A GIANT DINOSAUR FROM DURHAM DOWNS, QUEENSLAND.

BY HEBER A. LONGMAN, Director.

(Plates XXIX.-XXXIII.)

Introduction.—In February, 1924, Mr. Thomas Jack, of Dalby, and Mr. M. C. Wood, of Brisbane, informed me that a very large fossil was exposed on Durham Downs Station in the Roma District. As the result of correspondence, Mr. A. J. Browne, manager, forwarded fragments of vertebræ which were at once recognised as new to our collection. Subsequently Mr. Browne made arrangements to collect the whole of the remaining series as exposed in sandstone rock, amounting to about four cwt. of material. The specimens were packed in seven cases, and sent by motor lorry to Roma, and railed to Brisbane, where they were received at the Queensland Museum in May, 1925.

It is my pleasant duty very heartily to thank Mr. Browne for his great kindness in collecting, packing, and forwarding as a donation this valuable material.

Locality.—In response to my request Mr. Browne states that the exact location is as follows :—"About one-quarter of a mile on the south side of Eurombah Creek on Grazing Farm 1352A, Roma district, being portion 1V, parish of Narran, county of Aberdeen. The fossil is located in the north-west corner of the selection." Eurombah Creek is a tributary of the Dawson River.

Horizon.—Walloon Series, Jurassic, Freshwater. H. I. Jensen refers to the Durham Downs country as the "Lower Walloon or calcareous Walloon." He says that there is evidence of "a continued sweep of Lower Walloon strata from Taroom S.W. to Durham Downs, then W.N.W. to Boggarella."[1] In 1915, B. Dunstan, in his introduction to A. B. Walkom's study of our Mesozoic Floras, placed the Walloon Series as Jurassic, Freshwater, discarding the old term "Trias-Jura" as used by most earlier writers.[2] In a later paper[3] A. B. Walkom lists thirty-seven species from the Walloon Series and its equivalents, and states : "There is no doubt that the age of this flora is Lower Jurassic."

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[1] H. I. Jensen, Qld. Govt. Mining Jr., xxii., Oct. 1921, p. 403.
[2] B. Dunstan, Qld. Geol. Surv., Pub. No. 252, 1915, pp. 1-4.
[3] A. B. Walkom, Proc. Roy. Soc. Qld., xxxi, 1919, p. 15.

In 1923, H. I. Jensen states: "The Walloon Formations north of Roma have yielded no *Thinnfeldia*, and no large Tæniopteridæ. *Cladophlebis australis*, *Tæniopteris spatulata*, *Otozamites Feistmanteli*, and *Sphenopteris superba* were the principal fossils found in the Walloon in this area, the only others being fragments of Neocalamites and other Equisetales, *Ptilophyllum pecten*, *Dictyophyllum Davidi*, and seeds and spores. The Walloon Formations are Jurassic. . . ."[4]

The thickness of the Walloon Formations in the Roma district, as divided by Jensen (loc. cit., p. 157), is estimated at 5,000 ft. The Walloon Series and its equivalents are discussed by Bryan and Massey in a more recent paper.[5]

Material.—Over 100 specimens were forwarded, some of which are small shattered pieces. The main part consists of a series of twenty-two vertebræ, the majority of which were fractured, especially in the region of the neural arches. Owing to prolonged exposure some of the centra are much abraded on one side. There are also fragments representing central portions of the shafts of a femur, tibia, and fibula. In addition there are many smaller remains of pelvic elements, most of which are shattered into tiny pieces.

Matrix.—Mr. L. C. Ball, B.E., Deputy Chief Government Geologist, defines the matrix as "a very fine-grained, ferruginous, and highly calcareous sandstone, with attached masses of oxidised concretionary clay ironstone."

Great difficulty has been experienced in exposing the natural contours that were covered by matrix. In places the matrix forms a closely investing cement, much harder and less friable than the bone, and which, to use a mining term, is "frozen" to the surface of the specimens.

