

On the Triassic reptile, Hallopus Victor, Marsh / by F.R. von Huene and R.S. Lull.

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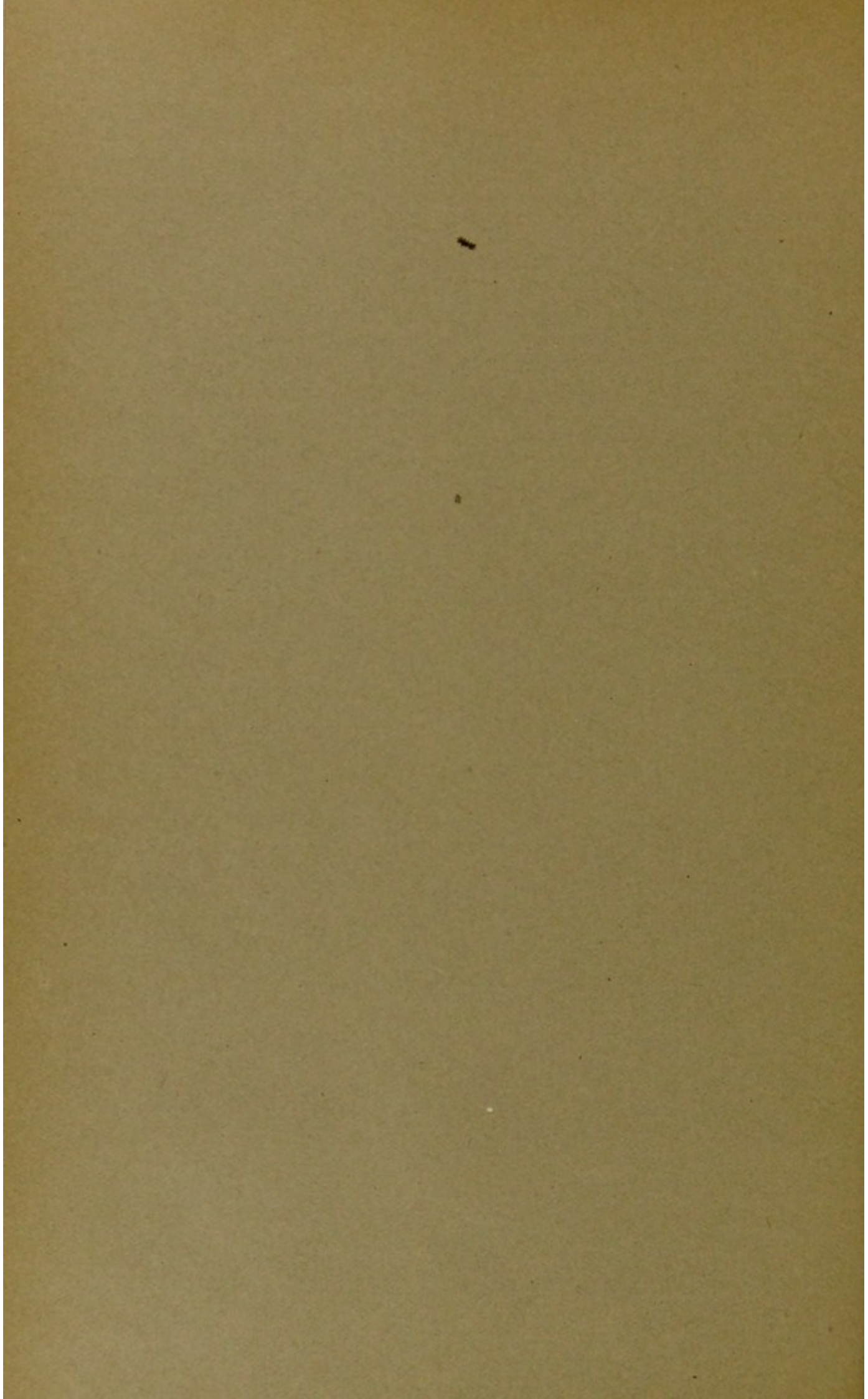
ON THE TRIASSIC REPTILE, HALLOPUS

VICTOR: MARSH.

By F. R. VON HUENE, Tübingen, Germany, and

R. S. LULL, New Haven, Conn





ART. XIII.—On the Triassic Reptile, *Hallopus* Victor Marsh;
by F. R. VON HUENE, Tübingen, Germany, and R. S. LULL,
New Haven, Conn.

