differentiated from the neck by a distinct circular ridge, so that the condyle and the neck form a somewhat mushroom-like shape. The latter is well 'constricted and 11mm long from the lateral trochanter. The diameter of the condyle is about 21mm and that of the neck 13mm. The lateral trochanter is strong with a deep lateral fossa. There is also a deep groove running from the posterior lateral side of the neck to the lower lateral part of the trochanter. The bone narrows distally from the lateral trochanter and retains the same degree of

thickness shortly before the distal end where the shaft begin to expand again. The distal end is rather strongly expanded and the medial and lateral condyles are well separated. The shaft curves considerably backwards. Total length, 221mm; breadth of the distal end, 30mm; breadth at the middle of the shaft, 14mm; anterio-posterior thickness, 11mm.

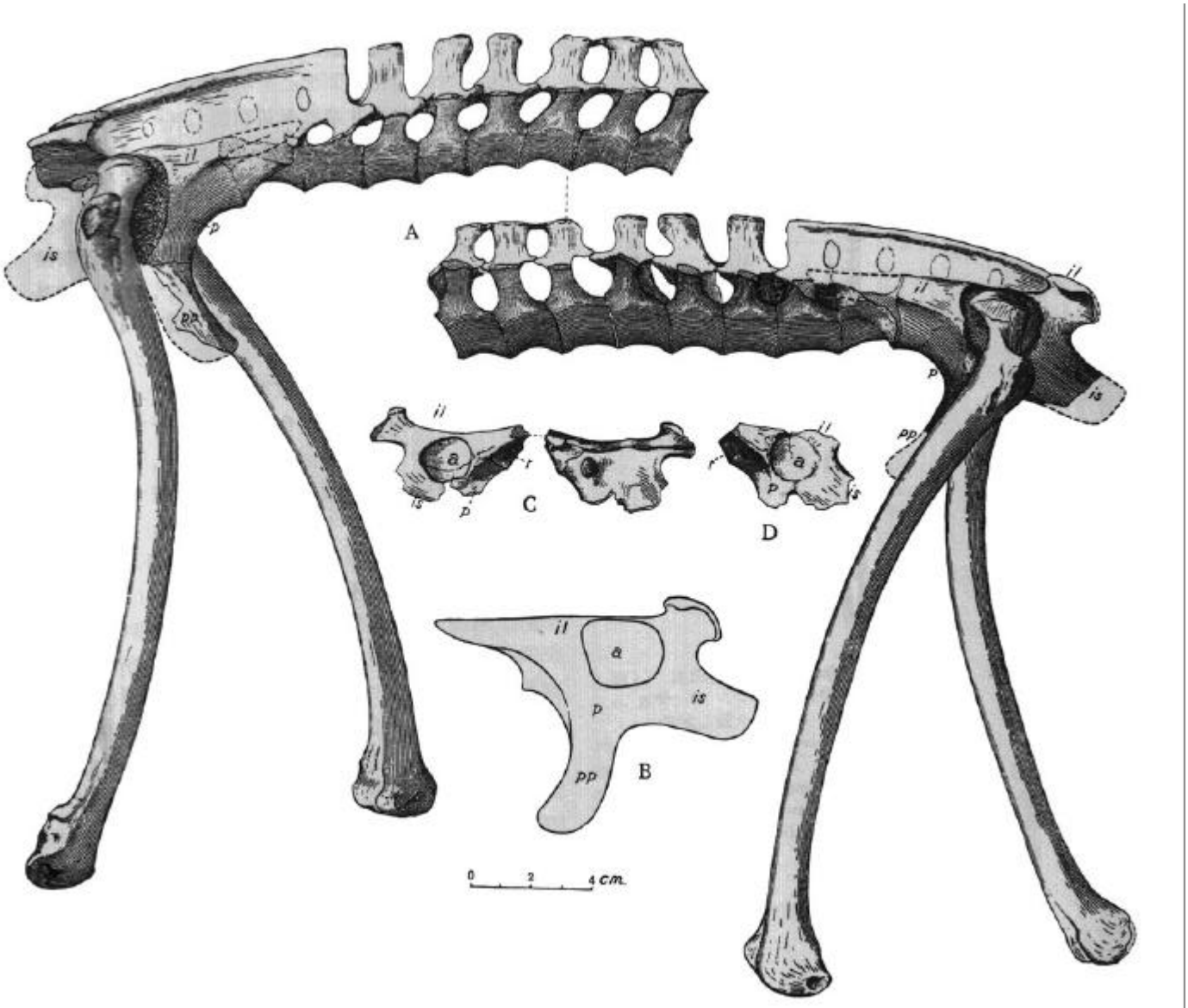

Fig. 6. *Dsungeripterus weii*. gen. et sp. nov. A. Sacral and presacral vertebrae (cf. fig. 3, C.) with both pelvic girdles and both femora in natural position; B. Reconstruction of the right pelvic girdle; C. Left pelvic girdle of V.2777 in lateral and inner views; D. Left pelvic girdle in lateral view. Of V.2777. For details see text. All ½ nat. size. Abbreviations: a, acetabulum; il, ilium; is, ischium; p., pubis; pp, prepubis; r., sacral rib.

A much smaller distal part of a femur (V.2777) (Fig. 7, B.) agrees well with that of the type. Distal breadth, 19mm.

On the whole the femur of the present form is very characteristic and differs very easily from other pterosaurians such as *Ornithodesmus, Pteranodon* etc.

