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A New Species of Sthenurus (Marsupialia, Macropodidae) from the Pleistocene of New South Wales

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A New Species of Sthenurus (Marsupialia, Macropodidae) from the Pleistocene of New South Wales

A contribution from the Museum of Paleontology, University of California, U.S.A.

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ABSTRACT

A new species of *Sthenurus*, *Sthenurus andersoni*, is described from the Pleistocene Bingara fauna of New South Wales, Australia. The holotype is a left mandible, lacking the ascending ramus. Fourteen paratypes and three referred specimens were also used in the description. *S. andersoni* appears to be closely related to *S. atlas*.

INTRODUCTION

The genus *Sthenurus* is represented by three species in the Bingara fauna from Murchison County, New South Wales, Australia (Marcus, 1962, unpublished Ph. D. dissertation). The holotype and paratypes of *Sthenurus andersoni*, the most abundant species of the genus, are from a quarry deposit excavated by the Department of Mines of New South Wales in 1887. William Anderson (1890) directed the collection of the specimens and described the deposit.

Sthenurus andersoni, is similar to, but smaller than, *S. atlas* (Owen), 1838. Its lower molars are lower crowned, shorter and relatively wider than those of *S. atlas*. *S. andersoni* and *S. atlas* represent long-jawed members of the genus, whereas *S. oreas* and *S. pales*, both represented at Bingara, and *S. occidentalis* from Western Australia are short-jawed (more like *Procoptodon* in this respect). *Sthenurus* molars maintained sharp crests throughout all wear stages. In *Procoptodon* they are worn off to form triturating surfaces. Propalinal motion would be restricted in *Sthenurus* by the interlocking of the upper and lower molar crests.

The clay deposit in which the Bingara fauna occurs is of limited extent and overlies late Tertiary or early Quaternary basalts. Hundreds of specimens were excavated from this deposit and these represent five families of marsupials. Mandibles of macropodids are the most abundant fossils. *Diprotodon optatus*, *Thylacoleo carnifex*, *Macropus titan*, and *Zygomaturus trilobus* are associated with *Sthenurus andersoni* at Bingara and the Wellington Caves in New South Wales, and at the Darling Downs in Queensland. These species were elements of a widespread middle to late Pleistocene fauna.

ACKNOWLEDGEMENTS

The author was a member of the University of California Museum of Palaeontology expedition to Australia in the summer of 1954, and was supported by that institution for continued research in Australia until January, 1955. Dr. R. A. Stirton arranged for the loan of specimens from the Australian Museum, Sydney. The collections, notes and diagrams that he made were constantly used during the preparation of this paper. Oliver Chalmers and Harold Fletcher, of the Australian Museum, gave invaluable assistance in the assembling and shipping of the extensive Bingara collection to the University of California. The illustrations were prepared by Augusta Lucas.

DESCRIPTION OF FOSSILS

Sthenurus andersoni*, Marcus, n. sp.

Holotype.—Left mandible, Australian Museum no. MF 946. Ascending ramus lacking; angle partially lacking; root of $I_{\overline{2}}$, $P_{\overline{3}}$, part of alveolus and anterior root of $M_{\overline{1}}$, and $M_{\overline{2-4}}$ preserved; Bone Camp Gully, V5572.

Paratypes†.—Bone Camp Gully, V5572: Left mandible, $P_{\overline{3}}$, $M_{\overline{1-2}}$, MF3. Right mandible, $P_{\overline{3}}$, $M_{\overline{1-3}}$, UC 60015. Right mandible, $M_{\overline{2-2}}$, UC 60016. Right mandible, $I_{\overline{2}}$, $P_{\overline{2}}$, $DP_{\overline{3}}$, $P_{\overline{3}}$ excavated from its crypt, MF 10. Left mandible, $M_{\overline{2-4}}$, MF 942. Left mandible,

* For the late Charles Anderson (1876-1944), of the Australian Museum, who before his death curated and was studying a large part of the Bingara collection.