A REEXAMINATION of the type specimen of *Hallopus*, preserved in the Peabody Museum at Yale, has brought forth some interesting new facts. We are giving here a short preliminary description and intend later to write a fully illustrated, detailed treatise in which *Hallopus* will be compared with other reptiles and its true relationships investigated.

Following Williston,* the *Hallopus* beds at Garden Park, near Canyon City, Colorado, supposed by Marsh to be Jurassic, are Upper Triassic. The type specimen is contained in two slabs of red sandstone fitting together and, while fairly well preserved, in some instances only the impression of the bone upon the matrix remains, adding to the difficulty of an exact interpretation.

Vertebrae.—There is one doubtful cervical vertebra, a doubtful broad and low neural spine of a dorsal vertebra, two sacrals and four anterior caudals, the latter still in connection with each other.

The sacrals show their upper surface in the smaller slab, but the greater part of the upper arches is missing. They are coössified, slightly elongated and possess strong sacral ribs, the second one being much stronger than the first. The direction of the first sacral rib is a little forward and that of the second more backward, the latter being longer than the former. The ventral part of the second sacral rib expands towards the first sacral rib so that they come in connection.

Length of both sacral vertebrae together	20 ^{mm}
Their width where they are coössified	6
Length of the right first sacral rib from the median line of the neural canal	11.5
Length of the left second sacral rib from the median line of the neural canal	16
Width of the first sacral rib at its narrowest place in the middle	4.5
Width of the second sacral rib at its narrowest place in the middle	7.5
From the anterior edge of distal extremity of the first to the posterior edge of distal extremity of the second sacral rib	30

The caudal centra are not constricted in the middle and only little longer than high. The neural spines are broad and bent backward; the zygapophyses are fairly large.

* Williston, 1905.

Length of caudal centra	7 ^{mm}
Height of caudal centra	5
From centro-neural suture to top of neural spine (in the 3rd of these vertebræ)	10

Ribs and Hæmapophyses.—There are several dorsal ribs; one of them shows the proximal extremity with two widely separated heads, as in the Dinosauria. The longest rib lying in the rock near the scapula and tibia is 33^{mm} in length without proximal end. One hæmapophysis, or chevron bone, lies below the preserved caudal vertebra; it is marked by length and slenderness. The opening is very long; both branches are connected by a clasp.

Length (probably not complete) of hæmapophysis,	32 ^{mm}
Width at articular face (only half of it preserved)	6
Width of the foramen	3
Length of the foramen	9
Thickness of the distal end of hæmapophysis ...	1·2

Scapula.—An isolated and peculiar-shaped scapula lies beneath the complete hind leg. We think it is quite complete and resembles most nearly that of *Erpetosuchus*. The extremity having a halfmoon-like depression, taken by Marsh as the articular cavity (glenoid fossa), we consider the distal end. At the other end of the bone is a narrow and thin but high process which we take as *processus deltoideus scapulæ*. It is very similar to that of *Erpetosuchus*. At the other edge of the same extremity is the articular face. Here and at the distal extremity the bone is thicker than in other places. What Marsh took for the articular end we think cannot be that, because there would be no space for the articulation with the coracoid.

Length of scapula from <i>processus deltoideus</i> to upper corner of distal end	28 ^{mm}
Length of scapula from articular face to lower corner of distal end	24
Width from articular face to <i>processus deltoideus</i> ,	12
Width at distal end	10·5
Width at narrowest place	4·5

Humerus.—In one corner of the larger slab is an impression which Marsh took for that of the humerus. He is possibly right, but it could also be the impression of the distal end of the second pubis.

Radius, Ulna and Manus.—The forearm with the manus of one side is still nearly in connection, lying beside the crushed tibia. The ulna is thicker than the radius, the latter being very thin.

Length of radius,	28 ^{mm}
Length of ulna,	29

Ilium.—Both ilia are preserved, one of them showing the inner, the other the outer surface. They are a little different from Marsh's figure, because he omitted the very sharp anterior edge of the *spina anterior*. Both ilia taken together complete each other, because in one of them the anterior and in the