Tibia (Fig. 7, A.) The only tibia is represented by proximal end with the shaft 170mm long preserved. It is interpreted as the left one. The proximal end is considerably expanded, overhanging much the shaft. The proximal surface is shallow concave and the border is somewhat elevated. It faces obliquely laterally. Breadth 27mm and anterio-posterior length, 21mm. The lateral projection of the surface represents the proximal part of the fibula which is completely fused with the tibia. It is broken immediately below the expanded part of the proximal end. The pointed splint of its distal part is probably short. The presence of the vestige of the fibula indicates one of the primitive features of our form. The shaft is perfectly straight and narrows distally very gradually. Its cross section is rounded triangular. The bone wall is

comparatively thick, slightly exceeding one millimetre. The total length of the tibia is unknown, certainly longer than the femur. Estimated length, 270mm.

An internal core, 162mm long, seems to represent the tibia of the other side.

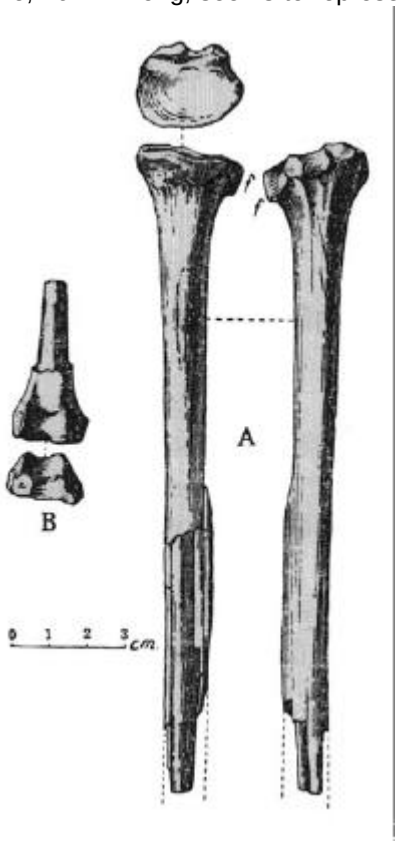

Fig. 7. *Dsungeripterus weii*. gen. at sp. nov. A. Left tibia in two views with the outline of the proximal end; B. Distal part of the femurs of V.2777. in anterior and end views. All ½ nat. size.

Mounting and Reconstruction

Although the present collection is not quite satisfactory and many important parts of the skull, lower jaw and postcranial skeleton are missing, it is possible to make a trial of a panel mounting and a fleshy restoration of the animal. The most important part of the bone especially the anterior part of the skull, and lower jaws, the wing-metacarpals and wing-fingers, part of the notarium, complete sacrum with the pelvic girdles and the femora in satisfactory condition of preservation. The mounting is made by Mr. Y. L. Sou under my direction and the restoration picture by W. L. Shen. The following notes may be added as comments of such work. Needless to say that all of these are provisional and subjected to change, if necessary.

The reconstruction of the skull The anterior part of the skull and the lower jaws are actual. The nasal and preorbital openings are most probably confluent with no bony separation, as is the case in most of the advanced pterodactyloids. The most interesting feature of our form is the presence of the saggital crest in front of and above this opening. Unfortunately its upper border is broken and its posterior extension is unknown. The notch at the base shows the start of the crest first at the anterior, progressing backwards. Such development is only known in *Pterodactylus kochi.* In this form the premaxilla is also sharply pointed and without teeth in the anterior part of the upper and lower jaws. The only difference is that the edentatous part is shorter with the tip part perfectly straight. We have thus reasons to assume that the posterior part of the skull may be rather similarly constructed as the named form as showing in the present reconstruction. It is, however, so restored that the post preorbital part seems to be somewhat larger than the preorbital and nasal opening in order to be more balanced with the long snout. It is absolutely not sure about the posterior extension of the saggital crest but most probably not extends much backwards as in the case of *Pterodactylus kochi.* It is almost certain that there is no posterior extension and the supraoccipital crest is absent.

The lower jaw is for the most part preserved. The posterior part is reconstructed mainly according to *Pterodactylus kochi.* The two fragments of the part behind the dental row do help the reconstruction. They suggest that the posterior part of the lower jaw narrows gradually backwards as in the case of *Ornithodesmus* and most probably no dental foramen as in the same form, because there is not much space left for such a foramen.

On the whole the posterior part of the skull and the lower jaw is reconstructed as given in figure 8 and plate I. The skull of our form is almost like an enlarged skull of *Pterodactylus kochi* but with characteristic upward bending of the anterior part and many other details.