† V and UC numbers refer to v rtebrate localities and specimens, respectively, of the University of California Museum of Paleontology; MF and F numbers refer to specimens in the Australian Museum.

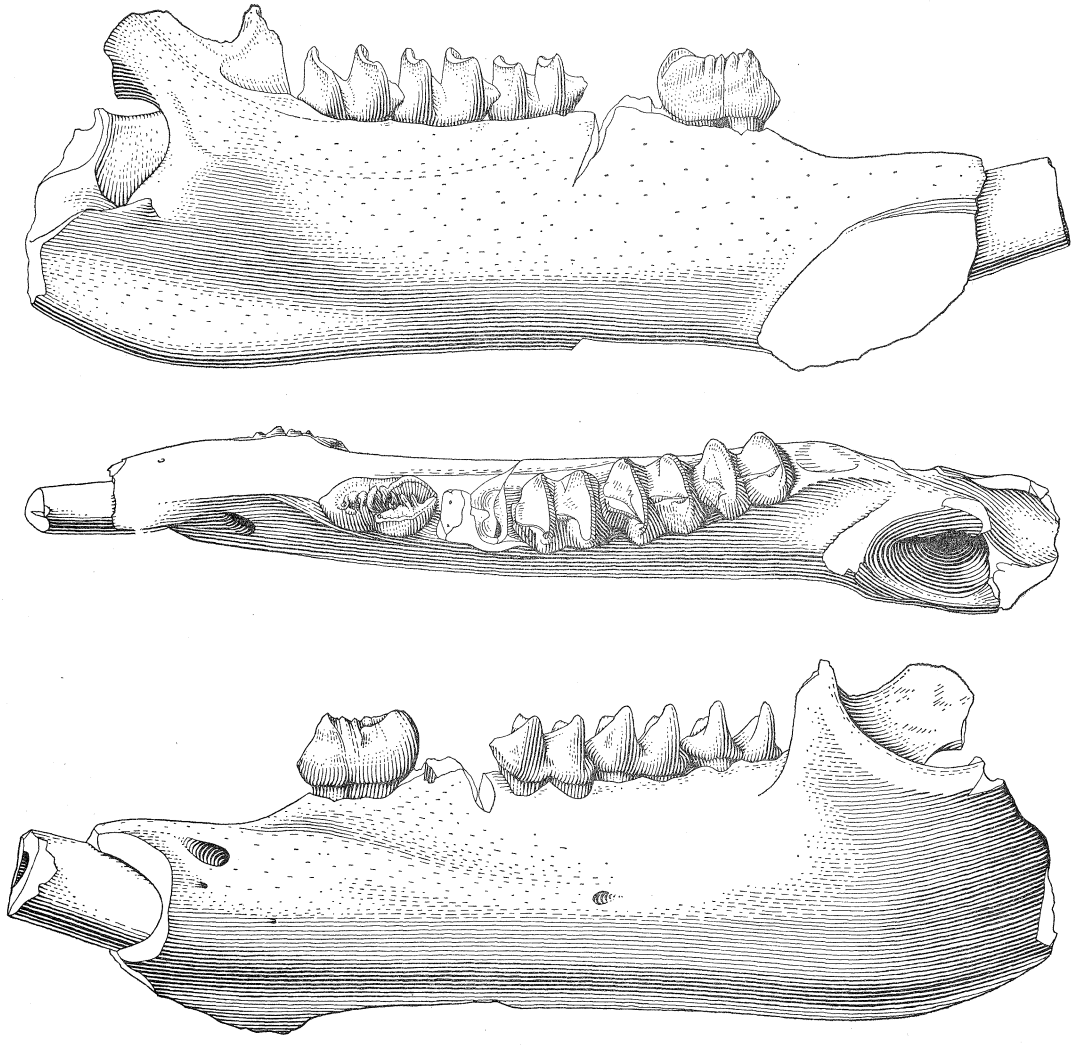

Fig. 1: *Sthenurus andersoni* Marcus, new species. Holotype, left mandible, incisor broken off, $P_{\overline{3}}$, $M_{\overline{1}}$ missing, $M_{\overline{2}} - M_{\overline{3}}$. Natural size. Aust. Mus. MF 946. Top, lingual view. Centre, occlusal view. Bottom, labial view.

