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1976
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A TAXONOMIC AND ECOLOGICAL STUDY OF THE LIVING AND FOSSIL HYSTRICIDAE WITH PARTICULAR REFERENCE TO SOUTHERN AFRICA

J M MAGUIRE

VOLUME TWO

APPENDICES I - XIV

Thesis submitted to the Faculty of Science of the University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the Degree of Doctor of Philosophy.

Johannesburg, May 1976

VOLUME TWO

CONTENTS

		Page
APPENDIX I	THE STRATIGRAPHY OF THE CAVE OF HEARTHS DEPOSIT....	1
APPENDIX II	IDENTIFICATORY AND DESCRIPTIVE CATALOGUE OF FOSSIL PORCUPINE MATERIAL FROM THE SOUTH AFRICAN AUSTRALOPITHECINE CAVES AND CAVE OF HEARTHS	7
APPENDIX III	ALPHABETICAL LIST OF THE PUBLISHED SPECIES OF HYSTRIX	37
APPENDIX IV	SYSTEMATICALLY ARRANGED LIST OF THE VALID SPECIES IN THE EXTANT GENERA OF THE FAMILIES HYSTRICIDAE AND ERETHIZONTIDAE WITH THEIR HYSTRIX SYNONYMS AND SYNONYMIZING AUTHORS	46
APPENDIX V	CRANIAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS...	57
APPENDIX VI	MANDIBULAR MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS	92
APPENDIX VII	DENTAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS....	99
APPENDIX VIII	CRANIAL, MANDIBULAR AND DENTAL MEASUREMENTS OF THE SOUTH AFRICAN FOSSIL HYSTRICID MATERIAL	150
	A CRANIAL	151
	B MANDIBULAR	156
	C DENTAL	158
APPENDIX IX	DENTAL MEASUREMENTS OF THE CAVE OF HEARTHS HYSTRICID MATERIAL	178
APPENDIX X	CATALOGUE OF FOSSIL HYSTRICIDAE	198
APPENDIX XI	LOCALITY MAPS OF PORCUPINE LAIRS STUDIED.....	345
APPENDIX XII	GLOSSARY OF TERMS USED	351
APPENDIX XIII	LIST OF GENERAL REFERENCES	362
APPENDIX XIV	ANNOTATED TAXONOMIC BIBLIOGRAPHY OF THE FAMILY HYSTRICIDAE	378

APPENDIX I

THE STRATIGRAPHY OF THE CAVE OF HEARTHS DEPOSIT

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THE STRATIGRAPHY OF THE CAVE OF HEARTHS DEPOSIT

In 1957 Mason published the first stratigraphic sequence for the Cave of Hearths. This is shown in the columns headed '1957' in Table I below, in this instance copied from the explanatory page to the catalogue of fossil mammalian remains recovered from the site. In this interpretation, the deposit was divided into twelve beds, but in a subsequently published pictorial reconstruction of the cave stratigraphy (Mason 1962a) reproduced in Fig. 15 section 2.1.1.2, only eleven beds are shown. In the latter interpretation it appears that Bed 11 of the original 1957 reconstruction has been incorporated in Bed 10, so that the Iron Age stratum which overlies it is numbered 11 instead of 12, as it was in 1957. Later, Mason (1971) once again revised the stratigraphy, after an extensive re-analysis of the Middle Stone Age artefact assemblages from Beds 4 to 9. In this publication, he formally withdrew the previous stratigraphic sequence, which divides the 5m (15ft) of MSA deposit into six distinct accumulation phases (Beds 4 to 9) and replaced the latter with 15 stratigraphic units. In most instances the new divisions cut across the old divisions between the beds. This re-grouping is shown in Table II, which has been compiled from a private communication circulated in 1972 (in press).

The terms 'Front Section', 'Rear Section', 'Subsided Block' and 'Sinkhole' refer to parts of the excavation. The sinkhole and main MSA breccia, the latter being the source of the specimens marked CH, are shown in Fig. 13, section 2.1.1.2, which also discusses the stratigraphy of the site. All the faunal remains from the Cave of Hearths, including the fossil porcupines, are marked according to the 1957 stratigraphy.

The dates which apply to the various Beds are recorded in Table III, this appendix.

The 1972 Amended Cave of Hearths Stratigraphic Sequence compared with the original 1957 Sequence (Mason 1957, 1972)

Depth	1957 Stratigraphic Terminology	1957 Cultural Terminology	1972 Amended Stratigraphic Terminology	Abbreviation	1972 Amended Cultural Terminology
0-18"	Bed 12	Iron Age-'Makapan Culture'	Iron Age Stratigraphic Unit I	CH IA SU I	CH IA SU I
18-20"	Bed 11	LSA-Smithfield	LSA Stratigraphic Unit I	CH LSA SU I	Earlier Smithfield in CH LSA SU I
20-48"	Bed 10	LSA-Smithfield			
48-60"		SAND IN REAR SECTION	Geological Stratigraphic Unit 3	CH GSU 3	
60-72"	Bed 9	MSA-Later Pietersburg	MSA Stratigraphic Units 1-15*	CH MSA SU 1-15	Later Pietersburg in CH MSA SU 6-15
72-94"	Bed 8	MSA-Later Pietersburg			
94-108"	Bed 7	MSA-Later Pietersburg			Middle Pietersburg in CH MSA SU 5
108-180"B	Bed 6	MSA-Later Pietersburg			
120-132"A	Bed 5	MSA-Middle Pietersburg			Earlier Pietersburg in CH MSA SU 1-4
132-180"A	Bed 4	MSA-Early Pietersburg			
		RUBBLE OVERLYING BED 3	Geological Stratigraphic Unit 2	CH GSU 2	
See Front Section	Bed 3	ESA-Later Acheulian (Fauresmith)	ESA Stratigraphic Units 1-3	CH ESA SU 1-3	Middle to Later Acheulian in CH ESA SU 1-3
Rear Section & Subsided Block below	Bed 2	ESA-Later Acheulian (Fauresmith)			
	Bed 1	ESA-Later Acheulian (Fauresmith)			
		ASH UNDERLYING BED 1	Geological Stratigraphic Unit 1	CH GSU 1	

* The amended MSA stratigraphic sequence and the depths of each unit, correlated with the 1957 'Bed" system is given in Table II

BEDS 3, 2 AND 1 IN FRONT SECTION (both 1957 and 1972 stratigraphies)

	Grid co-ordinates and depth
BED 3 (CH ESA SU 3)	J-L/ 3 - 0/ 8 - 11'
	M-N/ 0 - 2/ 8 - 11'
	H-J/ 3 - 2/12 - 14'
	KL / 2/14'
BED 2 (CH ESA SU 2)	EHL/ 3 - 0/17 - 20'
BED 1 (CH ESA SU 1)	E-L/ 5 - 0/21 - 25'

BEDS 3, 2 AND 1 IN REAR SECTION (both 1957 and 1972 stratigraphies)

	Grid co-ordinates and depth
BED 3 (CH ESA SU 3)	P-R/22 - 27/14 - 18'
BED 2 (CH ESA SU 2)	O-Q/21 - 25/19 - 24'
BED 1 (CH ESA SU 1)	O-Q/21 - 25/24 - 30'

BEDS 3, 2 AND 1 IN SUBSIDED BLOCK (both 1957 and 1972 stratigraphies)

	Grid co-ordinates and depth
BED 3 (CH ESA SU 3)	K-P/10 - 17/28 - 32'
BED 2 (CH ESA SU 2)	K-P/10 - 17/32 - 35'
BED 1 (CH ESA SU 1)	K-P/10 - 17/37 - 40'

SINKHOLE OR SWALLOWHOLE SPECIMENS (both 1957 and 1972 stratigraphies)

MIXED, MAINLY MSA P-W/15 - 21/28 - 45'

C-H SPECIMENS

See Fig. 13 and chapter 2.1.1.2

TABLE II

Amended (1972) MSA Stratigraphic Sequence (in Rear Section)

Amended Stratigraphic Terminology	Depth	Approximate 1957 Equivalent
CH MSA SU 15	60 - 72"	Bed 9
CH MSA SU 14	72 - 84"	part Bed 8
CH MSA SU 13	84 - 96"	part Bed 8, part Bed 7
CH MSA SU 12	96 - 108"	part Bed 7
CH MSA SU 11	108 - 120"	part Bed 6
CH MSA SU 10	132 - 144B"	part Bed 6
CH MSA SU 9	144 - 156B"	part Bed 6
CH MSA SU 8	156 - 168B"	part Bed 6
CH MSA SU 7	168 - 182B"	part Bed 6
CH MSA SU 6	120 - 132A"	Bed 5
CH MSA SU 5	132 - 144A"	part Bed 4
CH MSA SU 4	144 - 156A"	part Bed 4
CH MSA SU 3	156 - 168A"	part Bed 4
CH MSA SU 2	168 - 180A"	part Bed 4
CH MSA SU 1	180 - 192A"	not included in 1957 stratigraphy
FROM SUBSIDED BLOCK:		
CH MSA SU 1	KP/10 - 17/ 23 - 26'	

NOTE: CH MSA SU 1 - 4 = Earlier Pietersburg
CH MSA SU 5 = Middle Pietersburg
CH MSA SU 6 - 15 = Later Pietersburg

TABLE III

SUMMARY OF THE DATING OF THE CAVE OF HEARTHS

Stratigraphic Unit	Cultural Status	Radiometric date (Libby in Mason, 1962a)	Extrapolated date B.P. (Mason 1971, pers. comm.)	Maximum possible date B.P.
Bed 11	Iron Age		1,000	1,600 i)
Bed 10	LSA 'Smithfield'		20,000	37,000 ii)
	Epi-Pietersburg			> 50,000 ii)
Bed 9	MSA Later Pietersburg		30,000	
Bed 8	MSA Later Pietersburg			
Bed 7	MSA Later Pietersburg		40,000	
Bed 6	MSA Later Pietersburg	15,100 ± 730 B.P.		
Bed 5	MSA Middle Pietersburg	11,600 ± 700 B.P.	53,000	
Bed 4	MSA Early Pietersburg	11,700 ± 610 B.P. 11,811 ± 960 B.P.	60 - 70,000	> 120,000 iii)
Bed 3	ESA Later Acheulian		100,000	
Bed 2	ESA Later Acheulian		> 100,000	
Bed 1	ESA Later Acheulian			< 260,000 iv)

i) Beaumont and Vogel (1972a)
ii) Beaumont and Vogel (1972b)
iii) Klein (1973)
iv) Howell, F.C., et al. (1972)

APPENDIX II

IDENTIFICATORY AND DESCRIPTIVE CATALOGUE OF FOSSIL PORCUPINE MATERIAL FROM THE SOUTH AFRICAN AUSTRALOPITHECINE CAVES AND CAVE OF HEARTHS

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IDENTIFICATORY AND DESCRIPTIVE CATALOGUE OF FOSSIL PORCUPINE MATERIAL FROM THE SOUTH AFRICAN AUSTRALOPITHECINE CAVES AND CAVE OF HEARTHS

The following 203 fossil specimens have been considered in this thesis:

1. MAKAPANSGAT LIMEWORKS (71 specimens) pp. 9-20
   - M1000 - M1013
   - M1016
   - M1802 - M1825
   - M2516 - M2523
   - M2525 - M2527
   - M8220
   - M8233
   - M8276 - M8278
   - M8281 - M8282
   - M8284 - M8294
   - M8362 - M8364

2. STERKFONTEIN (22 specimens) pp. 20-23
   - STS 957a - e
   - STS 1622
   - STS 2061
   - STS 2078
   - STS 2095
   - SFN 1 - 17

3. SWARTKRANS (15 specimens) pp. 23-25
   - SK 2040
   - SK 2045
   - SK 2466a, b
   - SK 2835
   - SK 2875
   - SK 3063
   - SK 3082
   - SK 4315

SWARTKRANS (continued)

SK 6945

SK 7155

SK 14235 - SK 14238

4. KROMDRAAI A FAUNAL SITE (4 specimens) pp. 25-26

KA 757

KA 1432

KA 1607

KA 1912

5. CAVE OF HEARTHS (91 specimens) pp. 26-36

COH 712 - COH 769

COH 2356 - COH 2358

COH 2381 - COH 2410

The cavern deposits and breccias from which the above-mentioned fossils have been extracted and the possible ages of the deposits have been discussed in Chapter 2 (SOURCE OF THE FOSSIL MATERIAL). The specimens have also been discussed in Chapter 4 (MATERIALS).

Asterisks denote Holotype or Syn-type specimens.

1. MAKAPANSGAT LIMEWORKS

1.1 M1000

Right half-mandibular fragment of juvenile individual at growth stage 3. The specimen was broken in blasting operations immediately in front of M_1 and behind the vacant and collapsed crypt of M_3. M_1 is obliquely broken at the alveolar rim, and M_2 is slightly worn. The bony rugosities and depression marking the insertion of m. maxillomandibularis, and part of the crista masseterica (which forms part of the insertions of m. masseter pars superficialis and m. masseter pars profunda_ text Fig. 55) are clearly visible on the lateral jaw surface. Much of the coronoid process is preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

This description differs from that originally given by Greenwood (1955, p.77), for the following reason: even in very young individuals where dp_4 is the only functional cheek tooth (growth stage 1) the insertion of m. maxillomandibularis lies some distance below the

junction between dp_4 and M_1 on the lateral surface of the jaw, and is marked by an obvious depression. If, as in Greenwood's description, the two in situ teeth are identified as M_2 and M_3, the muscle insertion should not be visible, since the specimen is broken off immediately in front of 'M_2'. However, since the insertion is clearly visible, the author considers the original description to be incorrect. Comparisons of M1000 with a modern Hystrix africaeaustralis mandible at an equivalent stage of growth supports this view.

1.2 M1001

Small fragment of isolated upper left incisor, probably adult, incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Taxonomic status uncertain, but probably an early form of Hystrix africaeaustralis, alternatively, a juvenile representative of H. makapanensis.

1.3 M1002*

Anterior portion of left half-mandible of adult individual (growth stage 6) broken through M_1 with intra-alveolar fragment of I_1, well-worn P_4 and fragmentary well-worn M_1. Diastema largely intact. From the Grey Breccia. Holotype of Hystrix makapanensis Greenwood 1958.

1.4 M1003

Well-worn left M_3 of old individual at growth stage 6, with a small fragment of the adjacent M_2 embedded in a small mandibular fragment. From the Grey Breccia. Xenohystrix crassidens.

This specimen was originally identified as Hystrix major Greenwood 1955 (now synonymous with H. makapanensis Greenwood 1958). The present author places the specimen under Xenohystrix crassidens (see Chapter 11, TAXONOMIC STATUS OF THE FOSSIL MATERIAL).

1.5 M1004*

Right maxillary fragment of adult individual (growth stage 6) with well-worn M^1 and M^2 in situ. M^1 with well-developed divergent roots artificially exposed to reveal the structure. The position of the sphenopalatine foramen is apparent 15mm above the centre of the alveolar rim of M^2 on the buccal surface of the maxilla. From the Grey Breccia.. Syn-type A of Xenohystrix crassidens Greenwood 1955.

1.6 M1005*

Left maxillary fragment of adult individual (growth stage 6) with well-worn, chipped P^4 and compressed M^1 and M^2. The base of the root of the

jugal process of the maxillary is apparent lateral to the mesial face of P^4. From the Grey Breccia. Syn-type B of Xenohystrix crassidens Greenwood 1955.

1.7 M1006*

Upper left diastemic curve, part premaxilla, part maxilla, with the suture between the two clearly visible. I^1 is in situ but displaced laterally, incisial surface intact, on which fine striae, probably caused by feeding and tooth-sharpening activities, can be seen. These run antero-posteriorly on the anterior portion of the incisial surface and transversely (mesio-distally) on the posterior portion. The position of the incisor root is indicated by a slight protuberance of the maxillary bone behind the premaxillary-maxillary suture. The fragment is broken through the mesial suture, and the left half of the incisial foramen is visible immediately anterior to the premaxillary-maxillary suture. Probably adult, growth stage 6. Rooted end of incisor shows signs of dorsal prefossilization damage. From the Grey Breccia. Syn-type C of Xenohystrix crassidens Greenwood 1958.

1.8 M1007*

Most complete specimen available. Two-thirds of left half-mandible of robust adult individual at late growth stage 5, broken through the anterior portion of the diastema and obliquely through M_3. Intra-alveolar fragment of I_1, slightly-worn P_4 and well-worn M_1, M_2 and fragmentary M_3 preserved. Muscle attachments not preserved, but fracture caused by blasting operations in this region has exposed the well-developed and apparently divergent roots of M_2. From the Grey Breccia. Syn-type D of Xenohystrix crassidens Greenwood 1958.

1.9 M1008

Fragment of anterior portion of pre-fossilizationally mutilated left half-mandible of adult individual (growth stage 6) with the upper portion of diastemic curve and the upper portion of the curved socket of I_1 preserved. A moderately worn P_4 is preserved and behind it part of the socket of M_1, which indicates the divergent nature of its roots. From the Grey Breccia. Xenohystrix crassidens.

1.10 M1009

Isolated almost complete upper right incisor with complete incisial surface, on which fine striae, mainly antero-posteriorly (labio-lingually) orientated, have been preserved. Probably adult at growth

stage 5 or 6. From the Grey Breccia. Xenohystrix crassidens.

1.11 M1010

Extremely robust isolated mandibular tooth, even by gigantic standards. The large size, the shape, the persistence of the external enamel groove (hypostria) and to some extent the crown enamel pattern seems to suggest that it is P_4, but its root system and the fact that the damaged anterior enamel and dentine probably represents a very large mesial pressure facet would suggest that it is an M_3 of an adult individual at late growth stage 6. Taxonomically, it has been treated as M_3. From the Grey Breccia. Xenohystrix crassidens.

1.12 M1011

Isolated well-worn left upper molar of adult individual (growth stage 6) with rather unusual crown enamel pattern. Probably M^3. Root bases preserved. From the Grey Breccia. Xenohystrix crassidens.

1.13 M1012

Short fragment of isolated upper right incisor, incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.14 M1013

Short fragment of isolated lower left incisor, incisial surface not preserved, dentine split. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.15 M1014

Not Hystricid. Fragment of bovid incisor.

1.16 M1015

Portion of lower left diastemic curve containing fragment of I_1 and found to be part of specimen M1803. See 1.19.

1.17 M1016

Lightly worn isolated right upper molar at growth stage 3. Probably M^2. Papillate roots largely missing. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.18 M1802

Fragment of left half-mandible of adult individual (early growth stage 5) broken off in front of P_4 and behind M_3. Complete tooth row preserved as well as intra-alveolar fragment of I_1. P_4 newly-erupted and unworn,

M_1 - M_3 well-worn, the buccal enamel of M_1 damaged. The muscle attachment of m. maxillomandibularis is clearly visible laterally 8mm below the centre of the alveolar rim of M_1, and the direction of the crista masseterica and coronoid process are indicated. The outer mandibular bone surface is badly damaged. From the Grey Breccia. Xenohystrix crassidens.

1.19 M1803

Anterior portion of left half-mandible of adult individual (late growth stage 6). Much of diastemic curve preserved, formed largely by specimen M1015 which was found to be part of M1803. Mandible broken behind M_1. Intra-alveolar fragment of I_1 and well-worn P_4 and M_1 present. The exceptionally well-marked pit-like muscle attachment of m. maxillomandibularis is clearly visible laterally, 10mm below the centre of the alveolar rim of M_1. From the Grey Breccia. Xenohystrix crassidens.

1.20 M1804

Left maxillary fragment of adult individual (growth stage 6) with well-worn M^2 and M^3 present. The alveolus of M^1 indicates the nature of its roots and the degree of compression. The fragment is broken at the median and palatine sutures. The position of the sphenopalatine foramen 1,5cm above the M^2 is apparent on the lateral surface of the maxillary. From the Grey Breccia. Xenohystrix crassidens.

1.21 M1805

Left maxillary fragment of young adult individual (early growth stage 5) with newly-erupted unworn P^4, worn M^1 and fragmentary M^2. The location of the sphenopalatine foramen 10mm above the M^1/M^2 junction and the base of the jugal process of the maxillary lateral to the P^4 are visible on the buccal surface of the fragment. From the Grey Breccia. Xenohystrix crassidens.

1.22 M1806

Left mandibular fragment of adult individual (growth stage 5) broken in front of M_1 and behind M_3, with well-worn M_1, M_2 and M_3 and fragment of I_1 in situ. Exceptionally well-marked muscle attachments and the anterior part of the crista masseterica are visible on the lateral jaw surface. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.23 M1807

Well-worn right M_1 and M_2 of adult individual (growth stage 5) encased in small fragment of mandibular bone. Possibly counterpart of M1806. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.24 M1808

Well-preserved isolated right P_4 at growth stage 5, slightly worn and showing three well-developed divergent roots. From the Grey Breccia. Xenohystrix crassidens.

1.25 M1809

Exceptionally large upper right maxillary tooth at growth stage 6. Probably isolated right P^4 with somewhat aberrant crown enamel pattern. Position and size of roots indicated but not preserved. From the Grey Breccia. Xenohystrix crassidens.

1.26 M1810

Isolated well-worn right P_4 at growth stage 6, size and position of roots indicated but not preserved. From the Grey Breccia. Xenohystrix crassidens.

1.27 M1811

Isolated worn right P_4 at growth stage 6, broken off above root level. From the Grey Breccia. Probably referable to Hystrix makapanensis.

1.28 M1812

Isolated worn left P^4 at growth stage 6, with one of its three roots (the lingual) in a small maxillary fragment, the other two being partially preserved. From the Grey Breccia. Taxonomic affinities uncertain.Possibly a particularly small individual of Xenohystrix crassidens, although the strong curvature and rather poorly-developed roots suggest that it could be a normal-sized Hystrix makapanensis, of which this specimen would then be the only maxillary fragment available. The crown-enamel pattern compares favourably with both that of Xenohystrix and H. africaeaustralis, but the size of the tooth is beyond the range of that of the latter species.

1.29 M1813

Isolated well-worn right P_4 at growth stage 6 with only one of its three roots partially preserved. Well-marked distal pressure facet present. From the Grey Breccia. Xenohystrix crassidens.

1.30 M1814

Isolated well-worn right M_2 of adult individual at growth stage 6 broken above the level of root divergence. Well-marked anterior and posterior pressure facets present. From the Grey Breccia. Xenohystrix crassidens.

1.31 M1815

Isolated worn left P_4 at growth stage 6 with part of distal root preserved. Probably derived from the same individual as M1811. From the Grey Breccia. Probably referable to Hystrix makapanensis.

1.32 M1816

Isolated much-worn and antero-posteriorly compressed right M^1 of adult individual (growth stage 6) with part of the lingual root preserved. From the Grey Breccia. Xenohystrix crassidens.

1.33 M1817

Isolated well-worn left M_2 at growth stage 5, roots not preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.34 M1818

Isolated slightly worn right upper molar of juvenile individual, either M^1 or M^2, more probably M^2 at growth stage 3. The tooth is strongly curved buccally. Roots not preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.35 M1819

Isolated slightly-worn upper right molar, probably M^3 at growth stage 4. The tooth is strongly curved and broken at the junction of the roots and crown. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.36 M1820

Isolated worn right M^2 at growth stage 4, probably derived from the same individual as M1819. Tooth strongly curved buccally, roots not preserved.. A rather unusual tuberculate 'cusp' can be seen at the base of the internal enamel fold. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.37 M1821

Isolated slightly-worn left M^3 at growth stage 4, derived from the same individual as specimens M1819 and M1820. Tooth strongly curved buccally, roots not preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.38 M1822

Isolated well-worn left M^2 of adult individual at growth stage 6, with damaged papillate roots. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.39 M1823

Isolated well-worn right M^3 at growth stage 6 with damaged papillate roots. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.40 M1824

Isolated very well-worn right P^4 of old individual (late growth stage 6) with the lingual root preserved. From the Grey Breccia. Most probably referable to Xenohystrix crassidens.

1.41 M1825

Isolated unworn left maxillary molar of extremely young individual, either M^1 prior to the eruption of M^2 (growth stage 2) M^2 at growth stage 3, or M^3 (early growth stage 4). Tooth strongly curved buccally, roots not preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.42 M2516

Isolated well-worn left M_3 of mature adult individual (growth stage 6), roots not preserved. From the Grey Breccia. Xenohystrix crassidens.

1.43 M2517

Isolated worn left M_1 without roots, probably of young adult individual (growth stage 5). From the Grey Breccia. Probably referable to Xenohystrix crassidens.

1.44 M2518

Isolated well-worn left M^3 at growth stage 6, with roots partially preserved. From the Grey Breccia. Xenohystrix crassidens.

1.45 M2519

Anterior enamel fragment of isolated lower right incisor, prefossilizationally split along the enamel-dentine junction. Only a small part of the incisial surface is preserved. Growth stage uncertain, probably 5 or 6. Fine transverse (mesio-distal) striae, probably caused by gnawing and tooth sharpening activities are preserved on the remnant of the incisial surface. From the Grey Breccia. Xenohystrix crassidens.

1.46 M2520

Fragment of isolated upper right incisor, incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.47 M2521

Fragment of badly fractured (partly prefossilizationally) isolated lower right incisor, incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.48 M2522

Small fragment of anterior tip of upper right incisor with much of incisial surface preserved. Fine grooves, antero-posteriorly orientated on the anterior part and transversely on the posterior side of the surface, are present. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.49 M2523

Fragment of lower left incisor with a small sliver of dentine missing, incisial surface not preserved. Probably damaged post-fossilizationally. Growth stage uncertain. Xenohystrix crassidens. From the Grey Breccia.

1.50 M2524

Not Hystricid.

1.51 M2525

Small piece of lower incisor enamel, prefossilizationally split away from dentine. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.52 M2526

Anterior portion of isolated upper left incisor with perfectly preserved incisial surface, on which wear striae are clearly visible. Growth stage uncertain. From the Grey Breccia. Taxonomic affinities unclear because of undiagnostic nature of fragment. Probably a juvenile Hystrix cf. makapanensis.

1.53 M2527

Fragment of upper right incisor, probably juvenile, cutting edge not preserved. Growth stage uncertain. From the Grey Breccia. Hystrix cf. africaeaustralis.

1.54 M8220

Isolated worn right P^4 at growth stage 6 broken above root level. From the Grey Breccia. Taxonomic affinities uncertain but either Hystrix cf. makapanensis or more probably Xenohystrix crassidens.

1.55 M8233

Fragment of prefossilizationally damaged lower left incisor; incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

1.56 M8276

Extremely large isolated lower molar, even by gigantic standards. Rather aberrant ill-preserved roots and crown enamel pattern. Probably left M_3 at growth stage 6. From the Grey Breccia. Xenohystrix crassidens.

1.57 M8277

Fragmentary right half-mandible of adult individual at growth stage 6 with intact diastema preserved, jaw broken behind M_3. Complete tooth row P_4 to M_3 in situ, all well worn. I_1 is present but anteriorly displaced; incisial surface fractured. Muscle attachment for m. maxillomandibularis faintly indicated 13mm below the junction between P_4 and M_1 on the lateral surface of the jaw. From the Upper Phase I (Pink) Breccia. Early form of Hystrix africaeaustralis.

1.58 M8278

Fragment of left half-mandible of adult individual broken through diastema in front of P_4. A badly shattered M_1 and M_2, and intra-alveolar portion of I_1 are present. Muscle attachment for m. maxillo-mandibularis can be seen 1cm below the junction between P_4 and M_1 on the buccal surface of the jaw. From the Upper Phase I (Pink) Breccia. Fragmentary condition of specimen makes taxonomic placement difficult but on size alone it is probably Hystrix makapanensis or possibly an early form of H. africaeaustralis, with excessively well developed P_4, Stage 6.

1.59 M8281

Fragment of right half-mandible of young individual at growth stage 2. Much of the sharply-curved diastema preserved. Jaw broken some distance behind newly-erupted and very slightly worn M_2. A slightly worn dp^4 is also present. No muscle attachments preserved on lateral jaw

surface. Upper Phase I (Pink) Breccia. The sharply-curving diastema, the large size of the newly-erupted teeth and the depth of the ramus below the dp_4 suggest that this specimen represents a juvenile Xenohystrix crassidens.

1.60 M8282

Fragment of left half-mandible of juvenile individual at growth stage 3, broken obliquely through the diastema and dp_4, and behind M_2. Broken roots of dp_4, slightly worn M_1, newly erupted M_2 and intra-alveolar fragment of I_1 are preserved. The depression marking the attachment of m. maxillomandibularis is visible on the lateral surface of the jaw, 8mm below the centre of the alveolar rim of M_1. Part of the crista masseterica also preserved. From the Upper Phase I (Pink) Breccia. Probably juvenile Hystrix makapanensis.

1.61 M8283

Not Hystricid.

1.62 M8284

Isolated, worn and rather small left M^3 with strong buccal curvature and damaged papillate roots. Probably at growth stage 4. Phase II Breccia. Hystrix africaeaustralis.

1.63 M8285

Isolated, worn and rather small right M^3 with strong buccal curvature and damaged papillate roots. Probably at growth stage 4. Phase II Breccia. Hystrix africaeaustralis.

1.64 M8286

A well-worn left M_2 at growth stage 6 preserved in a small mandibular fragment. Rather well-developed roots and exposed buccally. From the Grey Breccia. Xenohystrix crassidens.

1.65 M8287

Isolated well-worn left M^3 at growth stage 6 with roots partially preserved. From the Grey Breccia. Xenohystrix crassidens.

1.66 M8288

Isolated slightly-worn left M^3 at growth stage 6, with root bases indicated. From the Grey Breccia. Xenohystrix crassidens.

1.67 M8289

Isolated, worn left M^2 at growth stage 6, probably the adjacent tooth

to M8288, with root bases indicated. From the Grey Breccia. Xenohystrix crassidens.

1.68 M8290

Very fragmentary isolated left P_4 at growth stage 6, roots not preserved. From the Grey Breccia. Probably referable to Hystrix makapanensis.

1.69 M8291

Fragmentary isolated slightly-worn lower left molar of juvenile individual, either M_1 or M_2 . Probably growth stage 3. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.70 M8292

Isolated unworn lower right molar. Probably M_3 at early growth stage 4. Roots not preserved. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.71 M8293

Small fragment of upper right incisor, incisial surface not preserved. Growth stage uncertain. From the Grey Breccia. Early form of Hystrix africaeaustralis.

1.72 M8294

Almost complete upper right incisor of very young individual, incisial surface preserved. Growth stage uncertain. From the Grey Breccia. Taxonomic affinities uncertain because incisor not very diagnostic, but probably referable to Hystrix africaeaustralis.

1.73 M8362 i)

Small fragment of lower incisor, split prefossilizationally along enamel-dentine junction, cutting edge not preserved. Growth stage uncertain. From the Grey Breccia. Xenohystrix crassidens.

2 STERKFONTEIN

2.1 STS 957a (Type Site)

Left mandibular fragment of juvenile individual at growth stage 3 with diastemic curve preserved. Specimen broken off immediately behind M_2. Intra-alveolar fragment of I_1, well-worn dp_4, M_1 and newly-erupted unworn M_2 present. The pit-like depression marking

i) Specimens M8363 (an isolated right lower incisor fragment) and M8364 (an isolated lower left M_3) both from the Grey Breccia and both referred to Xenohystrix crassidens were omitted in error from this list.

the insertion of m. maxillomandibularis is visible 1cm below the junction between dp_4 and M_1 on the lateral surface of the jaw.

2.1 STS 957b, c

Right mandibular fragment of same individual (in two pieces) and in similar condition, except that less of the diastema is preserved. Part of the collapsed alveolar crypt of M_3 can be seen behind M_2.

2.1 STS 957d, e

Very small mandibular fragments of same individual. Specimens 957a-e probably all derived from the Type Site (Pink) Breccia, but since all traces of the breccial matrix have been removed during acetic acid preparation the exact horizon from which they were recovered will remain uncertain. Hystrix africaeaustralis.

2.2 STS 1622

Isolated slightly-worn right M^3 at growth stage 4. Tooth strongly curved buccally, papillate roots preserved. Probably derived from the Type Site (Pink) Breccia. Hystrix africaeaustralis.

2.3 STS 2061

Small fragment of left premaxillary with part of intra-alveolar portion of I^1 present. Growth stage uncertain. Probably derived from the Type Site (Pink) Breccia. Hystrix africaeaustralis.

2.4 STS 2078

Complete left maxillary tooth row embedded in a very small maxillary fragment; P^4 newly-erupted and unworn, M^1-M^3 well-worn (growth stage 5). Probably derived from Type Site (Pink) Breccia. Hystrix africaeaustralis.

2.5 STS 2095

Fragment of anterior section of left half-mandible with intact diastema, fractured through P_4. Intra-alveolar portion of I_1 present but displaced. Growth stage 6. Probably derived from the Type Site (Pink) Breccia. Hystrix africaeaustralis.

2.6 SFN 1

Well-worn left P^4 (growth stage 6), distinctly small, and embedded in a very small maxillary fragment. From Dump I. Hystrix africaeaustralis.

2.7 SFN 2

Well-worn left M^3 of adult individual (growth stage 6), papillate roots intact. From Dump I. Hystrix africaeaustralis.

2.8 SFN 3

Isolated well-worn left M_3 (growth stage 6), roots intact. From Dump I. Hystrix africaeaustralis.

2.9 SFN 4

Isolated well-worn left M_2 at late growth stage 5, roots missing. From Dump I. Hystrix africaeaustralis.

2.10 SFN 5

Isolated newly-erupted and slightly-worn lower molar, too immature to determine with certainty whether M_1, M_2 or M_3 but probably M_1 or M_2. Growth stage thus uncertain but probably 2 or 3. Specimen fractured in such a way as to show a well-preserved section of the internal structure of the tooth. From Dump I. Hystrix africae-australis.

2.11 SFN 6

Isolated well-worn right M^3 at growth stage 6, roots missing. From Dump 2. Hystrix africaeaustralis.

2.12 SFN 7

Isolated worn right M^3 at growth stage 6. Tooth strongly curved buccally; papillate roots missing. From Dump 13. Hystrix africaeaustralis.

2.13 SFN 8

Isolated worn right lower molar, probably M_2, with papillate root bases indicated but roots almost completely destroyed. Growth stage 5. From Dump 8. Hystrix africaeaustralis.

2.14 SFN 9

Isolated well-worn right P_4 at growth stage 6 with poorly preserved roots. From Dump 8. Hystrix africaeaustralis.

2.15 SFN 10

Isolated well-worn right M_3 at growth stage 6, with poorly preserved roots. From Dump 8. Hystrix africaeaustralis.

2.16 SFN 11

Isolated well-worn antero-posteriorly compressed right M^1 at growth

stage 6, roots missing. From Dump 8. Hystrix africaeaustralis.

2.17 SFN 12

Isolated worn left upper molar, probably M^2, at early stage of wear; at early growth stage 4. From Dump 8. Hystrix africaeaustralis.

2.18 SFN 13

Isolated newly-erupted, unworn left lower (?) molar, too immature to determine with certainty whether M_1, M_2 or M_3, but more probably M_2 or M_3. Growth stage uncertain, probably 3 or 4. From Dump 8. Hystrix africaeaustralis.

2.19 SFN 14

Isolated newly-erupted unworn lower left molar, probably M_2, at growth stage 3. From Dump 8. Hystrix africaeaustralis.

2.20 SFN 15

Isolated well-worn fragmentary lower left molar, probably M_2. Roots and half of crown missing. Growth stage 5 or 6. From Dump 8. Hystrix africaeaustralis.

2.21 SFN 16

Isolated well-worn left M^1 of adult individual at growth stage 6 with root bases indicated but not well preserved. From Dump 8. Hystrix africaeaustralis.

2.22 SFN 17

Isolated rather large well-worn right M^2, probably at growth stage 5. Crown damaged and roots completely missing. From Dump 10. Hystrix africaeaustralis.

3. SWARTKRANS

3.1 SK 2040

Isolated slightly-worn rather small right M^3 showing strong buccal curvature, probably at early growth stage 4. Roots destroyed. From Swartkrans Member 2 (brown breccia). Hystrix africaeaustralis.

3.2 SK 2045

Almost complete isolated upper left incisor with incisial surface preserved, growth stage uncertain. Probably from Member 2 (?) (brown breccia). Hystrix africaeaustralis.

3.3 SK 2466a, b

Well-worn right M^3 and M^2 respectively, held together by matrix. Teeth strongly curved buccally, small papillate roots preserved. Growth stage 5. From Member I (pink breccia). Hystrix africaeaustralis.

3.4 SK 2835

Upper diastemic curve, formed by left and right premaxillaries and anterior portion of left and right maxillaries. The left and right incisial foramina are clearly visible immediately anterior to the premaxillary/maxillary suture, and a protuberance on each maxillary bone marks the positions of the roots of the incisors. Growth stage uncertain. From Member 2 (brown breccia). Hystrix africaeaustralis.

3.5 SK 2875

Enamel sheath of portion of isolated lower incisor (probably right) cutting edge not preserved. Growth stage uncertain. Probably from Member I (pink breccia). Hystrix africaeaustralis.

3.6 SK 3063

Almost complete left half-mandible at early growth stage 6, broken through anterior portion of diastema and posterior portion of ramus. Intra-alveolar portion of I_1 and complete tooth row P_4 to M_3 present, teeth all well-worn. Pit-like muscle attachment of m. maxillo-mandibularis and the anterior point of the crista masseterica preserved on outer surface of the jaw. Mesial surface of jaw badly crushed. From Member 2 (brown breccia). Hystrix africaeaustralis.

3.7 SK 3082

Posterior palatal fragment at early growth stage 4, bearing worn left M^2 and M^3 and fragmentary right M^2. Part of the palatal suture and maxillo-palatine suture preserved. From Member I (pink breccia). Associated with the remains of a large number of small rodents. Hystrix africaeaustralis.

3.8 SK 4315

Anterior part of isolated upper left incisor with small part of incisial surface preserved. Growth stage uncertain. Probably from Member I (pink breccia). Hystrix africaeaustralis.

3.9 SK 6945

Fragment of right half-mandible of individual at late growth stage 4, in process of shedding dp_4. Most of diastemic curve preserved;

specimen broken behind M_2. Intra-alveolar part of I_1, the roots of dp_4, and well-worn M_1 and M_2 *in situ*. Teeth rather large. A prominent swelling on the outer jaw surface either indicates the presence of the permanent P_4 below the alveolus of dp_4 or is a pathological deformity. Muscle attachment of *m. maxillomandibularis* preserved. From Member 2 'decalcified breccia'. *Hystrix africaeaustralis*.

3.10 SK 7155

Isolated well-worn left M_1 of adult individual at growth stage 6 but distinctly small, broken off above root level. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

3.11 SK 14235

Fragment of left half-mandible at growth stage 6, but distinctly small, broken through diastemic curve and immediately behind the alveolus of M_3. Intra-alveolar fragment of I_1 as well as well-worn P_4 (?) preserved. Muscle attachment of *m. maxillomandibularis* preserved on the outer surface of the jaw. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

3.12 SK 14236

Isolated well-worn left M^1, probably at growth stage 6 with broken roots. From Member 1 (pink breccia). *Hystrix africaeaustralis*.

3.13 SK 14237

Isolated well-worn left P_4 (growth stage 6) distinctly large, with broken roots. Probably from Member I (pink breccia). *Hystrix africaeaustralis*.

3.14 SK 14238

Small fragment of enamel sheath of isolated upper incisor, incisial surface not preserved. Growth stage uncertain. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

4. KROMDRAAI A

4.1 KA 757

Fragment of left half-mandible of young adult individual at growth stage 5, broken behind M_3 but with all except anterior terminal portion of diastemic curve intact. Intra-alveolar fragment of I_1 and complete tooth row P_4-M_3 preserved. P_4 newly-erupted and little-worn, M_1 to M_3 worn.

specimen broken behind M_2. Intra-alveolar part of I_1, the roots of dp_4, and well-worn M_1 and M_2 *in situ*. Teeth rather large. A prominent swelling on the outer jaw surface either indicates the presence of the permanent P_4 below the alveolus of dp_4 or is a pathological deformity. Muscle attachment of *m. maxillomandibularis* preserved. From Member 2 'decalcified breccia'. *Hystrix africaeaustralis*.

3.10 SK 7155

Isolated well-worn left M_1 of adult individual at growth stage 6 but distinctly small, broken off above root level. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

3.11 SK 14235

Fragment of left half-mandible at growth stage 6, but distinctly small, broken through diastemic curve and immediately behind the alveolus of M_3. Intra-alveolar fragment of I_1 as well as well-worn P_4 (?) preserved. Muscle attachment of *m. maxillomandibularis* preserved on the outer surface of the jaw. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

3.12 SK 14236

Isolated well-worn left M^1, probably at growth stage 6 with broken roots. From Member 1 (pink breccia). *Hystrix africaeaustralis*.

3.13 SK 14237

Isolated well-worn left P_4 (growth stage 6) distinctly large, with broken roots. Probably from Member I (pink breccia). *Hystrix africaeaustralis*.

3.14 SK 14238

Small fragment of enamel sheath of isolated upper incisor, incisial surface not preserved. Growth stage uncertain. From Member 2 (brown breccia). *Hystrix africaeaustralis*.

4. KROMDRAAI A

4.1 KA 757

Fragment of left half-mandible of young adult individual at growth stage 5, broken behind M_3 but with all except anterior terminal portion of diastemic curve intact. Intra-alveolar fragment of I_1 and complete tooth row P_4-M_3 preserved. P_4 newly-erupted and little-worn, M_1 to M_3 worn.

Muscle attachment of m. maxillomandibularis preserved on lateral surface of the jaw. Fine-grained Kromdraai A Breccia. Hystrix africaeaustralis.

4.2 KA 1432

Fragment of right half-mandible of juvenile individual at growth stage 3, much of diastema preserved. Specimen fractured some distance behind the newly-erupted M_2. Intra-alveolar fragment of I_1 and dp_4-M_2 preserved; dp_4 worn, M_1 slightly worn and M_2 newly-erupted and unworn. Although juvenile, teeth distinctly large. Posterior mesial portion of mandible badly crushed. Associated with numerous micro-mammalian limb-bones and isolated teeth. Fine-grained Kromdraai A Breccia. Hystrix africaeaustralis.

4.3 KA 1607

Isolated worn right M_3. Fine-grained Kromdraai A Breccia. Hystrix africaeaustralis.

4.4 KA 1912

Isolated right M^3 slightly-worn and probably at growth stage 5. Specimen has an aberrant crown-enamel pattern. From the fine-grained Kromdraai A Breccia (?). The site from which this specimen was derived is problematic. Tooth too large for Hystrix africaeaustralis and too small for Xenohystrix crassidens. Therefore probably Hystrix cf. makapanensis.

5 CAVE OF HEARTHS

All the specimens listed below are representatives of the modern southern African species, Hystrix africaeaustralis. All bear the catalogue code COH, denoting the Cave of Hearths. The letter or pair of letters and first figure or pair of figures appearing after the specimen number are the excavation grid co-ordinates, marking the position in the cave from which the specimen was removed. The last pair of figures refer to the depth at which the specimen was found, either in inches or feet. The stratigraphy of the Cave of Hearths has been dealt with in Appendix I.

5.1 COH 712 ESA (Beds 1-3 or CH ESA SU 1-3)

Badly shattered, burnt fragment of right half-mandible, with the remains of fractured I_1 and distorted M_1 in situ. Fragment held together by matrix. Juvenile, at growth stage 4.

5.2 COH 713 T - W/15 - 19/28 - 31' SINKHOLE

Complete, well-worn right mandibular tooth row of mature adult individual (growth stage 6) preserved in a small mandibular fragment.

5.3 COH 714 CH/72 - 84" Bed 8

Very small fragment of right half-mandible of individual at growth stage 6, with the remains of a badly-damaged large P_4 and a very well-worn and compressed fragmentary M_1 *in situ*.

5.4 COH 715 V - W/15 - 19/31 - 34' SINKHOLE

Complete well-worn left lower tooth row of adult individual at growth stage 6, embedded in a small fragment of mandibular bone.

5.5 COH 716 CH/108 - 180" Bed 6

Small fragment of right half-mandible of juvenile individual, probably at growth stage 4, with part of diastemic curve preserved. Specimen broken through alveolus of M_3. Only the alveoli of I_1, M_2, M_2 and M_3 and the roots of dp_4 are preserved. Specimen broken prior to fossilization.

5.6 COH 717 W/15 - 19/31 - 34' SINKHOLE

Small fragment of right half-mandible of adult individual, probably at growth stage 6, with the alveolus of M_1, a well-worn M_2 and part of the alveolus of M_3 preserved.

5.7 COH 718 R/15 - 19/31 - 34' SINKHOLE

Small fragment of right half-mandible of adult individual (growth stage 6) with the upper part of diastemic curve and a well-worn P_4 preserved.

5.8 COH 719 T - W/15 - 19/28 - 31' SINKHOLE

Fragment of right half-mandible of a very old individual, (terminal growth stage 6), practically edentulous with age. Part of an excessively worn P_4 is preserved. The alveoli of M_1 to M_3 resorbed, alveolus of I_1 empty. Muscle attachments apparent on lateral jaw surface.

5.9 COH 720 R/19 - 25' SINKHOLE

Fragment of left half-mandible of adult individual (growth stage 6) with diastema missing. Very shattered P_4 and M_1 (badly compressed) and a complete M_2 are preserved. Intra-alveolar fragment of I_1 also present. Muscle attachments visible laterally.

5.10 COH 721 C - H 156 - 168B" Bed 6

Left premaxilla, with I^1 in situ. Position of foramina incisiva and premaxilla-maxilla suture apparent. Incisial surface of incisor complete, pulp cavity exposed, i.e. growth stage 5 or 6.

5.11 COH 722 S/15 - 19/28 - 31' SINKHOLE

Small right mandibular fragment with M_1 preserved. Growth stage 6.

5.12 COH 723 Q/19/4 - 6' SINKHOLE

Fragment of right half-mandible of juvenile individual (growth stage 3) with the greater part of the diastema preserved. Specimen broken through M_1. Intra-alveolar fragment of I_1, newly-erupted dp_4 and M_1 (damaged) present. Incisial surface missing.

5.13 COH 724 R/15 - 19/31 - 34' SINKHOLE

Very small fragment of left half-mandible of immature individual at early growth stage 2, with small intra-alveolar fragment of I_1 and slightly-worn dp_4 in situ. Greater part of diastema preserved.

5.14 COH 725 S - U/15 - 19/31 - 34' SINKHOLE

Fragment of right half-mandible of mature adult individual at growth stage 6, with well-worn P_4. The alveoli only of I_1, M_1, M_2 and part of that of M_3 are preserved.

5.15 COH 726 W/15 - 19/31 - 34' SINKHOLE

Fragment of left half-mandible of juvenile individual at growth stage 2, containing slightly-worn M_1 and erupting M_2. Very small intra-alveolar fragment of incisor present. Diastema almost complete, specimen broken behind M_2.

5.16 COH 727 CH/120 - 132" Bed 5

Fragment of right half-mandible of juvenile individual with greater part of diastema preserved, specimen broken through alveolus of M_2. Alveoli of I_1 and dp_4 as well as newly erupted slightly worn M_1 present. Growth Stage 2.

5.17 COH 728 CH/94" 1 108" Bed 7

Fairly large badly shattered fragment of the left half-mandible of a robust adult individual (growth stage 6). Diastemic curve almost complete. Specimen broken posteriorly (behind M_3) and ventrally. Intra-alveolar fragment of incisor, well-worn P_4 and M_3 and matrix-filled alveoli of M_1 and M_2 preserved.

5.18 COH 729 * T - U/15 - 19/28 - 30' SINKHOLE

Fragment of left half-mandible of individual at terminal growth stage 6. The alveoli of M_1, M_2 and M_3 largely resorbed; these teeth were probably shed prior to death. Fragmentary roots of P_4 preserved. Muscle attachments visible laterally.

5.19 COH 730 * S - T/15 - 19/28 - 30' SINKHOLE

Small fragment of anterior part of left half-mandible of juvenile individual showing part of diastemic curve. Growth stage uncertain, probably growth stage 4 (early).

5.20 COH 731 T - W/15 - 19/28 - 31' SINKHOLE

Fragment of right half-mandible of mature adult individual at terminal growth stage 6 with vacant alveoli for I_1, P_4, M_1 and M_2.

5.21 COH 732 V - W/15 - 19/31 - 34' SINKHOLE

Small left mandibular fragment of adult individual bearing a well-worn M_2. Growth stage 6.

5.22 COH 733 R/17/24' SINKHOLE

Fragment of right half-mandible of juvenile individual (growth stage 3) with part of diastema preserved. Specimen broken through M_1. Part of fragmentary I_1, worn dp_4 and fragmentary worn M_1 present.

5.23 COH 734 S - U/15 - 19/31 - 34' SINKHOLE

Fragment of right half-mandible of very old individual (terminal growth stage 6) showing signs of prefossilization mutilation. The alveoli of M_1, M_2 and M_3 are almost completely resorbed, so that only stumps of these teeth could have been present at death. Alveolus for P_4 also vacant.

5.24 COH 735 CH/120 - 132A" Bed 5

Right premaxillary fragment, forming part of upper diastemic curve, with fragmentary I^1 present. Incisial surface partially preserved. Growth stage uncertain.

5.25 COH 736 R/19/25' SINKHOLE

Fragment of right half-mandible of adult individual (growth stage 6) broken at diastema and some distance behind matrix-filled alveolus of M_3. Well-worn P_4, M_1 and M_2 are present as well as part of empty alveolus of I_1.

5.26 COH 737 S - U/15 - 19/31 - 34' SINKHOLE

Part of upper diastemic curve, formed by small fragments of left and right premaxillaries, with position of foramina incisiva visible on right premaxillary. Part of alveolus of right I^1 preserved. Growth stage uncertain.

5.27 COH 738 T - W/15 - 19/28 - 31' SINKHOLE

Cranial fragment. Porcupine?

5.28 COH 739 S/15 - 19/28 - 31' SINKHOLE

The enamel portion of an almost complete isolated lower right incisor, split (prefossilizationally) along the enamel-dentine junction. Incisial surface partially preserved. Growth stage uncertain, probably 4, 5 or 6.

5.29 COH 740 W/15 - 19/31 - 34' SINKHOLE

The enamel part of an almost complete isolated upper left incisor, split (prefossilizationally) along the enamel-dentine junction. Incisial surface partially preserved. Growth stage uncertain.

5.30 COH 741 V - W/15 - 19/31 - 34' SINKHOLE

The enamel part of an almost complete isolated lower left incisor, split (prior to fossilization) along the enamel-dentine junction. Incisial surface partially preserved. Growth stage uncertain.

5.31 COH 742 W/15 - 19/31 - 34' SINKHOLE

Enamel part of isolated fragment of upper right incisor, incisial surface missing. Growth stage uncertain.

5.32 COH 743 V - W/15 - 19/31 - 34' SINKHOLE

Enamel part of isolated upper right incisor, dentine largely split away (prior to fossilization), incisial surface partially preserved. Growth stage uncertain.

5.33 COH 744 V - W/15 - 19/31 - 34' SINKHOLE

Small fragment of anterior portion of isolated right upper incisor, incisial surface almost completely destroyed. Growth stage uncertain.

5.34 COH 745 T - W/15 - 19/28 - 31' SINKHOLE

Small fragment of split (prior to fossilization) isolated lower right incisor, with part of incisial surface preserved. Growth stage uncertain.

5.35 COH 746 CH/60 - 72" Bed 9

Short fragment of isolated lower incisor, probably right, showing signs of pre-fossilization damage and artificial wear. Growth stage uncertain.

5.36 COH 747 V - W/15 - 19/31 - 34' SINKHOLE

Enamel portion of fragment of isolated lower incisor, probably left, split prior to fossilization from dentine. Incisial surface not preserved. Growth stage uncertain.

5.37 COH 748 W/15 - 19/31 - 34' SINKHOLE

Most of isolated left upper incisor, incisial surface preserved. Growth stage uncertain.

5.38 COH 749 V - W/15 - 19/31 - 34' SINKHOLE

Anterior fragment of isolated lower right incisor, split prior to fossilization along the enamel-dentine junction. Part of incisial surface preserved. Growth stage uncertain.

5.39 COH 750 V - W/15 - 19/31 - 34' SINKHOLE

Anterior fragment of isolated upper left incisor with part of incisial surface preserved. Growth stage uncertain.

5.40 COH 751 T - W/15 - 19/28 - 31' SINKHOLE

Part of enamel sheath of isolated upper incisor, probably right. Growth stage uncertain.

5.41 COH 752 1/9/11 - 13'

Calcined fragment of isolated lower right incisor. Probably from vicinity of hearth. Growth stage uncertain.

5.42 COH 753 T - W/15 - 19*28 - 31' SINKHOLE

Short fragment of isolated upper left incisor, incisial surface missing. Growth stage uncertain.

5.43 COH 754 V - W/15 - 19/31 - 34' SINKHOLE

Anterior enamel fragment of isolated lower left incisor, split prior to fossilization along the enamel-dentine junction. Growth stage uncertain.

5.44 COH 755 S - U/15 - 19/28 - 31' SINKHOLE

Isolated worn right P_4 (growth stage 6) roots partially preserved.

5.45 COH 756 V - W/15 - 19/31 - 34' SINKHOLE

Isolated well-worn left P_4 (growth stage 6), roots partially preserved.

5.46 COH 757 W/15 - 19/31 - 34' SINKHOLE

Isolated well-worn left P_4 (growth stage 6) of robust adult individual, roots partially preserved.

5.47 COH 758 W/15 - 19/31 - 34' SINKHOLE

Isolated worn left M^1 or M^2, probably M^2 with papillate roots preserved. Growth stage 5 (late) or 6.

5.48 COH 759 SURFACE

Isolated left M_1 or M_2 worn, probably at growth stage 3 or 4, roots absent.

5.49 COH 760 T - W/15 - 19/28 - 31' SINKHOLE

Isolated worn right upper molar, probably M^2 at growth stage 6, papillate roots partially preserved.

5.50 COH 761 S/15 - 19/31 - 34' SINKHOLE

Isolated well-worn M_2 at growth stage 6, roots partially preserved.

5.51 COH 762 V - W/15 - 19/31 - 34' SINKHOLE

Isolated worn left M_1 or M_2 at growth stage 5 or 6. Only root bases present.

5.52 COH 763 S/15 - 19/28 - 31' SINKHOLE

Isolated very well-worn right M^1 of mature adult at growth stage 6, markedly antero-posteriorly compressed. Roots partially preserved.

5.53 COH 764 CH/84 - 96" Bed 8

Isolated newly-erupted unworn left upper molar of juvenile individual, probably M^3. Roots missing. Growth stage 4.

5.54 COH 765 CH/84 - 96" Bed 8

Isolated worn lower left molar, probably M_3. Probably at growth stage 4. Roots missing.

5.55 COH 766 W/15 - 19/31 - 34' SINKHOLE

Isolated, newly-erupted unworn right lower molar of juvenile individual, probably M_3, roots missing. Growth stage 4.

5.56 COH 767 T - W/15 - 19/28 - 31' SINKHOLE

Isolated well-worn right M_1 at growth stage 5 or 6. Roots partially preserved.

5.57 COH 768 CH/84 - 96" Bed 8

Badly damaged isolated newly-erupted unworn upper molar, either M^1 or M^2. Growth stage uncertain.

5.58 COH 769 V - W/15 - 19/31 - 34' SINKHOLE

Damaged, isolated right M^1, well-worn and compressed. Growth stage 6.

5.59 COH 2356 T - W/15 - 19/28 - 31' SINKHOLE

Right mandibular diastemic fragment, bearing fragmentary incisor. Growth stage uncertain.

5.60 COH 2357 CH/42" Bed 10

Isolated worn left M^3, probably growth stage 4 or 5. Roots missing.

5.61 COH 2358 CH/42" Bed 10

Isolated well-worn left M^3, probably growth stage 5. Papillate roots present.

5.62 COH 2381 T - U/15 - 19/28 - 30' SINKHOLE

Fragment of left half-mandible of robust adult individual. Much of diastema preserved, specimen broken through ventral and posterior part of ramus. Complete tooth row P_4-M_3 *in situ*, all well-worn. P_4 cracked and distorted by matrix-filled cracks. Growth stage 6.

5.63 COH 2382 CH/60 - 72" Bed 9

Fragment of right half-mandible of adult individual with complete tooth row P_4 to M_3, all being well-worn. Growth stage 6. All teeth cracked and P_4, M_2 and M_3 particularly damaged. Muscle attachments clearly visible on lateral surface of the jaw. Coronoid, articular and angular processes missing.

5.64 COH 2383 CH/24 - 48" Bed 10

Fragment of left half-mandible of juvenile individual (growth stage 3) with small fragments of the roots of dp_4 occupying the alveolus, worn M_1 and M_2 and newly-erupted very slightly worn M_3 *in situ*. Part of alveolus of I_1 present. Specimen broken in front of dp_4 and some distance behind M_3.

5.65 COH 2384 CH/60 - 72" Bed 9

Fragment of left half-mandible of adult individual, tooth row P_4 to M_3 complete and well-worn. Growth stage 6. All teeth cracked, P_4, M_2 and M_3 damaged. Probably the half-mandible corresponding to COH 2382, as the specimens come from the same horizon within the deposit, and have identical crown enamel patterns.

5.66 COH 2385 T - U/15 - 19/28 - 30' SINKHOLE

Left half-mandibular fragment of adult individual at growth stage 6. Well-worn P_4, M_2 and M_3 in situ. Matrix-filled alveolus of M_1 also present. Muscle attachments visible laterally. Fragment broken in front of P_4 and behind M_3.

5.67 COH 2386 No co-ordinates provided

Fragment of left half-mandible of young adult individual at late growth stage 5. Slightly-worn P_4, well-worn M_1 and M_2 in situ. Remaining part of alveolus of I_1 vacant. Specimen broken immediately in front of P_4 and behind M_2. Since this specimen is obviously the counterpart of a subsequent specimen (5.69 COH 2388), it probably has been derived from the same stratum, and therefore probably comes from CH/24 - 48", Bed 10.

5.68 COH 2387 CH/24 - 48" Bed 10

Small manganese-stained fragmentary right half-mandible of juvenile individual (growth stage 4) with well-worn dp_4 (almost ready to be shed) worn M_3 and M_2 present. Apparently the counterpart of 5.64 COH 2383.

5.69 COH 2388 CH/24 - 48" Bed 10

Small fragment of right half-mandible of young adult individual at growth stage 5. Slightly-worn P_4 and worn M_1 in situ. Specimen broken immediately in front of P_4 and behind M_1. Apparently the counterpart to half mandible 5.67 COH 2386.

5.70 COH 2389 CH/120 - 132" Bed 5

Calcined dentine fragment of lower incisor. The enamel has probably been flaked off due to the heat from a nearby hearth. Incisial surface not preserved. Growth stage uncertain.

5.71 COH 2390 T - U/15 - 19/28 - 30' SINKHOLE

Isolated enamel fragment of lower left incisor, incisial surface not preserved. Growth stage uncertain.

5.72 COH 2391 S - U/15 - 19/28 - 30' SINKHOLE

Small fragment, mainly enamel, of isolated upper right incisor, incisial surface not preserved. Growth stage uncertain.

5.73 COH 2392 S - T/15 - 19/28 - 30' SINKHOLE

Small anterior fragment of isolated lower left incisor, incisial surface partially preserved. Specimen longitudinally split, probably prior to fossilization. Growth stage uncertain.

5.74 COH 2393 P - T/16 - 19/20 - 22' SINKHOLE
Small posterior fragment of isolated upper right incisor, incisial surface not preserved. Growth stage uncertain. Probably calcined and from the vicinity of a hearth. Shows localized wear.

5.75 COH 2394 No grid co-ordinates provided
Small anterior fragment of isolated upper left incisor, incisial surface partially preserved. Growth stage uncertain.

5.76 COH 2395 T - U/15 - 19/28 - 30' SINKHOLE
Small fragment of isolated upper left incisor, incisial surface not preserved. Growth stage uncertain.

5.77 COH 2396 T - U/15 - 19/28 - 30' SINKHOLE
Isolated well-worn upper molar, probably M^2, at growth stage 6. Papillate roots preserved.

5.78 COH 2397 No grid co-ordinates provided SINKHOLE ?
Isolated well-worn, damaged left P_4 at growth stage 6. Only one root preserved. Faded ink markings on specimen suggest that it is of sinkhole origin.

5.79 COH 2398 CH/60 - 72 Bed 9
Isolated well-worn badly damaged left P_4 (growth stage 6) showing internal morphology. Roots absent.

5.80 COH 2399 CH/24 - 48" Bed 10
Isolated well-worn right M_2, apparently part of specimen 5.69 COH 2388. Late growth stage 5. Papillate roots preserved.

5.81 COH 2400 CH/60 - 72" Bed 9
Isolated lower right molar, probably M_3, unworn. Roots absent. Probably growth stage 3.

5.82 COH 2401 CH/120 - 132" Bed 5
Isolated upper left molar, probably M^2 at growth stage 6. Roots absent.

5.83 COH 2402 S - U/15 - 19/28 - 30' SINKHOLE
Isolated well-worn left M^3 of adult individual, papillate roots preserved. Growth stage 6.

5.84 COH 2403 Iron Age. Bed 11 (or Bed 12)
Isolated well-worn, pressure-facetted left M_1 at growth stage 6, with small roots embedded in small mandibular fragment.

5.85 COH 2404 No grid co-ordinates provided

Isolated extremely well-worn left P_4 at terminal growth stage 6, roots preserved.

5.86 COH 2405 Iron Age. Bed 11 (or Bed 12)

Isolated perfect well-worn left dp_4 with well preserved roots. Probably at early growth stage 4.

5.87 COH 2406 No grid co-ordinates provided

Almost complete left premaxilla with the alveolus for the incisor preserved; position of the foramina incisiva indicated. Growth stage uncertain.

5.88 COH 2407 T - U/15 - 19/28 - 30' SINKHOLE

Most of left premaxilla with the alveolus containing remains of fractured I^1. Position of foramina incisiva visible. Specimen has a rather burnt appearance. Growth stage uncertain.

5.89 COH 2408 CH/60 - 72" Bed 9

Small mandibular fragment, no teeth preserved. Growth stage uncertain.

5.90 COH 2409 CH/Iron Age. Bed 11 (or Bed 12)

Small fragment of right maxillary of very young individual, bearing lightly-worn dp^4, growth stage 2. The base of the jugal process of the maxillary can be seen laterally.

5.91 COH 2410 CH/24 - 48" Bed 10

Small fragment of right half-mandible of very young individual, with alveolus for dp_4 preserved. Growth stage 1?

APPENDIX III

ALPHABETICAL LIST OF THE PUBLISHED SPECIES OF HYSTRIX

APPENDIX III

ALPHABETICAL LIST OF THE PUBLISHED SPECIES OF HYSTRIX

* denotes fossil species

(*) denotes modern species with fossil record

This appendix lists, in alphabetical order, all the species that have been described under the genus Hystrix Linnaeus 1758. The term 'hystrix', a Latin word meaning porcupine, was in use long before Linnaeus' time, and a number of pre-Linnaean species of Hystrix were described before the genus was formally established. Many of these very early species e.g. Hystrix orientalis singularis Seba 1734, have two trivial names, given by their authors purely as descriptive terms. Such species should not be confused with subspecies, marked s.sp. in this list, which also have two trivial names.

The genus Hystrix has since been subdivided into two subgenera (Ellerman 1940): Hystrix (Hystrix) and Hystrix (Acanthion), or more correctly, Cuvier's genus Acanthion has been incorporated into Hystrix as a subgenus, there being a gradation of characters from one to the other and no really good criteria by which the two can be separated. A large number of species which would otherwise have been listed under Acanthion have therefore been included in the list.

Taxonomic refinements such as subgenera cannot apply to the rare and usually fragmentary fossil remains, which are all merely described as Hystrix. Fossil species, marked with an asterisk, are followed by a note on their geological age and type locality. Modern species with a fossil history are marked with bracketed asterisks.

Ninety-eight species and a number of subspecies have been described under the genus Hystrix, twenty-three species being known only as fossils. In addition, several of the seventy-five extant species have fossil histories. Of the extant species, only three are valid representatives of Hystrix (Hystrix) : Hystrix (H.) cristata Linnaeus 1758, H. (H.) indica Kerr 1792 and H. (H.) africaeaustralis Peters 1852.

The generic name 'Hystrix' is feminine, and according to basic grammatical rules and to the International Rules of Zoological Nomenclature the specific epithet should, strictly speaking, have an ending

which is in agreement with this gender: i.e. the feminine ending 'a' should be used and not the masculine 'us'. However, in many instances in the literature, even in the case of the naming of new species, this practice has frequently been ignored, and the incorrect ending 'us' appears as frequently as the feminine ending. In this list all specific epithets have been given feminine endings.

The generic and species name shown after each item in the alphabetical list is the species with which the item is currently considered synonymous. These have been included for quick reference; a detailed list of synonyms with the synonymising authors is given in Appendix IV. Table I of Appendix IV should assist taxonomic orientation of the synonyms. All the references quoted are listed in the Annotated Taxonomic Bibliography.

ALPHABETICAL LIST OF THE NAMED SPECIES OF HYSTRIX

Hystrix

aerula Thomas 1925 = H. cristata Linn. 1758

(*) africaeaustralis Peters 1852 VALID

africaeaustralis prittwitzi s.sp. Müller 1910b
= H. africaeaustralis Peters 1852

africaeaustralis zuluensis s.sp. Roberts 1936
= H. africaeaustralis Peters 1852

africanus (Gray 1842) = Atherurus africanus Gray 1842

alba de Selys-Longchamps 1839 = H. cristata Linn. 1758 or nomen nudem

alophus Hodgson 1847 = H. (Acanthion) hodgsoni (Gray 1847)

americanus Raj. 1693 = Coendou sp. Lacépède 1799

americanus major Brisson 1762 prob. = Coendou sp. Lacépède 1799

* angressi Frenkel 1970. Upper Pleistocene (Levalloiso-Mousterian) Mt. Carmel, Haifa, N. Israel

* astasobae Bate 1951. Middle Pleistocene. Abu Hugar, Sudan.

bartletti (Gray 1866)[i] — nomen vadum

bengalensis Blyth 1851 — = H. (Acanthion) hodgsoni (Gray 1847)

(*) bessarabica Rjabinin 1929. Upper Miocene-Pliocene. Bessarabia, Moldavian S.S.R.

brachyura Linnaeus 1758 — = H.(Acanthion) brachyura Linnaeus 1758

brandtii Jentink 1879b — = Coendou brandtii (Jentink 1879b)

brasiliensis Oken 1816 — = Coendou sp. Lacépède 1799

brevispinosa Wagner 1844 — = H. (Acanthion) javanicum (Cuvier 1822)

canadensis Edwards circa 1750 — = Erethizon dorsata (Linn. 1758)

capensis Grill 1858 — = Hystrix africaeaustralis Peters 1852

chilensis Molina 1808 — = Coendou (Sphiggurus) chilensis (Molina 1808)

couiy Desmarest 1822 — = Coendou (Sphiggurus) paragayensis (Oken 1816)

* crassidens Lydekker 1886 Middle-Upper Pleistocene. Karnul Caves, Madras, India.

crassispinis Günther 1876 — = Thecurus crassipinis (Günther 1876)

* cristata Linnaeus 1758 — VALID

cristata europaea Kerr 1792 — = H. cristata Linn. 1758

cristata indica Kerr 1792 — = H. indica Kerr 1792

cristata orientalis Seba 1734 — = H. cristata Linn. 1758

cuandu Desmarest 1822 — = Coendou prehensilis (Linn. 1758)

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i) Gray originally described this species (the type species) under the genus Acanthochoerus, which he established to accommodate a hybrid porcupine resulting from a cross between a male Acanthion javanicum and a female Hystrix cristata, and a porcupine of similar appearance which he incorrectly quotes as having come from India, and named Acanthochoerus grotei. Most subsequent authors do not accept Acanthochoerus bartletti (subsequently Hystrix bartletti) as a valid species, nor Acanthochoerus as a valid genus. Acanthochoerus grotei is therefore also invalid.

cuneiceps Wroughton 1912	= H. indica Kerr 1792
cuvieri (Gray 1847)[i]	= H. cristata Linn. 1758
daubentoni Cuvier F. 1822	= H. cristata Linn. 1758
dorsata Linnaeus 1758	= Erethizon dorsata (Linn. 1758)
ecaudata van der Hoeven 1836	= H. (Acanthion) javanicum (Cuvier 1822)
* etrusca Bosco 1898	Lower Pleistocene (Villafranchian), Val d'Arno, Italy
europaea Kerr 1792	= H. cristata Linn. 1758
fasciculata Shaw 1801	= Trichys fasciculata (Shaw 1801) in Lyon 1907 p. 589 and Mohr 1965 p. 82, but = Atherurus macrourus (Linn. 1758) in Ellerman 1940 p. 206
flemingi (Gray 1847)[ii]	= H. (Acanthion) brachyura Linn. 1758
galeata Thomas 1893	= H. cristata Linn. 1758 in Corbet and Jones 1964 p. 296, but Mohr 1965 p. 146 maintains it as a valid species
g. ambigua s.sp. Lönnberg 1908	all forms of H. cristata Linn. 1758 according to Corbet and Jones 1964 or all forms of H. galeata Thomas 1893 according to Mohr 1965 p.146
g. conradsi s.sp. Müller 1910b	
g. lademanni s.sp. Müller 1910b	
g. lönnbergi s.sp. Müller 1910b	
g. somalensis s.sp. Lönnberg 1912	
* greenwoodi Bakr M.S. Circa 1960[iii]	Plio-pleistocene. Grey Breccia, Makapansgat Limeworks, South Africa
grotei (Gray 1866)[iv]	= H. (Acanthion) brachyura Linn. 1758 ; or Nomen vadum

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i) and ii) Originally described as species of Acanthion

iii) A description of this species has never been published, presumably existing in M.S. form only, if at all

iv) This species was originally described as Acanthochoerus grotei Gray 1866. See footnote on Hystrix bartletti (Gray 1866)

(*) hirsutirostris Brandt 1835 = H. indica Kerr 1792

h. aharonii s.sp. Müller 1911[i)]
h. blandfordi s.sp. Müller 1911
h. mersinae s.sp. Müller 1911
h. satunini s.sp. Müller 1911
h. schmitzi s.sp. Müller 1911
} all forms of H. indica Kerr 1792

hodgsonii (Gray 1847)[ii)] = H. (Acanthion) hodgsoni (Gray 1847)

hudsonis Brisson 1756 = Erethizon dorsata (Linn. 1758)

(*) indica Kerr 1792 VALID

insidiosa Kuhl 1820 = Coendou (Sphiggurus) insidiosus (Kuhl 1820)

javanica (Cuvier, F. 1822)[iii)] = H. (Acanthion) javanicum (Cuvier, 1822)

* karnuliensis (Lydekker 1886)[iv)] Middle-Upper Pleistocene Karnul Caves, Madras, India

* kiangsenensis Wang 1931 Pleistocene. Kiangsen, Chekiang, China

klossi (Thomas 1916)[v)] = H. (Acanthion) hodgsoni s.sp. subcristata (Swinhoe 1870) according to Ellerman et al. 1951 p. 519; = H. (Acanthion) klossi according to Mohr 1965 p. 126

* lagrellii Lönnberg 1924 Middle Pleistocene, Honan, N. China

* lamandini Filhol 1876 Early Oligocene. Phosphorites du Quercy, France

(*) leucura Sykes 1831 = H. indica Kerr 1792

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i) Originally described as subspecies of Hystrix hirsutirostris but frequently listed as a s.spp. of H. leucura
ii) Originally described as species of Acanthion
iii) Originally described as species of Acanthion
iv) Variously recorded as Hystrix karnuliensis (Matthew 1929 p. 559) and Atherurus karnuliensis (Lönnberg 1924 p.4: Mohr 1965 p.66) but originally described under Atherurus. Note Mohr's misspelling karmuliensis (sic.)
v) Originally described as species of Acanthion

longicauda Marsden 1810	= H. (Acanthion) brachyura (Linn. 1758)
macroura Marsden 1810	= Atherurus macrourus (Linn. 1758)
* major Gervais 1859 [i]	Plio-Pleistocene (Perrier-Villafranchian) Ratoneau Island Mediterranean
* makapanensis Greenwood 1958	Plio-Pleistocene. Grey Breccia. Makapansgat Limeworks, South Africa
malabarica Sclater 1865	= H. indica Kerr 1792
malaccensis Seba 1734	= H. (Acanthion) brachyura Linn. 1758
mesopotamica Müller 1920b	= H. indica Kerr 1792
mexicana Kerr 1792	= Coendou (Sphiggurus) mexicana (Kerr 1792)
millsi (Thomas 1922)	= H. (Acanthion) hodgsoni s.sp. subcristata Swinhoe 1870
* minor Malez 1963 [ii]	Pleistocene. Veternica Cave, Zagreb, Jugoslavia
mülleri Jentink 1879a	= H. (Acanthion) brachyura s.sp. longicauda Marsden 1810
narynensis Müller 1919	= H. indica Kerr 1792
nepalensis Hodgson 1847	= H. (Acanthion) hodgsoni Gray 1847
novae hispaniae Hernandez 1651	= Coendou (Sphiggurus) mexicana (Kerr 1792)
nycthemera Kuhl 1820	= C. (Sphiggurus) nycthemera (Kuhl 1820)
occidanea Cabrera 1924	= H. cristata Linn. 1758
orientalis Brisson 1756	= Atherurus macrourus (Linn. 1758)
orientalis cristata Seba 1734	= H. cristata Linn. 1758

i) H. major Gervais 1852 is not the same creature as H. major Greenwood 1955. Mohr 1965 p. 64 erroneously records the date of Gervais' H. major as 1879

ii) Originally described as H. cristata minor Malez but sometimes recorded as H. minor

orientalis singularis Seba 1734	= Atherurus macrourus (Linn. 1758)
paragayensis Oken 1816	= Coendou (Sphiggurus) paragayensis (Oken 1816)
pilosus americanus Catesby 1731	= Erethizon dorsata (Linn. 1758)
pollicaris Olfers 1818	No further information available. American species and therefore not Hystrix
prehensilis Linnaeus 1758	= Coendou prehensilis (Linn. 1758)
prehensilis major s.sp. Kerr 1792	= Coendou prehensilis (Linn. 1758)
prehensilis minor s.sp. Kerr 1792	= Coendou prehensilis (Linn. 1758)
* primigenia (Wagner 1848)[i]	Lower-Middle Pliocene (Pontian) Pikermi, Greece
pumila Günther 1879	= Thecurus pumilis (Günther 1879)
* refossa Gervais 1852	Upper Pliocene (Perrier-Villafranchian), Perrier, Montpellier, France
* schaubi Brunner 1954	Upper Pleistocene (Riss-Würm) Siegmannsbrunn, Austria
senegalica (Cuvier, F. 1822)[ii]	= H. cristata Linn. 1758
* sivalensis Lydekker 1878	Middle Pliocene, Hasnot, Siwaliks, N. India
* sivalensis sinhaleyus s.sp. Deraniyagala 1958	Middle-Upper Pleistocene, Ceylon
stegmanni Müller 1910a	= H. africaeaustralis Peters 1852
(*) subcristata Swinhoe 1870	= H. (Acanthion) hodgsoni s.sp. subcristata Swinhoe 1870
subcristatus papae s.sp.(Allen 1927)[iii]	= H. (Acanthion) hodgsoni s.sp. papae (Allen 1927)

i) Originally described as Lamprodon primigenius Wagner 1848
ii), iii) Originally described as species or subspecies of Acanthion

subhimalajana	No further information available
subspinosa Kuhl 1820	= Chaetomys subspinosa (Kuhl 1820)
* suevica Schlosser 1885	Upper Miocene (Vindobonian) Hader, Dinkelscherben, Germany
sumbawae (Schwarz 1911)[i)]	= H. (Acanthion) javanicum (Cuvier 1822)
torosa Merrem 1786	= Atherurus macrourus (Linn. 1758)
torquata van der Hoeven 1836	= H. (Acanthion) javanicum (Cuvier 1822)
tortilis Olfers 1820	= Chaetomys subspinosa (Kuhl 1820)
* venusta Leidy 1869	Pliocene. Dakota, Nebraska, N.America
* vinogradovi Argyropulos 1941	Middle Pleistocene, Binagady, near Baku, U.S.S.R. (Caspian Sea)
* wiedemanni Roger 1885	Upper Miocene (Vindobonian), Dinotheriensande, Germany
yunnanensis Anderson 1878	= H. (Acanthion) subcristata Swinhoe 1870 according to Mohr 1965 p. 128; or H. (A.) brachyura Linn. 1758 according to Ellerman et al. 1951 p. 518
zeylonensis Blyth 1851	= H. indica Kerr 1792

i) Originally described as species or subspecies of Acanthion

APPENDIX IV

SYSTEMATICALLY ARRANGED LIST OF THE VALID SPECIES IN THE EXTANT GENERA OF THE FAMILIES HYSTRICIDAE AND ERETHIZONTIDAE WITH THEIR HYSTRIX SYNONYMS AND SYNONYMISING AUTHORS

APPENDIX IV

SYSTEMATICALLY ARRANGED LIST OF THE VALID SPECIES IN THE EXTANT GENERA OF THE FAMILIES HYSTRICIDAE AND ERETHIZONTIDAE WITH THEIR HYSTRIX SYNONYMS AND SYNONYMISING AUTHORS

(23)

Note: Table I should help to orientate the genera taxonomically.
All synonyms listed were formerly known as species of Hystrix.
The synonyms are listed chronologically as far as possible.
Numbered references follow this list on page 54.