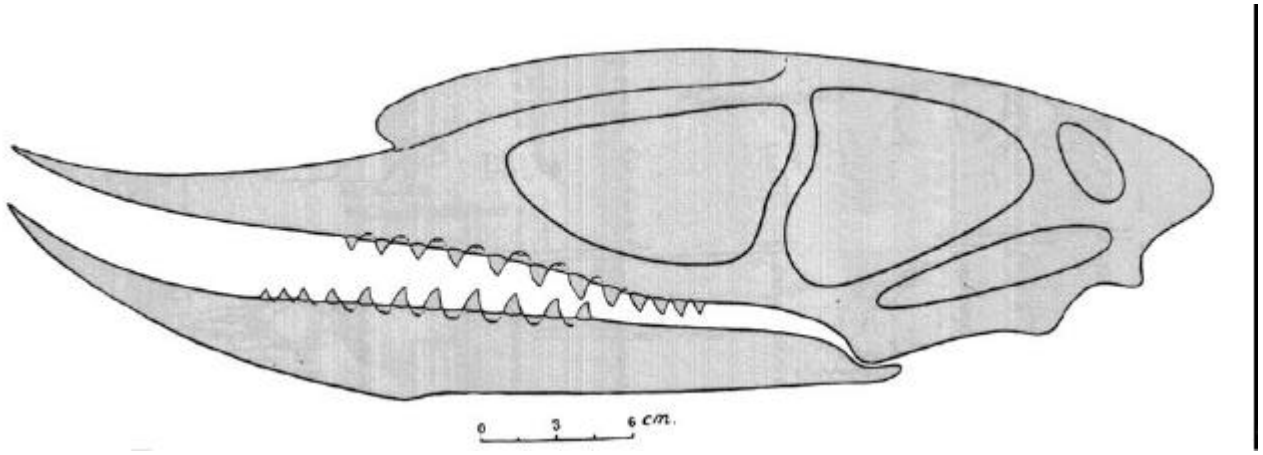

Fig. 8. *Dsungeripterus weii*. gen. at sp. nov. Reconstruction of the skull and lower jaw in side left view. For details see text. 1/3 nat.size.

The vertebral column is also easy to reconstruct because every segment of the column is represented and the posterior part of the column is almost complete. According to the two neck vertebrae, we may assume that the neck vertebrae are quite similar to those of the Ornithocheiridae in a broad sense. Our reconstruction of the neck is essentially made with reference to that of *Pteranodon.* The real shape of the notarium is uncertain but we have reasons to believe that it is neither like that of *Pteranodon* nor that of *Ornithodesmus.* It seems that our notarium is more loosely constructed and eight in number otherwise the body is much too short for the animal. The vertebrae after the notarium are mostly represented by real specimens except a few of the caudal ones which are missing. No doubt that the tail of our form is rather short. The whole column is shown in side view in plate 1.

The anterior limb is less well preserved except for the wing-fingers. There are no pectoral elements preserved at all. The humerus and the lower arms as well as the metacarpals are only represented by fragmentary bones. Our reconstruction of this part mainly adopts the current reconstruction of the Ornithocheirids and is hypothetical. Nevertheless, as shown above in the section of the description, the lower arm, represented by the ulna and the wing-metacarpal are considerably long and both bones may be subequal in length. The four wing-fingers are practically complete and very useful in determining the maximum width of the wings.

Both the pelvic girdles are nearly complete and supplement each other. They are still fixed with the sacrum in their natural position. Their broken parts are shown as dotted line in figure 6, A. and the tentative reconstruction is given in the same Figure 6, B.

Concerning the *posterior* limbs, the lower part of the tibia and the remaining parts are totally missing. Both of the femora are still adhering to the acetabulum but somewhat displaced. Their direction in the reconstruction of the whole animal is not natural. They should direct more posteriorly. The exact length of the tibia is not known. But judged by the preserved part of the left side, it must be rather long as shown in the given reconstruction, considerably longer than the femur. The first wing-finger and the femur are the two only long bones which are complete enough to give their dimensions, which is 58.6mm.

There are no bones preserved after the proximal part of the tibia. The restoration of this part is mainly made with the help of *Pteranodon* and other large *Ornithocheirids* and may be not quite correct.

The entire restoration as shown in the panel mounting plate 1 is presented in a good posture of flying except the two femora which should be direct more posteriorly. The total span of the wings is nearly three and half meters.

A more artistic painting is given in plate II for showing the picture of our animal that lived some 100,000,000 years ago.

Determination and discussion

In the course of the foregoing description, it is quite evident that the Sinkiang fossils belong to the suborder Pterodactyloidea. The question is to which family our form they belong to. It is certainly a new genus and species of which the diagnosis has previously been given.

In the latest classification of Pterodactyloidea there are five families given by Kuhn (1961). The first three families (Pterodactylidae, Ctenochsmatidae and Belonochasmatidae) can be at once excluded from the present consideration. They are either too small or too specialized in their dentition. The systematic position of the family Belonochasmatidae is still problematic and may not be pterosaurian at all (Kuhn, 1961. 4). Our form can evidently be compared with the last two families (Ornithodesmidae and Ornithocheiridae) with the presence of notarium.

In the course of the description made above we have repeatedly used the type genus and species of the family *Ornithodesmus latidens* (Hooley, 1913) for comparison. Nevertheless our form differs from this species fundamentally by many important features such as the long, compressed and upward bending snout, the edentatous nature of the anterior part of the premaxillae and the lower jaws, presumably greater number of anterior dorsal vertebrae of the notarium etc. The skull of the English form is much more lightly constructed and with the nasal and preorbital opening well separated. It is out of the question that our form can not be a member of this family.

It is equally evident that our form is quite different from the members of the family Ornithocheiridae. As noted above we have a conspicuous saggital ridge above the nasal and preorbital opening and presumably no supraoccipital crest as in the case of the genera of this family[2]. Furthermore the Sinkiang form is toothed, although the anterior part of the mouth is edentatous. There is also no supraneural plate developed in the notarium of our form.

It is therefore obvious that the Chinese form represents a new family, the Dsungaripteridae, fam. nov. with the type genus and type species as given in preceding pages.