Previous Records.—This Durham Downs fossil is the first consequential discovery of a large Dinosaur in Australia, but there are three previous records of fragments. In 1891 H. G. Seeley described[6] *Agrosaurus Macgillivrayi*, "a Saurischian reptile from the N.E. Coast of Australia," believed to have been collected by Macgillivray during the voyage of the "Fly" from "some locality which was then unnamed," attributed doubtfully to the Trias. In 1906 A. Smith Woodward described and figured an "ungual phalange of a carnivorous Dinosaur," from the Lower Jurassic, Cape Patterson, Victoria, which was compared with *Megalosaurus* but unnamed.[7] The same author in 1909 recorded a "tooth and a posterior caudal vertebra of a small Megalosaurian" from "the Upper Cretaceous opal-bearing sandstone of Lightning Ridge, near Walgett, New South Wales."[8]

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[4] H. I. Jensen, Proc. Linn. Soc. N.S.W., xlviii., 1923, p. 154.
[5] W. H. Bryan and C. H. Massey, Proc. Roy. Soc. Qld., xxxvii., 1925, p. 117.
[6] H. G. Seeley, Quart. Jr. Geol. Soc., vol. 47, 1891, p. 164.
[7] A. Smith Woodward, Ann. Mag. Nat. Hist. (7), vol. 18, 1906, p. 3.
[8] A. Smith Woodward, Rep. Brit. Assn., 1909, p. 482.

As will be seen from the descriptions, the Durham Downs specimens cannot be associated, for fairly obvious reasons, with the claw of a carnivorous Dinosaur from Victoria, and still less with the other two records.

Many comparisons have been made between our material and descriptions of Dinosaurs from other parts of the world, and, apart from the special significance of this discovery in Queensland, it is believed that the caudal vertebræ exhibit distinctive characters which require generic recognition. It may be remarked that Owen repeatedly pointed out the importance of vertebral characters,[9] and caudal vertebræ have been occasionally used for new generic and specific determinations. It is hoped, however, that additional remains, including cranial material, will be available later in order that other characteristics of this gigantic reptile may be made known.

Incidentally it may be mentioned that Leidy's genus *Antrodemus* was founded on the posterior half of a caudal centrum, with which C. W. Gilmore in 1920 associated *Allosaurus fragilis*.

RHŒTOSAURUS BROWNEI, new genus and species.[10]

Chief Characters.—Caudal vertebræ amphicœlous ; anterior ones gigantic ; centra solid, with expanded elliptical articulating surfaces, from which the body curves evenly to a median construction, which is more pronounced in the posterior elements ; centra somewhat compressed laterally. Prezygapophyses elongated, the articulating surfaces being vertical and not obliquely horizontal (orthozygous). Postzygapophyses absent, but the hyposphene is well developed. Neural spines stout and not greatly elongated ; anterior ones subrectangular in lateral outline, and with an oval median recess on the posterior margin above the junction with the hyposphene, which projects somewhat posteriorly ; inferior border of hyposphene free, articulating between the prezygapophyses in the hypantrum area and roofing the neural canal. Anterior chevrons massive and not elongated, intervertebral in attachment and partly lateral in position ; not confluent at their vertebral attachment ; posterior chevrons more inferior in position. Neural canal relatively large in the anterior caudals.

Caudal Vertebræ.—Although many of the vertebræ are in two or more pieces, it has been possible to reconstruct the centra and to place in correct juxtaposition a series of sixteen units. This demonstrates the careful way in which the fragments were collected by Mr. A. J. Browne and his assistants.

The antero-posterior extent of these sixteen consecutive vertebræ is 9 ft., or 2 metres, 743 mm. When photographed this consecutive series was slightly

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[9] "If I were restricted to a single specimen on which to deduce the nature of an extinct animal, I should choose a vertebra to work out a reptile, and a tooth in the case of a mammal."—R. Owen, Ann. Mag. Nat. Hist., ii., 1878, p. 216.

[10] From "Rhœtos," one of the giants in Greek mythology, sprung from the blood of Uranos. The specific name is in honour of Mr. A. J. Browne, of Durham Downs.

extended beyond this measurement, owing to difficulties of alignment (Plate XXIX.). In addition there are fragments representing at least six vertebræ in the posterior region. Judging from dimensions, one of these, to which is conjoined the anterior moiety of a second, should be placed in serial alignment near to No. 16 of our consecutive series.

In the anterior vertebræ there is an obvious difference between the antero-posterior diameter of the centrum, taken near the origin of the neural arches, and the diameter near the inferior margin. This suggests that the base of the tail had a pronounced downward curve, although the condition of the specimen and the amount of matrix between the centra prevent this from being manifested when the units are placed in juxtaposition.