TABLE I

Classification of the Suborder Hystricomorpha
(Modified after Simpson 1945 pp. 93-94)
SEE PAGE 56

FAMILY HYSTRICIDAE

GENUS HYSTRIX Linnaeus 1758

SUBGENUS HYSTRIX Linnaeus 1758

1758. Linnaeus, C. 'Systema Naturae' 10th Ed. (reprint) p.56

1. HYSTRIX CRISTATA Linnaeus 1758. 'Systema Naturae' 10th Ed. (reprint) p.56

CRESTED PORCUPINE OR COMMON PORCUPINE

Hystrix orientalis cristata Seba 1734	(sp. on which Linn. based H. cristata, syn. Linn. 1758 p.57)
Hystrix cristata orientalis Seba 1734[i)]	(= H. cristata, syn. Kerr 1792 p.212)
Hystrix europaea Seba 1734	(Syn. Ellerman 1940 p.219)
Hystrix cristata europaea Kerr 1792	(Kerr's renaming of H.cristata syn. Ellerman 1940 p.219)
Acanthion senegalica Cuvier 1822[ii)]	(Syn. Ellerman 1940 p.219)
Acanthion daubentoni Cuvier 1822	(Syn. Ellerman 1940 p.219

Hystrix alba de Selys-Longchamps 1839	(Syn. Ellerman 1940 p.219)
Acanthion cuvieri Gray 1847	(Syn. Ellerman 1940 p.219)
Hystrix galeata Thomas 1893[iii)]	(Syn. Corbet and Jones 1964 p.296)
H. galeata ambigua Lönnberg 1908	Currently considered as forms of H. cristata
H. galeata lademanni Müller 1910b	
H. galeata conradsi Müller 1910b	
H. galeata lönnbergi Müller 1910b	
H. galeata somalensis Lönnberg 1912	
Hystrix occidanea Cabrera 1924	(Syn. Ellerman & Morrison-Scott 1951 p.520)
Hystrix aerula Thomas 1925[iv)]	(Syn. Ellerman 1940 p.220)

2. HYSTRIX INDICA Kerr 1792[v)] 'Animal Kingdom' p.213

INDIAN CRESTED PORCUPINE

Hystrix cristata indica Kerr 1792	Kerr's original name
Hystrix leucura Sykes 1831	(Syn. Ellerman & Morrison-Scott 1951 p.518)
Hystrix hirsutirostris Brandt 1835	(Syn. Corbet & Jones 1964 p.297)
Hystrix zeylonensis Blyth 1851	(Syn. Ellerman & Morrison-Scott 1951 p.519)
Hystrix malabarica Sclater 1865	(Syn. Sclater 1871 p.234)
H. hirsutirostris satunini Müller 1911	Currently considered as forms of H. indica
H. hirsutirostris blandfordi Müller 1911	
H. hirsutirostris mersinae Müller 1911	
H. hirsutirostris aharonii Müller 1911	
H. hirsutirostris schmitzi Müller 1911	
Hystrix cuneiceps Wroughton 1912	(Syn. Ellerman & Morrison-Scott 1951 p.520)
Hystrix narynensis Müller 1920a	(Syn. Ellerman & Morrison-Scott 1951 p.520)

Hystrix mesopotamica Müller 1920b (Syn. Ellerman & Morrison-Scott 1951 p.520)

3. HYSTRIX AFRICAEAUSTRALIS Peters 1852 'Naturwissenschaftliche Reise Nach Mossambique' Zoologie I p.170

SOUTHERN AFRICAN CRESTED PORCUPINE

Hystrix capensis Grill 1858 (Syn. Ellerman 1940 p.219)

Hystrix stegmanni Müller 1910a (Syn. Corbet & Jones 1964 p.296)

H. africaeaustralis prittwitzi Müller 1910b[vi] (Syn. Ellerman 1940 p.219)

H. africaeaustralis zuluensis Roberts 1936[vii] (Syn. Ellerman 1940 p.219)

SUBGENUS ACANTHION Cuvier 1822

1822. Cuvier, F. Mem. Mus. Hist. Nat. Paris, 9 (1822) p.413

1. HYSTRIX (ACANTHION) BRACHYURA Linnaeus 1758 'Systema Naturae' p.57

MALAYAN PORCUPINE

Subspecies a (Malaya and Malayan Islands)

H. (Acanthion) brachyura brachyura Linn 1758

Hystrix brachyura Linn. 1758 (Cuvier 1822 p.413)

Hystrix malaccensis Seba 1734 (Formed the basis of Linn.'s H. brachyura Syn. Linn. 1758 p.57)

Acanthion flemingii Gray 1847 (Syn. Ellerman 1940 p.217)

Acanthochoerus grotei Gray 1866 (Syn. Lyon 1907 p.579)

Subspecies b (Sumatra)

H. (Acanthion) brachyura longicauda Marsden 1810

Hystrix longicauda Marsden 1810 (Syn. Mohr 1965 p.120)

Hystrix mülleri Jentink 1879[viii] (Syn. Marshall in Sclater 1871,p.235; see also Mohr 1965 p.120)

Subspecies c (Asiatic mainland, S. China)

H.(?) (Acanthion) brachyura yunnanensis Anderson 1878

Hystrix yunnanensis Anderson 1878	(Ellerman & Morrison-Scott 1951 p.518)

2. HYSTRIX (ACANTHION) JAVANICUM (Cuvier 1822) Mém. Mus. Hist. Nat. Paris, 9 (1822) p.431

JAVA PORCUPINE

Acanthion javanicum Cuvier 1822	Type Species
Hystrix torquata van der Hoeven 1836	(Syn. Marshall, in Sclater 1871 p.235)
Hystrix ecaudata van der Hoeven 1836	(Syn. Ellerman 1940 p.217)
Hystrix brevispinosa Wagner 1844	(Syn. Jentink 1879 p.88)
Acanthion sumbawae Schwarz 1911	(Syn. Mohr 1965 p.122)

3. HYSTRIX (ACANTHION) HODGSONI Gray 1847 Proc. Zool. Soc. Lond. 1847, p.101

LESSER INDIAN PORCUPINE, SUB-CRESTED INDIAN PORCUPINE OR CRESTLESS INDIAN PORCUPINE

Subspecies a (India, Himalayan region)

H. (Acanthion) hodgsoni hodgsoni Gray 1847

Hystrix hodgsoni Gray 1847	(Syn. Ellerman 1940 p.217)
Hystrix alophus Hodgson 1847	(Syn. Gray 1847 p.128)
Hystrix nepalensis Hodgson 1847	(Syn. Gray 1866 p.310)
Hystrix bengalensis Blyth 1851	(Syn. Ellerman 1940 p.217)
Acanthion millsi Thomas 1922[ix)]	(Syn. Mohr 1965 p.124)

Subspecies b (China)

H. (Acanthion) hodgsoni subcristata Swinhoe 1870

Hystrix subcristata Swinhoe 1870[x)]	(Syn. Ellerman & Morrison-Scott 1951 p.519)
Acanthion klossi Thomas 1916[xi)]	(Syn. Ellerman & Morrison-Scott 1951 p.519)
Acanthion millsi Thomas 1922	(Syn. Ellerman & Morrison-Scott 1951 p.519)
Hystrix yunnanensis Anderson 1878	(Syn. Mohr 1965 p.128)

Subspecies c (Hainan)

H. (Acanthion) hodgsoni papae (Allen 1927)

Acanthion subcristatus papae Allen 1927 (Ellerman & Morrison-Scott 1951 p.519)

Incertae sedis : Acanthochoerus bartletti Gray 1866

GENUS THECURUS Lyon 1907

1907. Lyon. Proc. U.S. Nat. Mus., 32 (1552) p.582

1. THECURUS CRASSISPINIS (Günther 1876) Proc. zool. Soc. Lond., 1876 p.736

Hystrix crassispinis Günther 1876 (Syn. Ellerman 1940 p.211)

2. THECURUS PUMILIS (Günther 1876) Ann. Mag. Nat. Hist., Ser. 5, 4 p.106

Hystrix pumila Günther 1876 (Syn. Lyon 1907 p.584)

3. THECURUS SUMATRAE Lyon 1907 Proc. U.S. nat. Mus., 32 (1552) p.583

No species from the genus Hystrix in the synonymy of this species

GENUS ATHERURUS Cuvier 1829

1829. Cuvier, F. 'Dictionnaire des Sci.nat', 59: 483

1. ATHERURUS MACROURUS (Linn. 1758) 'Systema Naturae' 10th Ed. p.57

Hystrix orientalis Brisson 1756 (Syn. Linn. 1755 p. with H. macroura)

Hystrix macroura Linn. 1758 (Transferred Cuvier 1829 p.483)

Hystrix orientalis singularis Seba 1734 (Basis of Linn.'s H. macroura 1758. Syn. Linn. 1758 with H. macroura)

Hystrix torosa Merrem 1786 (Syn. Kerr 1792 p.216)

Hystrix fasciculata Shaw 1801[xii)] (Syn. Ellerman 1940 p.206)

2. ATHERURUS AFRICANUS Gray 1842 Ann. Mag. Nat. Hist., 10 p.261

Atherurus africanus Gray 1842 Also called Hystrix africanus by Wagner 1844 p.24. A. africanus is a valid species

3. ATHERURUS CENTRALIS Thomas 1895
4. ATHERURUS TURNERI St. Leger 1932
5. ATHERURUS ANGUSTIRAMUS Mohr 1964
6. ATHERURUS RETARDUS Mohr 1964

No species of Hystrix are synonymous with these species

GENUS TRICHYS Günther 1876

1876. Günther. Proc. zool. Soc. Lond., 1876 p.739

1. TRICHYS FASCICULATA (Shaw 1801) 'General Zoology' 2 (1) p.11

Hystrix fasciculata Shaw 1801[xii] (Transferred Mohr 1965 p.82)

2. TRICHYS LIPURA Günther 1876
3. TRICHYS MACROTIS Miller 1903

No species of Hystrix are synonymous with these species

FAMILY ERETHIZONTIDAE

GENUS COENDOU Lacépède 1799

1799. Lacépède, B. 'Tableau des Divisions... des Mammifères p. 1 - 18

Remarks: Like the genus Hystrix in the family Hystricidae, two subgenera, Coendou Lacépède 1799 and Sphiggurus Cuvier 1824 are recognised (Tate 1935 p.306)

SUBGENUS COENDOU Lacépède 1799

1799. Lacépède, B. 'Tableau des Divisions... des Mammifères' p. 1 - 18

1. COENDOU PREHENSILIS (Linnaeus 1758) 'Systema Naturae' 10th Ed. p.57

Hystrix prehensilis Linn. 1758 (Transferred Lacépède 1799 p.11)

Hystrix americanus Raj 1693 (Syn. Kerr 1792 p.213)

Hystrix cuandu Desmarest 1822 (Syn. Tate 1935 p.306)

2 COENDOU BRANDTI (Jentink 1879b) Notes Leyden Mus., 1, note 22 p.96

Hystrix brandti Jentink 1879b (Syn. Tate 1935 p.306)

SUBGENUS SPHIGGURUS Cuvier 1824

1824. Cuvier. 'Dents des Mammiferes'

1. COENDOU (SPHIGGURUS) MEXICANUS (Kerr 1792) 'Animal Kingdom' p.213

Hystrix mexicana Kerr 1792 (Syn. Tate 1935 p.307)

Hystrix novae hispaniae Hernandez 1651 (H. mexicana Kerr based on this species)

(?) Hystrix americanus Raj 1693 (Based on Hernandez' description of H.novae hispaniae)

2. COENDOU (SPHIGGURUS) CHILENSIS (Molina 1808) In Riley 1808 translation. This reference proved untraceable

Hystrix chilensis Molina 1808 (Syn. Tate 1935 p.307)

3. COENDOU (SPHIGGURUS) PARAGAYENSIS (Oken 1816) 'Lehrbuch der Zoologie' p. 870 - 873

Hystrix paragayensis Oken 1816 (Syn. Tate 1935 p.306)

Hystrix couiy Desmarest 1822 (Syn. Tate 1935 p.307)

4. COENDOU (SPHIGGURUS) INSIDIOSUS (Kuhl 1820) 'Beitr. Zoologie' Mammalia pp. 1 - 74

Hystrix insidiosus Kuhl 1820 (Syn. Tate 1935 p. 307)

5. COENDOU (SPHIGGURUS) NYCTHEMERA (Kuhl 1820) 'Beitr. Zool. Mammalia' pp. 1 - 74

Hystrix nycthemera Kuhl 1820 (Syn. Tate 1935 p.307)

GENUS ERETHIZON Cuvier 1822

1822. Cuvier, F. Mem. Mus. Hist. Nat. Paris, 9 p.425

1. ERETHIZON DORSATA (Linnaeus 1758) 'Systema Naturae' 10th Ed. p.57

CANADIAN PORCUPINE

Hystrix dorsata Linnaeus 1758 (Transferred Cuvier 1822 p.425)

Hystrix dorsata alba Kerr 1792 s.sp.

Hystrix canadensis Edwards circa 1750	(Syn. H. dorsata Linn. 1758 p.57. Basis of H. dorsata)
Hystrix hudsonis Brisson 1756[xiii)]	(Syn. Shaw 1801 p.13 with H. dorsata)
Hystrix pilosus americanus Catesby 1731	(syn.Ellerman 1940 p.181)

GENUS ECHINOPROCTA Gray 1865

1865. Gray, J.E. Proc. zool. Soc. Lond., 1865 p.321

(No species from the genus Hystrix synonymised into any of the species of this genus)

GENUS CHAETOMYS Gray 1843

1843. Gray, J.E. List specimens Mamm. in Coll. Brit. Mus. p.123

1. CHAETOMYS SUBSPINOSA (Kuhl 1820) 'Beitr. Zool.' Mammalia p.71

Hystrix subspinosa Kuhl 1820	(See Ellerman 1940 p.177)
Hystrix tortilis Olfers 1820	(Syn. Ellerman 1940 p.177)

Incertae sedis:

Hystrix americanus major Brisson 1762

Hystrix brasiliensis Oken 1816

Hystrix pollicaris Olfers 1818

NUMBERED REFERENCES:

i) Linnaeus (1758 p.57) quotes Seba's species as Hystrix orientalis cristata whilst Kerr (1792 p.212) quotes it as H. cristata orientalis. The species is synonymous with H. cristata Linn. 1758.

ii) Ellerman (1940 pp.219,220) maintains this species as a subspecies of H. cristata.

iii) Ellerman (1940 p.220 item 30) still considers H. galeata Thomas 1893 to be a valid species. In 1951 Ellerman and Morrison-Scott (p.520) announced the probability that H. galeata was conspecific with H. cristata, and the former species was formally synonymised by Corbet and Jones 1964 p.296. However, more recent authors, for example Frenkel (1970) and Mohr (1965) continue to treat H. galeata as a valid species.

iv) Ellerman (1940 p.219,220) maintains this species as a subspecies of H. cristata.

v) For many years (ever since Sykes described H. leucurus in 1831) the Indian crested porcupine was known as H. leucurus Sykes, whilst H. indica, with Gray and Hardwicke quoted as authors, was placed in the list of synonyms for H. leucurus. Ellerman and Morrison-Scott (1951 p.518) pointed out that H. leucurus Sykes 1831 is H. indica Kerr 1792, and that the latter name is the prior and correct name for the species. Many authors, however, still refer to the Indian crested porcupine as H. leucurus Sykes 1831.

vi) Ellerman (1940 p.219) lists this as a subspecies of H. africaeaustralis.

vii) Ellerman (1940 p.219) lists this as a subspecies of H. africaeaustralis.

viii) H. mülleri Jentink was described from a species with an unpublished M.S. name (mülleri) given by Temminck. By correspondence, Marshall knew of its existence prior to publication by Jentink. Ellerman (1940 p.217) lists H. mülleri as a separate subspecies of H. (Acanthion) brachyura. The division of the species brachyura into subspecies is the combined work of Ellerman (1940) Ellerman and Morrison-Scott (1951) and Mohr (1965).

ix) Note that Mohr (1965 p.124) synonymises Acanthion millsi Thomas 1922 with H. (Acanthion)hodgsoni hodgsoni whilst Ellerman and Morrison-Scott (1951 p.519) placed it in the synonymy of the subspecies subcristata Swinhoe 1870.

x) According to Mohr (1965 p.128) Hystrix subcristata Swinhoe 1870 (original published name) has specific status, being listed as Acanthion subcristatum (Swinhoe) 1870. Hystrix yunnanensis Anderson 1878 and Acanthion subcristatus papae Allen 1927 have been placed in its list of synonyms. Ellerman and Morrison-Scott (1951 p.518), however, list H. yunnanensis as a subspecies of H. (Acanthion) brachyura (Linn.) and Acanthion subcristatus papae as a subspecies of H. (Acanthion) hodgsoni (p.519).

xi) Mohr (1965 p.126) maintains Acanthion klossi Thomas 1916 as an independant species.

xii) The illustrations in Shaw (1801 p.9) indicate that the 'iridescent porcupine' (H. macroura) and the 'brush-tailed porcupine' H. fasciculata now Trichys fasciculata) are rather different animals (see figs. 28 and 26b text). Note that Mohr 1965 p.82 places Hystrix fasciculata Shaw in the genus Trichys Günther 1876.

xiii) Hystrix hudsonis Brisson 1756 is sometimes (e.g. Kerr 1792 p.214), quoted as H. hudsonius.

TABLE I

Classification of the Suborder Hystricomorpha

(Modified after Simpson 1945 pp. 93 - 94)

SUBORDER	SUPERFAMILY	FAMILY	SUBFAMILY	GENUS
HYSTRICOMORPHA	HYSTRICOIDEA	HYSTRICIDAE	***HYSTRICINAE	Hystrix ** Acanthion Thecurus * Sivacanthion * Miohystrix * Xenohystrix
			***ATHERURINAE	Atherurus Trichys
	ERETHIZONTOIDEA	ERETHIZONTIDAE	* ACAREMYINAE	-
			ERETHIZONTINAE	Coendou Erethizon Echinoprocta
			CHAETOMYINAE	Chaetomys
	CAVIOIDEA	Not applicable		
	CHINCHILLOIDEA	Not applicable		
	OCTODONTOIDEA	Not applicable		

* Entirely fossil genera and subfamily

** Most modern authors class Acanthion as a subgenus of Hystrix.

*** Ellerman (1940) does not uphold the division of the family Hystricidae into two subfamilies, arguing that there is a gradation from the less-specialized Trichys to the highly developed Hystrix.

APPENDIX V

CRANIAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

APPENDIX V

CRANIAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

1. All measurements in mm. unless otherwise stated
2. The method of measurement of the various parameters has been discussed and illustrated in sections 7.2.1. to 7.2.11 of the main text
3. * = estimate due to fracture or distortion of cranial bone at critical point
4. $\overline{X}$ = arithmetic mean, correct to two decimal places
5. SD = Standard deviation
6. G/S = growth stage as defined in Chapter 7, sections 7.1.4. and 7.1.5 main text
7. Specimens listed in order of increasing maturity, PPM113-BPI/C682 juvenile, i.e. g/s 1-4; TM12165 to PPM123 adult, i.e. g/s 5 and 6

CONTENTS

		PAGE
TABLE I	GENERAL CRANIAL MEASUREMENTS: A: GREATEST LENGTH OF SKULL ABOVE; B: OCCIPITONASAL LENGTH; C: CONDYLO-INCISIVE LENGTH; D: BASILAR LENGTH	60
TABLE II	GENERAL CRANIAL MEASUREMENTS: A: GREATEST SKULL WIDTH; B: LEAST POSTORBITAL BREADTH; C: SKULL WIDTH AT CONDYLES; D: INTERORBITAL DISTANCE AT LACHRYMALS; E: INTERORBITAL DISTANCE AT POSTORBITAL PROCESS	62
TABLE III	GENERAL CRANIAL MEASUREMENTS: A: HEIGHT OF SKULL FROM PALATE TO NASALS; B: HEIGHT OF SKULL FROM PALATE BETWEEN M^1; C: LEAST BREADTH BETWEEN ORBIT AND FORAMEN INFRAORBITALE; D: BREADTH OF CHOANAE; E: LENGTH OF SAGITTAL CREST; F: POSITION OF SPHENOPALATINE FORAMEN	64
TABLE IV	MEASUREMENTS OF THE PREMAXILLA	67
TABLE V	MEASUREMENTS OF THE NASAL	69
TABLE VI	MEASUREMENTS OF THE FRONTAL AND PALATE	71

		PAGE
TABLE VII	PALATAL DISTANCES BETWEEN P^4, M^1, M^2 AND M^3; AVERAGE PALATAL WIDTH	74
TABLE VIII	MEASUREMENTS OF THE OCCIPUT	76
TABLE IX	MEASUREMENTS OF THE ZYGOMATIC AND TYMPANIC REGIONS	79
TABLE X	LENGTH OF NASAL BONES AS A PROPORTION OF OCCIPITO-NASAL SKULL LENGTH	82
TABLE XI	FRONTAL LENGTH AS A % OF NASAL LENGTH	83
TABLE XII	RELATIVE WIDTH OF NASALS	84
TABLE XIII	SHAPE OF NASALS	85
TABLE XIV	WIDTH OF NASAL PROCESS OF PREMAXILLA IN RELATION TO GREATEST WIDTH OF NASAL	86
TABLE XV	MAXIMUM WIDTH : MAXIMUM HEIGHT OF OCCIPUT	87
TABLE XVI	MAXIMUM WIDTH OF OCCIPUT : MAXIMUM WIDTH OF CONDYLI	88
TABLE XVII	HEIGHT OF SKULL AS A PERCENTAGE OF BASAL LENGTH	89
TABLE XVIII	ZYGOMATIC BREADTH : BASAL LENGTH	90
TABLE XIX	LENGTH OF MOLAR SERIES : MOLAR TYMPANIC DISTANCE	91

TABLE I

Cranial measurements of Hystrix africaeaustralis: A: Greatest length of skull above (7.2.1.1); B: Occipitonasal length (7.2.1.2); C: Condylo-incisive length (7.2.1.3); D: Basilar length (7.2.1.4) (mm)

Specimen	Growth Stage	A	B	C	D
PPM113	2	-	-	-	-
TM Nyasaland	2	116,2	109,6	113,8	104,8
TM5662	2	101,8	94,5	-	-
TM5661	2	103,2	96,0	-	98,7
TM12698	3	-	-	-	-
PPM114	3	-	-	-	-
PPM126	3	-	-	-	-
PPM115	3	-	-	-	-
TM12697	3	-	-	-	-
PPM116	4	136,0	-	139,5	128,2
PPM124	4	130,8	122,0	125,0	116,7
PPM125	4	-	-	-	-
Tm Mt.Zeb.Pk.	4	132,8	124,5	136,4	126,2
TM94F	4	144,9	137,8	143,4	132,7
TM2A	4	144,0	136,0	145,0	134,0
PPM789	4	-	-	-	-
TM753	4	-	-	-	-
TM594	4	145,0	134,8	149,7	138,0
BPI/C682	4	141,4	131,9	135,0	125,9
TM12165	5	155,1	147,0	156,0	145,0
PPM117	5	138,5	127,5	140,3	131,4
PPM118	5	142,0	131,8	139,0	130,0
TM866	5	148,4	139,8	149,0	139,1
TM8289	6	-	-	-	-
ZA911	6	148,5	138,6	143,7	140,0
PPM119	6	-	-	-	-
TM657	6	158,5	150,3	157,5	147,0
PPM122	6	142,7	131,0	143,7	135,0
TM623	6	157,5	149,7	152,0	143,8
BPI/C641	6	-	-	-	-
TM6066	6	155,0	149,7	159,0	147,1
PPM123	6	145,7	135,0	149,0	141,0

ANALYSIS OF TABLE I

A: GREATEST LENGTH OF SKULL ABOVE (7.2.1.1.)

	MAX	MIN	MEAN	N	SD
Growth stage 2	116,2	101,8	107,07	3	7,94
Growth stage 3	-	-	-	-	-
Growth stage 4	145,0	130,8	139,27	7	6,00
Growth stage 5	155,1	138,5	146,00	4	7,32
Growth stage 6	158,5	142,7	155,32	6	6,59
SAMPLE	158,5	101,8	139,40	20	16,03

B: OCCIPITONASAL SKULL LENGTH (7.2.1.2)

Growth stage 2	109,6	94,5	100,03	3	8,32
Growth stage 3	-	-	-	-	-
Growth stage 4	137,8	122,0	131,17	6	6,47
Growth stage 5	147,0	127,5	136,53	4	8,65
Growth stage 6	150,3	131,0	142,38	6	8,58
SAMPLE	150,3	94,5	130,92	19	16,19

C: CONDYLOINCISIVE LENGTH (7.2.1.3)

Growth stage 2	113,8	113,8	113,8	1	0
Growth stage 3	-	-	-	-	-
Growth stage 4	149,7	125,0	139,14	7	8,05
Growth stage 5	156,0	139,0	146,08	4	7,97
Growth stage 6	159,0	143,7	150,82	6	6,60
SAMPLE	159,0	113,8	143,17	18	11,27

D: BASILAR LENGTH (7.2.1.4)

Growth stage 2	104,8	98,7	101,75	2	4,31
Growth stage 3	-	-	-	-	-
Growth stage 4	138,0	116,7	128,81	7	7,22
Growth stage 5	145,0	130,0	136,38	4	7,00
Growth stage 6	147,1	135,0	142,32	6	4,64
SAMPLE	147,1	98,7	131,82	19	13,29

TABLE II

Cranial measurements of Hystrix Africaeaustralis: A: greatest skull width (7.2.1.5); B: least postorbital breadth (7.2.1.6); C:skull width at condyles (7.2.1.7); D: interorbital distance at lachrymals (7.2.1.8); E: interorbital distance at post-orbital process (7.2.1.9) (mm)

Specimen	Growth Stage	A	B	C	D	E
PPM113	2	-	-	-	-	-
TM Nyasaland	2	-	41,4	30,4	-	50,4
TM5662	2	60,3	39,1	-	51,2	52,2
TM5661	2	60,3	38,6	-	49,7	49,9
TM12698	3	-	-	-	-	64,6
PPM114	3	-	-	-	-	-
PPM126	3	-	-	-	-	-
PPM115	3	-	-	-	-	-
TM12697	3	-	-	-	-	-
PPM116	4	71,0*	42,7	29,0	58,7*	61,6*
PPM124	4	74,0	41,8	27,6	64,4*	62,0*
PPM125	4	-	-	-	-	-
TM Mt.Zeb.Pk.	4	-	44,6	27,0	-	63,0
TM94F	4	81,2	47,3	30,3	67,5	68,2
TM2A	4	82,1	46,6	31,6	69,4	70,0
PPM789	4	-	-	-	-	-
TM753	4	-	-	-	-	-
TM594	4	86,6	44,5	48,6	71,5	66,8
BPI/C682	4	79,7	43,0	27,8	68,5	66,8
TM12165	5	90,0	45,0	36,0	75,0	71,2
PPM117	5	78,3	47,7	25,8	65,2	62,9
PPM118	5	84,4	46,2	31,0	66,4	64,1
TM866	5	80,1	47,4	29,0	67,8	67,2
TM8289	6	-	-	-	-	-
Za911	6	88,0	48,4	28,9	70,8	72,0
PPM119	6	-	-	-	-	-
TM657	6	84,5	49,1	32,6	71,4	68,0
PPM122	6	81,8	49,0	29,0	70,0	69,8
TM623	6	86,0	47,3	30,5	73,2	71,5
BPI/C641	6	-	-	-	-	-
TM6066	6	96,4	50,7	29,6	80,8	78,0
PPM123	6	88,7	48,6	30,5	73,7	73,1

ANALYSIS OF TABLE II

A: GREATEST WIDTH OF SKULL ABOVE	Max	Min	$\bar{X}$ Mean	N	SD
Growth stage 2	60,3	60,3	60,3	2	0
Growth stage 3	-	-	-	-	-
Growth stage 4	86,6	71,0	79,10	6	5,69
Growth stage 5	90,0	78,3	83,20	4	5,21
Growth stage 6	96,4	81,8	87,57	6	4,99
Sample	96,4	60,3	80,74	18	9,47
B: SMALLEST POSTORBITAL WIDTH					
Growth stage 2	41,4	38,6	39,70	3	1,49
Growth stage 3	-	-	-	-	-
Growth stage 4	47,3	41,8	44,36	7	2,09
Growth stage 5	47,7	45,0	46,58	4	1,23
Growth stage 6	50,7	47,3	48,85	6	1,11
Sample	50,7	39,1	45,47	20	3,43
C: SKULL WIDTH AT CONDYLE					
Growth stage 2	30,4	30,4	30,4	1	0
Growth stage 3	-	-	-	-	-
Growth stage 4	48,6	27,0	31,70	7	7,63
Growth stage 5	36,0	25,8	30,45	4	4,28
Growth stage 6	32,6	28,9	30,18	6	1,37
Sample	48,6	25,8	30,84	18	4,98
D: SKULL WIDTH AT LACHRYMAL EDGE					
Growth stage 2	51,2	49,7	50,45	2	1,06
Growth stage 3	-	-	-	-	-
Growth stage 4	71,5	58,7	66,67	6	4,55
Growth stage 5	75,0	65,2	68,60	4	4,40
Growth stage 6	80,8	70,0	73,32	6	3,93
Sample	80,8	49,7	67,52	18	7,80
E: SKULL WIDTH AT RUDIMENTARY POSTORBITAL PROCESS					
Growth stage 2	52,2	49,9	50,83	3	1,21
Growth stage 3	64,6	64,6	64,6	1	0
Growth stage 4	70,0	61,6	65,49	7	3,28
Growth stage 5	71,2	62,9	66,35	4	3,71
Growth stage 6	78,0	68,0	72,07	6	3,41
Sample	78,0	49,9	65,40	21	7,33

TABLE III

Cranial measurements of Hystrix africaeaustralis: A: Height of skull from palate to nasals (7.2.1.10); B: height of skull from palate between M^1 (7.2.1.11); C:least breadth of bridge between orbit and foramen infra-orbitale (7.2.1.12); D: breadth of choanae (7.2.1.13); E: length of sagittal crest (7.2.1.14); F:position of sphenopalatine foramen (7.2.1.17)

Specimen	Growth Stage	(measurements in mm.) A	B	C	D	E	F
PPM113	2	-	-	-	-	-	-
TM Nyasaland	2	45,5	45,5	-	24,7	-	7,9
TM5662	2	42,0	42,5	11,2	21,6	-	6,5
TM5661	2	42,0	42,0	12,9	20,5	-	8,5
TM12698	3	55,5*	-	-	31,0*	-	10,5
PPM114	3	-	-	-	-	-	8,5
PPM126	3	-	-	-	-	-	-
PPM115	3	-	-	-	21,3	-	8,5
TM12697	3	57,0	-	17,3	28,0	-	7,3
PPM116	4	-	-	16,0	-	12,8	9,0
PPM124	4	52,5	52,0	16,0	30,0	13,0	8,0
PPM125	4	-	-	-	-	-	-
TM Mt. Zeb. Pk.	4	58,5*	55,5	13,9	29,0	16,6	10,6
TM94F	4	63,0	62,5	15,8	29,5	-	8,0
TM2A	4	63,0	63,5	16,6	34,0	10,0	8,4
PPM789	4	-	-	-	-	-	8,0
TM753	4	58,0	58,0	16,5	31,9*	-	8,0
TM594	4	64,5	67,0	15,7	37,4	8,8	8,5
BPI/C682	4	56,0	58,0	14,5	29,7	12,5	8,4
TM12165	5	67,5	66,5	18,0	35,0	17,0	9,8
PPM117	5	58,0	58,0	16,0	29,0	12,0	8,3
PPM118	5	60,5	59,5	13,9	28,0	17,4	10,0
TM866	5	67,5	69,0	16,0	28,7	19,6	11,5
TM8289	6	64,5	69,0	15,4	31,7	-	8,0
Za911	6	60,0	57,5	19,6	29,0	-	9,1
PPM119	6	-	-	-	-	-	-
TM657	6	69,5	69,5	17,5	35,0	10,5	13,0
PPM122	6	63,5	61,0	18,0	32,3	16,7	9,0
TM623	6	69,5	65,0	17,7	33,1	20,1	8,0
BPI/C641	6	58,5	57,0	15,8	28,1	-	9,2
TM6066	6	74,5	73,0	20,6	36,5	9,0	8,4
PPM123	6	68,0	64,0	15,8	34,7	17,3	10,0

ANALYSIS OF TABLE III

A: HEIGHT OF SKULL FROM PALATE TO NASO-FRONTAL SUTURE

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	45,5	42,0	43,17	3	2,02
Growth stage 3	57,0	55,5	56,25	2	1,06
Growth stage 4	64,5	52,5	59,36	7	4,36
Growth stage 5	67,5	58,0	63,38	4	4,87
Growth stage 6	74,5	58,5	66,00	8	5,37
Sample	74,5	42,0	59,88	25	8,20

B: HEIGHT OF SKULL FROM PALATE BETWEEN M^1

Growth stage 2	45,5	42,0	43,33	3	1,89
Growth stage 3	-	-	-	-	-
Growth stage 4	67,0	52,0	59,50	7	5,13
Growth stage 5	69,0	58,0	63,25	4	5,33
Growth stage 6	73,0	57,0	64,50	8	5,80
Sample	73,0	52,0	59,60	21	8,68

C: LEAST BREADTH OF BRIDGE BETWEEN ORBIT AND FORAMEN INFRAORBITALE

Growth stage 2	12,9	11,2	12,05	2	1,20
Growth stage 3	17,3	17,3	17,30	1	0,0
Growth stage 4	16,6	13,9	15,63	8	0,95
Growth stage 5	18,0	13,9	15,98	4	1,67
Growth stage 6	20,6	15,4	17,55	8	1,87
Sample	19,6	11,2	16,12	23	2,06

D: BREADTH OF CHOANAE

Growth stage 2	24,7	20,5	22,27	3	2,18
Growth stage 3	31,0	21,3	26,77	3	4,97
Growth stage 4	37,4	29,0	31,64	7	3,08
Growth stage 5	35,0	28,0	30,18	4	3,24
Growth stage 6	36,5	28,1	32,55	8	2,92
Sample	37,4	20,5	29,99	25	4,51

ANALYSIS OF TABLE III (continued)

E: LENGTH OF SAGITTAL CREST

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	-	-	-	-	-
Growth stage 3	-	-	-	-	-
Growth stage 4	16,6	8,8	12,28	6	2,71
Growth stage 5	19,6	12,0	16,50	4	3,21
Growth stage 6	20,1	9,0	14,72	5	4,74
Sample	20,1	9,0	14,22	15	3,80

F: DISTANCE OF SPHENOPALATINE FORAMEN ABOVE ALVEOLAR RIM

Growth stage 2	8,5	6,5	7,63	3	1,03
Growth stage 3	10,5	7,3	8,70	4	1,33
Growth stage 4	10,6	8,0	8,54	9	0,84
Growth stage 5	11,5	8,3	9,90	4	1,31
Growth stage 6	13,0	8,0	9,34	8	1,63
Sample	13,0	6,5	8,89	28	1,34

TABLE IV

Cranial measurements of Hystrix africaeaustralis: A: Length of nasal process of premaxilla (7.2.2.1); B: breadth of nasal process of premaxilla (7.2.2.2); C: breadth of nasal p. of p. midway between maxillo-frontal suture and masseteric ridge (7.2.2.3); D: sutural length of p. ventrally (7.2.2.4); E: sutural length of p. anterior to foramina incisiva (7.2.2.5)

Specimen	Growth Stage	(measurements in mm.) A	B	C	D	E
PPM113	2	-	-	-	-	-
TM Nyasaland	2	33,6	5,0	9,3	17,7	13,5
TM5662	2	29,0	2,7	7,0	16,0	11,9
TM5661	2	30,7	3,0	7,5	16,0	11,6
TM12698	3	45,0	7,0	9,4	21,6	16,8
PPM114	3	-	-	-	20,0	14,0
PPM126	3	-	-	-	-	-
PPM115	3	27,8	-	8,4	20,1	14,6
TM12697	3	43,0	6,4	10,0	20,0	16,0
PPM116	4	45,0*	-	-	24,7	18,5
PPM124	4	39,7	4,0	9,0	21,3	15,2
PPM125	4	-	-	-	-	-
TM Mt.Zeb.Pk.	4	37,6	3,0	8,7	22,8	17,7
TM94F	4	39,5	5,6	8,4	23,5	16,8
TM2A	4	42,6	4,8	10,0	24,0	17,9
PPM789	4	-	-	-	-	-
TM753	4	39,6	6,8	9,7	23,0	16,4
TM594	4	42,0	8,0	10,7	24,3	16,5
BPI/C682	4	42,5	3,4	12,0	20,7	15,6
TM12165	5	43,0	6,0	13,3	26,0	20,2
PPM117	5	42,7	1,0	8,0	22,8	16,6
PPM118	5	42,6	1,0	8,7	25,4	19,6
TM866	5	45,6	3,9	10,2	21,2	17,4
TM8289	6	45,6	5,6	10,6	28,0	22,0
Za911	6	42,0	3,7	8,8	25,0	20,3
PPM119	6	-	-	-	-	-
TM657	6	49,7	4,7	11,4	28,3	24,0
PPM122	6	42,4	2,0	8,0	25,7	20,0
TM623	6	47,6	4,0	13,7	27,3	21,8
BPI/C641	6	41,1	6,2	11,5	23,2	18,8
TM6066	6	55,5	3,2	14,8	26,3	18,5
PPM123	6	45,9	4,0	10,0	28,0	20,1

ANALYSIS OF TABLE IV

A: LENGTH OF NASAL PROCESS OF PREMAXILLA

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	33,6	29,0	31,10	3	2,33
Growth stage 3	45,0	37,8	41,93	3	3,72
Growth stage 4	45,0	39,5	41,06	8	2,37
Growth stage 5	45,6	42,6	43,48	4	1,43
Growth stage 6	55,5	41,1	46,23	8	4,77
Sample	55,5	29,0	41,97	26	5,51

B: BREADTH OF NASAL PROCESS AT FRONTO-PREMAXILLARY SUTURE

Growth stage 2	5,0	2,7	3,57	3	1,25
Growth stage 3	7,0	6,4	6,70	2	0,42
Growth stage 4	8,0	3,0	5,09	7	1,83
Growth stage 5	6,0	1,0	2,98	4	2,44
Growth stage 6	6,2	2,0	4,18	8	1,33
Sample	8,0	1,0	4,38	24	1,84

C: BREADTH OF NASAL PROCESS OF PREMAXILLARY BETWEEN F-P SUTURE AND MASSETERIC RIDGE

Growth stage 2	9,3	7,0	7,93	3	1,21
Growth stage 3	10,0	8,4	9,27	3	0,81
Growth stage 4	12,0	8,4	9,79	7	1,26
Growth stage 5	13,3	8,0	10,05	4	2,35
Growth stage 6	14,8	8,0	11,10	8	2,30
Sample	14,8	7,0	9,96	25	1,96

D: SUTURAL LENGTH OF PREMAXILLA VENTRALLY

Growth stage 2	17,7	16,0	16,57	3	0,98
Growth stage 3	21,6	20,0	20,43	4	0,78
Growth stage 4	24,3	20,7	22,80	7	1,35
Growth stage 5	26,0	21,2	23,85	4	2,25
Growth stage 6	28,3	23,2	26,48	8	1,78
Sample	28,3	16,0	23,01	26	3,48

E: SUTURAL LENGTH OF PREMAXILLA ANTERIOR TO FORAMINA INCISIVA

Growth stage 2	13,5	11,6	12,33	3	1,02
Growth stage 3	16,8	14,0	15,35	4	1,28
Growth stage 4	17,9	15,2	16,59	7	1,00
Growth stage 5	20,2	16,6	18,45	4	1,72
Growth stage 6	24,0	18,5	20,69	8	1,82
Sample	24,0	11,6	17,45	26	3,06

TABLE V

Cranial measurements of Hystrix africaeaustralis: A: Length of nasals (7.2.3.1); B: length of nasal suture (7.2.3.2); C: maximum width of nasals (7.2.3.3); D: width nasals anteriorly (7.2.3.4); E: posterior extent of nasals behind fronto-premaxillary suture (7.2.3.6) (mm)

Specimen	Growth Stage	A	B	C	D	E
PPM113	2	-	-	-	-	-
TM Nyasaland	2	51,0	50,5	19,9	15,4	8,2
TM5662	2	40,5	39,5	21,0	12,7	5,8
TM5661	2	45,0	45,0	20,2	12,8	7,1
TM12698	3	-	-	-	-	7,2*
PPM114	3	-	-	-	-	-
PPM126	3	-	-	-	-	-
PPM115	3	58,0	56,2	-	15,0	-
TM12697	3	68,7	66,9	28,3	18,3	17,0
PPM116	4	-	-	-	-	17,0*
PPM124	4	65,2	63,6	27,0	16,0	14,1
PPM125	4	-	-	-	-	-
TM Mt.Zeb.Pk.	4	60,6	57,2	29,5	18,3	16,0
TM94F	4	71,9	68,4	28,2	16,0	20,6
TM2A	4	71,7	68,7	30,3	20,3	18,0
PPM789	4	-	-	-	-	-
TM753	4	65,7	64,5	25,6	17,8	16,4
TM594	4	73,5	71,9	31,0	22,0	21,4
BPI/C682	4	65,8	63,0	30,7	17,6	15,0
TM12165	5	79,4	75,3	31,0	19,9	19,5
PPM117	5	69,6	67,0	28,3	16,0	16,5
PPM118	5	71,4	68,3	28,6	15,3	20,0
TM866	5	72,5	70,8	31,9	15,5	17,5
TM8289	6	81,8	79,2	32,6	20,5	22,9
Za911	6	66,9	63,3	31,0	16,7	18,4
PPM119	6	-	-	-	-	-
TM657	6	79,4	76,6	31,0	22,0	21,0
PPM122	6	76,4	74,6	33,3	18,6	26,7
TM623	6	89,3	84,5	33,4	20,5	27,9
BPI/C641	6	69,9	67,0*	28,0	16,5	23,8
TM6066	6	87,7	83,7	41,4	24,0	19,6
PPM123	6	-	-	35,8	21,0	-

ANALYSIS OF TABLE V

A: LENGTH OF NASALS

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	51,0	40,5	45,50	3	5,27
Growth stage 3	68,7	58,0	63,35	2	7,57
Growth stage 4	73,5	60,6	67,77	7	4,68
Growth stage 5	79,4	69,6	73,23	4	4,29
Growth stage 6	89,3	66,9	78,77	7	8,42
Sample	89,3	40,5	68,78	23	12,05

B: LENGTH OF NASAL SUTURE

Growth stage 2	50,5	39,5	45,00	3	5,50
Growth stage 3	66,9	56,2	61,55	2	7,57
Growth stage 4	71,9	57,2	65,33	7	4,82
Growth stage 5	75,3	67,0	70,35	4	3,66
Growth stage 6	84,5	63,3	75,56	7	8,01
Sample	84,5	39,5	66,33	23	11,20

C: MAXIMUM WIDTH OF NASALS

Growth stage 2	21,0	19,9	20,37	3	0,57
Growth stage 3	28,3	28,3	28,30	1	0,00
Growth stage 4	31,0	25,6	28,90	7	2,04
Growth stage 5	31,9	28,3	29,95	4	1,77
Growth stage 6	41,4	28,0	33,31	8	3,98
Sample	41,4	19,9	29,48	23	4,85

D: WIDTH OF NASALS ANTERIORLY

Growth stage 2	15,4	12,7	13,63	3	1,53
Growth stage 3	18,3	15,0	16,65	2	2,33
Growth stage 4	22,0	16,0	18,29	7	2,20
Growth stage 5	19,9	15,3	16,60	4	2,17
Growth stage 6	24,0	16,5	19,98	8	2,58
Sample	24,0	12,7	17,86	24	2,94

E: POSTERIOR EXTENT OF NASALS BEHIND F-P SUTURE

Growth stage 2	8,2	5,8	7,03	3	1,20
Growth stage 3	17,0	7,2	12,10	2	6,93
Growth stage 4	21,4	14,1	17,31	8	2,57
Growth stage 5	20,0	16,5	18,38	4	1,65
Growth stage 6	27,9	18,4	22,90	7	3,54
Sample	27,9	5,8	17,40	24	5,80

TABLE VI

Cranial measurements of Hystrix africaeaustralis: A: Length of frontal suture (7.2.4.1); B: length of fronto-premaxillary suture (7.2.4.2); C:fronto-occipital distance (7.2.5.1 and 7.2.5.2); D: palatal diastemic length (7.2.7.1); E: median sutural length of palate (7.2.7.2); F: median sutural length of maxillary (7.2.7.3); G: length/breadth of foramina incisiva (7.2.7.10) (mm)

Specimen	Growth Stage	A	B	C	D	E	F	G L	G B
PPM113	2	-	-	-	-	-	-	-	-
TM Nyasaland	2	42,6	5,0	29,3*	37,0	59,3	35,0*	5,0	6,0
TM5662	2	32,4	2,7	29,2	31,0	52,8	33,8	3,5	4,0
TM5661	2	29,8	3,0	26,5	36,0	57,6	37,6	5,0	4,0
TM12698	3	39,3	7,0	-	46,0	73,5	44,8	6,5	5,0
PPM114	3	-	-	-	36,0	61,3	37,0	5,5	4,0
PPM126	3	-	-	-	-	-	-	-	-
PPM115	3	-	-	-	41,0	67,9	39,8	6,5	4,5
TM12697	3	-	6,4	-	46,5	72,0	46,0	5,5	6,0
PPM116	4	44,5	-	27,0	53,0	78,0	46,7	8,0	5,5
PPM124	4	38,8*	4,0	27,0	46,4	69,8	43,0	6,0	4,5
PPM125	4	-	-	-	-	-	-	-	-
TM Mt.Zeb.Pk.	4	44,3	3,0	29,5	47,0	76,4	43,7	6,5	5,0
TM94F	4	45,6	5,6	33,4	50,3	74,8	45,8*	7,0	5,0
TM2A	4	47,0	4,8	27,0	52,8	79,7	47,0*	8,0	6,0
PPM789	4	-	-	-	-	-	-	-	-
TM753	4	39,6	6,8	-	51,0	75,0	46,0	8,0	6,0
TM594	4	45,7	8,0	37,0	51,0	78,9	47,8	8,5	5,0
BPI/C682	4	43,2	3,4	32,4	45,4	72,5	45,0	6,0	5,0
TM12165	5	45,6	6,0	34,5	54,0	88,0	54,0	6,5	5,0
PPM117	5	37,0	1,0	30,0	49,0	76,5	47,3	8,5	6,5
PPM118	5	43,3	1,0	30,5	46,0	80,5	48,0	6,5	6,0
TM866	5	46,5	3,9	30,0	48,5	79,0	51,6	7,0	5,0
TM8289	6	44,5	5,6	-	55,0	90,0	53,0*	6,8	6,5
Za911	6	50,5	3,7	30,8	50,6	81,0	49,7	8,0	7,0
PPM119	6	-	-	-	-	-	-	-	-
TM657	6	49,0	4,7	34,8	54,0	84,8	49,8*	7,0	6,5
PPM122	6	43,0	2,0	24,3	45,0	81,5	49,5	7,0	7,0
TM623	6	42,0	4,0	31,9	56,0	87,0	53,7	6,0	6,0
BPI/C641	6	27,5*	6,2	-	47,5	77,0	46,0	5,0	5,5
TM6066	6	53,0	3,2	24,5	59,0	83,5	51,0	7,5	7,5
PPM123	6	-	4,0	32,0	53,6	84,5	51,0*	7,0	5,0

ANALYSIS OF TABLE VI

A: LENGTH OF FRONTAL SUTURE

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	42,6	29,8	34,93	3	6,77
Growth stage 3	39,3	39,3	39,30	1	0,00
Growth stage 4	47,0	38,8	43,59	8	2,94
Growth stage 5	46,5	37,0	43,10	4	4,28
Growth stage 6	53,0	27,5	44,21	7	8,42
Sample	53,0	27,5	42,38	23	6,20

B: LENGTH OF FRONTO-PREMAXILLARY SUTURE

Growth stage 2	5,0	2,7	3,57	3	1,25
Growth stage 3	7,0	6,4	6,70	2	0,42
Growth stage 4	8,0	3,0	5,09	7	1,83
Growth stage 5	6,0	1,0	2,98	4	2,44
Growth stage 6	6,2	2,0	4,18	8	1,33
Sample	8,0	1,0	4,38	24	1,84

C: FRONTO-OCCIPITAL DISTANCE

Growth stage 2	29,3	26,5	28,33	3	1,59
Growth stage 3	-	-	-	-	-
Growth stage 4	37,0	27,0	30,47	7	3,92
Growth stage 5	34,5	30,0	31,25	4	2,18
Growth stage 6	34,8	24,3	29,72	6	4,33
Sample	37,0	24,3	30,08	20	3,43

D: PALATAL DIASTEMIC LENGTH

Growth stage 2	37,0	31,0	34,67	3	3,21
Growth stage 3	46,5	36,0	42,38	4	4,92
Growth stage 4	53,0	45,4	49,56	8	3,01
Growth stage 5	54,0	46,0	49,38	4	3,35
Growth stage 6	59,0	45,0	52,59	8	4,61
Sample	59,0	31,0	47,73	27	6,77

ANALYSIS OF TABLE VI (continued)

E: MEDIAN SUTURAL LENGTH OF PALATE

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	59,3	52,8	56,57	3	3,37
Growth stage 3	73,5	61,3	68,68	4	5,46
Growth stage 4	79,7	69,8	75,64	8	3,35
Growth stage 5	88,0	76,5	81,00	4	4,95
Growth stage 6	90,0	77,0	83,66	8	3,95
Sample	90,0	52,8	75,66	27	9,38

F: MEDIAN SUTURAL LENGTH OF MAXILLARY

Growth stage 2	37,6	33,8	35,47	3	1,94
Growth stage 3	46,0	37,0	41,90	4	4,23
Growth stage 4	47,8	43,0	45,63	8	1,64
Growth stage 5	54,0	47,3	50,23	4	3,14
Growth stage 6	53,7	46,0	50,46	8	2,37
Sample	54,0	33,8	46,06	27	5,48

G: L: LENGTH OF FORAMINA INCISIVA

Growth stage 2	5,0	3,5	4,50	3	0,87
Growth stage 3	6,5	5,5	6,00	4	0,58
Growth stage 4	8,5	6,0	7,25	8	1,00
Growth stage 5	8,5	6,5	7,13	4	0,95
Growth stage 6	8,0	5,0	6,79	8	0,92
Sample	8,5	3,5	6,60	27	1,20

G: B: BREADTH OF FORAMINA INCISIVA

Growth stage 2	6,0	4,0	4,67	3	1,15
Growth stage 3	6,0	4,0	4,88	4	0,85
Growth stage 4	6,0	4,5	5,25	8	0,53
Growth stage 5	6,5	5,0	5,63	4	0,75
Growth stage 6	7,5	5,0	6,38	8	0,83
Sample	7,5	4,0	5,52	27	0,96

TABLE VII

PALATAL DISTANCES BETWEEN P^4, M^1, M^2 and M^3; AVERAGE WIDTHS OF PALATES

SPECIMEN	G/S	INTER-P^4	INTER-M^1	INTER-M^2	INTER-M^3	AV. PALATE WIDTH
PPM113	2	-	-	-	-	-
TM Nyasa	2	8,6	8,0	-	-	8,3
TM5662	2	8,2	7,8	-	-	8,0
TM5661	2	8,5	8,1	-	-	8,3
TM12698	3	11,3	10,3	11,0	-	10,8
PPM114	3	9,1	6,8	6,9	-	7,6
PPM126	3	-	-	-	-	-
PPM115	3	8,1	8,0	9,1	-	8,4
TM12697	3	8,3	9,9	12,9	-	10,3
PPM116	4	8,0	7,4	8,2	-	7,8
PPM124	4	9,4	6,2	7,0	11,4	8,5
PPM125	4	-	-	-	-	-
Mt.Zeb.Pk.	4	11,9	8,0	8,2	9,1	9,3
TM94F	4	12,9	11,7	12,1	14,0	12,6
TM2A	4	11,2	9,9	9,4	12,3	10,7
PPM789	4	-	-	-	-	-
TM753	4	11,5	9,0	10,0	10,8	10,3
TM594	4	13,9	12,0	11,9	12,0	12,4
BPI/C682	4	8,4	6,9	6,0	9,0	7,5
TM12165	5	15,0*	12,8	12,1	13,0	13,2
PPM117	5	10,7	8,1	8,9	10,1	9,4
PPM118	5	11,5	7,7	8,5	9,6	9,3
TM866	5	11,5	10,9	11,0	12,9	11,5
TM8289	6	11,9	9,8	10,4	12,1	11,0
Za911	6	12,1	11,1	11,0	11,2	11,3
PPM119	6	-	-	-	-	-
TM657	6	10,1	11,2	11,4	12,1	11,2
PPM122	6	11,2	11,0	11,7	11,4	11,3
TM623	6	11,1	10,1	10,0	9,1	10,0
BPI/C641	6	10,0	9,9	10,1	10,8	10,2
TM6066	6	14,8	16,8	17,1	15,1	15,9
PPM123	6	12,8	-	14,0	14,0	13,6

ANALYSIS OF TABLE VII

Inter-P^4 distance (mm)	Max.	Min.	Mean	N	SD
Growth stage 2	8,6	8,2	8,43	3	0,21
Growth stage 3	11,3	8,1	9,20	4	1,47
Growth stage 4	13,9	8,0	10,90	8	2,12
Growth stage 5	15,0	10,7	12,18	4	1,92
Growth stage 6	14,8	10,0	11,75	8	1,56
Sample	15,0	8,0	10,81	27	2,04
Inter-M^1 distance (mm)					
Growth stage 2	8,1	7,8	7,97	3	0,15
Growth stage 3	10,3	6,8	8,75	4	1,64
Growth stage 4	12,0	6,2	8,89	8	2,16
Growth stage 5	12,8	7,7	9,88	4	2,41
Growth stage 6	16,8	9,8	11,41	7	2,45
Sample	16,8	6,2	9,59	26	2,30
Inter-M^2 distance (mm)					
Growth stage 2	-	-	-	-	-
Growth stage 3	12,9	6,9	9,98	4	2,57
Growth stage 4	12,1	6,0	9,10	8	2,18
Growth stage 5	12,1	8,5	10,13	4	1,71
Growth stage 6	17,1	10,0	11,96	8	2,44
Sample	17,1	6,0	10,37	24	2,43
Inter-M^3 distance (mm)					
Growth stage 2	-	-	-	-	-
Growth stage 3	-	-	-	-	-
Growth stage 4	14,0	9,0	11,23	7	1,79
Growth stage 5	13,0	9,6	11,40	4	1,80
Growth stage 6	15,1	9,1	11,98	8	1,87
Sample	15,1	9,0	11,58	19	1,76

TABLE VIII

Cranial measurements of Hystrix africaeaustralis : A:upper edge of foramen magnum to occ. crest (7.2.6.1); B:lower edge foramen magnum to occ.crest (7.2.6.2); C:breadth at paroccipital processes (7.2.6.4); D: length of paroccipital processes (7.2.6.5); E: distance between paroccipital processes (7.2.6.6); F:max. width occipital condyles between external edges (7.2.6.7)

Specimen	Growth Stage	A	B	C	D	E	F
		(measurements in mm.)					
PPM113	2	-	-	-	-	-	-
TM Nyasaland	2	22,8	32,9	45,4	11,2	38,8	31,2
TM5662	2	20,4	-	43,0	10,0*	33,4	-
TM5661	2	22,2	32,5	-	-	-	-
TM12698	3	-	-	-	-	-	-
PPM114	3	-	-	-	-	-	-
PPM126	3	-	-	-	-	-	-
PPM115	3	-	-	-	-	-	-
TM12697	3	-	-	-	-	-	-
PPM116	4	27,5	40,0	47,4	6,4	38,9	30,0
PPM124	4	22,0	37,5	42,2	13,7	33,4	27,9
PPM125	4	-	-	-	-	-	-
TM Mt.Zeb.Pk.	4	24,8	40,0	47,6	9,2	37,4	28,8
TM94F	4	26,0	41,3	49,5	8,6	40,8	31,7
TM2A	4	25,0	42,8	52,2	10,1	43,3	32,3
PPM789	4	-	-	-	-	-	-
TM753	4	-	-	-	-	-	-
TM594	4	29,8	41,6	52,4	10,9	42,0	29,9
BPI/C682	4	27,5	38,7	48,5	11,4	37,2	30,0
TM12165	5	23,7	41,7	-	8,0	-	37,0
PPM117	5	24,7	40,7	46,2	10,0	31,7	27,6
PPM118	5	24,3	38,0	51,0	9,4	38,2	32,5
TM866	5	27,0	41,0	49,5	10,4	36,8	31,4
TM8289	6	-	-	-	-	-	-
Za911	6	23,0	38,2	51,9	8,0	38,2	31,0
PPM119	6	-	-	-	-	-	-
TM657	6	26,0	38,7	52,4	8,2	40,4	33,4
PPM122	6	27,0	42,0	49,2	7,6	40,9	31,9
TM623	6	30,6	42,2	53,6	11,0	42,5	32,6
BPI/C641	6	-	-	-	-	-	-
TM6066	6	32,0	42,5	54,0	11,5	43,5	34,0
PPM123	6	29,1	41,8	50,0	8,7	39,8	32,5

ANALYSIS OF TABLE VIII

A: UPPER EDGE OF FORAMEN MAGNUM TO TOP OF MEDIAN OCCIPITAL CREST

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	22,8	20,4	21,80	3	1,25
Growth stage 3	-	-	-	-	-
Growth stage 4	29,8	22,0	26,09	7	2,49
Growth stage 5	27,0	23,7	24,93	4	1,44
Growth stage 6	32,0	23,0	27,95	6	3,28
Sample	32,0	23,7	25,77	20	3,08

B: LOWER EDGE FORAMEN MAGNUM TO TOP OF MEDIAN OCCIPITAL CREST

Growth stage 2	32,9	32,5	32,70	2	0,28
Growth stage 3	-	-	-	-	-
Growth stage 4	42,8	37,5	40,27	7	1,80
Growth stage 5	41,7	38,0	40,35	4	1,62
Growth stage 6	42,5	38,2	40,90	6	1,92
Sample	42,8	32,5	39,69	19	2,95

C: BREADTH AT PAROCCIPITAL PROCESSES

Growth stage 2	45,4	43,0	44,20	2	1,70
Growth stage 3	-	-	-	-	-
Growth stage 4	52,4	42,2	48,54	7	3,45
Growth stage 5	51,0	46,2	48,90	3	2,46
Growth stage 6	54,0	49,2	51,85	6	1,92
Sample	54,0	42,2	49,22	18	3,43

D: LENGTH OF PAROCCIPITAL PROCESSES

Growth stage 2	11,2	10,0	10,60	2	0,85
Growth stage 3	-	-	-	-	-
Growth stage 4	13,7	6,4	10,04	7	2,31
Growth stage 5	10,4	8,0	9,45	4	1,05
Growth stage 6	11,5	7,6	9,17	6	1,66
Sample	13,7	6,4	9,70	19	1,74

ANALYSIS OF TABLE VIII (continued)

E: DISTANCE BETWEEN PAROCCIPITAL PROCESSES

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	38,8	33,4	36,10	2	3,82
Growth stage 3	-	-	-	-	-
Growth stage 4	43,3	33,4	39,00	7	3,36
Growth stage 5	38,2	31,7	35,57	3	3,42
Growth stage 6	43,5	38,2	40,88	6	1,90
Sample	43,5	31,7	39,01	18	3,13

F: MAXIMUM WIDTH OF OCCIPITAL CONDYLES

Growth stage 2	31,2	31,2	31,20	1	0,00
Growth stage 3	-	-	-	-	-
Growth stage 4	32,3	27,9	30,09	7	1,50
Growth stage 5	37,0	27,6	32,13	4	3,87
Growth stage 6	34,0	31,0	32,57	6	1,06
Sample	37,0	27,6	31,43	18	2,26

TABLE IX

Cranial measurements of Hystrix africaeaustralis: A: Least vertical diameter of lower zygomatic root (7.2.8.1); B: jugal height at maxillo-jugal suture (7.2.8.2); C: jugal height at jugal-squamosal suture (7.2.8.3); D: length of jugal at orbital rim (7.2.8.4); E: distance of lachrymal from zygomatic (7.2.9.1); F: molar-tympanic distance (7.2.10.1) (mm)

Specimen	Growth Stage	A	B	C	D	E	F
PPM113	2	-	-	-	-	-	-
TM Nyasaland	2	1,8	-	-	-	-	29,6
TM5662	2	1,5	17,2	6,6	16,0	2,5	-
TM5661	2	2,0	17,9	5,0	16,8	3,7	25,6
TM12698	3	2,8	19,8	-	21,0	4,3	-
PPM114	3	2,0	-	-	-	-	-
PPM126	3	-	-	-	-	-	-
PPM115	3	1,5	-	-	-	3,0	-
TM12697	3	2,9	18,9	5,2	20,6	5,4	-
PPM116	4	1,0	16,0	4,9	23,2	1,6	33,4
PPM124	4	2,0	18,4	9,0	19,3	3,5	20,8
PPM125	4	-	-	-	-	-	-
TM Mt.Zeb.Pk.	4	1,9	19,8	6,6	20,4	5,6	25,6
TM94F	4	4,0	18,6	6,7	21,4	5,9	28,5
TM2A	4	2,0	20,0	7,6	23,4	5,5	25,8
PPM789	4	-	-	-	-	-	-
TM753	4	2,5	18,8	6,0	21,4	6,6	-
TM594	4	2,1	17,3	7,8	21,0	7,2	29,0
BPI/C682	4	2,5	17,0	4,2	18,7	6,8	28,1
TM12165	5	3,0	15,3	7,9	17,0	8,8	34,4
PPM117	5	2,3	22,4	7,0	24,0	3,4	26,0
PPM118	5	2,1	17,0	5,0	19,7	6,3	29,1
TM866	5	2,4	20,0	8,7	20,0	6,4	30,2
TM8289	6	-	19,1	-	-	5,0	-
Za911	6	2,5	23,2	9,3	21,5	4,6	29,8
PPM119	6	-	-	-	-	-	-
TM657	6	2,0	21,9	6,6	22,6	3,0	33,0
PPM122	6	2,2	23,5	6,6	20,6	2,3	27,3
TM623	6	3,2	20,7	4,1	24,3	4,0	29,8
BPI/C641	6	1,2	20,7	5,1	18,7	5,7	-
TM6066	6	2,0	22,0	9,1	23,2	5,6	35,7
PPM123	6	2,0	20,6	7,2	25,2	5,4	33,2

ANALYSIS OF TABLE IX

A: Minimum vertical height of lower bar of foramen infraorbitale

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	2,0	1,5	1,77	3	0,25
Growth stage 3	2,9	1,5	2,30	4	0,67
Growth stage 4	4,0	1,0	2,25	8	0,85
Growth stage 5	3,0	2,1	2,45	4	0,39
Growth stage 6	3,2	1,2	2,16	7	0,61
Sample	4,0	1,0	2,21	26	0,63

B: Vertical height of zygoma at maxillo-jugal suture

Growth stage 2	17,9	17,2	17,55	2	0,49
Growth stage 3	19,8	18,9	19,35	2	0,63
Growth stage 4	20,0	16,0	18,24	8	1,39
Growth stage 5	22,4	15,3	18,60	4	3,15
Growth stage 6	23,5	19,1	21,46	8	1,47
Sample	23,5	15,3	19,42	24	2,21

C: Vertical height of zygoma at jugo-squamosal suture

Growth stage 2	6,6	5,0	5,80	2	1,13
Growth stage 3	5,2	5,2	5,20	1	0,00
Growth stage 4	9,0	4,2	6,60	8	1,57
Growth stage 5	8,7	5,0	7,15	4	1,59
Growth stage 6	9,3	4,1	6,86	7	1,91
Sample	9,3	4,1	6,65	22	1,59

D: Length of jugal along orbital rim

Growth stage 2	16,8	16,0	16,40	2	0,56
Growth stage 3	21,0	20,6	20,80	2	0,28
Growth stage 4	23,4	18,7	21,10	8	1,66
Growth stage 5	24,0	17,0	20,18	4	2,88
Growth stage 6	25,2	18,7	22,30	7	2,23
Sample	25,2	16,0	19,65	23	5,34

ANALYSIS OF TABLE IX (continued)

E: Distance of lachrymal from maxillo-jugal suture

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	3,7	2,5	3,1	2	0,84
Growth stage 3	5,4	3,0	4,23	3	1,20
Growth stage 4	6,8	1,6	5,34	8	1,89
Growth stage 5	8,8	3,4	6,23	4	2,21
Growth stage 6	5,7	2,3	4,45	8	1,26
Sample	8,8	1,6	4,88	25	1,73

F: Molar tympanic distance

Growth stage 2	29,6	25,6	27,60	2	2,82
Growth stage 3	-	-	-	-	-
Growth stage 4	33,4	20,8	27,31	7	3,86
Growth stage 5	34,4	26,0	29,93	4	3,47
Growth stage 6	35,7	27,3	31,47	6	3,04
Sample	35,7	20,8	29,21	19	3,67

TABLE X

Cranial measurements of Hystrix africaeaustralis: Length of nasal bones (7.2.3.1) as a proportion of occipitonasal skull length (7.2.1.2)(%)

Specimen	Growth Stage	Length Nasal	Occipitonasal Length	Ratio %	Analysis	
PPM113	2	-	-	-	Max	47%
TM Nyasaland	2	51,0	109,6	47%	Min	43%
TM5662	2	40,5	94,5	43%	$\bar{X}$	45,67%
TM5661	2	45,0	96,0	47%	SD	2,31
TM12698	3	-	-	-		No
PPM114	3	-	-	-		data
PPM126	3	-	-	-		avail-
PPM115	3	58,0	-	-		able
TM12697	3	68,7	-	-		
PPM116	4	-	-	-	Max	55%
PPM124	4	65,2	122,0	53%	Min	49%
PPM125	4	-	-	-	$\bar{X}$	52%
TM Mt.Zeb.Pk.	4	60,6	124,5	49%	N	6
TM94F	4	71,9	137,8	52%	SD	2,19
TM2A	4	71,7	136,0	53%		
PPM789	4	-	-	-		
TM753	4	65,7	-	-		
TM594	4	73,5	134,8	55%		
BPI/C682	4	65,8	131,9	50%		
TM12165	5	79,4	147,0	54%	Max	55%
PPM117	5	69,6	127,5	55%	Min	52%
PPM118	5	71,4	131,8	54%	$\bar{X}$	53,75%
TM866	5	72,5	139,8	52%	SD	1,26
TM8289	6	81,8	-	-	Max	60%
Za911	6	66,9	138,6	48%	Min	48%
PPM119	6	-	-	-	$\bar{X}$	55,60%
TM657	6	79,4	150,3	53%	N	5
PPM122	6	76,4	131,0	58%	SD	5,03
TM623	6	89,3	149,7	60%		
BPI/C641	6	69,9	-	-		
TM6066	6	87,7	149,7	59%		
PPM123	6	-	135,0	-		

Sample Max = 60%; Sample Min = 43%; $\bar{X}$ = 52%; N = 18; SD = 4,44

TABLE XI

Frontal length as a percentage of nasal length

Specimen	Growth Stage	Frontal Length	Nasal Length	Ratio %	Analysis	
PPM113	2	-	-	-	Max	84%
TM Nyasaland	2	42,6	51,0	84%	Min	66%
TM5662	2	32,4	40,5	82%	$\bar{X}$	77,33
TM5661	2	29,8	45,0	66%	SD	9,87
TM12698	3	39,3	-	-		No
PPM114	3	-	-	-		data
PPM126	3	-	-	-		avail-
PPM115	3	-	58,0	-		able
TM12697	3	-	68,7	-		
PPM116	4	44,5	-	-	Max	73%
PPM124	4	38,8*	65,2	60%	Min	60%
PPM125	4	-	-	-	$\bar{X}$	64,29
TM Mt.Zeb.Pk.	4	44,3	60,6	73%	N	7
TM94F	4	45,6	71,9	63%	SD	4,57
TM2A	4	47,0	71,7	66%		
PPM789	4	-	-	-		
TM753	4	39,6	65,7	60%		
TM594	4	45,7	73,5	62%		
BPI/C682	4	43,2	65,8	66%		
TM12165	5	45,6	79,4	57%	Max	64%
PPM117	5	37,0	69,6	53%	Min	53%
PPM118	5	43,3	71,4	61%	$\bar{X}$	58,75
TM866	5	46,5	72,5	64%	SD	4,79
TM8289	6	44,5	81,8	54%	Max	75%
Za911	6	50,5	66,9	75%	Min	54%
PPM119	6	-	-	-		
TM657	6	49,0	79,4	62%	$\bar{X}$	56,14
PPM122	6	43,0	76,4	56%	N	7
TM623	6	42,0	89,3	47%	SD	11,45
BPI/C641	6	27,5*	69,9*	39%*		
TM6066	6	53,0	87,7	60%		
PPM123	6	-	-	-		

Sample Max = 84%; Sample Min = 53%; $\bar{X}$ = 62%; N = 21; SD = 10,48

TABLE XII

Relative width of nasals; greatest width : greatest length (%)

Specimen	Growth Stage	Nasal Width	Nasal Length	Relative Width %	Analysis	
PPM113	2	-	-	-	Max	51,85%
TM Nyasaland	2	19,9	51,0	39,02%	Min	39,02%
TM5662	2	21,0	40,5	51,85%	$\bar{X}$	45,25%
TM5661	2	20,2	45,0	44,89%	SD	6,42
TM12698	3	-	-	-	Max	41,19%
TM114	3	-	-	-	Min	41,19%
PPM126	3	-	-	-	$\bar{X}$	41,19%
PPM115	3	-	58,0	-	SD	0,00
TM12697	3	28,3	68,7	41,19%		
PPM116	4	-	-	-	Max	48,68%
PPM124	4	27,0	65,2	41,41%	Min	38,96%
PPM125	4	-	-	-	$\bar{X}$	42,77%
TM Mt.Zeb.Pk.	4	29,5	60,6	48,68%	N	7
TM94F	4	28,2	71,9	39,22%	SD	3,64
TM2A	4	30,3	71,7	42,26%		
PPM789	4	-	-	-		
TM753	4	25,6	65,7	38,96%		
TM594	4	31,0	73,5	42,18%		
BPI/C682	4	30,7	65,8	46,66%		
TM12165	5	31,0	79,4	39,04	Max	44,00%
PPM117	5	28,3	69,6	40,66%	Min	39,04%
PPM118	5	28,6	71,4	40,06%	$\bar{X}$	40,94%
TM866	5	31,9	72,5	44,00%	SD	2,15
TM8289	6	32,6	81,8	39,85%	Max	47,21%
Za911	6	31,0	66,9	46,34%	Min	37,40%
PPM119	6	-	-	-	$\bar{X}$	41,93%
TM657	6	31,0	79,4	39,04	N	7
PPM122	6	33,3	76,4	43,59%	SD	3,80
TM623	6	33,4	89,3	37,40%		
BPI/C641	6	28,0	69,9	40,06%		
TM6066	6	41,4	87,7	47,21%		
PPM123	6	35,8	-	-		

Sample Max = 51,85%; Sample Min = 37,40%; $\bar{X}$ = 42,43%; N = 22; SD = 3,77

TABLE XIII

Shape of nasals: width of nasals anteriorly: width of nasals posteriorly

Specimen	Growth Stage	Anterior Width	Posterior Width	Shape %	Analysis	
PPM113	2	-	-	-	Max	77,39%
TM Nyasaland	2	15,4	19,9	77,39%	Min	60,48%
TM5662	2	12,7	21,0	60,48%	$\bar{X}$	67,08%
TM5661	2	12,8	20,2	63,37%	SD	9,04
TM12698	3	-	-	-	Max	64,66%
TM114	3	-	-	-	Min	64,66%
PPM126	3	-	-	-	$\bar{X}$	64,66%
PPM115	3	15,0	-	-	N	1
TM12697	3	18,3	28,3	64,66%	SD	0,00
PPM116	4	-	-	-	Max	71,66%
PPM124	4	16,0	27,0	59,26%	Min	56,74%
PPM125	4	-	-	-	$\bar{X}$	63,36%
TM Mt.Zeb.Pk.	4	18,3	29,5	62,03%	N	7
TM94F	4	16,0	28,2	56,74%	SD	6,04
TM2A	4	20,3	30,3	67,00%		
PPM789	4	-	-	-		
TM753	4	17,8	25,6	69,53%		
TM594	4	22,0	31,0	71,66%		
BPI/C682	4	17,6	30,7	57,33%		
TM12165	5	19,9	31,0	64,19%	Max	64,19%
PPM117	5	16,0	28,3	56,54%	Min	48,59%
PPM118	5	15,3	28,6	53,50%	$\bar{X}$	55,70%
TM866	5	15,5	31,9	48,59%	SD	6,53
TM8289	6	20,5	32,6	62,88%	Max	70,97%
Za911	6	16,7	31,0	53,87%	Min	53,87%
PPM119	6	-	-	-	$\bar{X}$	60,06%
TM657	6	22,0	31,0	70,97%	N	8
PPM122	6	18,6	33,3	55,86%	SD	5,24
TM623	6	20,5	33,4	61,38%		
BPI/641	6	16,5	28,0	58,93%		
TM6066	6	24,0	41,4	57,97%		
PPM123	6	21,0	35,8	58,66%		

Sample Max = 77,39%; Sample Min = 48,59%; $\bar{X}$ = 61,42%; N = 23; SD = 6,67

TABLE XIV

Width of nasal process of premaxilla in relation to greatest width of nasal

Specimen	Growth Stage	Width of nasal process	Nasal width	Ratio %		Analysis
PPM113	2	-	-	-	Max	46,73%
TM Nyasaland	2	9,3	19,9	46,73%	Min	33,33%
TM5662	2	7,0	21,0	33,33%	$\bar{X}$	39,06%
TM5661	2	7,5	20,2	37,13%	SD	6,90
TM12698	3	9,4	-	-	Max	35,34%
TM114	3	-	-	-	Min	35,34%
PPM126	3	-	-	-	$\bar{X}$	35,34%
PPM115	3	8,4	-	-	SD	0,00
TM12697	3	10,0	28,3	35,34%		
PPM116	4	-	-	-	Max	39,09%
PPM124	4	9,0	27,0	33,33%	Min	29,49%
PPM125	4	-	-	-	$\bar{X}$	33,87%
TM Mt.Zeb.Pk.	4	8,7	29,5	29,49%	N	7
TM94F	4	8,4	28,2	29,79%	SD	3,67
TM2A	4	10,0	30,3	33,00%		
PPM789	4	-	-	-		
TM753	4	9,7	25,6	37,89%		
TM594	4	10,7	31,0	34,52%		
BPI/C682	4	12,0	30,7	39,09%		
TM12165	5	13,3	31,0	42,90%	Max	42,90%
PPM117	5	8,0	28,3	28,27%	Min	28,27%
PPM118	5	8,7	28,6	30,42%	$\bar{X}$	33,39%
TM866	5	10,2	31,9	31,97%	SD	6,52
TM82896	6	10,6	32,6	32,52%	Max	41,07%
Za911	6	8,8	31,0	28,39%	Min	24,02%
PPM119	6	-	-	-	$\bar{X}$	33,43
TM657	6	11,4	31,0	36,77%	N	8
PPM122	6	8,0	33,3	24,02%	SD	6,29
TM623	6	13,7	33,4	41,02%		
BPI/C641	6	11,5	28,0	41,07%		
TM6066	6	14,8	41,4	35,75%		
PPM123	6	10,0	35,8	27,93%		

Sample Max = 46,73%; Sample Min = 24,02%; $\bar{X}$ = 34,37%; N = 23; SD = 5,48

TABLE XV

Maximum width : maximum height of occiput (7.2.11.6): A: using height from top and B: using height from bottom of foramen magnum

Specimen	Growth Stage	A Ratio %	Analysis		B Ratio %	Analysis	
PPM113	2	-	Max	210,78	-	Max	140,72
TM Nyasaland	2	203,07	Min	193,69	140,72	Min	136,51
TM5662	2	210,78	$\overline{X}$	202,51	-	$\overline{X}$	132,50
TM5661	2	193,69	SD	8,56	132,30	SD	5,95
TM12698	3	-		-	-		-
TM114	3	-		-	-		-
PPM126	3	-		-	-		-
PPM115	3	-		-	-		-
TM12697	3	-		-	-		-
PPM116	4	181,81	Max	210,90	125,00	Max	125,90
PPM124	4	210,90	Min	176,17	123,73	Min	120,79
PPM125	4	-	$\overline{X}$	193,15	-	$\overline{X}$	124,59
TM Mt.Zeb.Pk.	4	196,37	N	7	121,75	N	6
TM94F	4	200,00	SD	13,84	125,90	SD	2,75
TM2A	4	206,80			120,79		
PPM789	4	-			-		
TM753	4	-			-		
TM594	4	176,17			126,20		
BPI/C	4	180,00			127,90		
TM12165	5	237,55	Max	237,55	135,01	Max	138,42
PPM117	5	205,26	Min	192,22	124,57	Min	124,57
PPM118	5	216,46	$\overline{X}$	212,87	138,42	$\overline{X}$	131,15
TM866	5	192,22	SD	19,20	126,58	SD	6,63
TM8289	6	-	Max	236,08	-	Max	142,14
Za911	6	236,08	Min	180,00	142,14	Min	122,38
PPM119	6	-	$\overline{X}$	196,94	-	$\overline{X}$	133,02
TM657	6	206,92	N	6	139,01	N	6
PPM122	6	190,37	SD	21,52	122,38	SD	7,38
TM623	6	180,00			127,96		
BPI/C641	6	-			-		
TM6066	6	180,62			136,00		
PPM123	6	187,62			130,62		

Using height A: Sample Max = 237,55; Min = 176,17; $\overline{X}$ = 199,63; N = 20; SD =17,44
Using height B: Sample Max = 142,14; Min = 120,79; $\overline{X}$ = 129,84; N = 19; SD =6,82

TABLE XVI

Maximum width of occiput : maximum width of condyli

Specimen	Growth Stage	Width Occiput	Width Condyli	Ratio %	Analysis	
PPM113	2	-	-	-	Max	148,39
TM Nyasaland	2	46,3	31,2	148,39	Min	148,39
TM5662	2	43,0	-	-	$\bar{X}$	148,39
TM5661	2	43,0	-	-	SD	0,00
TM12698	3	-	-	-		No
PPM114	3	-	-	-		data
PPM126	3	-	-	-		avail-
PPM115	3	-	-	-		able
TM12697	3	-	-	-		
PPM116	4	50,0	30,0	166,66	Max	175,58
PPM124	4	46,4	27,9	166,30	Min	160,06
PPM125	4	-	-	-	$\bar{X}$	166,67
TM Mt.Zeb.Pk.	4	48,7	28,8	169,09	N	7
TM94F	4	52,0	31,7	164,03	SD	4,81
TM2A	4	51,7	32,3	160,06		
PPM789	4	-	-	-		
TM753	4	-	-	-		
TM594	4	52,5	29,9	175,58		
BPI/C682	4	49,5	30,0	165,00		
TM12165	5	56,3	37,0	152,16	Max	183,69
PPM117	5	50,7	27,6	183,69	Min	152,16
PPM118	5	52,6	32,5	161,84	$\bar{X}$	165,74
TM866	5	51,9	31,4	165,28	SD	13,19
TM8289	6	-	-	-	Max	175,16
Za911	6	54,3	31,0	175,16	Min	161,07
PPM119	6	-	-	-	$\bar{X}$	166,89
TM657	6	53,8	33,4	161,07	N	6
PPM122	6	51,4	31,9	161,12	SD	5,44
TM623	6	54,0	32,6	165,64		
BPI/C641	6	-	-	-		
TM6066	6	57,8	34,0	170,00		
PPM123	6	54,6	32,5	168,00		

Sample max = 183,69; Sample min = 148,39; $\bar{X}$ = 165,50; N = 18; SD = 8,12

TABLE XVII

Height of skull as a percentage of basal length [i)]

Specimen	Growth Stage	Height	Basal Length	Ratio %		Analysis
PPM113	2	-	-	-	Max	43,42
TM Nyasaland	2	45,5	104,8	43,42	Min	42,55
TM5662	2	42,0	-	-	$\bar{X}$	42,98
TM5661	2	42,0	98,7	42,55	SD	0,61
TM12698	3	55,5*	-	-		No
PPM114	3	-	-	-		data
PPM126	3	-	-	-		avail-
PPM115	3	-	-	-		able
TM12697	3	57,0	-	-		
PPM116	4	-	128,2	-	Max	47,48
PPM124	4	52,5	116,7	44,99	Min	44,48
PPM125	4	-	-	-	$\bar{X}$	46,18
TM Mt.Zeb.Pk.	4	58,5	126,2	46,35	N	6
TM94F	4	63,0	132,7	47,48	SD	1,19
TM2A	4	63,0	134,0	47,07		
PPM789	4	-	-	-		
TM753	4	58,0	-	-		
TM594	4	64,5	138,0	46,74		
BPI/C682	4	56,0	125,9	44,48		
TM12165	5	67,5	145,0	46,55	Max	48,53
PPM117	5	58,0	131,4	44,14	Min	44,14
PPM118	5	60,5	130,0	46,54	$\bar{X}$	46,44
TM866	5	67,5	139,1	48,53	SD	1,79
TM8289	6	64,5	-	-	Max	50,65
Za911	6	60,0	140,0	42,86	Min	42,86
PPM119	6	-	-	-	$\bar{X}$	47,39
TM657	6	69,5	147,0	47,28	N	6
PPM122	6	63,5	135,0	47,04	SD	2,56
TM623	6	69,5	143,8	48,33		
BPI/C641	6	58,5	-	-		
TM6066	6	74,5	147,1	50,65		
PPM123	6	68,0	141,0	48,23		