Relationship and origin of Dsungaripterus By the sharply pointed snout without teeth, the presence of the saggital crest and the general construction of the skull we have the impression that *Pterodactylus kochi* Wagler may represent the ancestral type of form. *Pterodactylus kochi* is derived from the lithographic limestone of Eichstadt, Germany of Upper Jurassic age. According to the description by Plieninger with the well reproduced plate, this form differs from all the other *Pterodactylus* species by the presence of well-developed saggital crest above nasal and preorbital opening and the absence of teeth both in the anterior end of the upper and lower jaws. Together with the rather large preorbital opening and blunt teeth, it is little difficulty that this form could give rise of our form. By the same reasons we feel that it is necessary to erect a new genus for this peculiar type of *"Pterodactylus"* for which the name *Germanodactylus.* (Gen. nov.) is proposed, so the named species should be called G. *kochi* (Wagler). In *Rhamphorhynchus* there is also no anterior teeth of both upper and lower jaws but the other features differ widely from the named form.

The Sinkiang *Dsungaripterus* bears a series of characteristics, notably the upward bending of the snout and the lower jaw. Although the teeth of our form tend to reduce but we do not think that there is any relationship between the toothless *Pteranodon* (and other Upper Cretaceous pterosaurians) and the Chinese species. As before-mentioned it is most probable that there is no supraorbital crest developed in our form.

A suggested classification of Pterosaurians In all the current classification, Pterosauria is divided into two suborders, the long tailed Rhamphorhynchoidea and the short tailed Pterodactyloidea. The former suborder should include only the three families, Dimorphodontidae, Rhamphorhynchidae and Scaphognathidae. The Anurognathidae should be better included in the suborder Pterodactyloidea on account of its short tail and other peculiar characters (see Fig. 9.).

During the present study we feel that it is better to divide the Pterodactyloidea into two suborders. The suborder Pterodactyloidea should be restricted only to those forms without notarium of the Upper Jurassic time. It may include three widely different forms, possible also a fourth one. The crested Germanodactyloidae (new family), the anteriorly toothed Pterodactylidae (with the teeth before the nasal opening) and anuroganthidae with high and short skull. The family Ctenochasmatidae with numerous teeth may belong also to this suborder. The widely different types of this suborder suggest that the radiation of this group of Pterosaurians must have started rather earlier around the Middle Jurassic time, a period of which we know almost nothing about this order. Its relationship with the Rhamphorhynchoidea is not at all sure. The genus *Belonochasma is* a problematic form possibly to he excluded from this order.

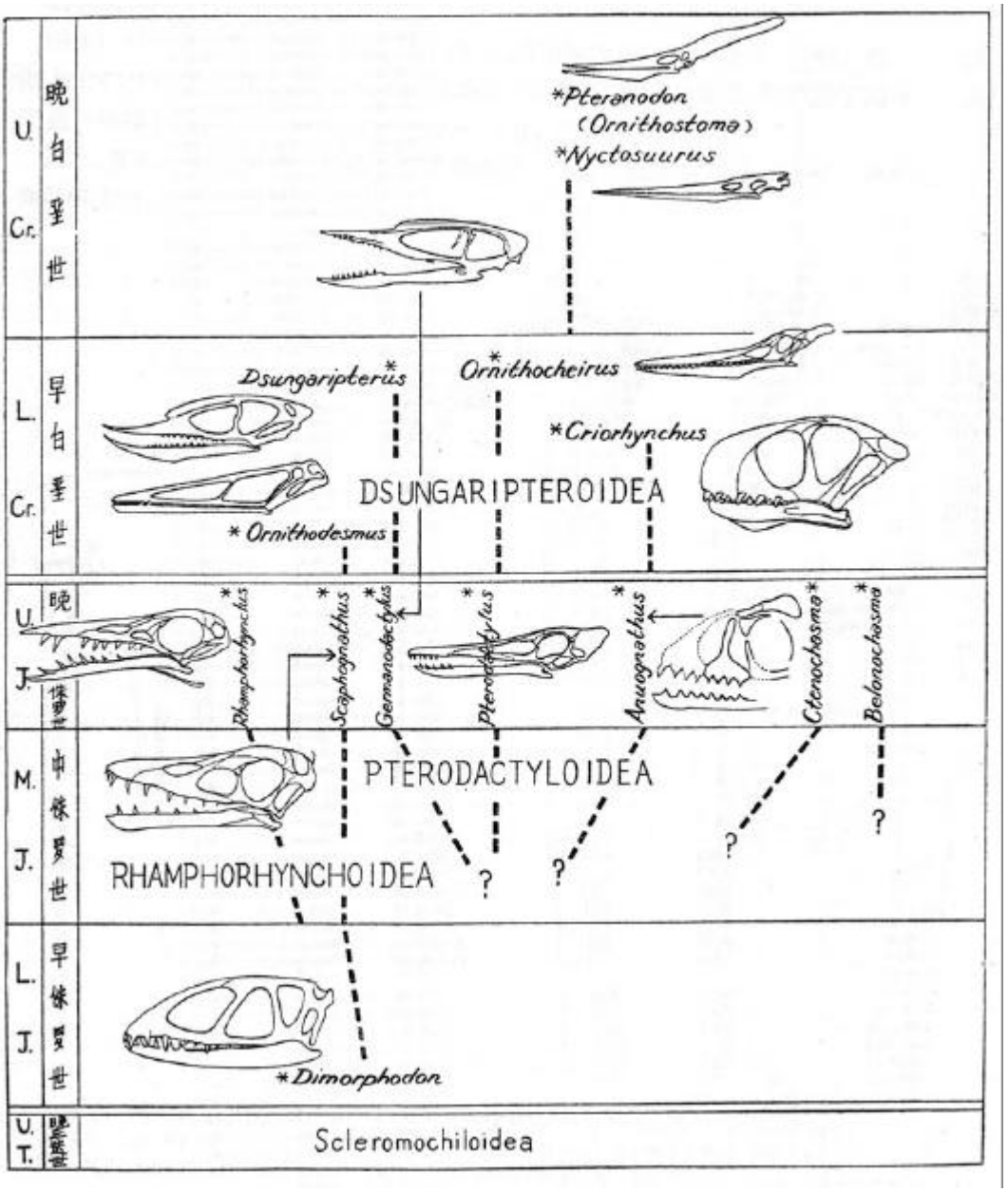

Fig. 9. A suggested classification of the order Pterosauria. Nearly all of the illustrated genera represents the type genus of a family or sub-family. The skulls of those forms are reduced to approximately the same size and not to scale, for an easy comparison of the various proportions. For details see text. Chinese names of the fossils omitted. The sketch of the skulls of various forms after Plieninger, Hooley and other current text books.

