RECORDS

OF THE

WESTERN AUSTRALIAN MUSEUM AND ART GALLERY

EDITED BY THE DIRECTOR,

BERNARD H. WOODWARD, F.G.S., C.M.Z.S.

VOLUME I.

PART I.

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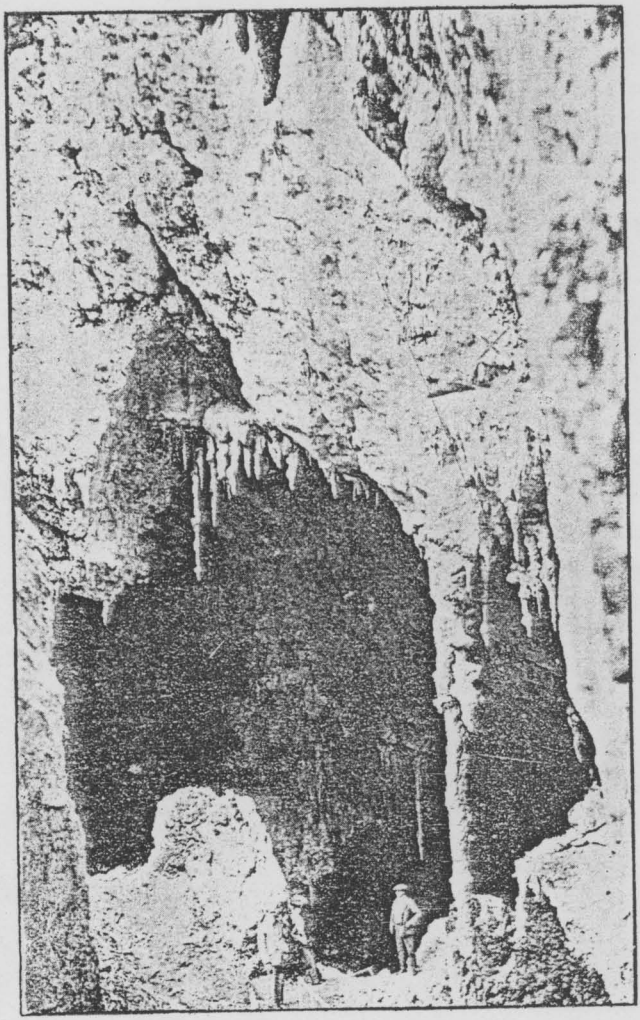

ENTRANCE TO THE MAMMOTH CAVE.

This illustration has been kindly lent by EDGAR ROBINSON, ESQ., the Superintendent of the Caves.

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THE COMMITTEE

OF THE

WESTERN AUSTRALIAN MUSEUM AND ART GALLERY

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(Curator 1889-1901).

THE WESTERN AUSTRALIAN MUSEUM AND ART GALLERY.

RISE AND PROGRESS.

1889.—The Geological Museum, Perth, established to display the specimens collected by Mr. H. Page Woodward, F.G.S., and by his predecessors in the office of Government Geologist, and to receive the contents of the Fremantle Geological Museum, which had been founded in 1881, by the Rev. C. G. Nicolay.

1892. The scope of the Institution was widened to include general Natural History and Ethnology. The contents of the Museum of the Swan River Mechanics' Institute purchased. That Institution was founded by Capt. John Septimus Roe, R.N., in 1860. The title abbreviated to the **Perth Museum** and the connection with the Geological Department terminated.

1895. The Mineral Gallery built; the collections placed under the control of a Committee; the Art Collections commenced.

1897. The James Street frontage erected. The present title given to denote that the Institution was National, not merely local.

1899. The Bird Gallery opened.

1906. The Mammalian Gallery installed.

1908. The Beaufort Street wing opened as an Art Gallery on the 25th June by H.E. the Governor, Sir F. G. D. Bedford, G.C.B.

FREE POPULAR LECTURES ON SCIENCE AND ART.

These Lectures, commenced in 1905, are delivered on alternate Friday evenings during the winter months and have proved most successful. The sixth series opens on April 8th next with a Lecture on "Some forward impulses in the History of Agricultural Progress," by Prof. W. Lowrie, to be followed by Lectures on Art and Science by the leading authorities in the State on such subjects. A programme will shortly be published.

RECORDS

OF THE

WESTERN AUSTRALIAN MUSEUM AND ART GALLERY.

THE time has arrived when it has become necessary to issue Records, as is done by the older Museums.

These will deal almost entirely with the Natural History of this State. They will contain the results of Original Research, of Collecting Expeditions, and will also include brief notes on other matters connected with this Institution.

Hitherto this information has been published through the medium of various Australian, British and foreign publications.

BERNARD H. WOODWARD,

Director.

1st January, 1910.

FOSSIL MARSUPIALS OF WESTERN AUSTRALIA.

By BERNARD H. WOODWARD, F.G.S., C.M.Z.S., Director of the W.A. Museum and Art Gallery.

INTRODUCTION.

In 1882, the late Mr. E. T. Hardman, F.G.S., the Government Geologist, reported the occurrence of *Diprotodon* bones in the Lennard River, Kimberley.

In 1895 Mr. Arthur found in a gully near Lake Darlot, a portion of a lower jaw of this animal, which he presented to this Museum. The specimen was, unfortunately, so much weathered that it was valueless except as a record. In 1898 the Museum Committee sent an expedition to Lake Darlot, and in 1908 the Hon. Dr. Hackett, at his own cost, sent another party to this place to search for further specimens, but neither succeeded in the quest.

In February, 1909, Mr. John Sharp, of Balladonia, Point Malcolm, on the South Coast, sent to the Museum a number of bones and a few teeth of *Diprotodon australis* that he had unearthed when sinking for water near his station, and has promised to send any more that may be found. These bones were so common in that district some years ago, that the settlers considered them of too little value to be worth preserving, but now that they have been awakened to their scientific interest, they will save and forward to Perth all future discoveries.

In 1904, Mr. E. A. Le Soeuf heard that some bones had been found in the Mammoth Cave, Margaret River, so he proceeded to the spot and secured a large number of fragments from a cutting that had been made when a pathway was being formed under the direction of the Superintendent of the Caves, Mr. Edgar Robinson.

Amongst these bones Mr. Le Soeuf found portions of two jaw bones of *Sthenurus*, which he retained, hoping to determine the species. The other specimens he returned to the Caves Board who presented them to the Museum. Unfortunately they contained nothing of interest except the posterior half of the right jaw of *Sthenurus*, which, though of no value in itself as it only carried two molar teeth, yet proved to be of the greatest interest, for when the Caves Board were enabled in 1908 to donate the jaws above-mentioned it was found to complete one of them. (See Plate V.).

In August, 1905, the writer was invited by the Hon. Dr. Hackett, who is Chairman of the Caves Board as well as of the Museum, to meet him at the Margaret River Caves to select sites for further exploration. After a careful examination he recommended that in the first place it would be advisable to thoroughly examine and excavate under the mass of stalagmite that had been partially removed in making the pathway in the Mammoth Cave. Nothing further, however, was done until February and March, 1909, when the Committee was able to obtain the services of Mr. Ludwig Glauert, F.G.S, Medallist in Geology and Demonstrator in Geology for five years in the University of Sheffield, who was then on the temporary staff of the Mines Department as palæontologist to the Geological Survey. The Hon. the Minister for Mines gave him leave of absence, without pay, in order that he might undertake this exploration under the direction of the writer. The Caves Board gave permission and the Superintendent, Mr. Edgar Robinson, rendered all assistance possible, and Mr. Glauert in less than two months collected 2,000 bones or fragments of bones. These include remains of *Diprotodon australis*, *Nototherium*, new species of *Sthenurus* and *Phascolomys*, of *Phascolarctus cinereus*, of *Echidna aculeata* and several species of wallabies; descriptions of the latter follow in Part II. of these Records. The wallabies include some species still living, *e.g.*, *M. brachyurus*; others may be new and in any case will certainly throw considerable light on the conditions which prevailed in prehistoric times on this Continent, as well as upon the relationships of the Marsupials.

The Caves Board has generously presented all these fossils to the Committee of the W.A. Museum.

The first instalment of Mr. Glauert's report, printed below, will give these Records a special interest to zoologists and palæontologists.

THE MAMMOTH CAVE.

By LUDWIG GLAUERT, F.G.S., ETC.

The Mammoth Cave, in which were obtained the various animal remains about to be described, is one of the finest of the numerous limestone caverns to be found in the extreme south-west of this State, from Cape Naturaliste to Cape Leeuwin.

They occur in a strip of Pleistocene foraminiferal limestone, the so-called "coastal limestone," resting upon the metamorphic rocks that form the range of hills running parallel to the coast-line in that district, at a distance of about four miles from the sea. At one time the gneissic slope extended uninterruptedly from the hills to the shore, but the strong south-west winds of the summer months soon gave rise to a chain of sand dunes which travelled inland and up the gentle escarpment of the hills. The material carried along by the wind consisted not only of the quartz grains which were derived from the disintegration of these rocks, but also included small shell fragments and the minute calcareous tests of foraminifera.

Rain water, by virtue of the small amount of carbonic acid which it obtains from the atmosphere, is able to dissolve this lime and carry it in solution to the lower portions of the pervious beds. Owing to evaporation, this lime is re-deposited and in due course the loose incoherent sand becomes solidified, forming either a calcareous sandstone or a sandy limestone, according to the amount of lime present in the rock.