Sample Max = 50,65%; Sample Min = 42,55%; $\bar{X}$ = 46,29%; N = 18; SD = 2,16

i) The skull height measurement is the one measured from the maxillary-palatine suture to the naso-frontal suture

TABLE XVIII

Zygomatic breadth as a percentage of basal length

Specimen	Growth Stage	Zygomatic Breadth	Basal Length	Ratio %	Analysis	
PPM113	2	-	-	-	Max	61,09
TM Nyasaland	2	-	104,8	-	Min	61,09
TM5662	2	60,3	-	-	$\bar{X}$	61,09
TM5661	2	60,3	98,7	61,09	SD	0,00
TM12698	3	-	-	-		No
PPM114	3	-	-	-		data
PPM126	3	-	-	-		avail-
PPM115	3	-	-	-		able
TM12697	3	-	-	-		
PPM116	4	71,0*	128,2	55,38	Max	63,41
PPM124	4	74,0	116,7	63,41	Min	55,38
PPM125	4	-	-	-	$\bar{X}$	61,21
TM Mt.Zeb.Pk.	4	-	126,2	-	N	6
TM94F	4	81,2	132,7	61,19	SD	3,01
TM2A	4	82,1	134,0	61,27		
PPM789	4	-	-	-		
TM753	4	-	-	-		
TM594	4	86,6	138,0	62,75		
BPI/C682	4	79,7	125,9	63,30		
TM12165	5	90,0	145,0	62,07	Max	64,92
PPM117	5	78,3	131,4	59,59	Min	57,58
PPM118	5	84,4	130,0	64,9=	$\bar{X}$	61,04
TM866	5	80,1	139,1	57,58	SD	3,17
TM8289	6	-	-	-	Max	65,53
Za911	6	88,0	140,0	62,86	Min	57,48
PPM119	6	-	-	-	$\bar{X}$	61,58
TM657	6	84,5	147,0	57,48	N	6
PPM122	6	81,8	135,0	60,59	SD	2,78
TM623	6	86,0	143,0	60,14		
BPI/C641	6	-	-	-		
TM6066	6	96,4	147,1	65,53		
PPM123	6	88,7	141,0	62,91		

Sample Max = 65,53%; Sample Min = 55,38%; $\bar{X}$ = 61,29%; N = 17; SD = 2,68

TABLE XIX

Length of molar series : molar tympanic distance

Specimen	Growth Stage	Alveolar Length molars	Molar-tympanic distance	Ratio %	Analysis
PPM113	2	-	-	-	Max 69,14
TM Nyasaland	2	17,5	29,6	59,12	Min 59,12
TM5662	2	17,0	-	-	$\bar{X}$ 64,13
TM5661	2	17,7	25,6	69,14	SD 7,09
TM12698	3	26,4	-	-	Max 26,4
PPM114	3	23,3	-	-	Min 23,3
PPM126	3	-	-	-	$\bar{X}$ 25,08
PPM115	3	24,5	-	-	N 4
TM12697	3	26,1	-	-	SD 1,45
PPM116	4	28,1	33,4	84,13	Max 151,44
PPM124	4	31,5	20,8	151,44	Min 84,13
PPM125	4	-	-	-	$\bar{X}$ 122,55
TM Mt.Zeb.Pk.	4	32,8	25,6	128,12	N 7
TM94F	4	33,6	28,5	117,89	SD 20,20
TM2A	4	34,0	25,8	131,78	
PPM789	4	-	-	-	
TM753	4	33,8	-	-	
TM594	4	35,5	29,0	122,41	
BPI/C682	4	34,3	28,1	122,06	
TM12165	5	36,4	34,4	105,81	Max 130,38
PPM117	5	33,9	26,0	130,38	Min 105,81
PP M118	5	32,0	29,1	109.96	$\bar{X}$ 115,51
TM866	5	35,0	30,2	115,89	SD 10,74
TM8289	6	36,0	-	-	Max 130,76
Za911	6	36,0	29,8	120,80	Min 77,87
PPM119	6	-	-	-	$\bar{X}$ 107,80
TM657	6	35,6	33,0	107,87	N 6
PPM122	6	35,7	27,3=	130,76	SD 19,33
TM623	6	34,6	29,8	116,10	
BPI/C641	6	32,8	-	-	
TM6066	6	27,8	35,7	77,87	
PPM123	6	31,0	33,2	93,37	

Max = 151,44; Min = 77,87; $\bar{X}$ = 110,26; N = 19; SD = 23,77

APPENDIX VI

MANDIBULAR MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

APPENDIX VI

MANDIBULAR MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

1. All measurements in mm. unless otherwise stated
2. The method of measurement of the various parameters has been discussed and illustrated in section 7.2.12 of the main text
3. * = estimate due to fracture or distortion of mandibular bone at critical point
4. $\overline{X}$ = arithmetic mean, correct to two decimal places
5. SD = Standard deviation
6. G/S = growth stage as defined in Chapter 7, sections 7.1.4. and 7.1.5. main text
7. Specimens listed in order of increasing maturity, PPM113 to BPI/C682 juvenile, i.e. g/s 1-4; TM12165 to PPM123 adult, i.e. g/s 5 and 6

CONTENTS PAGE

TABLE I GENERAL MANDIBULAR MEASUREMENTS: A: GREATEST LENGTH OF MANDIBLE; B: MANDIBULAR LENGTH FROM POSTERIOR BORDER OF INCISOR TO TOP OF ANGULAR PROCESS; C: HEIGHT OF MANDIBULA; D: DEPTH RAMUS BELOW P_4; E: DEPTH RAMUS BELOW M_1; F: DEPTH RAMUS BELOW M_2 94

TABLE II GENERAL MANDIBULAR MEASUREMENTS: A: ALVEOLE OF P_4 TO FORAMEN MENTALE; B: LENGTH OF DIASTEMA; C: CURVATURE OF DIASTEMA; D: POSITION OF ASCENDING RAMUS IN RELATION TO ALVEOLAR PLANE; E: POSITION OF TOP OF MESIAL SYMPHYSIS IN RELATION TO ALVEOLAR PLANE 97

TABLE I

Mandibular measurements of Hystrix africaeaustralis: A: greatest length (7.2.12.1); B: length from incisor to angular process (7.2.12.2); C; mandibula height (7.2.12.3); D: depth ramus below P_4 (7.2.12.4); E: depth ramus below M_1 (7.2.12.5); F: depth ramus below M_2

Specimen	Growth Stage	A	B	C	D	E	F[i)]
PPM113	2	59,9	56,5*	21,0	16,4	15,7	-
TM Nyasaland	2	78,6	76,0	28,2	19,4	18,0	-
TM5662	2	72,0	71,8*	31,0	20,2	19,7	-
TM5661	2	76,0	74,5	31,4	19,9	18,9	16,0
TM12698	3	91,0	91,0	34,2	22,8	21,0	19,0
PPM114	3	79,3	78,3	29,8	22,0	20,0	19,4
PPM126	3	91,7	91,6	33,9	23,8	22,5	17,0
PPM115	3	87,1	85,7	30,5	22,5	21,4	15,0*
TM12697	3	95,1	94,0	34,6	23,0	21,2	19,6
PPM116	4	100,4	100,0	32,4	23,8	22,2	21,6
PPM124	4	87,6	86,9	31,6	21,8	19,7	18,3
PPM125	4	95,0	92,2	35,7	23,3	22,0	20,4
TM Mt.Zeb.Pk.	4	93,8	93,9	40,2	24,0	20,9	19,7
TM94F	4	99,5	96,6	45,3	24,4	23,0	22,0
TM2A	4	105,8	103,5	39,6	25,5	24,8	22,9
PPM789	4	-	-	-	24,0	22,5*	21,5
TM753	4	95,0	95,0	36,7	21,0	21,9	21,2
TM594	4	106,3	102,6	40,6	25,5	23,5	21,6
BPI/C662	4	101,8	99,7	37,4	25,9	25,6	24,6
TM12165	5	110,6	110,8	40,1	25,4	23,8	21,7
PPM117	5	98,2	96,0	36,0	22,4	22,6	21,0*
PPM118	5	97,7	97,8	36,4	24,5	23,0	22,1
TM866	5	-	-	-	23,4	23,7	21,9
TM8289	6	107,1	-	-	27,5	-	
Za911	6	106,8	102,4	40,8	26,0	26,1	23,7
PPM119	6	100,6	97,2*	39,0*	27,7	25,3	23,2
TM657	6	110,5	110,0	44,7	27,4	26,5	26,8
PPM122	6	94,0	-	-	24,9	22,9	21,6
TM623	6	115,6	114,5	39,7	26,0	23,5	22,6
BPI/C641	6	-	-	-	-	-	-
TM6066	6	113,5	112,5	43,2	24,6	25,0	24,3
PPM123	6	-	-	-	-	-	-

i) Measured from the lingual side in growth stages 2 and 3 where the coronoid process obscures the buccal surface of M_2

ANALYSIS OF TABLE I

A: GREATEST LENGTH

	Max	Min	$\overline{X}$	N	SD
Growth stage 2	78,6	59,9	71,63	4	8,27
Growth stage 3	95,1	79,3	88,84	5	6,04
Growth stage 4	106,3	87,6	98,36	9	6,07
Growth stage 5	110,6	97,7	102,17	3	7,31
Growth stage 6	115,6	94,0	106,87	7	7,51
Sample	115,6	59,9	95,38	28	13,20

B: LENGTH FROM INCISOR TO ANGULAR PROCESS

Growth stage 2	76,0	56,5	69,70	4	8,97
Growth stage 3	94,0	78,3	88,12	5	6,27
Growth stage 4	103,5	86,9	96,71	9	5,34
Growth stage 5	110,8	96,0	101,53	3	8,08
Growth stage 6	114,5	97,2	107,32	5	7,28
Sample	114,5	56,5	93,50	26	13,60

C: HEIGHT OF MANDIBULA

Growth stage 2	31,4	21,0	27,90	4	4,82
Growth stage 3	34,2	29,8	32,60	5	2,26
Growth stage 4	45,3	31,6	37,42	9	4,40
Growth stage 5	40,1	36,0	37,50	3	2,26
Growth stage 6	44,7	39,0	41,48	5	2,40
Sample	45,3	21,0	35,95	26	5,58

D: DEPTH OF RAMUS BELOW P_4

Growth stage 2	20,2	16,4	18,98	4	1,75
Growth stage 3	23,8	22,0	22,82	5	0,66
Growth stage 4	25,9	21,0	23,92	10	1,58
Growth stage 5	25,4	22,4	23,93	4	1,30
Growth stage 6	27,7	24,6	26,30	7	1,27
Sample	27,7	16,4	23,63	30	2,55

ANALYSIS OF TABLE I (continued)

E: DEPTH OF RAMUS BELOW M_1

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	19,7	15,7	18,08	4	1,73
Growth stage 3	22,5	20,0	21,22	5	0,90
Growth stage 4	25,6	19,7	22,61	10	1,74
Growth stage 5	23,8	22,6	23,28	4	0,57
Growth stage 6	26,5	22,9	24,88	6	1,42
Sample	26,5	15,7	22,31	29	2,48

F: DEPTH OF RAMUS BELOW M_2

Growth stage 2	-	-	-	-	-
Growth stage 3	19,6	15,0	18,00	5	1,97
Growth stage 4	24,6	18,3	21,38	10	1,72
Growth stage 5	22,1	21,0	21,68	4	0,48
Growth stage 6	26,8	21,6	23,70	6	1,78
Sample	24,6	15,0	21,10	26	2,65

TABLE II

Mandibular measurements of Hystrix africaeaustralis: A: alveole P_4 to mental foramen (7.2.12.7); B: diastemic length (7.2.12.9); C: diastemic depth (7.2.12.10; Cii: diastemic curvature (7.2.12.10); D: height of ascending ramus above alveolar plane (7.2.12.12); E: mesial symphysis in relation to alveolar rim (mm)

Specimen	Growth Stage	A	B	C i	C ii	D	E[i)]
PPM113	2	7,6	18,5	5,5	29,7%	8,5	+1,5
TM Nyasaland	2	7,8	24,2	6,0	24,7%	10,0	+3,5
TM5662	2	7,0	19,9	6,3	31,6%	8,5	+3,0
TM5661	2	9,0	21,7	6,0	27,6%	13,5	+4,5
TM12698	3	10,0	27,8	8,0	28,7%	9,5	+6,0
PPM114	3	7,2	20,4	5,8	28,4%	12,0	+4,5
PPM126	3	12,3	25,7	10,5	40,8%	17,5	0,0
PPM115	3	8,5	25,0	6,5	26,0%	7,5	+3,5
TM12697	3	9,3	24,9	8,5	34,1%	9,0	+3,5
PPM116	4	10,0	34,0	9,2	27,0%	11,5	+3,0
PPM124	4	9,4	26,6	7,5	28,2%	9,5	+3,0
PPM125	4	8,5	23,4	7,5	32,0%	11,5	+7,0
TM Mt.Zeb.Pk.	4	9,7	24,3	7,0	28,8%	12,0	+3,0
TM94F	4	10,0	29,5	8,1	27,4%	18,0	+1,0
TM2A	4	12,5	32,6	8,0	24,5%	15,0	0,0
PPM789	4	9,4	29,6	8,0	27,0%	-	0,0
TM753	4	7,7	27,0	7,5	27,7%	10,5	+5,0
TM594	4	10,0	30,6	7,0	22,8%	12,0	+7,0
BPI/682	4	8,7	28,6	7,7	26,9%	11,5	+8,0
TM12165	5	11,0	31,9	10,0	31,3%	22,0	+4,0
PPM117	5	7,0*	30,0	7,8	26,0%	12,5	+4,0
PPM118	5	9,6	27,3	9,0	32,9%	17,5	+3,0
TM866	5	11,9	30,6	8,7	28,4%	-	+4,0
TM8289	6	11,8	28,8	9,0	31,2%	-	0,0
Za911	6	12,4	34,7	9,7	27,9%	19,0	+2,0
PPM119	6	11,0	29,4	9,5	32,3%	10,0	+8,0
TM657	6	9,6	37,5	9,5	25,3%	25,0	+3,5
PPM122	6	9,3	28,0	8,7	31,0%	17,5	+6,2
TM623	6	8,9	32,4	8,0	24,6%	14,5	+5,0
BPI/C641	6	-	-	-	-	-	-
TM6066	6	10,0	39,6	9,0	22,7%	22,0	+3,5
PPM123	6	-	-	-	-	-	-

i) + = above alveolar plane; - = below alveolar plane

ANALYSIS OF TABLE II

A: ALVEOLE OF P_4 TO FORAMEN MENTALE

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	9,0	7,0	7,85	4	0,84
Growth stage 3	12,3	7,2	9,46	5	1,90
Growth stage 4	12,5	7,7	9,59	10	1,27
Growth stage 5	11,9	7,0	9,88	4	2,14
Growth stage 6	12,4	8,9	10,43	7	1,33
Sample	12,5	7,0	9,57	30	1,58
B: LENGTH OF DIASTEMA					
Growth stage 2	24,2	18,5	21,08	4	2,46
Growth stage 3	27,8	20,4	24,76	5	2,70
Growth stage 4	34,0	23,4	28,62	10	3,38
Growth stage 5	31,9	27,3	29,95	4	1,94
Growth stage 6	39,6	28,0	32,91	7	4,52
Sample	39,6	18,5	28,15	30	4,97
C: CURVATURE OF DIASTEMA (%)					
Growth stage 2	31,6	24,7	28,40	4	2,96
Growth stage 3	40,8	26,0	31,60	5	5,94
Growth stage 4	32,0	22,8	27,23	10	2,44
Growth stage 5	32,9	26,0	29,65	4	3,06
Growth stage 6	32,3	22,7	27,86	7	3,75
Sample	40,8	22,7	28,58	30	3,74
D: HEIGHT OF ASCENDING RAMUS ABOVE ALVEOLAR PLANE					
Growth stage 2	13,5	8,5	10,13	4	2,36
Growth stage 3	17,5	7,5	11,10	5	3,93
Growth stage 4	18,0	9,5	12,39	9	2,57
Growth stage 5	22,0	12,5	17,33	3	4,75
Growth stage 6	25,0	10,0	17,00	6	5,34
Sample	25,0	7,5	13,54	27	4,55
E: HEIGHT OF MESIAL SYMPHYSIS ABOVE ALVEOLAR PLANE					
Growth stage 2	4,5	1,5	3,13	4	1,25
Growth stage 3	6,0	0,0	3,50	5	2,21
Growth stage 4	7,0	0,0	3,70	10	2,95
Growth stage 5	4,0	3,0	3,75	4	0,50
Growth stage 6	8,0	0,0	4,03	7	2,66
Sample	8,0	0,0	3,67	30	2,43

APPENDIX VII

DENTAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

APPENDIX VII

DENTAL MEASUREMENTS OF HYSTRIX AFRICAEAUSTRALIS

Note:
1. All measurements in millimetres
2. The method of measurement of the various parameters has been given in section 7.2.13 of the main text
3. * = Estimate due to tooth being damaged. Unworn or incompletely worn teeth have not been included in the tables of measurements taken at the occlusal surface
4. $\overline{X}$ = Arithmetic mean, correct to two decimal places
5. MD = Mesiodistal diameter or length
6. BL = Buccolingual diameter or breadth
7. LL = Labiolingual diameter or breadth (used for incisors only)
8. SD = Standard deviation
9. G/S = Growth stage, as defined in Chapter 7, main text
10. The specimens are listed in order of increasing maturity. PPM113 to TM594 (or BPI/C682) are juvenile; TM12165 to PPM123 are adult.

CONTENTS

		Page
TABLE I	THE INTER-PREMOLAR AND INTER-THIRD MOLAR DISTANCE OF UPPER AND LOWER DENTITIONS; DEGREE OF DIVERGENCE OF THE TOOTH ROWS FROM THE PARALLEL	102
TABLE II	WIDTH OF PALATE IN RELATION TO WIDTH OF MAXILLARY TEETH	105
TABLE III	LENGTH OF MAXILLARY TOOTH ROW MEASURED AT THE OCCLUSAL SURFACE	107
TABLE IV	LENGTH OF MAXILLARY TOOTH ROW MEASURED AT THE ALVEOLAR RIM	108
TABLE V	LENGTH OF MANDIBULAR TOOTH ROW MEASURED AT THE OCCLUSAL SURFACE	109
TABLE VI	LENGTH OF MANDIBULAR TOOTH ROW MEASURED AT THE ALVEOLAR RIM	110

		Page
TABLE VII	UPPER : LOWER INCISOR WIDTH	111
TABLE VIII	RADIUS OF CURVATURE OF THE UPPER AND LOWER INCISORS	113
TABLE IX	HEIGHTS OF MAXILLARY TEETH CROWNS	114
TABLE X	HEIGHTS OF MANDIBULAR TEETH CROWNS	116
TABLE XI	A - H MEASUREMENTS OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	118
TABLE XII	A - E OCCLUSAL SURFACE AREAS OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	122
TABLE XIII	A - E CROWN SHAPE INDICES OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	125
TABLE XIV	A - H MEASUREMENTS OF THE MANDIBULAR TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	128
TABLE XV	A - E OCCLUSAL SURFACE AREAS OF THE MANDIBULAR TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	132
TABLE XVI	A - E CROWN SHAPE INDICES OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	135
TABLE XVII	MEASUREMENTS OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS MEASURED AT THE ALVEOLAR RIM	138
TABLE XVIII	THE AREA ENCLOSED BY THE ALVEOLAR RIMS OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS	140
TABLE XIX	THE CROWN SHAPE INDICES OF THE MAXILLARY TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS MEASURED AT THE ALVEOLAR RIM	142
TABLE XX	MEASUREMENTS OF THE MANDIBULAR TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS MEASURED AT THE ALVEOLAR RIM	144
TABLE XXI	THE AREA ENCLOSED BY THE ALVEOLAR RIMS IN A SAMPLE OF THE MANDIBULAR TEETH OF HYSTRIX AFRICAEAUSTRALIS	146
TABLE XXII	THE CROWN SHAPE INDICES OF THE MANDIBULAR TEETH IN A SAMPLE OF HYSTRIX AFRICAEAUSTRALIS MEASURED AT THE ALVEOLAR RIM	148

TABLE I

THE INTER-PREMOLAR AND INTER-THIRD MOLAR DISTANCE OF UPPER AND LOWER DENTITIONS; DEGREE OF DIVERGENCE FROM THE PARALLEL OF THE TOOTH ROWS (7.2.13.1 - 7.2.13 4)[i)]

SPECIMEN	G/S	INTER-P^4 DIST.	INTER-M^3 DIST.	DIVER-GENCE	INTER-P_4 DISTANCE	INTER-M_3 DISTANCE	DIVER-GENCE
PPM113	2	-	-	-	-	-	-
TM Nyasa.	2	8,6	8,0*	108%	-	-	-
TM5662	2	8,2	7,8	105%	-	-	-
TM5661	2	8,5	8,1	105%	-	-	-
TM12698	3	11,3	11,0	103%	-	-	-
PPM114	3	9,1	6,9	132%	-	-	-
PPM126	3	-	-	-	-	-	-
PPM115	3	8,1	9,1	89%	-	-	-
TM12697	3	8,3	12,9	64%	-	-	-
PPM116	4	8,0	8,2	98%	13,5	13,0	104%
PPM124	4	9,4	11,4	82%	-	-	-
PPM125	4	-	-	-	-	-	-
TM Zeb.Pk.	4	11,9	9,1	131%	13,9	15,0	93%
TM94F	4	12,9	14,0	92%	-	-	-
TM2A	4	11,2	12,3	91%	-	-	-
PPM789	4	-	-	-	-	-	-
TM753	4	11,5	10,8	106%	-	-	-
TM594	4	13,9	12,0	116%	-	-	-
BPI/C682	4	8,4	9,0	93%	-	-	-
TM12165	5	15,0*	13,0	115%	-	-	-
PPM117	5	10,7	10,1	106%	-	-	-
PPM118	5	11,5	9,6	120%	17,1	19,1	90%
TM866	5	11,5	12,9	89%	-	-	-
TM8289	6	11,9	12,1	98%	15,0	18,9	79%
Za911	6	12,1	11,2	108%	-	-	-
PPM119	6	-	-	-	-	-	-
TM657	6	10,1	12,1	83%	15,1	18,1	83%
PPM122	6	11,2	11,4	98%	-	-	-

(continued)

TABLE I (continued)

SPECIMEN	G/S	INTER-P^4 DIST.	INTER-M^3 DIST.	DIVER-GENCE	INTER-P_4 DISTANCE	INTER-M_3 DISTANCE	DIVER-GENCE
TM623	6	11,1	9,1	122%	-	-	-
TM641	6	10,0	10,8	93%	-	-	-
TM6066	6	14,8	15,1	98%	22,0	27,0	81%
PPM123	6	12,8	14,0	91%	-	-	-

i) In specimens where the third molar has not yet erupted, i.e. specimens belonging to g/s 2 and 3, the distance has been measured between the last erupted tooth

Analysis of Table I

	Max.	Min	Mean	N	SD
Inter-P^4 distance (mm):					
Sample	15,0	8,0	10,81	27	2,04
Growth stage 2	8.6	8,2	8.43	3	
Growth stage 3	11,3	8,1	9,20	4	
Growth stage 4	13,9	8,0	10,90	8	
Growth stage 5	15,0	10,7	12,18	4	
Growth stage 6	14,8	10,0	11,75	8	
Inter M^3 distance (mm):					
Sample	15,1	6,9	10,81	27	2,15
Growth stage 2	8,1	7,8	7,97	3	
Growth stage 3	12,9	6,9	9,98	4	
Growth stage 4	14,0	8,2	10,85	8	
Growth stage 5	13,0	9,6	11,40	4	
Growth stage 6	15,1	9,1	11,98	8	
Divergence of Maxillary tooth rows (%)					
Sample	132	64	101,33	27	15,26
Growth stage 2	108	105	106,00	3	
Growth stage 3	132	64	97,00	4	
Growth stage 4	131	82	101,13	8	
Growth stage 5	120	89	107,50	4	
Growth stage 6	122	83	98,88	8	

Analysis of Table I (continued)

	Max.	Min.	Mean	N	SD
Inter P_4 distance (mm): i)					
Sample	22,0	13,5	16,10	6	3,15
Inter M_3 distance (mm):					
Sample	27	13,0	18,52	6	4,80
Divergence of mandibular tooth rows (%):					
Sample	104	79	88,33	6	9,37

i) The two halves of the mandible are less frequently found in association than are the maxillae, there is therefore insufficient data to provide statistics for each growth stage.

TABLE II

WIDTH OF PALATE IN RELATION TO WIDTH OF MAXILLARY TEETH (7.2.13.5; palatal width/tooth width x 100%)

SPECIMEN	G/S	AV.PALATAL WIDTH [i]	AV.TOOTH WIDTH [ii]	PALATAL WIDTH : TOOTH WIDTH x 100
PPM113	2	-	-	-
TM Nyasa	2	8,3	5,2	160%
TM5662	2	8,0	6,3	127%
TM5661	2	8,3	6,5	128%
TM12698	3	10,8	7,0	154%
PPM114	3	7,6	6,3	121%
TM126	3	-	-	-
PPM115	3	8,4	6,9	122%
TM12697	3	10,3	6,9	149%
PPM116	4	7,8	7,5	104%
PPM124	4	8,5	6,9	123%
PPM125	4	-	-	-
TM Mt.Zeb. Pk.	4	9,3	6,9	135%
TM94F	4	12,6	6,3	200%
TM2A	4	10,7	8,5	126%
PPM789	4	-	-	-
TM753	4	10,3	7,1	145%
TM594	4	12,4	7,0	177%
TM12165	5	13,2	9,3	142%
PPM117	5	9,4	6,6	142%
PPM118	5	9,3	7,2	129%
TM866	5	11,5	6,6	174%
TM8289	6	11,0	8,3	133%
Za911	6	11,3	8,2	138%
PPM119	6	-	-	-
TM657	6	11,2	8,7	129%
PPM122	6	11,3	8,4	135%
TM623	6	10,0	8,5	118%
TM6066	6	15,9	-	-
PPM123	6	13,6	-	-

i) From Table VII, Appendix V
ii) From Table XIA, Appendix VII

Analysis of Table II

Average width of palate in relation to average width of teeth 7.2.13.5 (%)

	Max.	Min.	Mean	N	SD
Sample	200	104	139,61	23	21,78
Growth stage 2	160	127	138,33	3	
Growth stage 3	154	121	136,50	4	
Growth stage 4	200	104	144,29	7	
Growth stage 5	174	142	146,75	4	
Growth stage 6	138	118	130,60	5	

TABLE III

Length of maxillary tooth row measured at the occlusal surface (7.2.13.6)(mm)

Specimen	Growth Stage	Occlusal length Tooth row	Analysis	
PPM113	2	-	Max	17,4
TM Nyasaland	2	16,3	Min	16,3
TM5662	2	16,4	$\overline{X}$	16,70
TM5661	2	17,4	SD	0,61
TM12698	3	18,7	Max	25,5
PPM114	3	22,5	Min	18,7
PPM126	3	-	$\overline{X}$	22,75
PPM115	3	24,3	N	4
TM12697	3	25,5	SD	2,97
PP M116	4	27,4	Max	33,9
PPM124	4	24,4	Min	24,4
PPM125	4	-	$\overline{X}$	28,25
TM Mt.Zeb.Pk.	4	24,4	N	8
TM94F	4	25,0	SD	3,88
TM2A	4	26,7		
PPM789	4	-		
TM753	4	31,5		
TM594	4	33,9		
BPI/C682	4	32,7		
TM12165	5	36,2*	Max	36,2
PPM117	5	31,5*	Min	30,6
PPM118	5	30,6*	$\overline{X}$	32,68
TM866	5	32,4*	SD	2,46
TM8289	6	34,6	Max	35,0
Za911	6	33,8	Min	28,5
PPM119	6	-	$\overline{X}$	33,21
TM657	6	35,0	N	7
PPM122	6	34,6	SD	2,23
TM623	6	32,9		
BPI/C641	6	33,1		
TM6066	6	28,5		
PPM123	6	-		

Sample Max = 36,2; Sample Min = 16,3; $\overline{X}$ = 28,09; N = 26; SD = 6,17

TABLE IV

Length of maxillary tooth row measured at the alveolar rim (7.2.13.7) (mm)

Specimen	Growth Stage	Alveolar length Tooth row	Analysis	
PPM113	2	-	Max	17,7
TM Nyasaland	2	17,5	Min	17,0
TM5662	2	17,0	$\bar{X}$	17,40
TM5661	2	17,7	SD	0,36
TM12698	3	26,4	Max	26,4
PPM114	3	23,3	Min	23,3
PPM126	3	-	$\bar{X}$	25,08
PPM115	3	24,5	N	4
TM12697	3	20,1	SD	1,45
PPM116	4	28,1	Max	35,5
PPM124	4	31,5	Min	28,1
PPM125	4	-	$\bar{X}$	32,95
Tm Mt.Zeb.Pk.	4	32,8	N	8
TM94F	4	33,6	SD	2,27
TM2A	4	34,0		
PPM789	4	-		
TM753	4	33,8		
TM594	4	35,5		
BPI/C682	4	34,3		
TM12165	5	36,4	Max	36,4
PPM117	5	33,9	Min	32,0
PPM118	5	32,0	$\bar{X}$	33,33
TM866	5	35,0	SD	1,85
TM8289	6	36,0	Max	36,0
Za911	6	36,0	Min	27,8
PPM119	6	-	$\bar{X}$	33,69
TM657	6	35,6	N	8
PPM122	6	35,7	SD	2,97
TM623	6	34,6		
BPI/C641	6	32,8		
TM6066	6	27,8		
PPM123	6	31,0		

Sample Max = 36,4; Sample Min = 17,0; $\bar{X}$ = 30,48; N = 27; SD = 6,00

TABLE V

Length of mandibular tooth row measured at the occlusal surface (7.2.13.6) (mm)

Specimen Number	Growth Stage	Occ. Length Tooth Row	Analysis
PPM113	2		
TM Nyasaland	2	Complete tooth	
TM5662	2	row not present	
TM5661	2		
TM12698	3		
PPM114	3	Complete tooth	
PPM126	3	row not present	
PPM115	3		
TM12697	3		
PPM116	4		
PPM124	4		
PPM125	4		
TM Mt.Zeb.Pk.	4	Complete tooth	
TM94F	4	row not present	
TM2A	4		
PPM789	4		
TM753	4		
TM594	4		
BPI/C682	4		
TM12165	5	34,80	Max 34,80
PPM117	5	33,00	Min 32,50
PPM118	5	32,50	Mean 33,73
TM866	5	34,60	N = 4; SD = 1,15
TM8289	6	37,40	Max 37,40
Za911	6	34,60	Min 34,40
PPM119	6	35,60	Mean 35,73
TM657	6	36,80	N = 6; SD = 1,18
PPM122	6	35,60	
TM623	6	34,40	
BPI/C641	6	-	
TM6066	6	-	
PPM123	6	-	

Sample Mean = 34,93; Sample SD = 1,51; Sample N = 10
Sample Max = 37,40; Sample Min = 32,50

TABLE VI

Length of mandibular tooth row measured at the alveolar rim (7.2.13.7) (mm)

Specimen Number	Growth Stage	Occ. Length Tooth Row	Analysis
PPM113	2	16,50	Max 19,85
TM Nyasaland	2	19,85	Min 16,50
TM5662	2	18,90	Mean 18,36
TM5661	2	18,20	N = 4, SD = 1,41
TM12698	3	30,70	Max 30,70
PPM114	3	26,10	Min 26,10
PPM126	3	28,30	Mean 28,56
PPM115	3	27,20	N = 5; SD = 2,02
TM12697	3	30,50	
PPM116	4	39,30	Max 39,30
PPM124	4	34,80	Min 33,73
PPM125	4	33,73	Mean 37,00
TM Mt.Zeb.Pk.	4	35,67	N = 10; SD = 1,91
TM94F	4	36,70	
TM2A	4	36,50	
PPM789	4	36,83	
TM753	4	38,70	
TM594	4	39,03	
BPI/C682	4	38,70	
TM12165	5	36,30	Max 36,30
PPM117	5	35,10	Min 34,13
PPM118	5	34,13	Mean 35,18
TM866	5	35,57	N = 4; SD = 0,89
TM8289	6	39,30	Max 39,30
Za911	6	35,60	Min 31,63
PPM119	6	36,60	Mean 35,69
TM657	6	36,17	N = 7; SD = 2,28
PPM122	6	35,63	
TM623	6	34,87	
BPI/C641	6	-	
TM6066	6	31,63	
PPM123	6	-	

Sample Mean = 32,57; Sample SD = 6,62; Sample N = 30
Sample Max = 39,30; Sample Min = 16,50

TABLE VII

UPPER INCISOR 'WIDTH' : LOWER INCISOR 'WIDTH' (7.2.13.9)

($MDI^1/MDI_2 \times \frac{100}{1}$, as a percentage)

SPECIMEN	MD I^1	MD I_1	MD I^1 : MD I_2 %	G/S
PPM113	-	3,7	-	2
TM Nyasaland	3,3	3,1	106%	2
TM5662	4,1	4,1	100%	2
TM5661	4,5	4,4	102%	2
TM12698	4,6	4,6	100%	3
PPM114	4,7	4,1	115%	3
PPM126	-	5,2	-	3
PPM115	4,9	4,6	107%	3
TM12697	5,4	4,8	113%	3
PPM116	-	5,8	-	4
PPM124	5,7	5,5	104%	4
PPM125	-	5,6	-	4
TM Mt.Zebra Park	6,1	6,1	100%	4
TM94F	-	5,7	-	4
TM2A	6,0	5,4	111%	4
PPM789	-	6,1	-	4
TM753	5,7	5,5	104%	4
TM594	-	5,6	-	4
TM12165	6,0	5,8	103%	5
PPM117	5,6	-	-	5
PPM118	5,9	5,5	107%	5
TM866	-	5,7	-	5
TM8289	6,0	5,8	103%	6
Za911	6,3	5,9	107%	6
PPM119	-	-	-	6
TM657	6,0	5,7	105%	6
PPM122	6,6	-	-	6
TM623	-	5,7	-	6
TM6066	7,3	6,8	107%	6
PPM123	-	-	-	6

Analysis of Table VII

Upper incisor 'width: lower incisor 'width', 7.2.13.9 (%)

	Max.	Min.	Mean	N	SD
Sample	115	100	105,53	17	4,37
Growth stage 2	106	100	102,67	3	
Growth stage 3	115	100	108,75	4	
Growth stage 4	111	100	104,75	4	
Growth stage 5	107	103	105,00	2	
Growth stage 6	107	103	105,50	8	

TABLE VIII

Radius of curvature of upper and lower incisors (7.2.13.10) (mm)

Specimen	Growth Stage	Upper Incisors	Analysis	Lower Incisors	Analysis
PPM113	2	-	Max 12,5	-	Max 37,5
TM Nyasaland	2	12,5*	Min 12,5	-	Min 37,5
TM5662	2	-	$\overline{X}$ 12,5	-	$\overline{X}$ 37,5
TM5661	2	-	SD 0,00	37,5	SD 0,00
TM12698	3	-	No	47,5	Max 47,5
PPM114	3	-	data	-	Min 47,5
PPM126	3	-	available	-	$\overline{X}$ 47,5
PPM115	3	-		47,5	N 2
TM12697	3	-		-	SD 0,00
PPM116	4	-	Max 22,5	-	Max 60,0
PPM124	4	17,5	Min 17,5	47,5	Min 47,5
PPM125	4	-	$\overline{X}$ 19,7	50,0*	$\overline{X}$ 51,88
TM Mt.Zeb.Pk.	4	-	N 3	-	N 4
TM94F	4	-	SD 2,8	-	SD 5,54
TM2A	4	22,5		-	
PPM789	4	-		-	
TM753	4	-		-	
TM594	4	-		60,0	
BPI/C682	4	17,5		50,0*	
TM12165	5	-	Max 22,5	-	Max 57,5
PPM117	5	20,0	Min 20,0	52,5	Min 52,5
PPM118	5	22,5*	$\overline{X}$ 21,25	57,5	$\overline{X}$ 54,17
TM866	5	-	SD 1,77	52,5	SD 2,89
TM8289	6	22,5*	Max 22,5	-	Max 62,5
Za911	6	-	Min 17,5	-	Min 62,5
PPM119	6	-	$\overline{X}$ 20,83	-	$\overline{X}$ 62,5
TM657	6	-	N 3	62,5	N 1
PPM122	6	-	SD 2,89	-	SD 0,00
TM623	6	-		-	
BPI/C641	6	17,5		-	
TM6066	6	22,5*		-	
PPM123	6	-		-	

Upper Incisors: Sample Max = 22,5; Min = 12,5; $\overline{X}$ = 19,44; SD = 3,49; N = 9

Lower Incisors: Sample Max = 62,5; Min = 37,5; $\overline{X}$ = 51,36; SD = 6,92; N = 11

TABLE IX

Crown heights of maxillary teeth (7.2.13.11) (mm) [i]

Specimen	Growth Stage	P^4	M^1	M^2	M^3
PPM113	2	-	-	-	-
TM Nyasaland	2	10,0	15,0	-	-
TM5662	2	-	19,5	-	-
TM5661	2	-	-	-	-
TM12698	3	-	16,2*	-	-
PPM114	3	-	-	-	-
PPM126	3	-	-	-	-
PPM115	3	8,0	-	19,0	-
TM12697	3	5,8	-	-	-
PPM116	4	-	-	-	-
PPM124	4	3,4	14,4*	16,8*	-
PPM125	4	-	-	-	-
TM Mt.Zeb.Pk.	4	-	-	-	-
TM94F	4	-	-	-	-
TM2A	4	-	-	-	-
PPM789	4	-	-	-	-
TM753	4	3,2	-	-	-
TM594	4	-	-	-	-
BPI/C682	4	8,0	14,0*	15,0*	15,0*
TM12165	5	17,3*	-	-	-
PPM117	5	-	14,0*	15,0*	12,0*
PPM118	5	-	-	14,6*	15,0*
PPM866	5	-	-	-	17,4
TM8289	6	-	-	-	-
Za911	6	-	-	-	-
PPM119	6	-	-	-	-
TM657	6	17,0*	9,4	-	-
PPM122	6	17,5	9,0*	12,3*	13,5*
TM623	6	-	-	-	-
BPI/C641	6	16,3*	-	-	-
TM6066	6	9,5*	-	-	-
PPM123	6	-	-	-	-

i) Data incomplete because in situ teeth could not be removed for measurement without damage to specimens

ANALYSIS OF TABLE IX

CROWN HEIGHTS OF P^4

	Max	Min	$\bar{X}$	N	SD
Growth stage 2	10,0	10,0	10,00	1	0,00
Growth stage 3	8,0	5,8	6,90	2	1,56
Growth stage 4	8,0	3,2	4,87	3	2,72
Growth stage 5	17,3	17,3	17,30	1	0,00
Growth stage 6	17,5	9,5	15,08	4	3,75
Sample	17,5	5,8	10,55	11	5,57

CROWN HEIGHTS OF M^1

Growth stage 2	19,5	15,0	17,25	2	3,18
Growth stage 3	16,2	16,2	16,20	1	0,00
Growth stage 4	14,4	14,0	14,20	2	0,28
Growth stage 5	14,0	14,0	14,00	1	0,00
Growth stage 6	9,4	9,0	9,20	2	0,28
Sample	19,5	9,0	13,94	8	3,43

CROWN HEIGHTS OF M^2

Growth stage 2	-	-	-	-	-
Growth stage 3	19,0	19,0	19,00	1	0,00
Growth stage 4	16,8	15,0	15,90	2	1,27
Growth stage 5	15,0	14,6	14,80	2	0,28
Growth stage 6	12,3	12,3	12,30	1	0,00
Sample	19,0	12,3	15,45	6	2,26

CROWN HEIGHTS OF M^3

Growth stage 2	-	-	-	-	-
Growth stage 3	-	-	-	-	-
Growth stage 4	15,0	15,0	15,00	1	0,00
Growth stage 5	17,4	12,0	14,80	3	2,71
Growth stage 6	13,5	13,5	13,50	1	0,00
Sample	17,4	12,0	14,58	5	2,01

TABLE X

Crown heights of mandibular teeth (7.2.13.11) (mm)[i)]

Specimen	Growth Stage	P^4	M_1	M_2	M_3
PPM113	2	-	-	-	-
TM Nyasaland	2	-	-	-	-
TM5662	2	-	-	-	-
TM5661	2	-	-	-	-
TM12698	3	8,6	14,3*	-	-
PPM114	3	6,0*	-	-	-
PPM126	3	-	-	-	-
PPM115	3	7,5	13,7	18,5	-
TM12697	3	-	-	15,5*	-
PPM116	4	-	-	-	-
PPM124	4	3,9*	14,1	12,7	15,0
PPM125	4	-	-	-	-
TM Mt.Zeb.Pk.	4	-	-	-	-
TM94F	4	-	-	-	-
TM2A	4	-	-	-	18,0
PPM789	4	-	-	-	-
TM753	4	-	-	-	-
TM594	4	-	-	-	-
BPI/C682	4	5,5	17,5	16,8	15,0
TM12165	5	-	-	16,8*	-
PPM117	5	17,4	-	-	-
PPM118	5	-	12,0	-	15,0
PPM866	5	-	-	-	-
TM8289	6	-	-	-	-
Za911	6	-	-	-	13,0*
PPM119	6	-	-	-	-
TM657	6	-	-	-	-
PPM122	6	-	-	-	-
TM623	6	14,5*	10,3*	12,2*	13,0*
BPI/C641	6	-	-	-	-
TM6066	6	-	-	-	-
PPM123	6	-	-	-	-

i) Data incomplete because in situ teeth could not be removed for measurement without damage to specimens

ANALYSIS OF TABLE X

CROWN HEIGHTS OF P_4	Max	Min	$\overline{X}$	N	SD
Growth stage 2	-	-	-	-	-
Growth stage 3	8,6	6,0	7,36	3	1,30
Growth stage 4	5,5	3,9	4,70	2	1,13
Growth stage 5	17,4	17,4	17,40	1	0,00
Growth stage 6	14,5	14,5	14,50	1	0,00
Sample	17,4	3,9	9,05	7	5,00
CROWN HEIGHTS OF M_1					
Growth stage 2	-	-	-	-	-
Growth stage 3	14,3	13,7	14,00	2	0,42
Growth stage 4	17,5	14,1	15,80	2	2,40
Growth stage 5	12,0	12,0	12,00	1	0,00
Growth stage 6	10,3	10,3	10,30	1	0,00
Sample	17,5	10,3	13,65	6	2,42
CROWN HEIGHTS OF M_2					
Growth stage 2	-	-	-	-	-
Growth stage 3	18,5	15,5	17,00	2	2,12
Growth stage 4	16,8	12,7	14,75	2	2,89
Growth stage 5	16,8	16,8	16,80	1	0,00
Growth stage 6	12,2	12,2	12,20	1	0,00
Sample	18,5	12,2	15,41	6	2,49
CROWN HEIGHTS OF M_3					
Growth stage 2	-	-	-	-	-
Growth stage 3	-	-	-	-	-
Growth stage 4	18,0	15,0	16,00	3	1,73
Growth stage 5	15,0	15,0	15,00	1	0,00
Growth stage 6	13,0	13,0	13,00	2	0,00
Sample	18,0	13,0	14,83	6	1,83

TABLE XI A

Measurements of the Maxillary Teeth in a Sample of *Hystrix africaeaustralis* i)

CATALOGUE NUMBER	I^1		dp^4/P^4		M^1		M^2		M^3		G/S
	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	
PPM 113	-	-	-	-	-	-	-	-	-	-	2
TM Nyasaland	3.3	4.5	9.1	5.8	7.8	4.6	-	-	-	-	2
TM 5662	4.1	5.0	9.2	6.7	7.7	6.0	-	-	-	-	2
TM 5661	4.5	5.0	9.3	7.3	8.1	5.8	-	-	-	-	2
TM 12698	4.6	6.0	10.5	7.7	8.7	6.4	-	-	-	-	3
PPM 114	4.7	5.6	7.4	6.9	8.4	7.0	8.0	5.1	-	-	3
PPM 126	-	-	-	-	-	-	-	-	-	-	3
PPM 115	4.9	6.1	8.4	7.3	7.8	7.3	8.3	5.8	-	-	3
TM 12697	5.4	6.4	8.9	7.0	8.1	7.2	9.3	6.7	-	-	3
PPM 116	-	-	9.9	7.4	8.8	7.8	8.6	7.5	-	-	4
PPM 124	5.7	6.7	8.3	6.9	8.2	7.3	8.1	6.5	-	-	4
PPM 125	-	-	-	-	-	-	-	-	-	-	4
TM Mt. Zebra Pk.	6.1	7.0	8.6	7.2	8.4	7.4	7.3	6.2	-	-	4
TM 94F	-	-	8.3	6.6	8.0	6.5	8.7	5.9	-	-	4
TM 2A	6.0	6.9	7.7	7.5	9.2	9.0	9.8	9.1	-	-	4
PPM 789	-	-	-	-	-	-	-	-	-	-	4
TM 753	5.7	7.0	6.4	6.6	8.8	8.1	9.2	7.4	7.4	6.6	4
TM 594	-	-	8.1	7.0	8.9	7.8	9.1	7.4	7.4	6.0	4
TM 12165	6.0	7.6	-	-	8.5	7.4	9.4	7.4	8.0	6.2	5
PPM 117	5.6	6.6	-	-	8.2	7.7	8.1	6.9	6.8	5.2	5
PPM 118	5.9	6.8	-	-	7.4	7.8	8.4	7.7	7.0	6.1	5
TM 866	-	-	8.3	5.2	7.8	7.4	8.7	7.6	8.3	6.5	5
TM 8289	6.0	7.4	8.6	7.3	8.5	8.5	9.0	9.0	8.5	8.4	6
Za 911	6.3	6.4	9.6	8.6	8.0	8.4	8.3	8.0	8.5	7.9	6
PPM 119	-	-	-	-	-	-	-	-	-	-	6
TM 657	6.0	7.8	9.2	9.2	7.6	8.8	9.2	8.6	9.5	8.3	6
PPM 122	6.6	7.5	10.7	8.7	7.0	8.8	8.2	8.5	8.6	7.6	6
TM 623	-	-	9.7	8.6	7.6	9.3	8.5	8.4	7.8	7.7	6
TM 6066	7.3	8.1	-	-	-	-	-	-	-	-	6
PPM 123	-	-	-	-	-	-	-	-	-	-	6

i) Measured at the occlusal surface

TABLE XI B

Mean Minimum and Maximum Mesiodistal Diameters (Lengths) of the Maxillary Teeth of Juvenile Specimens

	I^1	dp^4	M^1	M^2	M^3
Σx	55.00	120.10	116.90	86.40	14.80
N	11	14	14	10	2
$\bar{x}$	5.00	8.57	8.35	8.64	7.4
MINIMUM	3.30	6.40	7.70	7.30	7.4
MAXIMUM	6.10	10.50	9.20	9.80	7.4

TABLE XI C

Mean Minimum and Maximum Mesiodistal Diameters (Lengths) of the Maxillary Teeth of Adult Specimens

	I^1	P^4	M^1	M^2	M^3
Σx	49.70	56.10	70.60	77.80	73.00
N	8	6	9	9	9
$\bar{x}$	6.21	9.35	7.84	8.64	8.11
MINIMUM	5.60	8.30	7.00	8.10	6.80
MAXIMUM	7.30	10.70	8.50	9.40	9.50

TABLE XI D

Mean Minimum and Maximum Mesiodistal Diameters (Lengths) of the Maxillary Teeth of Sample

	I^1	dp^4/P^4	M^1	M^2	M^3
Σx	104.70	176.20	187.50	164.20	87.80
N	19	20	23	19	11
$\bar{x}$	5.51	8.81	8.15	8.64	7.98
MINIMUM	3.30	6.40	7.00	7.30	6.80
MAXIMUM	7.30	10.70	9.20	9.80	9.50

TABLE XI E

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of the Maxillary Teeth of Juvenile Individuals

	I^1	dp^4	M^1	M^2	M^3
Σx	66.20	97.90	98.20	67.60	12.60
N	11	14	14	10	2
$\bar{x}$	6.01	6.99	7.01	6.76	6.30
MINIMUM	4.50	5.80	4.60	5.10	6.00
MAXIMUM	7.00	7.70	9.00	9.10	6.60

TABLE XI F

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of the Maxillary Teeth of Adult Individuals

	I^1	P^4	M^1	M^2	M^3
Σx	58.20	47.60	74.10	72.10	63.90
N	8	6	9	9	9
$\bar{x}$	7.27	7.93	8.23	8.01	7.10
MINIMUM	6.40	5.20	7.40	6.90	5.20
MAXIMUM	8.10	9.20	9.30	9.00	8.40

TABLE XI G

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of the Maxillary Teeth of the Sample

	I^1	dp^4/P^4	M^1	M^2	M^3
Σx	124.40	145.50	172.30	139.70	76.50
N	19	20	23	19	11
$\bar{x}$	6.54	7.27	7.49	7.35	6.95
MINIMUM	4.50	5.20	4.60	5.10	5.20
MAXIMUM	8.10	9.20	9.30	9.10	8.40

TABLE XI H

Maximum, minimum and mean mesiodistal and buccolingual diameters of the maxillary dentition at each growth stage in the sample of Hystrix africaeaustralis

		I^1		dp^4/P^4		M^1		M^2		M^3	
		MD	BL	MD	BL	MD	BL	MD	BL	MD	BL
Growth	Max	4,5	5,0	9,3	7,3	8,1	6,0	-	-	-	-
Stage 2	Min	3,3	4,5	9,1	5,8	7,7	4,6	-	-	-	-
	Mean	3,97	4,83	9,20	6,6	7,87	5,47	-	-	-	-
	N	3	3	3	3	3	3	-	-	-	-
Growth	Max	5,4	6,4	10,5	7,7	8,7	7,3	9,3	6,7	-	-
Stage 3	Min	4,6	5,6	7,4	6,9	7,8	6,4	8,0	5,1	-	-
	Mean	4,90	6,02	8,8	7,2	8,5	6,98	8,53	5,87	-	-
	N	4	4	4	4	4	4	3	3		
Growth	Max	6,1	7,0	9,9	7,5	9,2	9,0	9,8	9,1	7,4	6,6
Stage 4	Min	5,7	6,7	6,4	6,6	8,0	6,5	7,3	5,9	7,4	6,0
	Mean	5,87	6,90	8,18	7,03	8,61	7,70	8,68	7,14	7,40	6,30
	N	4	4	7	7	7	7	7	7	2	2
Growth	Max	6,0	7,6	8,3	5,2	8,5	7,8	9,4	7,7	8,3	6,5
Stage 5	Min	5,6	6,6	8,3	5,2	7,4	7,4	8,1	6,9	6,8	5,2
	Mean	5,83	7,00	8,30	5,20	7,97	7,57	8,65	7,40	7,52	6,00
	N	3	3	1	1	4	4	4	4	4	4
Growth	Max	7,3	8,1	10,7	9,2	8,5	9,3	9,2	9,0	9,5	8,4
Stage 6	Min	6,0	6,4	8,6	7,3	7,0	8,4	8,2	8,0	7,8	7,6
	Mean	6,44	7,44	9,56	8,48	7,74	8,76	8,64	8,50	8,58	7,98
	N	5	5	5	5	5	5	5	5	5	5
Sample	SD	0,95	0,99	1,03	0,96	0,54	1,12	0,61	1,12	0,80	1,07
Sample	N	19	19	20	20	23	23	19	19	11	11

TABLE XII A

Occlusal Surface Areas of the Maxillary Teeth in a Sample of Hystrix africaeaustralis i)

CATALOGUE NUMBER	I^1	dp^4/P^4	M^1	M^2	M^3	G/S
	MD x LL	MD x BL	MD x BL	MD x BL	MD x BL	
PPM 113	-	-	-	-	-	2
TM Nyasaland	14.85	52.78	35.88	-	-	2
TM 5662	20.50	61.64	46.20	-	-	2
TM 5661	22.50	67.89	46.98	-	-	2
TM 12698	27.60	80.85	55.68	-	-	3
PPM 114	26.32	61.32	56.94	48.14	-	3
PPM 126	-	-	-	-	-	3
PPM 115	29.89	51.06	58.80	40.80	-	3
TM 12697	34.56	62.30	58.32	62.31	-	3
PPM 116	-	73.26	68.64	64.50	-	4
PPM 124	38.19	57.27	59.86	52.65	-	4
PPM 125	-	-	-	-	-	4
TM Mt. Zebra Pk.	42.70	61.92	62.16	45.26	-	4
TM 94F	-	54.78	52.00	51.33	-	4
TM 2A	41.40	57.75	82.80	89.18	-	4
PPM 789	-	-	-	-	-	4
TM 753	39.90	42.24	71.28	68.08	48.84	4
TM 594	-	56.70	69.42	67.34	43.20	4
TM 12165	45.60	-	62.90	69.56	49.60	5
PPM 117	36.96	-	63.14	55.89	35.36	5
PPM 118	40.12	-	57.72	64.68	42.70	5
TM 866	-	43.16	57.72	66.12	53.95	5
TM 8289	44.40	62.78	72.25	81.00	71.40	6
Za 911	40.32	82.56	67.20	66.40	67.15	6
PPM 119	-	-	-	-	-	6
TM 657	46.80	84.64	66.88	79.12	78.85	6
PPM 122	49.50	93.09	61.60	69.70	65.36	6
TM 623	-	83.42	70.68	71.40	60.06	6
TM 6066	59.13	-	-	-	-	6
PPM 123	-	-	-	-	-	6

i) Measured at the occlusal surface

TABLE XII B

Mean Minimum and Maximum Occlusal Surface Areas of the Maxillary Teeth of Juvenile Individuals

	I^1	dp^4	M^1	M^2	M^3
Σx	338.41	841.76	824.96	589.59	92.04
N	11	14	14	10	2
$\bar{x}$	30.76	60.12	58.92	58.95	46.02
MINIMUM	14.85	42.24	35.88	40.80	43.20
MAXIMUM	42.70	80.85	82.80	89.18	48.84

TABLE XII C

Mean Minimum and Maximum Occlusal Surface Areas of the Maxillary Teeth of Adult Individuals

	I^1	P^4	M^1	M^2	M^3
Σx	362.83	449.65	580.09	623.87	524.43
N	8	6	9	9	9
$\bar{x}$	45.35	74.94	64.45	69.31	58.27
MINIMUM	36.96	43.16	57.72	55.89	35.36
MAXIMUM	59.13	93.09	72.25	81.00	78.85

TABLE XII D

Mean Minimum and Maximum Occlusal Surface Areas of the Maxillary Teeth of the Sample

	I^1	dp^4/P^4	M^1	M^2	M^3
Σx	701.24	1291.41	1405.05	1213.46	616.47
N	19	20	23	19	11
$\bar{x}$	36.90	64.57	61.08	63.86	56.04
MINIMUM	14.85	42.24	35.88	40.80	35.36
MAXIMUM	59.13	93.09	82.80	89.18	78.85

TABLE XII E

Maximum, minimum and mean occlusal surface areas of the maxillary dentition at each growth stage in a sample of Hystrix africaeaustralis

		I^1	dp^4/P^4	M^1	M^2	M^3
		MD x LL	MD x BL	MD x BL	MD x BL	MD x BL
Growth	Max	22,50	67,89	46,98	-	-
stage 2	Min	14,85	52,78	35,88	-	-
	Mean	19,28	60,77	43,02	-	-
	N	3	3	3	-	-
Growth	Max	34,56	80,85	58,80	62,31	-
Stage 3	Min	26,32	51,06	55,68	40,80	-
	Mean	29,59	63,88	57,44	50,42	-
	N	4	4	4	3	-
Growth	Max	42,70	73,26	82,80	89,18	48,84
Stage 4	Min	38,19	42,24	52,00	51,33	43,20
	Mean	40,55	57,70	66,59	62,62	46,02
	N	4	7	7	7	2
Growth	Max	45,60	43,16	63,14	69,56	49,60
Stage 5	Min	36,96	43,16	57,72	55,89	35,36
	Mean	40,89	43,16	60,37	64,06	45,40
	N	3	1	4	4	4
Growth	Max	59,13	93,09	72,25	81,00	78,85
Stage 6	Min	40,32	62,78	61,60	66,40	60,06
	Mean	48,03	81,29	67,72	73,52	68,56
	N	5	5	5	5	5
Sample	SD	11,02	14,17	10,05	12,49	13,60
Sample	N	19	20	23	19	11

TABLE XIII A

Crown Shape Indices of the Maxillary Teeth in a Sample of Hystrix africaeaustralis[i)]

CATALOGUE NUMBER	I^1	dp^4/P^4	M^1	M^2	M^3	G/S
	$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	
PPM 113	-	-	-	-	-	2
TM Nyasaland	136.36	63.74	58.97	-	-	2
TM 5662	121.95	72.83	77.92	-	-	2
TM 5661	111.11	78.49	71.60	-	-	2
TM 12698	130.43	73.33	73.56	-	-	3
PPM 114	119.15	86.90	93.59	69.88	-	3
PPM 126	-	-	-	-	-	3
PPM 115	124.49	93.24	83.33	63.75	-	3
TM 12697	118.52	78.65	88.89	72.04	-	3
PPM 124	117.54	83.13	89.02	80.25	-	4
PPM 125	-	-	-	-	-	4
PPM 116	-	74.75	88.64	87.21	-	4
TM Mt. Zebra Pk.	114.75	83.72	88.09	84.93	-	4
TM 94F	-	79.52	81.25	67.82	-	4
TM 2A	115.00	97.40	97.83	92.86	-	4
PPM 789	-	-	-	-	-	4
TM 753	122.81	103.12	92.04	80.43	89.19	4
TM 594	-	86.42	87.63	81.32	83.33	4
TM 12165	126.67	-	87.06	78.72	77.50	5
PPM 117	177.86	-	93.90	85.18	76.47	5
PPM 118	115.25	-	105.40	91.67	87.14	5
TM 866	-	62.65	94.87	87.36	78.31	5
TM 8289	123.33	84.88	100.00	100.00	98.82	6
Za 911	101.59	89.58	105.00	96.38	92.94	6
PPM 119	-	-	-	-	-	6
TM 657	130.00	100.00	115.79	93.48	87.37	6
PPM 112	113.64	81.31	125.71	103.66	88.37	6
TM 623	-	88.66	122.37	98.82	98.72	6
TM 6066	110.96	-	-	-	-	6
PPM 123	-	-	-	-	-	6

i) Measured at the occlusal surface

TABLE XIII B

Mean Minimum and Maximum Crown Shape Indices of the Maxillary Teeth of Juvenile Individuals

	I^1	dp^4	M^1	M^2	M^3
Σx	1332.11	1155.24	1172.36	780.49	172.52
N	11	14	14	10	2
$\bar{x}$	121.10	82.51	83.74	78.04	86.26
MINIMUM	111.11	63.74	58.97	63.75	83.33
MAXIMUM	136.36	103.12	97.83	92.86	89.19

TABLE XIII C

Mean Minimum and Maximum Crown Shape Indices of the Maxillary Teeth of Adult Individuals

	I^1	P^4	M^1	M^2	M^3
Σx	939.30	507.08	950.10	835.27	785.64
N	8	6	9	9	9
$\bar{x}$	117.41	84.51	105.56	92.80	87.29
MINIMUM	101.59	62.65	87.06	78.72	76.47
MAXIMUM	130.00	100.00	125.71	103.66	98.82

TABLE XIII D

Mean Minimum and Maximum Crown Shape Indices of the Maxillary Teeth of Sample

	I^1	dp^4/P^4	M^1	M^2	M^3
Σx	2271.41	1662.32	2122.46	1615.76	958.16
N	19	20	23	19	11
$\bar{x}$	122.71	83.11	92.28	85.04	87.10
MINIMUM	101.59	62.65	58.91	63.75	76.47
MAXIMUM	136.36	103.12	125.71	103.66	98.82

TABLE XIII E

Maximum, minimum and mean crown shape indices for each growth stage in a sample of Hystrix africaeaustralis maxillary dentitions

		I^1	dp^4/P^4	M^1	M^2	M^3
		$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$
Growth	Max	136,36	78,49	77,92	-	-
Stage 2	Min	111,11	63,74	58,97	-	-
	Mean	123,14	71,69	69,50	-	-
	N	3	3	3	-	-
Growth	Max	130,43	93,24	93,59	72,04	-
Stage 3	Min	118,52	73,33	73,56	63,75	-
	Mean	123,15	83,03	84,84	68,56	-
	N	4	4	4	3	-
Growth	Max	122,81	103,12	97,83	92,86	89,19
Stage 4	Min	114,75	74,75	81,25	67,82	83,33
	Mean	117,52	86,86	89,21	82,11	86,26
	N	4	7	7	7	2
Growth	Max	177,86	62,65	105,40	91,67	87,14
Stage 5	Min	115,25	62,65	87,06	78,72	76,47
	Mean	139,93	62,65	95,31	85,73	79,85
	N	3	1	4	4	4
Growth	Max	130,00	100,00	125,71	103,66	98,82
Stage 6	Min	101,59	81,31	100,00	93,48	87,37
	Mean	115,90	88,88	113,77	98,47	93,24
	N	5	5	5	5	5
Sample	SD	15,63	10,80	15,68	11,36	7,80
Sample	N	19	20	23	19	11

TABLE XIV A

Measurements of the Mandibular Teeth in a Sample of Hystrix africaeaustralis i)

CATALOGUE NUMBER	I_1		dp_4/P_4		M_1		M_2		M_3		G/S
	MD	LL	MD	BL	MD	BL	MD	BL	BL	BL	
PPM 113	3.7	3.2	8.7	4.9	-	-	-	-	-	-	2
TM Nyasaland	3.1	2.9	10.1	4.1	7.7	5.0	-	-	-	-	2
TM 5662	4.1	4.0	9.7	6.5	8.8	5.7	-	-	-	-	2
TM 5661	4.4	4.4	9.7	6.5	8.7	5.8	-	-	-	-	2
TM 12698	4.6	4.7	10.8	6.8	10.1	6.8	-	-	-	-	3
PPM 114	4.1	4.7	8.0	5.9	8.5	6.8	8.1	5.8	-	-	3
PPM 126	5.2	5.6	9.6	6.2	9.3	6.8	8.4	6.0	-	-	3
PPM 115	4.6	5.4	8.9	6.0	8.8	6.6	8.4	5.9	-	-	3
TM 12697	4.8	5.2	9.9	5.9	10.0	7.0	10.0	6.6	-	-	3
PPM 116	5.8	5.4	9.8	6.7	9.7	7.6	9.7	6.9	-	-	4
PPM 124	5.5	5.8	8.7	5.8	8.8	6.8	8.8	6.8	-	-	4
PPM 125	5.6	6.0	8.0	5.7	8.7	7.6	8.0	6.8	-	-	4
TM Mt. Zebra Pk.	6.1	6.0	9.9	6.3	9.3	7.0	8.6	6.6	-	-	4
TM 94F	5.7	6.0	8.4	6.3	8.2	6.3	9.1	5.9	-	-	4
TM 2A	5.4	5.9	8.8	6.4	9.6	8.0	10.3	8.9	-	-	4
PPM 789	6.1	-	-	-	9.2	7.6	9.9	7.6	8.5	6.2	4
TM 753	5.5	5.7	8.8	6.0	9.3	7.2	9.6	7.6	7.8	5.7	4
TM 594	5.6	5.8	-	-	9.2	7.1	-	-	8.2	6.5	4
TM 12165	5.8	6.5	-	-	8.2	6.6	8.9	7.3	8.5	6.4	5
PPM 117	-	-	-	-	8.5	7.4	8.5	7.3	7.5	5.8	5
PPM 118	5.5	5.6	7.6	6.2	8.0	7.1	8.6	7.8	7.6	6.7	5
TM 866	5.7	5.8	7.9	6.4	8.3	7.0	9.5	7.6	8.8	6.7	5
TM 8289	5.8	5.6	9.0	6.9	8.7	7.7	10.7	8.6	9.1	6.8	6
Za 911	5.9	5.8	9.1	7.9	7.4	7.3	8.5	7.7	9.4	7.2	6
PPM 119	-	-	9.7	8.3	7.6	7.5	9.5	8.4	9.0	7.8	6
TM 657	5.7	6.5	10.3	7.5	8.6	7.8	9.3	7.7	9.1	7.2	6
PPM 122	-	-	10.3	8.2	7.4	7.5	8.7	8.2	9.0	7.1	6
TM 623	5.7	5.9	9.8	7.7	7.9	7.7	8.7	7.9	9.2	7.4	6
TM 6066	6.8	6.9	-	-	-	-	-	-	-	-	6
PPM 123	-	-	-	-	-	-	-	-	-	-	6

i) At the time of taking dental measurements specimens BPI/C 682 and BPI/C 641 listed in 'Materials', main text, were not available. Measured at occlusal surface

TABLE XIV B

Mean Minimum and Maximum Mesiodistal Diameters of Mandibular teeth of Juvenile Specimens

	I_1	dp_4	M_1	M_2	M_3
Σx	89.90	147.80	153.90	108.90	24.50
N	18	16	17	12	3
$\bar{x}$	4.99	9.23	9.05	9.07	8.16
MINIMUM	3.10	8.00	7.70	8.00	7.80
MAXIMUM	6.10	10.80	10.10	10.30	8.50

TABLE XIV C

Mean Minimum and Maximum Mesiodistal Diameters of Mandibular Teeth of Adult Specimens

	I_1	P_4	M_1	M_2	M_3
Σx	46.90	73.70	80.60	90.90	87.20
N	8	8	10	10	10
$\bar{x}$	5.86	9.21	8.06	9.09	8.72
MINIMUM	5.50	7.60	7.40	8.50	7.50
MAXIMUM	6.80	10.30	8.70	10.70	9.40

TABLE XIV D

Mean Minimum and Maximum Mesiodistal Diameters of Mandibular Teeth of Sample

	I_1	dp_4/P_4	M_1	M_2	M_3
Σx	136.80	221.50	234.50	199.80	111.70
N	26	24	27	22	13
$\bar{x}$	5.26	9.22	8.68	9.08	8.59
MINIMUM	3.10	7.60	7.40	8.00	7.50
MAXIMUM	6.80	10.80	10.10	10.70	9.40

TABLE XIV E

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of Mandibular Teeth of Juvenile Specimens

	I_1	dp_4	M_1	M_2	M_3
Σx	86.70	96.00	115.70	81.40	18.40
N	17	16	17	12	3
$\bar{x}$	5.10	6.00	6.80	6.78	6.13
MINIMUM	2.90	4.10	5.00	5.80	5.70
MAXIMUM	6.00	6.80	8.00	8.90	6.50

TABLE XIV F

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of Mandibular Teeth of Adult Specimens

	I_1	P_4	M_1	M_2	M_3
Σx	48.60	59.10	73.60	78.50	69.10
N	8	8	10	10	10
$\bar{x}$	6.07	7.38	7.36	7.85	6.91
MINIMUM	5.60	6.20	6.60	7.30	5.80
MAXIMUM	6.90	8.30	7.80	8.60	7.80

TABLE XIV G

Mean Minimum & Maximum Labiolingual & Buccolingual Diameters (Breadths) of Mandibular Teeth of Sample

	I_1	dp_4/P_4	M_1	M_2	M_3
Σx	135.30	155.10	189.30	159.90	87.50
N	25	24	27	22	13
$\bar{x}$	5.41	6.46	7.01	7.26	6.73
MINIMUM	2.90	4.10	5.00	5.80	5.70
MAXIMUM	6.90	8.30	8.00	8.90	7.80

TABLE XIV H

Maximum, minimum and mean mesiodistal and buccolingual diameters for each growth stage in a sample of Hystrix africaeaustralis mandibular dentitions

		I_1		dp_4/P_4		M_1		M_2		M_3	
		MD	LL	MD	BL	MD	BL	MD	BL	MD	BL
Growth	Max	4,4	4,4	10,1	6,5	8,8	5,8	-	-	-	-
Stage 2	Min	3,1	2,9	8,7	4,1	7,7	5,0	-	-	-	-
	Mean	3,83	3,63	9,55	5,50	8,40	5,50	-	-	-	-
	N	4	4	4	4	3	3	-	-	-	-
Growth	Max	5,2	5,6	10,8	6,8	10,1	6,6	10,0	6,6	-	-
Stage 3	Min	4,1	4,7	8,0	5,9	8,5	7,0	8,1	5,8	-	-
	Mean	4,66	5,12	9,44	6,16	9,34	6,80	8,73	6,08	-	-
	N	5	5	5	5	5	5	4	4	-	-
Growth	Max	6,1	6,0	9,9	6,7	9,7	7,6	10,3	8,9	8,5	6,5
Stage 4	Min	5,4	5,4	8,0	5,7	8,2	6,3	8,0	5,9	7,8	5,7
	Mean	5,70	5,83	8,91	6,17	9,11	7,24	9,25	7,14	8,17	6,13
	N	9	8	7	7	9	9	8	8	3	3
Growth	Max	5,8	6,5	7,9	6,4	8,5	7,4	9,5	7,8	8,8	6,7
Stage 5	Min	5,5	5,6	7,6	6,2	8,0	6,6	8,5	7,3	7,5	5,8
	Mean	5,67	5,97	7,75	6,30	8,25	7,03	8,88	7,50	8,10	6,40
	N	3	3	2	2	4	4	4	4	4	4
Growth	Max	6,8	6,9	10,3	8,3	8,7	7,8	10,7	8,6	9,4	7,8
Stage 6	Min	5,7	5,6	9,0	6,9	7,4	7,3	8,5	7,7	9,0	6,8
	Mean	5,98	6,14	9,70	7,75	7,93	7,58	9,23	8,08	9,13	7,25
	N	5	5	6	6	6	6	6	6	6	6
Sample	SD	0,85	0,96	0,86	0,97	0,79	0,70	0,76	0,90	0,64	0,62
Sample	N	26	25	24	24	27	27	22	22	13	13

TABLE XV A

Occlusal Surface Areas of the Mandibular Teeth in a sample of Hystrix africaeaustralis i)

CATALOGUE NUMBER	I_1	dp_4/P_4	M_1	M_2	M_3	G/S
	MD X LL	MD X BL	MD X BL	MD X BL	MD X BL	
PPM 113	11.84	42.63	-	-	-	2
TM Nyasaland	8.99	41.41	38.50	-	-	2
TM 5662	16.40	63.05	50.16	-	-	2
TM 5661	19.36	63.05	50.46	-	-	2
TM 12698	21.62	73.44	68.68	-	-	3
PPM 114	19.27	47.20	57.80	46.98	-	3
PPM 126	29.12	59.52	63.24	50.40	-	3
PPM 115	24.84	53.40	58.08	49.56	-	3
TM 12697	24.96	58.41	70.00	66.00	-	3
PPM 116	31.32	65.66	73.72	66.93	-	4
PPM 124	31.90	50.46	59.84	59.84	-	4
PPM 125	33.60	45.60	66.12	54.40	-	4
TM Mt. Zebra Pk.	36.60	62.37	65.10	56.76	-	4
TM 94F	34.20	52.92	51.66	53.69	-	4
TM 2A	31.86	56.32	76.80	91.67	-	4
PPM 789	-	-	69.92	75.24	52.70	4
TM 753	31.35	52.80	66.96	72.96	44.46	4
TM 594	32.48	-	65.32	-	53.30	4
TM 12165	37.70	-	54.12	64.97	54.40	5
PPM 117	-	-	62.90	62.05	43.50	5
PPM 118	30.80	47.12	56.80	67.08	50.92	5
TM 866	33.06	50.56	58.10	72.20	58.96	5
TM 8289	32.48	62.10	66.99	92.02	61.88	6
Za 911	34.22	71.89	54.02	65.45	67.68	6
PPM 119	-	80.51	51.00	79.80	70.20	6
TM 657	37.05	77.25	67.08	71.61	65.52	6
PPM 122	-	84.46	55.50	71.34	63.90	6
TM 623	33.63	75.46	60.83	68.73	68.08	6
TM 6066	46.92	-	-	-	-	6
PPM 123	-	-	-	-	-	6

i) Measured at occlusal surface

TABLE XV B

Mean Minimum and Maximum Occlusal Surface Areas of Mandibular Teeth of Juvenile Specimens

	I_1	dp_4	M_1	M_2	M_3
Σx	439.71	88.24	1052.36	744.43	150.46
N	17	16	17	12	3
$\bar{x}$	25.86	55.51	61.90	62.03	50.15
MINIMUM	8.99	41.41	38.50	46.98	44.46
MAXIMUM	36.60	73.44	76.80	91.67	53.30

TABLE XV C

Mean Minimum and Maximum Occlusal Surface Areas of Mandibular Teeth of Adult Specimens

	I_1	P_4	M_1	M_2	M_3
Σx	285.86	549.35	587.34	715.25	605.04
N	8	8	10	10	10
$\bar{x}$	35.73	68.66	58.73	71.52	60.50
MINIMUM	30.80	44.80	51.00	62.05	43.50
MAXIMUM	46.92	84.46	67.08	92.02	70.20

TABLE XV D

Mean Minimum and Maximum Occlusal Surface Areas of Mandibular Teeth of Sample

	I_1	dp_4/P_4	M_1	M_2	M_3
Σx	725.57	1437.59	1639.70	1459.68	755.50
N	25	24	27	22	13
$\bar{x}$	29.02	59.89	60.72	66.34	58.11
MINIMUM	8.99	41.41	38.50	46.98	43.50
MAXIMUM	46.92	84.46	76.80	92.02	70.20

TABLE XV E

Maximum, minimum and mean occlusal surface areas at each growth stage in a sample of Hystrix africaeaustralis mandibular dentitions [i)]

		I_1	dp_4/P_4	M_1	M_2	M_3
		MD x LL	MD x BL	MD x BL	MD x BL	MD x BL
Growth	Max	19,36	63,05	50,46	-	-
Stage 2	Min	8,99	41,41	38,50	-	-
	Mean	14,14	52,53	46,37	-	-
	N	4	4	3	-	-
Growth	Max	29,12	73,44	70,00	66,00	-
Stage 3	Min	19,27	47,20	57,80	46,98	-
	Mean	23,96	58,39	63,56	53,23	-
	N	5	5	5	4	-
Growth	Max	33,60	65,66	76,80	91,67	53,30
Stage 4	Min	31,32	50,46	51,66	53,69	44,46
	Mean	32,91	55,16	66,16	66,43	50,15
	N	8	7	9	8	3
Growth	Max	37,70	50,56	62,90	72,20	58,96
Stage 5	Min	30,80	47,12	54,12	62,05	43,50
	Mean	33,85	48,84	58,08	66,57	51,94
	N	3	2	4	4	4
Growth	Max	46,92	80,51	67,08	92,02	70,20
Stage 6	Min	32,48	62,10	51,00	65,45	61,88
	Mean	36,86	75,28	59,24	74,82	66,21
	N	5	6	6	6	6
i) Measured at the occlusal surface						
Sample	SD	8,70	12,27	8,55	12,05	8,94
Sample	N	25	24	27	22	13

TABLE XVI A

Crown Shape Indices of the Mandibular Teeth in a Sample of Hystrix africaeaustralis[i)]

CATALOGUE NUMBER	I_1	dp_4/P_4	M_1	M_2	M_3	G/S
	$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	
PPM 113	86.49	56.32	-	-	-	2
TM Nyasaland	93.55	40.59	64.94	-	-	2
TM 5662	97.56	67.01	64.77	-	-	2
TM 5661	100.00	67.01	66.67	-	-	2
TM 12698	102.17	62.96	67.33	-	-	3
PPM 114	114.63	73.75	80.00	71.60	-	3
PPM 126	107.69	64.58	73.12	71.43	-	3
PPM 115	117.39	64.41	75.00	70.24	-	3
TM 12697	108.33	59.59	70.00	66.00	-	3
PPM 116	93.10	68.37	78.35	71.13	-	4
PPM 124	105.46	66.67	77.27	77.27	-	4
PPM 125	107.14	71.25	87.36	85.00	-	4
TM Mt. Zebra Pk.	108.19	63.64	75.27	76.74	-	4
TM 94F	105.26	75.00	76.83	64.83	-	4
TM 2A	109.26	72.73	83.33	86.41	-	4
PPM 789	-	-	82.61	76.77	72.94	4
TM 753	103.64	68.18	77.42	79.17	73.08	4
TM 594	103.57	-	77.17	-	79.27	4
TM 12165	112.07	-	80.49	82.02	75.29	5
PPM 117	-	-	87.06	85.88	73.33	5
PPM 118	101.82	81.58	88.75	90.69	88.16	5
TM 866	101.75	81.01	84.34	80.00	76.14	5
TM 8289	96.55	76.67	88.50	80.31	74.72	6
Za 911	98.30	86.81	98.65	90.59	76.59	6
PPM 119	-	85.57	98.68	88.42	86.67	6
TM 657	114.03	72.81	90.69	82.79	79.12	6
PPM 122	-	79.61	101.35	94.25	80.43	6
TM 623	103.50	78.57	97.47	90.80	80.43	6
TM 6066	101.47	-	-	-	-	6
PPM 123	-	-	-	-	-	6

i) Measured at occlusal surface

TABLE XVI B

Mean Maximum and Minimum Crown Shape Indices of Mandibular teeth of Juvenile Specimens

	I_1	dp_4	M_1	M_2	M_3
Σx	1763.43	1042.06	1277.44	896.59	225.29
N	17	16	17	12	3
$\bar{x}$	103.73	65.12	75.14	74.71	75.09
MINIMUM	86.49	40.59	64.77	64.83	72.94
MAXIMUM	117.39	75.00	87.36	86.41	79.27

TABLE XVI C

Mean Maximum and Minimum Crown Shape Indices of Mandibular teeth of Adult Specimens

	I_1	P_4	M_1	M_2	M_3
Σx	829.49	642.63	915.98	865.75	790.88
N	8	8	10	10	10
$\bar{x}$	103.68	80.32	91.60	86.57	79.08
MINIMUM	96.55	72.81	80.49	80.00	73.33
MAXIMUM	114.03	86.03	101.35	94.25	88.16

TABLE XVI D

Mean Maximum and Minimum Crown Shape Indices of Mandibular Teeth of Sample

	I_1	dp_4/P_4	M_1	M_2	M_3
Σx	2592.92	1684.69	2193.42	1762.34	1016.17
N	25	24	27	22	13
$\bar{x}$	103.71	70.19	81.23	80.10	78.16
MINIMUM	86.49	40.59	64.77	64.83	72.94
MAXIMUM	117.39	86.81	101.35	94.25	88.16

TABLE XVI E

Maximum, minimum and mean crown shape indices at each growth stage in a sample of Hystrix africaeaustralis mandibular dentitions[i)]

		I_1	dp_4/P_4	M_1	M_2	M_3
		$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$
Growth	Max	100,00	67,01	66,67	-	-
Stage 2	Min	86,49	40,59	64,77	-	-
	Mean	94,40	57,73	65,46	-	-
	N	4	4	3	-	-
Growth	Max	117,39	73,75	80,00	71,60	-
Stage 3	Min	102,17	59,59	67,33	66,00	-
	Mean	110,04	65,06	73,09	69,82	-
	N	5	5	5	4	-
Growth	Max	109,26	75,00	87,36	86,46	79,27
Stage 4	Min	93,10	63,64	75,27	64,83	72,94
	Mean	104,45	69,41	79,51	77,16	75,09
	N	8	7	9	8	3
Growth	Max	112,07	81,58	88,75	90,69	88,16
Stage 5	Min	101,75	81,01	80,49	80,00	73,33
	Mean	105,21	81,29	85,16	84,65	78,23
	N	3	2	4	4	4
Growth	Max	114,03	86,81	101,35	94,25	86,67
Stage 6	Min	96,55	72,81	88,50	80,31	74,72
	Mean	102,77	80,00	95,89	87,86	79,66
	N	5	6	6	6	6
i) Measured at the occlusal surface						
Sample	SD	26,23	10,20	10,46	8,46	30,06
Sample	N	25	24	27	22	13