$M_{\overline{2}-\overline{3}}$, protolophid of $M_{\overline{4}}$, MF 1078. Left mandible, hypolophid of $M_{\overline{2}}$, $M_{\overline{3}-\overline{4}}$, MF 1137. Right mandible, $P_{\overline{3}}$, $M_{\overline{1}-\overline{2}}$, roots $DP_{\overline{3}}$ and $M_{\overline{3}}$, UC 60006. Right $P_{\overline{3}}$, UC 60005. Right $M_{\overline{2}}$, F 49661. Right $M^{\overline{3}}$, F 49662. Left $DP^{\overline{3}}$, F 49663. Right $M^{\overline{1}}$; right $M^{\overline{2}}$, UC 60008.

Referred specimens.—Wellington Caves, New South Wales, V5538: Left mandible, tip $I_{\overline{2}}$ broken off, $M_{\overline{1}-\overline{4}}$, angle and part of masseteric canal preserved, MF 39. Maxillary fragment, $P^{\overline{3}}$ exposed in its crypt, $M^{\overline{1}-\overline{4}}$, MF 21.

Lake Menindee, New South Wales, V5371: Ankylosed mandibles, left $P_{\overline{3}}$, $M_{\overline{1}-\overline{4}}$, right side broken at mental foramen; associated premaxillary with bases of upper incisors, right $M^{\overline{1}}$, UC 45673.

Specific diagnosis.—Long-jawed member of the genus, smaller than *S. atlas*, its closest relative; lower molars smaller, lower crowned, with lower links than in *S. atlas*; lower premolar shorter and narrower posteriorly than *S. atlas*; median groove at anterior end of labial crest of $P_{\overline{3}}$ shallower and less conspicuous than in *S. atlas*, in which this groove reaches nearly to base of tooth; median groove at anterior end of labial crest shallow, and does not separate the two crests in early and medium stages of wear as in *S. atlas*.

Type locality.—The west side of Bone Camp Gully, a tributary of Ironbark Creek, 15 miles east of Bingara, New South Wales, Australia. On the fifth edition of the Lands Department Map, August, 1946, Parish of Durham, the locality is in Portion 176, the property of Mr. Michael R. C. Fleming*.

Age.—Pleistocene.

Fauna.—Bingara.

DESCRIPTION†

Upper molars.—Two of the three upper molars may come from the same individual, as they fit closely together and are of the correct relative wear. A left $DP^{\overline{3}}$ came from a younger individual and is only slightly worn. The molars have a simple pattern without forelinks and only weak midlinks from the protocones to the centres of the metalophs. The anterior cingulum forms a shelf a little narrower than the protoloph which curves abruptly into the paracone and more gradually to the protocone. The paracone and metacone are almost connected by flanges forming a labial crest which nearly closes the labial end of the median valley. The median valley is sharply grooved to the base of the root lingually, but is more U-shaped in $M^{\overline{3}}$ than in $M^{\overline{1}}$ or $M^{\overline{2}}$. The lophs are broader than the lophids of the lower molars. They diverge more towards their bases. The wear surfaces are concave posteriorly. A fold formed by the hindlink is present on the posterior surface of the metaloph as in *Macropus*. Fine ridgelets may be present on the surface of the teeth.