The units in this series of consecutive vertebræ have been numbered from 1 to 16, whilst a more posterior vertebra is denoted as X. The dimensions of these are given in millimetres :—

Antero-posterior length of vertebræ—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	X
140	136	137	135	135	140	142	160	150	158	150	152	158	157	155	?	157

Vertical height (taken at the anterior articulating surface from the inferior border to base of neural canal)—

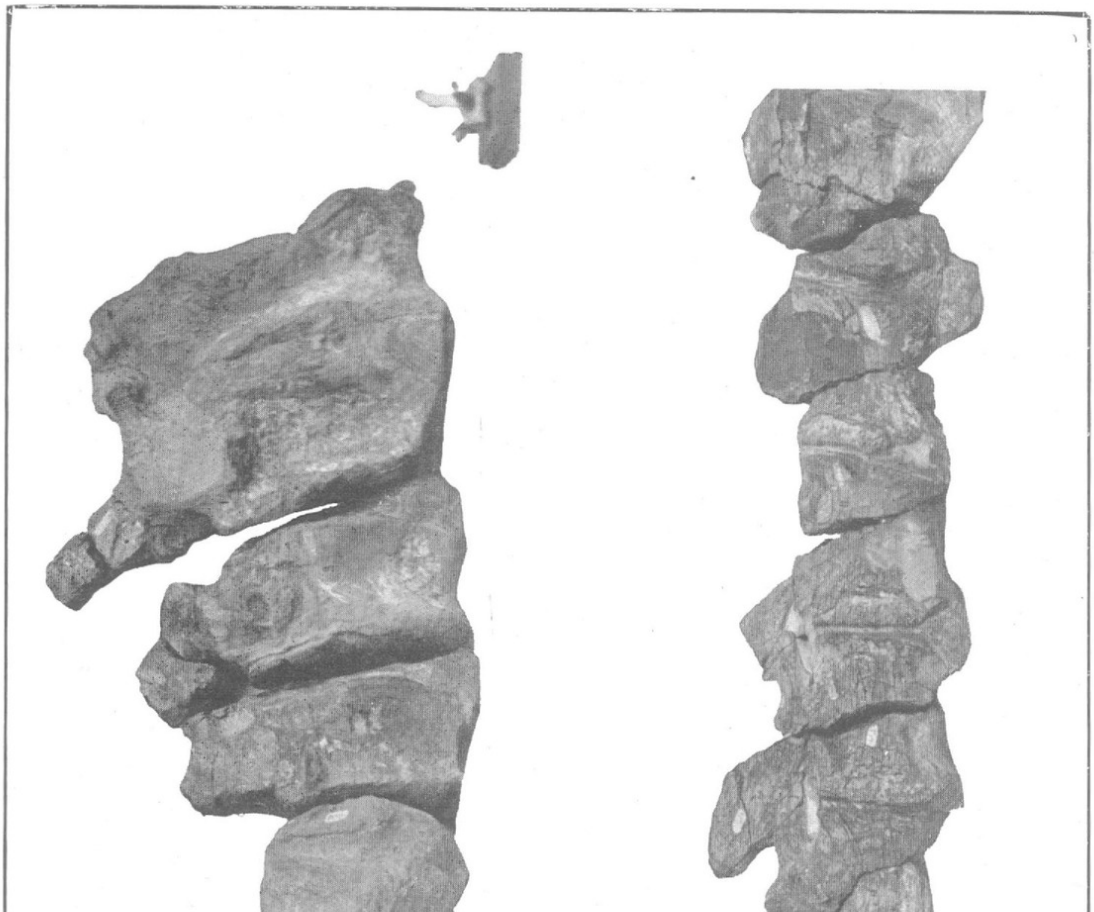
1	3	6	10	12	13	15	16	X
270	250	205	170	153	145	135	109	108

Measurements are given only of the units in which this area is best preserved. The height of No. 16 is taken at the posterior border.

Maximum transverse diameter of vertebræ at centre of articulating surfaces—

1	3	6	10	13	14	15	16	X
190	162 (?)	170	150	134	124	120	112 (posterior)	108

From the dimensions it will be seen that the tail of *Rhœtosaurus* formed of a rapidly tapering series of bulky elements. The vertical height of the centrum of No. 1 of our consecutive series is almost double the antero-posterior length. No. 6 is only one and a-half times the length. In No. 12 the proportions are about equal, whereas the length of Nos. 16 and X is approximately one and a-half times the height. Although the anterior vertebrae are so large, this rapid tapering suggests that the tail was not greatly elongated beyond the elements actually represented. The presence of chevron bones on the both sides of the first of our series suggests that there was at least one additional anterior caudal, and there is also definite evidence in a large lateral fragment of a neural arch that cannot be allocated with the continuous series. Distally there were undoubtedly several smaller



Rhœtosaurus brownei. Consecutive series of caudal vertebræ. Total length 9 ft. A caudal vertebra from *Crocodilus porosus* is shown on a small block for comparison.