The formation of caves, therefore, was accomplished without difficulty, and hastened by the fact that the rainfall on the western slope of the range is considerable, and drains through the limestone belt to the coast.

The numerous winter streams that rise in the hills proceed uninterruptedly till the limestone belt is reached, when they mostly disappear, either in the mouths of caves, or in "swallow-holes." The stream that flows through the Mammoth Cave is one of the former; it continues its course underground till it issues at the foot of the sea cliffs three miles to the westward. These subterranean watercourses are usually a succession of clefts and caverns,

increasing considerably in width and height when conditions are favourable. As a general rule the upper contour of the underlying granite forms the bed of the stream, but a very hard band of the limestone will answer the same purpose, though not in so satisfactory a manner. We have an example of this in the Mammoth Cave, for the blocks of limestone in the large main chamber (the size of which suggested its name) afford distinct evidence that formerly there were two caves, one above the other. In course of time the percolating water so weakened the limestone that formed the roof of one cavern and the floor of the other, that it collapsed, uniting the two into one huge chamber, the floor of which is strewn with large masses most of them hundreds of tons in weight. It was on the upper surface of one of these blocks, quite 70 ft. above the stream which flows through the cave, that the numerous specimens were collected. To an observer standing at that spot it is evident that the remains cannot have been introduced by way of the present entrance, which is about 70 ft. lower, for many of them bear unmistakable evidence of water transport. It was therefore necessary to seek another explanation for the presence of the bones at such a height above the present cave floor, and as the features observed tend to show that the double chamber evidently had existed, that solution may safely be adopted.

The material in which the bones were embedded, varied somewhat in nature; it comprised two groups, the lower and older series consisted of a reddish, fairly coarse sand, containing fragments of wood and gastropod shells in addition to the bones, with occasional bands of black loamy soil about an inch in thickness, which seem to prove the existence of floods in days gone by. Layers of stalactite often enclosing bones, wood fragments, etc., and bearing casts of eucalyptus leaves were not uncommon, one of these layers completely covered the series, thus protecting the animal remains and accounting for their fine state of preservation.

Above this there was another sandy bed which was yellowish in colour; the bones it contained were much fresher in appearance and are undoubtedly much more recent than the remains preserved in the lower series.

A layer of stalactite varying greatly in thickness covered the lot, and it was not until this layer was pierced that the presence of

fossils was made known. This discovery suggested the advisability of further investigations, which having been undertaken under the auspices of the Western Australian Museum and the Caves Board, resulted in the collection of some thousand bones and the addition of several species to the known fauna of the State.

ORDER MONOTREMATA. Fam. I. ECHIDNIDÆ.

Tachyglossus (Illiger).

Tachyglossus (*Echidna*) *aculeatus* (Shaw sp.) *var. typicus* (Tho).

Myrmecophaga aculeata, Shaw	Nat. Misc. iii., pl. cix., 1792
Ornithorhynchus hystrix, Home	Phil. Trans. 1802, p. 348, pls. 10-12
Echidna hystrix, E. Geoff.	Cat. Mus. p 224, 1803
,, *longiaculeata*, Tiedm.	Zool. i., p. 592, 1808
Tachyglossus aculeatus, Ill.	Prodr. Syst. Mamm. p. 114, 1811
Echinopus hystrix, G. Fisch.	Zoogn. iii., p. 692, 1814
Echidna aculeata, Garnot	N. Bull. Soc. Philom., p. 45, 1825
,, *australiensis*, Lesson	Man. Mamm., p. 318, 1827
Tachyglossus hystrix, Kaup.	Thierr. i., p. 255, 1835
Echidna australis, Lesson	Compl. a Buffon V., pl. 52, 1836
,, *acanthion*, Collett	Forh. Vid. Selsk., 1884, No. 13, 1885
,, *aculeata var. typica*, Thomas ..	P.Z.S. 1885, p. 338, pl. 23, 1886
,, ,, ,, ,, ..	Cat. Marsup. Brit. Mus., p. 379.

THE NATIVE PORCUPINE OR HEDGE-HOG.

One Monotreme is included in the list of specimens obtained, but the only bone yet recognised is the right humerus of a *Tachyglossus* from the older deposit. It is almost perfect, so that its comparison with other specimens is not difficult. The collection of Monotremes in the Mammalian Gallery contains several *Echidnæ* which are all somewhat smaller than the animal which yielded the bone now under review. The skeleton of *E. aculeata* is perfect, and gives ample opportunity for studying the typical bones.

It is seen at once that the Caves' specimen belongs to a larger animal, and that there are a few slight differences which are evidently only individual, as Owen's figure of the humerus of the same species, then called *E. hystrix* (pl. 14 in Phil. Trans., 1884, part 1, published in 1885) illustrates a bone which is identical with this, though slightly less in its dimensions.

Tachyglossus (*Echidna*), *aculeatus*, *var. typicus*, measurements :—

	Owen's *E. Hystrix*.		Mammoth Cave Specimen.	
	Inches.	Lines.	Inches.	Lines.
Length	2	—	2	3
Breadth (proximal end) ..	1	—	1	3
,, (middle of shaft) ..	—	4	—	5
,, (distal end) ..	1	9	2	—
Thickness of middle of shaft	—	3½	—	4½

It will be seen from the above table that there is an all round increase in size over the specimen that supplied Professor Owen's measurements; such an increase as would easily be accounted for by the greater size of an individual of the same species. A most careful examination of this specimen and a comparison with Owen's three figures disclose two points of difference, the greater size, in regard to the whole bone, of the process known as the "tricipital" which forms the termination of the "teretial" or "posterior tricipital ridge" that runs along the radial border of the humerus from the ento-tuberosity, and secondly the greater comparative depth of the "ulnar trochlea" at the distal end of the bone. Both these features are of little importance as they would most likely become accentuated as the animal increased in age and size.

It is an interesting fact that the days which saw the *Diprotodon* and *Nototherium* in the south-west of this State, also saw this ant-eater's range much more extended than at the present time.

ORDER MARSUPIALIA.

SUB-ORDER DIPROTODONTIA. Fam. iii., PHASCOLOMYIDÆ.

Phascolomys (Geoff.)

Didelphis, Shaw	.. ..	.. Gen. Zool. i., part 2, p. 504, 1800.
Wombat, Collins	.. ..	.. New South Wales ii., p. 153, 1802.
Phascolomys, E. Geoff.	..	.. Ann. Mus. ii., p. 364, 1803.
Vombatus, E. Geoff.	..	.. Bul. Soc. Philom. iii., p. 185, 1803
Wombatus, Desm.	.. ..	.. N. Dict. d'H.N. (1) XXIV., p. 20, 1803.
Amblotis, Illig.	.. ..	.. Prod. Syst. Mamm., p. 77, 1811.
Opossum, Perry	.. ..	.. Arcana, 1811.
Lasiorhinus, Gray	.. ..	.. Ann. Mag. N.H. (3) XI., p. 458, 1863.

THE WOMBAT.

Phascolomys Hacketti, Sp. Nov.

(PLATES II. AND III.)

From a "blow hole" penetrating the rock upon which the main mass of the osseous deposit was situated, numerous bones and skulls of small marsupials were obtained, the largest being the remains of a wombat which had either perished in the hole, or had its body transported there before decay was so far advanced as to allow portions of the skeleton to become detached, for even the lower jaw, which is so easily lost, was present along with the other bones.

This part of the deposit was connected with a thin layer overlying the main mass and is evidently of more recent age than the material which contained the bones of *Diprotodon* and *Nototherium*.

The nature of the hole and the way in which the sand and bones were cemented together, rendered the task of recovering the specimens a matter of the greatest difficulty, and in spite of the care taken, several bones are missing. Those portions of the skeleton which have been recognised up to the present time will be described in the following order: Cranium, mandible, vertebral column, sacrum, ribs, the pelvis, the fore limbs, and the hind limbs. The bones will be compared with the figures and descriptions in the works of reference available, and their differences and resemblances noted, particularly as the examination of the skull has revealed points of difference from the recognised phascolomine species.

The Cranium.

In this specimen we note many characters which prove conclusively that this Wombat is a member of the platyrhine group The skull is long and strong, rivalling in size the larger example of *P. mitchelli* quoted below from the "Catalogue of *Marsupialia* and *Monotremata* in the Collection of the British Museum" (1888). The nasals are large and expanded behind, their greatest width being about five-eighths of their length, their lateral margins are undulate, as in *P. ursinus* (and also occasionally, but to a less extent, in *P. mitchelli*), and the hind borders are convex. "The angular process of the malar part of the zygoma, which defines the orbit posteriorly," is well developed, and the maxilliary has that character which Prof. Owen holds to be of sufficient importance to distinguish *P. mitchelli* (*P. platyrhinus*) from *P. ursinus* (*P. wombatus*) and which he regards as a peculiar feature of the former species; see "The Extinct Mammals of Australia," p. 316, fig. 3, and p. 317.

The infra-orbital foramen is narrow and slit-like. The characters afforded by the upper surface of the skull are practically those of *P. mitchelli*, "the upper third of the temporal fossa is formed by a longitudinal strip of the parietal, whilst the slight rising developed along the line of the parietal-squamosal suture is distinct and can be traced to the posterior surface of the skull.