TABLE XVII

Measurements of the maxillary teeth in a sample of Hystrix africae-australis measured at the alveolar rim

Specimen	I^1		P^4		M^1		M^2		M^3		Growth
Number	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	Stage
PPM113	-	-	-	-	-	-	-	-	-	-	2
TM Nyasaland	3,3	4,5	8,2	6,2	8,7	7,5	-	-	-	-	2
TM5662	4,1	5,0	8,5	7,8	8,2	7,8	-	-	-	-	2
TM5661	4,5	5,0	8,9	7,7	8,2	8,3	-	-	-	-	2
TM12698	4,6	6,0	8,9	7,7	8,6	8,4	-	-	-	-	3
PPM114	4,7	5,6	6,9	7,4	7,7	8,0	8,4	7,5	-	-	3
PPM126	-	-	-	-	-	-	-	-	-	-	3
PPM115	4,9	6,1	7,6	7,4	7,5	8,0	8,5	7,5	-	-	3
TM12697	5,4	6,4	8,1	8,2	7,9	8,1	9,1	7,8	-	-	3
PPM116	-	-	8,7	7,9	9,1	8,8	9,1	8,7	-	-	4
PPM124	5,7	6,7	6,4	6,7	7,8	8,1	8,0	7,0	-	-	4
PPM125	-	-	-	-	-	-	-	-	-	-	4
TM Zeb.Pk.	6,1	7,0	7,6	7,2	7,4	7,9	7,0	8,1	-	-	4
TM94F	-	-	8,1	6,7	7,6	7,7	8,2	7,5	-	-	4
TM2A	6,0	6,9	7,0	8,0	8,1	9,3	9,0	-	-		4
PPM789	-	-	-	-	-	-	-	-	-	-	4
TM753	5,7	7,0	7,3	7,3	7,9	8,5	8,9	8,1	7,9	6,9	4
TM594	-	-	8,4	6,8	8,1	7,8	9,1	7,0	7,7	7,4	4
BPI/C682	5,4	7,1	6,7	9,8	10,0	10,0	9,1	10,4	9,1	8,1	4
TM12165	-	-	9,1	7,7	7,6	7,9	8,3	7,7	7,9	7,8	5
PPM117	5,6	6,6	-	-	7,5	8,5	7,9	7,7	7,7	6,6	5
TM866	-	-	9,7	8,0	6,9	7,8	8,0	8,1	8,4	7,3	5
PPM118	5,9	6,8	8,1	7,7	6,4	8,0	7,8	7,6	7,5	7,1	5
TM8289	6,0	7,4	8,5	8,5	7,1	8,7	8,4	8,8	8,8	7,8	6
PPM119	-	-	-	-	-	-	-	-	-	-	6
Za911	6,3	6,4	10,1	9,3	7,1	8,6	7,3	7,8	8,9	7,5	6
TM657	6,0	7,8	9,5	8,6	7,3	8,7	8,3	8,7	8,7	7,7	6
PPM122	6,6	7,5	11,1	9,1	7,0	10,0	7,7	9,3	8,2	8,1	6
TM623	-	-	10,3	9,1	5,9	8,6	7,7	8,8	8,7	8,6	6
BPI/C641	6,3	7,8	10,0	9,0	6,1	9,8	7,1	10,0	7,7	7,9	6
TM6066	7,3	8,1	-	-	-	-	-	-	-	-	6
TM123	-	-	7,2	9,1	6,7	9,0	7,0	8,0	7,5	7,0	6

Analysis of Table XVII

		I^1		P^4		M^1		M^2		M^3	
		MD	LL	MD	BL	MD	BL	MD	BL	MD	BL
Growth	Max	4,5	5,0	8,9	7,8	8,7	8,3	-	-	-	-
Stage 2	Min	3,3	4,5	8,2	6,2	8,2	7,5	-	-	-	-
	Mean	3,96	4,83	8,53	7,23	8,37	7,87	-	-	-	-
	N	3	3	3	3	3	3	-	-	-	-
Growth	Max	5,4	6,4	8,9	8,2	8,6	8,4	9,1	7,8	-	-
Stage 3	Min	4,6	5,6	6,9	7,4	7,5	8,0	8,4	7,5	-	-
	Mean	4,90	6,02	7,87	7,67	7,92	8,12	8,66	7,60	-	-
	N	4	4	4	4	4	4	3	3	-	-
Growth	Max	6,1	7,1	8,7	9,8	10,0	10,0	9,3	10,4	9,1	8,1
Stage 4	Min	5,4	6,7	6,4	6,7	7,4	7,7	7,0	7,0	7,7	6,9
	Mean	5,78	6,94	7,52	7,45	8,24	8,36	8,59	8,23	8,23	7,47
	N	5	5	8	8	8	8	8	7	3	3
Growth	Max	5,9	6,8	9,7	8,0	7,6	8,5	8,3	8,1	8,4	7,8
Stage 5	Min	5,6	6,6	8,1	7,7	6,4	7,8	7,8	7,7	7,5	6,6
	Mean	5,75	6,70	8,97	7,80	7,10	8,05	8,00	7,77	7,87	7,20
	N	2	2	3	3	4	4	4	4	4	4
Growth	Max	7,3	8,1	11,1	9,3	7,3	10,0	8,4	10,0	8,9	8,6
Stage 6	Min	6,0	6,4	7,2	8,5	5,9	8,6	7,0	7,8	7,5	7,0
	Mean	6,42	7,50	9,53	8,96	6,74	9,06	7,64	8,77	8,36	7,80
	N	6	6	7	7	7	7	7	7	7	7
Sample	Max	7,3	8,1	11,1	9,8	10,0	10,0	9,3	10,4	9,1	8,6
	Min	3,3	4,5	6,4	6,2	5,9	7,5	7,0	7,0	7,5	6,6
	Mean	5,52	6,59	8,43	7,92	7,63	8,40	8,19	8,23	8,19	7,56
	N	20	20	25	25	26	26	22	21	14	14
Sample	SD	0,94	0,99	1,22	0,85	0,88	0,70	0,70	0,90	0,56	0,55

TABLE XVIII

The area enclosed by the alveolar rims of the maxillary teeth in a sample of Hystrix africaeaustralis

Specimen Number	I^1 MD x LL	P^4 MD x BL	M^1 MD x BL	M^2 MD x BL	M^3 MD x BL	Growth Stage
PPM113	-	-	-	-	-	2
TM Nyasaland	14,85	50,84	65,25	-	-	2
TM5662	20,50	66,30	63,96	-	-	2
TM5661	22,50	68,53	68,06	-	-	2
TM12698	27,60	68,53	72,24	-	-	3
PPM114	26,32	51,06	61,60	63,00	-	3
PPM126	-	-	-	-	-	3
PPM115	29,89	56,24	60,00	63,75	-	3
TM12697	34,56	66,24	63,99=	70,98	-	3
PPM116	-	68,73	80,08	79,17	-	4
PPM124	38,19	42,88	63,18	56,00	-	4
PPM125	-	-	-	-	-	4
TM Zeb.Pk.	42,70	54,72	58,46	56,70	-	4
TM94F	-	54,27	58,52	61,50	-	4
TM2A	41,40	50,40	64,80	83,70	-	4
PPM789	-	-	-	-	-	4
TM753	39,90	53,29	67,15	72,09	54,51	4
TM594	-	57,12	63,18	63,70	56,98	4
BPI/C682	38,34	65,66	100,00	94,64	73,71	4
TM12165	-	70,07	60,04	63,91	61,62	5
PPM117	36,96	-	63,75	60,83	50,82	5
TM866	-	77,60	53,82	64,80	61,32	5
PPM118	40,12	62,37	51,20	59,28	53,25	5
TM8289	44,40	72,25	61,77	73,92	68,64	6
PPM119	-	-	-	-	-	6
Za911	40,32	93,93	61,06	56,94	66,75	6
TM657	46,80	81,70	63,51	72,21	66,99	6
PPM122	49,50	101,01	70,00	71,61	66,42	6
TM623	-	91,00	49,88	67,76	74,82	6
BPI/C641	49,14	90,00	59,78	71,00	60,83	6
TM6066	59,13	-	-	-	-	6
PPM123	-	65,52	62,10	56,00	52,50	6

(square mm)

Analysis of Table XVIII

		I^1 MD x LL	P^4 MD x BL	M^1 MD x BL	M^2 MD x BL	M^3 MD x BL
Growth Stage 2	Max	22,5	68,53	68,06	-	-
	Min	14,85	50,84	65,25	-	-
	Mean	19,28	61,89	65,76	-	-
	N	3	3	3	-	-
Growth Stage 3	Max	34,56	68,53	72,24	70,98	-
	Min	27,60	66,42	63,99	63,00	-
	Mean	29,59	60,56	64,46	65,91	-
	N	4	4	4	3	-
Growth Stage 4	Max	42,70	68,73	100,00	94,64	73,71
	Min	38,19	42,88	58,46	56,00	54,51
	Mean	40,11	55,88	69,42	70,94	61,73
	N	5	8	8	8	3
Growth Stage 5	Max	40,12	77,60	63,75	64,80	61,62
	Min	36,96	62,37	51,20	59,28	50,82
	Mean	38,54	70,01	57,20	62,20	56,75
	N	2	3	4	4	4
Growth Stage 6	Max	59,13	101,01	70,00	73,92	74,82
	Min	40,32	65,52	49,88	56,00	52,50
	Mean	48,04	85,06	61,16	67,06	65,28
	N	6	7	7	7	7
Sample	Max	59,13	101,01	100,00	94,64	74,82
	Min	14,85	42,88	49,88	56,00	50,82
	Mean	37,16	67,22	64,13	67,43	62,08
	N	20	25	26	22	14
Sample	SD	10,91	15,10	11,82	9,69	7,78

TABLE XIX

The crown shape indices of the upper teeth in a sample of Hystrix africaeaustralis measured at the alveolar rim

Specimen Number	I^1 $\frac{LL}{MD} \times 100$	P^4 $\frac{BL}{MD} \times 100$	M^1 $\frac{BL}{MD} \times 100$	M^2 $\frac{BL}{MD} \times 100$	M^3 $\frac{BL}{MD} \times 100$	Growth Stage
PPM113	-	-	-	-	-	2
TM Nyasaland	136,00	76,00	86,00	-	-	2
TM5662	121,95	91,76	95,12	-	-	2
TM5661	111,11	86,52	101,22	-	-	2
TM12698	130,43	86,52	97,67	-	-	3
PPM114	119,15	107,25	103,90	89,28	-	3
PPM126	-	-	-	-	-	3
PPM115	124,49	97,37	106,66	88,23	-	3
TM12697	118,52	101,23	102,53	85,71	-	3
PPM116	-	90,80	96,70	95,60	-	4
PPM124	118,00	105,00	104,00	88,00	-	4
PPM125	-	-	-	-	-	4
Mt. Zeb. Pk.	114,75	94,74	106,76	115,71	-	4
TM94F	-	82,72	101,31	91,46	-	4
TM2A	115,00	102,86	101,25	96,77	-	4
PPM789	-	-	-	-	-	4
TM753	122,81	100,00	107,59	91,01	87,34	4
TM594	-	80,95	96,29	76,92	96,10	4
BPI/C682	131,00	146,00	100,00	114,00	89,00	4
TM12165	-	84,61	103,94	92,77	98,73	5
PPM117	117,86	-	113,33	97,46	85,71	5
TM866	-	82,47	113,04	101,25	86,90	5
PPM118	115,25	95,06	125,00	97,43	94,66	5
TM8289	123,33	100,00	122,53	104,76	88,63	6
PPM119	-	-	-	-	-	6
Za911	101,59	92,08	121,12	106,84	84,26	6
TM657	130,00	90,53	119,17	104,81	88,50	6
PPM122	114,00	82,00	143,00	121,00	99,00	6
TM623	-	91,00	145,76	114,28	98,85	6
BPI/C641	124,00	90,00	161,00	141,00	103,00	6
TM6066	110,96	-	-	-	-	6
PPM123	-	126,00	130,00	114,00	93,00	6

Analysis of Table XIX

		I^1	P^4	M^1	M^2	M^3
		MD/LL x 100	MD/BL x 100	MD/BL x 100	MD/BL x 100	MD/BL x 100
Growth	Max	136,00	91,76	101,22	-	-
Stage 2	Min	111,11	76,00	86,00	-	-
	Mean	123,02	84,76	94,11	-	-
	N	3	3	3	-	-
Growth	Max	130,43	107,25	106,66	89,28	-
Stage 3	Min	118,52	86,52	97,67	85,71	-
	Mean	123,14	98,09	102,69	87,74	-
	N	4	4	4	3	-
Growth	Max	131,00	146,00	107,59	115,71	96,10
Stage 4	Min	114,75	80,95	96,29	76,92	87,34
	Mean	120,31	100,38	101,74	96,18	90,81
	N	5	8	8	8	8
Growth	Max	117,86	95,06	125,00	101,25	98,73
Stage 5	Min	115,25	82,47	103,94	92,77	85,71
	Mean	116,56	87,38	113,83	97,23	91,50
	N	2	3	4	4	4
Growth	Max	130,00	126,00	161,00	141,00	103,00
Stage 6	Min	101,59	82,00	119,17	104,76	84,26
	Mean	117,31	95,94	134,65	115,24	93,61
	N	6	7	7	7	7
Sample	Max	136,00	146,00	161,00	141,00	103,00
	Min	101,59	76,00	86,00	76,92	84,26
	Mean	120,01	95,34	111,75	101,29	92,41
	N	20	25	26	22	14
Sample	SD	8,17	14,92	17,59	14,48	5,98

TABLE XX

Measurements of the mandibular teeth in a sample of Hystrix africae-australis measured at the alveolar rim

Specimen	I_1		P_4		M_1		M_2		M_3		Growth
Number	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	Stage
PPM113	3,7	3,2	8,7	5,6	-	-	-	-	-	-	2
TM Nyasaland	3,1	2,9	8,2	6,2	9,0	7,0	-	-	-	-	2
TM5662	4,1	4,0	9,4	7,1	8,7	7,3	-	-	-	-	2
TM5661	4,4	4,4	9,0	6,8	8,8	7,5	-	-	-	-	2
TM12698	4,6	4,7	9,6	7,1	9,8	8,1	-	-	-	-	3
PPM114	4,1	4,7	8,0	6,1	7,6	7,1	8,7	7,2	-	-	3
PPM126	5,2	5,6	8,6	5,3	9,1	7,7	10,1	7,0	-	-	3
PPM115	4,5	5,4	8,8	6,3	8,1	7,3	8,7	7,9	-	-	3
TM12697	4,8	5,2	9,0	6,8	9,3	7,6	9,6	7,3	-	-	3
PPM116	5,8	5,4	9,7	7,0	9,1	8,0	9,9	8,4	-	-	4
PPM124	5,5	5,8	9,6	5,7	8,5	8,5	9,6	8,6	8,1	6,4	4
PPM125	5,6	6,0	8,8	6,8	7,5	8,0	8,8	7,9	8,7	7,2	4
TM Zeb.Pk.	6,1	6,0	8,9	6,5	8,3	7,9	8,4	7,8	-	-	4
TM94F	-	-	-	-	7,9	7,3	8,7	7,4	8,0	5,2	4
TM2A	5,4	5,9	8,3	6,9	8,8	8,3	9,7	9,2	8,4	8,0	4
PPM789	6,1	-	9,7	6,0	9,3	7,6	9,6	8,0	9,5	7,8	4
TM753	5,5	5,7	-	-	8,1	7,7	9,6	7,6	9,1	7,8	4
TM594	5,6	5,8	-	-	9,2	7,3	-	-	8,7	7,6	4
BPI/C682	6,0	5,9	10,4	7,3	8,6	8,6	9,8	8,9	9,7	7,8	4
TM12165	5,8	6,5	8,6	6,6	7,6	7,0	8,7	8,5	8,3	7,5	5
PPM117	-	-	8,7	8,1	8,1	7,5	8,4	8,0	8,1	8,2	5
TM866	5,7	5,8	8,9	7,5	7,8	7,1	8,2	7,8	9,0	7,5	5
PPM118	5,5	5,6	9,3	8,0	7,2	8,0	8,3	8,3	8,1	6,9	5
TM8289	5,8	5,6	10,2	8,2	8,1	7,9	9,3	8,7	8,9	7,2	6
PPM119	-	-	10,4	8,6	7,3	7,6	8,7	9,0	8,5	8,0	6
Za911	5,9	5,8	10,1	8,1	7,5	7,3	8,3	7,7	9,3	7,3	6
TM657	5,7	6,5	10,6	8,0	7,4	7,8	8,0	7,8	8,9	7,5	6
PPM122	-	-	10,8	8,6	7,1	7,2	8,1	7,8	8,0	6,9	6
TM623	-	-	10,7	8,2	6,5	7,8	7,7	8,4	8,9	8,5	6
BPI/C641	-	-	-	-	-	-	-	-	-	-	6
TM6066	6,8	6,9	-	-	-	-	-	-	-	-	6
PPM123	-	-	-	-	-	-	-	-	-	-	6

Analysis of Table XX

		I_1		P_4		M_1		M_2		M_3	
		MD	LL	MD	BL	MD	BL	MD	BL	MD	BL
Growth	Max	4,6	4,4	9,4	7,1	9,0	7,5	-	-	-	-
Stage 2	Min	3,1	2,9	8,2	5,6	8,7	7,0	-	-	-	-
	Mean	3,83	3,63	8,83	6,43	8,83	7,27	-	-	-	-
	N	4	4	4	4	3	3	-	-	-	-
Growth	Max	5,2	5,6	9,6	7,1	9,8	8,1	10,1	7,9	-	-
Stage 3	Min	4,1	4,7	8,0	5,3	7,6	7,1	8,7	7,0	-	-
	Mean	4,66	5,12	8,80	6,32	8,78	7,56	9,28	7,35	-	-
	N	5	5	5	5	5	5	4	4	-	-
Growth	Max	6,1	6,0	10,4	7,3	9,3	8,6	9,9	9,2	9,7	8,0
Stage 4	Min	5,4	5,4	8,3	5,7	7,5	7,3	8,4	7,4	8,0	6,4
	Mean	5,73	5,81	9,34	6,60	8,53	7,92	9,34	8,20	8,78	7,23
	N	9	8	7	7	10	10	9	9	8	8
Growth	Max	5,8	6,5	9,3	8,1	8,1	8,0	8,7	8,5	9,0	8,2
Stage 5	Min	5,5	5,6	8,6	6,6	7,2	7,0	8,2	7,8	8,1	6,9
	Mean	5,67	5,97	8,88	7,55	7,68	7,4	8,4	8,15	8,38	7,53
	N	3	3	4	4	4	4	4	4	4	4
Growth	Max	6,8	6,9	10,8	8,6	8,1	7,9	9,3	9,0	9,3	8,5
Stage 6	Min	5,7	5,6	10,1	8,0	6,5	7,2	7,7	7,7	8,0	6,9
	Mean	6,05	6,20	10,47	8,28	7,32	7,60	8,35	8,23	8,75	7,57
	N	4	4	6	6	6	6	6	6	6	6
Sample	Max	6,8	6,9	10,8	8,6	9,8	8,6	10,1	9,2	9,7	8,5
	Min	3,1	2,9	8,0	5,3	6,5	7,0	7,7	7,0	8,0	6,4
	Mean	5,25	5,39	9,35	7,05	8,23	7,64	8,91	8,05	8,68	7,41
	N	25	24	26	26	28	28	23	23	18	18
	SD	0,87	0,97	0,82	0,05	0,83	0,51	0,70	0,59	0,53	0,75

TABLE XXI

The area enclosed by the alveolar rims in a sample of the mandibular teeth of Hystrix africaeaustralis

Specimen Number	I_1 MD x LL	P_4 MD x BL	M_1 MD x BL	M_2 MD x BL	M_3 MD x BL	Growth Stage
PPM113	11,84	48,72	-	-	-	2
TM Nyasaland	8,99	50,84	63,00	-	-	2
TM5662	16,40	66,74	63,51	-	-	2
TM5661	19,36	61,20	66,00	-	-	2
TM12698	21,62	68,16	79,38	-	-	3
PPM114	19,27	48,80	53,96	62,64	-	3
PPM126	29,12	45,58	70,07	70,70	-	3
PPM115	24,84	55,44	59,13	68,73	-	3
TM12697	24,96	61,20	70,68	70,08	-	3
PPM116	31,32	67,90	72,80	83,16	-	4
PPM124	31,90	54,72	72,25	82,56	51,84	4
PPM125	33,60	99,84	60,00	69,52	62,64	4
TM Zeb. Pk.	36,60	57,85	65,57	65,52	-	4
TM94F	-	-	57,67	64,38	41,60	4
TM2A	31,85	57,27	73,04	89,24	67,20	4
PPM789	-	58,20	70,68	76,80	74,10	4
TM753	31,35	-	62,37	72,96	70,98	4
TM594	32,48	-	67,16	-	66,12	4
BPI/C682	35,40	75,90	73,96	87,22	71,78	4
TM12165	37,70	56,76	53,20	73,95	62,25	5
PPM117	-	70,47	60,75	67,20	66,42	5
TM866	33,06	66,75	57,51	63,96	67,50	5
PPM118	30,80	74,40	57,60	68,89	55,89	5
TM8289	32,48	83,64	63,99	80,91	64,08	6
PPM119	-	89,44	55,48	78,30	68,00	6
Za911	34,22	81,81	54,75	63,91	67,89	6
TM657	37,05	84,80	57,72	62,40	66,75	6
PPM122	-	92,88	51,12	63,18	55,20	6
TM623	-	87,74	50,70	64,68	75,65	6
BPI/C641	-	-	-	-	-	6
TM6066	46,92	-	-	-	-	6
PPM123	-	-	-	-	-	6

Analysis of Table XXI (square mm)

		I_1	P_4	M_1	M_2	M_3
		MD x LL	MD x BL	MD x BL	MD x BL	MD x BL
Growth	Max	19,36	66,74	66,00	-	-
Stage 2	Min	8,99	50,84	63,00	-	-
	Mean	14,15	56,88	64,17	-	-
	N	4	4	3	-	-
Growth	Max	29,12	68,16	79,38	70,80	-
Stage 3	Min	19,27	45,58	53,96	62,64	-
	Mean	23,96	55,84	53,92	68,04	-
	N	5	5	5	4	-
Growth	Max	36,60	75,90	73,96	89,24	74,10
Stage 4	Min	31,32	54,72	57,67	64,38	41,60
	Mean	33,06	61,67	67,55	76,82	63,28
	N	8	7	10	9	8
Growth	Max	37,70	74,40	60,75	73,95	67,50
Stage 5	Min	30,80	56,76	53,20	63,96	55,89
	Mean	33,85	67,10	57,27	68,50	63,02
	N	3	4	4	4	4
Growth	Max	46,92	92,88	63,99	80,91	75,65
Stage 5	Min	32,48	81,81	50,70	62,40	55,20
	Mean	37,67	86,72	55,63	68,90	66,26
	N	4	6	6	6	6
Sample	Max	46,92	92,88	79,38	89,24	75,65
	Min	8,99	45,58	50,70	62,40	41,60
	Mean	28,88	67,96	63,00	71,78	64,22
	N	24	26	28	23	18
	SD	8,87	15,12	7,73	8,27	8,46

TABLE XXII

The crown shape indices of the mandibular teeth in a sample of Hystrix africaeaustralis measured at the alveolar rim

Specimen Number	I_1 $\frac{LL}{MD} \times 100$	P_4 $\frac{BL}{MD} \times 100$	M_1 $\frac{BL}{MD} \times 100$	M_2 $\frac{BL}{MD} \times 100$	M_3 $\frac{BL}{MD} \times 100$	G/S
PPM113	86,49	64,37	-	-	-	2
TM Nyasaland	94,00	76,00	78,00	-	-	2
TM5662	97,56	75,53	83,91	-	-	2
TM5661	100,00	75,55	85,23	-	-	2
TM12698	102,17	73,96	82,65	-	-	3
PPM14	114,63	76,25	93,42	82,76	-	3
PPM126	108,00	62,00	85,00	69,00	-	3
PPM115	117,39	71,59	90,12	90,80	-	3
TM1269	108,33	75,55	81,72	76,04	-	3
PPM116	93,10	72,16	87,91	84,85	-	4
PPM124	105,00	59,00	100,00	90,00	79,00	4
PPM125	107,00	77,00	107,00	90,00	83,00	4
TM Mt.Zeb.Pk.	108,19	73,03	95,18	92,86	-	4
TM94F	-	-	92,40	85,06	65,00	4
TM2A	109,26	83,13	94,32	94,84	95,24	4
PPM789	-	62,00	75,00	83,00	82,00	4
TM753	103,64	-	95,06	79,17	85,71	4
TM594	103,57	-	79,35	-	87,36	4
BPI/C682	98,00	70,00	100,00	91,00	80,00	4
TM12165	112,07	76,74	92,10	97,70	90,36	5
PPM117	-	93,10	92,59	95,24	101,23	5
TM866	101,75	84,27	91,03	95,12	83,33	5
PPM118	101,82	86,02	111,11	100,00	85,18	5
TM8289	96,55	80,39	97,53	93,55	80,90	6
PPM119	-	82,69	104,11	103,45	93,12	6
Za911	98,30	80,20	97,33	92,77	78,49	6
TM657	114,03	75,47	105,40	97,50	84,27	6
PPM122	-	80,00	101,00	96,00	86,00	6
TM623	-	76,64	120,40	109,09	95,50	6
BPI/C641	-	-	-	-	-	6
TM6066	101,47	-	-	-	-	6
PPM123	-	-	-	-	-	6

Analysis of Table XXII

		I_1	P_4	M_1	M_2	M_3
		$\frac{LL}{MD}$ x 100	$\frac{BL}{MD}$ x 100	$\frac{BL}{MD}$ x 100	$\frac{BL}{MD}$ x 100	$\frac{BL}{MD}$ x 100
Growth	Max	100,00	76,00	85,23	-	-
Stage 2	Min	86,49	64,37	78,00	-	-
	Mean	94,51	72,86	82,38	-	-
	N	4	4	3	-	-
Growth	Max	117,39	76,25	93,42	90,80	-
Stage 3	Min	102,17	62,00	81,72	69,00	-
	Mean	110,10	71,87	86,58	79,65	-
	N	5	5	5	4	-
Growth	Max	109,26	83,13	107,00	94,84	95,24
Stage 4	Min	93,10	59,00	75,00	79,17	65,00
	Mean	103,47	70,90	92,62	87,86	82,16
	N	8	7	10	9	8
Growth	Max	112,07	93,10	111,11	100,00	101,23
Stage 5	Min	101,75	76,74	91,03	95,12	83,33
	Mean	105,21	85,03	96,71	97,02	90,03
	N	3	4	4	4	4
Growth	Max	114,03	82,69=	120,40	109,09	95,50
Stage 6	Min	96,55	75,47	97,33	92,77	78,49
	Mean	102,59	79,23	104,30	98,73	86,55
	N	4	6	6	6	6
Sample	Max	117,39	93,10	120,40	109,09	101,23
	Min	86,49	59,00	75,00	69,00	65,00
	Mean	103,43	75,49	93,17	90,86	85,37
	N	24	26	28	23	18
	SD	7,24	7,76	10,60	9,03	8,16

APPENDIX VIII

CRANIAL, MANDIBULAR AND DENTAL MEASUREMENTS OF THE SOUTH AFRICAN HYSTRICID MATERIAL

APPENDIX VIII

CONTENTS

Page

A. CRANIAL MEASUREMENTS

Position of sphenopalatine foramen 151
Mesial sutural length of premaxilla ventrally 155
Palatal length of premaxilla medially, in front of foramina incisiva 155
Upper diastemic length 155
Median sutural length of palate 155
Median sutural length of maxillary 155
Width of palate between dp^4/P^4, M^1, M^2 and M^3 155
Length and breadth of foramina incisiva 156

B. MANDIBULAR MEASUREMENTS

Greatest length of mandible 156
Depth of mandibular ramus below dp_4/P_4, M_1, M_2 156
Alveole of dp_4/P_4 to foramen mentale 157
Length of diastema 157
Curvature of diastema 157
Position of top of mesial symphysis in relation to alveolar plane of molars 158

C. DENTAL MEASUREMENTS

Width of palate in relation to width of teeth 158
Length of maxillary tooth row, measured at the occlusal surface 158
Length of the mandibular tooth row, measured at the occlusal surface 158
Length of maxillary tooth row, measured at the alveolar rim. 159
Length of mandibular tooth row, measured at the alveolar rim 159
Curvature of upper incisors 159
Curvature of lower incisors 159
Crown height of maxillary teeth 160
Crown height of mandibular teeth 161

Page

DENTAL MEASUREMENTS (continued)

The MD and LL diameters of the upper incisors 161
The MD and LL diameters of the lower incisors 162
The crown occlusal areas of the upper incisors 163
The crown occlusal areas of the lower incisors 163
The crown shape indices of the fossil upper incisors 164
The crown shape indices of the fossil lower incisors 164
The MD and BL diameters of the maxillary teeth measured at the occlusal surface 166
The crown occlusal areas of the maxillary teeth measured at the occlusal surface 168
The crown shape indices of the maxillary teeth measured at the occlusal surface 170
The MD and BL diameters of the mandibular teeth measured at the occlusal surface 172
The crown occlusal areas of the mandibular teeth, measured at the occlusal surface 174
The crown shape indices of the mandibular teeth, measured at the occlusal surface 176

APPENDIX VIII

CRANIAL, MANDIBULAR AND DENTAL MEASUREMENTS OF SOUTH AFRICAN FOSSIL HYSTRICID MATERIAL

Asterisked measurements denote estimates due to fracture, distortion or displacement. Measurements marked with a double asterisk indicate uncertain tooth identifications; in such cases the measurement has also been included (bracketed) under the measurement column of the most likely alternative tooth. Descriptions of the cranial, mandibular and dental morphology of the various fossil forms have been provided in the main text; measurements only are given below. The species assignations of the various specimens are shown in Table I (this Appendix) and in section 14.3 of the main text. The text section where a parameter definition and method of measurement may be found and the figure(s) illustrating the parameter are indicated in brackets after each measurement title. The code letters prefixing the specimen numbers indicate the following localities:

M - Makapansgat Limeworks, all breccias
STS - Sterkfontein Type Site Locality
SFN - Sterkfontein, various dumps
SK - Swartkrans, Member I (Primary) and Member II (Secondary) breccias
KA - Kromdraai Faunal Locality

The exact breccial source within each deposit from which the specimens have been derived is discussed in Appendix II.

The age class to which each specimen belongs is indicated with each measurement.

A. CRANIAL MEASUREMENTS

Position of sphenopalatine foramen (7.2.1.17)

M1004 (growth stage 6) = 18,2mm above buccal alveolar rim of M^2, 1/3 of length from front

M1804 (growth stage 6) = 17,0mm above centre of buccal alveolar rim of M^2

M1805 (growth stage 5) = 15,0mm* above the junction of the buccal alveolar rims of M^1 and M^2

TABLE I

SPECIES ALLOCATIONS OF THE FOSSIL MATERIAL*

Site and Horizon	Hystrix africaeaustralis	Hystrix makapanensis	Xenohystrix crassidens
MAKAPANSGAT LIMEWORKS			
Grey breccia or			
Member 3:	M1000	M1001?	M1003?-M1009
	M1001?	M1002	M1010?
	M1016	M1003?	M1011-M1013
	M1806	M1811	M1015
	M1807	M1812	M1802-M1805
	M1817-M1823	M1815	M1808-M1810
	M1825	M2516?	M1813
	M2527	M2526?	M1814
	M8291-M8294	M8220?	M1816
		M8290	M1824
		M8362?	M2516?
			M2517-M2523
			M2525
			M8220?
			M8233
			M8276?
			M8286
			M8287-M8289
			M8362?
			M8363
			M8364
Pink breccia or			
Member 4:	M8277	M8278	M8281
		M8282?	M8282?
Phase II breccia or			
Member 5:	M8284		
	M8285		

* Queried specimens have been discussed fully in the main text (Chapter 14) and under the relevant species in Appendix X.

Continued/..

Site and Horizon	Hystrix africaeaustralis	Hystrix makapanensis	Xenohystrix crassidens
STERKFONTEIN			
Type Site Locality:	STS957a-e		
	STS 1622		
	STS2061		
	STS2078		
	STS2095		
Dump 1:	SFN1-5		
Dump 2:	SFN6		
Dump 8:	SFN8 - SFN14		
	SFN15?	SFN15?	
	SFN16		
Dump 10:	SFN17?	SFN17?	
Dump 13:	SFN7		
SWARTKRANS			
Pink breccia or			
Member 1:	SK2466a		
	SK2466b		
	SK2875		
	SK3082		
	SK4315		
	SK14236		
	SK14237?	SK14237?	
Brown breccia or			
Member 2:	SK2040		
	SK2045		
	SK2835		
	SK3063		
	SK6945		
	SK7155		
	SK14235		
	SK14238		

Site and Horizon	Hystrix africaeaustralis	Hystrix makapanensis	Xenohystrix crassidens
KROMDRAAI A			
Fine-grained breccia:	KA757		
	KA1432		
	KA1607		
	KA1912?	KA1912?	

Mesial sutural length of premaxilla ventrally (7.2.2.4, Fig. 48T)

M1006 (growth stage 5 or 6) = 35,2mm*

SK2835 (growth stage unknown probably 3 or 4) = 17,0mm*

Palatal length of premaxilla medially, in front of foramina incisiva (7.2.2.5, Fig. 48U)

M1006 (growth stage 5 or 6) = 18,5mm*

SK2835 (growth stage unknown probably 3 or 4) = 10,7mm*

Upper diastemic length (7.2.7.1, Fig. 48V)

M1006 (growth stage 5 or 6) = 58,0mm*

SK2835 (growth stage unknown probably 3 or 4) = 40,3mm*

Median sutural length of palate (7.2.7.2, Fig. 48W)

An approximation of this measurement (100mm) was obtained for Xenohystrix crassidens from the reconstruction of the palatal view of its cranium (Fig. 130), at growth stage 6.

Median sutural length of maxillary (7.2.7.3, Fig. 48X)

An approximation of this measurement (67mm) was obtained for Xenohystrix crassidens from the reconstruction of the palatal view of its cranium (Fig. 130), at growth stage 6.

Width of palate between dp^4/P^4, M^1, M^2 and M^3 (7.2.7.4 - 7.2.7.7, Fig. 48Y, Z, A^1 and B^1)

SK 3082 (late growth stage 4 or growth stage 5) Between M^2 = 15,0mm

Between M^3 = 15,7mm*

Approximations of these palatal widths were obtained for Xenohystrix crassidens from the reconstruction of the palatal view of its cranium (Fig.), at growth stage 6:

Palatal width between P^4 = 13,0mm*

Palatal width between M^1 = 12,5mm*

Palatal width between M^2 = 16,0mm*

Palatal width between M^3 = 19,0mm*

Length and breadth of foramina incisiva (7.2.7.10, Fig. 48)

M1006	(growth stage 5 or 6)	length	=	15,0mm
		breadth	=	9,5mm (i.e. twice foramen width to midline)
SK2835		length	=	7,0mm
		breadth	=	6,6mm

B. MANDIBULAR MEASUREMENTS

Greatest length of mandible (7.2.12.1, Fig. 56 B^2)

Approximations of this measurement were obtained from reconstructions of the mandible from the following mandibular fragments:

M1007	(growth stage 5)	=135,0mm*
STS957a	(growth stage 3)	= 90,5mm*
SK3063	(growth stage 6)	=100,5mm*
KA757	(growth stage 5)	= 97,6mm*

Depth of mandibular ramus below dp_4/P_4, M_1, and M_2 (7.2.12.4 to 7.2.12.6, Fig. 56 E^2, F^2 and G^2)

		dp_4/p_4	M_1	M_2	
M1002	(growth stage 6)	26,9	-	-	mm
M1007	(growth stage 5)	38,3	40,6	-	mm
M1802	(growth stage 5)	32,2*	-	-	mm
M1803	(growth stage 6)	39,2	39,7	-	mm
M8278	(growth stage 6)	23,8	-	-	mm
M8277	(growth stage 6)	22,7*	-	-	mm
M8281	(growth stage 2)	20,4	-	-	mm
STS957a	(growth stage 3)	20,3	19,6	17,3*	mm
STS957c	(growth stage 3)	20,0	-	-	mm
STS2095	(growth stage 6)	22,9*	-	-	mm
SK3063	(growth stage 6)	26,5*	30,0	29,0	mm
SK6945	(growth stage 4)	25,9	-	-	mm
SK14235	(growth stage 6)	23,8	22,7*	-	mm
KA757	(growth stage 5)	23,7*	-	-	mm
KA1432	(growth stage 3)	21,0*	-	-	mm

Alveole of dp_4 or P_4 to foramen mentale (7.2.12.7, Fig. 56 H^2)

M1002	(growth stage 6)	10,0mm
M1007	(growth stage 5)	12,0mm*
M1008	(growth stage 6)	12,0mm*
M1802	(growth stage 6)	12,0mm*
M1803	(growth stage 6)	12,0mm
M8278	(growth stage 6)	9,5mm*
M8277	(growth stage 6)	9,2mm
M8281	(growth stage 2)	6,0mm
STS957a	(growth stage 3)	8,7mm
STS957c	(growth stage 3)	8,3mm
STS2095	(growth stage 6)	10,3mm*
SK3063	(growth stage 6)	8,4mm*
SK14235	(growth stage 6)	10,4mm
KA757	(growth stage 5)	9,0mm
KA1432	(growth stage 3)	9,0mm

Length of diastema (7.2.12.9, Fig. 56 I^2)

M1002	(growth stage 6)	34,0mm
M1007	(growth stage 5)	30,0mm*
M1008	(growth stage 6)	30,1mm*
M1803	(growth stage 6)	29,0mm*
M8277	(growth stage 6)	35,0mm
M8281	(growth stage 2)	13,0mm*
STS957a	(growth stage 3)	19,4mm*
STS2095	(growth stage 6)	30,3mm

Curvature of diastema (7.2.12.10, Fig. 112)

M1002	(growth stage 6)	26%
M1007	(growth stage 5)	32%*
M1008	(growth stage 6)	30%*
M1803	(growth stage 6)	38%*
M8277	(growth stage 6)	25%
M8281	(growth stage 2)	31%*
STS957a	(growth stage 3)	23%
STS2095	(growth stage 6)	26%

Position of top of mesial symphysis in relation to alveolar plane of molars (7.2.12.13, Fig. 56 K^2)

M1002	(growth stage 6)	3,0mm above alveolar plane of molars
M1007	(growth stage 5)	10,0mm above alveolar plane of molars
M1008	(growth stage 6)	9,0mm above alveolar plane of molars
M1603	(growth stage 6)	12,0mm above alveolar plane of molars
M8277	(growth stage 6)	1,5mm above alveolar plane of molars
M8281	(growth stage 2)	5,2mm above alveolar plane of molars
STS957a	(growth stage 3)	Flush with alveolar plane of molars?
STS2095	(growth stage 6)	Flush with alveolar plane of molars?

C. DENTAL MEASUREMENTS

Width of palate in relation to width of teeth (7.2.13.5)

This could only be estimated for Xenohystrix crassidens (132%) based on the reconstruction of the palatal view of its cranium (Fig. 130) at growth stage 6, and for SK3082 (Hystrix africae-australis,185%), growth stage 4 or 5, based on the reconstruction of a palate from this specimen.

Length of maxillary cheek tooth row, measured at the occlusal surface (7.2.13.6)

STS2078 (early growth stage 5) = 30,4mm

An estimate (52,0 mm) of this parameter was obtained for Xenohystrix crassidens, based on the reconstructed palatal view of its cranium (Fig.130).

Length of mandibular cheek tooth row, measured at the occlusal surface (7.2.13.6

M1007	(growth stage 5)	=	53,6mm*
M1802	(growth stage 5)	=	48,1mm
M8277	(growth stage 6)	=	35,0mm
STS957a	(growth stage 3)	=	28,1mm
SK3063	(growth stage 6)	=	37,3mm
KA757	(growth stage 5)	=	32,3mm
KA1432	(growth stage 3)	=	30,0mm

Length of maxillary cheek tooth row, measured at the alveolar rim (7.2.13.7)

STS2078 (early growth stage 5) = 31,5mm*

Length of mandibular cheek tooth row, measured at the alveolar rim (7.2.13.7)

M1007	(growth stage 5)	= 53,6mm*
M1802	(growth stage 5)	= 50,6mm
M8277	(growth stage 6)	= 36,6mm
STS957a	(growth stage 3)	= 30,3mm
SK3063	(growth stage 6)	= 40,0mm
KA757	(growth stage 5)	= 32,8mm
KA1432	(growth stage 3)	= 32,3mm

Curvature of upper incisors (7.2.13.10)

All growth stages of the isolated upper incisors are uncertain.

M1001	r[i)]	= 20,0mm
M1006	r	=+-20,0mm*
M1009	r	= 20,0mm
M1012	r	= 17,5mm
M2520	r	= 17,5mm
M2522	r	= 22,5mm*
M2526	r	= 15,0mm
M2527	r	= 12,5mm
M8293	r	= 15,0mm
M8294	r	= 10,0mm
SK2045	r	= 20,0mm
SK4315	r	= 15,0mm

Curvature of lower incisors (7.2.13.10)

The growth stages to which the isolated lower incisors belong are uncertain

M1012	r	= 50,0mm
M2519	r	= 50,0mm*
M2521	r	= 52,5mm
M2523	r	= 55,0mm
M2525	r	= 30,0mm*

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i) r = radius of curvature

M8233	r	=	47,5mm*
M8362	r	=	50,0mm*
M8363	r	=	50,0mm
STS 2095	r	=	52,5mm*
SK 2875	r	=	52,5mm*

Crown height of maxillary teeth (7.2.13.11) (in mm.)

Specimen	Growth stage	dp^4/p^4	M^1	M^2	M^3
M1004	6		12,6		
M1011	6				14,4
M1016	3			17,8	
M1805	5		16,9	16,5*	
M1809	6	18,0			
M1812	6	24,8			
M1820	4			21,3	
M1821	4				21,2*
M1823	6				17,8
M1824	6	11,3			
M2518	6				17,8
M8284	4				15,7
M8285	4				16,4
M8287	6				17,6
M8288	5			23,4**	(23,4)**
M8289	5		21,4**	(21,4)**	
STS1622	4				17,8
STS2078	4-5	22,6*			
SFN6	6				11,8
SFN7	6				19,6*
SFN11	6		9,6		
SFN12	4				19,0*
SFN16	6		14,8*		
SK2040	3-4				19,0*
SK2466a	5				20,0*
SK2466b	5			19,0*	

Crown height of mandibular teeth: (7.2.13.11)(in mm.)

Specimen	Growth stage	dp_4/P_4	M_1	M_2	M_3
M1007	5				
M1008	6	18,2*			
M1010	6	(14,2)**			14,2**
M1808	5	20,3			
M1810	6	17,3*			
M1811	6	20,0			
M1813	6	18,7			
M1814	6			12,6	
M1815	6	21,6			
M1817	5			15,2	
M2516	6				10,0
M2517	5		20,0		
M8276	6				15,0
M8286	6			11,4	
M8364	6				10,2
SFN4	5			12,7	
SFN5	2-3		15,3**	(15,3)**	(15,3)**
SFN8	5			13,4*	
SFN9	6	14,0			

The mesiodistal and labiolingual diameters (length and breadth) of the upper incisors (7.2.13.17)(in mm.)
(growth stages uncertain)

Specimen	MD	LL
M1001	7,6	7,9
M1006	10,5	11,7*
M1009	10,6	12,0
M1012	10,7	12,0
M2520	11,2	12,2
M2522	10,7	-
M2526	6,8	8,2
M2527	4,8	6,2
M8293	7,2	8,0
M8294	3,6	4,7

The mesiodistal and labiolingual diameters (length and breadth) of the upper incisors (continued)

Specimen	MD	LL
SK2045	6,1	7,8
SK2835	5,0	-
SK4315	6,8	9,6
SK14238	6,2	-

The mesiodistal and labiolingual diameters (length and breadth) of the lower incisors (7.2.13.17) (in mm.)

(growth stages uncertain)

Specimen	MD	LL
M1002	7,7	-
M1007	9,8*	-
M1013	11,5	10,9
M1802	8,7	9,7*
M1803	10,4	11,5
M1806	6,7	-
M2519	12,2	-
M2521	10,5	10,6
M2523	11,7	11,5
M2525	11,6	-
M8233	12,8	11,5*
M8277	6,5	6,2
M8278	6,4	-
M8362	9,7	-
M8363	10,7	11,0*
STS2095	6,9	6,7
SK2875	7,9	-
SK6945	5,0	5,5*
KA757	6,1	-
KA1432	4,9*	-

The crown occlusal area of the fossil upper incisors (7.2.13.19)

(in sq. mm.)

(growth stages uncertain)

Specimen	Occlusal area (MD x LL)
M1001	
M1006	122,85*
M1009	127,20
M1012	128,40
M2520	136,64
M2522	-
M2526	55,76
M2527	29,76
M8293	57,60
M8294	16,92
SK2045	47,58
SK2835	-
SK4315	65,28
SK14238	-

The crown occlusal area of the fossil lower incisors (7.2.13.19)

(in sq. mm.)

(growth stages uncertain)

Specimen	Occlusal area (MD x LL)
M1002	-
M1007	-
M1013	125,35
M1802	84,39*
M1803	119,60
M1806	-
M2519	-
M2521	111,30
M2523	134,55
M2525	-
M8233	147,20
M8277	40,30
M8278	-

The crown occlusal areas of the fossil lower incisors (continued)

Specimen	Occlusal area (MD x LL)
M8362	-
M8363	117,70
STS2095	46,23
SK2875	-
SK	27,50*
KA757	-
KA1432	-

The crown shape indices of the fossil upper incisors (7.2.13.20) (as a percentage)

(growth stages uncertain)

Specimen	Index $\left(\frac{LL}{MD} \times 100\%\right)$
M1001	103,95
M1006	111,43*
M1009	113,21
M1012	112,15
M2520	108,93
M2522	-
M2526	120,59
M2527	129,17
M8293	111,11
M8294	130,56
SK2045	127,86
SK2835	-
SK4315	141,17
SK14238	-

The crown shape indices of the fossil lower incisors (7.2.13.20 (as a percentage)

(growth stages uncertain)

Specimen	Index $\left(\frac{LL}{MD} \times 100\%\right)$
M1002	-
M1007	-
M1013	94,78
M1802	111,49*

The crown shape indices of the fossil lower incisors (continued)

Specimen	Index $\left(\frac{LL}{MD} \times 100\%\right)$
M1803	110,58
M1806	-
M2519	-
M2521	100,95
M2523	98,29
M2525	-
M8233	89,83
M8277	95,38
M8278	-
M8362	-
M8363	102,80
STS2095	97,10
SK2875	-
SK6495	110,00*
KA757	-
KA1432	-

The mesiodistal and buccolingual diameters (length and breadth) of the fossil maxillary teeth measured at the occlusal surface (7.2.12.21 and 7.2.12.23) (in mm.)

SPECIMEN		dp^4/P^4		M^1		M^2		M^3	
NUMBER	G/S	MD	BL	MD	BL	MD	BL	MD	BL
M1004	6	-	-	12,4	11,8	12,4	11,9*	-	-
M1005	6	11,9	11,3	10,2	11,8	11,5	11,9	-	-
M1011	6	-	-	-	-	-	-	12,1	14,6
M1016	3	-	-	-	-	9,1	6,3	-	-
M1804	6	-	-	-	-	12,5	11,5	11,5	9,6
M1805	5	-	-	12,0	10,5	11,6	-	-	-
M1809	6	14,0	14,2	-	-	-	-	-	-
M1812	6	10,0	8,2	-	-	-	-	-	-
M1816	6	-	-	10,7	13,4	-	-	-	-
M1818	3	-	-	(9,0)**	(6,2)**	9,0**	6,2**	-	-
M1819	4	-	-	-	-	-	-	9,3	6,4
M1820	4	-	-	-	-	9,0	6,7	-	-
M1821	4	-	-	-	-	-	-	9,0	6,4
M1822	6	-	-	-	-	8,8	8,5	-	-
M1823	6	-	-	-	-	-	-	9,3	7,4
M1824	6	11,7	10,7	-	-	-	-	-	-
M1825	3	-	-	(9,1)**	(5,4)**	9,1**	5,4**	(9,1)**	(5,4)**
M2518	6	-	-	-	-	-	-	11,0	10,2
M8220	6	10,5	8,6	-	-	-	-	-	-
M8284	4	-	-	-	-	-	-	7,6	6,6
M8285	4	-	-	-	-	-	-	8,1	6,7
M8287	6	-	-	-	-	-	-	12,0	12,6
M8288	6	-	-	-	-	-	-	12,8	11,2
M8289	6	-	-	-	-	12,4	9,7	-	-
STS1622	4	-	-	-	-	-	-	7,0	5,0
STS2078	5	-	-	7,3	7,0	7,8	6,8	6.6	5,5
SFN1	6	8,7	7,9	-	-	-	-	-	-
SFN2	6	-	-	-	-	-	-	8,7	8,0
SFN6	6	-	-	-	-	-	-	9,1	7,2
SFN7	6	-	-	-	-	-	-	8,7	6,6

The mesiodistal and buccolingual diameters (length and breadth) of the fossil maxillary teeth, measured at the occlusal surface (continued)

SPECIMEN		dp^4/P^4		M^1		M^2		M^3	
NUMBER	G/S	MD	BL	MD	BL	MD	BL	MD	BL
SFN11	6	-	-	7,2	8,1	-	-	-	-
SFN12	4	-	-	-	-	7,5**	5,6**	(7,5)**	(5,6)**
SFN13[i)]	?	-	-	-	-	8,6	5,3	(8,6)	(5,3)
SFN16	6	-	-	8,0**	8,1**	(8,0)**	(8,1)**	-	-
SFN17	5	-	-	-	-	10,6	8,6	-	-
SK2040	4	-	-	-	-	-	-	8,1	5,9
SK2466a	5	-	-	-	-	-	-	9,1	7,6*
SK2466b	5	-	-	-	-	9,6	8,7	-	-
SK3082	4	-	-	-	-	8,6	7,2	7,2*	6,4
SK14236	6	-	-	9,1	8,1	-	-	-	-
KA1912	5	-	-	-	-	-	-	9,6	6,1

i) SFN13 is possibly a mandibular tooth

The crown occlusal areas of the fossil maxillary teeth measured at the occlusal surface (7.2.13.25) (in sq. mm.)

SPECIMEN	G/S	dp^4/P^4	M^1	M^2	M^3
M1004	6	-	146,32	147,56*	-
M1005	6	134,47	120,36	136,85	-
M1011	6	-	-	-	176,66
M1016	3	-	-	57,33	-
M1804	6	-	-	143,75	110,40
M1805	5	-	126,00	-	-
M1809	6	198,80	-	-	-
M1812	6	82,00	-	-	-
M1816	6	-	143,38	-	-
M1818	3	-	(55,80)**	55,80**	-
M1819	4	-	-	-	59,52
M1820	4	-	-	60,30	-
M1821	4	1	1	1	57,60
M1822	6	-	-	74,80	-
M1823	6	-	-	-	68,82
M1824	6	125,19	-	-	-
M1825	3	-	(49,14)**	49,14**	(49,14)**
M2518	6	-	-	-	112,20
M8220	6	90,30	-	-	-
M8284	4	-	-	-	50,16
M8285	4	-	-	-	54,27
M8287	6	-	-	-	151,20
M8288	6	-	-	-	143,36
M8289	6	-	-	120,28	-
STS1622	4	-	-	-	35,00
STS2078	5	-	51,10	53,04	36,30
SFN1	6	68,73	-	-	-
SFN2	6	-	-	-	69,60
SFN6	6	-	-	-	65,52
SFN7	6	-	-	-	57,42
SFN11	6	58,32	-	-	-
SFN12	4	-	-	42,00**	(42,00)**

The crown occlusal areas of the fossil maxillary teeth measured at the occlusal surface (continued)

SPECIMEN	G/S	dp^4/P^4	M^1	M^2	M^3
SFN13[i)]	?	-	(45,58)**	45,58**	(45,58)**
SFN16	6	-	64,80*	(64,80)**	-
SFN17	5	-	-	91,16	-
SK2040	4	-	-	-	47,79
SK2466a	5	-	-	-	69,16
SK2466b	5	-	-	83,52	-
SK3082	4	-	-	61,92	46,08*
SK14236	6	-	73,71	-	-
KA1912	5	-	-	-	58,56

i) SFN13 may be a mandibular tooth

The crown shape indices of the fossil maxillary teeth measured at the occlusal surface (7.2.13.27) (as a percentage; $\frac{BL}{MD} \times 100\%$)

SPECIMEN	G/S	dp^4/P^4	M^1	M^2	M^3
M1004	6	-	95,16	95,97*	-
M1005	6	94,96	115,69	103,48	-
M1011	6	-	-	-	120,66
M1016	3	-	-	69,23	-
M1804	6	-	-	92,00	83,48
M1805	5	-	87,50	-	-
M1809	6	101,43	-	-	-
M1812	6	8206	-	-	-
M1816	6	-	125,23	-	-
M1818	3	-	(68,89)**	68,89**	-
M1819	4	-	-	-	68,82
M1820	4	-	-	74,44	-
M1821	4	-	-	-	71,11
M1822	6	-	-	96,59	-
M1823	6	-	-	-	79,57
M1824	6	91,45	-	-	-
M1825	3	-	(59,34)**	59,34**	(59,34)**
M2518	6	-	-	-	92,73
M8220	6	81,90	-	-	-
M8284	4	-	-	-	86,84
M8285	4	-	-	-	82,72
M8287	6	-	-	-	105,00
M8288	6	-	-	-	87,50
M8289	6	-	-	78,22	-
STS1622	4	-	-	-	71,43
STS2078	5	-	95,89	87,18	83,33
SFN1	6	90,80	-	-	-
SFN2	6	-	-	-	91,95
SFN6	6	-	-	-	79,12
SFN7	6	-	-	-	75,86
SFN11	6	112,50	-	-	-

The crown shape indices of the fossil maxillary teeth measured at the occlusal surface (continued)

SPECIMEN	G/S	dp^4/P^4	M^1	M^2	M^3
SFN12	4	-	-	74,67**	(74,67)**
SFN13[i)]	?	-	(61,63)**	61,63**	(61,63)**
SFN16	6	-	101,25**	(101,25)**	-
SFN17	5	-	-	81,13	-
SK2040	4	-	-	-	72,84
SK2466a	5	-	-	-	83,52*
SK2466b	5	-	-	90,62	-
SK3082	4	-	-	83,72	88,89*
SK14236	6	-	89,01	-	-
KA1912	5	-	-	-	63,54

i) SFN13 may be a mandibular tooth

The mesiodistal and buccolingual diameters (length and breadth) of the fossil mandibular teeth measured at the occlusal surface (7.2.13.29 and 7.2.13.31) (in mm.)

SPECIMEN		dp_4/P_4		M_1		M_2		M_3	
NUMBER	G/S	MD	BL	MD	BL	MD	BL	MD	BL
M1000	3	-	-	-	-	8,7*	5,0*	-	-
M1002	6	12,0	9,5	-	8,9*	-	-	-	-
M1003	6	-	-	-	-	-	-	13,0	10,7
M1007	5-6	13,0	8,9	14,0	10,8*	13,9	11,0*	-	-
M1008	6	12,5	9,6	-	-	-	-	-	-
M1010	6	(17,4)*	(13,4)	-	-	-	-	17,4*	13,4
M1802	5	-	-	12,6	9,6*	13,2	10,4	10,8	9,0
M1803	6	13,6	10,9	12,7	11,6	-	-	-	-
M1806	5	-	-	9,7	8,0	9,3	8,2	8,0	6,6
M1807	5	-	-	9,7	7,9	9,3	8,0	-	-
M1808	5	13,4	8,8	-	-	-	-	-	
M1810	6	13,4	10,3	-	-	-	-	-	-
M1811	6	11,4	8,0	-	-	-	-	-	-
M1813	6	13,8	10,6	-	-	-	-	-	-
M1814	6	-	-	-	-	13,7	12,0	-	-
M1815	6	11,4	8,4	-	-	-	-	-	-
M1817	5	-	-	-	-	9,8	8,4	-	-
M2516	6	-	-	-	-	-	-	12,0	10,9
M2517	5	-	-	12,0	9,0	-	-	-	-
M8276	6	-	-	-	-	-	-	14,4	12,4
M8277	6	8,9	6,1	9,3	7,8	8,7	7,4	7,8	6,0
M8278	6	12,0*	9,9	-	-	-	-	-	-
M8281	2	10,7*	7,0*	10,8*	7,0*	-	-	-	-
M8282	3	-	-	11,4*	6,0*	9,5*	5,2*	-	-
M8286	6	-	-	-	-	13,5	12,0	-	-
M8291	3	-	-	(10,0)**	(5,7)**	10,0**	5,7**	-	-
M8292	4	-	-	-	-	-	-	7,7*	5,7*
M8364	6	-	-	-	-	-	-	11,9	9,4
STS957a	3	8,8	6,5	9,4	6,4	8,5*	5,0*	-	-
STS957b,c	3	9,0	6,5*	9,5	6,5	8,5*	5,0*	-	-

The mesiodistal and buccolingual diameters (length and breadth) of the fossil mandibular teeth, measured at the occlusal surface (continued)

SPECIMEN		dp_4/P_4		M_1		M_2		M_3	
NUMBER	G/S	MD	BL	MD	BL	MD	BL	MD	BL
SFN3	6	-	-	-	-	-	-	9,3*	8,2
SFN4	5	-	-	-	-	8,4	7,0	-	-
SFN5	2-3	-	-	(8,7)*	(5,4)**	8,7**	5,4**	-	-
SFN8	5	-	-	-	-	9,1	6,9	-	-
SFN9	6	9,9	7,6	-	-	-	-	-	-
SFN10	6	-	-	-	-	-	-	8,8	7,5
SFN14	3	-	-	-	-	8,8*	5,0*	-	-
SFN15	5-6	-	-	-	-	-	8,1*	-	-
SK3063	6	9,4	7,0	9,7	7,9	9,7	8,3	7,3	6,6
SK6945	4	-	-	9,2	8,0	9,9	8,1	-	-
SK7155	6	-	-	7,5	6,9	-	-	-	-
SK14235	6	8,8*	7,0	-	-	-	-	-	-
SK14237	6	10,4	8,6	-	-	-	-	-	-
KA757	5	7,3*	5,0*	7,9	6,0	8,7	6,6	7,1	5,2
KA1432	3	9,2*	6,1	9,9	5,6	9,5*	5,7*	-	-

The crown occlusal areas of the fossil mandibular teeth, measured at the occlusal surface (7.2.13.33)(in sq. mm.)

SPECIMEN	G/S	dp_4/P_4	M_1	M_2	M_3
M1000	3	-	-	43,50*	-
M1002	6	114,00	-	-	-
M1003	6	-	-	-	139,10
M1007	5-6	115,70	151,20*	152,90*	-
M1008	6	120,00	-	-	-
M1010	6	(233,16)*	-	-	233,16*
M1802	5	-	120,96*	137,28	97,20
M1803	6	148,24	147,32	-	-
M1806	5	-	77,60	76,26	52,80
M1807	5	-	76,63	74,40	-
M1808	5	117,92	-	-	-
M1810	6	138,02	-	-	-
M1811	6	91,20	-	-	-
M1813	6	146,28	-	-	-
M1814	6	-	-	164,40	-
M1815	6	95,76	-	-	-
M1817	5	-	-	82,32	-
M2516	6	-	-	-	130,80
M2517	5	-	108,00	-	-
M8276	6	-	-	-	178,56
M8277	6	54,29	72,54	64,38	46,80
M8278	6	118,80*	-	-	-
M8281	2	74,90*	75,60*	-	-
M8282	3	-	68,40*	49,40*	-
M8286	6	-	-	162,00	-
M8291	3	-	(57,00)**	57,00**	-
M8292	4	-	-	-	43,89*
M8364	6	-	-	-	111,86
STS957a	3	57,20	60,16	42,50*	-
STS 957b,c	3	58,50*	61,75	42,50*	-
SFN3	6	-	-	-	76,26*
SFN4	5	-	-	58,80	-

The crown occlusal areas of the fossil mandibular teeth measured at the occlusal surface (continued)

SPECIMEN	G/S	dp_4/P_4	M_1	M_2	M_3
SFN5	2-3	-	(46,98)*	46,98*	-
SFN8	5	-	-	62,79	-
SFN9	6	75,24	-	-	-
SFN10	6	-	-	-	66,00
SFN14	3	-	-	44,00*	-
SFN15	5-6	-	-	-	-
SK3063	6	65,80	76,63	80,51	48,18
SK6945	4	-	73,60	80,19	-
SK7155	6	-	51,75	-	-
SK14235	6	61,60*	-	-	-
SK14237	6	89,44	-	-	-
KA757	5	36,50*	47,40	57,42	36,92
KA1432	3	56,12*	55,44	54,15*	-

The crown shape indices of the fossil mandibular teeth, measured at the occlusal surface (7.2.13.35) ($\frac{BL}{MD}$ x 100, as a percentage)

SPECIMEN	G/S	dp_4/P_4	M_1	M_2	M_3
M1000	3	-	-	57,47*	-
M1002	6	79,17	-	-	-
M1003	6	-	-	-	82,31
M1007	5-6	68,46	77,14*	79,14*	-
M1008	6	76,80	-	-	-
M1010	6	(77,01)*	-	-	77,01*
M1802	5	-	76,19*	78,79	83,33
M1803	6	80,15	91,34	-	-
M1806	5	-	82,47	88,17	82,50
M1807	5	-	81,44	86,02	-
M1808	5	65,67	-	-	-
M1810	6	76,87	-	-	-
M1811	6	70,18	-	-	-
M1813	6	76,81	-	-	-
M1814	6	-	-	87,59	-
M1815	6	73,68	-	-	-
M1817	5	-	-	85,71	-
M2516	6	-	-	-	90,83
M2517	5	-	75,00	-	-
M8276	6	-	-	-	86,11
M8277	6	68,54	83,87	85,06	76,92
M8278	6	82,50*	-	-	-
M8281	2	65,42*	64,81*	-	-
M8282	3	-	52,63*	54,74*	-
M8286	6	-	-	88,89	-
M8291	3	-	(57,00)**	57,00**	-
M8292	4	-	-	-	74,02*

The crown shape indices of the fossil mandibular teeth, measured at the occlusal surface (continued)

SPECIMEN	G/S	dp_4/P_4	M_1	M_2	M_3
M8364	6	-	-	-	78,99
STS957a	3	73,86	68,08	58,82*	-
STS957b,c	3	72,22*	68,42	58,82*	-
SFN3	6	-	-	-	88,17*
SFN4	5	-	-	83,33	-
SFN5	2-3	-	(62,07)*	62,07*	-
SFN8	5	-	-	75,82	-
SFN9	6	76,77	-	-	-
SFN10	6	-	-	-	85,23
SFN14	3	-	-	56,82*	-
SFN15	5-6	-	-	-	-
SK3063	6	74,47	81,44	85,57	90,41
SK6945	4	-	86,96	81,82	-
SK7155	6	-	92,00	-	-
SK14235	6	79,54*	-	-	-
SK14237	6	82,69	-	-	-
KA757	5	68,49*	75,95	75,86	72,34
KA1432	3	66,30*	56,56	60,00*	-

APPENDIX IX

DENTAL MEASUREMENTS OF THE HYSTRICID MATERIAL RECOVERED FROM THE CAVE OF HEARTHS

APPENDIX IX

DENTAL MEASUREMENTS OF THE HYSTRIX MATERIAL RECOVERED FROM THE CAVE OF HEARTHS

All measurements are given in millimetres and have been made at the occlusal surface. Asterisked measurements denote estimates due to fracture, distortion or displacement. Measurements marked with a double asterisk indicate uncertain tooth identifications; in such cases the measurement has also been included (bracketed) under the measurement column of the most likely alternative tooth. $\overline{X}$ denotes arithmetic mean, correct to two decimal places. The explanation and use of growth stages is given in the main text, sections 7.1.4 and 7.1.5. Precise estimates (e.g. early or late growth stage 5 etc.) are given in the descriptive catalogue, Appendix II, pp. 26-36.

CONTENTS

Page

TABLE I Basic occlusal dimensions of the mandibular teeth

TABLE II Occlusal surface areas of the mandibular teeth

TABLE III Crown Shape Indices of the mandibular teeth

TABLE IV Basic dimensions of the maxillary teeth

TABLE V Occlusal surface areas of the maxillary teeth

TABLE VI Crown Shape Indices of the maxillary teeth

TABLE VII Maximum, minimum and mean MD, BL and LL diameters at each growth stage in a sample of Hystrix mandibular dentitions from the Cave of Hearths

TABLE VIII Maximum, minimum and mean crown occlusal areas at each growth stage in a sample of Hystrix mandibular dentitions from the Cave of Hearths

TABLE IX Maximum, minimum and mean crown shape indices at each growth stage in a sample of Hystrix mandibular dentitions from the Cave of Hearths

TABLE X Maximum, minimum and mean MD, BL and LL diameters at each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths

Page

TABLE XI Maximum, minimum and mean crown occlusal areas at each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths

TABLE XII Maximum, minimum and mean crown shape indices at each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths

TABLE I

Dimensions of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1		dp_4/P_4		M_1		M_2		M_3		GROWTH STAGE
	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	
COH 712	-	-	-	-	7.3	6.6	-	-	-	-	4
COH 713	-	-	11.3	8.3	7.3	7.2	9.3	8.5	9.4	7.8	6
COH 714	-	-	-	9.9	-	-	-	-	-	-	6
COH 715	-	-	10.1	7.8	8.2	9.8	9.1	8.4	9.4	7.9	6
COH 717	-	-	-	-	-	-	9.7	8.5	-	-	6
COH 718	-	-	11.0	8.5	-	-	-	-	-	-	6
COH 720	6.4*	-	-	-	-	-	8.5	7.4	-	-	6
COH 722	-	-	-	-	8.5	7.9	-	-	-	-	6
COH 723	5.1	4.8	10.1	5.8	-	-	-	-	-	-	3
COH 724	4.0	-	10.5	4.5	-	-	-	-	-	-	2
COH 725	-	-	11.0	9.1	-	-	-	-	-	-	6
COH 726	-	-	-	-	8.9	5.4	-	-	-	-	2
COH 727	-	-	-	-	9.7	5.6*	-	-	-	-	2
COH 728	7.7*	-	10.9	8.6	-	-	-	-	9.5	7.8	6
COH 732	-	-	-	-	-	-	9.3	9.4	-	-	6
COH 733	5.9*	-	10.5	6.5	-	-	-	-	-	-	3
COH 736	-	-	8.3	6.7	8.0	7.0.	8.5	7.6	-	-	6
COH 739	7.7	-	-	-	-	-	-	-	-	-	5?
COH 741	7.2	-	-	-	-	-	-	-	-	-	?
COH 746	7.5	8.0	-	-	-	-	-	-	-	-	?
COH 747	7.0	-	-	-	-	-	-	-	-	-	?
COH 749	7.1	-	-	-	-	-	-	-	-	-	?
COH 754	7.1	-	-	-	-	-	-	-	-	-	?
COH 755	-	-	10.2	8.1	-	-	-	-	-	-	6
COH 756	-	-	10.8	8.8	-	-	-	-	-	-	6
COH 757	-	-	10.6	8.8	-	-	-	-	-	-	6
COH 759	-	-	-	-	9.7**	5.8**	(9.7)**	(5.8)**	-	-	4?
COH 761	-	-	-	-	-	-	9.4	9.0	-	-	6
COH 762	-	-	-	-	(9.9)**	(8.3)**	9.9**	8.3**	-	-	6?
COH 765	-	-	-	-	-	-	-	-	8.0	5.7	4
COH 766	-	-	-	-	(9.3)**	(5.7)**	(9.3)**	(5.7)**	9.3**	5.7**	4
COH 767	-	-	-	-	9.4	9.0	-	-	-	-	6
COH 2356	5.9	-	-	-	-	-	-	-	-	-	?
COH 2381	-	-	12.5*	10.5*	8.3	8.0	9.3	8.8	9.6	8.4	6
COH 2382	-	-	-	-	8.1	8.4	9.4	-	9.4	-	6
COH 2383	-	-	-	-	10.4	8.4	10.3	8.7	8.5*	7.0*	3
COH 2384	-	-	11.5*	9.5*	8.1	8.4	9.1	-	-	8.9*	6
COH 2385	-	-	10.9	8.8	-	-	9.7	9.0	8.9	8.0	6
COH 2386	-	-	9.5	7.8	9.5	8.0	10.7	8.7	-	-	5
COH 2387	-	-	-	7.0*	10.1	8.4	-	-	-	-	4
COH 2388	-	-	9.5	7.4	9.7	8.1	10.5	8.5	-	-	5
COH 2390	7.0	-	-	-	-	-	-	-	-	-	?
COH 2397	-	-	-	7.5	-	-	-	-	-	-	6
COH 2399	-	-	-	-	-	-	10.5	8.5	-	-	5
COH 2400	-	-	-	-	(9.6)**	(6.0)**	(9.6)**	(6.0)**	9.6**	6.0**	3

TABLE I
Continued

Dimensions of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1		dp_4/P_4		M_1		M_2		M_3		GROWTH STAGE
	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	
COH 2403	-	-	-	-	9.0	9.4	-	-	-	-	6
COH 2404	-	-	10.8	8.3	-	-	-	-	-	-	6
COH 2405	-	-	9.5	6.2	-	-	-	-	-	-	4?
Σx	85.6	12.8	199.5	174.4	179.9	151.4	181.8	136.8	91.6	73.2	
N	13	2	19	22	20	20	19	17	10	10	
$\bar{x}$	6.58	6.40	10.50	7.92	8.99	7.57	9.56	8.04	9.16	7.32	
MINIMUM	5.1	4.8	8.3	4.5	7.3	5.4	8.5	5.7	8.0	5.7	
MAXIMIM	7.7	8.0	12.5*	10.5*	10.4	9.8	10.5	9.4	9.6	8.9*	

TABLE II

Occlusal Surface Areas of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1 MD x LL	dp_4/P_4 MD x BL	M_1 MD x BL	M_2 MD x BL	M_3 MD x BL	GROWTH STAGE
COH 712	-	-	48.18	-	-	4
COH 713	-	93.79	52.56	79.05	73.32	6
COH 714	-	-	-	-	-	6
COH 715	-	78.78	80.36	76.44	74.26	6
COH 717	-	-	-	82.45	-	6
COH 718	-	93.50	-	-	-	6
COH 720	-	-	-	62.90	-	6
COH 722	-	-	67.15	-	-	6
COH 723	24.48	58.58	-	-	-	3
COH 724	-	47.25	-	-	-	2
COH 725	-	100.10	-	-	-	6
COH 726	-	-	48.06	-	-	2
COH 727	-	-	54.32*	-	-	2
COH 728	-	93.74	-	-	74.10	6
COH 732	-	-	-	87.42	-	6
COH 733	-	68.25	-	-	-	3
COH 736	-	55.61	56.00	64.00	-	6
COH 739	-	-	-	-	-	5?
COH 741	-	-	-	-	-	?
COH 746	60.00	-	-	-	-	?
COH 747	-	-	-	-	-	?
COH 749	-	-	-	-	-	?
COH 754	-	-	-	-	-	?
COH 755	-	82.62	-	-	-	6
COH 756	-	95.04	-	-	-	6
COH 757	-	93.28	-	-	-	6
COH 759	-	-	56.26**	(56.26)**	-	4?

TABLE II
continued

Occlusal Surface Areas of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1 MD x LL	dp_4/P_4 MD x BL	M_1 MD x BL	M_2 MD x BL	M_3 MD x BL	GROWTH STAGE
COH 761	-	-	-	84.60	-	6
COH 762	-	-	(82.17)**	82.17**	-	6?
COH 765	-	-	-	-	45.60	4
COH 766	-	-	(53.01)**	(53.01)**	53.01**	4
COH 767	-	-	84.60	-	-	6?
COH 2356	-	-	-	-	-	?
COH 2381	-	131.25*	66.40	81.84	80.64	6
COH 2382	-	-	68.04	-	-	6
COH 2383	-	-	87.36	89.61	59.50*	3
COH 2384	-	109.25*	68.04	-	-	6
COH 2385	-	95.92	-	87.30	71.20	6
COH 2386	-	74.10	76.00	93.09	-	5
COH 2387	-	-	84.84	-	-	4
COH 2388	-	70.30	78.57	89.25	-	5
COH 2390	-	-	-	-	-	?
COH 2397	-	-	-	-	-	6
COH 2399	-	-	-	89.25	-	5
COH 2400	-	-	(57.60)**	(57.60)**	57.60**	3
COH 2403	-	-	84.60	-	-	6
COH 2404	-	89.64	-	-	-	6
COH 2405	-	58.90	-	-	-	4?
Σx	84.48	1589.90	1354.12	1316.84	589.23	
N	2	19	20	17	9	
$\bar{x}$	42.24	83.67	67.70	77.46	65.47	
MINIMUM	24.48	47.25	48.06	53.01	45.60	
MAXIMUM	60.00	131.25*	87.36	93.09	80.64	

TABLE III

Crown Shape Indices of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1	dp_4/P_4	M_1	M_2	M_3	GROWTH STAGE
	$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	
COH 712	-	-	90.41	-	-	4
COH 713	-	73.45	98.63	91.40	82.98	6
COH 714	-	-	-	-	-	6
COH 715	-	77.23	119.51	92.31	84.04	6
COH 717	-	-	-	87.63	-	6
COH 718	-	77.27	-	-	-	6
COH 720	-	-	-	87.06	-	6
COH 722	-	-	92.94	-	-	6
COH 723	94.12	57.43	-	-	-	3
COH 724	-	42.86	-	-	-	2
COH 725	-	82.73	-	-	-	6
COH 726	-	-	60.67	-	-	2
COH 727	-	-	57.73*	-	-	2
COH 728	-	78.90	-	-	82.10	6
COH 732	-	-	-	101.08	-	6
COH 733	-	61.90	-	-	-	3
COH 736	-	80.72	87.50	89.41	-	6
COH 739	-	-	-	-	-	5?
COH 741	-	-	-	-	-	?
COH 746	106.67	-	-	-	-	?
COH 747	-	-	-	-	-	?
COH 749	-	-	-	-	-	?
COH 754	-	-	-	-	-	?
COH 755	-	79.41	-	-	-	6
COH 756	-	81.48	-	-	-	6
COH 757	-	83.02	-	-	-	6
COH 759	-	-	59.79**	(59.79)**	-	4?
COH 761	-	-	-	95.74	-	6
COH 762	-	-	(83.84)**	83.84**	-	6?