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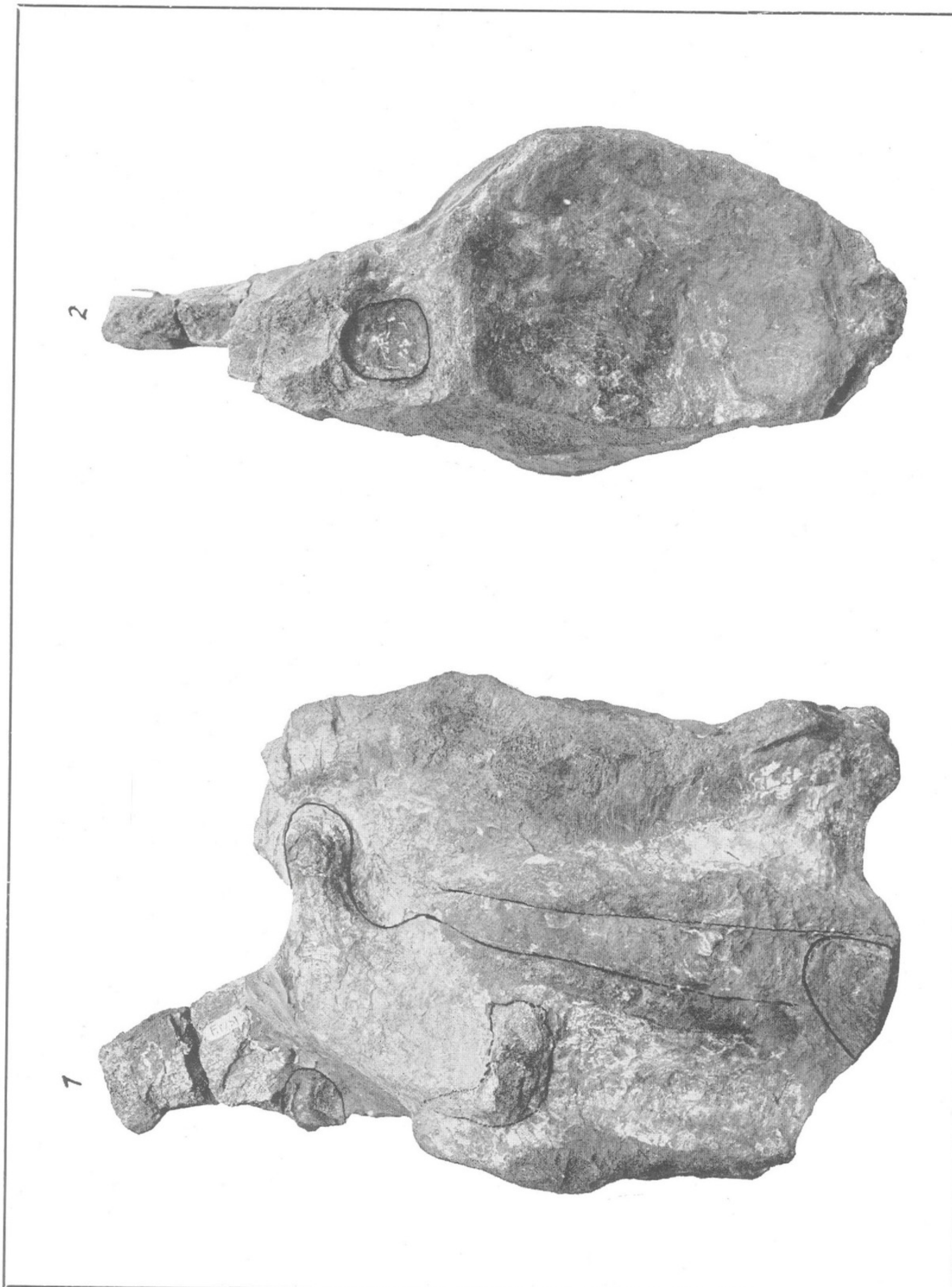

Rhœtosaurus brownei. Fig. 1.—Lateral view of conjoined anterior vertebræ. Fig. 2.—Anterior face of first vertebra.

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vertebræ, but it is thought that the total number of caudal vertebræ was about thirty or thirty-five at most. It is assumed that there was no whip-like distal extension as in *Diplodocus*.