The longitudinal strip of the parietal bends down less abruptly in this specimen than in the form *P. ursinus* (*wombatus*) as shown in the figures in "The Extinct Mammals of Australia," and as described on p. 305 of that work. The inter-orbital region is smooth and evenly convex, the post-orbital processes are rudimentary and the distance between their tips identical with the inter-orbital breadth; there is a fairly well developed tubercle on the lachrimal.

The extent of the naso-premaxillary suture is twice as long as the naso-maxillary one.

The occipital region and the under surface of the skull could not be examined in detail as the very hard and adhesive nature of the matrix, and the thin and delicate nature of the bone in these parts rendered any attempt at cleaning a matter of such great risk that it was thought advisable not to undertake it. The anterior palatine foramina are long and narrow, and the posterior palatine vacuities "triangular, about equal in size to one of the molars."

The measurements taken are tabulated below and compared with those given by Mr. Oldfield Thomas in the British Museum Catalogue quoted above.

SKULL MEASUREMENTS OF PHASCOLOMYS (in mm).

Characters.	Sp. nov.	*P. mitchelli* Aged		*P. ursinus* Adult	*P. latifrons* Aged
Basal length	179	185	161	143	167
Greatest breadth	139	145	135	125	144
Nasals, length	83	81	70	62	65
,, greatest breadth ..	50	55	49	46	67
,, least breadth ..	18	15	15	17	29
Inter-orbital breadth ..	43	63	55	50	69
Breadth between tips of post orbital processes ..	43	67	60	52.5	90
Inter-temporal constriction	36	47.5	49	40	46
Palate, length	?	125	106	93.5	110
Diastema, length	45?	48.5	40	31.5	46.5
Palatal foramen	13	14	11	10	10
Basi-cranial axis	54?	57	50	48	58
Basi-facial axis	?	130	113	96.5	110
Facial index	—	228	226	201	190
Tooth series, length of ..	54?	57	51	47	50

It will be seen at a glance how the new specimen differs from the forms with which it is here compared. In appearance it closely resembles *P. ursinus*, having the same shaped nasals and the narrower cranial portion of the skull, but its size (length) is so much in excess of that of this Tasmanian species that it is impossible to regard them as identical.

The common Australian Wombat is often found to have a skull equal in length, but there are many points of distinction, chief among which are inter-orbital breadth and certain other measurements of the cranium given above.

It is interesting that in spite of its slender width, the greater expanse of the zygomæ should increase the total width to such a degree that it is very little less than that of the largest Wombat in the British Museum list.

Briefly stated, though the skull of this specimen is almost as long as that of the largest quoted in the British Museum list; the inter-orbital breadth, the breadth between the tips of the post-orbital processes and the inter-temporal constrictions are appreciably less than in the much smaller *P. ursinus*.

The Dentition.

None of the teeth of the upper jaw are in position, but fortunately ten of them were recovered from the "blow hole."

The **incisors,** unlike Owen's figures, have no sharp anterior edge, differing in this point from all the species described in Owen's work, their section too, being broad and oval, is rather more like that of *P. latifrons*, though the coating of enamel is of greater extent than is usual in this species; the faintness of the grooves reminds one of *P. mitchelli* (*platyrhinus*).

The **pre-molars** have the characteristic form of those of *P. mitchelli* (*platyrhinus*). They present a sub-triangular transverse section or working surface, the base being backwards, the apex forward; the inner side is shorter than the outer side, and is indented near the apex by a groove traversing the tooth lengthwise; the outer angle of the base is somewhat elongated by oblique attrition. The enamel begins anteriorly at the outer part of the apex, opposite the groove, is continued inwards and backwards, and upon the base (of the triangle) two-thirds of the way towards the outer angle, which, with the outer side of the tooth to near the anterior angle or apex, is coated only by cement.

The **molars** from M1 to M4 (D4-M3 of Owen) are all represented in the six teeth figured, with the exception of M4 (M3 of Owen), which are both missing, that is if we compare them with Owen's figures of *P. platyrhinus*. On the other hand, the same authority's drawings of *P. mitchelli* show last molars which differ very little from the anterior ones, in which case it is very likely that we have examples of all the cheek teeth from M1 to M4. The teeth are all more or less coated, and as they are of comparatively little value for specific determination, it was thought wiser not to attempt to clear them of matrix.

The Mandible.

Taking Owen's figures of the lower jaws as the standard, it is seen that in *P. latifrons* the curve of the under surface is much more pronounced than in *P. mitchelli* (*platyrhinus*), and that the inner angle of the condyle is much less produced in the latifront type, or in Owen's words[1] "the curve of the lower jaw is deeper, the

[1] Owen, Osteology of the Marsupialia Trans. Zool. Soc., Vol. III, p. 304, and Vol. VIII., p. 353.

inner angle of the condyle is produced inwards, and the coronoid process higher and narrower" than in the platyrhine species. The Cave form has an outline which agrees almost entirely with Owen's figure of *P. latifrons*, the chief variation being the shorter inner projection of the condyle. The under contour, the length of the diastema, and the depth of the jaw agree exactly with Owen's figures.

As far as the size and shape of the condyle and its inner angle, which extends inwards past the coronoids, are concerned, there is not the slightest doubt that they are most distinctly platyrhine.

Of the alveoli of the lower incisors, that of the right tooth seems to be perfect, and recalls Owen's figures of *P. wombatus* when viewed from above, but the lateral border is nearly vertical, and does not slope backwards as is usually the case with *P. platyrhinus*. The backward extent of the symphysis is as far as the vertical groove of the third cheek tooth, thus differing from Owen's figures of *P. platyrhinus* and *P. latifrons*. Subsequent observers[1] have however, shown that this feature is so variable in individuals as to render it quite useless for specific determinations.

There seems to be no intercommunicating foramen from the entry of the dental canal to the outer surface of the base of the coronoid, and it is unfortunate that the tender nature of the bone renders it impossible to undertake the cleaning necessary to ascertain whether this really is the case.

The post-symphysial foramina are only 4mm. in a horizontal line from the posterior margin of the symphysis, a distance which is much exceeded in the usual platyrhine Wombats.

The dentition of the mandible is very similar to that of Owen's *P. platyrhinus*, the most noticeable variation being the rounding by wear of the anterior edges of the incisors.

MEASUREMENTS.

The total length of the mandible	140mm. (5½in.)
Extreme width of the mandible	139mm.
Length of diastema	28mm.
Length of symphysis	62mm.
Thickness (depth) under M_3	35mm.
Length of cheek series of teeth	52mm.
Length of four molars (M_1-M_4)	47mm.

[1] De Vis, Proc. Linn. Soc. N.S. Wales, Vol. VI. for 1891, p. 239.

The Vertebræ.

Of the seven **cervical vertebræ** only two are represented, one of which is almost perfect, possessing, as it does, the neural spine and one of the transverse processes, which, in the words of Prof. Owen[1], "show the usual character of perforation due to the union of the outer extremities of par- and di-apophyses with a rudimentary rib." Comparison with the figure on plate xcviii. (loc. cit.) suggests that these are the third and fourth vertebræ of the series.

There are numerous **dorsal vertebræ**, those from the anterior portion of the body bearing long and strong neural spines, which contrast greatly with the small delicate ones present on the two cervical vertebræ pertaining to this collection. In all there are 13 rib-bearing members, so that there are two missing from the series as represented by *P. mitchelli* of Owen, the form to which our specimen is most closely related.

The four **lumbar vertebræ**, though none of them perfect, show their characteristics with distinctness, the diapophysis are large and flat, though in the last they assume a shape more approaching that of the same process in the four sacral vertebræ and the articular processes of the neural arch are more developed than in the dorsal vertebræ. Professor McCoy noticed that in several of the fossil remains of *Phascolomys* examined by him, the last lumbar vertebra showed signs of a strong inclination to become fused with those united to form the sacrum, in fact he goes further by stating[2] that "in several of the specimens the neural spine of the first sacral vertebra is like our fossil, nearly as high as those of the lumbar vertebræ, contrasting with the abruptly lowered or undeveloped neural spines of the following sacrals; giving the impression that the last lumbar became sacral by anchylosis with the body of the succeeding one, and by the articulation of its diapophysis with the ilia." A figure given on p. 30 of the work cited illustrates this diagramatically.

This new species is one of the intermediate forms, for in it the last lumbar with its diapophysis is much thicker and narrower than is the case with the other three lumbars, and more nearly approaching in every way the succeeding sacrals. There is, however, no

[1] Owen, Extinct Mammals of Australia, p. 297.
[2] Prof. McCoy, Prodromus of the Palæontology of Victoria, dec. vii., p. 29 (1882).

sign of any anchylosis either at the centrum or at the outer extremities of the transverse processes. On the other hand, an examination of the outer margin of the right diapophysis, which is practically intact, reveals that there was undoubted articulation with the ilium.

The **sacrum** was recovered from the deposit and luckily has suffered little from the process of separating the bone from the matrix, only the left diapophysis of the fourth sacral being absent.

Prof. Owen[1] considered that the form adopted by the fused diapophysis was distinct in the different species, and his figures certainly show considerable variation, but later Prof. McCoy states[2] "The vertebral bones forming the sacrum are singularly diverse in each of the living species of Wombat or *Phascolomys*, and were supposed to afford good specific characters, but I find the variations of individuals of each species so great that I attach no value to characters which, without this experience might seem specific."