All the post Jurassic pterosaurians are much larger in size, some of them even gigantic, all with the development of notarium, certainly in connection with increasingly high power of flying. They are, however, quite variable in structure in spite of the common nature of the notarium. It would be more suggestive to combine them into one Suborder, or at least one superfamily and subdivided into several families or subfamilies. Concerning the systematic position of our *Dsungaripterus* this has already been made clear. It represents a special family and may be derived from the Upper Jurassic *Germanodactylus.* Its development of the notarium is not entirely clear but this may be rather loosely constructed and rather primitive in nature.

The representative genus *Ornithodesmus* of the family Ornithodesmidae is very characteristic by the light structure of its skull. Its relationship with the earlier Rhamphorhynchoidea such as *Dimorphodon* and *Scaphognathus* has been suggested by Hooley (1913). Its teeth are entirely restricted before the nasal opening as in the case of *Ptero*dactylus. The family Ornithocheiridae represented by *Ornithocheirus* is poorly known but the presence of a supraoccipital crest is evident and the teeth are prolonged anterior to the muzzle.

By the former character, it is very likely that it may be the ancestral type of the late toothless *Pteranodon* and other related genera. It may be derived from the small *Pterodactylus* of the Upper Jurassic in view of the general architecture of

the Skull, especially the pointed muzzle and the backward shifting of various openings as well as the lengthening of the beak but more effective proof is lacking. The high and short skull of *Anuroganthus* is very conspicuous and it is very unnatural to put it under the suborder Rhamphorhynchoidea on account of its short tail and to group it with the other Pterodactyloids on account of the special shape of the skull. It is probable that the equally high skull form like *Criorhynchus* etc. may be the descendant of this form. Its ancestors may be traced to the lower Jurassic *Dimorphodon.*

In doing so it seems necessary to erect a new name of higher rank to cover all the Cretaceous forms for which the name Dsungaripteroidea is proposed. Its sharp separation with the Upper Jurassic Pterodactyloidea is evident by the common character of the suprapreorbital crest or supraoccipital crest and the Notarium.

In figure 9 the above statements are given in a more graphic and chronologic way. No attempt is made for the detailed, diagnosis and classification below the rank of genus.

NOTE ON OTHER REMAINS OF PTEROSAURIANS IN CHINA, AND OTHER DOUBTFUL "AVIANS"

Pterosaurians from Laiyang, Shantung

The present described *Dsungaripterus weii* represents the first record of a determinable Pterosaurians in China but by no means for the first time that this interesting order is observed. In 1958, some fragments of limb bones were determined as ?Pterosauria indet. (Young, 1958). With the study of the present form we have, however, better understanding of those fossils from Laiyang.