TABLE III

continued

Crown Shape Indices of the Mandibular Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I_1	dp_4/P_4	M_1	M_2	M_3	
	$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	GROWTH STAGE
COH 765	-	-	-	-	71.25	4
COH 766	-	-	(61.29)**	(61.29)**	61.29**	4
COH 767	-	-	95.74	-	-	6?
COH 2356	-	-	-	-	-	?
COH 2381	-	84.00*	96.38	94.62	87.50	6
COH 2382	-	-	103.70	-	-	6
COH 2383	-	-	80.77	84.47	82.35*	3
COH 2384	-	82.61*	103.70	-	-	6
COH 2385	-	80.73	-	92.78	89.89	6
COH 2386	-	82.10	84.21	81.31	-	5
COH 2387	-	-	83.17	-	-	4
COH 2388	-	77.89	83.50	80.95	-	5
COH 2390	-	-	-	-	-	?
COH 2397	-	-	-	-	-	6
COH 2399	-	-	-	80.95	-	5
COH 2400	-	-	(62.50)**	(62.50)**	62.50	3
COH 2403	-	-	104.44	-	-	6
COH 2404	-	76.85	-	-	-	6
COH 2405	-	65.26	-	-	-	4?
Σx	200.79	1425.84	1710.42	1427.13	703.90	
N	2	19	20	17	9	
$\bar{x}$	100.39	75.04	85.52	83.94	78.21	
MINIMUM	94.12	42.86	57.73*	59.79	61.29	
MAXIMUM	106.67	84.00*	119.51	101.08	89.89	

TABLE IV

Dimensions of the Maxillary Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I^1		dp^4/P^4		M^1		M^2		M^3		GROWTH STAGE
	MD	LL	MD	BL	MD	BL	MD	BL	MD	BL	
COH 721	7.2	8.6	-	-	-	-	-	-	-	-	5 or 6
COH 735	7.4	8.4	-	-	-	-	-	-	-	-	?
COH 740	7.2	-	-	-	-	-	-	-	-	-	?
COH 742	8.0	-	-	-	-	-	-	-	-	-	?
COH 743	7.7	-	-	-	-	-	-	-	-	-	?
COH 744	7.9	-	-	-	-	-	-	-	-	-	?
COH 748	7.9	9.1	-	-	-	-	-	-	-	-	?
COH 750	8.0	-	-	-	-	-	-	-	-	-	?
COH 751	7.2	-	-	-	-	-	-	-	-	-	?
COH 753	7.2	7.4	-	-	-	-	-	-	-	-	?
COH 758	-	-	-	-	-	-	9.0	8.7	-	-	5 or 6
COH 760	-	-	-	-	-	-	9.1	8.4	-	-	6
COH 763	-	-	-	-	7.2	9.5	-	-	-	-	6
COH 769	-	-	-	-	7.8	-	-	-	-	-	6
COH 2357	-	-	-	-	-	-	-	-	9.4	6.9	4 or 5
COH 2358	-	-	-	-	-	-	-	-	7.9	7.5	5
COH 2391	7.6	-	-	-	-	-	-	-	-	-	?
COH 2393	6.5	-	-	-	-	-	-	-	-	-	?
COH 2394	6.0	-	-	-	-	-	-	-	-	-	?
COH 2395	6.3	-	-	-	-	-	-	-	-	-	?
COH 2396	-	-	-	-	-	-	9.0	8.7	-	-	6
COH 2401	-	-	-	-	-	-	9.4	9.4	-	-	6
COH 2402	-	-	-	-	-	-	-	-	8.8	8.9	6
COH 2407	6.7	-	-	-	-	-	-	-	-	-	?
COH 2409	-	-	9.9	6.3	-	-	-	-	-	-	2
Σx	108.8	33.5	9.9	6.3	15.0	9.5	36.5	35.2	26.1	23.3	
N	15	4	1	1	2	1	4	4	3	3	
$\bar{x}$	7.25	8.37	9.90	6.30	7.50	9.50	9.12	8.80	8.70	7.76	
MINIMUM	6.0	7.4	9.9	6.3	7.2	9.5	9.0	8.4	7.9	6.9	
MAXIMUM	8.0	9.1	9.9	6.3	7.8	9.5	9.4	9.4	9.4	8.9	

TABLE V

Occlusal Surface Areas of the Maxillary Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I^1 MD x LL	dp^4/P^4 MD x BL	M^1 MD x BL	M^2 MD x BL	M^3 MD x BL	GROWTH STAGE
COH 721	61.92	-	-	-	-	5 or 6
COH 735	62.16	-	-	-	-	?
COH 740	-	-	-	-	-	?
COH 742	-	-	-	-	-	?
COH 743	-	-	-	-	-	?
COH 744	-	-	-	-	-	?
COH 748	71.89	-	-	-	-	?
COH 750	-	-	-	-	-	?
COH 751	-	-	-	-	-	?
COH 753	53.28	-	-	-	-	?
COH 758	-	-	-	78.30	-	5 or 6
COH 760	-	-	-	76.44	-	6
COH 763	-	-	68.40	-	-	6
COH 769	-	-	-	-	-	6
COH 2357	-	-	-	-	64.86	4 or 5
COH 2358	-	-	-	-	59.25	5
COH 2391	-	-	-	-	-	?
COH 2393	-	-	-	-	-	?
COH 2394	-	-	-	-	-	?
COH 2395	-	-	-	-	-	?
COH 2396	-	-	-	78.30	-	6
COH 2401	-	-	-	88.36	-	6
COH 2402	-	-	-	-	78.32	6
COH 2407	-	-	-	-	-	?
COH 2409	-	62.37	-	-	-	2
Σx	249.25	62.37	68.40	321.40	202.43	
N	4	1	1	4	3	
$\bar{x}$	62.31	62.37	68.40	80.35	67.47	
MINIMUM	53.28	62.37	68.40	76.44	59.25	
MAXIMUM	71.89	62.37	68.40	88.36	78.32	

TABLE VI

Crown Shape Indices of the Maxillary Teeth in the Collection of Porcupine Material from the Cave of Hearths

CATALOGUE NUMBER	I^1 $\frac{LL}{MD} \times 100$	dp^4/P^4 $\frac{BL}{MD} \times 100$	M^1 $\frac{BL}{MD} \times 100$	M^2 $\frac{BL}{MD} \times 100$	M^3 $\frac{BL}{MD} \times 100$	GROWTH STAGE
COH 721	119.44	-	-	-	-	5 or 6
COH 735	113.51	-	-	-	-	?
COH 740	-	-	-	-	-	?
COH 742	-	-	-	-	-	?
COH 743	-	-	-	-	-	?
COH 744	-	-	-	-	-	?
COH 748	115.19	-	-	-	-	?
COH 750	-	-	-	-	-	?
COH 751	-	-	-	-	-	?
COH 753	102.78	-	-	-	-	?
COH 758	-	-	-	96.67	-	5 or 6
COH 760	-	-	-	92.31	-	6
COH 763	-	-	131.94	-	-	6
COH 769	-	-	-	-	-	6
COH 2357	-	-	-	-	73.40	4 or 5
COH 2358	-	-	-	-	94.94	5
COH 2391	-	-	-	-	-	?
COH 2393	-	-	-	-	-	?
COH 2394	-	-	-	-	-	?
COH 2395	-	-	-	-	-	?
COH 2396	-	-	-	96.67	-	6
COH 2401	-	-	-	100.00	-	6
COH 2402	-	-	-	-	101.14	6
COH 2407	-	-	-	-	-	?
COH 2409	-	63.64	-	-	-	2
Σx	450.92	63.64	131.94	385.65	269.48	
N	4	1	1	4	3	
$\bar{x}$	112.73	63.64	131.94	96.41	89.82	
MINIMUM	102.78	63.64	131.94	92.31	73.40	
MAXIMUM	119.44	63.64	131.94	100.00	101.14	

TABLE VII

Maximum, minimum and mean MD, BL and LL diameters for each growth stage in a sample of Hystrix mandibular teeth from the Cave of Hearths [i)]

		I_1		dp_4/P_4		M_1		M_2		M_3	
		MD	LL	MD	BL	MD	BL	MD	BL	MD	BL
Growth	Max	4,0	-	10,5	4,5	9,7	5,6	-	-	-	-
Stage 2	Min	4,0	-	10,5	4,5	8,9	5,4	-	-	-	-
	Mean	4,0	-	10,5	4,5	9,3	5,5	-	-	-	-
	N	1	-	1	1	2	2	-	-	-	-
Growth	Max	5,9	4,8	10,5	6,5	10,4	8,4	10,3	8,7	9,6	7,0
Stage 3	Min	5,1	4,8	10,1	5,8	10,4	8,4	10,3	8,7	8,5	6,0
	Mean	5,5	4,8	10,30	6,15	10,40	8,40	10,30	8,70	9,05	6,50
	N	2	1	2	2	1	1	1	1	2	2
Growth	Max	-	-	-	7,0	10,1	8,4	-	-	9,3	5,7
Stage 4	Min	-	-	-	6,2	7,3	5,8	-	-	8,0	5,7
	Mean	-	-	-	6,6	9,33	6,93	-	-	8,65	5,7
	N	-	-	-	2	3	3	-	-	2	2
Growth	Max	-	-	9,5	7,8	9,7	8,1	10,7	8,7	-	-
Stage 5	Min	-	-	9,5	7,4	9,5	8,0	10,5	8,5	-	-
	Mean	-	-	9,5	7,6	9,6	8,05	10,56	8,56	-	-
	N	-	-	1	2	2	2	3	3	-	-
Growth	Max	7,7	-	12,5	10,5	9,9	9,8	9,9	9,0	9,6	8,9
Stage 6	Min	6,4	-	8,3	6,7	7,3	7,0	8,5	7,4	8,9	7,8
	Mean	7,05	-	10,76	8,61	8,48	8,34	9,27	8,49	9,37	8,13
	N	2	-	13	15	10	10	12	10	6	6

i) Measured at the occlusal surface

TABLE VIII

Maximum, minimum and mean crown occlusal areas at each growth stage in a sample of Hystrix mandibular dentitions from the Cave of Hearths [i]

		I_1	dp_4/P_4	M_1	M_2	M_3
		MD x LL	MD x BL	MD x BL	MD x BL	MD x BL
Growth	Max	-	47,25	54,32	-	-
Stage 2	Min	-	47,25	48,06	-	-
	Mean	-	47,25	51,19	-	-
	N	-	1	2	-	-
Growth	Max	24,48	68,25	87,36	89,61	59,50
Stage 3	Min	24,48	58,58	87,36	89,61	57,60
	Mean	24,48	63,41	87,36	89,61	58,55
	N	1	2	1	1	2
Growth	Max	-	58,90	84,84	-	53,01
Stage 4	Min	-	58,90	48,18	-	45,60
	Mean	-	58,90	63,09	-	49,30
	N	-	1	3	-	2
Growth	Max	-	74,10	78,57	93,09	-
Stage 5	Min	-	70,30	76,00	89,25	-
	Mean	-	72,20	77,28	90,53	-
	N	-	2	2	3	-
Growth	Max	-	131,25	84,60	87,42	80,64
Stage 6	Min	-	55,61	52,56	62,90	71,20
	Mean	-	93,27	69,75	78,82	74,70
	N	-	13	9	10	5

i) Measured at the occlusal surface

TABLE IX

Maximum, minimum and mean crown shape indices at each growth stage in a sample of Hystrix mandibular dentitions from the Cave of Hearths[i)]

		I_1	dp_4/P_4	M_1	M_2	M_3
		$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$
Growth Stage 2	Max	-	42,86	60,67	-	-
	Min	-	42,86	57,73	-	-
	Mean	-	42,86	59,20	-	-
	N	-	1	2	-	-
Growth Stage 3	Max	94,12	61,90	80,77	84,47	82,35
	Min	94,12	57,43	80,77	84,47	62,50
	Mean	94,12	59,66	80,77	84,47	72,42
	N	1	2	1	1	2
Growth Stage 4	Max	-	65,26	90,41	-	71,25
	Min	-	65,26	59,79	-	61,29
	Mean	-	65,26	77,79	-	66,27
	N	-	1	3	-	2
Growth Stage 5	Max	-	82,10	84,21	81,31	-
	Min	-	79,89	83,50	80,95	-
	Mean	-	80,99	83,85	81,07	-
	N	-	2	3	3	-
Growth Stage 6	Max	-	84,00	119,51	101,08	89,89
	Min	-	73,45	87,50	83,84	82,10
	Mean	-	79,88	100,28	91,59	85,30
	N	-	13	9	10	5

i) Measured at the occlusal surface

TABLE X

Maximum, minimum and mean MD, BL and LL diameters at each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths

		I^1		dp^4/P^4		M^1		M^2		M^3	
		MD	LL	MD	BL	MD	BL	MD	BL	MD	BL
Growth Stage 2	Max			9,9	6,3						
	Min			9,9	6,3						
	Mean			9,9	6,3						
	N			1	1						
Growth Stage 3	Max	NO INFORMATION AVAILABLE									
	Min										
	Mean										
	N										
Growth Stage 4	Max	-	-	-	-	-	-			9,4	6,9
	Min	-	-	-	-	-	-			9,4	6,9
	Mean	-	-	-	-	-	-			9,4	6,9
	N	-	-	-	-	-	-			1	1
Growth Stage 5	Max	7,2	8,6	-	-	-	-	9,0	8,7	9,4	7,5
	Min	7,2	8,6	-	-	-	-	9,0	8,7	7,9	6,9
	Mean	7,2	8,6	-	-	-	-	9,0	8,7	8,65	7,20
	N	1	1	-	-	-	-	1	1	2	2
Growth Stage 6	Max	7,2	8,6	-	-	7,8	9,5	9,4	9,4	8,8	8,9
	Min	7,2	8,6	-	-	7,2	9,5	9,0	8,4	8,8	8,9
	Mean	7,2	8,6	-	-	7,5	9,5	9,12	8,8	8,8	8,9
	N	1	1	-	-	2	1	4	4	1	1

TABLE XI

Maximum, minimum and mean occlusal surface areas at each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths [i)]

		I^1	dp^4/P^4	M^1	M^2	M^3
		MD x LL	MD x BL	MD x BL	MD x BL	MD x BL
Growth Stage 2	Max	-	62,37	-	-	-
	Min	-	62,37	-	-	-
	Mean	-	62,37	-	-	-
	N	-	1	-	-	-
Growth Stage 3	Max					
	Min		INFORMATION NOT AVAILABLE			
	Mean					
	N					
Growth Stage 4	Max	-	-	-	-	64,86
	Min	-	-	-	-	64,86
	Mean	-	-	-	-	64,86
	N	-	-	-	-	1
Growth Stage 5	Max	-	-	-	72,30	64,86
	Min	-	-	-	72,30	59,25
	Mean	-	-	-	72,30	62,05
	N	-	-	-	1	2
Growth Stage 6	Max	-	-	68,40	88,36	78,32
	Min	-	-	68,40	72,30	78,32
	Mean	-	-	68,40	78,85	78,32
	N	-	-	1	4	1

i) Measured at the occlusal surface

TABLE XII

Maximum, minimum and mean crown shape indices of each growth stage in a sample of Hystrix maxillary dentitions from the Cave of Hearths[i)]

		I^1	dp^4/P^4	M^1	M^2	M^3
		$\frac{LL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$	$\frac{BL}{MD} \times 100$
Growth Stage 2	Max	-	63,64	-	-	-
	Min	-	63,64	-	-	-
	Mean	-	63,64	-	-	-
	N	-		-	-	-
Growth Stage 3	Max	NO INFORMATION AVAILABLE				
	Min					
	Mean					
	N					
Growth Stage 4	Max	-	-	-	-	73,40
	Min	-	-	-	-	73,40
	Mean	-	-	-	-	73,40
	N	-	-	-	-	1
Growth Stage 5	Max	-	-	-	96,67	94,94
	Min	-	-	-	96,67	73,40
	Mean	-	-	-	96,67	84,17
	N	-	-	-	1	2
Growth Stage 6	Max	-	-	131,94	100,00	101,14
	Min	-	-	131,94	92,31	101,14
	Mean	-	-	131,94	96,41	101,14
	N	-	-	1	4	1

i) Measured at the occlusal surface

APPENDIX X

CATALOGUE OF FOSSIL HYSTRICIDAE

CATALOGUE OF FOSSIL HYSTRICIDAE

The purpose of compiling this catalogue was to provide a basis of comparison for the South African fossil porcupine material - the living members of the genus Hystrix have a wide ecological tolerance, existing in tropical forest as well as desert savanna regions in Africa and Asia, and the possibility therefore existed that any one of the three fossil species described from South Africa or the undescribed South African material might in reality be synonymous with one of the previously described fossil species from Europe or Asia. A second reason was that an overview of the fossil history of the family Hystricidae was necessary in order to obtain some idea of the evolutionary trends that have taken place - the validity, morphological characteristics and geological age of each fossil species therefore had to be considered.

The twenty-eight described species of fossil Hystricidae, alphabetically arranged, have all been dealt with in this appendix. The following information has been provided for each: references additional to the original published description, type locality, other localities where found, geological age, material available, list of published illustrations, diagnosis, description or other taxonomic remarks, and measurements. An attempt has been made to provide at least one illustration of each species; these have been reproduced where possible at natural size, so that the illustrations are directly comparable.

The heading 'comments' (the author's own) attached to each species attempts to evaluate the taxonomic status and validity of the species, as far as this is possible from published data alone. It became obvious that there are many cases of potential synonyms, this situation arising from the fact that many authors describing new species appear to be ignorant of the descriptions of earlier writers. Unfortunately, it is unsatisfactory or impossible to settle the taxonomy in this fashion without recourse to the actual specimens. However, the potential synonyms have been pointed out.

The following twenty-eight species have been listed:

		Page
1.	Hystrix cf. africaeaustralis Peters 1852. Figs. 1a, 1b....	204
2.	Hystrix cf. angressi Frenkel 1970. Figs. 2-6	209
3.	Hystrix astasobae Bate 1951. Fig. 7	223
4.	Hystrix bessarabica Rjabinin 1929	226
5.	Hystrix crassidens Lydekker 1886. Fig. 8	229
6.	Hystrix etrusca Bosco 1898. Figs. 9, 10	233
7.	Hystrix greenwoodi Bakr circa 1960. See Figs. 1a, 1b	240
8.	Hystrix cf. hirsutirostris Brandt 1835[i]. Figs. 4, 5, 6 ..	241
9.	Hystrix cf. karnuliensis (Lydekker 1886). Fig. 8	243
10.	Hystrix kiangsenensis Wang 1931. Fig. 11	245
11.	Hystrix (Acanthion) lagrellii Lönnberg 1924. Figs. 12,13,14	250
12.	Hystrix lamandini Filhol 1876. Fig. 15	258
13.	Hystrix cf. leucura Sykes 1831 [i]. Figs. 16-19	262
14.	Hystrix major Gervais 1859. Fig. 25	269
15.	Hystrix major Greenwood 1955. Figs. 20a, 20b	271
16.	Hystrix makapanensis Greenwood 1958. Figs. 20a, 20b	272
17.	Hystrix minor Malez 1963. Fig. 21	278
18.	Hystrix primigenia (Wagner 1848). Figs. 22-24	281
19.	Hystrix refossa Gervais 1852. Fig. 25	295
20.	Hystrix schaubi Brunner 1954. Fig. 26	299
21.	Hystrix sivalensis Lydekker 1878. Figs. 27, 28	302
22.	Hystrix cf. subcristata Swinhoe 1870. Figs. 29-32	309
23.	Hystrix suevica Schlosser 1884. Fig. 33	318
24.	Hystrix venusta Leidy 1869	323
25.	Hystrix vinogradovi Argyropulous 1941. Fig. 24	325
26.	Hystrix wiedemanni Roger 1885. Fig. 35	329
27.	Sivacanthion complicatus Colbert 1933. Figs. 36, 37	333
28.	Xenohystrix crassidens Greenwood 1955. Figs. 38-40	338

The figures listed after each species refer to illustrations of that particular named species only - if this happens to be synonymous with one or more other species the illustrations for the synonymous species should also be consulted. Detailed descriptions of the three South African

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i) Hystrix hirsutirostris Brandt 1835 and H. leucura Sykes 1831 are synonyms of H. indica Kerr 1792.

fossil species have been given in the main text and have thus not been repeated here.

A geological timescale of the Miocene to Recent and a geological chart correlating the fossiliferous beds of different countries have been provided (Figs. 41 and 42, this appendix).

APPENDIX X

ILLUSTRATIONS

List of Figures — Page

Fig. 1 Photograph of right half-mandible of Hystrix africaeaustralis (M8277) compared with modern H. africaeaustralis at same stage of growth 208

Fig. 2 Illustrations of the holotype and some of the paratype specimens of Hystrix angressi Frenkel 1970, photographed from Frenkel 1970 Plate V p.77 213

Fig. 3 Illustrations of some of the paratype specimens of Hystrix angressi Frenkel 1970, photographed from Frenkel 1970 Plate VI p.78 215

Fig. 4 Illustrations of the cranium and occipital region of Hystrix angressi Frenkel 1970 compared with those of H. galeata and H. indica photographed from Frenkel 1970 Plate IIp.54 217

Fig. 5 Ventral views of the maxillaries and palatines and facial and lingual views of the mandible of Hystrix angressi Frenkel 1970 compared with those of H. galeata and H. indica, photographed from Frenkel 1970 Plate II p.59 219

Fig. 6 Photograph showing the various stages of wear in the upper and lower dentitions of Hystrix angressi Frenkel 1970 compared with those of H. indica, and the astragalus and metatarsal III of H. angressi compared with those of H. indica, taken from Frenkel 1970 Plate III p.65 221

Fig. 7 Illustration of holotype skull of Hystrix astasobae Bate 1951, photographed from Bate 1951 p.5 Fig. 1 ... 225

Fig. 8 Illustrations of Hystrix crassidens Lydekker 1886 and Atherura karnuliensis Lydekker 1886, photographed from Lydekker 1886 Plate 8 231

Fig. 9 Illustrations of Hystrix etrusca Bosco 1898 taken from Bosco 1898 Tav. 10 (1) 236

Fig. 10 Illustration of Hystrix etrusca Bosco 1898 taken from Bosco 1898 Tav. 11 (2) 238

Fig. 11 Illustrations of Hystrix kiangsenensis Wang 1931 photographed from Wang 1931 Taf. 2 p. 63 248

Page

Fig. 12 Photograph illustrating the type specimen of Hystrix (Acanthion) lagrelii Lönnberg 1924 taken from Lönnberg 1924 Plate I 254

Fig. 13 Photograph illustrating the cranium and dentition of Hystrix (Acanthion) lagrelii Lönnberg 1924 from Locality 13 of Choukoutien, taken from Teilhard de Chardin and Pei 1941 Fig. 48a p.59 256

Fig. 14 Photograph illustrating the mandible and mandibular dentition of Hystrix (Acanthion) lagrellii Lönnberg 1924 from Locality 13 of Choukoutien, taken from Teilhard de Chardin and Pei 1941 Fig. 48b p.60 257

Fig. 15 Illustrations of Hystrix lamandini Filhol 1876 and H. suevica Schlosser 1884, from Schlosser 1884 Taf. 7 (3) 261

Fig. 16 Illustration showing lateral aspect of the juvenile cranium of Hystrix cf. leucura (B.M.15923) initially referred by Lydekker (1884) to Hystrix sp., probably H. sivalensis. From Lydekker 1884 p.110 Fig. 5 265

Fig. 17 Sketch showing the upper and lower dentition of the immature cranium of Hystrix cf. leucura (B.M.15923) From Matthew 1929 p.559 Fig. 55 265

Fig. 18 Sketch showing the occlusal surface and buccal aspect of isolated lower left M_1 (A.M.N.H.19909) of Hystrix cf. leucura, initially identified (Colbert 1935) as H. sivalensis. From Colbert 1935 p.72 Fig. 32 265

Fig. 19 Photograph showing the cranium and dentition of Hystrix cf. leucura (B.M.15923). From Black 1972 p.248 Fig. 3 267

Fig. 20 a & b Photograph illustrating type specimen of Hystrix makapanensis Greenwood 1958 (= H. major Greenwood 1955) compared with a) Xenohystrix crassidens at same growth stage and b) with H. africaeaustralis at same growth stage 276

Fig. 21 Sketch showing the left half-mandible of Hystrix minor Malez 1963. From Mottl 1967 p.308 Fig. 3 280

Fig. 22 Photograph showing the left mandible of Hystrix primigenia (Wagner 1848) ; its maxillary dentition (B) and its mandibular dentition (C), from Abel 1922 p.127 Fig. 113 290

Fig. 23 Photograph illustrating palate and maxillary dentition of Hystrix primigenia (Wagner 1848) from Weze, Poland. From Sulimski 1960 Plate 1 291

Page

Fig. 24 Photograph illustrating mandible and mandibular dentition of Hystrix primigenia (Wagner 1848) from Weze, Poland. From Sulimski 1960 Plate II 293

Fig. 25 Illustration of the type specimen of Hystrix refossa Gervais 1852, re-photographed from Gervais 1852 (2nd Ed.) Plate 48, Figs. 11, 12 298

Fig. 26 Sketch showing the type mandible of Hystrix schaubi Brunner 1954, a right mandibular fragment with P_4, M_1 and M_2 in situ. Natural size. Redrawn from Brunner 1954 p.99 Fig. 6 301

Fig. 27 Illustration of the type specimen (Ind.Mus.D.96) of Hystrix sivalensis Lydekker 1878, from Lydekker 1884 p.109(5) Fig. 4 306

Fig. 28 Sketch showing detail of crown structure of Hystrix sivalensis Lydekker 1878, from Piveteau 1958 p.707 Fig. 62 306

Fig. 29 Hystrix cf. subcristata Swinhoe 1870 from Locality 1 (Sinanthropus Locality) of Choukoutien, taken from Young 1934 p.110 Fig. 46 314

Fig. 30 Photograph showing occlusal and labial views of right lower jaw fragment (c/c 1769) of Hystrix cf. subcristata Swinhoe 1870 from Locality 1 of Choukoutien. From Young 1934 Plate 9 p.159 314

Fig. 31 Illustration of Hystrix subcristata Swinhoe 1870 from Locality 13 of Choukoutien, China. From Teilhard de Chardin and Pei 1941, p.61 Fig. 49 316

Fig. 32 Illustration of Hystrix subcristata Swinhoe 1870 (A.M.N.H. No.18747) from Yenchingkou, Szechwan, China. From Colbert and Hooijer 1953 p.41 Fig. 14. Lateral view of right mandibular ramus with M_1 in situ, natural size 316

Fig. 33 Illustrations of Hystrix suevica Schlosser 1884. From Schlosser 1902, Taf. 1 (6) 322

Fig. 34 Sketch showing the left mandible of Hystrix vinogradovi Argyropulos 1941 from Binagady, redrawn from Mottl 1967 p.308 Fig. 4 328

Fig. 35 Illustration showing an incisor and molar pattern of Hystrix wiedemanni Roger 1885, re-photographed from Seeman 1938 Figs. 30 and 31 332

Fig. 36 Photograph showing type specimen of Sivacanthion complicatus Colbert 1933 taken from Colbert 1933 p.4 Fig.2 Occlusal and lateral view of left half-mandible with P_4 M_1, M_2 in situ, alveolus for M_3 empty 336

Page

Fig. 37 Illustration showing detail of crown enamel pattern of M_1 and M_2 of Sivacanthion complicatus Colbert 1933. From Piveteau 1958 p.708 Fig. 65 336

Fig. 38 Photograph showing fragmentary left half-mandible of Xenohystrix crassidens Greenwood 1955 (M1808) compared with mandible of Hystrix africaeaustralis Peters 1852 at same growth stage 342

Fig. 39 Photograph illustrating the crown enamel pattern of left cheek tooth row (M1802) of Xenohystrix crassidens Greenwood 1955 342

Fig. 40 Photograph comparing Xenohystrix crassidens Greenwood 1955 with Hystrix makapanensis Greenwood 1958 344

Fig. 41 Geological timescale of the Miocene to Recent..... 345

Fig. 42 Geological correlation chart 346

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HYSTRIX cf. AFRICAEAUSTRALIS Peters 1852

1852. Peters, W.C.H. Naturwissenschaftliche Reise Nach Mossambique Zoologie I. Saugethiere pp. 170-173, Pl. 32, figs.6, 7

References to Hystrix cf. africaeaustralis (or to fossil remains of H. africaeaustralis):

Broom and Schepers 1946 p. 82 (as H. cristata)[i)]

Greenwood 1955 pp.77-78

Locality and horizon from which H. cf. africaeaustralis originally described:

'Australopithecus prometheus' layer, Makapansgat Limeworks, Transvaal, South Africa (Greenwood 1955), i.e. the Grey Breccia, according to the terminology of Brain (1958) or Makapansgat Member 3, according to Partridge (1975, in preparation)

Additional localities:

Sterkfontein - various deposits (Broom and Schepers 1946 p.82)

Makapansgat Limeworks, Upper Phase I or Pink Breccia of Brain (1958) or Makapansgat Limeworks Member 4 of Partridge (1975, in prep.) (Maguire, this thesis, Chapter 14, as H. africae-australis)

Makapansgat Limeworks Phase II breccia of Brain (1958) or Makapansgat Limeworks Member 5 of Partridge (1975 in prep.) (Maguire, this thesis, Chapter 14, as H. africaeaustralis)

Sterkfontein Type Locality (Maguire, this thesis, Chapter 14, as H. africaeaustralis)

Sterkfontein Dumps 1, 2,8, 10 and 13 (Maguire, this thesis Chapter 14, as H. africaeaustralis)

Swartkrans Pink breccia (Brain 1958) or Member 1 (of Butzer 1974) (Maguire, this thesis Chapter 14 as H. africaeaustralis)

Swartkrans Brown breccia (of Brain 1958) or Member 2 (of Butzer 1974) (Maguire, this thesis, Chapter 14, as H. africaeaustralis)

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i) Broom 1946, p.82, refers fossil porcupine specimens retrieved from the vicinity of Sterkfontein to the living local species which he erroneously states is H. cristata. The present author considers that the latter specimens are referable to H. africaeaustralis, as H. cristata is confined to suitable localities north of 2°S.

Swartkrans 'decalcifying breccia' Member 2? (Maguire, this thesis Chapter 14, as H. africaeaustralis)

Kromdraai A (Maguire, this thesis, Chapter 14 as H. africaeaustralis)

Cave of Hearths (Cooke, H.B.S. in Mason 1962 as H. africaeaustralis)

Numerous Middle and Upper Pleistocene cave and 'open' archaeological sites in southern Africa.

Geological age:

Makapansgat Limeworks Member 3 = +- 3,0-3,67 m.y.B.P. but not older than 4,0 m.y.B.P. (see Chapter 2.2 thesis text)

Makapansgat Limeworks Member 4 = +- 2,75-3,0 m.y.B.P. (see Chapter 2.2 thesis text)

Makapansgat Limeworks Member 5 = +- 2,6-2,75 m.y.B.P. (see Chapter 2.2 thesis text)

Sterkfontein Type Locality (STS) = 1,7-3,26 m.y.B.P. (see Chapter 2.2 thesis text)

Sterkfontein Dump 8 = < 50,000-100,000 years B.P. Florisbad Faunal Span (See Chapter 2.2 thesis text)

Dumps 1, 2, 3 and 10 Age unknown

Swartkrans Member 1 (SKa) = 1,8-2,57 m.y.B.P. (see Chapter 2.2 thesis text)

Swartkrans Member 2 (SKb early) = Late Cornelia Faunal Span (see Chapter 2.2 thesis text)

Swartkrans 'decalcified breccia' (SKb later?) = < 50,000-> 100,000 years B.P. Florisbad Faunal Span (see Chapter 2.2 thesis text)

Kromdraai A = +- 0,7-1,0 m.y.B.P. early Cornelia Faunal Span (see Chapter 2.2 thesis text)

The species thus first appears in Middle or Upper Pliocene times (between three and four million years ago, during Makapansgat grey breccia times) and extends through the Pleistocene to the present day.

Material:

Also see Appendix II, pp. 7-26 for descriptions of specimens

Makapansgat Limeworks, grey breccia or Member 3:

M1000 (referred by Greenwood 1955)

M1001? (referred by Greenwood 1955 to H. cf. africaeaustralis but may represent juvenile H. makapanensis)

Makapansgat Limeworks:

grey breccia or Member 3 (continued)

M1016	
M1806-M1807	
M1817-M1823	Referred by Maguire,
M1825	this thesis to
M2527	H. africaeaustralis
M8291-M8294	

pink breccia or Member 4:

M8277	Referred by Maguire, this thesis to H. africaeaustralis
M8278?	M8278 may represent H. makapanensis

Phase II breccia or Member 5

M8284	Referred by Maguire, this
M8285	thesis to H.africaeaustralis

Sterkfontein Type Site (STS)

STS 957 a-e	
STS 1622	
STS 2061	Referred by Maguire,
STS 2078	this thesis, to
STS 2095	H. africaeaustralis

Sterkfontein Dump 1

SFN 1-5

Sterkfontein Dump 2

SFN 6

Sterkfontein Dump 3

SFN 7

Sterkfontein Dump 8

SFN 8-16

Sterkfontein Dump 10

SFN 17

Swartkrans:

pink breccia or Member 1:

SK 2466a, b
SK 2875
SK 3082
SK 4315
SK 14236
Sk 14237

referred by Maguire, this thesis to H. africaeaustralis

brown breccia or Member 2:

SK 2040
SK 2045
SK 2835
SK 3063
SK 7155
SK 14235
SK 14238

referred by Maguire, this thesis, to H. africaeaustralis

Kromdraai A, fine grained breccia:

KA 757
KA 1432
KA 1607
KA 1912?

referred by Maguire, this thesis to H. africaeaustralis. K.1912, whose derivation is uncertain, may belong to H. makapanensis

Illustrations:

See Figs. 1a, 1b, this appendix. Also any illustrations for modern H. africaeaustralis, e.g. Roberts 1951

Taxonomic remarks:

See description, main text Chapter 14

Measurements:

See Appendix VIII, A, B and C and Chapter 14, main text

COMMENTS:

No significant differences could be found which would effectively separate this material (consisting mainly of isolated teeth) from H. africaeaustralis. It was therefore felt that the material could with confidence be referred directly to H. africaeaustralis, without using the tentative 'cf.'.

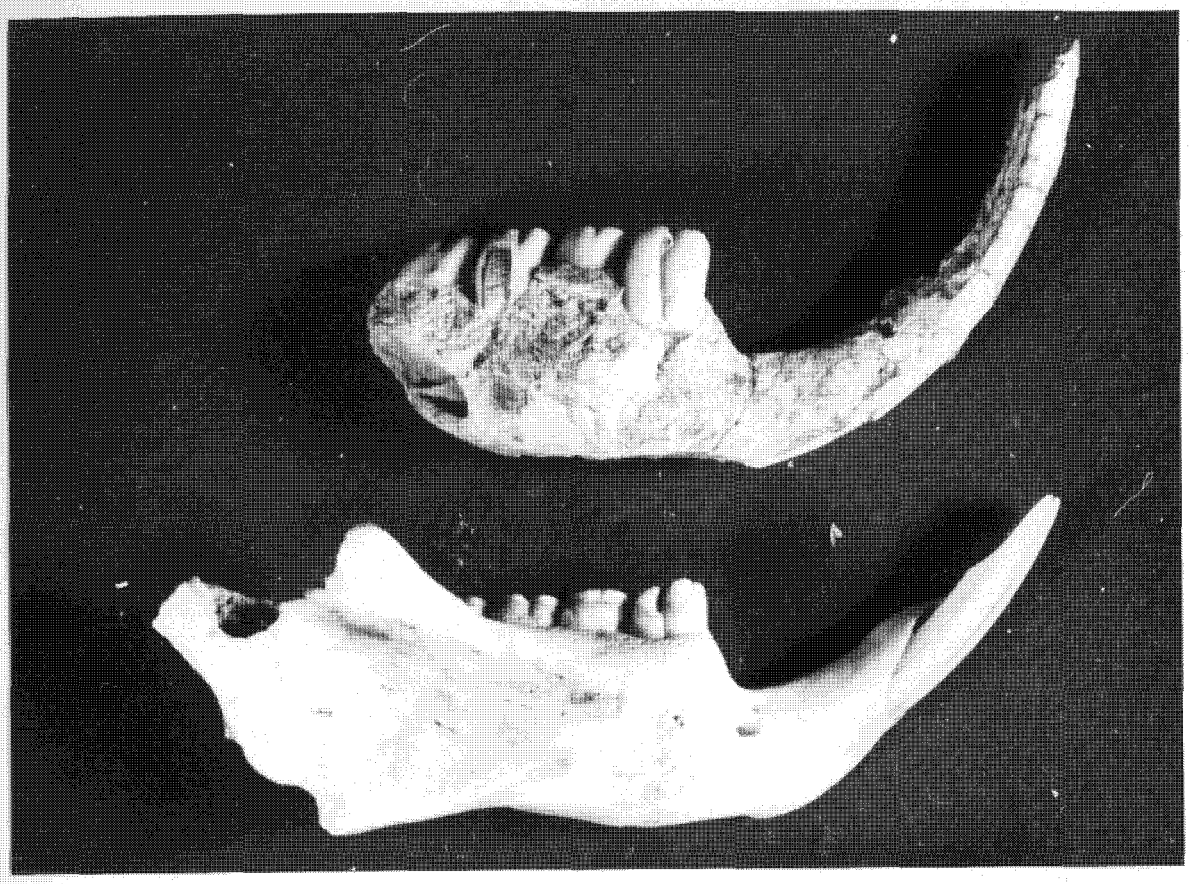


Fig 1 A

Photograph showing right half-mandible of Hystrix africaeaustralis (M8277) from the Upper Phase I (Pink) breccia at Makapansgat Limeworks compared with modern H. africaeaustralis at same stage of growth (below). x 1.



Fig 1B

Occlusal view of H. africaeaustralis (M8277) from the Upper Phase I Breccia at Makapansgat Limeworks.

2

HYSTRIX ANGRESSI Frenkel 1970

1970. Frenkel, H. Israel J. Zool., 19 (1): 51-82, Pls. 1-6

Additional references:

None to date

Type locality and horizon:

Levels A, B and B_2 Geula Cave, Mt. Carmel, near Haifa, Israel
Coord. 1504/2446 Israel Grid. (Frenkel 1970, p.51)

Other localities:

None recorded to date

Geological age:

Levalloiso-Mousterian (Frenkel 1970, p.51) i.e. Early Upper Pleistocene; the Upper Levalloiso-Mousterian at Tabun (Mt. Carmel) has been dated at 39,700 +-800 B.P. (GrN-2534) (Vogel & Waterbolk 1963, p.172, 174)

Material:

The material available is listed in Frenkel (1970). The type material is as follows:

Holotype:

GA - 108 Pair of dentate maxillaries with right M^3 missing. (Fig. 2, No. 6 in this appendix)

Paratypes:

GA - 112 Occiput (See Fig. 2 No. 1; Fig. 4 No. 5)

GA - 308 Pair of parietals and an incomplete pair of frontals (See Fig. 2 No.2; Fig. 4 No.1)

GB - 353 Incomplete pair of nasals (See Fig. 2 No.4; Fig. 4 No.1)

GB - 116 Pair of parietals (See Fig. 2 No.3; Fig. 4 No.3)

G - 29 Pair of dentate maxillaries, both right and left M^3 missing (See Fig. 2 No.5; Fig.5 No.2)

G - 21 Right mandible, angular process missing (See Fig. 2 No.7; Fig. 3 No. 1; Fig. 5 No.8)

GA - 100 Left mandible, angular process missing (See Fig. 5 No.5)

GB - 184 Left humerus, greater tuberosity missing (See Fig. 3 No.2)

G - 20 Left ulna (See Fig. 3 No.3)

GB - 193 Left femur, distal end missing (See Fig. 3 No.4)

GB - 196 Right tibia (See Fig. 3 No.5)

GB - 212 Right fibula (See Fig. 3 No.6)

G - 19 Right astragalus (See Fig. 6 No.21)

GA - 114 Right calcaneum

G - 12 Right metatarsus III (See Fig. 6 No.24)

Illustrations:

See Frenkel 1970.

The holotype and paratypes are illustrated in Frenkel 1970, Pls. 3, 4, 5 and 6 and have been re-photographed for Figs. 2, 3 and 6 of this appendix. The cranium and occiput of H. angressi are shown compared with those of H. galeata and H. indica (Frenkel 1970, Pl.1, see Fig. 4). The maxillaries, maxillary dentition and mandible of H. angressi are also shown compared with those of H. galeata and H. indica (Frenkel 1970, Pl. 2 see Fig. 5), and finally, the dentitions of H. angressi and H. indica (the recent porcupine of Israel) are illustrated (Frenkel 1970, Pl.3, see Fig. 6).

Diagnosis, taxonomic remarks:

The species diagnosis is as follows:

> H. angressi is bigger than any recent Hystrix hitherto known. Occiput higher and narrower than that in H. cristata and H. galeata. Nasals longer than those of H. indica. Parietals broad, narrower than in H. cristata but much broader than in H. indica. Coronoid process of mandible showing a slanting, dorsally thickened crest, hitherto unknown in Hystrix, but resembling the mandible of Thecurus. The two maxillary teeth rows converge anteriorly, unlike H. indica and H. cristata. Long bones extremely broad and thick, esp. metacarpals and metatarsals. Long bones 20% longer and 30-40% wider than those of H. indica Therefore the limb skeleton is much stouter than that of any recent species (Frenkel 1970, p.55)

Frenkel (op. cit.) also provides an excellent description of the new species.

Measurements:

Maxillary dentition (in mm)(after Frenkel 1970, Tables 6 and 7 p.66)

	MD	BL
I^1	6.3	7.8 Min.
	7.3	8.7 Max.
	6.6	8.3 Mean, N = 19
dp^4	8.2	5.2 Min.
	8.8	7.0 Max.
	8.6	6.1 Mean, N = 4
P^4	10.0	8.3 Min.
	11.0	10.5 Max.
	10.5	9.6 Mean, N = 14
M^1	6.8	6.5 Min.
	9.6	8.6 Max.
	9.0	7.7 Mean, N = 13
M^2	7.8	7.5 Min.
	11.0	9.0 Max.
	9.5	8.2 Mean, N = 14
M^3	7.8	6.6 Min.
	10.5	8.7 Max.
	9.1	7.6 Mean, N = 13

Mean upper alveolar length = 38.7mm (Frenkel op. cit. Table 3, p.60).

Mandibular dentition (in mm) (after Frenkel op. cit. Table 5 p.63 and Table 7 p.66)

	MD	BL
I_1	5.5	6.6 Min.
	6.8	7.8 Max.
	6.3	7.4 Mean, N = 11 (Table 7 p.66)
dp_4	8.1	4.9 Min.
	9.8	6.2 Max.
	8.9	5.5 Mean, N = 14 (Table 5, p.63)
P_4	9.5	7.0 Min.
	13.0	9.0 Max.
	10.8	8.2 Mean, N = 24 (Table 5, p.63)
M_1	7.2	6.4 Min.
	10.5	8.8 Max.
	9.0	7.5 Mean, N = 15 (Table 5, p.63)

	MD	BL	
M_2	8.4	7.2	Min.
	11.0	8.5	Max.
	9.6	7.8	Mean, N = 13 (Table 5, p.63)
M_3	8.5	6.2	Min.
	11.0	8.5	Max.
	10.0	7.4	Mean, N = 23 (Table 5, p.63)

Mean lower alveolar length = 38.5mm (Frenkel 1970, Table 4, p.61).

Frenkel (op. cit.) provides several other measurements: occipital (Table 1), cranial (Table 2), palatal and maxillary (Table 3), mandibular (Table 4), humeral (Table 8), ulnar (Table 9), radial (Table 10), metacarpal III (Table 11), pelvic (Table 12), femoral (Table 13), tibial (Table 14), fibular (Table 15), astragalus (Table 16) and the dimensions of metatarsal III (Table 17).

COMMENTS:

Some of the characters used in the diagnosis (e.g. height and width of occiput and the thickened dorsal crest of the coronoid process of the mandible) have been shown to be extremely variable. However, *H. angressi* does seem to be generally larger than the local extant form, *H. indica*. Where a Pleistocene species has a modern counterpart, it frequently happens that the Pleistocene form is the larger. For example, *H.* cf. *subcristata* (Lower Pleistocene, No. 22 in this appendix) is larger than its modern counterpart *H. subcristata*, and the porcupine from the Cave of Hearths, Transvaal, R.S.A. (Middle to Upper Pleistocene, No. 1) is more robust than the modern form of the same species. *H. angressi* appears to be another example of this phenomenon. The range in tooth size for *H. angressi* overlaps that of *H. indica*, falling just within the upper part of the range of the latter, but the tooth size mean differs somewhat. Since the delimitation of species is largely subjective, it appears best to uphold the specific status of *H. angressi*. However, the possibility that *H. angressi* is merely a robust form of *H. indica* cannot be ruled out.

Fig. 2

Illustrations of the holotype and some of the paratype specimens of Hystrix angressi Frenkel 1970, photographed from Frenkel 1970 Plate V p. 77.

No. 1	GA - 112; paratype.	Occipital region, posterior view.
No. 2	GA - 308; paratype.	Posterior region of skull, dorsal view.
No. 3	GB - 116; paratype.	Pair of parietals, dorsal view.
No. 4	GB - 353; paratype.	Incomplete pair of nasals, dorsal.
No. 5	G - 29; paratype.	Palatal fragment comprising dentate maxillaries and palatines, ventral view.
No. 6	GA - 108; holotype.	Palatine fragment comprising dentate maxillaries and palatines, ventral view.
No. 7	G - 21; paratype.	Right half-mandible, facial view.

Scale: All figures natural size.

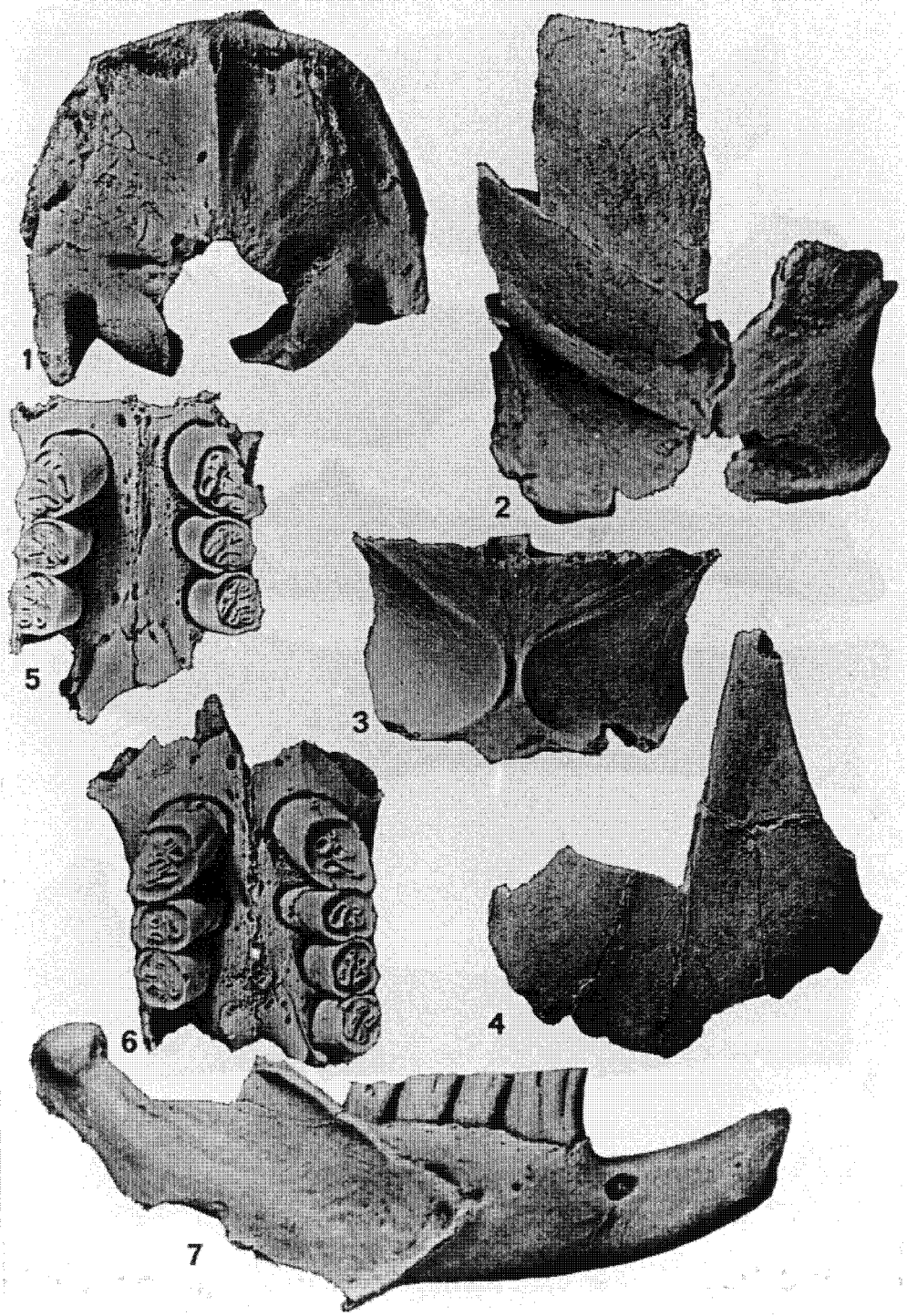


PLATE V

Fig. 2

Fig. 3

Illustrations of some of the paratype specimens of Hystrix angressi Frenkel 1970, photographed from Frenkel 1970 Plate VI p. 78.

No. 1 G - 21; right mandible, lingual view.
No. 2 GB - 184; left humerus, anterior view.
No. 3 G - 20; left ulna, anterior view.
No. 4 GB - 193; left femur, posterior view.
No. 5 GB - 196; right tibia, lateral exterior view.
No. 6 GB - 212; right fibula, lateral interior view.

Scale: All figures natural size.



PLATE VI

Fig. 3

Fig. 4

Illustrations of the cranium and occipital region of Hystrix angressi Frenkel 1970 compared with those of H. galeata and H. indica, photographed from Frenkel 1970 Plate I p. 54.

No. 1 Dorsal view of the reconstruction of the posterior region of the skull of Hystrix angressi, using paratypes GA - 308 and GB - 353.

No. 2 Dorsal view of the same region of the skull of H. galeata (recent, Ethiopia).

No. 3 GB - 116; paratype. Parietal region of skull of H. angressi.

No. 4 Dorsal view of the posterior region of the skull of H. indica (recent Israel).

No. 5 GA - 112; paratype. Posterior view of occipital region of H. angressi.

No. 6 Posterior view of the occipital region of H. galeata.

No. 7 Posterior view of the occipital region of H. indica.

Scale: All figures x 0.75.

PLATE I

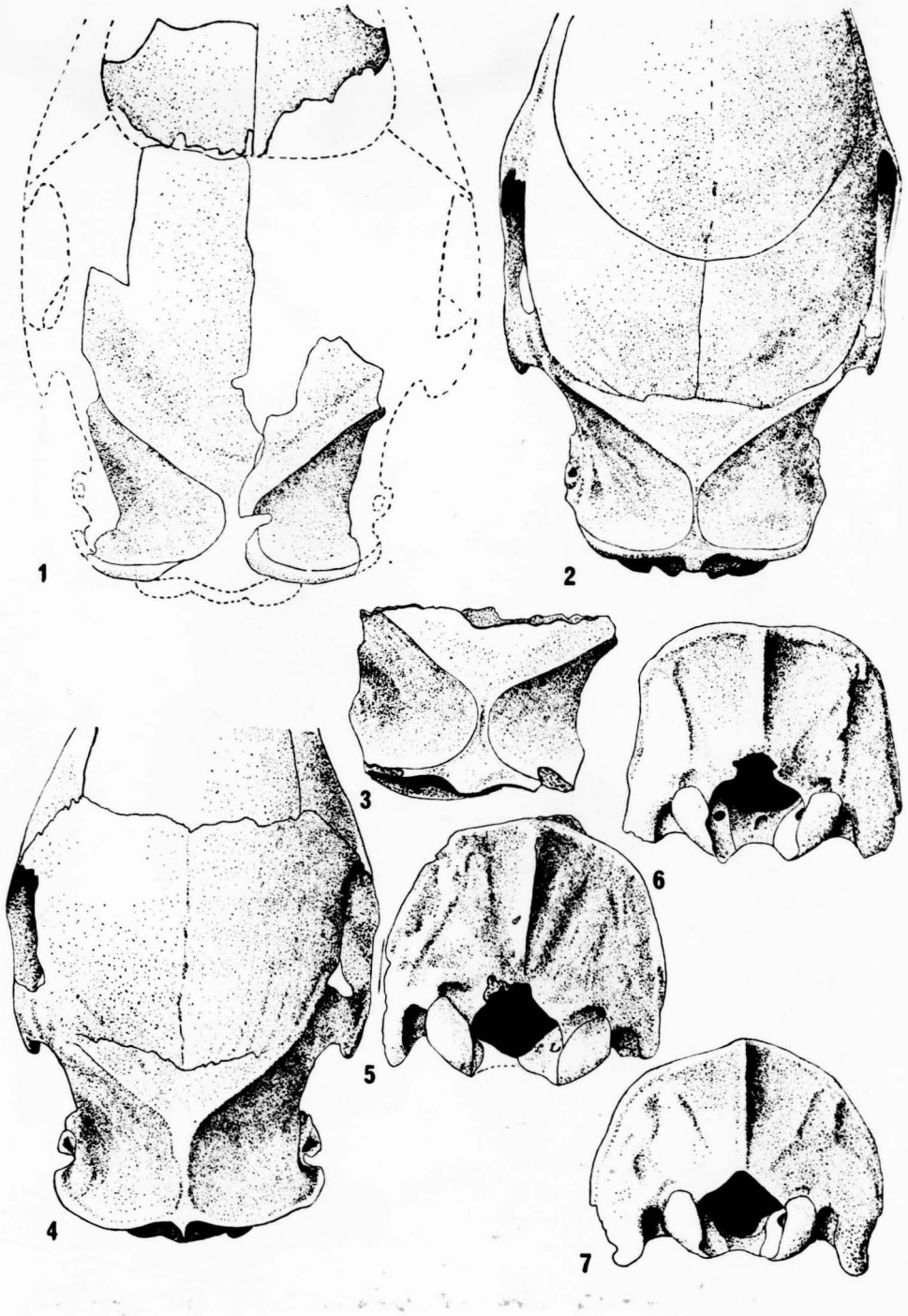


Fig. 4

Fig. 5

Ventral views of the maxillaries and palatines and facial and lingual views of the mandible of Hystrix angressi Frenkel 1970 compared with those of H. galeata and H. indica, photographed from Frenkel 1970 Plate II, p. 59.

No. 1 Ventral view of the palate of H. indica (recent, Israel).
No. 2 Ventral view of the palate of H. angressi (G - 29; paratype).
No. 3 Ventral view of the palate of H. galeata (recent, Ethiopia).
No. 4 Facial view of right mandible of H. indica.
No. 5 Facial view of left mandible of H. angressi (GA - 100; paratype).
No. 6 Facial view of light mandible of H. galeata.
No. 7 Lingual view of right mandible of H. galeata.
No. 8 Lingual view of right mandible of H. angressi (G - 21; paratype).
No. 9 Lingual view of right mandible of H. indica.
No. 10 Facial view of left mandible of Thecurus crassispinis x 0.5.

Scale: Except for No. 10, all figures x 0.75.

PLATE II

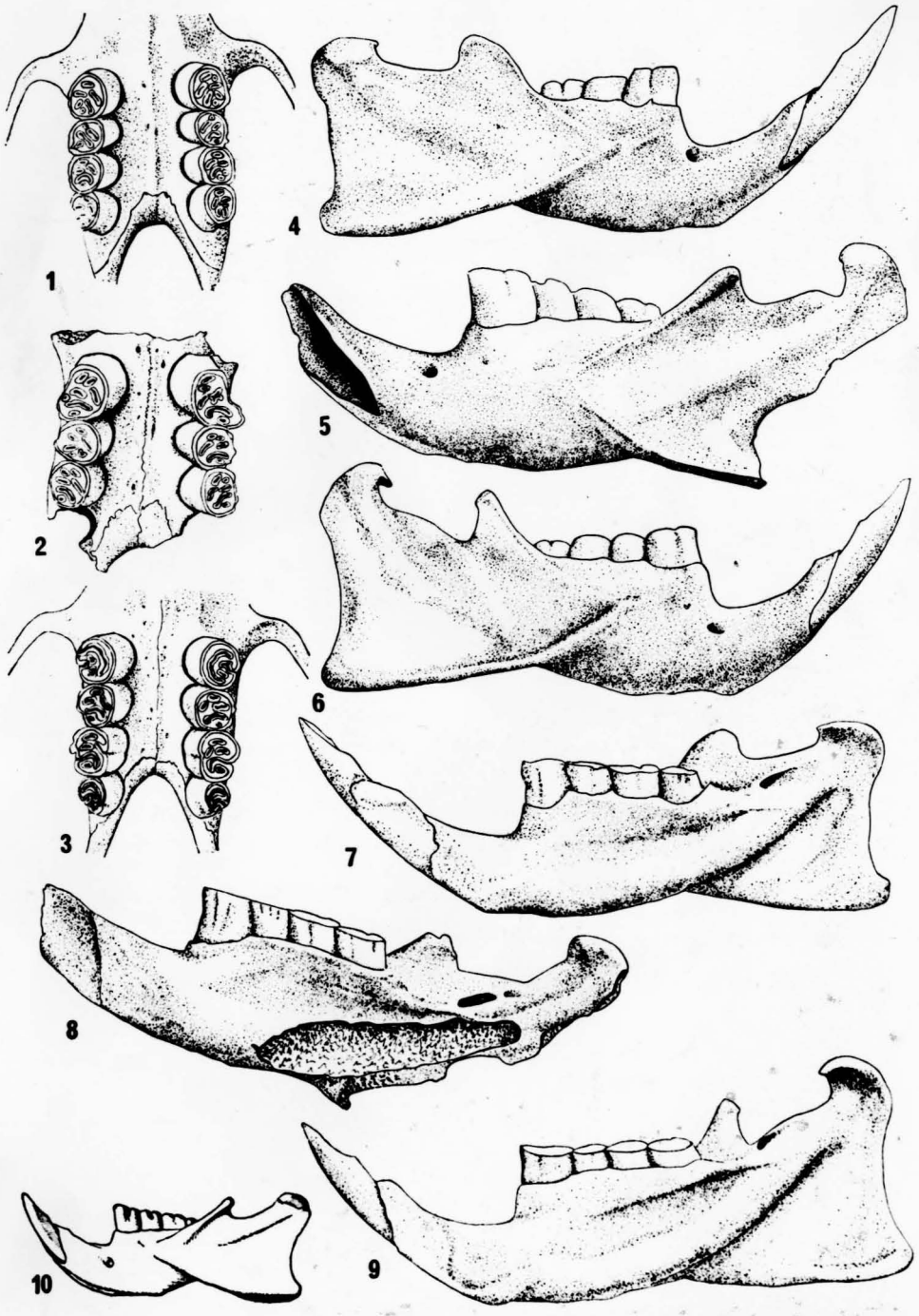


Fig. 5

Fig. 6

Photograph showing the various stages of wear in the upper and lower dentitions of Hystrix angressi Frenkel 1970 compared with those of H. indica, and the astragalus and metatarsal III of H. angressi compared with those of H. indica, taken from Frenkel 1970 Plate III p. 65.

Nos. 1, 3, 5	Hystrix indica, right upper cheek teeth x 1.5.
Nos. 2, 4, 6	H. angressi, the corresponding right upper cheek teeth (M^3 missing) x 1.5.
Nos. 7 - 12	H. angressi, mandibular dentition. Nos. 7 - 9 right mandible, 10 left mandible, 11 and 12 right mandible, x 1.5.
Nos. 13 - 20	H. indica, right mandible dentition x 1.5.
No. 21	Dorsal view of right astragalus of H. angressi (G - 19; paratype) x 1.
No. 22	Dorsal view of right astragalus of H. indica x 1.
No. 23	Dorsal view of right metatarsal III of H. indica x 0.75.
No. 24	Dorsal view of right metatarsal III of H. angressi (G - 12; paratype) x 0.75.

M.F.L. - Median facial loop
P.F.L. - Posterior facial loop
A.L.L. - Anterior lingual loop
M.L.L. - Medial lingual loop
P.L.L. - Posterior lingual loop

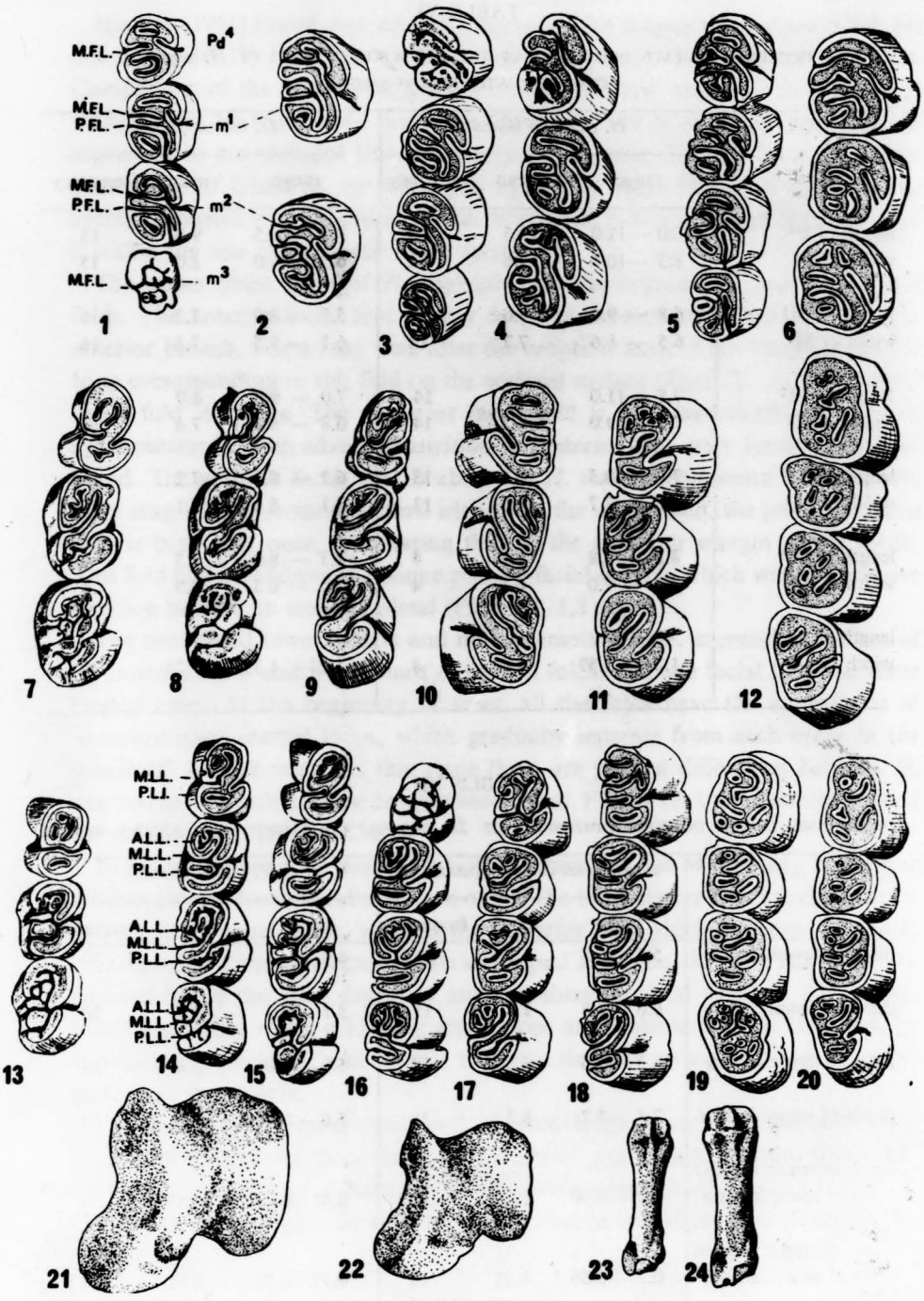


PLATE III

Fig. 6

3

HYSTRIX ASTASOBAE Bate 1951

1951. Bate, D.M.A. Foss. Mamm. Afr. (B.M.N.H.), 2: 3-5, Figs. 1a, 1b

Additional references:

Greenwood 1955 p.79

Landry 1957 p.62

Sulimski 1960 p.330

Mohr 1965 p.65

Type locality and horizon:

Abu Hugar, about twenty-five miles upstream from Singa on the Blue Nile, at the base of the river bank (Bate 1951, p.4).

Other localities:

None recorded to date

Geological age:

Pleistocene, associated with a human industry (Bate 1951 p.2), i.e. Middle or Upper Pleistocene. Late Pleistocene (Sulimski 1960, p.330). The specimen is therefore younger than 700,000 B.P., the date for the interface between the Lower and Middle Pleistocene (Van Couvering 1971).

Material:

The holotype is a poorly preserved cranial fragment with two maxillary teeth.

Illustrations:

See Bate 1951.

Bate (Figs. 1a, 1b, p.4) shows a lateral and ventral view of the cranium, see Fig. 7.

Diagnosis, taxonomic remarks:

The diagnosis has been given as follows:

> A Hystrix about the size of H. cristata with similar inflation of roof of skull. Rostrum short, shorter than in Recent species, and stout, anterior portion not narrowly constricted as in Recent species. Upper anterior border of premaxilla prominent, not deeply excavated as in Recent species..... Upper posterior process of premaxilla narrow..... Posterior processes of palatines and pterygoids stout, stouter than in Recent species (Bate 1951, pp. 3, 4).

A number of other features, in common with either H. cristata or H. africaeaustralis are listed.

Measurements:

Maxillary dentition (in mm) (measured from Bate 1951 Fig. 1)

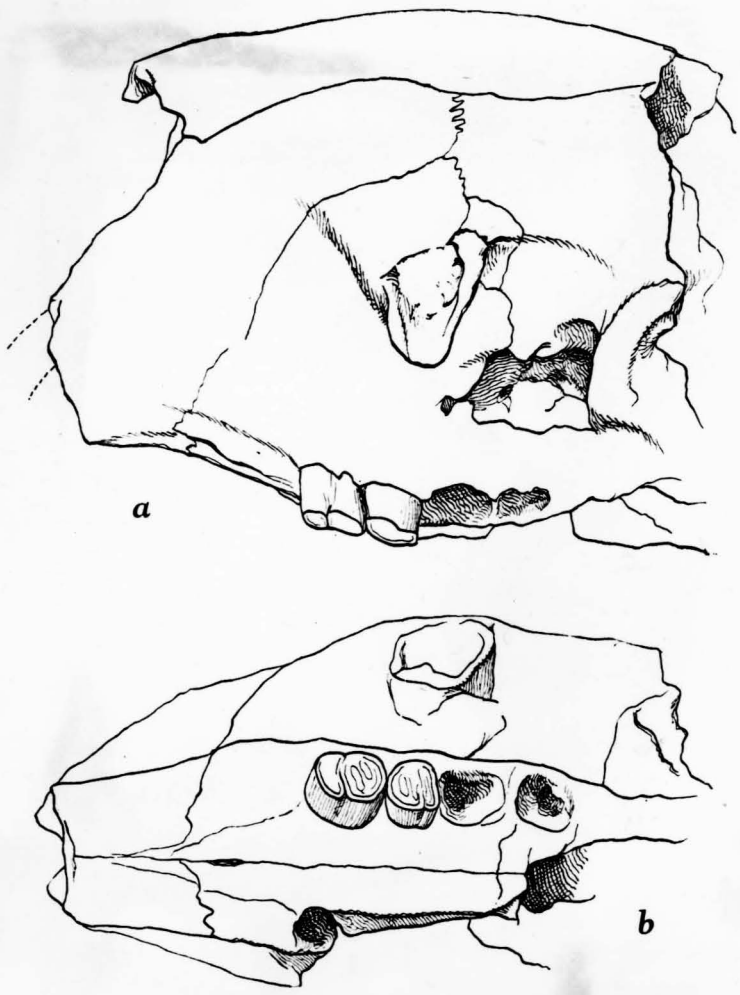
	MD	BL
P^4	10,0	6,5
M^1	7,0	6,75

The upper tooth row length at the alveoli measured from the above-mentioned figure is 35,5mm.

COMMENTS:

The present author is of the opinion that comparison with a large sample of adult H. cristata skulls (the recent porcupine occurring in this area) will reveal that all the supposedly diagnostic features of H. astasobae will fall within the range of variation for the former species. Many mammalian species from a variety of genera dating from the Pleistocene are known to be somewhat larger but otherwise indistinguishable from their recent counterparts (see also comments to No. 2, H. angressi and No. 5, H. crassidens).

Sulimski (1960, p.330) states that the taxonomic position of this species (H. astasobae) is quite uncertain, while Corbet and Jones (1964, p.300) are of the opinion that it is synonymous with H. cristata. The present author agrees with the latter opinion.



Holotype skull of *Hystrix astasobae* sp. n.: (a) lateral view; (b) palatal view, natural size.

Fig. 7

Illustration of holotype skull of Hystrix astasobae Bate 1951, photographed from Bate 1951 p. 5, Fig. 1. Natural size.

4

HYSTRIX BESSARABICA Rjabinin 1929

1929. Rjabinin, A.M. Trudy. Geol. Muz. Nauk SSR., 5: 75-115 (127-134fr.), Pl. 10, figs. 1, 1a

Additional references:
Sulimski 1960, pp.327, 329, 330, 332; 1964, pp.233, 234.

Type locality and horizon:
Taraklia beds of Bessarabia, Moldavian SSR. (Sulimski 1960 p.327; 1964, p.234)

Other localities:
The species has not been recorded from any other locality to date

Geological age:
Pliocene (Sulimski 1960, p.237; 1964, p.233)

Material:
The material described by Rjabinin 1929 is apparently the only material available and includes a specimen showing the upper dentition.

Illustrations:
See Rjabinin 1929.
Rjabinin illustrates the upper dentition (1929 Pl. 10; vide Sulimski 1960), but this illustration has not been seen.

Diagnosis, taxonomic remarks:
The original diagnosis of this species could not be acquired. However, a number of remarks concerning its characteristics have been made by Sulimski (1960):

> Hystrix bessarabica is smaller than 'H.' lamandini and H. suevica. H. bessarabica differs from H. primigenia in its smaller dimensions. However, the upper dentitions of specimens of H. primigenia from Weze and Pikermi show great similarities with the dentition of H. bessarabica and there are also similarities in the general morphology of the skulls of the two species. The P^4 of H. primigenia from Pikermi and that of H. bessarabica from Taraklia are identical. pp.237, 329, 330

Measurements:
None available

COMMENTS:

It appears from the literature that H. primigenia (Wagner 1848)(No.18) and H. bessarabica are indistinguishable except on size (which can be

considered a poor diagnostic criterion), H. bessarabica being the smaller. The geological age ascribed to H. bessarabica is an approximation, but it is obvious from Sulimski's comments (1964) concerning a 'primigenia-bessarabica'evolutionary line that he considers H. bessarabica to be younger than H. primigenia or at least overlapping with only the final stages of the time-range of the latter species. Unfortunately, no further reference to the Taraklia Beds of Bessarabia and their geological age could be found in the available literature. More precise information on the latter aspect could possibly resolve this problem and give a clue to the evolutionary position of H. bessarabica. The 'typical' form of H. primigenia is Pontian, i.e. Lower Pliocene, while the H. primigenia population from Roussillon has a Villafranchian age; Sulimski (1964) considers the latter remains amongst the relics of the Lower Pliocene fauna, and there seems to be some dispute as to whether the 'typical' Pontian H. primigenia remains from Pikermi (and elsewhere, see No. 18) and the Roussillon 'H. primigenia' are conspecific.

The possibility exists that the recovery of further H. bessarabica material (known to date only from a single locality) will show that it is conspecific with the H. primigenia relics from Weze and Roussillon (Upper Pliocene or Lower Pleistocene).

H. bessarabica therefore probably represents a somewhat less brachydont temporal and morphological transitional form between the robust, brachydont 'typical' H. primigenia of the Lower Pliocene and the smaller hypsodont modern European form, H. cristata.

Note: Since writing the above, a translation of a comprehensive work on Russian palaeontology (Orlov 1962) has come to my attention, in which the Taraklia (Tarakliya) beds are referred to as being of Meotian (i.e. Upper Miocene) age. If this is the case, H. bessarabica, together with H. suevica Schlosser 1884 (No. 23) from the Upper Miocene of Europe, would be the oldest European Hystrix fossil material, since the typical form of H. primigenia is Pontian (Lower Pliocene) in age. As such, H. bessarabica cannot represent a transitional form between H. primigenia and the modern H. cristata. From Sulimski's remarks concerning H. bessarabica (see Diagnosis, taxonomic remarks) two alternatives appear possible: either the contemporaneous H. bessarabica and H. suevica are synonymous (the former is said to be 'smaller' than H. suevica which has

a mandibular tooth row of 28,5mm in length but would be considerably smaller than the 'typical' H. primigenia with a tooth row of up to 47,0mm in length), or H. bessarabica and the 'typical' H. primigenia are synonymous, despite the slight difference in their geological age. Unfortunately, published measurements of H. bessarabica were unavailable and the measurements obtained for H. suevica are questionable.

The date for the Taraklia beds appears to be uncertain. In view of these difficulties the taxonomic position of H. bessarabica cannot be settled without recourse to the relevant fossil material, and must be considered as uncertain.

Note: Bakr (1959 p.8) places H. bessarabica in the synonymy of Hystrix primigenia (Wagner 1848).

5

HYSTRIX CRASSIDENS Lydekker 1886

1886. Lydekker, R. Mem. geol. Surv. India (Palaeont. Indica), Ser. 10, 4 (1): 37-38, Pl. 8, figs. 16-21

Additional references:

Matthew 1929, p.560

Mohr 1965, p.65

Type locality and horizon:

Beds C and Cd of the 'Cathedral', Karnul Caves, Madras, Southern India (Lydekker 1886, p.37)

Other localities:

Also from beds Cc. Ce and Cf, 'Cathedral', Karnul Caves (Lydekker 1886)

Geological age:

Pleistocene = Later Marbada Beds[i] (Lydekker 1886, p.26), i.e. younger than 1,8m.y.B.P., see Chap. 2, main text. Orlov (1962 p.40) equates these beds with the Riss and Saale glaciations of Europe.

Material:

The material described by Lydekker is apparently all that is available, and includes two dentigerous left mandibles (one complete), a right P^4, a pair of upper incisors and a pair of lower incisors.

Illustrations:

See Lydekker 1886.

Lydekker illustrates all the material mentioned above (Pl. 8, figs.16, 17, 17a, 18, 18a, 19-21; see Fig. 8).

Diagnosis, taxonomic remarks:

Lydekker (1886) defines this species as follows:

> This form is considerably larger than H. hirsutirostris from which it is also distinguished by the circumstance that the upper incisors are much wider than the lowers (p.37).

Furthermore, Lydekker (op. cit.) states that the latter characteristic serves to distinguish H. crassidens not only from H. hirsutirostris (now synonymous with H. indica) but from all other existing species, and makes the following statements concerning the form:

> In respect of size H. sivalensis agrees with H. crassidens, but the former has low-crowned and rooted molars. It is probable that H. crassidens is the connecting link between

---

i) Orlov (1962 p.40) refers to these as the Narbada beds

the Siwalik and existing Indian porcupine. Beyond their superior size, it does not appear that the cheek-teeth of H. crassidens can be distinguished from those of the recent species. (pp. 37, 38)

Measurements:

Maxillary dentition (in mm)

	MD	BL	
I^1	8,0	11,0	(calculated from Lydekker 1886 p.37)

Mandibular dentition (in mm)

	MD	BL	
I_1	6,4	7,1	(calculated from Lydekker 1886 p.37)
P_4	12,5	-	(calculated from Lydekker 1886 p.37)
	9,0	6,0	(measured from Lydekker 1886 P1.10, fig.17)
M_1	10,0	7,0	(measured from Lydekker 1886 P1.10, fig.17)
	11,0	9,0	(measured from Lydekker 1886 P1.10, fig.16)
M_2	9,0	6,5	(measured from Lydekker 1886 P1.10, fig.17)
	9,5	7,0	(measured from Lydekker 1886 P1.10, fig.16)

Length of mandibular tooth row = 35,5mm-40,0mm (measured from Lydekker 1886 P1.10, figs.16, 17).

Note: Measurements from figures must be taken only as rough approximations.

COMMENTS:

Lydekker himself stated (1886) that beyond the superior size of the cheek teeth of H. crassidens, the species cannot be distinguished from those of the recent species (H. indica). The measurements of some teeth in fact fall within the range for those of H. indica. It thus seems that like H. angressi (no. 2) and H. astasobae (no. 3), H. crassidens represents yet another large Pleistocene form of a modern species.

Note that Hystrix crassidens Lydekker 1886 is not the same as Xenohystrix crassidens Greenwood 1955.

Fig. 8

Illustrations of Hystrix crassidens Lydekker 1886 and Atherura karnuliensis Lydekker 1886 photographed from Lydekker 1886 Plate 8.

No. 16	Hystrix crassidens. Left mandibular fragment from Bed C, Cathedral. No. F. 219.
Nos. 17, 17a	H. crassidens. Left mandibular fragment and cheek teeth from Bed Cd, Cathedral. No. F. 219a.
Nos. 18, 18a	H. crassidens. Right P^4 from Bed Cd, Cathedral. No. F. 220.
No. 19	H. crassidens. Anterior aspect of upper incisors from Bed Cd, Cathedral. No. F. 220b.
No. 20	H. crassidens. Outer (distal) aspect of left upper incisor from Bed Cd, Cathedral. No. F. 220a.
No. 21	H. crassidens. Anterior aspect of part of lower incisor from Bed Cd, Cathedral. No. F. 221a.
Nos. 22, 22a	Atherura karnuliensis. Right upper incisor from Bed Cd, Cathedral. No. F. 221b.
Nos. 23, 23a	A. karnuliensis. Right lower incisor, from Bed Cd, Cathedral.

Scale: All figures natural size.

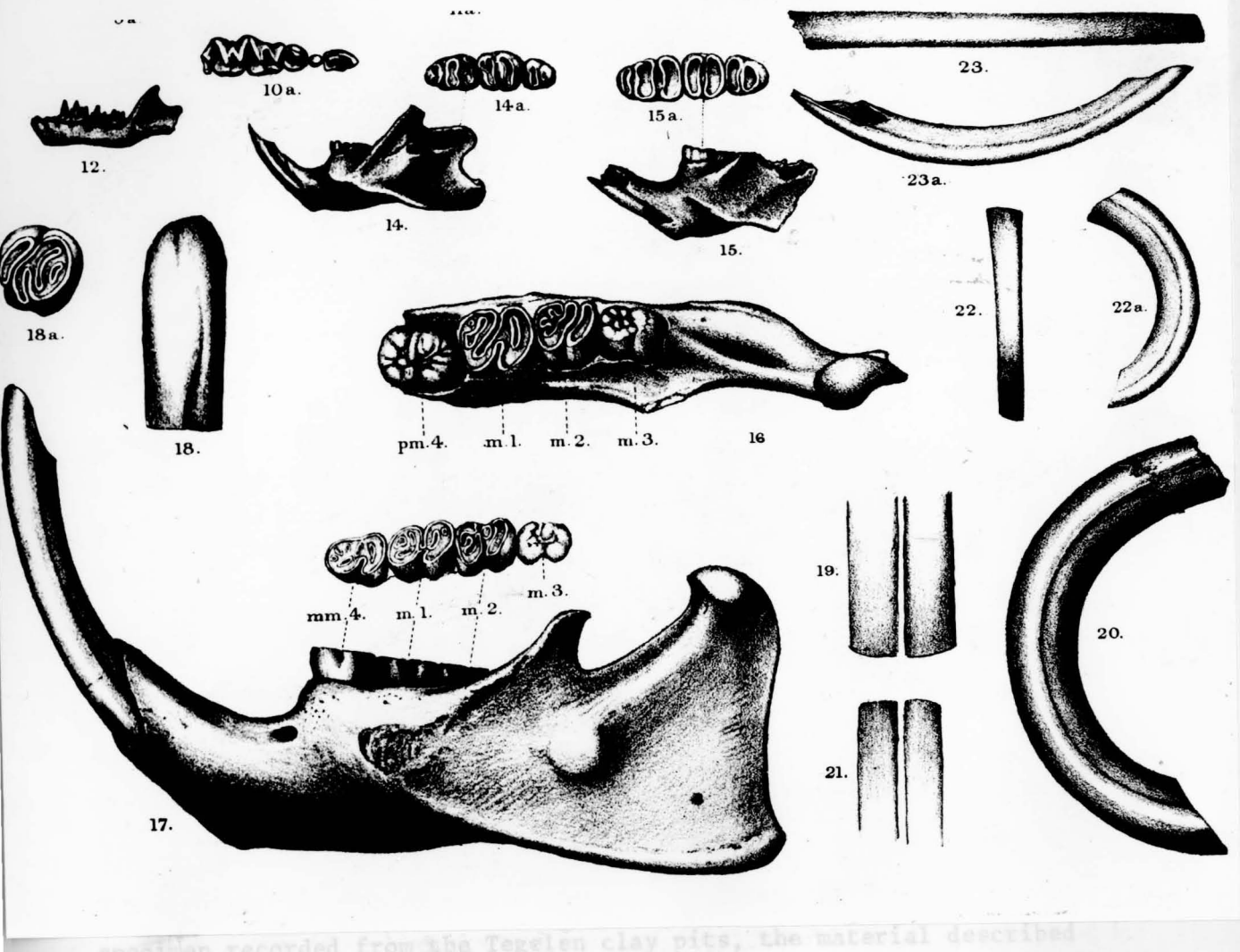

10a.
14a.
15a.
12.
14.
15.
23.
23a.
18a.
18.
22.
22a.
pm.4.
m.1.
m.2.
m.3.
16
mm.4.
m.1.
m.2.
m.3.
17.
19.
20.
21.

Fig. 8

6

HYSTRIX ETRUSCA Bosco 1898

1898. Bosco, C. Palaeontog. Italica, 4: 141(1) - 153(13), Tav. 1, figs.1-9, Tav. 2, figs.1-6

Additional references:

Major 1878 p.75 (as H. sp.) (vide Bosco 1898 p.142(2), footnote)
Landry 1957 p.61, 62
Sulimski 1960 p. 326, 329
Kortenboudt van der Sluys 1962 p.36 (as H. cf. etrusca)
Mohr 1965 p.63

Type locality and horizon:

Upper stratum, Val d'Arno, Central Italy (Bosco 1898 p.141(1))

Other localities:

Valley of the Magra, Italy (Bosco 1898 p.141)
The Lignites of Ghivizzano in the Valley of Serchio (Bosco 1898 p.141)
Tegelen Clay Pits, Netherlands (Kortenboudt van der Sluys 1962 p.36)

Geological age:

Pliocene superiore di Toscana (Bosco 1898 p.141(1));
Villafranchian, Late Pliocene (Landry p.61; Mohr 1965 p.63); Early Pleistocene, Villafranchian (Sulimski 1960 p.326; Kortenboudt van der Sluys 1962 p.36). Therefore +- 1,8m.y.B.P. (see Chap. 2, main text).

Material:

The type specimen is an almost complete cranium. Apart from the specimen recorded from the Tegelen clay pits, the material described by Bosco (1898) is apparently all that is available. This material includes a well-preserved cranium (see Fig. 9, no.1; Fig. 10, nos. 1, 3 in this appendix); a second cranium (see Fig. 9, nos. 2, 3; Fig. 10, no.2 in this appendix); a fragmentary left half-mandible with perfectly preserved cheek teeth (see Fig. 9, nos.4, 5 in this appendix); an isolated lower left premolar (see Fig. 10, nos.4, 5, 6 in this appendix); a small fragment of the right half-mandible (see Fig. 9, nos.8, 9 in this appendix); the anterior portion of a left upper incisor (see Fig. 9, no.7 in this appendix) and finally, a fragmentary right upper incisor (see Fig. 9, no.6 in this appendix).

Illustrations:

See Bosco 1898

Bosco illustrates all the material discussed above (Tav. 10(1) and 11(2), see Figs. 9, 10 in this appendix).