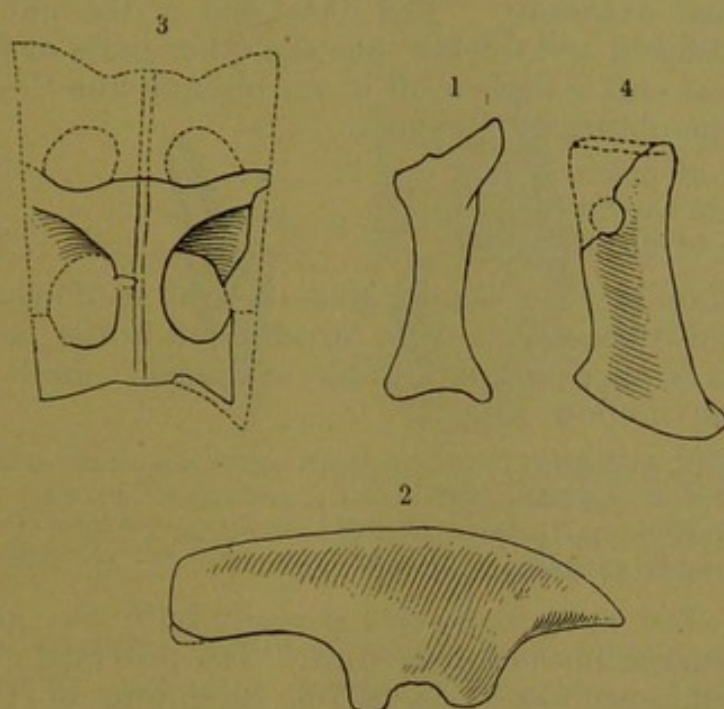


FIG. 1. (left) *Scapula*, natural size. The articular end is the upper one in the figure with the *processus deltoideus* at the right upper corner.

FIG. 2. *Ilium*, natural size. The *spina anterior* is at the right side of the figure. The outlines are a combination of both ilia. The acetabulum was probably nearly or quite closed.

FIG. 3. *Sacrum*, seen from above. Natural size. The first sacral vertebra is at the top of the figure. The dotted lines are reconstructed exactly the same size as fig. 2 (ileum) to show that there must have been three sacral vertebrae. Drawn from the small slab.

FIG. 4. Right *pubis*, natural size. Partly reconstructed (dotted line).

other the posterior part is missing. The *processes pro-* and *post-acetabularis* are short and directed downward. The ilium extends very far back and nearly as far forward.

Length of (restored) ilium	45 ^{mm}
Height of <i>processus post-acetabularis</i>	12
Width of acetabulum	7

Marsh thought the two sacral vertebrae were the complete sacrum, but upon comparing the measurements with those of the ilium we find that there were, necessarily, three sacra. Our reconstruction of the sacrum is given in fig. 3.

Pubis and Ischium.—There is one broad and two long and slender bones belonging to the pelvis. Marsh took the former for the ischium and the rod-like bones for pubic bones. We

cannot imagine that what Marsh took for the ischium can really be that bone. It is too long for a plate-like ischium, and a distally expanded ischium together with rod-like pubes would be too peculiar and without parallel among other reptiles. Therefore we take the two rod-like but proximally expanded bones as ischia and the broad bone as the pubis with complete distal but imperfect proximal extremity. The distal end of the pubis is obliquely broadened and thicker than the other parts of the bone. The proximal end is broken off in an oblique line through the middle of the obturator foramen.

Length of pubis	32 ^{mm}
Width in the middle	11
Length of distal border	16

The ischium is very slender and of oval section; near the proximal end it becomes a little broader and in the last (proximal) 10^{mm} it is curved and slightly expanded. Both ischium and pubis are hollow.

Length of ischium	49 ^{mm}
Its diameter at distal end	3
Its diameter near proximal end	4
Its diameter at proximal end	7

Femur.—The right femur is a strongly built but quite hollow bone, curved in the upper third. The proximal extremity is broken off, but it still shows the beginning of the high *trochanter major*. The *trochanter quartus* is not visible. In the smaller slab the bone shows its posterior, in the greater its anterior aspect. The condyles at the distal end (the end Marsh figured as the proximal one) are small.

Length of femur	71 ^{mm}
Diameter in the middle	7-8
Longest diameter at the proximal end	12.5

Tibia.—Both tibiae are preserved. In the left one the proximal end is missing, the right one is complete and still in connection with the other bones, but lying beside the right femur. It is very slender and quite as hollow as the femur. The proximal end is anteriorly thickened and the articular face is prominent backwards. The distal end is broadened and flattened in a transverse direction.

Length of tibia	97 ^{mm}
Supero-posterior diameter at proximal end	12
Diameter in the middle	7
Antero-posterior diameter at distal end	4.5
Transverse diameter at distal end	9-10

Fibula.—There is only the distal (following Marsh it would be proximal) part of the left fibula lying beside the left crushed tibia. It is very thin and the distal end only is a little enlarged. The preserved length of it is 65^{mm}.