This view is confirmed by our specimen which has singular resemblances to both the *platyrhinus* and *latifrons* types, its description is as follows:—Sacrum consisting of four anchylosed vertebræ, the posterior moiety of the first centum considerably narrower than the anterior, which has the same width as the centrum of the fourth lumbar; the posterior portion of the centrum of the first sacral, the second, third, and fourth are all equal in width but losing considerably in height as we proceed towards the caudals. Height of the neural spine on the first vertebra about 2mm., the spine is scarcely visible on the second and entirely absent on the third and fourth, the articular processes well developed on the anterior aspect of the first sacral, but fused and more and more indistinct and rudimentary as they approach the last sacral, the posterior face of which has more perfect processes for the articulation of the first caudal. The diapophysis, all anchylosed at their distal ends, the first and anterior moiety of the second articulating with the ilium on either side. The diapophysis of the third and fourth considerably broader but much thinner than those of the second, which again have not one-eighth the volume of those belonging to the first. The vacuities between the first

[1] Owen, Trans. Zool. Soc., vol. 8, p. 468-9, Ext. Mam. Aust., p. 359, *et seq.*
[2] McCoy, loc. cit., p. 27.

and second pair of diapophysis have their longest axes at right angles to the vertebral column, whilst the two succeeding pairs have them directed anteriorly, in this way appreciably resembling *P. latifrons* as figured by Owen[1]. On the other hand, the form under discussion differs from both the typical examples as figured by Prof. R. Owen in the slight backward extension of the articular surfaces for the ilia, but if, as probable, the last lumbar to a great extent assumed the duties of a sacral, then the total extent would closely agree with the area shown in figure 4 of the plate just referred to. As a natural consequence of the above peculiarity, the width of the sacrum rapidly diminishes at a point one-third down the second vertebra, being considerably earlier than in Owen's example.

The following measurements are taken :—

Length of the four sacrals (bodies)	86 mm.
Width across diapophysis of S1	72 mm.?
,, ,, ,, S2	70 mm.
,, ,, ,, S3	59 mm.
Width of anterior face of centrum of S1	26 mm.
,, ,, posterior ,, ,, ,, ...	14½mm.
,, ,, ,, ,, ,, S4	14 mm.
Greatest height of first sacral, S1	22 mm.
,, ,, fourth ,, S4	12 mm.
Length of articular surface for ilium	32 mm.?
Greatest width of ,, ,, ...	19 mm.

It will be seen from the above that the Mammoth Cave sacrum differs from both Owen's figures in several respects; it resembles both forms, and would be exceedingly difficult to connect with either.

Unfortunately the **caudal vertebræ** are altogether absent from the collection, so that any assistance which they might give is missing. There is, however, no doubt that these vertebræ or any of them were not united with the sacrals, for the posterior face of the last vertebra of the sacrum and the articular processes on the degenerated neural arch show that there was no coalescence at that point.

Of the **ribs** we have very few examples; the first and second left ribs are practically perfect, but all the others that are represented are in a fragmentary condition.

[1] Owen, Ext. Mam. Aust., pl. xcix., fig. 1.

As none of the books at hand refer to the differences and resemblances between these portions of the skeleton of the various species of Wombat, it is of little value to go more fully into the matter.

The Fore Limbs.

The **clavicles** are either missing or have not yet been identified.

The **scapulæ** are both present in a fragmentary state: of the right one there is the bone surrounding the glenoid cavity, which has the outline of that part of the scapula of *P. latifrons*, and a small portion of the distal end, or base, of the blade, including the beginning of the spine as well as another fragment of the spine. The left scapula is more complete; the major portion of the blade is preserved, and the greater part of the spine, as well as half the acromion.

In this part of the skeleton we again see a striking example of the variability of form. There is no doubt that the general outline of the cranium of this animal is almost identical with *P. mitchelli*, but here once more the form of the part under consideration approaches more nearly to the other species, *P. latifrons*. The hind border has the same curvature, and carries a similar prominence[1] at the angle furthest away from the glenoid cavity; the spine is likewise thickest near its outer border, but is not as stout as the corresponding part of *P. platyrhinus* of Owen (*P. mitchelli* of more recent authorities). The blade also is narrower in proportion to its length than in Owen's figure of *P. platyrhinus*.

The only measurements that can be taken with certainty are:—

Length of base (vertebral costa)	..	..	50mm.
Breadth of middle of scapula	..	..	46mm.
Greatest diameter (length) of glenoid cavity		..	26mm.
Greatest width (antero-posterior)	..	..	19mm.

Each **humerus** is represented: the right one is perfect in its proximal three-fourths, and the other in its distal three-fourths. Whilst the slender form of the bone reminds one of the platyrhine group, the bone is in several respects inclined to be latifront. The head of the humerus shows those characters which the size of the glenoid cavity of the scapula would indicate—namely, the articular surface is wider transversely and extends further down the shaft

[1] Owen regards this as one of the points of difference between the species. Ext. Mam. Aust., page 361.

than in the figured bones of *P. mitchelli*, but the ecto-tuberosity has an outline that approaches that of the platyrhine species. The ridge that extends about two-thirds along the inner surface of the shaft is only weakly developed compared with the striking ridge shown in the figures of the bone taken from *P. latifrons*. The "predeltoid" and the "deltoid" ridges are less prominent than in either of the figures, *P. latifrons* and *P. mitchelli* (*platyrhinus*); the latter is even somewhat rounded, lacking the sharp profile which is so pronounced in the figures. The possible youth of the animal may account for this, although the rugged nature of the whole mass forming the prominence would not suggest this fact.

The "supinator ridge" is best seen in the left humerus, and has the straight outline associated with *latifrons*, against the curve that seems to characterise the other group. It is very slender at its proximal end, but gains rapidly in thickness to form the ectocondylar triangular surface at the distal end of the bone. The arch of the bone that stretches from the shaft to the entocondylar angle or process is more slender even than is usual in *P. mitchelli*.

The distal articular surfaces are distinctly seen, and again approach the platyrhine type, although the difference between the two species is very slight, and hardly to be noticed in a cursory examination.

The usual extraordinary thinness of the bone above the ulnar division of the distal articular surface is somewhat obscured by matrix.

The following measurements were made:—

	P. Platyrh.[1]	Mammoth Cave.
Approximate length	113 mm.	113mm.
Width of shaft at its proximal third ..	24 mm.	21mm.
Antero-posterior thickness	14.5mm.	14mm.
Long diameter of head and greater tuberosity	42 mm.	36mm.
Short diameter across head	?	15mm.
Width of distal end of humerus	51 mm.	46mm.

The **radius** of the right fore-limb is present. As it varies so much from the bone figured by Prof. Owen (on Plate CI., loc. cit.), it is advisable to describe it more fully:—The bone is very slender and much more curved than the example figured by Owen. The

[1] De Vis, Proc. Lin. Soc. N.S. Wales, Vol. VI. for 1891, p. 240, etc., and Owen, loc. cit. (figs.); chiefly the latter work.

head of the radius, which is concave, is irregular in outline, being much less circular than the same portion of the skeleton of *P. latifrons*; the "narrow semi-elliptical convex surface," which is on the posterior edge of the head, and fits into the "radial concavity of the ulna," is not quite as deep as is shown in the figures referred to. On the other hand, the distance between this feature and the "tuberosity for the biceps" agrees exactly, though our bone is somewhat longer from end to end. This tuberosity is not by any means as prominent as in *P. latifrons*. Proceeding down the shaft it will be noticed to increase gradually in thickness, and also that it tends to assume a triangular shape—one of the angular ridges being that for the insertional fascia of the "supinator longus" —and gaining in sharpness till it reaches a small tuberosity at the distal end, just above the base of the short, thick styloid process. It is also possible to trace the rough tract on the interosseal ridge or angle, situated in relatively the same position as on the bone of the figured species.

Prof. Owen states that this bone is less thick in proportion to its length in *P. platyrhinus* (*P. mitchelli*) than in the latifront species, but in the new form it is considerably so, as may be seen from the appended measurements, besides, though Owen states that the radius is "slightly bent with the convexity forward" his figures, however, show a bone which is much less arched than this specimen, for it is impossible to place this bone in a position which, whilst giving a straight outline, shows up the features as illustrated in Owen's figures.

TABLE OF MEASUREMENTS.

Features.	Measured on Owen's figure.	Measurement of cave specimen.
Total length	107mm.	111mm.
Width at head (proximal end)	14½-15mm.	12½mm.
Width below the tuberosity for the biceps ..	10mm.	9 mm.
Width at rough tract on interosseal angle ..	13mm.	12 mm.
Width at tuberosity at distal end of bone ..	23-24mm.	22½mm.

The Ulna. Both the right and the left are in very good condition and therefore a satisfactory examination can be made. Owen states (loc. cit.) that the platyrhine and the latifront species resemble one another to a very great extent as far as this bone is concerned. He notices that "the ulna of *P. latifrons* differs chiefly from that of *P. platyrhinus* in the quadrate form of the long olecranon which

preserves its breadth to the truncate summit, while in *P. platyrhinus* it contracts to that summit which is thick, obtuse and tuberous. The hind border of the olecranon is thicker in *P. latifrons* than in *P. platyrhinus*. The surface for the ulnar division of the humeral joint is relatively longer, narrower and more obtuse in *P. latifrons* than in *P. platyrhinus*.

The specimen under examination is much more closely allied to the platyrhine type in the form and size of the olecranon, and the surface for the ulnar division of the humeral joint, and as it agrees with Owen's figures in all other points further notice is unnecessary. The total length of the bone is 148mm.