Diagnosis, taxonomic remarks:

Bosco does not give a diagnosis or definition as such, but provides a very adequate description, and compares his species with all living and fossil species considered valid at that time. He makes the following statements concerning the form:

> H. etrusca does not differ very much in size from H. refossa (= H. major Gervais) but the morphology of the tooth crowns differs considerably; these differences may, however, be due to a differing degree of wear (p.151 (11)). H. etrusca is larger than H. sivalensis. (p.152 (12)).

Bosco also states that the discovery of further remains may lead to the conclusion that H. etrusca and the porcupine from Roussillon (identified by Deperet 1890 as H. primigenia) are conspecific, since the deposits from which the two forms have been derived are of the same age and have similar faunas. Bosco, however, does not agree with Deperet that the Roussillon species and the typical H. primigenia from the Pikermi are the same and would prefer the Pikermi and Roussillon forms to be kept separate. However, he also states that H. etrusca and the typical H. primigenia have identical dimensions. Amongst the living species, Bosco is of the opinion that his species is closest to H. cristata or H. hirsutirostris (= H. indica) (p.142 (12, 153(13)).

Landry (1957) states that:

> It has hypsodont teeth and greatly inflated nasals and is not very different from the living Italian porcupine H. cristata. (p.62)

COMMENTS:

Schlosser (1884) equates H. major Gervais 1859 with H. refossa Gervais 1852, while Deperet (1890) equates H. refossa with H. primigenia, more particularly with the H. primigenia which he described from Roussillon. Bosco considers that his H. etrusca may be conspecific with the Roussillon 'primigenia' porcupine but that the latter form and the 'typical' Lower Pliocene form of the species from Pikermi and elsewhere should be kept separate. With regard to this separation,

Sulimski (1964 p.234) considers that the Roussillon remains (probably Upper Pliocene or 'Villafranchian') should be regarded as relicts of the Lower Pliocene fauna, and that the 'relict' H. primigenia probably differed from the 'typical' form in several respects.

From the above it follows that H. refossa Gervais 1852, H. major Gervais 1859, H. etrusca and the 'H. primigenia' from Roussillon may be synonymous - all four species dating from the 'Villafranchian' (Upper Pliocene-Lower Pleistocene). Synonymy would not be out of place since it is highly improbable that four such similar species would occur synchronously in a restricted area. Without having access to the material in question, it is impossible to say whether such synonymy is justifiable; at best, comparisons of collected published data, measurements and illustrations of the four species can be made (see nos. 14, 18 and 19).

All four species have been described as being larger than the living porcupine (H. cristata, in this instance), while H. major has been described as being 1/3 larger than the largest living porcupine (H. cristata). In addition, H. refossa, H. etrusca and H. primigenia have been described as having short crowns (brachydont)[i] and having mandibular molars with well-developed divergent roots. There seems to be some doubt as to the validity of H. major and H. refossa as species within the genus Hystrix, but examination of the figures illustrating the mandibular dentitions of H. etrusca (Fig. 9) and H. primigenia (Figs. 23 and 24) certainly indicate that in crown enamel pattern and brachydonty they are remarkably similar. Fig. 23 is of the 'relic H. primigenia' from Weze. Furthermore, the size ranges of the dentitions of H. etrusca and H. primigenia (both forms) overlap, and both have been quoted as most closely resembling H. cristata amongst living forms.

The present author is of the opinion that further collection and examination of material of the four fossil European species mentioned above will lead to the conclusion that H. major, H. refossa (if the latter two belong to Hystrix at all) H. etrusca, Late Pliocene and Villafranchian forms of H. primigenia and possibly even H. bessarabica (no. 4) from Moldavia, are synonymous.

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i) Landry (1957) describes H. etrusca as 'hypsodont'; the use of the terms hypsodont and brachydont appears to be relative

Note: Bakr (1959 p.23) places H. etrusca in the synonymy of Hystrix refossa Gervais 1852.

Fig. 9

Illustrations of Hystrix etrusca Bosco 1898 taken from Bosco 1898 Tav. 10(1).

No. 1 Dorsal view of cranium A from the upper stratum, Val d'Arno.
No. 2 Dorsal view of cranium B from the same locality.
No. 3 Ventral view of cranium B.
No. 4 Occlusal view of a left mandibular fragment from the upper stratum, Val d'Arno.
No. 5 Facial view of the same fragment.
No. 6 Isolated right upper incisor from Olivola in the Val di Magra, distal (outer) view.
No. 7 Isolated left upper incisor from the upper stratum, Val d'Arno, mesial view.
No. 8 Right mandibular fragment from the lignites of Ghivizzano in the Valle di Serchio, occlusal view.
No. 9 The same fragment, facial view.

Scale: All figures natural size.

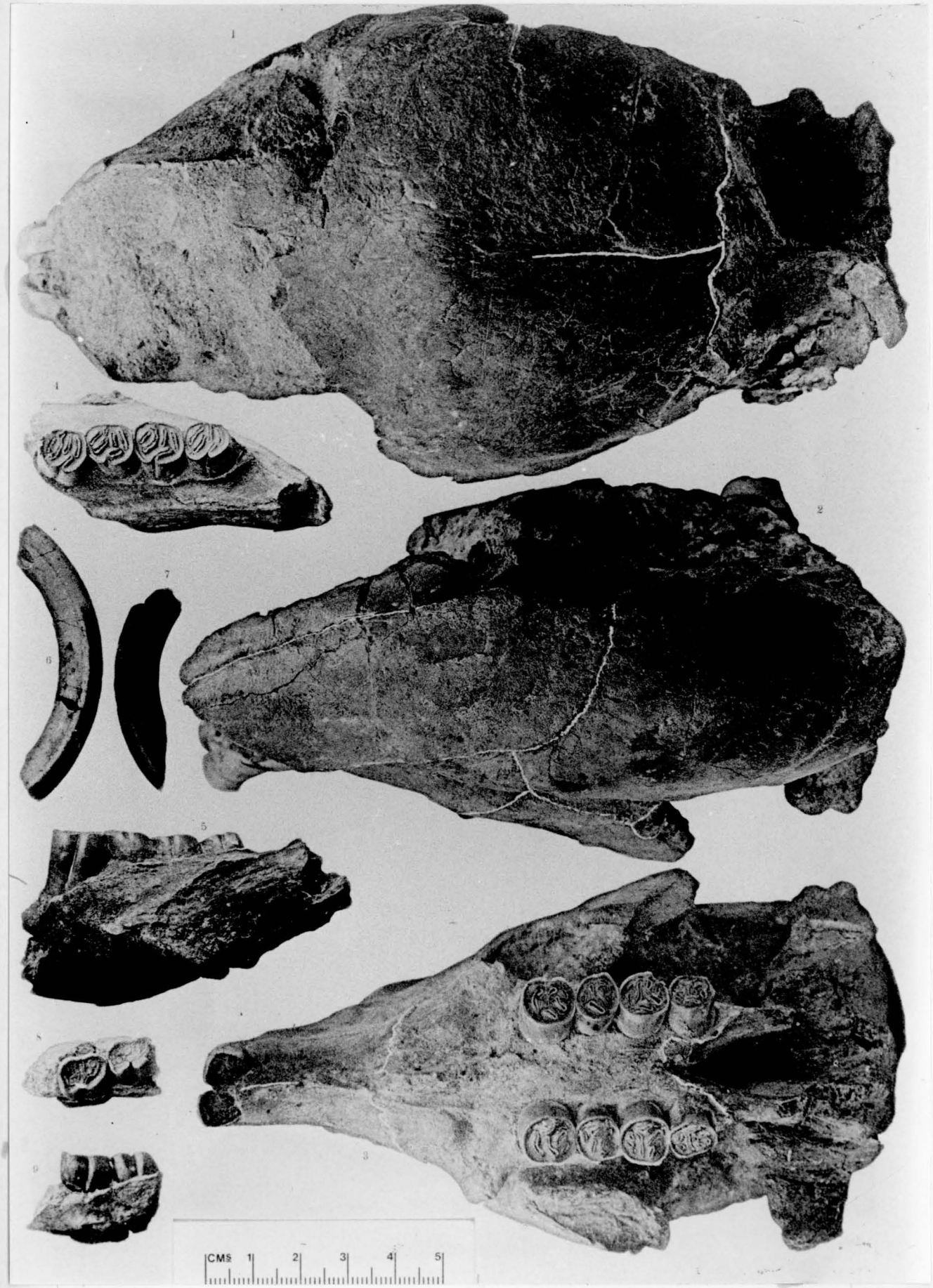


Fig 9

Fig. 10

Illustrations of Hystrix etrusca Bosco 1898 taken from Bosco 1898 Tav. 11(2).

No. 1 Cranium A from the upper stratum, Val d'Arno, ventral view.
No. 2 Cranium B from the same locality, lateral view.
No. 3 Cranium A, lateral view.
No. 4 Isolated lower left premolar, lingual view.
No. 5 The same, occlusal view.
No. 6 The same, distal view.

Scale: All figures natural size.



Fig 10

7

HYSTRIX GREENWOODI Bakr circa 1960

Probably only in manuscript form. In Museum of Comparative Zoology, Harvard?

Some time after Greenwood (1958) had published her new name for Hystrix major Greenwood 1955 (H. makapanensis)i.e. about 1960, a large sample of fossil Hystrix material, much larger than the one from which Greenwood (1955) had originally identified Xenohystrix crassidens, Hystrix makapanensis and H. cf. africaeaustralis, was lent to an American research student from Asia, a Mr. Abu Bakr, then studying under Dr. Bryan Patterson of the Museum of Comparative Zoology, Harvard University. This sample, which represented all the fossil Hystrix material that was available from Makapansgat Limeworks at that time, included numerous specimens not seen by Greenwood.

From this larger sample, Bakr suggested that a fourth species, which he suggested should be called H. greenwoodi, was present, and named M1806 as the type. This suggestion was returned with the specimens, written on a small sheet of notepaper which included a list of specimens to be referred to the new species.

All attempts to discover whether a description of H. greenwoodi has been published have failed. Letters to Dr. Patterson and to all the major Palaeontological, Geological and Zoological research institutions in Asia, (Pakistan, Bangladesh and India) have been unsuccessful. The species, as far as could be ascertained, has not been mentioned in print by any other author to date.

The present author compared the 'type' (a small mandibular fragment at growth stage 5) with a mandible of the modern H. africaeaustralis at the same stage of growth and could find no reliable characteristics by which it could be differentiated from the latter, and for this reason it is proposed that H. greenwoodi be declared nomen nudum.

8

HYSTRIX cf. HIRSUTIROSTRIS Brandt 1835

1835. Brandt, J.F. Mem. de l'acad. de St. Petersb. Ser. 6, Scienc. mathem., phys. et natur. 3 (2): 375, Pl. 8

Note: H. hirsutirostris Brandt 1835 is synonymous with H. indica Kerr 1792 (Ellerman and Morrison-Scott 1951 p.518) H. leucura Sykes 1831 (No. 13) is also a synonym of the latter species (the living Indian porcupine, see Appendix IV, p.48) and thus the references to cf. hirsutirostris and cf. leucura should be considered together.

Additional references:

Vereschagin 1959 p.127 (as H. cf. leucura), 117 (as H. cf. Hirsutirostris), 474 (as H. leucura)

Sulimski 1960 p.327

Mottl 1967 pp.305-312

Localities and horizons from which H. cf. hirsutirostris or fossil forms of H. hirsutirostris described:

Various Pliocene localities in Russian Caucasia (Vereschagin 1959), Lower and Middle Palaeolithic sites in Russian Caucasia; Sakazhia cave (op. cit.); Early Pleistocene localities in Bavaria (Sulimski 1960); various Middle-Upper Pleistocene localities in Central Europe (Mottl 1967).

Geological age:

From the foregoing, apparently from Pliocene - Recent.

Material:

No accurate records available, but apparently plentiful.

Illustrations:

See Figs. 4, 5 and 6, in this appendix for illustrations of H. indica, with which H. cf. hirsutirostris material is synonymous. Also Mottl (1967 p. 307, Fig. 2).

Taxonomic remarks:

Sulimski (1960) states that some of the material referred to H. cf. hirsutirostris is smaller than H. sivalensis and H. cristatus but its root structure is similar to that of H. sivalensis (i.e. low-crowned and rooted; see No. 21A)

Measurements:

As for H. indica and H. leucura (no. 13), one of its synonyms. No specific measurements for H. cf. hirsutirostris available.

COMMENTS:

It is probable that most of the fossil material described as H. cf. hirsutirostris is actually referrable to H. indica.

9

HYSTRIX KARNULIENSIS (Lydekker 1886)

1886. Lydekker, R. Mem. geol. Surv. India (Palaeont. Indica) Ser. 10, 4 (1) p.38, Pl. 8, figs.22, 22a, 23, 23a

Note: This species was originally described as Atherura karnuliensis Lydekker 1886 but Matthew (1929 P.559, 560) refers to it as Hystrix karnuliensis.

Additional references:

Matthew 1929, pp.559, 560 (as H. karnuliensis)

Mohr 1965 p.66 (as Atherurus karnuliensis)

Type locality and horizon:

Bed cd, 'Cathedral', Karnul Caves, near Madras, southern India (Lydekker 1886, p.23; legend to Pl. 8)

Other localities:

None recorded to date

Geological age:

Pleistocene, Later Marbada beds (Lydekker 1886, p.26), i.e. probably Middle to Upper Pleistocene, and hence less than 700,000 yrs.B.P. (see Chap. 2, main text). See age for No. 5, H. crassidens.

Material:

Lydekker (1886, p.38) mentions only a few isolated upper and lower incisors (illustrated in Fig. 8, this appendix) whilst Matthew (1929, p.559) mentions a mandibular fragment, M3448, containing a moderately-worn dp_4 with spreading roots.

Illustrations:

See Lydekker 1886

Lydekker illustrates an isolated upper right incisor (Pl.8, figs.22, 22a; see Fig.8) and an isolated lower right incisor (Pl.8, figs. 23, 23a; see Fig.8).

Diagnosis, taxonomic remarks:

Lydekker (1886) states that the incisors of Atherurus karnuliensis are much smaller than those of any existing species of Hystrix and that

..... their resemblance to the incisors of Atherura is indeed so close as to leave little, if any, doubt as to their generic identity. (p.38)

Measurements:

Mandibular and Maxillary dentition (in mm) (measured from Lydekker 1886 Pl.8, fig. 23)

	MD	BL
I^1	4,0	-
I^1	3,5	-

COMMENTS:

It seems as if Matthew's (1929) re-naming of the species is totally unjustified. Examination of Lydekker's illustration of the incisors of the species (see Fig.8) suggests that Lydekker was right in the first instance, since for their length, the incisors are far narrower than those of any Hystrix known, the length precluding the possibility that the teeth are those of very young individuals. There seems little reason, therefore, to continue considering this species as a fossil form of Hystrix.

10

HYSTRIX KIANGSENENSIS Wang 1931

1931. Wang, K.M. Contr. Nat. Res. Inst. Geol. (Acad, Sinica) 1: 47-49, Taf. 2, figs.3-13

Note: Synonymous with Hystrix cf. subcristata, according to Colbert and Hooijer (1953 p.41, Table 8) and Young (1934, p.111). All references to H. kiangsenensis therefore apply equally well to H. cf. subcristata.

Additional references:
Young 1934 p.111 (as H. cf. subcristata)
Colbert and Hooijer 1953 p.41 (as H. cf. subcristata)

Type locality and horizon:
Drachen-Maul-Höhle, Kiangsen, Chekiang, China

Other localities:
None. Otherwise see No.22, H. cf. subcristata

Geological age:
Upper Pliocene to Lower Pleistocene, or corresponding in age to Samenian of China (fissure faunas of the Yangtse-region)(Wang 1931, pp.42, 43). If the species is indeed synonymous with H. cf. subcristata from numerous localities in North and Central China, then a more likely age would be Late Lower to Early Middle Pleistocene, and therefore approximately 700,000 yrs.B.P. in age (see Chap. 2, main text).

Material:

The material described by Wang (1931) is apparently all that is available of this species. This includes: the anterior portion of a fragmentary right half-mandible bearing P_4 and a broken M_1; an isolated upper right incisor; an isolated lower right incisor; an isolated right P^4 (?); an isolated left M^3; an isolated left P_4; an isolated left M_1 and an isolated dp_4.

Illustrations:
See Wang 1931, also those for H. cf. subcristata (Figs. 29,30,32, this appendix)

Wang (Taf.2, figs.3-13, see Fig. 11) illustrates all the material mentioned above.

Diagnosis, taxonomic remarks:

Wang (1931) does not provide a specific diagnosis or definition of his species, but provides a broad description, and makes the following statements concerning it:

> Incisors have red-brown labial surface. Upper incisor is not much broader than lower. Mental foramen lies below the anterior edge of P_4. P_4 is somewhat bowed anteriorly and has well-marked outer fold, inner folds indicated by an indistinct furrow. The enamel folds extend to the base of the crown. The occlusal surface does not show a large number of enamel islands. The P^4 is sharply inward-curving and only has one fold on the outer side. On the inner side are one long and two shorter folds. Its occlusal surface shows more enamel islands than that of P_4. The morphology of the M_1 resembles that of P_4 but has more enamel islands on the anterior part of the occlusal surface. M_2 has one outer fold and three inner folds which continue as enamel loops on the occlusal surface. M^3 is small, sharply inward-curving with a circular cross-section. All the teeth are hypsodont and have small roots, one larger posterior root and two small anterior rootlets. (p.48)
>
> H. kiangsensis is distinguished from H. (Acanthion) lagrelli (no. 11) by its larger dimensions and by the build of the cheek-teeth. From H. crassidens (no. 5) the species differs in not having its upper incisors markedly broader than the lowers. H. sivalensis (no. 21) has larger dimensions and has more enamel islands on the occlusal surface of its teeth, it is also more brachydont and its cheek teeth each have three long roots. H. primigenia (no. 18) from Pikermi has larger dimensions than H. kiangsenensis and a more strongly developed masseteric crest. H. refossa (no. 19) has more enamel islands, lower crowns and more strongly developed cheek tooth roots. H. kiangsenensis is closest in morphology and size to H. subcristata (no. 22) and is genetically related to it. (op. cit. pp.48, 49; numbers in brackets are those of the present author).

Measurements:

Maxillary dentition (in mm)(after Wang, 1931, p.48)

	MD	BL
I^1	5.7	1.2
P^4	8.4	7.5
M^3	7.3	8.1

Mandibular dentition (in mm)(after Wang 1931, p.48)

	MD	BL
I^1	5.7	6.7

	MD	BL
	7.4	6.7
dp_4	7.7	5.3
P_4	7.5	6.8
	9.6	8.2
M_1	7.0	-
	7.4	6.0
M_2	8.2	6.8
	8.0	7.6

Length of lower cheek-tooth row measured at alveolus = 29.4mm.

COMMENTS:

Most of the 'diagnostic characters' discussed by Wang in his description of H. kiangsenensis are common to many species of Hystrix and in fact to other genera; in view of this not one of the characters mentioned really serves to differentiate the species from any other species of Hystrix. One of the characters discussed, where the upper premolar is described as sharply inward-curving and as having one outer and three inner enamel folds, is precisely the reverse of the situation that exists in Hystrix (upper molars curve outwards, have one internal and three outer enamel folds), and the present author is thus of the opinion that Wang has erroneously identified and orientated the teeth he describes.

Young (1934, p.111) and Colbert and Hooijer (1935, p.41, Table 8) consider H. kiangsenensis to be conspecific with H. subcristata. H. (Acanthion) subcristata is the modern Chinese porcupine. See also comments for H. cf. subcristata (no. 22).

Fig. 11

Illustrations of Hystrix kiangsenensis Wang 1931 photographed from Wang 1931 Taf. 2 p. 63.

No. 3 Mesial view of upper right incisor.
No. 4 The same, labial view.
No. 5 Lower right incisor, mesial view.
No. 6 The same, labial view.
No. 7 Facial view of fragmentary right half-mandible.
No. 8 The same, occlusal view.
No. 9 Isolated right p^4, occlusal view.
No. 10 Isolated left M^3, occlusal view.
No. 11 Isolated left p_4, occlusal view.
No. 11a The same, buccal view.
No. 12 Isolated left M_1, occlusal view.
No. 12a Not listed in original legend.
No. 13 Isolated left dp_4, occlusal view.

Scale: All figures natural size.


1
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7
5
9
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12a
11a
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29
26

Fig. 11

11

HYSTRIX (ACANTHION) LAGRELII Lönnberg 1924

1924. Lönnberg, E. Palaeont. Sinica, Ser. C, 1 (3) pp 1-4
Pl 1 figs. 1-4

Additional references:

Young 1930, p.15

Wang 1931, p.48

Teilhard de Chardin 1936, p.20 (vide Teilhard and Pei, p.59)

Teilhard de Chardin and Pei, 1941 pp.58-61, Figs. 48a, 48b, p.60

Greenwood 1955, pp.82, 83; Tables 6, 7.

Sulimski 1960, p.327; Table 1.

Mohr 1965, p.66

Type locality and horizon:

10 li (Chinese measurement of length) north of Mien-chih-hsien, 65km (40 miles) west of Honan-Fu, Honan, central China; from an unidentified red clay

Other localities:

Locality 9, Choukoutien, China (Teilhard de Chardin 1936, p.20)

Locality 13, Choukoutien, China (Teilhard de Chardin and Pei 1941, p.58)

Geological age:

No age was given with the original description but since the species has also been recovered from Localities 9 and 13 of Choukoutien, it probably dates from the late Lower Pleistocene (the approximate age of Choukoutien) approximately 700,000 to 1,000,000 yrs.B.P.

Sulimski (1960, p.327) gives the age as Pontian (i.e. Lower Pliocene) but this seems far too early, since it is generally accepted that Choukoutien is Pleistocene.

Young (1930, p.15) is of the opinion that H. (A.) lagrelii is geologically older than H. cf. subcristata (age given as Pleistocene), but this cannot be so since both occur together at Localities 9 and 13 Choukoutien (Teilhard de Chardin and Pei 1941, p.59).

Material:

The type specimen is a well-preserved almost complete cranium, with a full set of teeth from Mien-Chih-Hsien, Honan, China (Lönnberg 1924 p.1).

Teilhard de Chardin (1936, p.20) has ascribed two lower jaws from Locality 9, Choukoutien, to this species.

Teilhard de Chardin and Pei (1941, p.58) list a slightly crushed and compressed complete juvenile cranium with a full set of teeth and three mandibles with slightly worn teeth from Locality 13, Choukoutien.

Illustrations:

See Lönnberg 1924, Teilhard de Chardin and Pei, 1941

Lönnberg (Pl.1, figs.1-4) illustrates the type cranium compared with that of H. (A.) javanica (see Fig.12, this appendix), and Teilhard de Chardin and Pei (1941, Figs.48 a,b) illustrate the complete cranium and maxillary dentition and a right mandible and mandibular dentitions - see Figs.13, 14 in this appendix.

Diagnosis, taxonomic remarks:

The following diagnostic remarks concerning this species have been made:

> A small Hystrix, its skull of the Acanthion type, strongly reminiscent of H. (Acanthion) javanica. Frontal region shortened, snout decidedly more slender than in H. (A) javanica. Nasals more than 1/3rd upper skull length but relatively short, not extending beyond the transverse plane between P^4 and M^1; little expanded. Frontals long. Hypsodont dentition with molars that are more cylindrical in cross-section and smaller than those of H. (A) javanica. Molar series shorter than in H. (A) javanica. Roots vestigial. Pterygoid fossa extends forwards as far as the middle of M_2 (fossa terminates between M_2 and M_3 in type). (Lönnberg 1924, pp.1-4; Teilhard de Chardin and Pei 1941, pp.58, 59).

Measurements:

Maxillary dentition (in mm)

	MD	BL	
I^1	5.0	-	(Lönnberg 1924, p.2)
	5.0	-	(Lönnberg 1924, p.2)
	4.1	-	(Teilhard de Chardin & Pei 1941, p.60)
	5.0	-	(Teilhard de Chardin & Pei 1941, p.60)
P^4	6.00	5.5	(Lönnberg 1924, p.2; Greenwood 1955, p.82)
	5.1	4.5	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)
	6.0	5.5	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)
M^1	5.3	5.4	(Lönnberg 1924, p.2; Greenwood 1955, p.82)
	5.1	4.5	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)

	MD	BL	
	5.3	5.4	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)
M^2	5.3	5.2	(Lönnberg 1924, p.2; Greenwood 1955, p.82)
	5.1	4.1	(Teilhard de Chardin & Pei, 1941 p.60; Sulimski 1960, Table 1)
	5.3	5.2	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)
M^3	4.8	4.3	(Lönnberg 1924, p.2; Greenwood 1955, p.82)
	4.1	3.5	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)
	4.8	4.3	(Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1)

Length of maxillary tooth row = 22.0mm (Lönnberg 1924, p.2; Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1); 20.5mm (Teilhard de Chardin & Pei 1941, p.60; Sulimski 1960, Table 1).

Mandibular dentition (in mm)

	MD	BL	
P_4	5.0	5.2	(Teilhard de Chardin & Pei 1941, p.60)
	5.0	5.0	(Sulimski 1960, Table 1)
	6.0	5.2	(Sulimski 1960, Table 1)
M_1	5.5	4.5	(Teilhard de Chardin & Pei 1941, p.61)
	5.0	4.5	(Teilhard de Chardin & Pei 1941, p.61)
	5.0	4.0	(Sulimski 1960, Table 1)
	6.0	4.5	(Sulimski 1960, Table 1)
M_2	5.7	5.0	(Teilhard de Chardin & Pei 1941, p.61)
	5.5	5.0	(Teilhard de Chardin & Pei 1941, p.61)
	5.0	5.0	(Sulimski 1960, Table 1)
	5.7	5.0	(Sulimski 1960, Table 1)
M_3	5.0	4.5	(Teilhard de Chardin & Pei 1941, p.61; Sulimski 1960, Table 1)
	4.2	4.0	(Teilhard de Chardin & Pei 1941, p.61; Sulimski 1960, Table 1)

Length of mandibular cheek-tooth row = 22.0mm (Teilhard de Chardin and Pei 1941, p.61; Sulimski 1960, Table 1)

COMMENTS:

H.(Acanthion) lagrelii appears to be considerably smaller than the fossil porcupine H. cf. subcristata, with which it is contemporaneous. H.(Acanthion) lagrelii, probably a small forest-loving form, may therefore be a valid species which lived synchronously with the larger, savanna-adapted H. cf. subcristata.

Fig. 12

Photograph illustrating the type specimen of Hystrix (Acanthion) lagrelii Lonnberg 1924 taken from Lönnberg 1924 Plate 1.

No. 1a Dorsal view of the skull of H. (A) lagrelii from Mien-Chih-Hsien.

No. 1b Dorsal view of the skull of the recent H. (A) javanica from Java.

No. 2 Right lateral view of the skull of H. (A) lagrelii.

No. 3 Left lateral view of same.

No. 4a Palatal view of the skull of H. (A) lagrelii.

No. 4b Palatal view of the same skull figured in 1b, H. (A) javanica.

Scale: Approximately natural size.

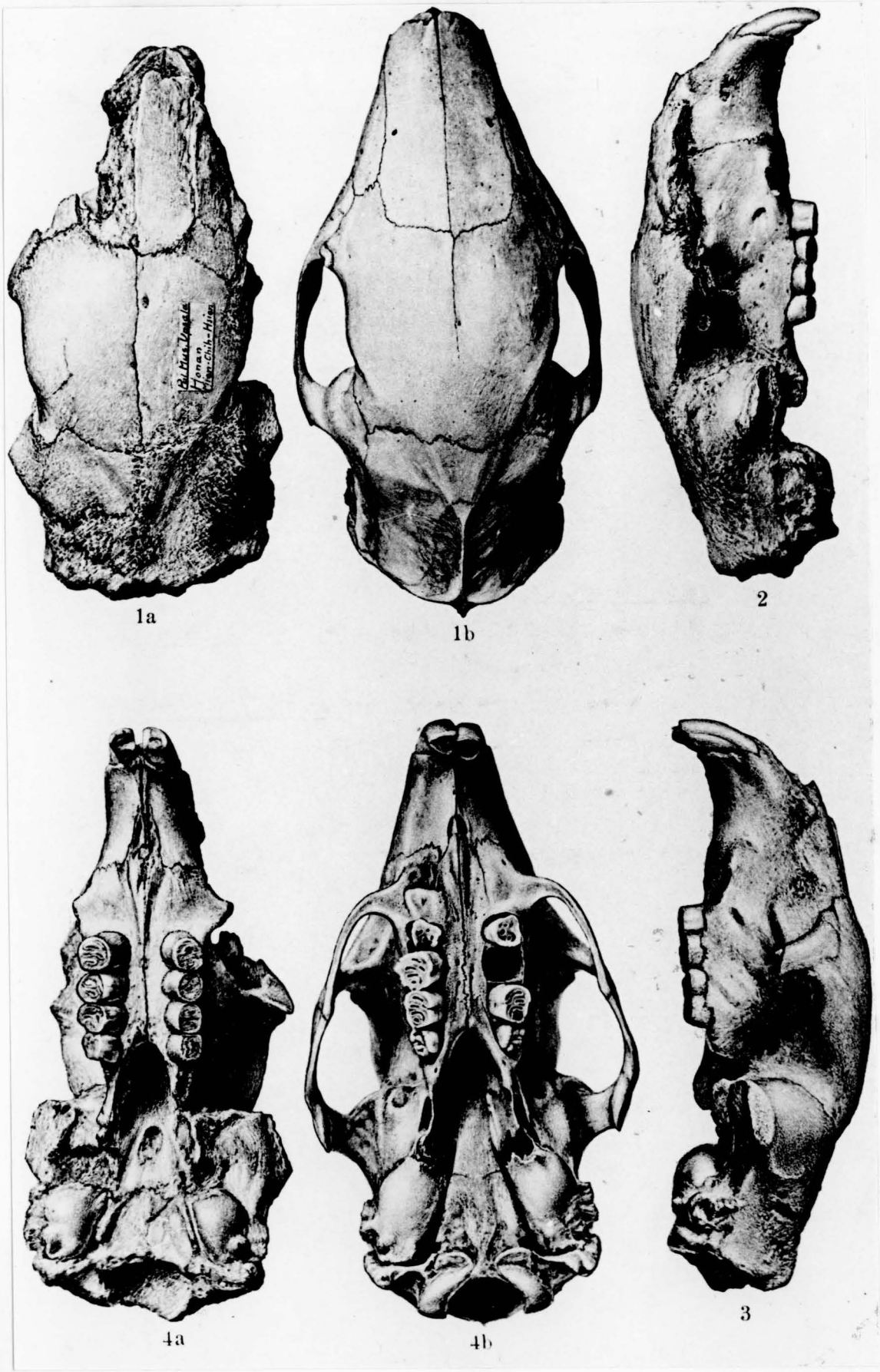


Fig. 12

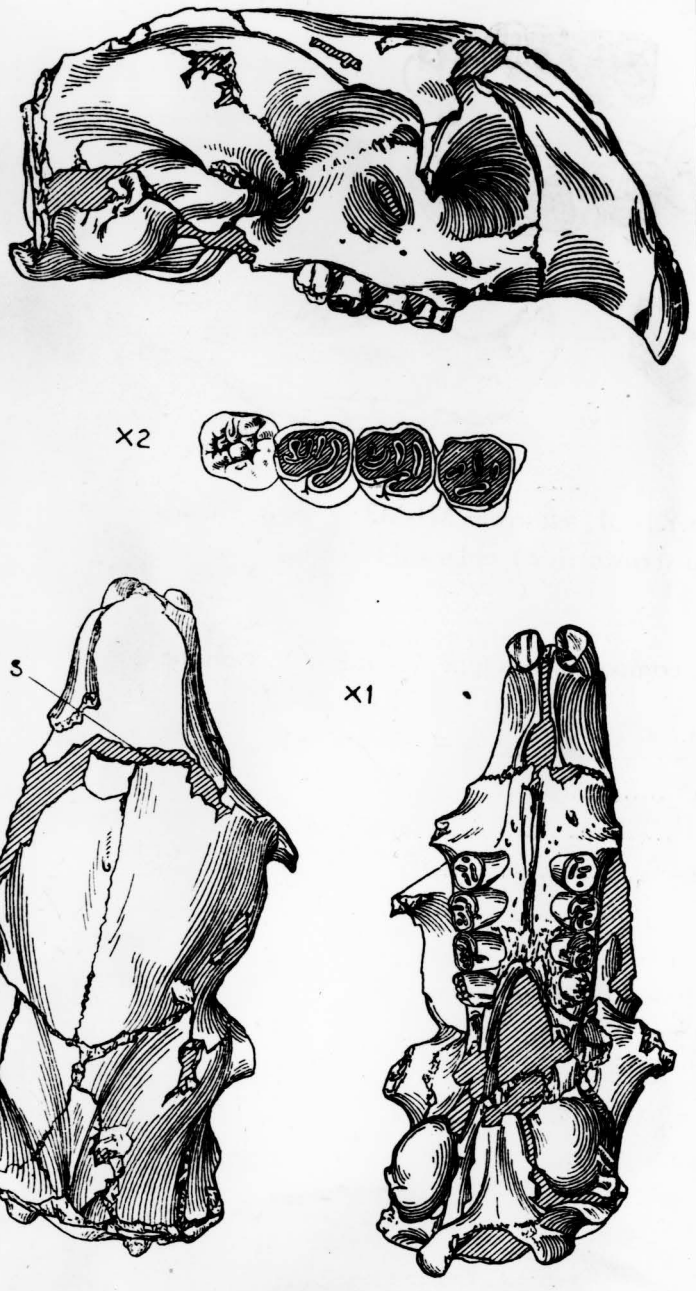


Fig. 48a.—*Hystrix lagrelii* Lonnberg.—Skull, natural size; and right upper cheek-teeth, enlarged twice.

Fig. 13

Photograph illustrating the cranium and dentition of Hystrix(Acanthion)lagrelii Lonnberg 1924 from Locality 13 of Choukoutien, taken from Teilhard de Chardin and Pei 1941 Fig. 48a p. 59.

Lateral, dorsal and ventral views of cranium natural size, right maxillary cheek-teeth enlarged twice.

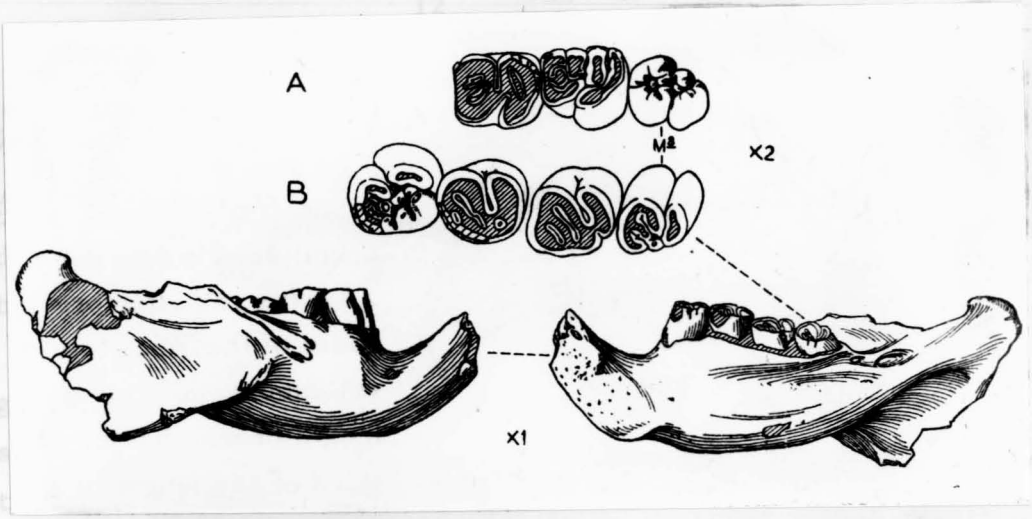


Fig. 14

Photograph illustrating the mandible and mandibular dentition of Hystrix (Acanthion) lagrelii Lonnberg 1924 from Locality 13 of Choukoutien, taken from Teilhard de Chardin and Pei 1941 Fig. 48b p. 60.

A. Occlusal view of lower left M_1 to M_3 x 2.
B. Occlusal view of lower right P_4 to M_3.

Lateral and lingual view of right half mandible, shown natural size.

12

HYSTRIX (?) LAMANDINI Filhol 1876

1876. Filhol, H. Ann. Sc. Geol., 7(7): 49

Additional references:

Lydekker 1884, pp. 108(4), 110(6)

Schlosser 1884 pp. 47(29), 48(30), Taf. 7(3), figs.32, 34, 35, 36, 38-41

Roger 1885, p.110

Bosco 1898, p.150(10), 151(11)

Zittel 1925, p.112

Korvenkontio 1934, p.? (vide Landry 1957, p.61)

Landry 1957, pp.60, 61

Sulimski 1960, p.327

Mohr 1965, p.63

Type locality and horizon:

Phosphorites du Quercy (Filhol 1876)

Other localities:

Phosphorit von Bosc negre bei Lamandine (Tarn et Garonne);
Phosphoriten von Escamps bei Lalbenque (Schlosser 1884, legend to Taf. 3)

Geological age:

Originally quoted as Upper Eocene (Filhol 1876, p.49) and therefore the earliest recorded occurrence of a porcupine. Landry (1957), Sulimski (1960) and Mohr (1965) quote the age as Early Oligocene.

Material:

The type specimen is a mandibular fragment without teeth (Filhol 1876, p.49). Schlosser (1884) added to this another toothless mandibular fragment and an upper incisor (apparently from Bosc negre near Lamandine) and a metacarpal II, metatarsal II and metatarsal IV from 'Phosphoriten von Escamps bei Lalbenque' (see legend to Taf. 3; Fig. 15 this appendix). The mandibular fragment figured may in fact be the type.

Illustrations:

See Schlosser.1884, (Fig.15, this appendix), Korvenkontio 1934. Schlosser (1884) illustrates the type specimen (?) (Taf. 7(3), figs.32, 32a), the incisor from Lalbenque (figs.34, 35, 41) and the metatarsal II, metacarpal II and metatarsal IV (figs.36, 38, 39, 40) from the same locality (see Fig. 15).

Diagnosis, taxonomic remarks:

No description of the fossil was provided with the publication originally naming the species. Schlosser (1884, p.47) gives a good description of this species. Even at this time he began to doubt that the remains belonged to Hystrix at all, and implied that they showed affinities with Sciurioides. Bosco (1898, p.150(10)) states that the generic determination is very doubtful. Korvenkontio (1934) examined the incisor enamel of H. (?) lamandini and showed clearly that it did not resemble that of any hystricomorph but was of the type found in Arctomys. Landry (1957, p.61) considers that this is convincing enough evidence to exclude this fossil from the genus. Sulimski (1960, p.327) also considers the generic determination to be doubtful. Mohr (1965) states that:

> Fossils formerly described as H. (?) lamandini Filhol are now widely considered as not belonging to this genus at all but as representatives of a marmot-like animal whilst some consider that they should be included in the genus Arctomys. (p.63)

The mandible illustrated by Schlosser certainly does not have a Hystrix-like appearance.

Measurements: (after Schlosser 1884, p.47(29), measured at alveolus)

	MD	BL
P_4	5.5	-
M_1	6.0	-
M_2	6.0	-
M_3	7.0	-

Length of mandibular tooth row = 26.5mm.

COMMENTS:

After examination of Schlosser's figure (Fig. 15 in this appendix) the present author would tend to agree with Korvenkontio, Landry and Mohr that this species does not belong in the genus Hystrix.

Fig. 15

Illustrations of Hystrix lamandini Filhol 1876 and H. suevica Schlosser 1884, from Schlosser 1884 Taf. 7 (3).

Fig. 27 Hystrix suevica Schlosser 1884. Isolated molar from Hader near Dinkelscherben. 3/2 nat. size. (This specimen later transferred to H. wiedemanni).

Fig. 32 Hystrix lamandini Filhol 1876. Lateral view of mandible (Type ?). Eocene of Bosc negre near Lamandine. Nat. size.

Fig. 32a The same, viewed from above.

Fig. 34 H. lamandini Filhol (?). Incisor, distal surface shown. Bosc negre near Lamandine. Nat. size.

Fig. 35 The same, viewed from above.

Fig. 36 H. lamandini Filhol (?). Metatarsal II. Escamps near Lalbenque. Nat. size.

Fig. 36a Proximal surface of same.

Fig. 38 Proximal surface of metatarsal IV shown in Fig. 40. Nat. size.

Fig. 39 H. lamandini Filhol (?). Metacarpal II from behind; proximal facet shown below. Nat. size.

Fig. 40 H. lamandini Filhol (?). Metatarsal IV from behind. Nat. size.

Fig. 41 Isolated incisor, the same as shown in Figs. 34 and 35, mesial view.

The originals of Figs. 36, 38 - 40 come from Escamps near Lalbenque.

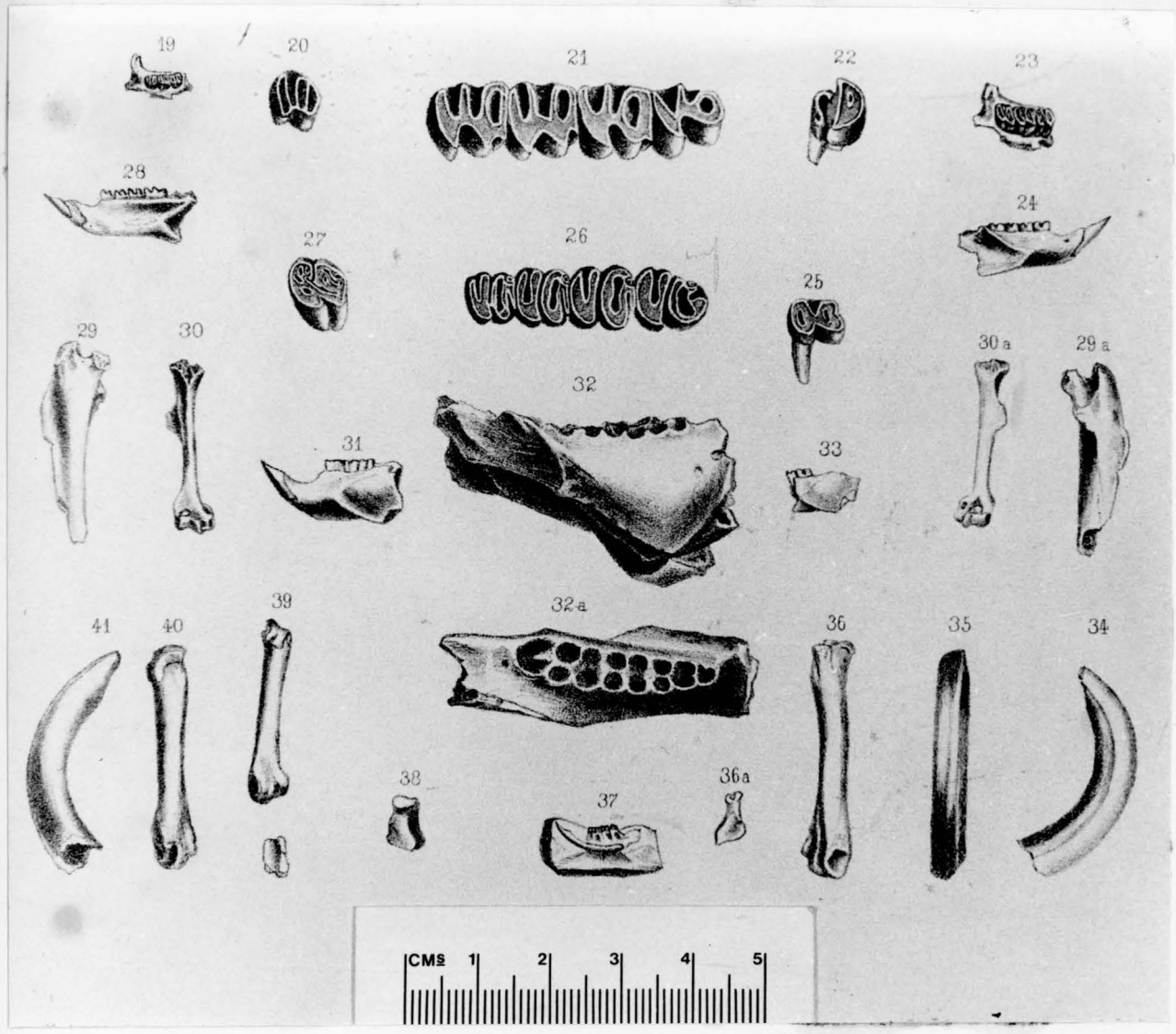

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Fig 15

13

HYSTRIX cf. LEUCURA Sykes 1831

1831. Sykes, W.H. Proc. zool. Soc. Lond., 1831 p.103

Note: (i) Hystrix leucura Sykes 1831 is a synonym of H. indica Kerr 1792 (Ellerman and Morrison-Scott 1951 p.518) and hence all fossils known as H. cf. leucura should rightfully be referred to as H. cf. indica.

(ii) Part of H. sivalensis Lydekker 1884 (the young cranium, p.110 Fig. 5) is synonymous with H. cf. leucura (Matthew 1929 p.559) as is the isolated molar referred to H. sivalensis by Colbert (1935 p.72 Fig. 32)(Black 1972 p.248), a fact of which many modern authors seem unaware.

References to H. cf. leucura:

Lydekker 1884 p.110(6), Fig. 5 (as Hystrix sp., probably H. sivalensis); 1885a p.13 (probably as H. sivalensis, at least in part); 1885b pp.248, 249 Fig.33 (as H. sivalensis, at least in part).

Pilgrim 1910 p.200 (as Hystrix sp.)

Matthew 1929 pp.559, 560 Fig. 55

Colbert 1935 p.72 Fig. 32 (as H. sivalensis), p.73

Greenwood 1955 pp.82, 83 Tables 7, 8 (specimen AM 19909, listed as H. sivalensis has been transferred to H. cf. leucura by Black 1972)

Landry 1957 p.63

Sulimski 1960 p.66

Black 1972 pp.246, 247, Fig. 3 p.248

Type locality and horizon:

The specimen initially described by Lydekker (1884 p.110(6)) as Hystrix sp. probably H. sivalensis and which later became the 'type' of H. cf. leucura (B.M. 15923) was apparently collected by Durand and Baker, but no exact locality has been given (Lydekker p.110(6)). Matthew (1929 p.559) Sulimski (1960 p.327) and Black (1972 p.247) between them state that the specimen comes from the Pinjor Beds, Upper Siwaliks.

Other localities:

An isolated molar (A.M.N.H. 19909) described by Colbert (1935 p.72 Fig.32) as H. sivalensis and referred by Black (1972 p.247) to H. cf. leucura

comes from the Middle Siwaliks, 2½ miles north of Hasnot, Salt Range, Jhelum District, Punjab, this also being the type locality of H. sivalensis Lydekker 1878. Black states that the Colbert specimen is from the Upper and not the Middle Siwaliks. Greenwood (1955 pp.82 (footnote), 83) implies that A.M.N.H. 19909 comes from Mogok, Burma.

Geological age:

Villafranchian, Late Pliocene (Landry 1957 p.63; Middle Siwaliks = Pliocene, Upper Siwaliks = Pleistocene (Sulimski 1960 pp.326, 327). An approximate absolute age would therefore be 1,8 to 2,0 m.y.B.P.

Material:

B.M. 15923, an immature cranium with separated jaws, and A.M.N.H. 19909, an isolated left M_1.

Illustrations:

See Lydekker 1884, 1885b, Matthew 1929, Colbert 1935, Black 1972. Lydekker (1884 Fig. 5; see Fig. 16 in this appendix) illustrates the lateral aspect of the young cranium B.M. 15923; his 1885b illustration is probably the same specimen. Matthew (Fig. 55; see Fig. 17 in this appendix) provides a sketch of the upper and lower dentition of the same specimen. Colbert (Fig. 32; see Fig. 18 in this appendix) illustrates A.M.N.H. 19909, the lower left M_1 from Hasnot. Black (Fig. 3; see Fig. 19 in this appendix) illustrates lateral and ventral views of the 'type' cranium and occlusal and labial views of the maxillary and mandibular tooth rows.

Description, taxonomic remarks:

No adequate description of the fossil form H. cf. leucura has been published, but several statements concerning its characteristics have been made.

Lydekker (1884 pp.110(6), 111(7)) in the original description of the skull B.M. 15923 states that the dimensions of the left M_1 are similar to those of the corresponding tooth of H. sivalensis, and that the external enamel fold extends as near down to the roots as in the latter species; he considers the cranium to be similar in general contour to those of H. hirsutirostris (= H. indica) and H. cristata.

Matthew, however (1929 p.559) rejects Lydekker's claim that the specimen is the same size as H. sivalensis, stating that it is much smaller and more hypsodont and prefers to refer it to H. leucurus(a)

(= H. indica),or to an ancestral form of this species, or to some other hypsodont species of this size. the specimen is much smaller than the H. crassidens from the Karnul Caves.

The present author has noted, however (no. 5, H. crassidens)that the latter species has been synonymized with H. cf. leucura by several authors.

Sulimski (1960 p.329) mentions that the specimen (referred by Matthew to H. cf. leucurus(a) is much more hypsodont than H. sivalensis, and that it is probably ancestral to H. leucura. He states that it is smaller than H. crassidens, H. refossa and H. primigenia.

Black (1972 p.247) refers the molar identified by Colbert (1935) as H. sivalensis to H. cf. leucura on account of its hypsodonty.

Measurements:

Mandibular measurements (in mm)

	MD	BL	
M_1	7.3	7.3	(Matthew 1929 p.559)
	9.0	7.5	(Colbert 1935 p.72, as H. sivalensis)
	9.0	7.5	(Greenwood 1955 p.83, as H. sivalensis)

COMMENTS:

The present author considers that Hystrix cf. leucura will eventually prove to be conspecific with Hystrix indica Kerr 1792.The measurements for the isolated fossil tooth (M_1) originally referred to H. cf. leucura by Matthew (1929) fall well within the range of measurement for the corresponding tooth in H. indica (MD = 6.7 - 7.7, N = 11; BL = 6.2 - 7.3, N = 11 Frenkel 1970 Table V). The measurements for the molar AM 19909 referred by Colbert (1935) to H. sivalensis and transferred by Black (1972) to H. cf. leucura, however, fall slightly beyond the limit obtained for H. indica. The taxonomic status of the latter specimen should therefore be considered as somewhat uncertain. It is probable that like H. angressi (no. 2) and H. crassidens (no. 5), the specimens referred to H. cf. leucura represent a large Plio-Pleistocene form of H. indica.

Fig. 16

Illustration showing lateral aspect of the juvenile cranium of Hystrix cf. leucura (B.M. 15932), initially referred by Lydekker (1884) to Hystrix sp., probably H. sivalensis. From Lydekker 1884 p. 110 Fig. 5; natural size.

Fig. 17

Sketch showing the upper and lower dentition of the immature cranium of Hystrix cf. leucura (B.M. 15932). From Matthew 1929 p. 559 Fig. 55; natural size.

Fig. 18

Sketch showing the occlusal surface and buccal aspect of isolated lower left M_1 (A.M.N.H. 19909) of Hystrix cf. leucura, initially identified (Colbert 1935) as H. sivalensis. From Colbert 1935 p. 72 Fig. 32; natural size.

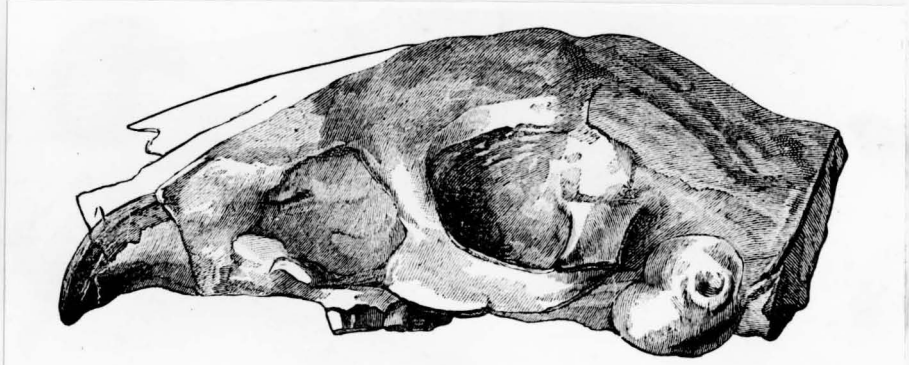


Fig. 5. *Hystrix* sp. Left lateral aspect of the cranium of a young individual from the Siwalik Hills, with the nasals restored. British Museum (No. 15,923). ½.

Fig. 16

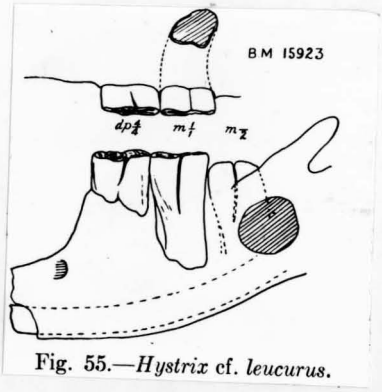


Fig. 55.—*Hystrix* cf. *leucurus*.

Fig. 17

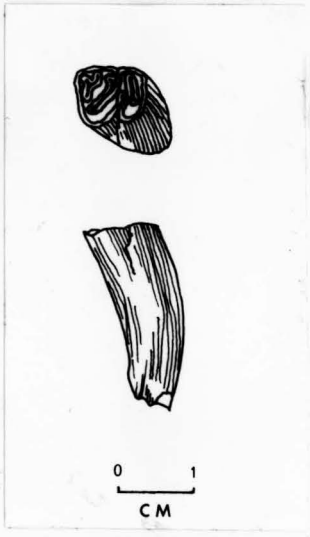


Fig. 18

Fig. 19

Photograph showing the cranium and dentition of Hystrix cf. leucura (B.M. 15923). From Black 1972 p.248, Fig. 3. (Labels for sketches from Black 1972).

A + B Ventral and lateral views of the juvenile cranium B.M. 15923; no scale given but probably natural size.

C Occlusal view of left M^1 - M^3 of same specimen; scale not given. The present author is of the opinion that Black has misinterpreted and mis-identified these teeth; the illustration is actually of the dp^4, M^1 and unworn M^2. Since BM 15923 is juvenile, the anterior-most tooth would be dp^4; M^3 has not yet erupted.

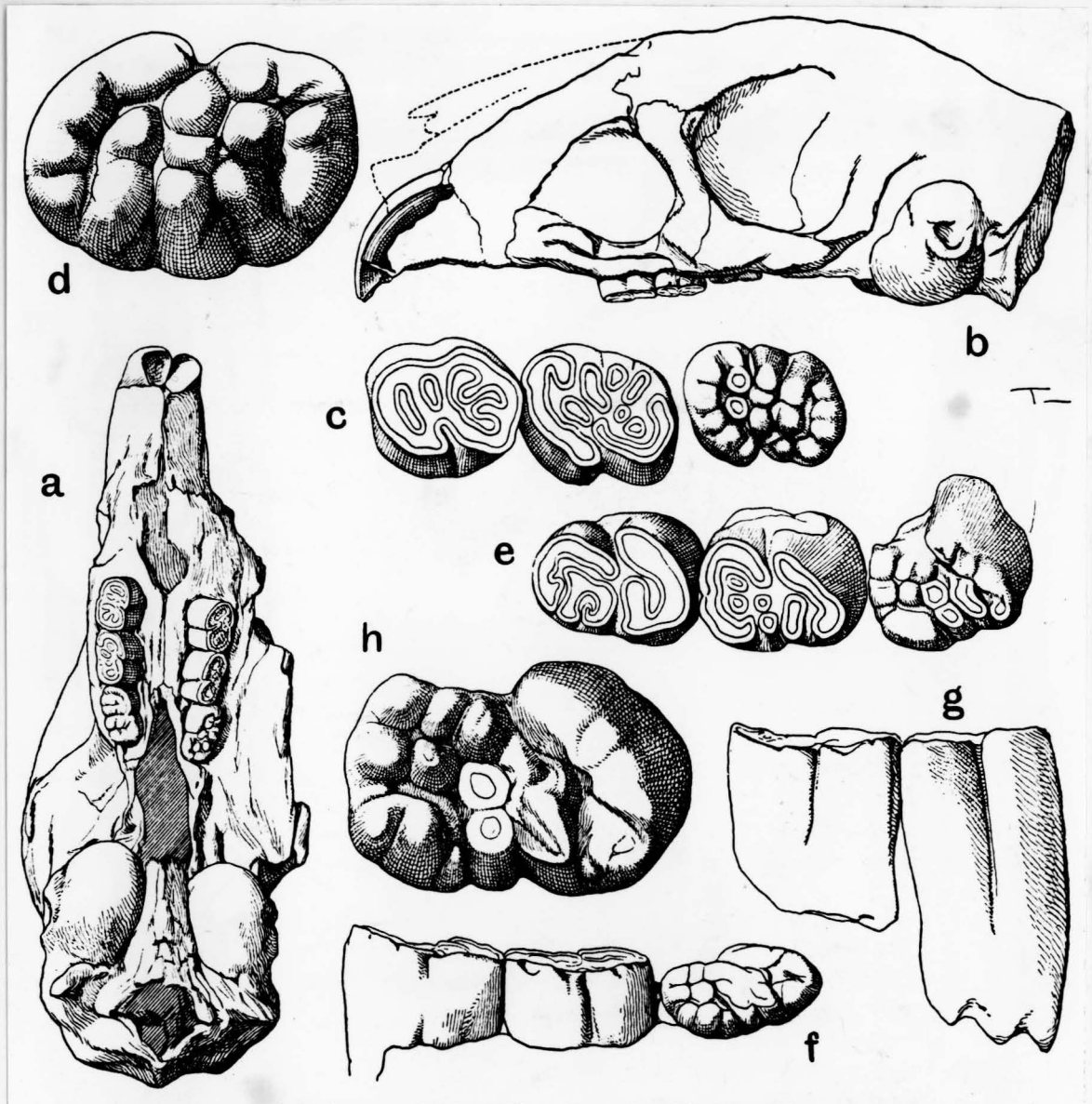
D Occlusal view of left unworn M^3; scale not given. The present author feels that this identification should read right M^2, since the main enamel fold is not orientated correctly for the tooth to be a left, and since in B.M. 15923 M^3 has not yet erupted.

E Occlusal view of right M^1 - M^3 same specimen, scale not given. This appears to be another erroneous identification or misprint, the crown enamel pattern is too divergent from that of C (which would be the opposite tooth row of the same animal) and the main enamel fold is not correctly orientated for Black's identification to be correct. The identification should read 'right dp_4 - M_2'.

F Lateral view of M_1 - M_2, occlusal view M_3; scale not given. Again the present author considers that the identification is incorrect and should read left dp_4 - M_2; the anterior-most tooth is dp_4 and not M_1, M_3 has not yet erupted.

G Lateral view of left dp_4 and M_1, showing downwards extent of external enamel fold or groove; scale not given, incorrectly labelled in Black.

H Occlusal view of either left M^3 or right M_3, and probably the latter, neither scale nor label given in Black.



TEXT-FIG. 3. *Hystrix* cf. *H. leucurus*, B.M. 15923. a. Ventral and b, lateral views of skull. c. d, and e. Occlusal views LM^1–M^3, LM^3, RM^1–M^3, f. Lateral view LM_1–M_2, occlusal view M_3. g. Occlusal view, M_3.

Fig. 19

14

HYSTRIX MAJOR Gervais 1859

1859. Gervais, O. C. r. Acad. Sci. Paris, 49 pp.511, 512

Note: (i) Not the same as Hystrix major Greenwood 1955 from Makapansgat Limeworks, Transvaal, South Africa.

(ii) Hystrix major Gervais 1859 has been synonymized with H. refossa Gervais 1852 (Schlosser 1884 p.46 (28)). H. major may in turn be synonymous with H. primigenia (Wagner 1848) (op. cit. p.45 (27)).

(iii) Depéret (1890, vide Bosco 1898 p.152) considers H. refossa to be synonymous with H. primigenia, hence H. major, H. refossa and H. primigenia may all be synonymous.

Additional references:

Gervais 1867 - 1869 pp.76, 77 Fig. 3 (vide Schlosser 1884 p.46, Bosco 1898 p.151)

Bosco 1898 pp.151, 152

Landry 1951 p.62

Mohr 1965 p.64

In addition, all the references to H. refossa and H. primigenia with which H. major may be synonymous.

Type locality and horizon:

The breccias of Ratoneau Island near Marseille (Gervais 1859 p.511)

Other localities:

None

Geological age:

None provided with original description. Bosco (1898 p.151) suggests that it is Quaternary, or perhaps even earlier. H. refossa is Villafranchian or late Pliocene to Early Pleistocene, whilst specimens referred to H. primigenia range in age from Early to Late Pliocene.

Material:

The type material comprises several fragments of incisors, the isolated teeth of several individuals, the upper half of a humerus and femur, the lower end of a tibia, a metacarpal and a first phalanx (Gervais 1859).

Illustrations:

See Gervais 1859, also illustrations listed under H. refossa, see Fig 25

Gervais 1859 (in Zoologie et Paléontologie générales p.76 Fig. 3) illustrates an isolated molar (vide Bosco 1898 p.151).

Diagnosis, taxonomic remarks:

Gervais (1859) in his diagnosis of the species, has stated that it is one-third bigger than the largest living porcupines from Africa and India (H. cristata, H. africaeaustralis and H. indica)according to the size of its dentition and limb-bones. The post-cranial material in particular is more robust than in living forms. Gervais describes one of the incisors recovered as having a very slight groove on its anterior surface (op. cit. pp.511, 512).

Measurements:

Maxillary measurements (in mm)

	MD	BL	
I^1	7.0	-	(Gervais 1859 p.511, not grooved)
	6.0	-	(Gervais 1859 p.511, with anterior groove)

COMMENTS:

Grooved incisors are not characteristic of the genus Hystrix in either recent or extinct forms and this species must therefore be considered with some doubt as belonging to Hystrix, although the grooved incisor alone may have been misidentified.

Schlosser (1884) has synonymized H. major with H. refossa Gervais 1852, whilst Bosco (1898) considers the latter species to be conspecific with at least some of the specimens referred to H. primigenia.

The present author is of the opinion that H. major (= H. refossa), the Late Pliocene and Villafranchian relic forms of H. primigenia from Weze and Roussillon, H. etrusca and H. bessarabica, that is all the European 'Villafranchian' fossil forms, will eventually prove to be synonymous with one another (see comments, H. bessarabica no. 4 and H. etrusca no. 6).

15

HYSTRIX MAJOR Greenwood 1955

1955. Greenwood M. Palaeont. afr. 3: 78-79, Figs 27a and b.

In 1955 Greenwood described a large fossil porcupine from the 'Australopithecus prometheus layer' (grey breccia) at Makapansgat Limeworks, Transvaal, as belonging to a new species, H. major, which was 1/3 larger than the recent H. africaeaustralis Peters 1852. Some time later Dr. Abu Bakr pointed out to Greenwood that the name H. major is a junior homonym of H. major Gervais 1859. Greenwood therefore renamed the species H. makapanensis (1958 p.365). The 1955 description for H. makapanensis as H. major remains valid.

16

HYSTRIX MAKAPANENSIS Greenwood 1958

1958. Greenwood, M. Ann. Mag. nat. Hist. Ser. 13, 1(5): 365

Note: The material referred to H. makapanensis by Greenwood 1958 was originally described as H. major Greenwood 1955, a name which was later found to be a junior homonym of H. major Gervais 1859. The original description of H. makapanensis will thus be found in Greenwood 1955.

Additional references:
Greenwood 1955 pp.78-79, Tables 6 and 7
Sulimski 1960 p.329, Table 1
Mohr 1965 p.65

Type locality and horizon:
'Australopithecus prometheus' zone, Makapansgat Limeworks, Transvaal, South Africa (1955 p.78), i.e. the grey breccia or Member 3.

Other localities:
Possibly the pink breccia (Upper Phase I breccia or Member 4) at Makapansgat Limeworks (specimens M8278 and M8282) and very tentatively Swartkrans (specimen SK 14237) and Kromdraai (KA 1912).

Geological age:
The grey breccia horizon at Makapansgat Limeworks dates to the Middle or Upper Pliocene, i.e. +-3,0-3,67 m.y.B.P. and the pink breccia horizon to 2,75-3,0 m.y.B.P. Swartkrans Member 1 (the pink breccia or SKa, from which SK 14237 was derived) is approximately 1,8-2,57 million years old whilst Kromdraai A, the source of KA 1912, is approximately 0,7-1,0 million years old (see Chapter 2.2 thesis text).

Material:
See also Appendix II for descriptions of specimens

Makapansgat Limeworks:

Grey breccia or Member 3

M1001? (referred by Greenwood 1955 to H. cf. africaeaustralis but possibly represents young H. makapanensis

M1002 Type specimen

(Grey breccia continued)

M1003 ? (referred by Greenwood 1955 to H. makapanensis, but possibly represents Xenohystrix crassidens)

M1811 Referred by Maguire, this thesis

M1812 ? Referred by Maguire, this thesis, otherwise very small X. crassidens individual.

M1815 Referred by Maguire, this thesis

M2526 ? Referred by Maguire, this thesis

M8220 ? Referred by Maguire, this thesis, otherwise small X. crassidens specimen

M8290 Referred by Maguire, this thesis

Pink breccia or Member 4

M8278 ?

M8282 ?

Swartkrans:

SK 14237 (from Swartkrans pink breccia or Member 1 or SKa, referred by Maguire, this thesis)

Kromdraai A

KA 1912 (tentatively referred by Maguire, this thesis)

Illustrations:

See Greenwood 1955, Fig. 20 this appendix.

Greenwood (Fig. 27 A and B) illustrates the type specimen, an anterior left half-mandible fragment (see Fig. 20, this appendix)

Diagnosis, taxonomic remarks:

The specific diagnosis is given as:

> An extinct Hystrix with cheek teeth approximately one third larger than Hystrix africaeaustralis. (Greenwood 1955 p.78)

Greenwood (op. cit.) also states that the enamel island wear pattern is similar to that in H. africaeaustralis at an equivalent stage of wear, and that the mandibular teeth are semi-rooted, the M_3 proportionately more robust and divergent than in the latter species but comparing favourably with H. cristata.

She also states that the lower extremity of the external enamel fold almost reaches the 'root/crown' junction (i.e. the alveolar rim) unlike the situation in H. africaeaustralis, where the fold stops short of the alveolar rim. The mandible itself is described as being similar to that of H. africaeaustralis, except that the diastemic length is shorter than that of the latter species, despite the larger overall size of H. major. The in situ P_4 of H. major is described as agreeing closely with that of H. primigenia from Pikermi except that the P_4 of the former species is more antero-posteriorly elongated. The diastema of H. primigenia is shallower and flatter than that of H. major.

Sulimski (1960 p.330) corroborates Greenwood's statements concerning the similarity of H. major and H. primigenia, adding that the former species also resembles the H. primigenia material from Weze (Poland) and Roussillon.

Measurements:

See Appendix VII A, B and C

COMMENTS:

For a full description of the species see main text Chapter 14.

The species is very poorly represented at the type locality, Makapansgat Limeworks, and the single specimens recorded from Swartkrans and Kromdraai are only tentatively referred to this species. Only four specimens from Makapansgat can with reasonable certainty be assigned to H. makapanensis, three of these being isolated lower permanent premolars and the fourth being a small fragment of a left half-mandible. M1003, an almost isolated left M_3, referred by Greenwood to the latter species, has been transferred to Xenohystrix crassidens (Maguire, this thesis). There is thus no definite H. makapanensis maxillary material. All the referred maxillary material is thus tentative.

The specimens SK14237 (a left P_4) and KA 1912 (a right M^2 or M^3) from Swartkrans and Kromdraai respectively have tentatively been referred to H. makapanensis but may represent large H. africaeaustralis, though this is less likely in the case of the latter specimen. As there is no H. makapanensis maxillary material with which to compare this material its taxonomic status is uncertain, as is the site source of the latter specimen (see Appendix II).

H. makapanensis is decidedly less robust than the giant Xenohystrix, even taking such features as sexual dimorphism into account, but larger and more robust than the largest and most mature H. africaeaustralis specimen available for comparison. It is thus likely that H. makapanensis is a valid species.

Fig 20A

Lateral view of the type specimen of Hystrix makapanensis Greenwood 1958 (M1002, growth stage 6, below) compared with Xenohystrix crassidens Greenwood 1955 (M1803) specimen at same growth stage. Both from the Makapansgat Limeworks grey breccia. x 1

Fig 20B

Lateral view of the type specimen of Hystrix makapanensis Greenwood 1958 (M1002, growth stage 6 above) compared with modern Hystrix africaeaustralis Peters 1852 mandible at same growth stage. x 1

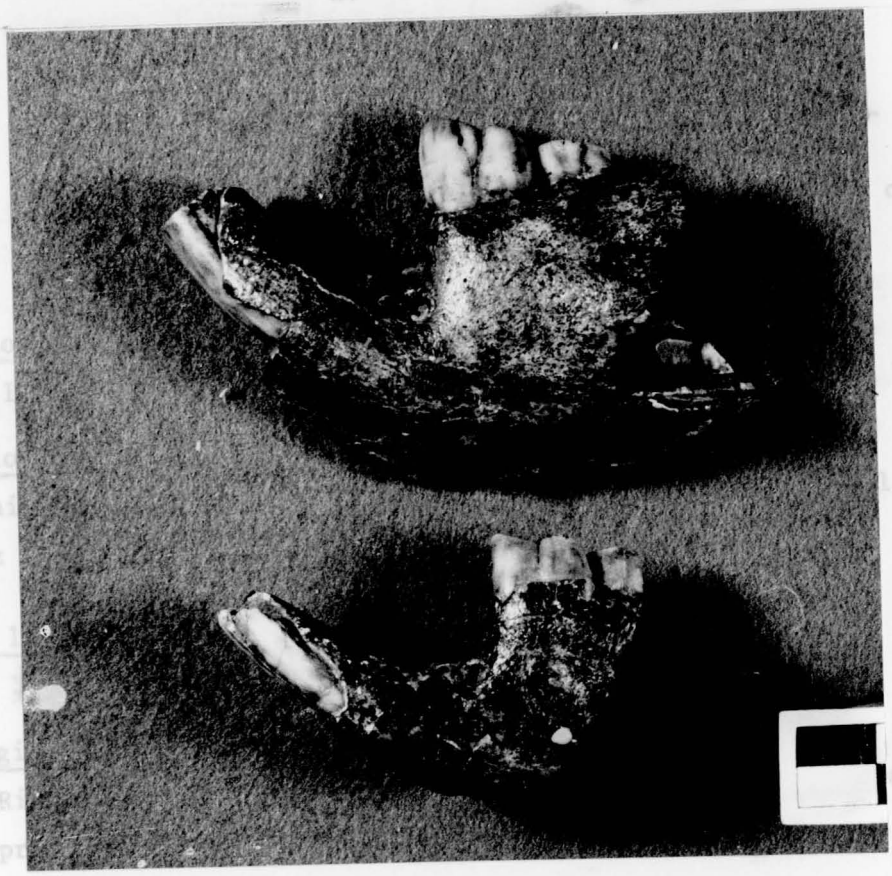


Fig 20A



Fig 20B

17

HYSTRIX MINOR Malez 1963

1963. Malez, M. Palaeont. Jugosl. 5, Zagreb pp. 1-198 Taf. 5

Note: Mottl (1967 p.305) lists this species as a subspecies of H. cristata, H. cristata minor

Additional references:
Mottl 1967 pp.305, 307-311, Fig. 3 p.308

Type locality and horizon:
Veternica-Höhle near Zagreb, Medvednica-Croatia, north Jugoslavia (Malez 1963, Mottl 1967 p.305)

Other localities:
None

Geological age:
Late Riss-Würm Interglacial to onset of Würm (Mottl 1967) i.e. Eemian or approximately 118,000 - 128,000 B.P.

Material:
The type specimen is apparently a left mandibular fragment with teeth missing (vide Mottl 1967 p.307, 308). Mottl also mentions the existence of several juvenile mandibular fragments and a single left M_2.

Illustrations:
See Malez 1963, Mottl 1967
Both the above authors illustrate the type mandible, see Fig. 21

Diagnosis, taxonomic remarks:
Original diagnosis by Malez of the species or subspecies was not available, but the mandible and left M_2 are said to resemble closely those of H. cristata, of which H. minor (or H. cristata minor) may merely represent a small form. (Mottl 1967, pp.307, 308).

Measurements:

Mandibular measurements (in mm) (after Mottl 1967)

	MD	BL	
dp_4	7.1	5.0	(p.310)
	7.3	5.0	(p.310)

Overall length of mandible = 89.3 (p.308)

Ramus height = 35.6 (p.308)

$dp_4 - M_3$ = 31.0 (p.308)

COMMENTS:

Probably a small sub-species of the extant H. cristata. The species has not been compared with the other fossil species, H. schaubi Brunner 1954, with which it is contemporaneous. As the latter species is also a small form of Hystrix, H. minor may prove synonymous with it.

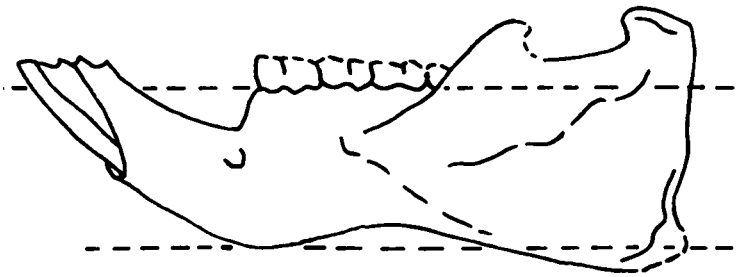


Fig. 21

Sketch showing the left half-mandible of Hystrix minor Malez 1963. From Mottl 1967 p. 308 Fig. 3; natural size.

18

HYSTRIX PRIMIGENIA (Wagner 1848)

1848. Wagner, A. Abh. Math. Phys. Cl. K. bayer. Akad. Wiss., 5(2) p.374, Taf. 4 Figs.7, 8

Note: (i) Wagner's original 1848 publication (not seen) has been quoted by three different authors in three different ways; these have been listed under 'Additional references'.*

(ii) The type material now known as Hystrix primigenia was originally described as Lamprodon primigenius Wagner 1848. Roth and Wagner (1854) transferred the material to Castor atticus, Castor being a genus of beavers. Later, Wagner (1860) decided that all the material was actually Hystricid, and renamed it Hystrix primigenia.

(iii) The material described as H. major by Gervais (1867-1869, Zool. et Pal. gen. p.76 Fig. 3) is instead potentially synonymous with H. primigenia (Schlosser 1885 p.45 (21)).

(iv) Deperet (1890 p.43) considers H. refossa (= H. major Gervais 1859) a synonym of H. primigenia.

Additional references:

* Wagner 1848 p.374 Taf. 1, Figs.7, 8 as Lamprodon primigenius. (vide Wagner 1860)

* Wagner 1848 p.374 Taf. 4(12), Figs.7, 8 as Lamprodon primigenius. (vide Bosco 1898 and Sulimski 1960)

* Wagner 1848 p.374 Taf. 12, Fig. 78 as Lamprodon primigenius. (vide Schlosser 1885)

Roth and Wagner 1854 p.414 Taf. 4, Figs. 5, 5a as Castor atticus. (vide Wagner 1860)

Roth and Wagner 1854 p.44 Taf. 10, Fig. 93 as Castor atticus. (vide Schlosser 1885)

Wagner 1860 pp.129, 130 Taf. 5, Fig. 12

Lartet, some date prior to 1860. Compt. rendus 43 p. 273
(vide Wagner 1860)

Gaudry 1862 pp. 122, 126 Taf. 18, Fig. 2 (vide Schlosser 1885)

Gervais 1867 - 1869 pp.76, 77 Fig. 3, as H. major
(vide Bosco 1898)

Lydekker 1878 pp.99, 100; 1884 p. 109(5), 110(6)

Roger 1885 p.110

Schlosser 1885 pp.45 - 46(27 - 28); 1902 p.24(138)

Depéret 1890 pp.43 - 47, Taf. 4(7) Figs. 12 - 16 (vide Bosco 1890, Sulimski 1960)

Bosco 1898 pp.141(1), 151(11) - 153(13)

Abel 1922 p.127, Fig. 133

Matthew 1929 pp.559, 560

Wang 1931 p.49

Greenwood 1955 pp. 79 Tables 6, 7 pp.82, 83

Landry 1957 p.61

Piveteau 1958 p.708

Sulimski 1960 pp.319-333, Figs. 1 - 5, Pls. 1, 2; 1964 pp.233, 234

Mohr 1965 p.63

Hugueney and Mein 1966 p.264

Melentis and Schneider 1966 pp.282 - 284, Fig. 4, Pl. 2 Fig. 1

Melentis 1968 pp.321 - 323, Fig. 8 Pl. 8 Fig. 3

Bachmayer and Wilson 1970, p.519

Type locality and horizon:

Pikermi, Greece (Wagner 1848)

Other localities:

Roussillon, France (Depéret 1890, Hugueney and Mein 1966), Weze, Polgardi, Cimislia and Veles in Poland and Westhoffen in Germany (Sulimski 1960, 1964), Halmyropotamos and Alifaka in Greece (Melentis and Schneider 1966, Melentis 1968); i.e. Central and south-east Europe

Geological age:

Pikermi, Greece = Upper Miocene (Lydekker 1878 Bosco 1890) Pontian, Early Pliocene (Landry 1957, Sulimski 1964)

Roussillon, France = Upper Pliocene (Depéret 1890), Pliocene (Hugueney and Mein 1966)

Polish and German sites = Pliocene (Sulimski 1960, 1964)

Halmyropotamos = Pontian (Melentis 1968), i.e. Early Pliocene

Alifaka = Pontian (Melentis and Schneider 1966) i.e. Early Pliocene

Material:

The type material is apparently a badly damaged skull and a dorsoventrally compressed mandible with the entire left tooth row and both left and right incisors preserved, but one of the latter broken (Wagner 1848, 1860). Housed in the Munchener Museum, Germany (Schlosser 1885).

Gaudry (1862), under the name H. primigenia, discusses a mandible (a type specimen?), maxillary tooth row, humerus, ulna, radius and 'hand' (vide Schlosser 1885).

The remains from Roussillon described by Depéret (1890) include a mandible, an upper incisor and an isolated M^2, whilst Bosco (1898) mentions the presence of an unpublished cranium of this species in the Museo di Monaco di Baviera.

Sulimski (1960) has described the following material from Weze, Poland, housed in the Museum Ziemi, Warsaw:

No. Rod. 1 A palatal fragment with right P^4-M^3 and left M^1- M^3 preserved.
No. Rod. 2 A mandibular fragment with P_4-M_2 preserved.
No. Rod. 3 An isolated dp_4.
No. Rod. 4 An isolated I_1.
No. Rod. 5 An isolated I_1.
No. Rod. 6 An isolated I^1.

Later, 7 additional specimens from the same locality (2 upper and 2 lower incisors and 3 isolated molars) were discovered (Sulimski 1964).

Hugueney and Mein (1966) list the following material from Roussillon, France: right mandibular fragment containing P_4-M_3, right mandibular

fragment containing P_4-M_2, isolated left M_3, isolated right M_1, an unidentified upper molar, two upper right incisors and a lower left incisor; all housed in the Palaeontological Institute of the University of Vienna.

Melentis and Schneider (1966 p.284) give the measurements for one specimen from Alifaka, a left maxillary fragment with M^1 and M^2 in situ (Ath. No. 1966/35) and compare these with those of Ath. No. 1966/43 and Ath. No. 1966/44, two dentigerous mandibular fragments from Pikermi, the former containing the left M_1 and M_2 and the latter both left and right M_1 and M_2. Melentis (1968) also lists Ath. No. 1967/11, a right mandibular fragment containing M_2 and M_3 and Ath. No. 1967/12, a left mandibular fragment containing M_1 and M_2, both from the Pikermi site. This material is housed in the Palaeontology Museum of the University of Athens.