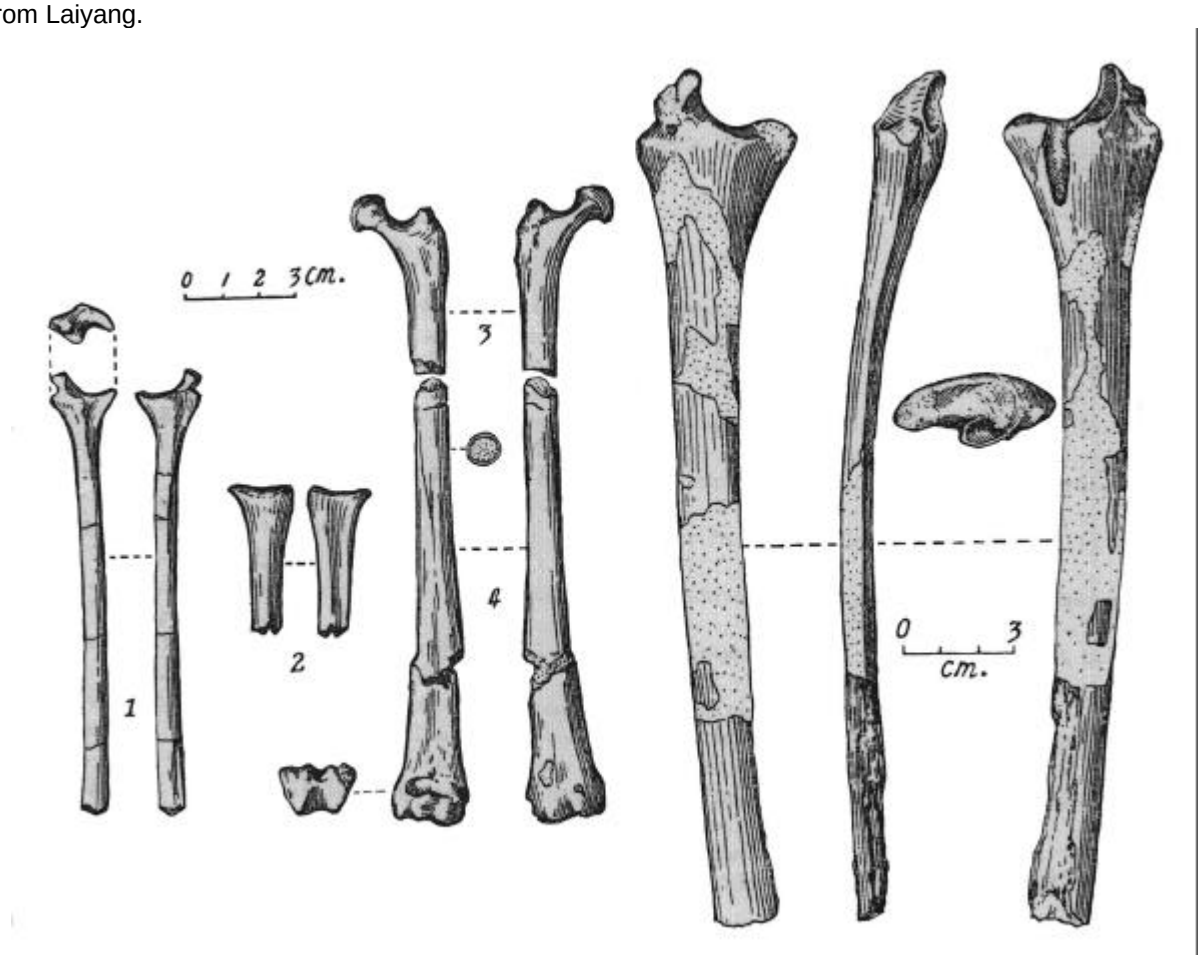

Fig. 10. Left figures 1-4 Pterosauria indet. From Laiyang, Shantung modified from Young 1953. Right figures Pterosauria indet. From Mengyin, Shantung after Young, 1935. For details see text. All ½ nat. size.

The only determinable bone of the fragments of the locality N. E. of Laiyang City is more probably a ulna. It is smaller than that of the Sinkiang species. V.755.

The material from Toushan (T. 1) includes the proximal part of the second phalanx (Fig. 10, 2). The end is deeply concave as that of the corresponding one of the Sinkiang form and probably also a left one. It is almost one third smaller

than the named form. Proximal breadth, 17mm (V.746 not V.747). The proximal and distal parts of the right femur fit almost in direct connection (Fig. 10, 3d 4). It fits almost exactly with the femur from Sinkiang. Its weak curvature can be observed in side view, although it looks straight dorsally and ventrally. The condyle is well separated by a neck from the shaft, as in the named form. The distal end is however less expanded. It is about one fourth smaller than the Sinkiang form. Proximal breadth 24mm; distal breadth, 21mm.

The remains of this locality can be identified at least to the genus Dsungaripterus, but we prefer to wait for further facts for a name of this locality. V.746.

The well preserved proximal part of a bone illustrated in fig. 10, 1 is certainly a first wing-phalanx (Cat. no. V.747 and not V.755) It corresponds in general structure with the Sinkiang form but has a much smaller proximal breadth 17mm. The expanded proximal part narrows very abruptly towards the distal end. It may represent another unknown form of Dsungaripteroids. The other fragment is probably a middle part of an ulna. V.747.

The revision of the previously known remains from Laiyang shows that the Dsungaripterus like forms and possibly other member of this interesting group are present in E. Shantung. The geological age of the Toushan is known as Chingshan Beds of Lower Cretaceous in association with Psittacosaurs.

Pterosaurian from Mengyin, Shantung

As I have noted in 1958 the bone described as Theropoda indet. (?ulna) (Young, 1935, p. 531, fig. 8.) represents also a pterosaurian (Fig. 10, right figure). It is the proximal part of the first wing-phalanx. It is about the same size (slightly larger) and structure as the same bone of the Sinkiang specimen. We have thus evidence that *Dsungaripterus* may present as far as Shantung.

In view of the peculiarities of the fauna discovered from Hsichuefu, this is not in conflict with the view that the Helopus-bearing Beds are Upper Jurassic. In this locality, besides the pterosaurian, a peculiar Sauropod and a large Stegosaur have been found. It is quite possible that some Lower Cretaceous Beds may be recognized, if detailed stratigraphy is going to be made.

Pterosaurian from Inner Mongolia

An ulna, probably the right side (Fig. 11, A.), with the proximal end damaged has been collected by a geological field party from Inner Mongolia. The locality indicates only "A-machia-han" without any other information. According to the label attached, it was derived from a sort of bright red sandstone and the age is given as Cr5. The filled matrix in the shaft of the bone shows, however, that it is a sort of yellowish grey sandstone. The bone is yellow in colouration and the bone is extremely thin, less than 0.5mm. Judged from the weakly expanded part of the upper breakage it must be quite near to the proximal end. Cat. no. V.2778.

Judged by the ulna of *Ornithodesmus,* this specimen belongs most probably to the right side. Its distal end fits almost exactly with the same of the named form including the circular pit, oval convex condyle and the articular surface etc. It is, therefore, beyond any doubt that we have to deal with a large pterosaurian. Preserved length 224mm; actual length probably about 230mm; proximal breadth at the breakage, 25mm; distal breadth, 43mm; breadth and thickness at the middle 17 and 12mm. The dorsal side is moderately convex and ventral side flat.