The inferior border of the centrum in the anterior vertebræ appears to have been obtusely keeled, but in the median and posterior units of our series it is smoothly rounded. In the lateral outline the inferior border is very concave, especially in the posterior vertebræ.

Chevrons.—On the anterior vertebræ these are somewhat thick, subtriangular plates, which do not appear to have had very elongated processes. The apex of the triangle lies within the groove between the articulating surfaces of the vertebræ, the infero-lateral margins of which diverge to accommodate the expanding plates. In one or two of the anterior vertebræ, the greater part of these sub-triangular bones lies within the plane of the centra, and it seems probable that the area of the hæmal canal must have been relatively small. Some of these chevrons, however, may have been forced upward during the process of fossilisation. The inferior borders of the chevrons are fairly straight, and, although they may be contiguous in the pairs preserved in position, there is no evidence of ankylosis. The contours of the inferior borders do not suggest lengthy inferior blades. In the series as a whole there is evidently considerable variation in the size, contours, and positions of the chevrons, and no one of the posterior elements is well preserved.

On the first two vertebræ the superior margin of the chevrons is obtusely rounded and the shape of the plate is thus more oval than sub-triangular (Plate XXXI., fig. 3). On vertebra No. 10 of our series the conjoined inferior margin of the chevrons is distinctly concave, and, in this respect, resembles those of *Cetiosaurus leedsi*[11] (Plate XXXI., fig. 2). On the posterior vertebræ, the chevrons, which are still sub-triangular, are more inferior in position and are contiguous beneath the centra. Here there is evidence of projections at the posterior angle.

The massive, short chevron plates of the anterior vertebræ with wide areas for intervertebral articulations appear to be very distinctive.

Neural Spines.—With the exception of that on one of the posterior vertebræ (No. 12 in our consecutive series), the neural spines are very imperfect, and it has been found possible to reconstruct only two of the anterior ones. The anterior spines slope backwards at an angle of about 130 degrees from the plane of the centra, and they attain an antero-posterior diameter of about 90 mm. and a transverse diameter of about 40 mm. Although the distal margins are incomplete it is evident that the height of the anterior spines was at least three times the antero-posterior diameter. Unplaced fragments have apices which are truncated or broadly rounded in lateral profile, whilst the more posterior spines are acuminate in transverse profile.

[11] B. M. Guide Foss. Rept. and Fishes, 1905, Plate III.

The spines decrease in height and general bulk towards the end of the series; here they are much more obliquely set, the posterior margin is very concave, and the apex reaches a point above the middle of the subsequent vertebra.