No other bones of the fore limb have, as yet, been recognised, though it is quite possible that some may be present in the collection.

The sacrum has already received attention so that we may proceed to describe the **pelvis.** The upper portion of the right "os innominatum" is fairly complete, though the greater portion of bones forming the pelvis are either missing or in a fragmentary state. In the Caves specimen the bone (the ilium) is slender as in the platyrhine type and is much more elongated than is the corresponding portion of the skeleton in *P. latifrons.*

Of the other extremity of the bone we have the end of the ischium including "the expansion of the great tuberosity" in which again there is both in extent and outline an undoubted similarity with the platyrhine and a difference from the latifront forms.

Of the bones of the hind limbs there is the **femur** in a perfect state. Referring to this bone in examples of *P. platyrhinus* and *P. latifrons*, Owen says, "The femur is thicker in proportion to its length in *P. latifrons* than in *P. platyrhinus.* Both trochanters are rather more prominent, but the genuine characters of the bone . . are closely preserved in all Wombats." This authority figures bones of *P. latifrons* only, so that there is no opportunity of comparing the specimens with drawings of that portion of the skeleton of the other species; at the same time it may be stated that the Mammoth Cave specimens are decidedly more slender than the bones exemplified by Owen's figures.

Another authority, C. W. De Vis, of the Queensland Museum, enters more fully into the shape, size and character of this bone of

the hind limb in an article[1] in which he discusses the correctness of the assertion that *P. mitchelli* and *P. platyrhinus* are one and the same species, and that the name *P. platyrhinus* is reduced to a synonym[2]. In the course of his remarks he quotes numerous measurements which, together with some collected from Oldfield Thomas' work, and others made from Owen's figures (loc. cit.) are given below in tabular form.

MEASUREMENTS (in mm.)

	Mammoth Cave specimen.	*P. latifrons*	*P. mitchelli*	*P. platyrhinus*	*P. ursinus* (*wombatus*)
Length	159	141	168	163	155
Least transverse diameter of shaft	15.5	17	17.5	14.5	14.5
Breadth of distal end	32.5	37	39	—	—
Antero-posterior diameter of head	20	24	26	—	—
Distance between the summits of the two trochanters ..	39	41	47.5	44	40
Antero-posterior dimension of the inner condyle	31	30	36	31	29

It will thus be seen that whereas the femur of this form has a slightly stouter shaft than that of *P. platyrhinus*, being almost the same strength as the bone of *P. latifrons* figured by Owen (loc. cit.); it is shorter, the breadth at the distal end is less, as also is the space between the two trochanters. On the other hand the antero-posterior dimension of the inner condyle of this form and *P. platyrhinus* agrees. In consequence, the bone cannot be referred to any of the existing or recognised species on account of a distinct variation from any one of them.

The **tibia**. The remains of this bone are only fragmentary, We have the proximal end and a portion of the shaft of the left; and the head, distal end and almost half the shaft of the right. This is unfortunate, as the available parts are too scanty to allow of any conclusions being drawn as regards the differences and resemblances of the specimens.

This concludes the description of the identified remains of the skeleton of this animal. As already stated, it is

[1] C. W. De Vis, Proc. Linn. Soc. N.S. Wales, Vol. VI. for 1891, p. 240, etc.

[2] Oldfield Thomas. Catalogue of the Marsupialia and Monotremata in the Collection of the British Museum, p. 214, 1888. R. Lydekker, Catalogue of the Fossil Mammals in the Collection of the Brit. Mus., part V., p. 153, 1887. Murie, Proc. Zool. Soc., London, 1865, p. 851.

possible that more bones may yet be recognised as belonging to this animal, but this is not probable, as the bones were carefully sorted out upon several occasions.

Taking into consideration all the bones examined and referred to above, there seems a close relationship between this specimen and the platyrhine form as exemplified by Owen's *P. platyrhinus*; on the other hand, there are striking points of difference. For instance, of the skull, those most important bones, the nasals, though longer and having a greater "least breadth" than the corresponding bones of *P. platyrhinus*, are very slender when their greatest breadth is concerned, thus suggesting in a general way the narrower form of the cranium proper which is so marked in the post-orbital region.

The greater lateral extent of the zygomal arches, bringing up to normal the greatest breadth of the skull, is also a point that must not be overlooked.

In the mandible we have several variations, chief amongst them being the contour of the under surface.

The scapula, humerus, radius and femur all appear to vary from the corresponding bones of the continental species, so that there seems some justification for considering the Mammoth Cave form a species distinct from all of them.

SPECIFIC CHARACTERS.

Skull. Large, of the platyrhine type, with a basal length of 179mm.; nasals large, expanded behind, but less so than in *P. mitchelli*, their greatest breadth five-eighths of their length, their lateral margins undulate, posterior border convex; width of cranial portion of skull, exclusive of the zygomæ, much less in proportion to the basal length than in the other forms; zygomal arch very large; extent of the naso-premaxillary suture twice as long as the naso-maxillary suture.

Teeth. Upper incisors comparatively broad, oval in section, faintly grooved; lower incisors sub-triangular in section, their breadth less than their depth; molars as usual.

Size of the animal. As large as *P. mitchelli*.

I have named this Wombat *Phascolomys hacketti*, in honour of the distinguished Doctor, who is Chairman not only of the Museum

and of the Caves Board, but also President of the Zoological Gardens, in order to commemorate the vast amount of time and energy that he has devoted to the advancement of science in this State.

Fam.: PHALANGERIDÆ. Sub. Fam.: PHASCOLARCTINÆ.

Phascolarctus, Blainv. (1816).

Phascolarctus cinereus, Goldf. sp.

Koala, G. Cuv.	R. Anim. i., p. 184, IV. pl. lf. 5, 1817
Lipurus cinereus, Goldf.	Isis, p. 274, 1819
Morodactylus cinereus, Goldf.	Zool. ii., p. 445, 1820
Phascolarctus fuscus, Desm.	Mamm. i., p. 276, 1820
,, *koala*, Gray	Griff. Cuv. An. K., p. 205, 1827
,, *flindersi*, Less.	Man. Mamm. p. 221, 1827
,, *cinereus*, J. B. Fisch. ..	Syn. Mamm., p. 285, 1829

THE KOALA, OR NATIVE BEAR.

PLATE IV.

Examination of the many small mandibles obtained revealed two which differed materially from all the others in the collection. The one, that of a full grown (adult) animal, was as perfect as could be expected, only a portion, a very small portion, of the coronoid process being wanting; the other, that of a younger individual with M4 not yet up into line is more imperfect at the coronoid, and has also one of the incisors missing.

They evidently belonged to a comparatively small animal which, like the Wombat, has a remarkably broad head; the coronoid process is very much prolonged, and the condyle is a considerable distance above the level of the teeth, the angle, too, is very prominent and considerably inflected. As regards the teeth, the dental formula is as follows, for the lower jaw: $I_{\overline{100}}$, $C_{\overline{0}}$, $P_{\overline{0004}}$, $M_{\overline{1234}}$.

The incisor is narrow, sharp-edged, and deep antero-posteriorly, the premolar, a little less in length than M1, has a sharp edge that branches posteriorly into two diverging ridges. The four molars vary very little in size, the first one being the smallest; they have four tubercles or cusps in the shape of sharp curved crests which have the concave sides interiorly and the convex sides exteriorly. All these characters are associated with herbivorous animals.

A careful search through the specimens in the Museum and the figures and descriptions to be found in the works of reference available, showed that without a doubt the two mandibles are those of a Koala, or Native Bear (*Phascolarctus*). See Owen's "Extinct Mammals of Australia," fig. 11, p. 90; fig. 5, p. 152; fig. 6, p. 153; fig. 3, pl. xxxii. Also British Museum Catalogue of Marsupialia and Monotremata, pp. 209, 210, 212.

The following measurements were taken in mm :—

	Aged	Young
Antero-posterior length	100	80
Height (coronoid)	70	49
Thickness behind M4	9.5	—
Width, exterior of condyle to exterior of condyle ..	67	—
Greatest width (coronoids)	74	53.5
Length of incisors	11?	11
Thickness of do.	3.5	3.5
Depth at socket	7	6
Length of cheek series	35	38?
Length of premolar	6.5	7
Greatest thickness of premolar	4.5	4.5
Length of M1-M3	21.5	23
Length of M1-M4	28.5	31?
Length of M1	7	7.5
Thickness of M1	5.5	5.5
Length of M2	7.25	7.5
Thickness of M2	5.5	5.5
Length of M3	7.25	7.5
Thickness of M3	5	5
Length of M4	7.25	7.5
Thickness of M4	5	5
Depth of jaw under P4..	18.5	14
Depth of jaw under M4	22	19.5
Distance of condyle above the alveolus of M4 ..	32	21
Length of symphysis	24	?

Fam. MACROPODIDÆ. Sub-Fam. MACROPODINÆ.

Sthenurus, Owen (1873)[1].