Illustrations:

See Wagner 1848, 1854, 1860, Gaudry 1862, Depéret 1890, Abel 1922, Sulimski 1960, Melentis and Schneider 1966, Melentis 1968.
Wagner (1848) illustrates the upper incisors of the type, whilst Roth and Wagner (1854) and Wagner (1860) illustrate the mandibular teeth of the type. Gaudry illustrates a mandible, the mandibular and maxillary dentition and several post-cranial bones and Depéret illustrates the remains from Roussillon listed above. Abel (1922) has redrawn from Gaudry (1862) a lateral view of a left mandible and the mandibular and maxillary dentition, see Fig. 22 in this appendix.

Sulimski (1960) has provided the best illustrations of H. primigenia to date: five text figures illustrating the dentition of the species and two plates, one showing the palate and maxillary dentition the other showing the mandible and mandibular dentition (see Figs. 23 and 24 in this appendix).

Melentis and Schneider (1966) illustrate the details of the crown enamel pattern of Ath. No. 1966/35 (M^1 and M^2) and Melentis (1968) the dentition of the matching half-mandibles Ath. Nos. 1967/11 and 1967/12.

Diagnosis, taxonomic remarks:

The early publications by Wagner (1848 and 1854) which perhaps contain a definition or description of the species, were not available, and his 1860 publication merely records the transfer of specimens listed under Lamprodon primigenius and Castor atticus to Hystrix primigenia. Wagner does mention, however, that amongst living forms, H. primigenia shows

the greatest similarity with H. cristata, but differs in its much larger dimensions, especially of the dentition. Wagner (1860 p.129) quotes the skull length of the former species (from the occiput to the anterior rim of the incisor alveolus) as 7 inches (17.8cm) and states that the length of the skull of H. cristata is not more than 6 inches (15.25cm). The figure provided in the latter publication, showing the mandibular dentition, indicates that there is marked differentiation of the mandibular teeth; the P_4 is almost perfectly cylindrical and is much larger than the small, more rectangular M_3.

Lydekker (1878, 1884) has compared H. primigenia with H. sivalensis and has stated that although comparable in size, their crown enamel patterns differ, that of H. sivalensis being more complicated. He also states that H. primigenia closely resembles the present day porcupine of the Mediterranean region, i.e. H. cristata (1884 p.45).

Depéret (1890) has recorded the presence of H. primigenia in the Pliocene of Roussillon, but Bosco (1898 p.152) does not agree that the Roussillon specimens are the same as the type specimens from Pikermi, basing his contention on the fact that the faunas and geological ages of the two sites differ. Recently, however, Sulimski (1964) has termed the Roussillon specimens 'Late Pliocene relicts' and although they may differ slightly in morphology from the Lower Pliocene type, they have nevertheless been retained under H. primigenia. Hugueney and Mein (1966) also refer a number of specimens from Roussillon to H. primigenia.

Bosco (1898 p.153) states that H. etrusca from the Villafranchian of Italy, and H. primigenia from Pikermi have identical dimensions but that H. etrusca resembles and is also synchronous with the so-called H. primigenia from Roussillon. Neither H. etrusca nor H. primigenia has a sharply curved diastema - see Fig. 24.

Matthew (1929 p.559) describes the teeth of H. primigenia as brachydont, or at least considerably less hypsodont than those of any modern Hystrix.

Wang (1931 p.49) states that H. primagenia has larger dimensions and a more strongly developed crista masseterica than H. kiangsenensis (= H. cf. subcristata) and that its teeth are much more brachydont than those of the latter species but only slightly less hypsodont than those of H. cristata.

According to Greenwood (1955) the P_4 of H. primigenia agrees closely with that of her species, H. makapanensis Greenwood 1958 (= H. major Greenwood 1955), but the teeth of the latter species are very much more

elongated than those of H. primigenia and its diastema is not as flat.

Landry (1951 pp.61, 63) describes H. primigenia as being more hypsodont than the 'primitive' subfamily (Atherurinae) and states that it represents the earliest satisfactory Hystrix fossil material from Europe, the three geologically older species H. lamandini (Oligocene), H. suevica (Upper Miocene) and H. wiedemanni (Upper Miocene) are apparently doubtful representatives of Hystrix.

Sulimski (1960) provides a fairly comprehensive description of the H. primigenia material from Weze, Poland.

Melentis (1968 p.323) is of the opinion that H. primigenia spread over the whole of Europe and Africa during Pontian times.

Measurements:

Maxillary measurements (in mm)

	MD	BL	
I^1	8.0	-	(Greenwood 1955 Table 6 p.82, after Gaudry 1862)
	8.5	6.5	(Sulimski 1960 Table 1)
	8.0	-	(Sulimski 1960 Table 1)
	6.8	8.0	(Hugueney and Mein 1966 p.264)
	7.5	7.9	(Hugueney and Mein 1966 p.264)
P^4	11.0	11.0	(Greenwood 1955 Table 6 p.82)
	9.5	-	(Greenwood 1955 Table 6 p.82)
	13.2	11.8	(Sulimski 1960 Table 1)
	12.0	11.6	(Sulimski 1960 Table 1)
	12.0	11.0	
M^1	10.0	-	(Gaudry 1862, vide Melentis et al. 1966 p.284)
	9.7	11.0	(Greenwood 1955 Table 6 p.82)
	10.0	-	(Greenwood 1955 Table 6 p.82)
	11.0	10.0	(Sulimski 1960 Table 1)
	11.2	11.0	(Sulimski 1960 Table 1)
	10.0	10.5	(Sulimski 1960 Table 1)
	10.4	9.4	(Melentis and Schneider 1966 p.284)
	10.0	-	(Melentis and Schneider 1966 p.284)
	10.5	11.0	
M^2	9.5	10.7	(Greenwood 1955 Table 6 p.82)
	9.0	-	(Greenwood 1955 Table 6 p.82)
	11.0	10.0	(Sulimski 1960 Table 1)

	MD	BL	
	11.0	10.0	(Sulimski 1960 Table 1)
	9.7	10.5	(Sulimski 1960 Table 1)
	11.0	9.8	(Melentis and Schneider 1966 p.284)
	10.0	-	(Gaudry 1862, vide Melentis et al. 1966, p.284)
M^3	9.5	9.7	(Greenwood 1955 Table 6 p.82)
	8.0	-	(Greenwood 1955 Table 6 p.82)
	10.0	9.0	(Sulimski 1960 Table 1)
	9.7	9.7	(Sulimski 1960 Table 1)
	10.3	9.0	

Length of palate = 55.0 (Sulimski 1960 p.321)

Average width of palate measured between lingual borders of maxillary teeth = 15.0 (Sulimski 1960 p.321)

Length of maxillary tooth row (P^4-M^3 = 45.5 (Sulimski 1960 Table 1)

= 41.0 (Sulimski 1960 Table 1)

Mandibular measurements (in mm)

	MD	BL	
I_1	8.5	-	(Greenwood 1955 Table 7 p.83)
	8.8	7.0	(Sulimski 1960 Table 1)
	8.5	-	(Sulimski 1960 Table 1)
	6.4	7.5	(Hugueney and Mein 1966 p.264)
P_4	12.0	11.0	(Greenwood 1955 Table 7 p.83)
	12.4	9.7	(Sulimski 1960 Table 1)
	11.5	10.8	(Sulimski 1960 Table 1)
	12.0	9.8	(Sulimski 1960 Table 1)
	11.8	9.3	(Hugueney and Mein 1966 p.264)
	12.2	9.3	(Hugueney and Mein 1966 p.264)
	11.5	9.4	(Melentis 1968 p.322)
M_1	10.5	11.0	(Greenwood 1955 Table 7 p.83)
	11.7	11.2	(Sulimski 1960 Table 1)
	11.5	10.0	(Sulimski 1960 Table 1)
	11.0	10.0	(Sulimski 1960 Table 1)
	10.9	8.9	(Hugueney and Mein 1966 p.264)
	* 9.4	9.0	(Hugueney and Mein 1966 p.264)

* Identification of tooth uncertain

	MD	BL	
	10.3	9.2	(Melentis and Schneider 1966 p.284)
	10.4	8.0	(Melentis and Schneider 1966 p.284)
	10.5	8.5	(Melentis and Schneider 1966 p.284)
	10.0	-	(Melentis and Schneider 1966 p.284)
	10.0	-	(Melentis 1968 p.322)
	9.8	9.1	(Melentis 1968 p.322)
M_2	11.0	11.0	(Greenwood 1955 Table 7 p.83)
	11.7	11.2	(Sulimski 1960 Table 1)
	11.0	10.0	(Sulimski 1960 Table 1)
	11.0	10.0	(Sulimski 1960 Table 1)
	10.0	8.5	(Melentis and Schneider 1966 p.284)
	10.6	8.7	(Melentis and Schneider 1966 p.284)
	10.0	-	(Melentis and Schneider 1966 p.284)
	11.6	10.4	(Hugueney and Mein 1966 p.264)
	9.5	8.6	(Melentis 1968 p.322)
	10.4	8.9	(Melentis 1968 p.322)
	10.2	9.2	(Melentis 1968 p.322)
	11.0	9.5	(Melentis 1968 p.322)
M_3	10.3	9.0	(Greenwood 1955 Table 7 p.83)
	10.0	9.7	(Sulimski 1960 Table 1)
	9.0	8.2	(Sulimski 1960 Table 1)
	9.0	8.8	(Sulimski 1960 Table 1)
	8.2	7.1	(Hugueney and Mein 1966 p.264)
	9.3	7.9	(Melentis 1968 p.322)
	9.9	8.8	(Melentis 1968 p.322)

Length of mandibular tooth row (P_4 - M_3)
= 47.0 (Sulimski 1960 Table 1)
= 45.0 (Sulimski 1960 Table 1)
= 42.0 (Sulimski 1960 Table 1)
= 44.5 (Bosco 1898 p.153)
= 40.0 (Bosco 1898 p.153)

Length of M_1 - M_3
= 33.5 (Sulimski 1960 Table 1)
= 32.5 (Sulimski 1960 Table 1)
= 31.1 (Sulimski 1960 Table 1)

COMMENTS:

There seems some doubt as to whether all the material described under H. primigenia really belongs to this species, the argument being as to whether the Upper Pliocene and Villafranchian specimens from Roussillon, Weze and Germany are conspecific with the Lower Pliocene 'typical' H. primigenia from Pikermi in Greece. The assignment of the Lower Pliocene Alifaka and Halmyropotamos remains (from Greece) to H. primigenia has not been questioned.

Slight morphological differences between the Upper and Lower Pliocene forms and differences in the associated fossil faunas have been held up in support of Bosco's (1898) suggestion that the Upper Pliocene 'relict' form and the 'typical H. primigenia' should be kept separate, but as Hystrix appears to be a very conservative genus the latter argument would not carry much weight.

Several Upper Pliocene and Villafranchian fossil forms may be synonymous with (at least) the Roussillon 'relict' H. primigenia - H. refossa Gervais 1852 (no. 19) (= H. major Gervais 1859 no. 14) H. etrusca Bosco 1898 (no. 6) and possibly H. bessarabica Rjabinin 1929 (no. 4) (see comments to all these species). The date for H. bessarabica seems uncertain but if, as Orlov (1962) has suggested, it is Meotian (Upper Miocene), it would be more likely that H. bessarabica (Taraklia beds, Moldavian U.S.S.R.) and the Pliocene form of H. primigenia would be synonymous. On the other hand, all the Pliocene and Villafranchian forms may be synonymous.

Such problems cannot be resolved without recourse to the specimens themselves and without accurate absolute or relative dates for the various source localities. The typical H. primigenia, at least, is an uncontested valid species.

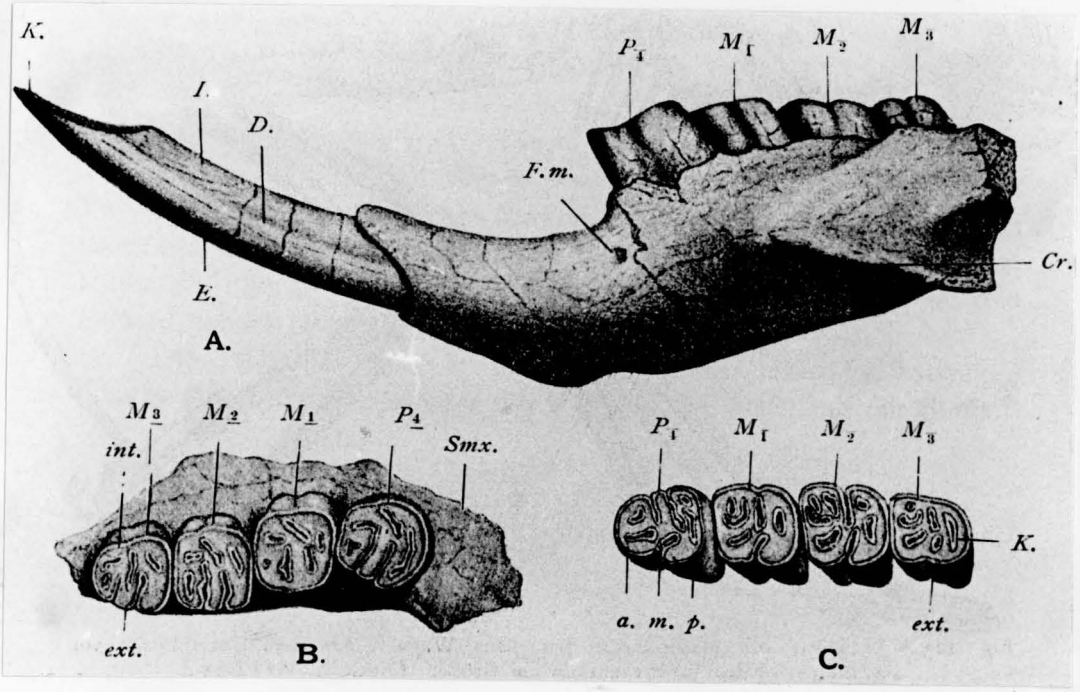


Fig. 22

Photograph showing the left mandible of Hystrix primigenia (Wagner) 1848, its maxillary dentition (B) and its mandibular dentition (C). From Abel 1922 p. 127 Fig. 113. Approximately natural size.

Fig. 23

Photograph illustrating palate and maxillary dentition of Hystrix primigenia (Wagner) 1848 from Weze, Poland. From Sulimski 1960 Plate 1.

No. 1 Fragment of skull No. Rod 1 showing: a, sphenopalatine foramen, b, alveolar foramen of M^3, c, jugal process of maxilla, Natural size.

No. 2 Palatal view of the same specimen:d, internal choanae. Natural size.

No. 3 Detail of right maxillary tooth row P^4 to M^3: 1a., anterior lobe, s.a., anterior sulcus, x 2.

Note: Labels from Sulimski 1960.

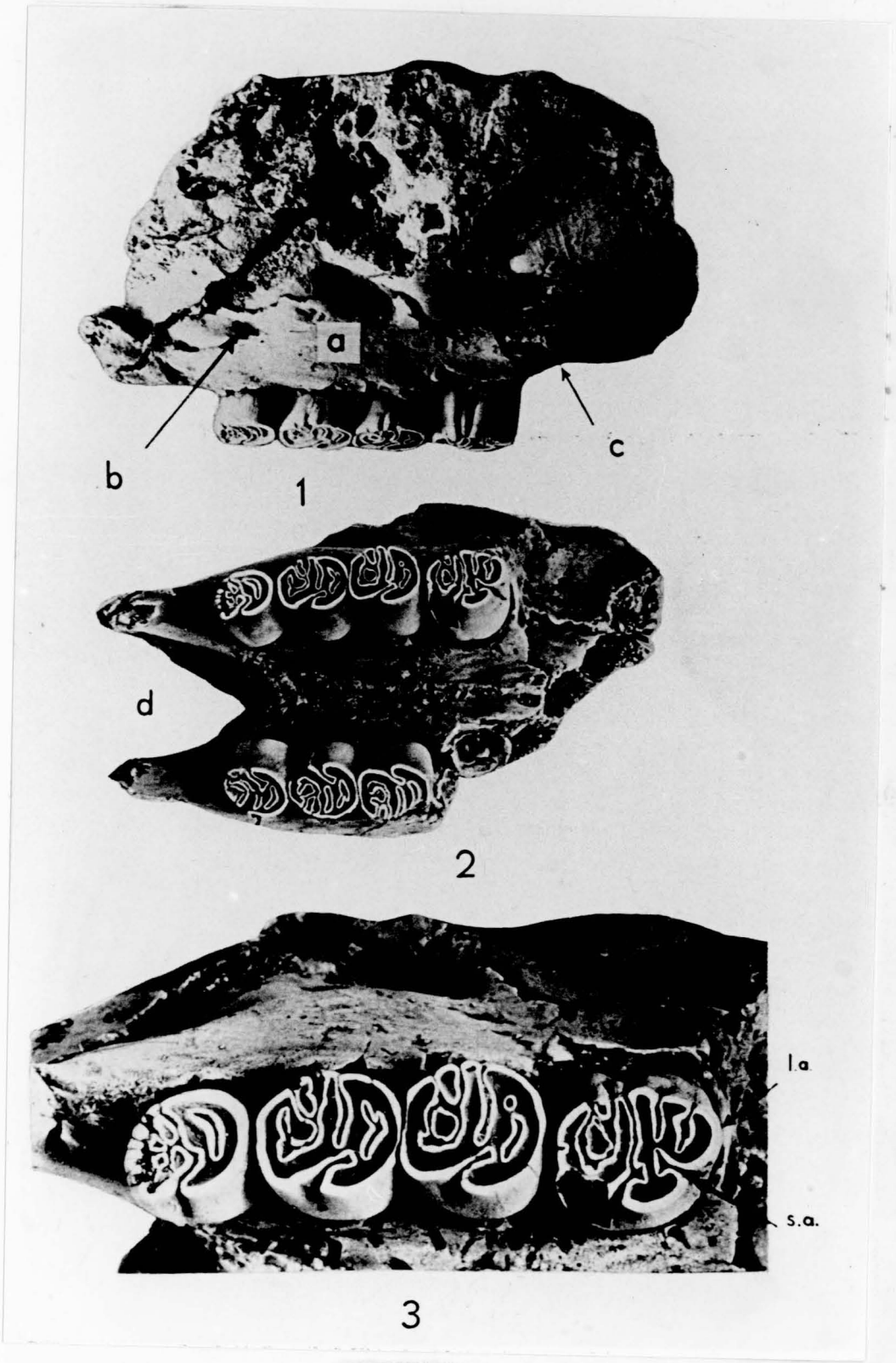


Fig. 23

Fig. 24

Photograph illustrating mandible and mandibular dentition of Hystrix primigenia (Wagner) 1848 from Weze, Poland. From Sulimski 1960 Plate II.

No. 1 Isolated dp_4, specimen No. Rod 3, occlusal surface, a vestigial labial (?) cusp. Twice natural size.

No. 2 The same schematically: I - IV re-entrant folds, 1 - 15 lobes.

No. 3 Fragment of right half mandible, specimen No. Rod 2, labial (buccal) view, showing P_4 - M_2. Natural size.

No. 4 The same, occlusal view.

No. 5 Right mandibular tooth row, occlusal view. I - IV re-entrant folds, 1 - 5 lobes, vestigial re-entrant fold. Twice natural size.

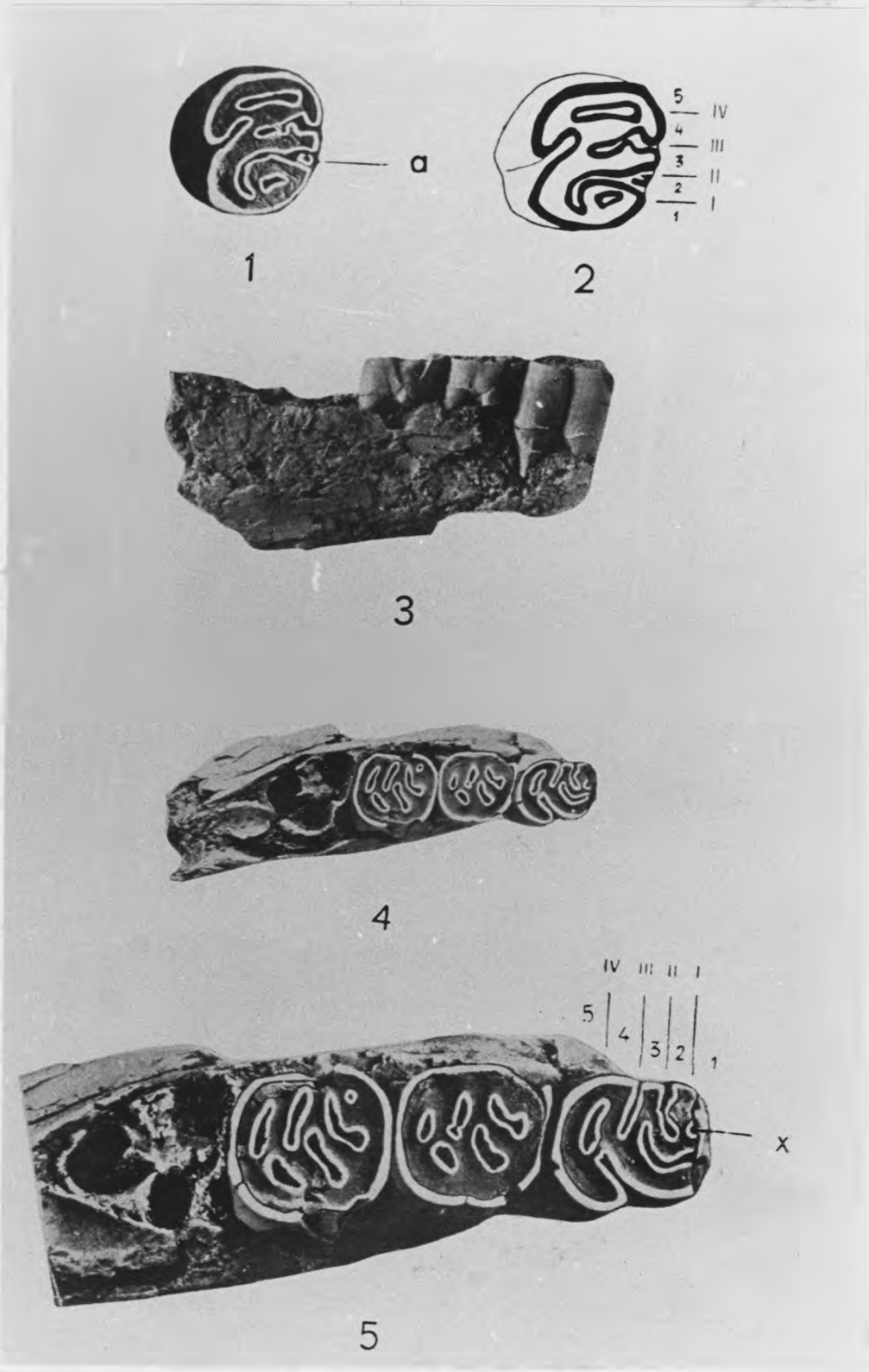


Fig. 24

19

HYSTRIX REFOSSA Gervais 1852

1852. Gervais, P. 'Zoologie et Paléontologie Francaise' 2nd. Ed pp.17-18, Plate 48 Figs.11, 12

Note: (i) Bosco (1898 p.152(12)) records that Schlosser (1884 p.46) synonymized H. major Gervais 1859 with H. refossa, and that Depéret (1890 p.43) synonymized H. refossa with H. primigenia. Sulimski (1960 p.329) confirms that H. refossa = H. major and states that the latter approaches H. primigenia, so it is possible that all three of these Villafranchian species are synonymous.

Additional references:

Gervais 1867-1869 p.76 Fig.3, as H. major (vide Schlosser 1884)
Lydekker 1878 p.99; 1884 pp.108(4) - 110(6)
Quenstedt 1882 p.57, Taf.3 Fig.55 (vide Schlosser 1884)
Schlosser 1884 p.46
Depéret 1890 p.43, Pl.4 Figs. 12-16 (vide Bosco 1890)
Bosco 1898 pp.151, 152
Harlé 1910 pp.532, 533 (vide Mohr 1965)
Matthew 1929 p.560
Wang 1931 p.49
Landry 1957 p.62
Sulimski 1960 pp.326, 329
Mohr 1965 pp.63, 64

Type locality and horizon:

The sub-volcanic alluvium of Puy de Dome, Issoire, France (Lydekker 1878, Schlosser 1885)

Other localities:

Perrier and Montpellier (Sulimski 1960), Ratoneau Island off Marseille Mediterranean (as H. major), (Gervais 1859 p.11)

Geological age:

Miocene (Lydekker 1884 p.109), Pliocene (Depéret 1890 p.43) Upper Pliocene, Perrier-Villafranchian (Landry 1957 p.62), Late Pliocene-Early Pleistocene (Sulimski 1960 p. 326)

Material:

The type specimen, and seemingly the only material originally described as H. refossa, is a left mandibular fragment with the premolar in situ and an empty alveolus. (Lydekker 1884 p.110). If the so-called H. major from Ratoneau is really synonymous with H. refossa this material (see no. 14) can be added to the list.

Illustrations:

See Gervais 1852, 1867-1869; Quenstedt 1882; Depéret 1890. All the above illustrations are of the type specimen - see Fig. 25.

Diagnosis, taxonomic remarks:

The original diagnosis of this species was not available. However, a number of comments concerning its characteristics have been published:

Lydekker (1878 p.99) describes the enamel islands present on the occlusal surface of the premolar as unusually numerous when compared with H. cristata, and the external enamel fold as very slight. He also notes that Pomel (giving the reference as Pictet Vol I p.255) considers H. refossa to be an agouti (family Dasyproctidae). Lydekker (1884) describes H. refossa as having very distinct roots and short crowns to the molars, and notes that Bravard has actually referred the species to Dasyprocta.

Schlosser (1884 p.46) states that the teeth of H. refossa are larger than those of the living species while Bosco (1898 p.151) states that they equal in size those of H. etrusca, which in turn is the same size as H. primigenia.

According to Wang (1931 p.49) H. refossa has lower crowns, larger, more heavily-rooted cheek teeth and more numerous enamel islands than H. kiangsenensis (= H. cf. subcristata).

Sulimski (1960 p.329) states that H. refossa has a similar alveolar pattern to H. primigenia and to several other fossil porcupines.

If H. major is actually a synonym of H. refossa, it can be said that H. refossa is at least 1/3 bigger than the biggest living porcupine.

Measurements:

Maxillary measurements (in mm)

	MD	BL	
I^1	7.0	-	(Gervais 1859, as H. major)
I^1	6.0	-	(Gervais 1859, as H. major)

COMMENTS:

There seems to be some doubt as to the status of this species, which was apparently established on the strength of the evidence of a single small mandibular fragment with a single *in situ* tooth. *H. refossa* and the species which is supposedly synonymous with it, *H. major* Gervais 1859, may not even belong in *Hystrix* (see Comments to No. 14 *H. major*).

If they do, it seems probable that they, with *H. etrusca*, will prove to be synonymous with *H. primigenia* (Wagner 1848).

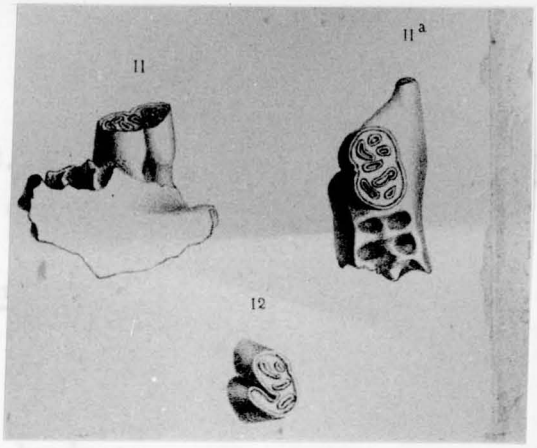


Fig 25

Illustration of the type specimen of Hystrix refossa Gervais 1852, re-photographed from Gervais 1852 (2nd Ed.) Pl. 48, Figs. 11a,b. Fig. 12 is H. cristata.

20

HYSTRIX SCHAUBI Brunner 1954

1954. Brunner, G. Neues Jb. Geol. u. Palaeont. Abh., 100 (1) p.99

Additional references:

Mohr 1965 p.64

Mottl 1967 p.311

Type locality and horizon:

Fuchsloch bei Siegmannsbrunn, Oberfranken, Germany (Brunner 1954)

Other localities:

None recorded to date

Geological age:

Riss-Würm Interglacial (Brunner 1954) i.e. +-118,000 to 128,000 B.P. Middle to Upper Pleistocene

Material:

The type specimen is a right mandibular fragment with well-worn in situ P_4, M_1 and M_2 and the empty alveolus of M_3, apparently the only material that is available.

Illustrations:

See Brunner 1954.

Brunner illustrates the type specimen - see Fig. 26

Diagnosis, taxonomic remarks:

Brunner himself queries his identification on account of the paucity of material. He states that H. schaubi closely resembles H. brachyura (more correctly H. (Acanthion) brachyura) but that his species has considerably higher molar crowns than the latter. He also gives a detailed description of the crown enamel pattern of the teeth preserved and states that similar molar structures is not found in any other species of Hystrix.

Measurements:

Mandibular measurements (in mm) (after Brunner 1954 p.100)

	MD	BL
P_4	7.7	-

Length of P_4 - M_2 = 20.6mm

COMMENTS:

The illustration (Fig. 26) suggests that the specimen undoubtedly belongs to Hystrix, but the species has been defined almost exclusively on the basis of the crown enamel pattern, which has been demonstrated (main text, chapter 7.1.5) as being highly variable. It appears to be a small form of Hystrix, probably very like H. minor which Malez described in 1963, with which it is contemporaneous. The latter species was not compared with H. schaubi and, unless it is decided to incorporate H. minor in H. cristata, H. minor will probably prove to be synonymous with H. schaubi. Both species may simply represent small forms of H. cristata.

H. vinogradovi Argyropulos 1941 (no.25) another Riss-Würm European porcupine of smaller dimensions than H. cristata, may also be synonymous with H. minor and H. schaubi.

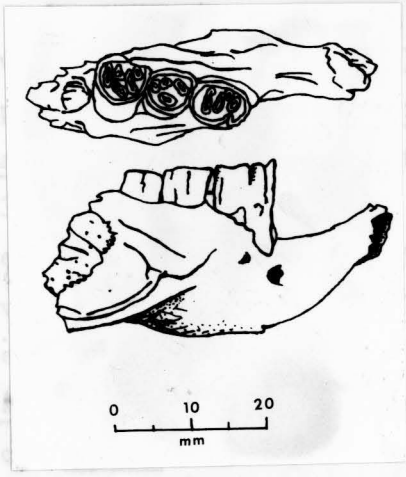


Fig. 26

Sketch showing the type mandible of Hystrix schaubi Brunner 1954, a right mandibular fragment with P_4, M_1 and M_2 in situ. Natural size. Redrawn from Brunner 1954 p. 99 Fig. 6.

21A

HYSTRIX SIVALENSIS Lydekker 1878

1878. Lydekker, R. Rec. geol. Surv. India, II:98-100

Note: (i) The juvenile cranium (B.M.15923) referred by Lydekker (1884 p.110(6) Fig. 5) to Hystrix sp. probably H. sivalensis and also illustrated in Lydekker 1885b Fig. 33 has since been referred to H. cf. leucura (Matthew 1929 p.559). Bosco (1898 p.152) also discusses the juvenile cranium as H. sivalensis.

(ii) The specimen A.M.19909 referred by Colbert 1935 p.72 to H. sivalensis was transferred to H. cf. leucura (= H. cf. indica)by Black (1972 p.247).

Additional references:

Lydekker 1880 p.33 (vide Colbert 1935); 1883 pp.84, 91; 1884 pp.109, 111, 126; 1885a p.13 (probably H. cf. leucura, in part, vide Colbert 1935); 1886 p.38

Bosco 1898 pp. 151(11) - 152(12)

Pilgrim 1910 p.200; 1913 p.293

Matthew 1929 p.444, 559, 560

Wang 1931 pp. 48, 49

Colbert 1933 p.1; 1935 p.72

Greenwood 1955 p.79, Tables 6, 7 pp. 82, 83

Landry 1957 p.63

Deraniyagala 1958 p.83

Piveteau 1958 p.707 Fig. 62

Sulimski 1960 pp. 327, 328, Table 1

Mohr 1965 pp.65, 66

Melentis and Schneider 1966 p.284

Melentis 1968 p.323

Black 1972 pp.246, 247

Type locality and horizon:

From the Siwaliks of the village if Asnot (Lydekker 1878 p.98)

Other localities:

None recorded to date. The specimen from Pinjor recorded by Colbert (1935 p.72) has been referred to H. cf. leucura (Black 1972 p.247)

Geological age and horizon:

Upper Pliocene (Lydekker 1883 p.84); Middle Siwaliks of Hasnot, Punjab (Matthew 1929 p.559); Dhok Pathan stage of the Siwalik series, Pontian - Plaisancian, Middle Pliocene (Landry 1957 p.63)

Material:

The type specimen consists of the middle portion of the right ramus of the mandible containing the two first molars and the sockets of the premolar and last molar; the cutting extremity of the lower incisor of the same side was also obtained (Lydekker 1878 p.98). Matthew (1929) and Colbert (1935) have quoted this specimen as Ind. Mus. (G.S.I.) No. D 96.

Colbert (1935 p.72) has referred a left M_1 (A.M. 19909) from the Middle Siwaliks, north of Hasnot, to this species, but Black (1972 p.247) has transferred this specimen to H. cf. leucura.

Illustrations:

See Lydekker 1884; 1885; Piveteau 1958
All illustrations are of the type mandible, see Figs. 27, 28
Deraniyagala (1958) illustrates some teeth of H. sivalensis sinhaleyus.

Diagnosis, taxonomic remarks:

Lydekker (1878) defines his species in the following way:

> M_1 longer than M_2 (M_2 longer than M_1 in H. leucura)
> M_1 larger than M_1 pf H. leucura (= H. indica).
>
> M_2's of equivalent length .....
> The surface of the incisive edge is more concave than in H. leucura. The muscle attachments on the mandible of the fossil are much more pronounced than in the living species.
> (pp.99, 100)

Some comments are made concerning supposed differences in the crown enamel pattern of the two species (H. sivalensis and H. leucura) but since the closure of the various enamel folds is a function of age and wear, the present author does not consider them as diagnostically valid. The species was compared with H. refossa, H. primigenia and H. venusta and found to be different.

Lydekker (1884) describes the three distinct roots of the P_4 as being situated only just below the lower extremity of the external enamel fold, and the roots of the M_1 and M_2 as equally well-developed

and also commencing shortly below the lower extremity of their respective external enamel folds. He notes that the molars are shorter-crowned than in living species and that as a consequence, the incisor alveolus is more superficial. The mental foramen is described as being closer to the P_4 and the diastemic curve as flatter than in the living species (H. indica). It was also noted that the ridge forming the anterior boundary of the masseteric fossa is more strongly developed.

Lydekker is of the opinion that:

> The characters in which the Siwalik form differs from the existing species are precisely those which might be expected to occur in an early, or generalized form and it is therefore quite possible that it may be the ancestor of the large existing Indian species.

H. sivalensis apparently agrees with H. crassidens in size but has rooted low-crowned molars (Lydekker 1886 p.38).

Bosco (1898 p.152) states that H. sivalensis is smaller than H. etrusca. The species is therefore smaller than H. primigenia since H. etrusca and H. primigenia are of the same size.

According to Matthew (1929 p.559) H. sivalensis proper is nearly comparable with H. primigenia of Pikermi, although not so brachydont. From these descriptions it therefore seems intermediate in brachydonty between H. primigenia and modern Hystrix.

Wang states (1931 pp.48, 49) that H. sivalensis has larger dimensions and more enamel islands than H. kiangsenensis (= H. cf. subcristata) and that it has low crowns with three long roots on the premolar and molars. He also states that it is somewhat larger than H. hirsutirostris (= H. indica) but that the roots of the cheek teeth have a similar build. The latter statements concerning the cheek teeth seem what contradictory, the first implying brachydonty, but the teeth of H. indica, which are supposed to be similar to those of H. sivalensis, are known to be hypsodont.

Colbert (1935) diagnoses the species by its large size and by the separate roots on the P_4.

H. makapanensis (= H. major Greenwood 1955) resembles H. sivalensis in the development of its roots (Greenwood 1955).

Landry (1957 p.63) quotes Matthew (1929) as having stated that H. sivalensis is hypsodont; the present author considers that this

is a misinterpretation of Matthew's text. Mohr (1965 p.65) virtually writing from Landry's text, has made the same error.

Sulimski (1960 p.328) states that H. sivalensis has slightly smaller tooth dimensions than the Weze form of H. primigenia but shows great similarity in the crown enamel pattern of M_1 and M_2.

Black (1972 p.247) gives the diagnosis as 'P_4 large, cheek teeth low-crowned'.

Measurements:

Mandibular measurements (in mm)

	MD	BL	
M_1	9.9	8.4	(Lydekker 1878 p.99, converted from inches)
	9.3	9.3	(Matthew 1929 p.559)
	10.0	7.5	(Greenwood 1955 Table 7, p.83)
	10.0	9.5	(Sulimski 1960 Table 1)
M_2	9.1	7.9	(Lydekker 1878 p.99, converted from inches)
	9.2	8.5	(Greenwood 1955 Table 7, p.83)
	9.0	9.0	(Deraniyagala 1958 p.83)
	9.0	9.0	(Sulimski 1960 Table 1)

COMMENTS:

It is obvious from examination of the illustration of the type of H. sivalensis (Fig. 27) that the 'P_4' mentioned in most of Lydekker's descriptions of the species is in reality dp_4, as the specimen is juvenile; the M_3 has not yet erupted. In this case, the fact that the 'P_4' has three distinct roots is only to be expected.

Some of the other'diagnostic criteria'mentioned by Lydekker, for instance the closure of the enamel folds and the robustness of the muscle attachments on the jaw are known to be too variable to be of taxonomic significance, the first-mentioned criterion being a function of age and wear.

With only a single specimen to go by, it is difficult to comment on the status of H. sivalensis, it may well be a distinct species. If this is the case, its diagnosis needs revision.

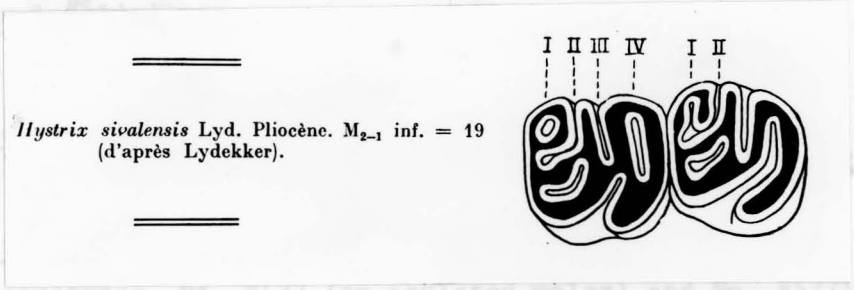


pm. 4. m. 1. m. 2. m. 3.

Fig. 4. *Hystrix sivalensis*. Fragment of the right ramus of the mandible ; from the Siwaliks of Asnot, Punjab. Indian Museum (No. D. 96). ½

Fig. 27

Illustration of the type specimen (Ind. Mus. D 96) of Hystrix sivalensis Lydekker 1878, from Lydekker 1884 p. 109 (5) Fig. 4. Natural size.



Hystrix sivalensis Lyd. Pliocène. M_{2-1} inf. = 19 (d'après Lydekker).

Fig. 28

Sketch showing detail of crown structure of Hystrix sivalensis Lydekker 1878, from Piveteau 1958 p. 707 Fig. 62.

Scale: $M_1 + M_2 = 19$ mm.

21B

HYSTRIX SIVALENSIS SINHALEYUS Deraniyagala 1951

1951. Deraniyagala, P.E.P. Spolia Zeylanica. 26 p.122

Note: Originally described as Acanthion sivalensis sinhaleyus but transferred to Hystrix by Deraniyagala 1958 p.83

Additional references:

Deraniyagala 1958 p.83 Pl. 39, Figs. 1-6

Landry 1957 p.62 (as Acanthion sivalensis)

Mohr 1965 pp.65, 66

Type locality and horizon:

With Bibos gaurus sinhaleyus and Hexaprotodon sinhaleyus 2,3m (7ft) down in a gem pit at Gorak gaha deniya, Gonapitiya, Kuruvita, Ceylon (Deraniyagala 1958)

Other localities:

None recorded to date

Geological age:

Middle Pleistocene (Deraniyagala 1958, Table on p.41)

Material:

The paratypes, No. F132 (an isolated molar) and No. F57/148/17 (an upper left molar) are in the Ratnapura Museum, and the co-types, No. F57/147/17a (probably a left M^2) and No. F57/147/17b (probably a right M_3) are in the Colombo Museum. These isolated teeth are apparently all the material of this subspecies that is available.

Illustrations:

See Deraniyagala 1958

Deraniyagala (pl. 26 Figs.1-6) illustrates in lateral and occlusal view all the material listed above with the exception of F.132.

Diagnosis, taxonomic remarks:

'A porcupine allied to H. sivalensis Lydekker 1878 but with smaller cheek teeth'. (Deraniyagala 1958 p.83)

Measurements:

Maxillary measurements (in mm) (after Deraniyagala 1958 p.83)

	MD	BL
M^1	9.5	7.0
M^2	8.0	6.0

Mandibular measurements (in mm) (after Deraniyagala 1958 p.83)

	MD	BL
M_3	7.0	6.0

COMMENTS:

Judging by the measurements given, the subspecies is obviously somewhat smaller than H. sivalensis, and falls well within the range for H. indica. It seems probable that the subspecies is conspecific with the latter species. Fossil subspecies are not generally acceptable.

Note: Bakr (1959 p.38) places Acanthion sivalensis sinhaleyus Deraniyagala 1951 and Hystrix sivalensis sinhaleyus Deraniyagala 1958 in the synonymy of H. indica Kerr 1792.

HYSTRIX cf. SUBCRISTATA Swinhoe 1870

1870. Swinhoe, R. Proc. zool Soc. Lond., 1870 p. 638, 639

Note: (i) Hystrix subcristata, the living Chinese porcupine, has been placed in the subgenus Acanthion, being one of the smaller hystricids, and is therefore more correctly designated Hystrix (Acanthion) subcristata.

(ii) Hystrix kiangsenensis Wang 1931 is considered by Young (1934 p.111) and Colbert and Hooijer (1953 p.41) to be a synonym of H. cf. subcristata.

(iii) Chikushan is an alternative name for Choukoutien Locality 6.

Additional references:

Lönnberg 1924 p.4, as H. sp. (vide Landry 1957)

Young 1927 pp.5-82 (vide Young 1934); 1930 pp.14, 15, as H. sp. probably H. cf. subcristata; 1932 pp.383-393 (vide Young 1934); 1934 pp.109-112, Fig. 46, p.110 Pl. 9, Figs. 10, 10a.

Wang 1931 pp.47-49 Taf. 2,Figs. 3-13 as H. kiangsenensis

Pei 1936 p.81 Pl. 5, Figs. 23, 24; 1940 pp.147-188

Teilhard de Chardin 1936 p.22 (vide Sulimski 1960)

Teilhard de Chardin and Pei 1941 p.61 Fig. 49

Colbert and Hooijer 1953 pp.40, 41, Fig. 14

Landry 1957 p.62

Sulimski 1960 p.328, Table 1

Mohr 1965 p.66, as Acanthion subcristatum

Localities from which H. cf. subcristata has been described:

The present-day range of the living H. subcristata is in Kiangsi, Hupei, Kwangsi, Fokien and Anhwei in southern China (Wang 1931).

Fossil H. cf. subcristata from: Chaoyangtung, Fangshanhsien, Hopeh, near Peiping, China (Young 1927 pp.5-82; 1930 p.14)

Chikushan, near Choukoutien (Young 1930 p.14)

Chingyangfu, Kansu (Young 1930 p.14; 1934 p.111)

Choukoutien Locality 1, Hopeh (Young 1930 p.15; 1934 p.109)

Choukoutien Locality 3, Hopeh (Young 1934 p.111; Pei 1936 p.81)

Choukoutien Locality 4, Hopeh (Young 1934 p.111)

Choukoutien Locality 6, Hopeh (Young 1930 p.15)

Choukoutien Locality 9, Hopeh (Teilhard de Chardin 1936 p.22)

Choukoutien Locality 13, Hopeh (Young 1934 p.111; Teilhard de Chardin and Pei 1941 p.61)

Hoshangtung, Yunnan, China (Young 1932 pp.383-393; 1934 p.111)

Drachen-Maul-Hoehle, Kiangsen, Chekiang (Wang 1931 pp.47-49)

Tanyang, Kiangsu, Chian (Pei 1940 pp. 147-188)

Fukien, China (Colbert and Hocijer 1953 p.41)

Yenchingkou, Szechwan, China (Colbert and Hooijer 1953 p.41)

Geological age and horizon:

Choukoutien = Early Middle Pleistocene (1.5 million years for Locality 18, Kurten 1972, pp.193, 452, 453)

Yenchingkou, Szechwan, China = Pleistocene (Colbert and Hooijer 1953 p.41)

H. cf. subcristata occurs together with H. (A) lagrelli in Localities 9 and 13 of Choukoutien (Teilhard de Chardin and Pei 1941 p.59) although previously (1930) Young had considered H. (A) lagrelli to be geologically older.

Material:

Chaoyangtung - mandible with P_4 in situ (Young 1934 p.111)

Chikushan - isolated lower left molar (Young 1930 p.14), upper incisor lower incisor, P^4 and P_4 (Young 1934 p.111)

Chiangyangfu - isolated P^4 (Young 1930 p.15; 1934 p.111)

Choukoutien Locality 1 - Three incomplete lower jaws and a few isolated upper and lower incisors and molars No. C/C 1769-Yc 1774 - see Figs. 29, 30 in this appendix (Young 1934 pp.109, 110)

Choukoutien Locality 3 - several isolated teeth; unworn P_4, worn P_4, including C/C 2636 (Pei 1936 p.81)

Choukoutien Locality 13 - left lower half-mandible with complete tooth row P_4-M_3 in situ, see Fig.31 in this appendix (Teilhard and Pei 1941 p.61)

Drachen-Maul-Hoehle, Chekiang - right mandibular fragment with P_4 and M_1, isolated upper right incisor, isolated lower right incisor, isolated right P^4, isolated left M^3, isolated left P_4, isolated left M_1, isolated dp_4; i.e. all the material initially described by Wang (1931) as H. kiangsenensis - see No. 10, Fig. 11 in this appendix

Szechwan, China - a fragmentary right half-mandible with M_1 in situ; A.M.N.H. 18747 see Fig. 32 in this appendix, and C.N.H.M. No. 39455, an isolated M_1 (Colbert and Hooijer 1953 p.41)

Illustrations:

See Wang 1931; Young 1934; Pei 1936; Teilhard de Chardin and Pei 1941; Colbert and Hooijer 1953

The illustrations of Wang, Young, Teilhard de Chardin and Pei and Colbert and Hooijer are reproduced in Figs. 11, 29, 30, 31 and 32 respectively. Pei (1936) illustrates some isolated teeth.

Description, taxonomic remarks:

The modern H. subcristata was defined by Swinhoe (1870).

Young (1934 p.109) describes H. cf subcristata as a rather large porcupine, with the base of the masseteric crest set far back on the mandible below the P_4, and with a small foramen mentale (p.110). The P^4 has a deep inner fold and two outer folds, the crown is strongly convex inward (?). The P_4 has its posterior portion a little expanded. The folds rapidly become islands.

Teilhard de Chardin and Pei (1941 p.61) state that the dimensions of the H. cf. subcristata remains from Choukoutien Localities 1, 9 and 13 exceed those of the modern H. subcristata.

Colbert and Hooijer (1953 p.41) note that most of the Pleistocene porcupines from China have been referred to H. subcristata or to H. cf. subcristata, the modern Chinese species, stating that the fossil H. cf. subcristata shows few if any appreciable differences from the recent form.

The taxonomic remarks for H. kiangsenensis (No. 10) should also be referred to.

Measurements:

Maxillary measurements (in mm)

	MD	BL	
I^1	6.0	-	(Young 1934 p.111)
	6.0	-	(Young 1934 p.111)

	MD	BL	
P^4	6.5	6.0	(Wang 1931, p.48, for H. kiangsenensis)
	10.0	7.0	(Young 1930 p.15)
	8.2	6.2	(Young 1934 p.111)
	8.0	-	(Young 1934 p.111)
	8.5	7.0	(Young 1934 p.111)
	10.0	7.5	(Young 1934 p.111)
	6.0	5.5	(Sulimski 1960 Table 1)
	10.0	7.5	(Sulimski 1960 Table 1)
M^1	7.0	6.5	(Sulimski 1960 Table 1)
	7.4	7.3	(Sulimski 1960 Table 1)
M^2	7.0	6.5	(Sulimski 1960 Table 1)
	7.4	7.2	(Sulimski 1960 Table 1)
M^3	6.0	5.5	(Sulimski 1960 Table 1)
	7.0	6.5	(Sulimski 1960 Table 1)
	6.2	6.0	(Wang 1931 p.48, for H. kiangsenensis)

Length of cheek-tooth row P^4-M^3 = 32.0 (Sulimski 1960 Table 1)

Mandibular measurements (in mm)

	MD	BL	
I_1	6.0	6.7	(Wang 1931 p.48 for H. kiangsenensis)
	7.0	-	(Young 1932 p.111, vide Young 1934 p.111)
	7.0	-	(Young 1934 p.111)
P_4	8.5	7.0	(Wang 1931. p.48)
	9.0	7.2	(Young 1934 p.111)
	8.0	6.0	(Young 1934 p.111)
	7.5	6.8	(Young 1934 p.111)
	9.6	8.2	(Young 1934 p.111)
	10.0	8.0	(Young 1934 p.111)
	10.0	7.5	(Teilhard and Pei 1941 p.61)
	7.5	6.0	(Sulimski 1960 Table 1)
	10.0	8.2	(Sulimski 1960 Table 1)
M_1	6.5	5.0	(Young 1930 p.14)
	6.5	7.0	(Wang 1931 p.48)
	7.4	6.0	(Young 1934 p.111)
	8.0	7.5	(Teilhard and Pei 1941 p.61)

	MD	BL	
	7.5	7.3	(Colbert and Hooijer 1953 p.41)
	7.6	6.7	(Colbert and Hooijer 1953 p.41)
	7.4	-	(Colbert and Hooijer 1953 p.41
	7.4	6.0	(Sulimski 1960 Table 1)
	9.0	8.0	(Sulimski 1960 Table 1)
M_2	7.3	7.0	(Wang 1931 p.48)
	8.5	8.0	(Teilhard and Pei 1941 p.61)
	9.0	7.0	(Sulimski 1960 Table 1)
	9.5	8.0	(Sulimski 1960 Table 1)
M_3	9.0	7.2	(Teilhard and Pei 1941 p.61)
	9.0	7.2	(Sulimski 1960 Table 1)

Length of cheektooth row P_4-M_3 = 31.0 (Wang 1931 p.48 for H. kiangsenensis)
= 35.0 (Teilhard and Pei 1941 p.61)
= 32.5 (Sulimski 1960 Table 1)
= 37.0 (Sulimski 1960 Table 1)

Depth of ramus at P_4 = 25.0 (Young 1934 p.111)
= 25.5 (Colbert and Hooijer 1953 p.41)
= 28.5 (Colbert and Hooijer 1953 p.41)

Depth of ramus in front of P_4 = 15.0 (Young 1934 p.111)
= 14.8 (Young 1934 p.111)

COMMENTS:

All the descriptive features mentioned by Young (1934) are highly variable and are common to other species of Hystrix as well. The crowns of the maxillary teeth in Hystrix (all species) curve outwards (buccally) and not inwards as he has said.

Comparison shows the H. cf. subcristata mandible depicted in Fig.31 this appendix, to correspond in size with a H. africaeaustralis mandible at an equivalent stage of growth, but the diastema of the former species is apparently shorter and more strongly curved.

Like Colbert and Hooijer (1953) the present author considers the material referred to H. cf. subcristata to be conspecific with the living Chinese form, or at most to represent a robust Pleistocene form of this species (i.e. H. (A) subcristata).

Fig. 29

Hystrix cf. subcristata Swinhoe 1870 from Locality 1 (Sinanthropus Locality) of Choukoutien, taken from Young 1934 p. 110 Fig. 46. Natural size. Lower jaws C/C 1769 - C/C 1770, teeth C/C 1771.

Fig. 30

Photograph showing occlusal and labial views of right lower jaw fragment (C/C 1769) of Hystrix cf. subcristata Swinhoe 1870 from Locality 1 of Choukoutien. From Young 1934 Plate 9 p. 159, natural size.

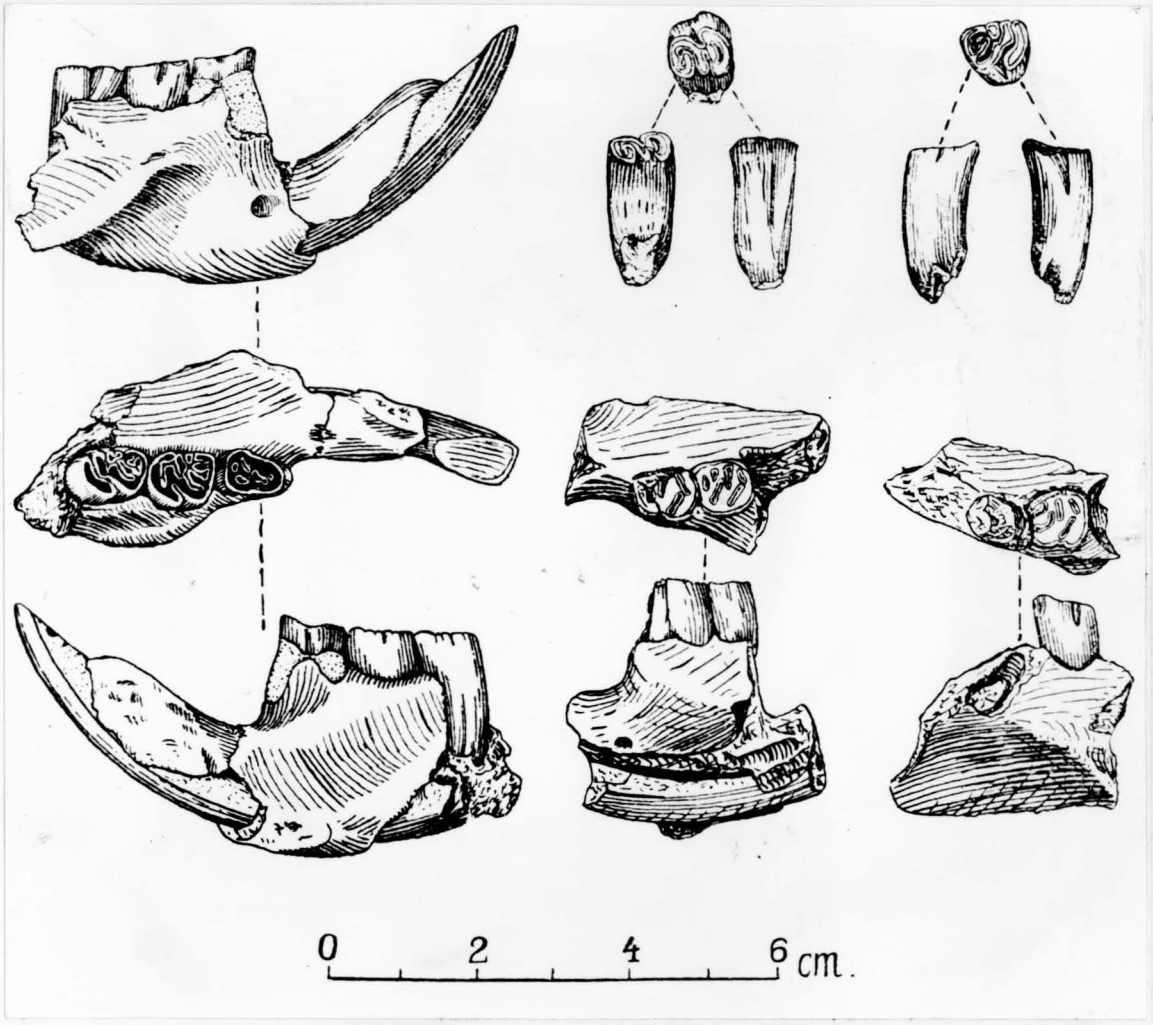


Fig. 29

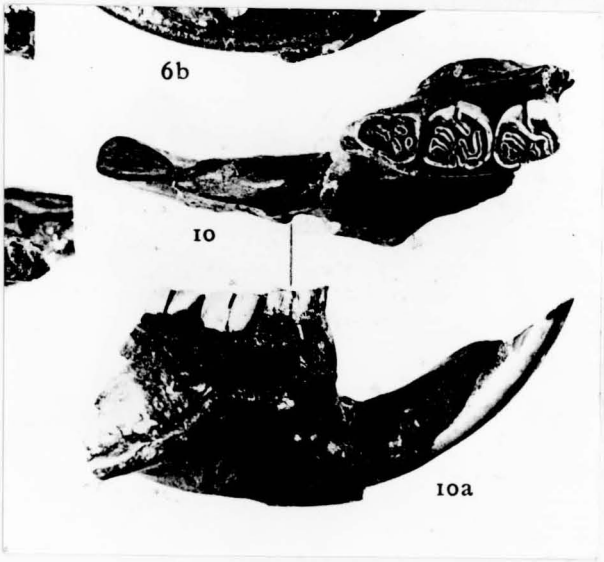


Fig. 30

Fig. 31

Illustration of Hystrix subcristata Swinhoe 1870 from Locality 13 of Choukoutien, China. From Teilhard de Chardin and Pei 1941 p. 61 Fig. 49; left lower half-mandible natural size, teeth enlarged twice.

Fig. 32

Illustration of Hystrix subcristata Swinhoe 1870 (A.M.N.H. No. 18747) from Yenchingkou, Szechwan, China. From Colbert and Hooijer 1953 p. 41 Fig. 14. Lateral view of right mandibular ramus with M_1 in situ, natural size.

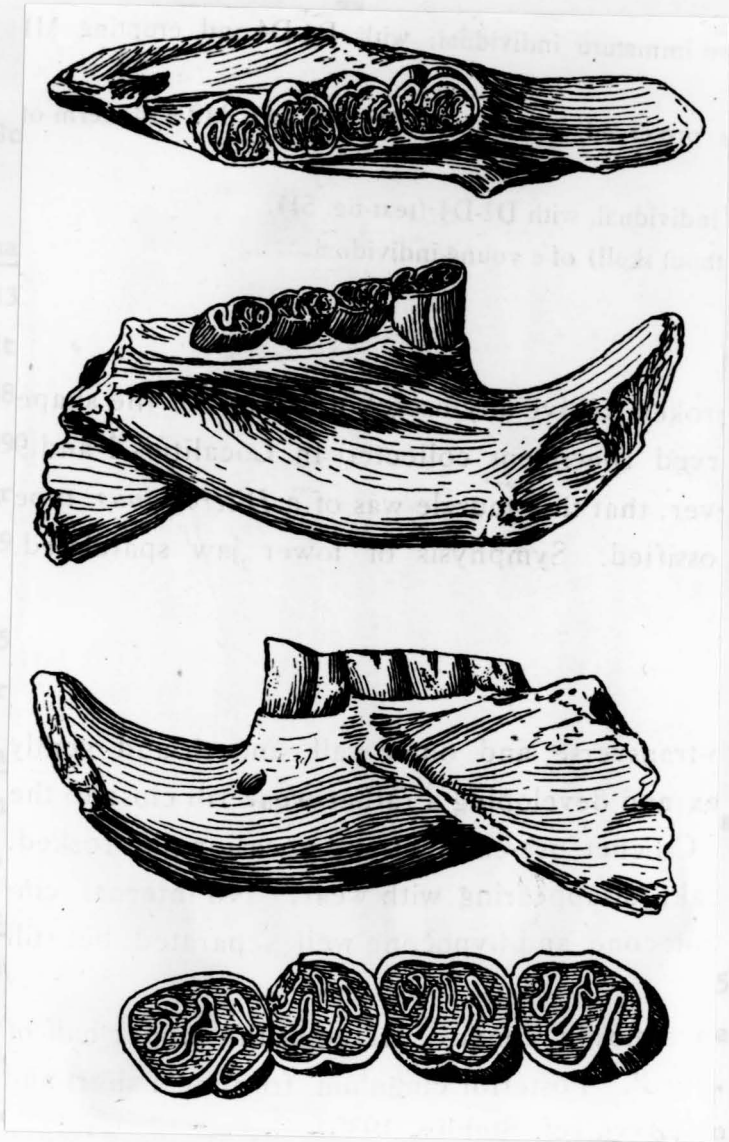


Fig. 31

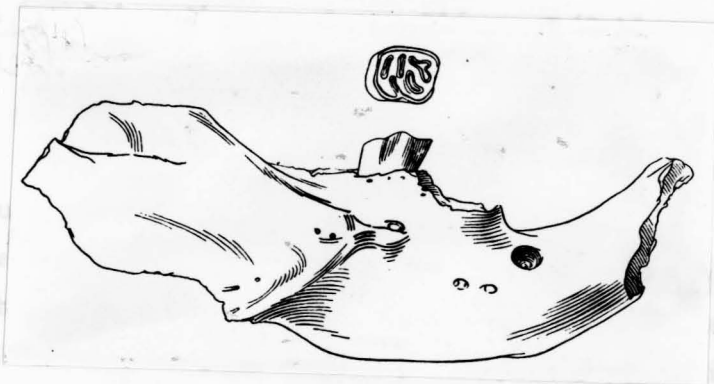


Fig. 32

23

HYSTRIX SUEVICA Schlosser 1884

1884. Schlosser, M. Palaeontographica, Folge 7, 31(3) p.46
Taf. 7 (3) Fig. 27

Additional references:

Jager 1835 (presumably as H. sp.) p.17, Taf. 3, Figs 38,39
Quenstedt 1882 (as H. sp.) pp.57, 58, Taf. 3, Figs. 25, 26, 53, 54
Roger 1885 p.109; 1900 p.? (vide Landry 1957)
Bosco 1898 pp.150(10), 151(11)
Schlosser 1902 p.138(24), Taf. 1(6), Figs. 10, 11, 15, 24
Landry 1957 p.61
Sulimski 1960 p.327
Mohr 1965 p.63
Bachmayer and Wilson 1970 (as Hystrix cf. H. suevica) pp.579, 580

Type locality and horizon:

Bohnerzen von Salmendingen, Germany; Hader bei Dinkelscherben, Augsburg, Germany (Schlosser 1884 p.46(28)

Other localities:

Reischenau, Zusamthal in Schwaben, Germany (Roger 1885 p.109). Dinotheriensande der Bayerisch-Schwaebischen Hochebene, Germany (Landry 1957 p.61 and Mohr 1965 p.63 from Roger 1900). Kohfidisch fissures of Burgenland (Austria) (Bachmayer and Wilson 1970 p.579).

Geological age:

No indication of age of type localities given with original description.

Bohnerzen von Salmendingen = Lower Pliocene (Schlosser 1902) p.138(24)
Hader bei Dinkelscherben = Late Miocene, Vindobonian (= Obermiocan) (Schlosser 1902 p.138(24); Landry 1957 p.63; Mohr 1965 p.63)
Reischenau = Miocene (Roger 1885 p.100)
Dinotheriensande = Miocene (Landry 1957 p.63)
Kohfidisch fissures = Late Pannonian (= Pikermian) (Bachmayer and Wilson 1970 p.580), i.e. approximately Lower Pliocene

Material:

(a) Type specimens a left P^4 and left M^1 described by Quenstedt (1882) from Salmendingen and referred by Schlosser to H. suevica, and a right upper molar from Hader (Schlosser 1884 p.46(28). Quenstedt also described an upper and a lower incisor from Salmendingen which have also been referred to H. suevica. The molar from Hader was later referred to Anchitheriomys wiedemanni (= H. wiedemanni).

(b) The isolated molar from Reischenau mentioned by Roger (1885, p.109).

(c) The humerus and maxillary fragment containing two molars from the Dinotheriensande referred by Roger (1900) to H. suevica.

(d) The four maxillary teeth referred to H. cf. suevica by Bachmayer and Wilson (1970 p.580) from the Kohfidisch fissures.

Illustrations:

See Jager 1835, Quenstedt 1882, Schlosser 1884, 1902.
The upper and lower incisor and left P^4 and M^1 described by Quenstedt (1882) are illustrated in op. cit. Taf. 3, Figs. 25, 26, 53 and 54 respectively. Schlosser's (1884) right upper molar is illustrated in Taf. 7(3), Fig. 27, see Fig. 15 in this appendix. This specimen was subsequently transferred to Anchitheriomys wiedemanni. All four of Quenstedt's original illustrations are redrawn in Schlosser 1902 Taf. 1(6), Figs. 10, 11, 15, 24, see Fig. 33 in this appendix.

Diagnosis, taxonomic remarks:

Schlosser (1884 p.46(28) referred the left P^4 and M^1 (and presumably also the upper and lower incisors) described by Quenstedt from 'Bohnerzen von Salmendingen' and an upper molar of his own obtained from 'Hader bei Dinkelscherben' to H. suevica, and suggested that all Upper Miocene Hystrix fragments should be referred to this species. Later (1902 p.138(24)), Schlosser decided that considerable differences existed between the teeth from the two localities, and that since the sites also differed faunistically and in their geological age, it was unlikely that the teeth belonged to the same species. He confined the name H. suevica to the Salmendingen (Lower Pliocene) specimens and transferred the Hader material to Anchitheriomys wiedemanni (Roger 1885) (see No. 26). It is therefore unlikely that any of the Miocene material listed belongs to H. suevica. The taxonomic status of the

Miocene material from the Dinotheriensande and Reischenau referred by Roger (1885, 1900) to H. suevica is therefore quite uncertain. It appears that the material from the latter localities has been included in H. wiedemanni Roger 1885 (No. 26), but the status of the latter species is likewise uncertain.

H. suevica has never been adequately described. The following statements concerning it have been made:

> The teeth of H. suevica are much smaller than those of H. etrusca (which resembles H. cristata) and very different. The cheek teeth are divided into two lobes by deep folds. (Bosco 1898 p.151(11))

> The species (i.e. H. cf. suevica) is considerably smaller than H. primigenia and distinctly smaller than H. cristata. Teeth moderately hypsodont with distinct roots. (Bachmayer and Wilson 1970)

Measurements (in mm, after Bachmayer and Wilson 1970 p.580)

	MD	BL
P^4 ?	7.9	7.9
M^1 ?	6.7	7.3
M^2 ?	7.1	6.4
M^3 ?	7.1	6.4
	6.8	6.9

Maxillary tooth row length is therefore approximately 28.5mm.

COMMENTS:

Examination of the illustrations of the Salmendingen material (Fig. 33) shows that H. suevica is smaller than H. africaeaustralis, and the species would therefore be considerably smaller than the fossil species with which it is contemporaneous - the Lower Pliocene H. primigenia. There seems to be some doubt as to whether any of the material described as H. suevica from Miocene localities really belongs to H. suevica - it seems more likely that it should be referred to H. wiedemanni. As there is some doubt as to the inclusion of H. wiedemanni in the genus Hystrix, the Pliocene H. primigenia and H. suevica material is the oldest satisfactory Hystrix material in Europe.

According to the published statements concerning dental size of H. suevica and judging from the measurements for Hystrix cf. H. suevica (Bachmayer and Wilson 1970), it does seem that the species is smaller than the contemporaneous H. primigenia, and is therefore probably a

distinct species.

One other European fossil Hystrix, H. bessarabica Rjabinin 1929 (No. 4) may be contemporaneous with H. suevica, and the possibility exists that the two forms may be synonymous. Unfortunately no measurements for H. bessarabica were available and the only measurements for H. suevica were obtained from the doubtfully referred and identified Hystrix cf. H. suevica material described by Bachmayer and Wilson (op. cit.). Published illustrations of the very scrappy material of both species are poor. The problem can thus not be settled without recourse to the original material.



Fig. 33

Illustrations of Hystrix suevica Schlosser 1884. From Schlosser 1902 Taf. 1(6).

Fig. 10 Hystrix suevica from Salmendingen. Left M^1, occlusal surface. Drawn from Quenstedt 1882 Taf. 3 Fig. 53. Natural size.

Fig. 11 H. suevica from Salmendingen. Left P^4, occlusal surface. Drawn from Quenstedt 1882 Taf. 3 Fig. 54. Natural size.

Fig. 15 H. suevica from Salmendingen. Upper right incisor, distal surface and cross-section shown. Drawn from Quenstedt 1882 Taf. 3, Fig. 26. Natural size.

Fig. 24 H. suevica from Salmendingen. Lower left incisor, distal surface and cross-section shown. Natural size.

All figures redrawn from Quenstedt 1882 Taf. 3.

24

HYSTRIX VENUSTA Leidy 1869

1869. Leidy, J. Acad. nat. Sci. Philadel., Ser. 2, 7: 343, Pl. 26, Figs. 22, 23, 24

Additional references:

Lydekker 1878 pp.99, 100; 1884 pp.108(4)-110(6)

Schlosser 1884 p.48(30)

Bosco 1898 pp.151(11), 152(12)

Wang 1931 p.49

Type locality and horizon:

Pliocene beds of Nebraska and Dakota (Lydekker 1878 p.99)

Other localities:

None recorded

Geological age and horizon:

Pliocene (Lydekker 1878 p.99; 1884 p.48)

Material:

The type specimen is a single isolated molar (Lydekker 1884 p.110(6)

Illustrations:

See Leidy 1869

Leidy (1869 Pl.26, Figs.22, 23, 24) illustrates the single preserved molar.

Diagnosis, taxonomic remarks:

Lydekker (1878 p.100) states that the molars of H. venusta are very large and that the folds are simpler than those of H. sivalensis. The folds of H. sivalensis are already very simple (see Lydekker 1884, Fig. 4; see Figs.25, 26 in this appendix). Lydekker (1884 p.100(6)) also states that the molar resembles the corresponding tooth of H. cristata, but that it appears to have had a short crown with distinct fangs. Bosco (1898 p.152(12)) states that there is neither figure nor adequate description of this fossil.

Measurements:

None recorded

COMMENTS:

Considering its locality, it seems unlikely that H. venusta belongs to the Old World genus, Hystrix.

25

HYSTRIX VINOGRADOVI Argyropulos 1941

1941. Argyropulos A.I. Priroda, 3: 88-91

Additional references:

Gromov 1952 pp.203-349, Figs. (vide Mohr 1965; Mottl 1967)

Vereshchagin 1959 pp.136, 143, 144, 149, 77; Tables 17, 22; Map 73, Fig. 69, Nos. 31, 32 (page and Fig. Nos. of translation)

Janossy 1964 Fig. 2 No. 13; Taf. 2, Figs. 2, 3, 6 (also H. cf. vinogradovi) (vide Mottl 1967)

Mohr 1965 p.64

Mottl 1967 pp.305, 306, 308, 309, 310; Figs.4, 5 (also H. cf. vinogradovi)

Frenkel 1970 pp.52, 76

Type locality and horizon:

Middle Pleistocene layers of the asphalt pits at Binagady near Baku, Moldavian U.S.S.R. (Vereshchagin 1959 p.777, Map 73; Mohr 1965 p.64; Mottl 1967, p.305)

Other localities:

Apsheron, Transcaucasian U.S.S.R. (Vereshchagin 1959 p.144, Table 22)

Kalman Lambrecht-Höhle Beds IV-V, North Hungary (Janossy 1964; Mottl 1967 p.305) (H. cf. vinogradovi)

Kiskevelyerhoehle, Hungary (Mottl 1967 p.309) (H. cf. vinogradovi)

Repolusthöhle near Graz, Austria (Mottl 1967 p.309) (H. cf. vinogradovi)

Roten Berg near Saalfeld, Germany (Mottl 1967 p.309, 311)

Brasov, Roumania (Mottl 1967 p.306) (H. cf. vinogradovi)

Geological age:

Binagady = Middle Pleistocene to Riss-Würm Interglacial (Vereshchagin 1967 p.777; Mohr 1965 p.64; Mottl 1967 p.305)

Apsheron = Pleistocene to Recent (Vereshchagin 1959 p.144)

Kalman Lambrecht-Höhle = Late Riss-Würm Interglacial (Janossy 1964; Mottl 1967 p.305)

Kiskevelyerhoehle = Jungpleistozan-Letztinterglazial bis Würmanfang (Mottl 1967 p.305) i.e. Upper Pleistocene

Repolusthoehle = Jungpleistozan-Letztinterglazial bis Würmanfang (Mottl 1967 p.305) i.e. Upper Pleistocene

Roten Berg = Jungpleistozan-Letztinterglazial bis Würmanfang (Mottl 1967 p.305) i.e. Upper Pleistocene

Brasov = Late Lower Pleistocene (Mottl 1967 p.306), apparently the earliest representative of the form

The species is therefore Middle to Upper Pleistocene in age, i.e. approximately 700,000 to approximately 75,000 years B.P.

Material:

(a) Vinogradov (1941) described 25 individuals from the type locality including the type material

(b) Several molars from the Kalman-Lambrecht Höhle described and figured by Janossy (1964, Tab. 2, Figs. 2, 3)

(c) Several mandibular fragments and some post-cranial remains from the Kiskevelyerhoehle (H. cf. vinogradovi)

(d) A left mandibular fragment with I_1, dp_4-M_3, a right mandibular fragment with M_1-M_2, an upper incisor, a fragmentary femur and a left M^2 from the Repolusthoehle described and figured by Mottl (1967 p.308-311, Fig. 5, p.310) (H. cf. vinogradovi)

(e) A cheek tooth row from Roten Berg discussed and illustrated by Janossy (1964, Taf. 2, Fig. 6)

(f) The Brasov material (?) discussed by Janossy (1964)

Illustrations:

See Gromov 1952, Vereshchagin 1959, Janossy 1964, Mottl 1967. Vereshchagin (1957 Fig. 69, Nos.31, 32) illustrates a complete left half-mandible and scapula from Binagady (photograph); Janossy illustrates a mandible (1964 Fig. 2 No.13), the molars of H. cf vinogradovi from Kalman Lambrecht-Höhle (Taf.2, Figs.2, 3) and the tooth row of H. cf. vinogradovi from Roten Berg (Taf.2, Fig.6), Mottl (1967 p.308, see Fig. 34 in this appendix) illustrates a complete left mandible and a left mandibular fragment of H. cf. vinogradovi from the Repolusthoehle (p.310, Fig. 5)

Diagnosis, taxonomic remarks:

A small form of Hystrix (Mohr 1965 p.63; Mottl 1967 p.306). The mandible resembles that of H. leucura hirsutirostris (i.e. H. indica). Most of the ascending ramus lies above the alveolar plane. The mandible has a better-developed, more vertical coronoid process than H. cristata.

The top of the mesial symphysis does not reach above the occlusal plane (Mottl 1967 p.308). The mandible has a completely different shape from that of H. cristata.

Measurements (in mm after Mottl 1967, p.310)

	MD	BL
I^1	5.4	6.0
M^2	7.1	6.8
I_1	4.8	5.8
dp_4	8.0	6.0
M_1	8.0	6.5
	7.0	6.0
M_2	8.5	6.6
	7.8	6.2

Length of mandibular tooth row = 27.0-31.0 (Mottl 1967 pp.308, 310)
Length of mandibular tooth row of H. cf. vinogradovi from Repolusthoehle = 31.5 (Mottl 1967, p.310)
Height of ramus = 31.0-35.0 (Mottl 1967 p.308)
Length or ramus = 78.0-85.0 (Mottl 1967 p.308)

COMMENTS:

The mandible illustrated by Mottl (1967) see Fig. 34 in this appendix, is rather different from that of the modern H. cristata. The dental measurements, however, overlap with the lower part of the range obtained for the latter species, some of the measurements for H. vinogradovi falling below the range for H. cristata.

Europe is at present occupied by only one species of Hystrix, (H. cristata), and it is highly unlikely that three distinct species simultaneously occupied this zoogeographically restricted area during the Middle and Upper Pleistocene. It is therefore probable that either (or both) H. schaubi Brunner 1954 and H. minor Malez 1963 will prove synonymous with H. vinogradovi Argyropulos 1941. It is also possible that all three fossil species merely represent small fossil forms of the living European porcupine.

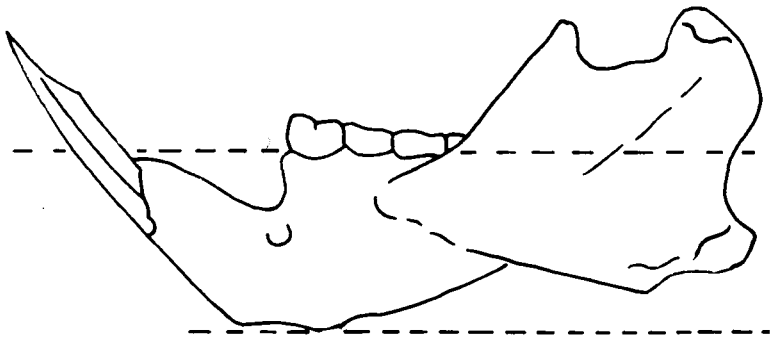


Fig. 34

Sketch showing the left mandible of Hystrix vinogradovi Argyropulos 1941 from Binagady, redrawn from Mottl 1967 p. 308 Fig. 4. Natural size.

26

HYSTRIX WIEDEMANNI Roger 1885

1885. Roger, O. Ber. Naturwiss. Ver. Augsburg, 28 p.109
Taf. 1, Fig. 12

Note: Hystrix wiedemanni has been synonymized with Anchitheriomys wiedemanni Roger 1900 (Schlosser 1902 p.138(24) ; Landry 1957 p.61; Mohr 1965 p.63)

Additional references:

Schlosser 1884 (Hader specimens, as H. suevica) p.46, Taf 7(3), Fig. 27; 1902 p.138(24)

Roger 1888 p.109, Taf. 1, Fig. 12; 1898 (probably as Anchitheriomys wiedemanni) p.7, Taf. 3, Figs.9, 10; 1900 (as A. wiedemanni) p.? (vide Landry 1957)

Seeman 1938 (as A. wiedemanni) p.? (vide Landry 1957)

Landry 1957 p.61

Type locality and horizon:

Reischenau, Zusamthal in Schwaben, Sanden her Huegel von Breitenbronn und Kutzenhausen, Germany (Roger 1885 p.99). (The latter locality the same as 'Dinotheriensande der Bayerisch-Schwaebischen Hochebene'? - see Landry 1957 p.61?)

Other localities:

Hader bei Dinkelscherben (Schlosser 1902 p.138)

Dinotheriensande der Bayerisch-Schwaebischen Hochebene (Roger 1898 p.8; 1900)

Braunkohle von Viehhausen bei Regensburg (Seeman 1938)

Geological age:

Reischenau = Miocene (Roger 1885 p.100)

Hader = Obermiocan (Schlosser 1902 p.138)

Dinotheriensande = Miocene (Landry 1957 p.61)

Braunkohle, Regensburg = Obermiocan (Seeman 1938)

Material:

(a) Type specimen an isolated fragment of upper incisor (Roger 1885, 1888)

(b) Roger's 1898 and 1900 material

(c) The right upper molar from Hader initially described by Schlosser (1884 p.46) as H. suevica, later transferred to H. wiedemanni (Schlosser 1902)

(d) The jaw fragment and molars described by Seeman (1838).