This bone is smaller than the named English form. Since the ulna of *Dsungaripterus* weii is poorly preserved, it is difficult to compare. But one has the impression that the present specimen is stouter and comparatively broader than the longer, stretched and slender ulna of the named form. It therefore, probably belongs to another Dsungaripteroidea but not the same genus and species.

The occurrence of the pterosaurian in Inner Mongolia is of two-fold interest, not only because the pterosaurian was first recorded in Inner Mongolia but also because its geographical location locates the remains of the same order widely between areas like Sinkiang and Shantung.

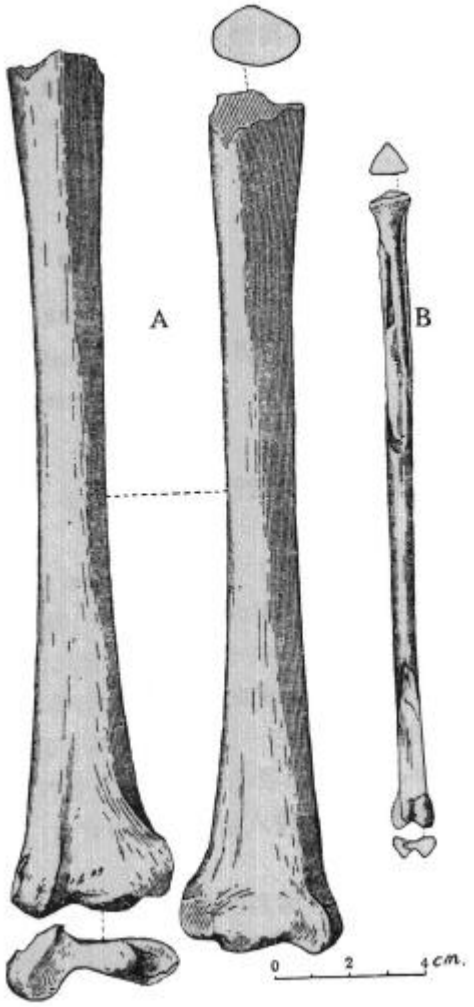

Fig. 11. *Dsungeripterus* indet.
A. An ulna from inner Mongolis;
B. A tibia from Changchi, Sinkiang.
All ½ nat. size.
For details see text.

? Ornithosauria indet. from Changchi, Sinkiang

A piece of long bone (Fig. 11, B) embedded in blue-grey sandstone collected by a field party of Bureau of Petroleum from Changchi, west of Urumchi, Sinkiang. The label indicates only "Changchiho" without any further information. Field number 880, matrix, sandstone and age, Cr1; Collector, K. S. Liu. Cat. no. V.2779.

The bone is almost black in colour and part of the surface near the proximal and the distal end is damaged. However, both ends still well-preserved. Total length 165mm. The bone is perfectly straight and slender with both ends distinctly thickened. The proximal end is triangular in outline and somewhat obliquely oriented. Maximum breadth, 11mm. The distal end is less well preserved but showing the well divided condyles for the articulation with the tarso-metatarsus II and IV, one is damaged and one is in good condition. Preserved breadth across the distal end, 10mm. Along the lateral border of the damaged part below the proximal end there is a splint-like bone extending downwards about 63mm. It is certainly the degenerated fibula and the whole bone should be considered as the right side.

This bone looks quite similar to the tibia of *Hesperornis* and other hawks-like birds. It is much smaller than the named genus. We refrain from further speculation but would like to point out that the present specimen may some day proved to be the first record of Mesozoic avian find in China.

* * *

ACKNOWLEDGMENTS

The writer is deeply indebted to prof. Dr. Oskar Kuhn of Munich for some valuable information during the present study. To Mr. W. L. Shen and Mrs. W. C. Hu for the drawings and the restorations of the paper reconstruction; to Messrs. Y. L. Sou and K. Y. Chang and C. T. Chen for the preparation and the panel mounting of the skeleton the writer likes to express his sincere thanks for their laborious work and help. It is not out of place to express his sincere thanks also to Ai-ling Sun and Mr. H. C. Chao who brought back this interesting material to the laboratory and transferred to the writer for study. First of all, we like to give our best regards and deep indebtedness to the Bureau of Petroleum of Sinkiang, especially the discoverer Mr. C. M. Wie for the permission to study this material and to contribute these valuable specimens to the Museum of the Institute of Vertebrate Palaeontology and Palaeoanthropology.

Footnotes

1. There are two ways of interpretation of the Wing-metacarpal and the Wing-phalanges, one as the fourth finger and the other as the fifth one. In the present paper the former interpretation is adopted. In the earlier archosaurians from which the pterosaurian is most probably derived, the fourth finger of the hand is always the longest and the fifth one tends to reduce or disappears. The writer believes, thus, the first case is more likely true.

2. Even in Nyctosaurus the supraoccipital is developed.

Bibliography

Arthaber, G. v., 1922: Uber Entwicklung, Ausbildung und Absterben der Flugsaurier. Paläontol. Z., 4, 1-7.

Broili, F., 1939: Ein *Dorygnathus* mit Hautresten. Math. Naturw. Abt. S. B. Bayer. Akad. Wiss.

Broili, F., 1939: Ube rein neues Wirbeltier aus dem oberen Jura Frakens. S. B. Bayer. Akad. Wiss., math. –naturw. Abt.

Hooley, R. W., 1913: On the Skeleton of *Ornithodesmus latidens*; an Ornithosaur from the Wealden Shales of Atherfield (Isle of Wight). London. 69. 372-422.

Hooley, R. W., 1914: On the Ornithosaurian Genus Ornithocheirus, The Annals and Magazine of Natural History, Ser. 8, Vol. 13, No. 78.