Sthenurus—Owen	..	Proc. Royal Society XXI., No. 141, p. 128, 1873
Owen	..	Phil. Trans. Royal Society, p. 264, 1874
Lydekker	..	Catalogue Fossil Mammals, Brit. Mus., N.H. vol. V., p. 231, 1887
De Vis	..	Proc. Linn. Society N.S. Wales, 2nd series, vol. X., p. 88, 1895
Protemnodon (partim)—Owen	..	Proc. Royal Society XXI., No. 141, p. 128, 1873
Owen	..	Phil. Trans. Roy. Soc., p. 274, 1874
Procoptodon—Owen	..	Proc. Roy. Soc. XXI., No. 145, p. 387, 1873
Owen	..	Phil. Trans. Royal Society, p. 788, 1874
Lydekker		Catalogue Fossil Mammals Brit. Mus., N.H. vol. V., p. 231, 1887

This form being extinct, it has no vernacular name; it belongs to the kangaroo family.

STHENURUS OCCIDENTALIS, Sp. Nov.

PLATE V.

[Report originally prepared for the Caves Board on the specimens originally found by Mr. E. A. Le Souef. It was not printed, and has since been revised and extended.]

The specimen about to be described consists of the right and left horizontal rami, united in their natural position, with incisors, premolars and molars all in place, and up in line. The hind lobe of the last molar, M4, showing traces of wear, the animal would be considered AGED by Oldfield Thomas,[2] and ADULT by C. W. De Vis.[3] The lower half of the right coronoid is present, but of the left very little remains.

It has been possible, however, to make the following measurements:—

Incisor. Length from base of enamel to the extremity of the worn crown, 22mm.; length of the cutting edge of crown, 13mm.; thickness of crown, 6.5mm.; vertical diameter at base of enamel, 11mm.; transverse diameter, 7mm.

Diastema. Length from posterior base of enamel of incisor to anterior edge of socket of premolar, 22.5mm.

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1 Owen, Proc. Royal Soc. Lond. XXI., No. 141, p. 128, 1873. Owen, Phil. Trans. Royal Soc. Lond., p. 265, 1874.

2 O. Thomas, Catalogue of Marsupialia and Monotremata in the Collection of the British Museum (N.H.), p. 7, 1888.

3 C. W. De Vis, Proc. Linn. Soc. N.S. Wales (2nd ser.), vol. X., p. 79, 1895.

Cheek Teeth. Length of entire series (in situ) from anterior edge of P4 to hind edge of M4 60 to 61mm., M1 to M4 44.5mm., M1 to M3 32.5mm.

Premolar (P4), antero-posterior dimension 17mm., summit of crown 12.5mm., greatest width of anterior moiety 7mm., of posterior 9mm.

First Molar (M1)[1], length 10.5mm., fore lobe 8.5mm., hind lobe 8.5mm.

Second Molar (M2), length 11.5mm., fore lobe 8.5mm., hind lobe 9.5mm.

Third Molar (M3), length 12.5mm., fore lobe 10mm., hind lobe 10mm.

Fourth Molar (M4), length 11.5mm., fore lobe 9.5mm., hind lobe 9mm.

The Mandible, greatest length of jaw 160mm. (from the tip of the incisor to the hind margin of the coronoid); greatest depth in front of P4, 34mm.; greatest depth at M4, 35mm.; depth behind P4, 31mm. Thickness under P4, 15mm.; behind M3, 17-18mm. Dental vascular foramen $7\frac{1}{2}$ to 8mm. below the edge of diastema, slightly in advance of P4. A second smaller foramen below the base of posterior lobe of M1.

Description of the Specimen.

The **incisor** much resembles the corresponding tooth of the *S. atlas* figured by Owen (Phil. Trans. 1874, pl. xxii., figs. 5 and 6), but has a relatively longer working surface, possibly on account of the greater age of the individual, and is more erect.

The **premolar** is elongately oval in horizontal section, possessing a marked constriction at a point 7mm. from the anterior basal edges, particularly on the outer aspect, which almost divides the tooth into a fore and a hind lobe; the oblique horizontal continuation of this vertical groove, inwards and backwards, gives a transversely bilobed appearance to the hinder part of the crown, and causes the lobe that represents the anterior portion of the outer aspect to form the whole of the inner surface. The posterior

[1] This tooth corresponds to the D4 of Prof. Owen. The M1 of this authority agrees with the M2 of later authorities. In this table of measurements the width of the lobes of the molars is the extent of the cutting edges of the lobes.

portion of the crown is shorter than the succeeding molar, and has a broad working surface with complex transverse ridging between the inner and outer simple trenchant edges. A basal ridge is present on the inner, fore, and outer aspects; that on the front of the tooth is plain, but the other two each give rise to three swellings or ribs that pass upwards to the crown. A vertical fold in the enamel is present at the intero-posterior angle; the hind surface of the tooth is perfectly smooth and convex, both vertically and horizontally.

The Molars (M1-M4). The lobes are thin and almost straight, though slightly convex backwards, crests slightly concave, angles sharp, particularly on the inner edge; from the outer angle of the hind lobe, a marginal fold sweeps downwards and forwards, almost closing the mid-valley; this fold from the fore lobe forms the edge of the anterior talon. Similar branching marginal folds are present on the anterior surface of the inner angle of the hind lobe. There are several vertical folds on the fore surface of each lobe. On the hind surface they are more numerous (about nine), but are almost rudimentary. A basal ridge is present on the hind surface of each molar, that on M1 being little more than a slight swelling. As a general rule the ornamentation on the posterior molars is less complicated than on the anterior ones. A longitudinal link connects the fore lobe with the hind one.

The Ramus is strong and powerful, it is convex vertically and slightly so horizontally. The anterior vascular foramen is slightly in advance of the premolar and of fair size, as in *S. atlas* of Owen, but the second one is placed under M1 instead of beneath one of the posterior molars. The under surface of the ramus shows a distinct upward arch, the posterior portion passing up in an unbroken curve to form the under aspect of the coronoid. Of the coronoid sufficient is present to show that the anterior margin of the ascending ramus ran at right angles to the line of the teeth; the condyle is absent. The "fenestral vacuity" takes the shape of a pouch, having its opening slightly below the level of the teeth, it contains the posterior outlet of the dental canal and a fenestral foramen communicating with the inner pouch of the ramus. The symphysis is anchylosed and the diastema very short.

Specific Characters.

Longitudinal links continuous with the outermost of the incumbent folds, low but distinct, a second link lower and very indistinct in a worn tooth; present in the mid-valley of all the molars. Posterior basal ridge absent in M1 and but faintly seen in the other molars.

Mandible thick, symphysis anchylosed. Incisor inclined, posterior dental foramen below the level of the teeth, level with the ectalveolar groove. Anterior edge of coroncid process rising at right angles to the line of the teeth. Under surface of the mandible arched upwards. Diastema short. Ramus thinner than in *S. oreas* (De Vis) and deeper than in *S. atlas* (Owen).

Differences and Resemblances.

S. oreas (De Vis)[1] has the same general outline as our form, the same depth of ramus and an anchylosed symphysis. On the other hand its ramus is much stouter, 22.5-25.8mm. against 17mm., and the molars broader.

S. atlas (Owen). This species, according to De Vis, is distinguished from the preceding by having a much more slender ramus and by the fact that the symphysis is not anchylosed. In shape, too, the ramus is "flat exteriorly, increasing in depth posteriorly. Lower contour line flat or arched upwards." Against this, our form is thick, the exterior surface is convex and the lower contour line arched upwards; the symphysis is anchylosed. Again, the incisor of the new species is much more erect and the diastema appreciably shorter. In the older form the depths of the jaw are 26.1 to 28.5mm. and 29mm.-32.7mm., against 34 and 35mm.; the teeth are smaller in the animal from the Eastern States.

ADDITIONAL SPECIMENS.

The collection contains numerous rami and portions of rami belonging to members of this genus.

They all belong to adult or aged (Thomas) animals, having all the four molars in line and more or less worn. In consequence they give every opportunity for comparison with the type specimen

1 De Vis, loc. cit, pp. 89 and 96.

of *Sthenurus occidentalis* the species I had the honour to examine, describe and name for the Caves Board.

The most perfect specimen consists of the left ramus showing the condyle, the outer "pouch" the fenestral vacuity, the fenestral foramen, and the posterior outlet of the dental (vascular) canal; but wanting the upper portion of the coronoid process. All the cheek teeth are present, though fairly worn; of the incisors only the bases are preserved, the teeth themselves having most likely been lost in the course of the excavations. There is a complete anchylosis of the symphysis as in the type specimen.

Of the right ramus we have all the cheek teeth in good condition, but not a trace of the ascending ramus, the coronoid process.

All the measurements practically coincide with those of the type, there being only an occasional variation of less than 1mm. Judging by the amount of wear exhibited by the teeth, the animal evidently attained a considerable age before it met its death.

A second specimen consists of the practically complete left mandibular ramus comprising the incisor, all the cheek teeth, practically all the coronoid, the condyle, and what is so often missing, the angle, in this case almost intact.

The specimen is evidently a *Sthenurus occidentalis*, almost every measurement agreeing with the type.

There are two additional specimens consisting of the four molars of the right and left ramus respectively, in which all the teeth show signs of wear, the dentine being exposed in M1, and also slightly in M2. The whole series measure 47mm. against 45mm. in the type, but I have no doubt that these two belong to the same species, being simply the remains of a larger individual. There is no appreciable difference in the tooth sculpture between these and the type molars.