Measurements in Millimetres

Dimension	UC 60008 right $M^{\overline{1}}$	UC 60008 right $M^{\overline{2}}$	F 49662 right $M^{\overline{3}}$
length	11·0	13·0	13·6
width protoloph ..	11·2	12·8	13·0
width metaloph ..	11·8	12·8	12·4

Mandible.—The body of the ramus is slimmer and not as deep as in *S. atlas*. The lower border is rounded and the lingual surface from below $P_{\overline{3}}$ to $M_{\overline{3}}$ is convex. The disgastric ridge starts below the hypolophid of $M_{\overline{3}}$ (holotype of MF 946). Viewed from the lingual side, the alveolar border and lower border are nearly parallel, diverging only posterior to $M_{\overline{4}}$ (MF 5 and MF 946). The symphysis is not highly rugose and does not extend behind the geniohyal pit as in *S. oreas* or the other short-jawed members of the genus. The diastema is as long as in *S. atlas* with the mental foramen slightly posterior to the midpoint between $P_{\overline{3}}$ and $I_{\overline{2}}$ as in that species. The anterior border of the symphysis forms approximately a 15 to 20 degree angle with the alveolar border.

The upper border of the angle is about 10 millimetres below the alveolar plane. The masseteric canal is large and communicates with the mandibular canal by a large foramen which is visible internally above the edge of the masseteric fossa. Two small foramina are present on the anterior end of the ridge separating the mandibular and masseteric canals in MF 5 and MF 946. The ascending ramus is perpendicular or at slightly greater than a right angle to the alveolar line, and begins behind $M_{\overline{4}}$, except in younger individuals where it is more anterior.

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* Military grid reference 378303, Ordinance sheet Inverell, New South Wales, H56/5, Zone 8, second edition 1942; Scale 1:253440.

† The description is based on the types and referred specimens.

Lower dentition.—$I_{\overline{2}}$ Only one incisor was associated with a mandibular fragment, MF 10, in the Bingara material. Though this incisor has been glued in, its fit is so perfect that this does not appear to be a fortuitous association. This incisor is barely worn, with its blade thickening below. The dentine surface extends forward into the outer and internal enamel surfaces. The lower edge curves upward sharply toward the tip. Wear is exclusively on the upper edge of the blade where the wear surface is at a 15-degree angle to the axis of the tooth. The broken $I_{\overline{2}}$ in MF 39 from Wellington Caves is worn considerably and its tip broken off. The enamel is very thin of the lingual surface of $I_{\overline{2}}$ in MF 39, and there is a facet on the lower lingual border which is worn smooth from contact with the opposite $I_{\overline{2}}$

$P_{\overline{2}}$ is represented by only one specimen, which is moderately worn, exposing dentine (MF 10). It has a lingual crest subdivided by a mid-vertical groove, and what was probably a labial crest separated by a groove. Both grooves reached the base of the tooth. Finer details cannot be discerned, though this tooth is smaller and appears less complex than its counterpart in *S. atlas*.

$DP_{\overline{3}}$ is molariform and heavily worn in the single example available for study, MF 10. The lophids converge to a V lingually and labially in the median valley. The midlink is prominent in this well-worn tooth. The labial wall of the protolophid slopes slightly medially.

$P_{\overline{3}}$—Seven examples of this tooth are preserved, four unerupted and unworn. The premolar is two-rooted with the smaller root anterior. It is small compared to that of *S. atlas* (see table). A bulge above the roots forms a cingulumlike structure on the anterior half which may bear a small cuspule on its anterior edge, as in UC 60006. This structure may continue posteriorly. The main features of the crown are a lingual crest divided into 6 cuspules, the last three of which may be less distinct, and a shorter crescent-shaped posterolabial crest which usually connects to the lingual crest by one or more tranverse ridgelets. The lingual cuspules may be split longitudinally (UC 60015) and the anterior one may be more complex. The labial crest is smooth and undivided; in MF 10 the posterior part is set off by a small vertical ridge. The valley between the main crests may have ridgelets on the labial side. The transverse ridges may bifurcate into two branches lingually (UC 60005) and (UC 60015), be double (MF 946), or the bifurcation may be almost absent (MF 10)*.