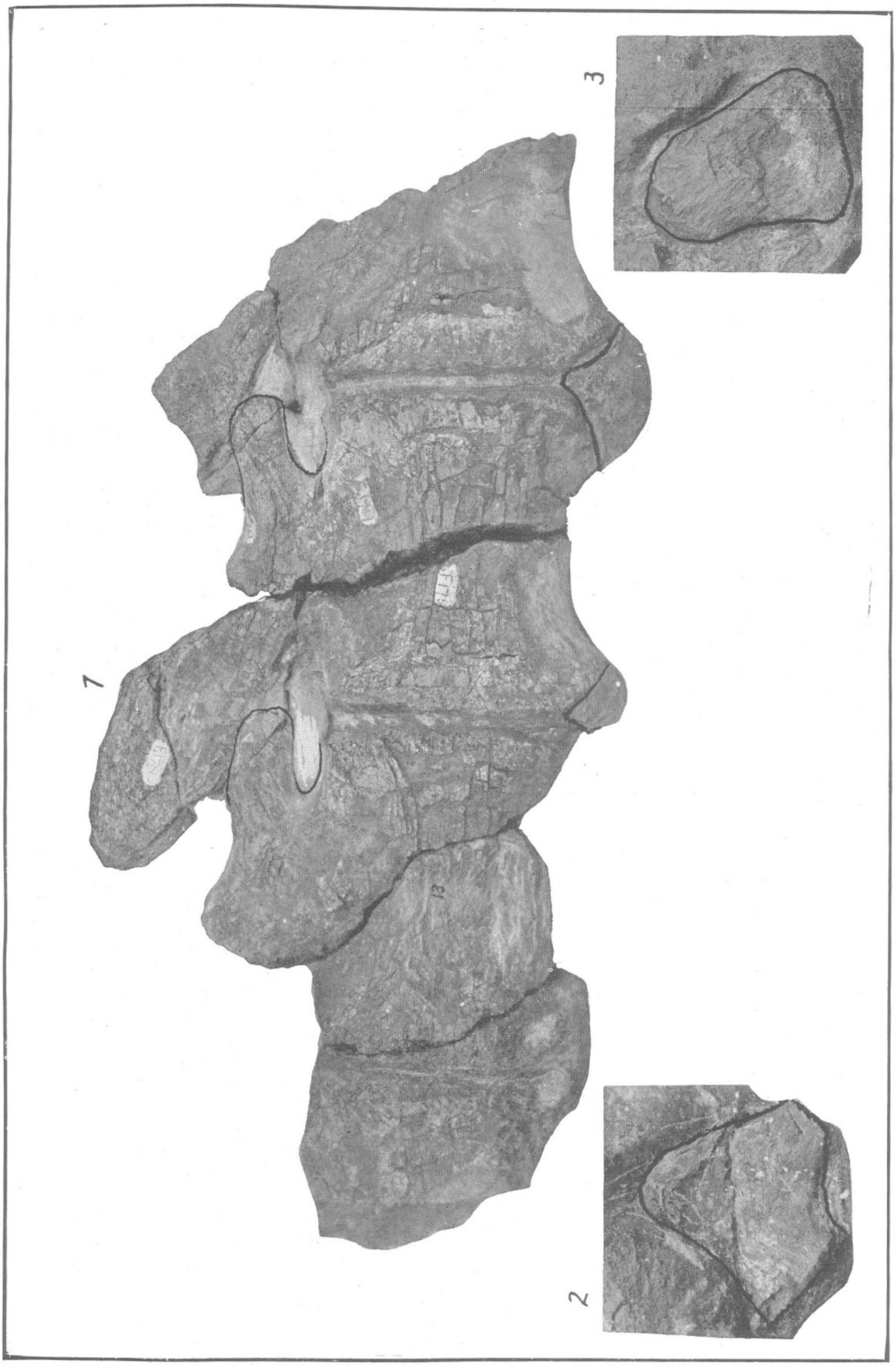
Included among the unplaced fragments are remains of several spines, but as they were obviously broken and abraded long before the fossil was collected it is impossible to place them in correct position. There is no evidence that any of the neural spines were emarginated distally, as in many of the anterior caudals of *Diplodocus.*

Transverse Processes.—Although none of the diapophyses are present, areas of fracture denote that the first six of our consecutive series carried transverse processes. The first vertebra is too much abraded to yield evidence of the extent of the processes. On the second vertebra the transverse processes were situated above the upper third of the centrum (Plate XXX., fig. 1). The fractured area denoted an antero-posterior length of about 70 mm. with a thickness of 30 mm., and the process was angulated posteriorly with a superior buttress. On the third vertebra the area of fracture is slightly lower in position and more oval, and the same applies to No. 4. The area of No. 5 is somewhat obscured; it resembles 4 but is lower in position. The sixth vertebra apparently carried a small transverse process, but there is no positive evidence on the seventh.

Neural Arches.—The neural arches are medially situated on the centra and are strong processes supporting prominent prezygapophyses, stout spines, a specialised hyposphene, but with no distinctive postzygapophyses. In the anterior vertebræ, the body of the neural arches occupies, in antero-posterior extent, about two-thirds of the length of the centrum, whilst the transverse diameter is about equal to half that of the centrum.

In the first three vertebræ, the prezygapophyses overlap the contiguous centrum and reach a point above the origin of the posterior part of the neural arch (Plate XXX., fig. 1). They are not quite horizontal in position, but project upwards somewhat, terminating in an obtuse apex, and in transverse section they are semi-circular, with the flat articulating surfaces vertically placed. In the more posterior vertebræ, as shown in Nos. 12 and 13, they do not project further than the intervertebral area and the arms are much compressed laterally. The transverse diameter of the neural arch at the articulating area is relatively small.

In the anterior vertebræ, the hyposphene projects backwards from the infero-posterior border of the neural spine and overlaps the inter-vertebral area and terminates just beyond this point. As may be seen from exposed cross-sections, its lateral contours are adapted to the curved recess between the arms of the prezygapophyses (Plate XXXII., figs. 1 and 2). Its inferior border, as distinct from the lateral areas, does not articulate with any



Rhœtosaurus brownei. Fig. 1.—Vertebræ 12 and 13 with moieties of Nos. 11 and 14. Figs. 2 and 3.—Chevron plates.

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Longman, Heber A. 1926. "A giant dinosaur from Durham Downs, Queensland." *Memoirs of the Queensland Museum* 8, 183–194.

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