Lastly, there is a specimen comprising the four molars, the last almost in place, the base of the coronoid and the posterior portion of the horizontal ramus which is of interest, as the teeth have a somewhat different type of ornamentation from that of the previous rami and are somewhat smaller. The ramus, too, is more slender and has a decided angle at the posterior lower end of the horizontal ramus in place of the graceful curve that characterises *S. occidentalis.* In these respects it resembles the right ramus of a young individual obtained in the cave when the deposit was discovered some years ago.

These rami of young examples of *S. occidentalis* are of value, as they allow us to form a better idea of the appearance of fresh and unworn molars.

The type specimen is the mandible of an old individual, rendering the accurate description of these teeth rather difficult. It is gratifying to be able to state that a careful examination of the teeth of these younger examples has confirmed the statements made in my report to the Caves Board of W.A. some months ago. The only additional feature to which attention may be drawn being the fact that the outer aspect of the "external incumbent fold on the fore lobe which sweeps round to form the sharp ridge along the anterior talon of the tooth," is ornamented with two or three vertical folds which are most prominent on the true molars, M1 to M3, and only rudimentary on M4.

The angle at the base of the coronoid of the younger individuals to which reference was made above, is a character which loses its sharpness as the animal increases in size, for we have several intermediate stages from a young animal with its deciduous molars, D2-D3, still in position, to the aged individual that has had its last molar (M4) in use for some considerable time. As might be expected, these younger animals have a ramus which is considerably shorter, shallower, and much more slender than that of a full grown member of the same species. It must also be added that their teeth, too, possess a rather smaller "crown only" measurement, as they are comparatively speaking unworn and preserve all the sharp edges of the crowns or ridges of the lobes, the links, talons and folds.

MUSEUM NOTES.

SOME IMPORTANT ADDITIONS TO THE COLLECTIONS RECEIVED SINCE 1st JULY, 1909.

Zoology.—Sir Ernest H. Shackleton, C.V.O., has presented a Crab-eating Seal, *Lobodon carcinophagus*, and an Emperor Penguin, *Aptenodytes forsteri*, collected on the South Polar Expedition. Mr. Gregory Mathews has sent, in exchange, specimens of the Tinamous, *Tinamus latifrons*, and of the Sand-grouse, *Pteroclis bicinctus*, examples of two orders of birds not hitherto represented.

Botany.—Mr. J. H. Maiden, F.L.S., the Government Botanist of New South Wales, has given specimens of two new gums, *Eucalyptus woodwardi* and *E. morrisoni*, which were collected by Mr. Henry Deane, M.A., far to the East of Kalgoorlie during the Transcontinental Railway Survey.

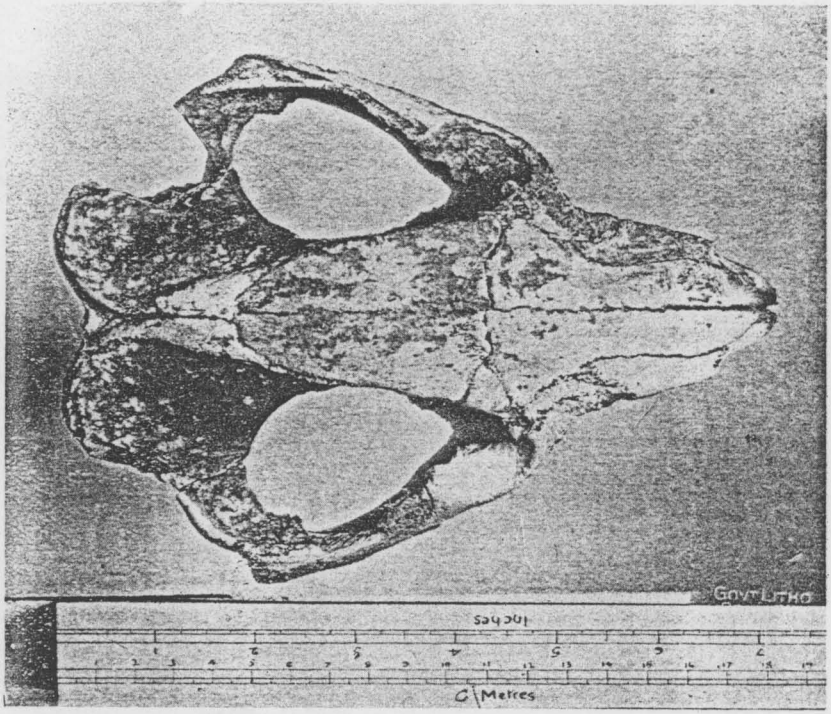
Mineralogy.—A series of Antarctic rocks, of lava and pumice from Mt. Erebus, forwarded by Professor T. W. E. David, of Sydney University, on behalf of the donor, Sir Ernest H. Shackleton, C.V.O. Various W.A. rocks, ores etc., from residents in this State.

Paintings.—The late Hon. Sir George Shenton, Kt., has bequeathed the oil-colours "Evening on the Sussex Downs," by A. F. Grace, and two seascapes, County Clare, Ireland. A Portrait of a Lady of the Court of Louis XIII., by Phillippe de Champaigne (1602-1674), and the "Widow's Acre," by G. H. Boughton, R.A. (1834-1905), have been purchased on the recommendation of Sir James D. Linton, P.R.I. The Hon. Dr. J. W. Hackett has presented three oil paintings, a Sketch on the Normandy Coast, by J. W. Morrice, a Canadian artist; the "Reprimand," by Henriette Browne (Madame Jules de Saux) (1820-1904); and "Loves me, loves me not," by E. Phillips Fox. "A Feather fallen from the Wings of Cupid," by Rupert C. W. Bunny, has been purchased. Messrs. Fox and Bunny are the first two

Australians to have attained the distinction of election as Associés de la Societé des Beaux Arts in Paris. The Gallery is indebted to Sir James D. Linton, P.R.I., for the present of a charming "Portrait of a Lady" by Sir Wm. Beechey, R.A. (1753-1839).

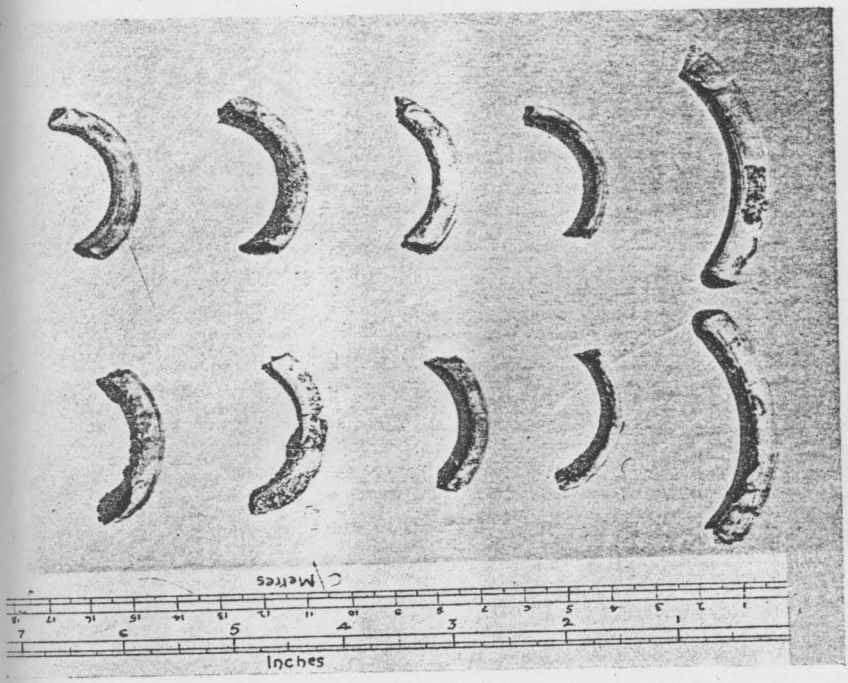
Arts and Crafts.—The Imperial Academy of Science at St. Petersburg has sent out a very valuable collection of Russian porcelain, which includes a statuette, "Lost in Thought." These have been acquired in exchange for native weapons and other duplicate specimens.

N.B.—With the exception of the Frontispiece, the plates were made by Mr. H. J. Pether, the Government photolithographer, from photographs taken by Mr. G. Pitt Morison, of the Museum. It has been found necessary to print each block on a separate page, therefore there are two each of Plates II., III., and V.



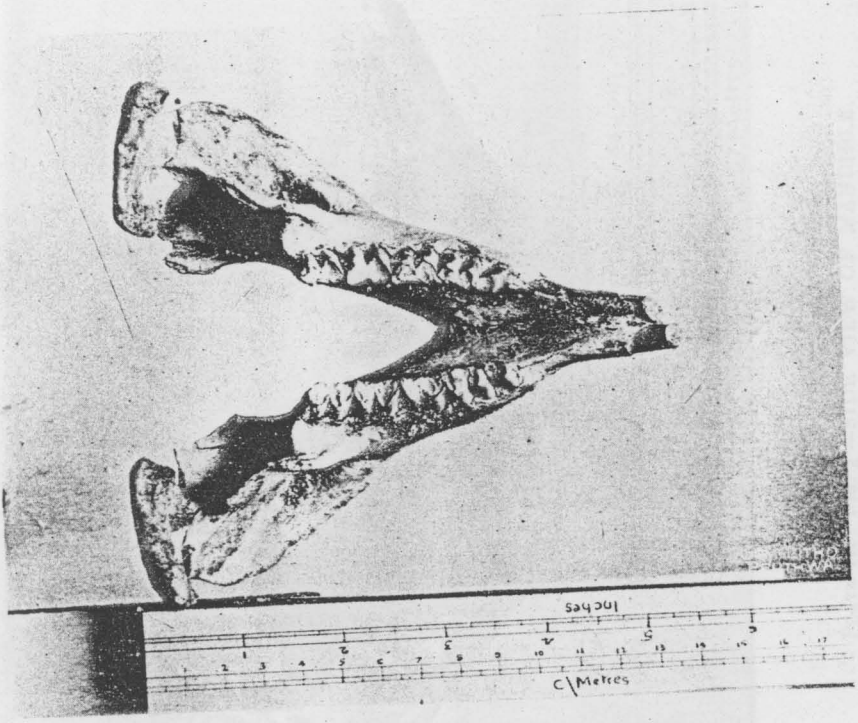
Phascolomys hacketti (sp. nov.)