Huene, F. v., 1914: Beiträge zur Kenntnis Schädeleiniger Pterosaurier. Geol. Palaeontol. Abh., 13, S. 57-65.

Huene, F. v., 1956: Palaeontologie und Phylogenie der Niederen Tetrapoden. Jena. Mit Nachträge und Engänzungen 1959.

Koh, T. P., 1937: Untersuchungen Uber dei Gattung *Rhamphorhynchus*. N. Jb. Mineral. Usw., Adt. B, Beil. Bd. 77, S. 455-506, Abb., Taf. 26.

Khun, O., 1961: Die Familian der recent und fossilien Amphibien und Reptilien. Bamberg. 62-64.

Kuhn, O., 1961A: Die Tier-und Pflanzenwelt des Solnhofener Scheifers, Geologica Bavarica Nr. 48.

Kuhn, O., 1963: Die Tierwelt des Solnhofener Scheifers 318, Die Neue Brehm-Bücherei.

Plieninger, F., 1894-1895: *Campylognathus Zitteli*. Ein neuer Flugsaurier aus dem Oberen Lias Schwabens. Palaeontographica Band 41, S. 193-222, Mit Tafel XIX und 8 Textfiguren.

Plieninger, F., 1901-1902:Beiträge zur Kenntniss der Flugsaurier. Palaeontogr., 48, s. 65-90.

Plieninger, F., 1905-1906:Die Pterosaurier der Juraformation Schwabens, Palaeontographica Band 53, S. 209-316, Mit Tafel XIV-XIX und 40 Textfiguren.

Stromer, E. 1913: Rekonstruktion des Flugsauriers *Rhamphorhynchus gemmingi* H. v. Meyer. N. Jb. Minral. Usw., S. 49-68.

Viushkov, B. P., 1954: (*Belonochasma* aus dem lithographischen Scheifer Bayerns), Priroda, 43, S. 114-115.

Young, C. C., 1935: Dinosaurian Remains from Mengyin, Shantung, Bull. Geol. Soc. China. 14, 4, 519-544.

Young, C. C., 1958: The dinosaurian Remains of Laiyang, Shantung, Pal. Sin. Whole Ser. 142, New Ser. C. 16, 1-138.

A. ? . P??????, 1948: ??????? ? ??????? ????? ??? ????-???, ????? ????????????????? ????????, ??? 15, ? ? ?. 1. (A. N. Rjabinin, 1948: Note about the flying reptile of the Jurassic of Karatau, the transactions of paleontological Institute, Trudy 15, plate. 1.)

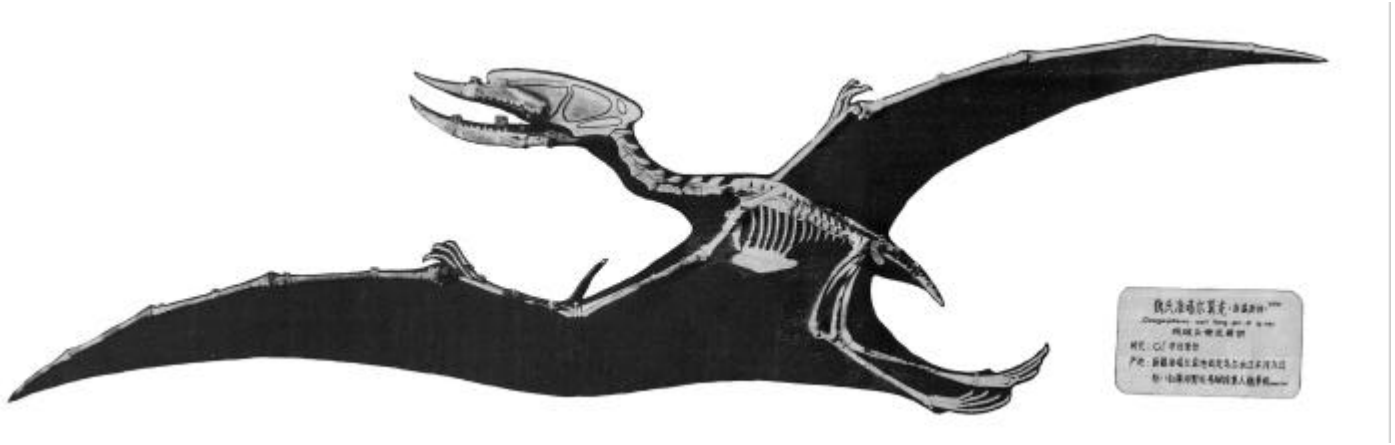

Plate 1. Dsungeripterus weii. gen. et sp. nov. Panel mounting of the skeleton of the type specimen about 1/6 natural size. The actual bones can easily be observed in relief and missing parts by painting in lighter colouration. The outline of the wing is shown in darker colour. Photo by C. Tu.

The above plate was a photograph that spanned two pages in the original text in the form of a fold out illustration. This has been reduced to fit onto the page here. The textured wall wash background of the original photograph has been omitted. The original image was folded in three, the folds being almost through the claws of each manus.

Plate 2. Picture of a fleshy restoration of the same animal by W. L. Shem

The second plate was damaged on the original and was unsuitable for copying. The plate was of a painting showing a landscape with possibly two *Dsungeripterus* in flight.

Remodelled cast of a skull of *Dsungeripterus weii* photographed in 1977 at the Natural History Museum, London, showing the overall structure of the skull, the extent of the jaws and the crests.