Molars.—The molars increase in size from $M_{\overline{1}}$ to $M_{\overline{3}}$. $M_{\overline{3}}$ is longer than $M_{\overline{4}}$ though the protolophid of $M_{\overline{4}}$ may be nearly as wide as $M_{\overline{3}}$. The lophids are narrow and appear as columns viewed from either side, and are separated by broad U-shaped valleys. Their crown surfaces are slightly concave forward, and thus curve slightly posteriorly at their centres from bottom to top. The anterior cingulum shelf is approximately half the width of the tooth. The forelink, which is not strong, proceeds from the protoconid to the centre of the anterior edge of the tooth, where it curves back to form a semicircular ridge on the anterior cingulum shelf. The forelink is very low. Fine ridgelets may be present on the anterior surface of the protolophid. The midlink runs across a raised surface in the centre of the median valley. A small ridge from the entoconid may contribute to this eminence. There is a low posterior cingulum which may be peaked into a vertical ridge labiad of the centre of the hypolophid on the anterior molars. Fine ridgelets may cover the hind surface of the hypolophid. Viewed anteriorly, the lateral surfaces of the lophids are highly convex, so that the maximum lophid width occurs well above the base of the tooth. The line of the molars forms a convex curve anteroposteriorly on the labial side. The crown of $M_{\overline{1}}$ faces slightly labiad, whereas that of $M_{\overline{4}}$ faces slightly linguad expressing a tortion of the tooth row as in *Procoptodon*. The molars are low crowned, (lower crowned than those of *S. atlas*) and the lophids are higher labially than lingually.

TOOTH ERUPTION AND WEAR

In UC 60015, $M_{\overline{4}}$ erupted before $P_{\overline{3}}$ (the $M_{\overline{4}}$ is absent in this specimen, but its alveolus shows that it was in place and had erupted). $P_{\overline{3}}$ must have erupted very shortly after $M_{\overline{4}}$ for it is only slightly worn in MF 5, as in that specimen $M_{\overline{3}}$ is advanced in wear only slightly over that of UC 60015. The crests of the lophids remain sharp in intermediate wear stages, with initial wear concentrated on the posterior edge of the lophids, which form crescentic edges. After additional wear, the lophid crests flatten somewhat and dentine is exposed, first labially and then lingually. In the heaviest worn specimen, MF 1137, dentine is exposed on both lophids of $M_{\overline{2}}$, a little on the corner of $M_{\overline{3}}$ and only on the protoconid of $M_{\overline{4}}$. In that specimen the lophids still retain sharp edges. The teeth of *Sthenurus* appear to be subject to less attrition than those of *Procoptodon*.

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* The median groove at the anterior end of the labial crest is shallow and does not separate the two crests in early and medium stages of wear as in *S. atlas*.

MEASUREMENTS OF THE HOLOTYPE AND SUMMARY OF MEASUREMENTS OF THE MANDIBLES AND LOWER CHEEK TEETH OF *STHENURUS ANDERSONI* FROM BINGARA AND *STHENURUS ATLAS* FROM THE WELLINGTON CAVES.