PLATE II., FIG. 1.—TOP VIEW OF SKULL.



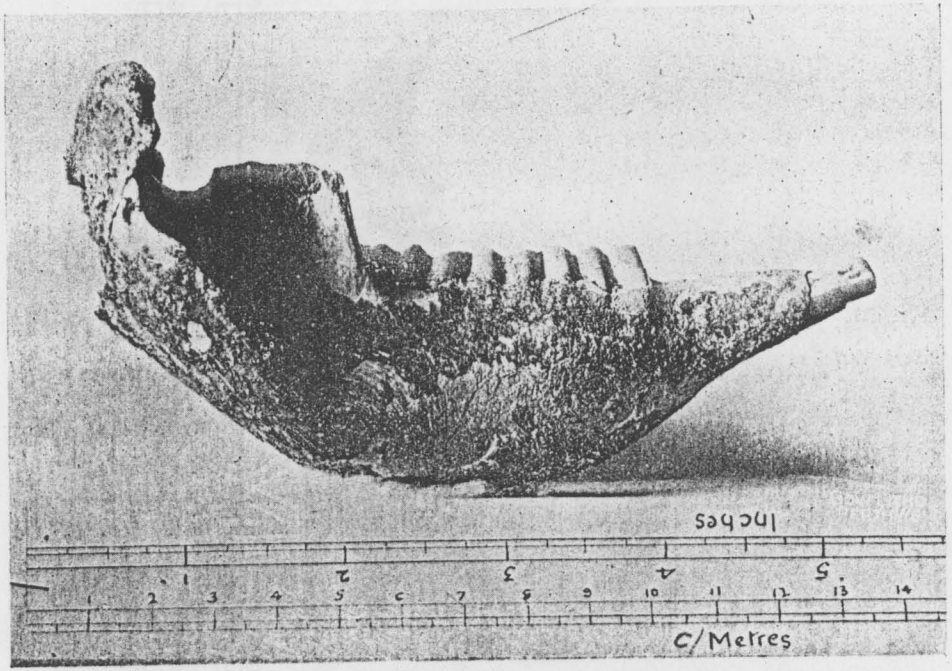
Phascolomys hacketti (sp. nov.)

PLATE II., FIG. 2.--TEETH OF UPPER JAW.



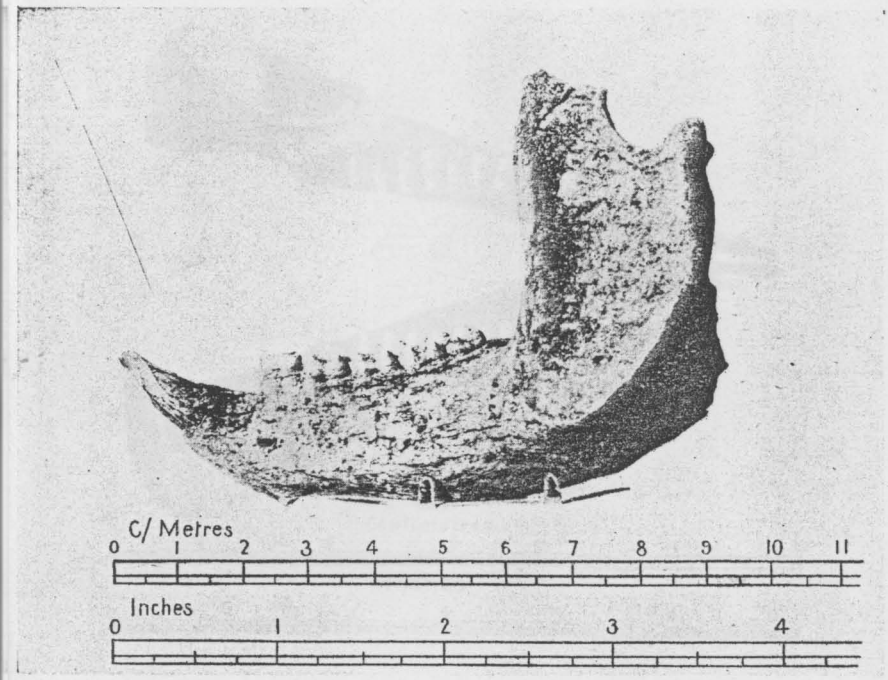
Phascolomys hacketti (sp. nov.)

PLATE III., FIG. 3.—TOP VIEW OF MANDIBLE.



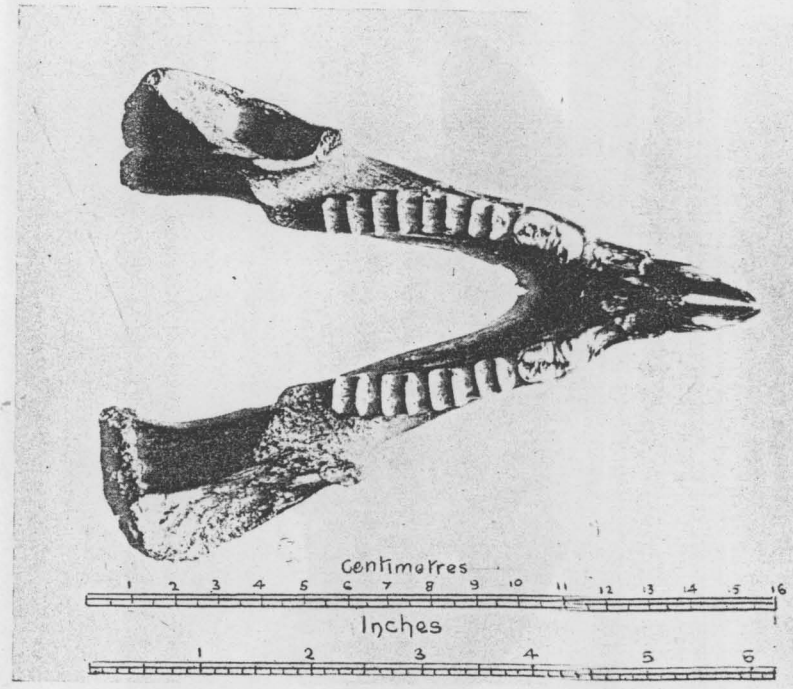
Phascolomys hacketti (sp. nov.)

PLATE III, FIG. 4—SIDE VIEW OF MANDIBLE.



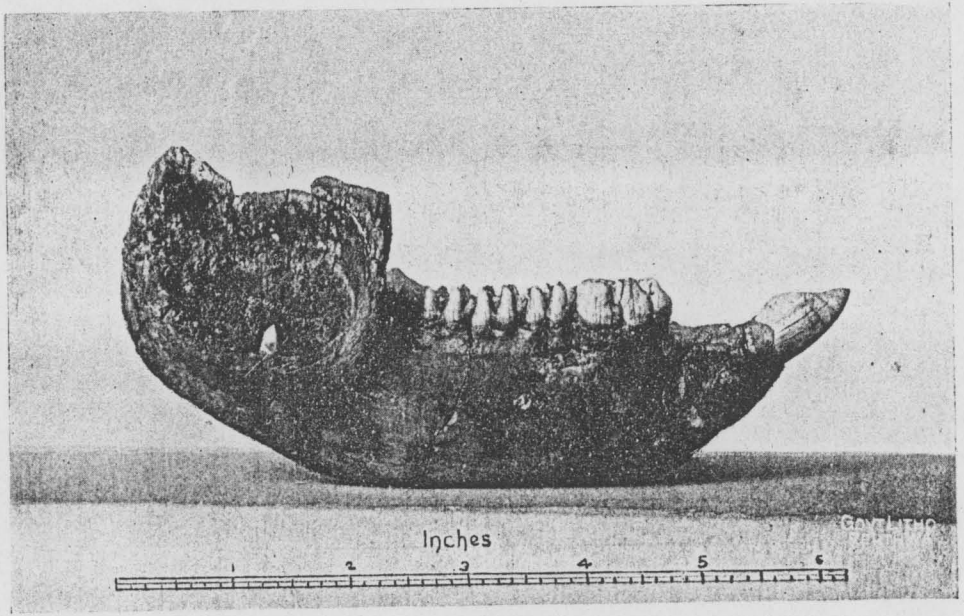
Phascolarctus cinereus (Goldf. sp.)

PLATE IV., FIG. 5.—SIDE VIEW OF MANDIBLE.



Sthenurus occidentalis (sp. nov.)

PLATE V., FIG. 6.—TOP VIEW OF MANDIBLE.



Sthenurus occidentalis (sp. nov.)

PLATE V., FIG. 7.—SIDE VIEW OF MANDIBLE.