Diameter 33 ^{mm} above the distal end.....	2 ^{mm}
Diameter at the distal end.....	5.5

Tarsus.—In the right foot the astragalus, calcaneum and cuboid still remain.

The *astragalus* is a very thick bone, rounded beneath. It is

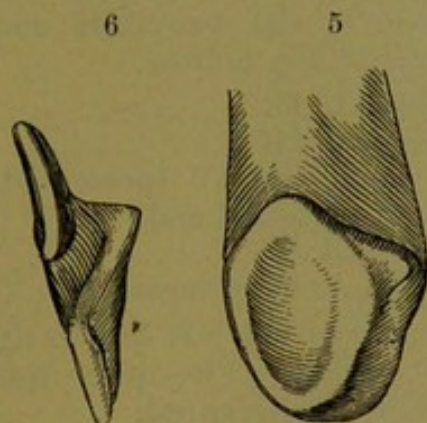


FIG. 5. Left *astragalus* in its natural connection with the tibia. Twice natural size. Seen obliquely from lateral side and behind.

FIG. 6. Left *calcaneum*, twice natural size. Seen from above. The lower edge of the figure is the *tuber calcanei* and the long straight border is the lateral one.

as broad as the distal end of the tibia and it has a short and thin ascending process at the posterior corner of the lateral border. Below that process the surface of the astragalus is concave for the articulation with the fibula and calcaneum.

Transverse diameter of astragalus.....	9 ^{mm}
Supero-posterior diameter of astragalus.....	4
Height with ascending process.....	10
Height without ascending process (medial border).....	6.5

The *calcaneum* is a very large but strongly compressed bone. Except for the compression it is like the same bone in crocodiles, but with a large tuber. It is not preserved in the natural position, but turned downwards with the metatarsus.

Greatest length of calcaneum.....	15 ^{mm}
Its thickness near astragalus.....	4.5
Its thickness at the tuber.....	1.5

The *cuboid* is only recognizable by its position on the top of metatarsal IV. It is a thick, cushion-like bone rounded beneath, 6^{mm} broad and 3.5^{mm} thick, laterally with a face for metatarsal V.

Metatarsus.—The foot had five toes but the first is not preserved. The fifth is vestigial and short, but the others are extremely long and slender. In the right foot there are in position, metatarsal II, III (better seen on the small slab) proximal end of IV, and V (only in the great slab). There lies also,

near the good dorsal rib, the other (left) metatarsal III and, near the ischia, the left fourth metatarsal with fragments of phalanges. Metatarsal II and III are straight, while metatarsal IV is a little curved near the proximal extremity. The second one is the broadest and the third the longest. Metatarsal IV is probably only little shorter than metatarsal II. Very short, but broad at the proximal end, is metatarsal V.

All of the metatarsals are hollow.

Length of metatarsal II	41 ^{mm}
Length of metatarsal III	48
Length of left metatarsal IV (preserved portion) (incomplete at proximal end)	30
Length of metatarsal V	15
Breadth of proximal end of metatarsal V	6

One of the *phalanges* of the left fourth digit seems to be 7^{mm} long and about 2^{mm} broad. The other remains of phalanges are too fragmentary to be measured.

In addition to the described bones and impressions there are still a few impressions which we are not yet able to determine.

Conclusions.

Marsh placed *Hallopus* among the theropodous Dinosauria. The pelvic bones, as Marsh determined them, are quite different from all Theropoda and other Dinosaurs. Following our interpretation of the ischium and pubis, the pelvis is more dinosaurian. The long and slender *spina anterior ilai* is impossible for a theropodous dinosaur, and resembles nearly that of the Orthopoda. But there are some other facts which would be very striking even for the Orthopoda: the pubis, the calcaneum, the extreme thickness of the astralagus, the form of the scapula, also the surprisingly high ilium, are different from those of the Orthopoda. We find *Hallopus* more naturally placed with *Scleromorphus*,* *Ornithosuchus*, *Erpetosuchus* and *Aëtosaurus*. These systematic and phylogenetic views we shall present in detail in our forthcoming memoir.

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 1 fig. p. 233, 240, 241, pl. vi.§
 Williston, 1905, Jour. of Geol., xiii, p. 338-341.§

*The senior author has been able to study all these type specimens and has found some new evidence.

†As distinct order, doubtful if dinosaurian or not.

‡As theropod.

§As Triassic, recognized for the first time.