All measurements in millimetres

	Sthenurus andersoni from Bingara						*Sthenurus atlas* from the Wellington Caves					
	Holotype (MF 946)	Summary of measurements*					Holotype (cast)	Summary of measurements*				
		N	O.R	$\bar{X}$	S	V		N	O.R	$\bar{X}$	S	V
Dimension												
$P_{\overline{3}}$ length	15·7	7	14·4-16·3	15·09	·880	5·83	17·4	4	16·7-17·4	17·12	·341	2·00
width protolophid ..	7·0	7	6·2- 7·0	6·44	·399	6·20	..	3	6·3- 7·0	6·65	·360	5·42
width hypolophid ..	7·6	7	6·6- 7·6	7·03	·411	5·85	9·0	4	8·1- 9·0	8·50	·392	4·61
$M_{\overline{1}}$ length	..	5	11·4-11·9	11·80	·235	2·01	..	3	12·7-13·7	13·10	·530	4·05
width protolophid ..	..	5	8·2- 8·9	8·48	·269	3·16	10·5	4	8·9-10·5	9·62	·692	7·18
width hypolophid ..	..	5	8·5- 8·9	8·74	·152	1·74	10·7	4	9·4-10·7	9·95	·615	6·18
$M_{\overline{2}}$ length	13·8	8	12·5-13·8	13·28	·423	3·19	14·3	2	14·3-14·4	14·35		
width protolophid ..	10·2	8	9·6-10·2	9·94	·199	2·00	11·8	2	10·4-11·8	11·10		
width hypolophid ..	10·2	8	9·7-10·2	9·92	·149	1·50	11·8	2	10·8-11·8	11·30		
$M_{\overline{3}}$ length	14·3	6	12·6-14·3	13·80	·610	4·42						
width protolophid ..	11·3	5	10·8-11·4	11·10	·255	2·30						
width hypolophid ..	11·2	6	10·5-11·2	10·70	·253	2·36						
$M_{\overline{4}}$ length	12·7	3	12·7-13·5	13·00	·356	2·74						
width protolophid ..	11·1	4	10·6-11·3	10·95	·269	2·46						
width hypolophid ..	10·4	3	9·7-10·4	10·07	·287	2·69						
Mandible depth ..	30·3	5	26·4-30·3	27·70	28·12	10·15						
$M_{\overline{2}-\overline{3}}$ width	15·4	5	13·0-15·4	14·42	·876	6·07						

* Statistics: N—sample size; O.R.—observed range; $\bar{X}$—sample mean; s—sample standard deviation; V—sample coefficient of variation as defined in Simpson, Roe and Lewontin (1960).

VARIATION

Measurements for mandible and lower cheek tooth dimensions of the holotype of *Sthenurus andersoni* and of a cast of the holotype of *Sthenurus atlas* are given in the table, together with a summary of measurements for paratypes of each species. The tooth dimensions of *S. andersoni* vary little, as expressed by the coefficient of variation (1·50—6·20). $P_{\overline{3}}$ is the most variable tooth in both length and width. The premolars of *S. atlas* are as variable as in *S. andersoni*, whereas $M_{\overline{1}}$, the only tooth for which there was sufficient data, is less variable in *S. andersoni*. A larger sample of specimens would be necessary to establish the variation patterns with more confidence. The differences in tooth dimensions between *S. atlas* and *andersoni* are significant, except for the anterior width of $P_{\overline{3}}$.

DISCUSSION

Sthenurus andersoni appears to be closely related to *S. atlas*. The type of *S. atlas* is a mandibular fragment of a juvenile containing $DP_{\overline{3}}$, $M_{\overline{1}-\overline{2}}$, with $P_{\overline{3}}$ excavated from its crypt (Owen, 1838; 1874, Plate 22, figure 4). It is from Wellington Caves. *S. andersoni* is smaller than *S. atlas*, with a shorter and proportionately narrower $P_{\overline{3}}$. The body of the ramus is shallower and narrower in *S. andersoni* than in *S. atlas*. The continuation of the forelink into the anterior cingulum shelf on the lower molars is more pronounced in *S. atlas*.

S. atlas has been reported from Balladonia, Eucla Division, Western Australia (Glauert, 1912), but the few comments Glauert makes regarding these specimens suggest a species near *S. oreas* rather than the long-jawed *S. atlas*. *S. atlas* and *S. andersoni* occur together at Wellington Caves and Lake Menindee (Tedford, 1960, unpublished Ph. D. dissertation) in east-central and western New South Wales, respectively. Only *S. andersoni* occurs at Bingara in north-eastern New South Wales. Devis' (1895) description of the specimen he referred to as *S. atlas* from the Darling Downs of south-eatern Queensland are in part suggestive of *S. andersoni*, but apparently include a wide range in morphology and thus probably include more than one species of *Sthenurus*.

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