(e) If, as Schlosser has suggested (1902 p.138), none of the Miocene material belongs to H. suevica, it is probable that the isolated molar from Reischenau (Roger 1885 p.109) and the humerus and maxillary fragment from the Dinotheriensande (same locality, Roger 1900) belong to H. wiedemanni

Illustrations:

See Roger 1885, 1888, 1898; Schlosser 1884; Seeman 1938
The type specimen is illustrated in Roger 1885 Taf. 1, Fig. 12; 1888 Taf. 1, Fig. 12. Schlosser illustrated an upper right molar (see Fig. 15 in this appendix). Seeman has illustrated a jaw fragment showing the molar pattern (Fig. 35, this appendix).

Diagnosis, taxonomic remarks:

In 1900 (perhaps 1898?) Roger decided that the material he had described as H. wiedemanni in 1885 actually represented the remains of a beaver, for which he created the name Anchitheriomys wiedemanni (Landry 1957 p.61). In 1938, Seeman published a picture showing the molar pattern of this species, and after an examination of his figure Landry (1957 p.61) decided that the enamel pattern of the teeth was much more complex than is normal for beavers, and stated that Anchitheriomys was probably a hystricine porcupine after all. On the other hand, Stirton (Landry, op. cit.) considers Anchitheriomys to be a castorid similar to, if not identical with Amblycastor of the N. American Miocene.

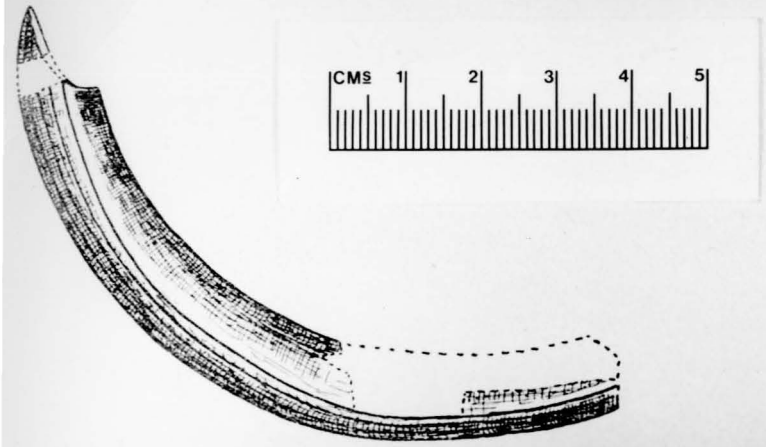
Examination of the figure of the type indicates that the incisor is longitudinally striated and shows signs of a central groove, both characteristics being unknown within the genus Hystrix. The taxonomic status of this fossil thus still seems in doubt.

Measurements:

	MD	BL	
I^1	10.25	-	(Roger 1885 p.109)
$M^{1,2,3}$?	7.0	6.5	(Schlosser 1885 p.46, as H. suevica)

COMMENTS:

The taxonomic status of this species seems to be uncertain; most modern authors exclude it from *Hystrix*.



bb. 30. *Anchitheriomys wiedemanni*. Schneidezahn des rechten Unterkiefers. (Inv.-Nr. 127 f.) ca. 1 : 1.

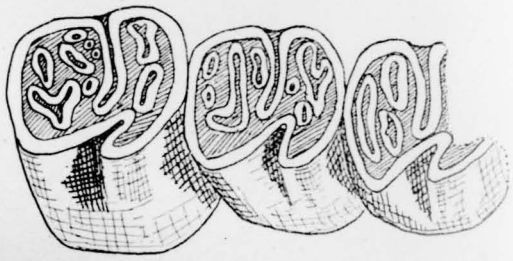


Abb. 31. *Anchitheriomys wiedemanni*. M_2, M_1, P_4 des linken Unterkiefers. (Inv.-Nr. 127 b.) 2,3 : 1.

Fig 35

Illustration showing an incisor and molar pattern of Hystrix wiedemanni Roger 1885, re-photographed from Seeman 1938 Figs. 30 and 31

SIVACANTHION COMPLICATUS Colbert 1933

1933. Colbert, E.H. Amer. Mus. Novit., No. 633 pp.3-5 Fig. 2

Additional references:

Colbert 1935 pp.73, 74 Fig.33

Landry 1957 pp.62, 63

Piveteau 1958 p.708, Fig. 64

Sulimski 1960 pp.327, 329, 331 Table 1

Mohr 1965 p.66

Type locality and horizon:

Four miles northeast of Chinji Rest House, Salt Range, Northern Punjab. From the Lower Siwaliks at the level of Chinji Rest House (Colbert 1933 p.3)

Other localities:

None recorded to date

Geological age:

Upper Miocene or Lower Pliocene (Colbert 1933 p.1; Mohr 1965 p.66); Sarmatian, Late Miocene (Landry 1957 p.62)

Material:

The type is A.M.N.H. 19626, two fragments of the mandible, a right half-mandible with unerupted P_4 and M_1-M_2, and a left half-mandible with P_4-M_2 and the alveolus of M_3. The left premolar has been exposed to show its crown pattern (Colbert 1933 p.3). No additional material has yet been discovered.

Illustrations:

See Colbert 1933, 1935; Piveteau 1958.

In both instances Colbert illustrates the type specimen (illustrations identical, see Fig. 36 in this appendix). Piveteau shows the detail of the crown enamel pattern; see Fig. 37 in this appendix.

Diagnosis, taxonomic remarks:

Colbert (1933) gives the generic diagnosis as follows:

> An hystricomorph of medium size, considerably smaller than the modern species of Hystrix or Acanthion. Dental formula 1 - 0 - 1 - 3. Angle of mandibular ramus very strong, as in

> other Hystricidae. Hystricomorph pattern of the molar enamel complicated by secondary foldings. (p.3)

Colbert also states that Sivacanthion represents an animal

> ....intermediate in size between Hystrix or Acanthion, and Atherura, though somewhat nearer to the latter (p.3)

The bone enclosing the incisor is said to form a prominent ridge on the inner and along the lower border of the ramus, as in Acanthion. Colbert notes that in contradistinction to the specialized crown patterns the tooth remains fairly primitive by virtue of its relative brachydonty. As regards its affinities, Colbert states that Sivacanthion is most closely related to Hystrix or Acanthion, noting that its tooth pattern is similar to that in Acanthion. On the other hand, in size and brachydonty, it resembles Atherura (1933 pp.3, 4, 5).

Landry (1957 pp.62, 63) disagrees with Colbert's interpretation that Sivacanthion is most closely related to the subgenus Hystrix (Acanthion) and states that it is an atherurine porcupine similar to if not identical with Atherura, basing his argument on the configuration of the masseteric crest and the incisor alveolus. He also mentions that the unworn molar enamel pattern in Atherurus may be more complicated than it is in Hystrix.

Mohr (1965 p.66) states that Sivacanthion is a small form which in size, brachydonty and in the relationships of the cranial bones (?) resembles the modern Atherurus so closely that Landry (1957) is of the opinion that it should be included in this genus.

Measurements :

Mandibular measurements (in mm)

	MD	BL	
P_4	6.1	5.7	(Colbert 1933 p.5; 1935 p.74)
	6.1	-	(Sulimski 1960 Table 1)
M_1	5.3	5.1	(Colbert 1933 p.5; 1935 p.74)
	5.3	4.4	(Sulimski 1960 Table 1)
M_2	5.2	5.4	(Colbert 1933 p.5; 1935 p.74)
	5.2	4.4	(Sulimski 1960 Table 1)

Length of mandibular tooth row P_4-M_3 = 22.0 (Sulimski 1960 Table 1)
= 16.8 (Colbert 1933 p.5)

Depth of mandible below M_1 = 13.8 (Colbert 1933 p.5)

COMMENTS:

The author, judging from the illustrations (Figs. 36 and 37) and measurements alone, would tend to agree with Landry (1957) and Mohr (1965) that Sivacanthion complicatus shows more affinities with the atherurine porcupines than with Acanthion or Hystrix. Probably a valid species.

Fig. 36

Photograph showing type specimen of Sivacanthion complicatus Colbert 1933 taken from Colbert 1933 p. 4 Fig. 2. Occlusal and lateral view of left half-mandible with P_4, M_1, M_2, in situ, alveolus for M_3 empty. x 2.

Fig. 37

Illustration showing detail of crown enamel pattern of M_1 and M_2 of Sivacanthion complicatus Colbert 1933. From Piveteau 1958 p. 708 Fig. 65.

Scale: Length of $M_1 + M_2$ = 11.0 mm.

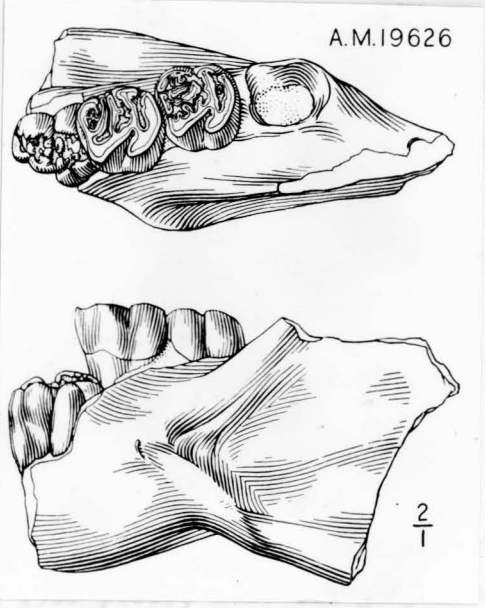


Fig. 36

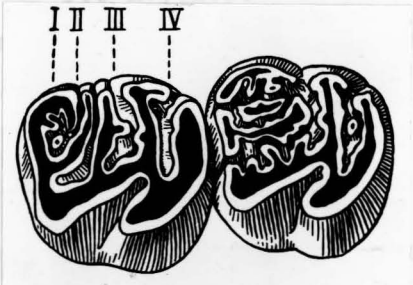


FIG. 64. — *Sivacanthion complicatus* Colbert. Sivaliks inférieurs. M_{2-1} inf. = 11 (d'après Colbert).

Fig. 37

28

XENOHYSTRIX CRASSIDENS Greenwood 1955

1955. Greenwood, M. Palaeont. afr. 3: 80-85, Fig. 28

Additional references:

Sulimski 1960 pp. 327, 329; Table I

Orlov 1962 p.190

Mohr 1965 p.65

Bishop and Miller 1972 p.242

Type locality and horizon:

Australopithecus prometheus zone of the Limeworks quarry, Makapan Valley (Greenwood 1955 p.81), i.e. the grey breccia or Makapansgat Member 3

Other localities:

Pink breccia or Member 4, Makapansgat Limeworks (Maguire, this thesis). Possibly Chemeron Formation, Lake Baringo, East Africa. (cf. X. crassidens, Bishop and Miller 1972 p.242)

Geological age:

Makapansgat Limeworks grey breccia or Member 3 = 3,0-3,67 m.y.B.P.
Makapansgat Limeworks pink breccia or Member 4 = 2,75-3,0 m.y.B.P.
Chemeron Formation = +- 3,0 m.y.B.P.

For a discussion of the derivation of these dates see Chapter 2.2, main text.

Material:

See also Appendix II, pp.7-26 for description of specimens

Makapansgat Limeworks grey breccia or Member 3:

M1003	Referred by Greenwood 1955 to H. major (= H. makapanensis) but transferred to X. crassidens, (Maguire, this thesis)
M1004	Syn-type A of X. Crassidens. Referred by Greenwood 1955
M1005	Syn-type B of X. crassidens. Referred by Greenwood 1955
M1006	Syn-type C of X. crassidens. Referred by Greenwood 1955
M1007	Syn-type D of X. crassidens. Referred by Greenwood 1955

M1008-M1011	
M1012-M1013	
M1015-M1016	Referred by Maguire, this thesis to
M1802-M1805	X. crassidens
M1808-M1810	
M1812?	Either X. crassidens or more probably H. makapanensis. Referred by Maguire, this thesis, to the latter species
M1813-M1814	
M1816	
M1824	Referred by Maguire, this thesis, to
M2516-M2523	X. crassidens
M2525	
M8220?	Possibly small X. crassidens but more likely H. makapanensis. Tentatively referred by Maguire, this thesis, to the latter species
M8233	Referred by Maguire, this thesis, to
M8276	X. crassidens
M8286-M8289	
M8362	

Makapansgat Limeworks pink breccia or Member 4:

M8281

Illustrations:

See Figs. 38-40 this appendix, and Greenwood 1955 Fig. 28 A-E.

Greenwood illustrates Syn-type A, B, C and D and specimen M1008. See also main text.

Diagnosis, taxonomic remarks:

Greenwood (1955) gives the generic diagnosis as follows:

> A large extinct Hystricoid with rooted upper molars; transverse and anterior posterior diameter of the upper teeth subequal, with occasionally the transverse diameter greater; diastemic portion of the premaxilla and the maxilla strongly arched, and mandibular diastema with corresponding degree of curvature. Type species. Xenohystrix crassidens sp. nov. (p.81)

The species diagnosis is given as follows:

> Teeth of large size: overall length of P^4-M^3 series 40mm or more (the mean length of the P^4-M^3 as determined from a sample of eleven Hystrix africae-australis is 33.8mm.). (p.81)

Greenwood (op. cit.) states that the crown enamel pattern of the molars of syn-type B (a dentigerous maxillary fragment) approximates to that of H. africaeaustralis at the same stage of wear, but that the upper premolars of X. crassidens bear no trace of an external enamel fold, a feature which she says persists in both H. cristata and H. africaeaustralis. The present author finds the latter statement to be incorrect - the internal enamel fold persists longest in Hystricoids, and by the time it has become obliterated by wear the external enamel folds have long since disappeared. At growth stage 6 which all the type specimens of X. crassidens appear to have reached, an external enamel fold is therefore not to be expected, and even in H. cristata and H. africaeaustralis, any external folds will have disappeared by the time this growth stage is reached.

Furthermore, Greenwood (op. cit.) states that:

> The characteristic outline of the occlusal surface in Xenohystrix crassidens is related to the subequal antero-posterior and transverse dimensions of the crown. In Hystrix, on the other hand, the occlusal surface is more nearly rectangular, with the antero-posterior clearly exceeding the transverse dimension. (p.84)

Studies of a large growth series of H. africaeaustralis have shown that the phenomenon of subequal transverse and antero-posterior diameters is merely a function of age and wear: had Greenwood had access to such a growth series, particularly one which included individuals at growth stage 6, she would have found that the feature she describes as characteristic of Xenohystrix also occurs in adult H. africaeaustralis at growth stage 6 (see Figs. 71, 72, main text). X. crassidens specimens at growth stage 5 and below also have the more nearly rectangular occlusal outline she describes for H. africaeaustralis.

Greenwood stresses that a marked difference between the upper teeth of the genera Hystrix and Xenohystrix is the fact that those of the former are rootless or semi-rooted whereas the latter has rooted upper molars. The enamel sheath of the upper molars of Xenohystrix stops short 'immediately distal' to the junction of the root and crown, whereas in Hystrix, the present author has found that the enamel sheath extends beyond the latter point, sometimes well into the papillate rootlets themselves.

The lower premolars, on the other hand, are described (op. cit.) as having roots which are similar in proportion to those of the living Hystrix. The present author does not agree with this statement - the roots of the P_4 of Xenohystrix are considerably better developed than those of H. africaeaustralis; Hystrix has a far more hypsodont mandibular dentition than Xenohystrix.

The preserved alveolus of an M_1 in specimen M1008 has been quoted (op. cit.) as indicating that the roots of the lower teeth of Xenohystrix were only semi-rooted. However, this specimen was advanced in age at death and since the M_1 is the oldest tooth in the mandibular tooth row, its roots alveoli appear shallow because the alveoli do tend to become shallower with increasing age - this process eventually leading to the shedding of the tooth - see section 7.1.4 and Fig. 74, main text. The present author considers the roots of the lower teeth of Xenohystrix to be considerably better developed and more divergent than those of any Hystrix, and as in the case of the upper molars, the enamel sheath has been observed to terminate at the junction of crown and root. The present study has shown that in Hystrix the enamel sheath frequently extends beyond the latter junction into the rootlets. For these reasons, the present author proposes to class the lower dentition of Xenohystrix as rooted.

For further discussion of the taxonomy of this genus, see main text, Chapter 14.

Measurements:

See Appendix VIII, A, B and C.

COMMENTS:

Xenohystrix crassidens is a very distinctive giant porcupine unlike any other fossil Hystricid previously described, whether contemporaneous or otherwise, and as such, is a valid genus and species. Its large size and robustness, the rooted upper and lower molars, the great depth of the mandibular ramus below P_4 and the sharply curving upper and lower diastema are its most important distinguishing characteristics.

Fig 38

Lateral view of fragmentary left half-mandible of Xenohystrix crassidens Greenwood 1955 (M1803, growth stage 6, above) from the Makapansgat Limeworks grey breccia, compared with modern Hystrix africaeaustralis Peters 1852 mandible at same growth stage. x 1

Fig 39

Occlusal view of mandibular dentition of Xenohystrix crassidens Greenwood 1955 (M1802, growth stage 5) showing crown enamel pattern. From the Makapansgat Limeworks grey breccia. x 1

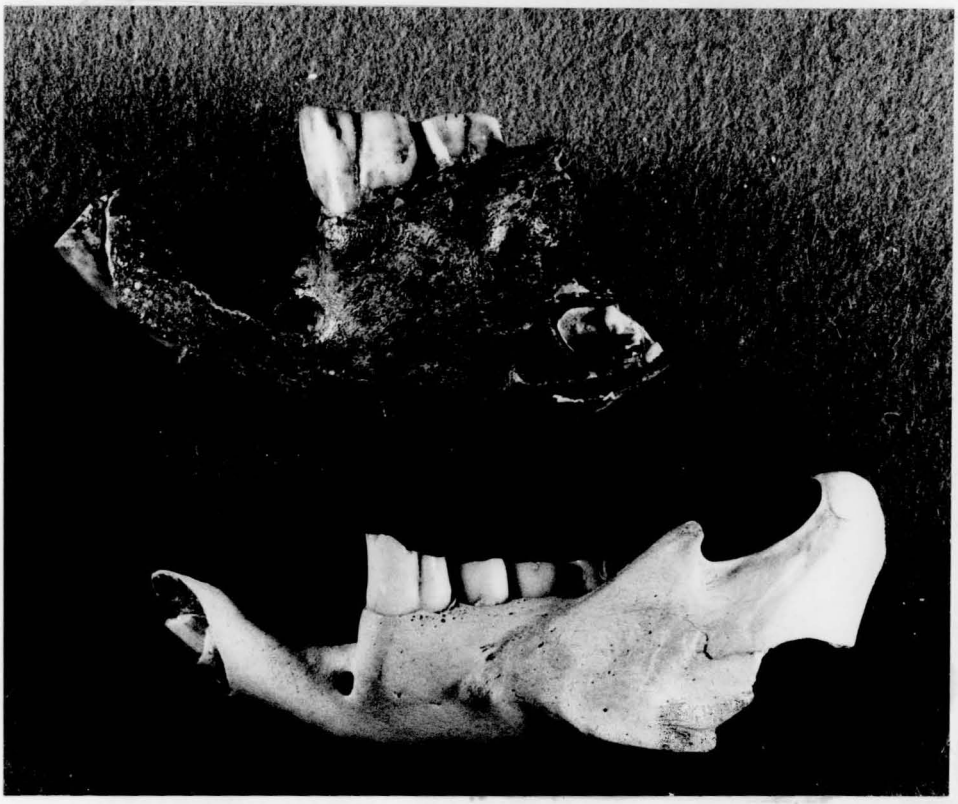


Fig 38



Fig 39



Fig 40

Occlusal view of Xenohystrix crassidens Greenwood 1955 (M1803, growth stage 6, below) compared with Hystrix makapanensis Greenwood 1958 at same growth stage. Both from the Makapansgat Limeworks grey breccia.

GEOLOGICAL CORRELATION CHART AND TIMESCALE

AGE/ EPOCH in M.y.	EUROPEAN LAND MAMMAL AGES	EUROPEAN VERTEBRATE FAUNAS	PONTO CASPIAN REGION, SOVIET AGE/STAGES		INDIA	CHINA, MONGOLIA	EAST AFRICA	SOUTH AFRICA
		H. cristata / H. angressi / H. schaubi			H. indica			
		H. minor / H. vinogradovi	A. indica		Athertua karnulkensis	H. subcristata	H. cristata	H. africaeaustralis
0,5	OLDENBURGIAN				NARBADA Hystrix crassidens			
PLEISTOCENE	BIHARIAN	CROMERIAN (NETH.) TIRASPOL (U.S.S.R.)	BAKUNIAN TIRASPOLIAN	PLEISTOCENE	Boulder conglomerates	H. cf subcristata H. (A). lagrelli CHOUKOUTIEN I		
1,0	VILLAFRANCHIAN LATE	(0,8+) (0,9+) UPPER VALDARNO (Hystrix refossa) = H. etrusca = H. major	APSHERONIAN TAMANIAN	EOPLEISTOCENE OR, PLIOCENE	PINJOR (Upper Siwaliks) H. cf. indica			
1,5	MIDDLE	(1,75)				NIKHEVAN (Sanmen I) H. cf. subcristata	OLDUVAI BED I USNO + SHUNGURA BEDS, LOWER OMO BASIN	
2,0	EARLY 'TYPE'	(2,4)	AKCHAGYLIAN KHAPROVIAN MOLDAVIAN	UPPER	TATROT			
PLIOCENE	MONTOPOLI, LOWER VALDARNO ETOUAIRES, VILLAFRANCA	(3,2) (3,4)					H. africaeaustralis H. makapanensis Xenohystrix crassidens	Taung (?), KA, SK, STS, MAKAPANSGAT
3,0								
4,0	RUSCINIAN 'Astian faunas of W. and Central Europe	WEZE ROUSSILLON, MONTPELLIER (Hystrix primigenia)	CIMMERIAN	PLIOCENE	?	ERTEMTE	MURSI, KANAPOI	
5,0								
6,0	?				DHOK Hystrix sivalensis			
7,0	TUROLIAN 'Pontian s.s. or Pannonian Land Mammal faunas of Central Europe (in part)'	SAMOS 5	PONTIAN	'MIDDLE'	PHATAN		MPESIDA	
8,0								
9,0		SAMOS 1-4, PIKERMI, SALONIKA, POLGARDI (Hystrix primigenia)	MAEOTIAN		NAGRI	BAODE (RED BEDS)		
10,0								
11,0	VALLESIAN 'Maeotian faunal assemblages of Central Europe'	KOHFIDISCH (Hystrix suevica)	SARMATIAN of Eastern Europe	'LOWER' PLIOCENE	CHINJI (Lower Siwaliks) Siracanthion complicatus		UPPER NGORORA BEDS	
12,0								
MIOCENE	OENINGIAN	'Hystrix Wiedemanni' (13,4)						
13,0		(13,65)						
14,0	VINDOBONIAN		BADENIAN TORTONIAN OF PRAETETHYS	UPPER MIOCENE	KAMLIAL	TUNG GUR	FORT TERNAN	
15,0								

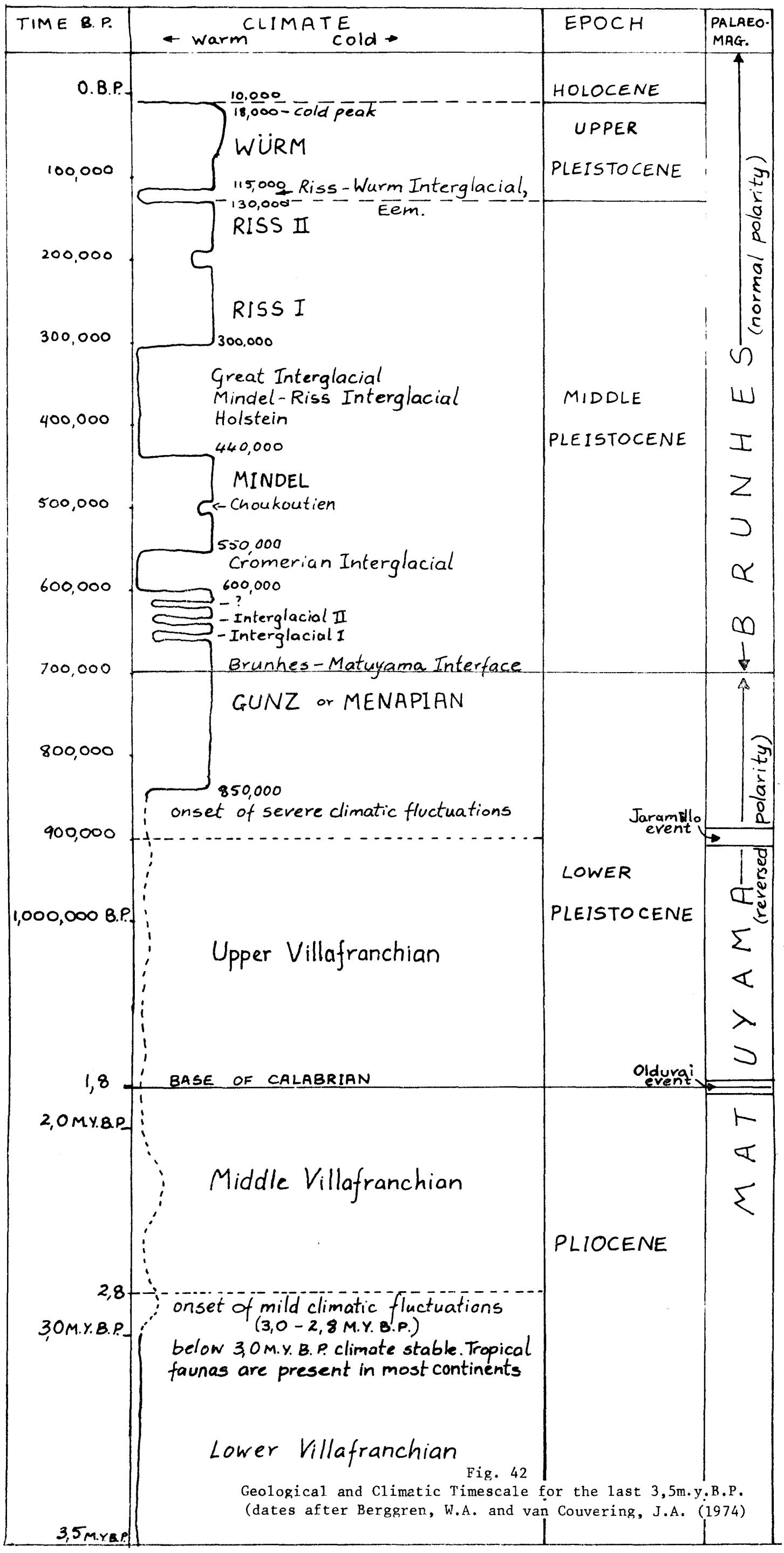
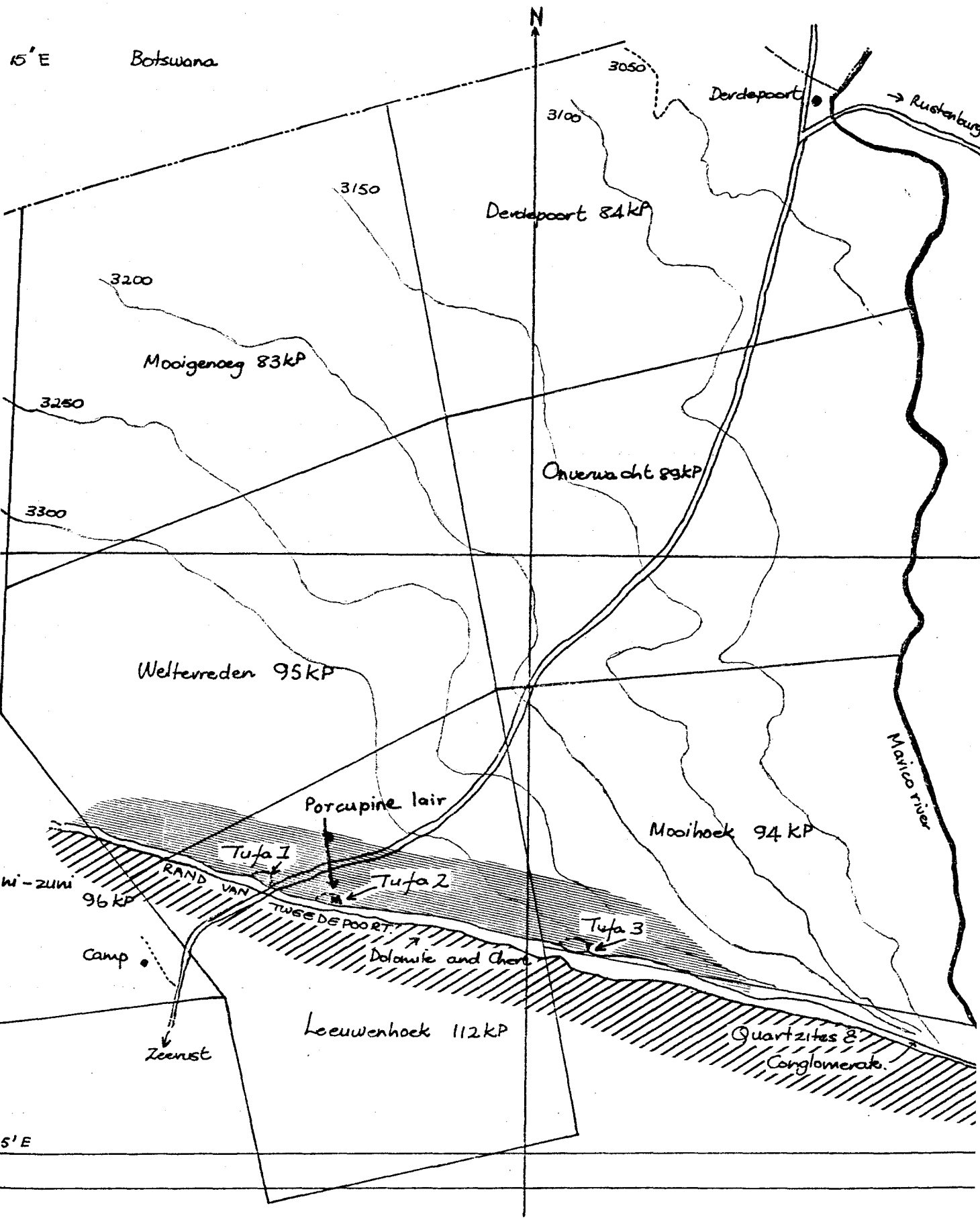


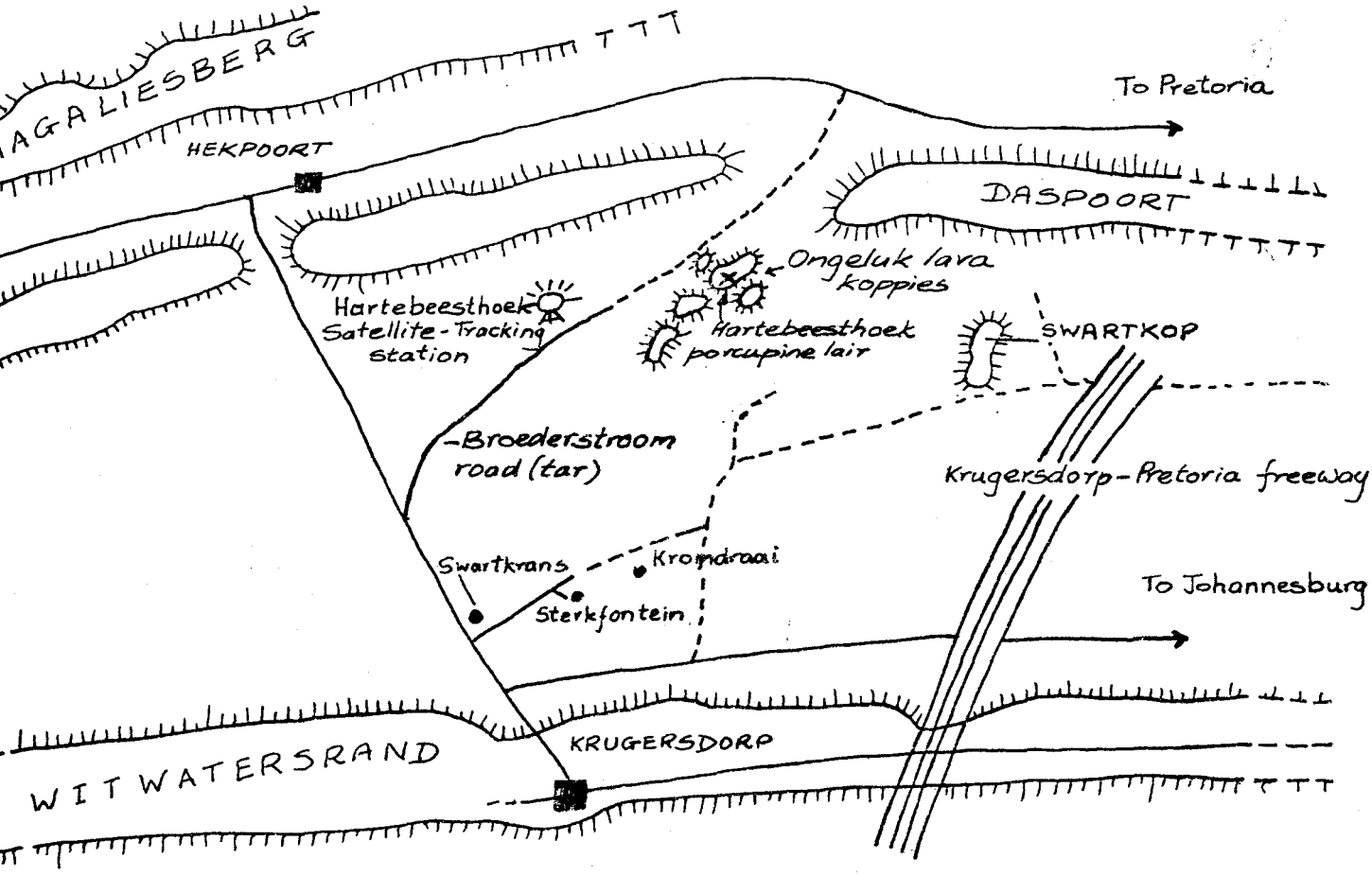
Fig. 42
Geological and Climatic Timescale for the last 3,5m.y.B.P.
(dates after Berggren, W.A. and van Couvering, J.A. (1974)

APPENDIX XI

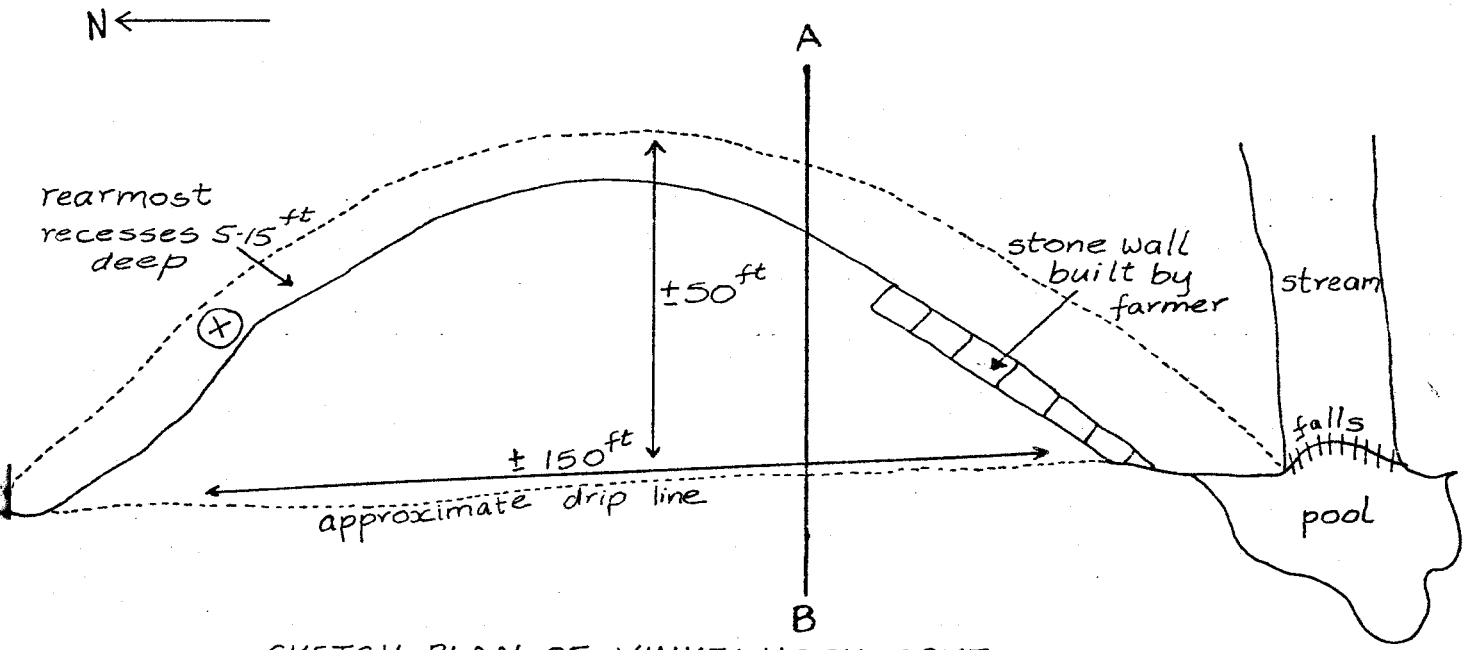
LOCALITY MAPS OF PORCUPINE LAIRS STUDIED



Locality map of Rand van Tweedepoort porcupine lair

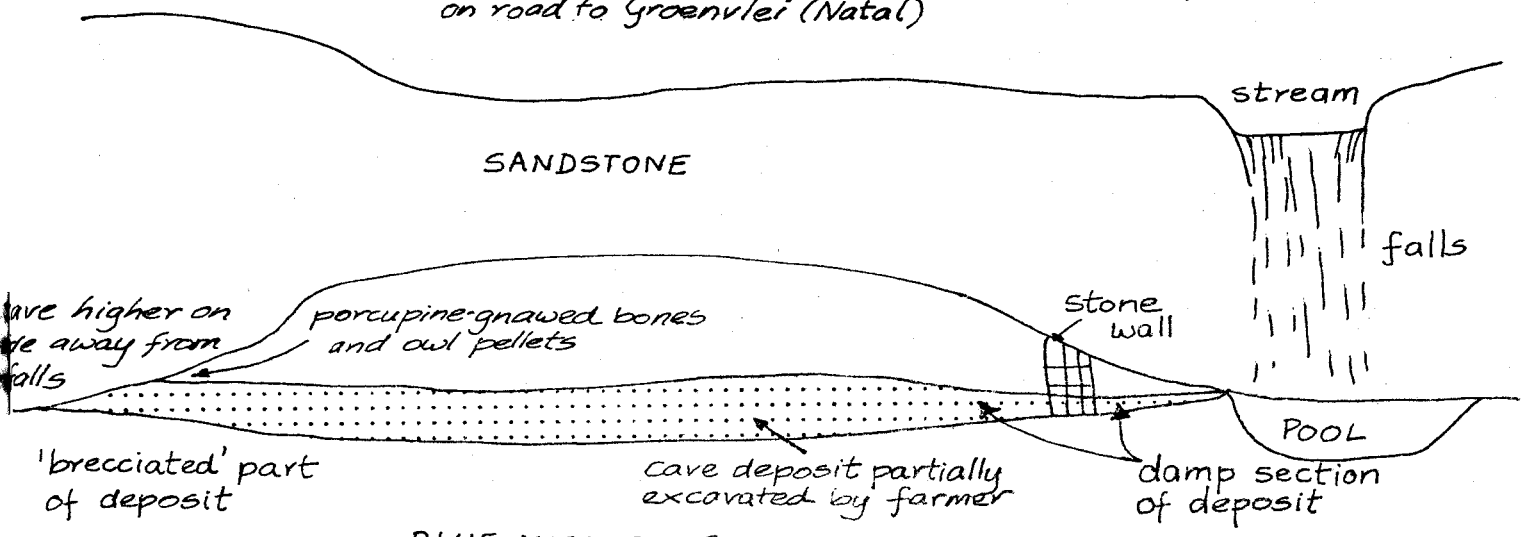


SKETCH MAP SHOWING APPROXIMATE LOCATION OF HARTEBEESTHOEK PORCUPINE LAIR

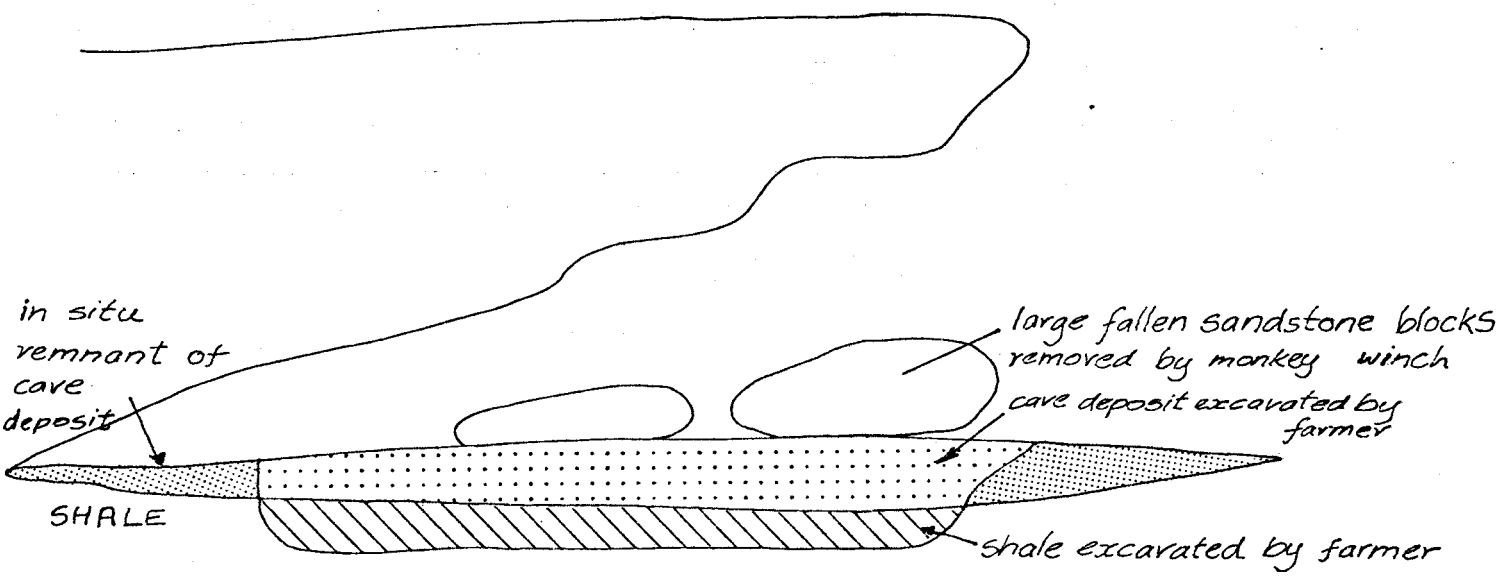


SKETCH PLAN OF WINKELHOEK CAVE

re on farm of Mr. Craffert, 'Winkelhoek' S. of Wakkerstroom on N. Natal/Transvaal border on road to Groenvlei (Natal)



VIEW LOOKING EAST AT CAVE ENTRANCE



SECTION OF CAVE THROUGH A - B

SKETCHES OF WINKELHOEK CAVE PORCUPINE LAIR

APPENDIX XII

GLOSSARY AND DEFINITIONS OF TERMS AND ABBREVIATIONS USED IN THE TEXT AND TEXT FIGURES

APPENDIX XII

GLOSSARY AND DEFINITIONS OF TERMS AND ABBREVIATIONS USED IN THE TEXT AND TEXT FIGURES

ABBREVIATIONS USED IN TEXT FIGURES

	Maxillary dentition		Mandibular dentition
a	paraflexus	or	paraflexid
b	mesoflexus	or	mesoflexid
c	metaflexus	or	metaflexid
d	entoflexus	or	entoflexid
e	hypoflexus	or	hypoflexid
A	parafossette	or	parafossettid
B	mesofossette	or	mesofossettid
C	metafossette	or	metafossettid
D	entofossette	or	entofossettid
E	hypofossette	or	hypofossettid

A*,B* etc. - parafossette or parafossetid (A*) or mesofossette or mesofossettid (B*) which is confluent on the inside with one or more flexuoses of flexids, which may still be open to the outside of the tooth, or confluent with one or more other fossettes of fossettids.

r - radius of curvature. The radius of the circle of which a curved structure (e.g. an incisor) represents a circumference section.

GLOSSARY OF TERMS AND ABBREVIATIONS USED IN THE TEXT (listed alphabetically)

adult - those individuals which are at growth stages 5 or 6 i.e. which have a permanent premolar which has erupted above the level of the maxillary or mandibular bone

whether or not the occlusal surface is worn. Permanent premolar unworn = young adult, permanent premolar fully worn = mature adult

alveolus (plural alveoli) - usually defined in the sense of a cavity within the maxillary or mandibular bone in which the root of a tooth is housed, but used in this thesis to refer to the entire cavity, whether this houses embedded crown or the papillate rootlets of the teeth of the hystricids studied (see section 7.1.3 and Figs 59 and 60, main text). Some authors prefer the term 'socket' and use 'alveolus' to refer to the cavity housing an unerupted tooth

alveolar-crown junction; alveolar rim - the junction between the apparent crown and embedded crown of a Hystricid tooth at the rim of the alveolus; alternatively, the base of the apparent crown where the remainder of the tooth becomes hidden within the alveolus

alveolar plane of tooth row - the best fitting straight line that can be drawn through the alveolar rims of all four cheek teeth

alveolar process (processus alveolaris) - that portion of the premaxilla, maxilla or mandibular that contains the alveoli (or sockets) of erupted teeth and the alveoli or crypts of developing teeth

apex, apical region - the terminal end of the root of a tooth

BL - abbreviation for bucco-lingual, usually referring to the bucco-lingual diameter of a tooth, i.e. the transverse diameter from the buccal (cheek) side to the lingual (tongue) side

BP - before present. Usually in conjunction with m.y. or yrs and hence m.y.B.P. (million years before present) or yrs.B.P. (years before present)

buccal - pertaining to the cheek, and hence buccal surface of tooth - the surface of a tooth next to the cheek

bucco-lingual - see 'BL'

bucco-lingual diameter - see also sections 7.2.13.23 and 24. The greatest bucco-lingual diameter that can be measured across the occlusal surface from a buccal face to a lingual face, at right angles to the mesio-distal diameter; alternatively, the greatest bucco-lingual diameter occurring at the alveolar rim

cement (= cementum) - the tissue which in human (and porcupine) dentition resembles bone, forming and covering the outer

surface of the roots of the teeth. In Hystrix and Xenohystrix cementum covers not only the papillate rootlets but covers the entire surface of the crown of a newly-erupted tooth. Wear eventually exposes the enamel. In life, the embedded portion of the crown is likewise covered with cement, which may even cover part of the apparent crown (see Fig. 60 main text)

C.E.P. - crown enamel pattern

cheek teeth - a term used by many early authors to refer collectively to those teeth adjacent to the cheeks, i.e. the premolars and molars

COH - official catalogue abbreviation denoting 'Cave of Hearths' marking all bone fragments excavated from this deposit

contact point - the point on a proximate surface of a tooth which touches a neighbouring tooth. In Hystrix and Xenohystrix these points are by pressure invariably expanded into contact areas and have been referred to as pressure facets. See 'pressure facet'

Cornelia Faunal Span - Initially defined by Wells (1962) as the 'Cornelia Faunal Stage', coming between the 'Swartkrans Stage' and the'Florisbad Stage' and based on the fossil fauna present at Cornelia, O.F.S. 50% of the recorded species can be referred to living forms. The term 'Stage' was later changed to 'Span' (Cooke 1967), hence 'Cornelia Faunal Span', and is dated at between approximately 500,000 yrs. B.P. to about 900,000 yrs. B.P. (Vrba 1974b)

crown - the normal definition of this term has been modified to make it applicable to hystricid dentitions. Throughout the present study it has been used to refer to that part of the tooth which is covered with enamel, i.e. the whole tooth, with the exception of the papillate rootlets, whether the enamel is in turn covered with cement or whether part of the enamel-covered portion is embedded within an alveolus or not

crown area - a somewhat rough measurement of the area occupied by each tooth in the jaw and obtained by multiplying the MD and BL diameters as obtained either at the occlusal surface or at the alveolar rim. It is a better comparative measurement for taxonomic purposes than either MD or BL in isolation, because of the compression of the teeth which occurs with age

crown shape index - a rough measure of crown shape, obtained by expressing the ratio BL : MD as a percentage

crypt - a cavity in the alveolar process of maxilla or mandible containing the developing tooth germ or bud of a permanent tooth

dp^4 or dp_4 - abbreviation for deciduous maxillary and deciduous mandibular fourth premolars respectively

deciduous tooth - a tooth of a juvenile which is shed and replaced by a permanent tooth. Also referred to as 'temporary tooth'

diastemic curvature (curvature of diastema) - the degree of curvature occurring over the diastemic length. Measured as described in section 7.2.12.10, main text

diastemic depth - see section 7.2.12.4-6, main text

diphyodont - referring to an animal which develops two sets of teeth, i.e. deciduous and permanent. Hystrix and Xenohystrix are partially diphyodont as the original set of teeth is only partially replaced

distal - away from the median line of the head following the curve of the dental arch; that surface of a tooth most distant from the median line

ESA - abbreviation for Earlier Stone Age (African context)

Eem, Eemian - the last interglacial, i.e. the Riss-Würm Interglacial, dated between +- 130,000 (termination of Riss glaciation) and 118-115,000 yrs.B.P. (onset of Würm glaciation) See Appendix X Fig. 41

flake - shaft pieces (usually of long limb bones) in which less than half the circumference of the shaft is preserved (after Brain 1974)

flexid, flexus - terms for the mandibular and maxillary crown enamel folds respectively, prior to the 'closure' of these folds to form fossettids or fossettes. In the mandibular dentition of Hystrix and Xenohystrix there is one external (buccal) and three or four internal (lingual) flexids, whilst in the maxillary dentition the situation is reversed and there is a single lingual and four buccal flexuoses (see Figs. 61 and 62, main text)

Florisbad Faunal Span - originally defined as the 'Florisbad Faunal Stage (Wells 1962), a faunal stage coming after the Cornelia Faunal Stage (see above) and preceding the recent fauna, and based on the fossil fauna from Florisbad near Bloemfontein, O.F.S. 80% of the species referred to this stage are reported to be indistinguishable from living forms. (Cooke (1967) changed the term 'stage' to 'span', hence the 'Florisbad Faunal Span'. Its duration was apparently from approximately 50,000 to somewhat less than 100,000 yrs.B.P. (Vrba 1974b).

fossette fossettid - a term applied to the 'enamel islands' manifest on the occlusal surfaces of maxillary and mandibular teeth respectively, resulting from the 'closure' of the flexuoses and flexids externally (see Figs. 61 and 62, main text)

incisial surface - the roughly triangular cutting surface of the incisors

Jungpleistozan - the Upper Pleistocene, see 'Pleistocene'

juvenile - those specimens still in possession of a deciduous fourth premolar in either upper or lower jaw, i.e. growth stages 1-4

KA - official abbreviation for the Kromdraai faunal locality

KB - official abbreviation for the Kromdraai australopithecine locality

labial - pertaining to the lips, next to or toward the lips, as in labial surface (below)

labial surface - dental term referring to that surface of the tooth next to the lips. In Hystricidae, only the incisors have labial surfaces

labio-lingual - from the lips towards the tongue, as in the labio-lingual diameter of an incisor

LL - abbreviation for labio-lingual, usually applied to the labio-lingual diameter (width) of the incisors, and referring to the labial (lip side) and lingual (tongue side) surfaces of the teeth

Letztinterglazial - the last Interglacial, or Riss-Würm Interglacial or Eem (see Eem, Eemian)

Levalloiso-Mousterian	-	European lithicultural term referring to a Middle Palaeolithic culture which persisted from +-100,000 to about 37-or 35,000 yrs.B.P. in Europe and coincided with the Neanderthal period
lingual	-	pertaining to the tongue, next to or toward the tongue as in lingual surface (below)
lingual surface	-	a dental term referring to the surface of the teeth next to the tongue; all teeth have lingual surfaces
M	-	catalogue abbreviation (originally denoting'mammalian material') prefixing the catalogue number of cranial fragments (e.g. M1808) or suffixing the catalogue number of postcranial remains (e.g.1808M) and in this thesis (though not necessarily throughout the mammalian catalogue) referring only to fossil specimens from the Makapansgat Limeworks. It therefore does <u>not</u> denote Makapansgat
MAK	-	commonly used abbreviation for Makapansgat Limeworks, but not used to mark specimens from this deposit
M^1 or M_1	-	abbreviation for upper and lower first molars respectively
M^2 or M_2	-	abbreviation for upper and lower second molars respectively
M^3 or M_3	-	abbreviation for upper and lower third molars respectively
MD	-	abbreviation for mesio-distal (see below)
median line	-	the antero-posterior perpendicular central line of the body
mesial, mesially	-	toward the median line, as in mesial surface, i.e. those surfaces of the teeth which, as they are embedded in the arch and following its curve, are toward the median line
mesio-distal	-	from mesial to distal, as in mesio-distal diameters of the teeth (see below)
mesio-distal diameter	-	the greatest antero-posterior diameter of the tooth, from the mesial surface to the distal, measured either at the occlusal surface or at the alveolar rim. An alternative term for tooth length

mesoflexus - term for one of the three or four buccal (external) enamel folds present on the maxillary teeth of Hystrix and related genera, used to describe the second fold from the anterior or mesial surface of the tooth and working backwards (see Fig. 61, main text)

mesoflexid - term for one of the three or four lingual (internal) enamel folds present on the mandibular teeth of Hystrix and related genera, used to describe the second fold from the anterior or mesial surface and working backwards (see Fig. 62 main text)

mesofossette - a mesoflexus which has 'closed' to form an enamel island or fossette (see above) on the occlusal surface of a Hystricid tooth. A term to describe the buccal fossette which lies second from the mesial surface of a maxillary tooth (see Fig. 61, main text)

mesofossettid - a mesoflexid which has 'closed', the second lingual enamel island or fossette from the mesial surface of a mandibular tooth of Hystrix or related genera

metaflexus - a term used to describe the third buccal enamel fold or flexus (see above) from the anterior or mesial surface of a maxillary tooth of Hystrix or related genera (see Fig. 61, main text)

metaflexid - term applied to the third lingual flexid from the mesial surface of a mandibular tooth of Hystrix or related genera (see Fig. 62, main text)

metafossette - a metaflexus which has 'closed' to form an enamel island or fossette on the occlusal surface of a hystricid tooth. A term to describe the third buccal fossette from the mesial surface of a maxillary tooth

metafossettid - a metaflexid which has 'closed' to form an enamel island or fossette on the occlusal surface of a hystricid tooth. A term to describe the third lingual fossette from the mesial surface of a maxillary tooth

monophyodont - referring to an animal which develops only one set of teeth

MSA - abbreviation for Middle Stone Age (African context)

m.y. - abbreviation for million years, usually used in conjunction with B.P., hence million years before present

neck - used, when discussing Hystricid dentitions, to refer to the junction between the embedded crown (in situ teeth) or crown (isolated teeth) and the rootlets

occlusal surface - that surface of a premolar or molar that makes contact with a tooth of the opposite jaw when the mouth is closed

P^4 or P_4 - abbreviations for the permanent upper and lower fourth premolar respectively

Pannonian - a subdivision or stage of the Pliocene epoch which is in turn subdivided into two: the Meotian (lower Pannonian) and Pontian (upper Pannonian). The Pannonian stage is equivalent to the Lower Pliocene, but its temporal duration is still problematic

paraflexus - term used to describe the anteriormost of three or four buccal enamel folds on the maxillary teeth of Hystrix or related genera

paraflexid - the anteriormost of the lingual enamel folds on the occlusal surface of the mandibular teeth of Hystrix and related genera

parafossette - a paraflexus which has 'closed' to form a fossette; the anteriormost fossette on the buccal side of the occlusal surface of a maxillary tooth of Hystrix or a related genus

parafossettid - a paraflexid which has 'closed' to form the anteriormost fossette on the lingual surface of a mandibular tooth of Hystrix or a related genus

permanent teeth - the teeth of adult age as distinguished from temporary or deciduous teeth. Thus in Hystrix and Xenohystrix, the original molars of both maxilla and mandible may be considered as permanent teeth

Pikermian - Late Pontian, see Pontian

Pleistocene - Geological epoch succeeding the Pliocene and preceding the present Recent epoch - spanning the period 1,8m.y.B.P. to 11,000B.P. The following subdivision has been adhered to in this thesis:

Upper Pleistocene	130,000 yrs.B.P. - 11,000 B.P.
Middle Pleistocene	700,000 yrs.B.P. - 130,000 yrs.B.P.

Lower Pleistocene 1,800,000 yrs. B.P. - 7000,000 yrs.B.P.
(see Appendix X, Fig. 41)

Pliocene - Geological epoch following the Miocene and preceding the Pliocene and spanning the period 5,0m.y.B.P. to 1,8m.y.B.P. It is divided into two stages: the Lower Pliocene or Pannonian Stage and the Upper Pliocene which is in turn sub-divided into two stages, the Plaisancian and the Astian (see Pannonian and Fig. 41, Appendix X)

Pontian - lower Pliocene, see 'Pannonian'

proximate contact - the contact or touching of the proximate surfaces of neighbouring teeth

proximate surface - the surface of a tooth lying next to another tooth

Riss - the Central European term for the penultimate glacial period in Europe. The north European term for the same glacial period is Saalian Glaciation. The Riss glaciation lasted from +-300,000 yrs.B.P. to +-130-125,000 yrs.B.P. (see Fig. 41 Appendix X)

Riss-Würm Interglacial - alternative term for the Eem (European); the warm period intervening between the Riss and Würm (most recent) glaciations, lasting from +-130-125,000 yrs.B.P. to about 115,000 yrs.B.P.

root - in the descriptions of Hystricid dentitions refers to the cementum-covered papillate (in Hystrix) or divergent (in Xenohystrix) protuberances from the main body of the tooth, whether these have a small amount of underlying enamel or not

Saale Saalian - alternative (north European) term for the penultimate glaciation in Europe, i.e. equivalent to the Riss

SE - abbreviation denoting 'Sterkfontein Extension Locality'

SFN - catalogue code (Bernard Price Institute for Palaeontological Research) for material derived from the fossiliferous demps at the Sterkfontein australopithecine locality

SH - abbreviation denoting 'sink-hole' or 'swallow-hole' and used to differentiate specimens recovered from an area of collapse in the Cave of Hearths deposit

shaft piece - long limb bone shaft fragments in which half or more than half of the circumference of the shaft has been preserved (after Brain 1974)

SK - catalogue code (Transvaal Museum) for specimens derived from the Swartkrans australopithecine locality

SKa - abbreviation (now also catalogue code?) denoting the Swartkrans 'Primary Breccia' or 'Member 1'. The Pink or'Paranthropus'breccia. See section 2.1.2.2, main text

SKb - abbreviation (now also catalogue code?) denoting the Swartkrans 'Secondary Breccia' or 'Member 2'. The Swartkrans brown breccia. Vrba (1974b) further divides this breccia as follows: SKb (earlier) and SKb (later). See section 2.1.2.2, main text

STS - abbreviation and catalogue code denoting Sterkfontein Type Site

tubercle - a slight rounded elevation on the surface of the tooth

Villafranchian - Villafranchian is currently thought to have lasted from 3-3,5m.y.B.P. to approximately 900,000 yrs.B.P., when it terminated abruptly with the onset of the first severe climatic fluctuations which heralded the Günz glaciation in Europe, the climatic fluctuations apparently being responsible for the extinction of many mammalian forms which characterised the Villafranchian

Vindobonian - Stage of the Miocene epoch; Upper Miocene. The Sarmation Stage intervenes between it and the Miocene-Pliocene interface (see Fig.42 Appendix X)

Würm - The last glaciation, central European terminology, = Weichselian Glaciation. The Würm glaciation is taken by some authors as beginning at 115,000yrs. B.P. when the warm climate which had characterised the Eemian Interglacial began to deteriorate with a series of relatively mild climatic fluctuations, and others at a slightly younger date. The onset of the first severe cold period was at 75,000 B.P. The Würm terminated at +-11,000 yrs.B.P., the latter date also marking the termination of the Pleistocene epoch

Würmanfang - the beginning of the Würm glaciation

APPENDIX XIII

GENERAL REFERENCES

APPENDIX XIII

GENERAL REFERENCES*

* The references listed below are all non-taxonomic; taxonomic references are listed in Appendix XIV

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APPENDIX XIV

ANNOTATED TAXONOMIC BIBLIOGRAPHY

ABEL, O. 1922. Lebensbilder aus der Tierwelt der Vorzeit II. In der buchsteppe von Pikermi in Attika zur untern Pliozänzeit. Jena : Gustav Fischer. 643pp.

Fossil rodents discussed pp.75-165. Hystrix primigenia (Wagner) from Pikermi, Greece (Lower Pliocene) discussed and illustrated p.127, Fig.113, showing lateral view of left mandible (A) left maxillary dentition (B) and left mandibular dentition (C), occlusal view.

ALLEN, G.M. 1927. Porcupines from China. Am. Mus. Novit. No. 290: 1-4

Acanthion subcristatus papae Allen n.ssp. pp.3-4. No illustration but several measurements given. Atherurus macrourus stevensi Thomas, A. m. hainanus J.A. Allen and Acanthion subcristatus subcristatus (Swinhoe) also discussed.

ANDERSON, J. 1878. Anatomical and Zoological researches: comprising an account of the zoological results of the two expeditions to western Yunnan, Asia and India in 1868 and 1875. Vol I (text) London: Bernard Quaritch xi + 984pp.; (Vol. II, illustrations, 84 Pls.).

Hystrix yunnanensis n. sp. described p.332. Not seen. After Colbert and Hooijer 1953.

ARGYROPULOS, A.I. 1941. Tschetwertitschnaja fauny gryzunov i nasekomovadnykh Binagadov (Apsheronskii poluostrov) Priroda. 3: 88-91. Leningrad. (Quaternary Fauna of Binagady, Apsheron Peninsula: Rodents and Insectivores).

Hystrix vinogradovi n. sp. described from the tar pits of Binagady, near Baku, Apsheron Peninsula, U.S.S.R. Not seen, after Mohr 1965.

BACHMAYER, F and WILSON, R.W. 1970. Small mammals from the Kohfidish fissures of Burgenland, Austria. Ann. Naturhistor. mus. Wien 74 : 533-584

Family Hystricidae discussed pp.579-580. Hystrix cf H. suevica Schlosser 1884 discussed pp.579-580. Dental measurements of four maxillary teeth given.

Bakr, A. 1959 Rodentia and Carnivora from the Pontian of Samos (in the American Museum of Natural History). Unpublished PhD thesis, Department of Biology, Harvard University, Cambridge, Mass. H. greenwoodi sp. nov. pp.25-26

BATE D.M.A. 1951. The mammals from Singa and Abu Hugar. Foss. Mamm. Afr. London : B.M.N.H. 2 : 1-50

Hystrix astasobae n. sp. described pp.3-5,from Abu Hugar, a Pleistocene locality on the Blue Nile. Fig. 1a and b, p.4 (rather poor line drawings) show lateral and palatal views of fragmentary cranium. Good text description.

BLACK, C.C. 1972. Review of fossil rodents from the Neogene Siwalik Beds of India and Pakistan. Palaeontology 15 (2) : 238-266.

Sivacanthion complicatus Colbert, Hystrix sivalensis Lydekker and Hystrix cf. H. leucurus Sykes 1831 discussed pp.246-247. H. cf. H. leucurus illustrated (line drawings) Fig.3 a-h, p.248. Lateral and palatal views of cranium and occlusal and lateral views of maxillary and mandibular teeth shown. Drawn from specimen B.M. 15923.

BLYTH, E. 1851. Report on the mammalia and more remarkable species of birds inhabiting Ceylon. J. Asiat. Soc. Beng. 20 : 169-172.

H. bengalensis n. sp. and H. zeylonensis n. sp. described on pp.170 and 171 respectively. No illustrations.

BOSCO, C. 1898. Hystrix etrusca n. sp. Palaeontgr. italica 4 : 141-153.

Good text description, measurements and illustrations (Tav. 10 figs. 1-9, Tav. 11 figs. 1-6) of H. etrusca n. sp. This species compared with all living and fossil species then known. H. bengalis, H. cristata, H. hirsutirostris and H. javanica of the modern species, and H. lamandini, H. major, H. primigenia, H. refossa, H. sivalensis, H. suevica and H. venusta of the fossil species mentioned. In Italian.

BRANDT, J.F. 1835. Mammalium Rodentium Exoticorum Novorum vel minus vite cognitorum. Mém. de l'acad. de St. Petersb. Ser. 6, Scienc. mathem., phys. et natur. 3 (2) : 357-442 Pls. 1-17.

With 17 plates, 10 of these depicting Hystricidae. Hystrix hirsutirostris n. sp. described p.375, illustrated pl. 8. Not seen After Mohr 1965, p.157.

BRANDT, J.F. 1855. Beiträge zur nähern Kenntniss der Säugethiere Russlands Mém. de l'acad. de St Petersb. Ser. 6, Scienc. mathem., phys. et natur. 9 (5) : 125-365

With Plates 1-11. Discusses the basic three-fold division of the Order Rodentia into Sciuromorpha (p.144) Myomorpha (p.292) and Hystricomorpha (p.299), based on jaw musculature. Not seen. After Simpson 1945.

BRISSON, A.D. 1756. Regnum Animale in classes IX distributum, sive synopsis methodica. Paris : Cl. Jean-Baptiste Bauche vii + 382pp.

Hystrix novae hispaniae n. sp. (after Ray 1693) p.127, H. hudsonis n. sp. p.128 and H. orientalis n. sp. p.131 described. Illustrated. Not seen. After Tate 1935 p.297.

BRISSON, A.D. 1762. Regnum Animale in classes IX distributum, sive synopsis methodica. Paris : Cl. Jean-Baptiste Bauche (2nd Ed.)

Hystrix americanus major n. sp. described p.89. Not seen After Tate 1935 p.297.

BRUNNER, G. 1954. Das Fuchsloch bei Siegmannsbrunn (Oberfr.) - eine Mediterrane Riss-Würm-Fauna. Neues Jb. Geol. Paläont. Abh. 100 (1) : 83-113.

Hystrix schaubi n. sp. described pp.99-101. Occlusal and lateral views of the mandible illustrated (line drawing) Fig. 6 p.99. A few dental measurements provided. Poor description.

CABRERA, A. 1924. Hystrix occidanea sp. n. Bol. Soc. Esp. Hist. Nat. 24 220-223

In Spanish. Hystrix occidanea n. sp. described p.220. Lateral view of cranium (line drawing) shown p.221, no figure number. Cranial measurements of H. cristata, H. senegalica, and H. occidanea on p.220.

GATESBY, ? 1731 Title untraceable. Nat. Hist. Carolina 1, XXX

Hystrix pilosus americanus n. sp. or 'hairy Canada porcupine' described. Not seen. After Ellerman 1940 p.181

COLBERT, E.H. 1933. Two new rodents from the Lower Siwalik Beds of India. Am. Mus. Novit. No. 633: 1-6

Sivacanthion complicatus new genus, n. sp. described p.3 Line drawings (Fig. 2 p.4) illustrate occlusal and lateral views of left mandibular fragment, specimen A.M.N.H. No. 19626. Dental measurements of S. complicatus, Acanthion subcristata papae Allen and Atherura macroura hainana Allen provided p.5

COLBERT, E.H. 1935. Siwalik mammals in the American Museum of Natural History. Trans. Am. Phil. Soc. N.S. 26 : 1-396

Hystrix sivalensis Lydekker 1878 discussed p.72. Line drawing (Fig. 32,p.72) illustrates lower M_1, occlusal and lateral view. Measurements of M_1 provided. This particular H. sivalensis specimen has since been transferred to H. cf. leucura (Black 1972). H. cf. leucurus Sykes discussed p.73. Sivacanthion complicatus Colbert described and illustrated p.73 Fig. 33, a line drawing of occlusal and lateral views of left mandibular fragment. Measurements of latter species provided. Good list of references.

COLBERT, E.H. and JONES, D.A. 1953. Pleistocene mammals from the limestone fissures of Szechwan, China. Bull. Am. Mus. Nat. Hist. 102 (1) : 1-134.

Hystrix cf. subcristata discussed pp.40-41. Fig. 14, p.41 (line drawing) illustrates specimen A.M.N.H. No. 18747, a right mandible, lateral view. Occlusal surface of in situ M_1 also shown. Table 8 p.41 gives measurements of H. subcristata from various localities.

CORBET, G.B. and JONES, L.A. 1964. The specific characters of the crested porcupines, subgenus Hystrix. Proc. zool. Soc. Lond. 144 (2) : 285-300.

An important taxonomic paper. The reliability of the characters used for specific diagnoses in the subgenus Hystrix is examined. Only three species are recognized: H. (H.) cristata Linn. 1758, H. indica Kerr 1792 and H. africaeaustralis Peters 1852. The taxonomic status of H. stegmanni, H. galeata and H. hirsutirostris is assessed. Several synonyms listed. Several tables, figures and lists of cranial and dental measurements provided.

CUVIER, G.F. 1822. Title not traceable. Mem. Mus. Natn. d'Hist. nat. Paris 9 : 413-437.

Erethizon, new genus, and Acanthion, new genus defined on p.425. Acanthion senegalica n. sp. and A. daubentoni n. sp. described on pp.430 and 431 respectively. Illustrated in Pl. 20. Not seen. After Tate 1935 p.299 and Simpson 1945.

CUVIER, F. 1829. Genre des Atherures. Dictionnaire des Sci. nat, 59 : 483. Strasbourg and Paris

Atherurus, new genus, defined on p.483. Not seen. After Mohr 1965 p.157.

CUVIER, Baron G. 1829.Le Règne Animale Vol. I 2nd Ed. Paris

Atherura, new genus, described p.215. Not seen. After Gray, 1847 p.98.

DE SELYS- LONGCHAMPS? 1839. Etudes de Micromammifères p.152. The rest of this reference proved untraceable.

Hystrix alba n. sp. described p.152. Not seen. After Ellerman 1940 p.219.

DEPERET, C. 1890. Les animaux Pliocènes du Roussillon. Mém. Soc. géol. France, Paléont. 3 : 1-194, Pls. 1-19. Paris . (Bosco 1898 p.151 quotes the reference as Vol. 1 (2) :43 Tav. IV, figs. 12-16)

Hystrix primigenia (Wagner) mentioned pp.43-47, illustrated Pl. IV, fig. 7 and 12-16. Not seen, after Hugueney and Mein (1966) p.266, Bosco (1898) p.151.

DERANIYAGALA, P.E.P. 1951. Some mammals of the extinct Ratnapura of Ceylon Part III. Spolia Zeylanica 26 : 117-124.

Acanthion sivalensis sinhaleyus. Deraniyagala 1951 described. Not seen, vide Deraniyagala 1958.

DERANIYAGALA, P.E.P. 1958. The Pleistocene of Ceylon. Nat Hist. Ser. Ceylon Nat Mus. 1-IX : 1-164

Hystrix sivalensis sinhaleyus n. ssp. described p.83, mentioned p.41. Illustrated (photographs of isolated teeth lateral and occlusal views), Pl.3 figs. 2-3, Pl.39, figs. 1-6.

DESMAREST, A.G. 1822. Mammalogie. Description des espèces de Mammifères. Vol. II. Paris. Veuve Agasse.

Hystrix couiy n. sp. and H. cuandu n. sp. described pp.345 and 346 respectively, illustrated in Pl. 64 fig. 4. Not seen. After Tate 1935 p.299.

EDWARDS, G. circa 1750. The title and place of publication of this reference proved untraceable. It is mentioned in Linnaeus 1758 p.57 as'Edv. av. 52, t. 52' and in Shaw 1801 p.13

Hystrix canadensis n. sp. described p.52, illustrated Pl. 52. Not seen. From Linnaeus 1758 and Shaw 1801.

ELLERMAN, J.R. 1940. The families and Genera of Living Rodents, with a list of named forms. (1758-1936) Volume I. Rodents other than Muridae. London : B.M.N.H.

A standard text on rodent taxonomy in which all the known forms are listed with synonyms, and compared. Pp.173-220 deal with the Families Erethizontidae and Hystricidae. The skull of a species representative of each genus is illustrated in lateral, dorsal and palatal view. Geographical distributions given. Measurements (mainly cranial) provided. Good reference list.

ELLERMAN, J.R. and MORRISON-SCOTT, T.C.S. 1951. Checklist of Palearctic and Indian mammals. London : B.M.N.H.

Pages 517-520 list members of the Family Hystricidae which occur in this region. Many synonyms and references given but no illustrations or measurements.

FILHOL, H. 1876. Recherches sur les phosphorites du Quercy. Etude des fossiles qu'on y rencontre et spécialement de Mammifères. Ann. Sc. Geol. 7 (7) : 1-220

Hystrix (?) lamandini n. sp. Named on p.49. No real description, measurements or illustrations.

FRENKEL, H. 1970. Hystrix angressi sp. nov. A large fossil porcupine from the Levalloiso-Mousterian of the Geula cave. Israel J. Zool. 19 (1) : 51-82

Hystrix angressi n. sp. described p.53. Six plates and 17 tables amply illustrate and provide measurements of the species and compare it with H. cristata, H. indica and H. africaeaustralis. Comprehensive well-presented data.

GAUDRY, A. 1862. Animaux fossiles et géologie de l'Attique d'après les rechèrches faites en 1855-1856 et en 1860 sous les suspices de l'Academie des Sciences. Paris.

Hystrix primigenius (sic) Wagner 1860, discussed and illustrated on p.122, Pl.18 fig.2. Not seen. After Schlosser 1885 p.45 and Bosco 1898 p.151 (11).

GERVAIS, P. 1852. Zoologie et Paléontologie Française. 2nd Ed. Paris

Hystrix refossa, a new fossil species, described pp.17, 18, illustrated Pl.48 figs. 11a, 11b and 12.

GERVAIS, P. 1859. Sur une espèce de Porc-epic fossile dans le brèches osseuses de l'île de Ratoneau, près Marseille. C.r. Acad. Sci. Paris 49 : 511-512

Post-cranial remains of H. major described but not figured.

GERVAIS, P. 1867-1869. Zoologie et Paléontologie générale Série I Paris : 76-77 Fig. 3

Hystrix major, a fossil species described and illustrated

GRAY, J.E. 1842. Title untraceable. Ann. Mag. nat. Hist. 10 : 261

Atherurus africanus n. sp. described p. 261. After Ellerman 1960 p.208

GRAY, J.E. 1843. List of the specimens of Mammals in the collection of the British Museum (Natural History) London B.M.N.H. xxviii + 216pp.

Chaetomys, new genus, described on p.123, the type species of which is Hystrix subspinosa Kahl. Not seen. After Ellerman 1940 p.175.

GRAY, J.E. 1847. On the porcupines of the older or Eastern Continent, with descriptions of some new species. Proc. zool. Soc. Lond. 1847 : 97-104

Synopsis of Hystrix, Acanthion and Atherura, with lists of all known species (in 1847) with synonyms of each. Acanthion hodgsonii n. sp. p.101, A. cuvieri n. sp. p.102 and A.flemingii n. sp. p.103. Comprehensive cranial measurements for Hystrix cristata and H.leucurus (p.101) and the three new species of Acanthion (p.103)

GRAY, J.E. 1865. Notice of an apparently undescribed species of American porcupine. Proc. zool. Soc. Lond. 1865 : 321-322

Echinoprocta, new genus described p.321. Erethizon (Echinoprocta) rufescens n. sp. illustrated Pl. XI.

GRAY, J.E. 1866. On the species of porcupines in the Gardens of the Society and in the British Museum. Proc. zool. Soc. Lond. 1866 : 306-311

The genus Acanthion Cuvier 1822 is divided into three genera, two of them new :Oedocephalus Gray (p.308) Acanthochoerus Gray (p.309) and Acanthion (p.310). Acanthochoerus bartletti and A. grotei n.spp. described on p.310. The latter is illustrated (Pl.31, engraving, external morphology). Hybrid porcupines discussed. Several synonyms of species of Hystrix mentioned.

GREENWOOD, M. 1955 Fossil Hystricoidea from the Makapan Valley, Transvaal.

Palaeont. afr. 3 : 77-85, Figs. 27-28

Three fossil species and one new genus of porcupines from the grey breccia, Makapansgat Limeworks: Hystrix cf africaeaustralis (p.77) H. major n. sp. (p.78) and Xenohystrix crassidens new genus n. sp. (p.81). Line

drawings. Fig. 27a,b illustrates type specimen (mandible) of H. major Fig. 28a-e the syn-types of X. crassidens. Dental measurements for new species and for H. africaeaustralis, H. cristata, H. primigenia H. sivalensis and H. lagrelli. See Tables 6,7 pp.82-83.

GREENWOOD, M. 1958. Fossil Hystricoidea from the Makapan Valley, Transvaal. Hystrix makapanensis nom. nov. for Hystrix major Greenwood. Ann. Mag. nat. Hist. Ser 13 1 (5) : 365

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Hystrix capensis n. sp. described p.19

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HODGSON, J.(?) 1847. On a new species of porcupine. J. Asiat. Soc. Bengal 16 : 771-774

Hystrix alophus n. sp. (p.771) Pl. 32. H. nepalensis mentioned p.772.

HOOIJER,D.A. 1946. Some remarks on recent prehistoric and fossil porcupines from the Malay Archipelago. Zool. Med. 26 : 251-276

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JAGER ? 1835. Ueber die fossilen Säugethiere welche in Württemburg gefunden worden sind. Place and name of publisher untraceable.

Hystrix suevica (as Hystrix sp.?) p.17 illustrated Taf. 3 figs. 38, 39. After Schlosser 1902 p.138(24).

JANOSSY, D. 1964. Letzinterglaziale Vertebratenfauna aus der Kalman Lambrecht Höhle, Bukk-Gebirge, NO-Ungarn II Acta Zool Acad. Sci. Hung. 10 (1,2) pp.? Hystrix vinogradovi discussed and illustrated Taf. 2, figs 2,3,6; Fig. 2 No. 13. (Vide Mottl 1967 pp.308,309)

JENTINK, F.A. 1879a. On the Sumatra porcupine Hystrix mulleri, Temminck MS. Notes Leyden Mus. 1 Note 21 : 87-91.

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H. americanus Raj 1693 = Coendou sp. Coendou new genus p.11 (according to Ellerman 1940 p.182). Not seen, vide Ellerman 1940 (p.refs given as 1-18) and Simpson 1945 (p.refs. given as 144.195).

LANDRY, S.O. 1957. The interrelationships of the New and Old World Hystricomorph Rodents. Univ. Calif. publ. Zool. 56 :1-105

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Hystrix venustus described p.343 illustrated Pl.26 figs. 22,23,24. (vide Schlosser 1884 p.48)

LINNAEUS, C. 1758. Systema Naturae. 10th Ed., 1 : 56-57

Original description of the generic character of Hystrix . Five species H. cristata (p.56), H. prehensilis, H. dorsata, H. macroura and H. brachyura (p.75) briefly described, synonyms mentioned. No illustrations or measurements.

LÖNNBERG, E. 1908. Mammals Schwed. zool. Exped. nach d. Kilimandjaro und Meru. Uppsala pp.28-31.

Hystrix galeata ambigua n. ssp. p.29. Pl. 5. After Lönnberg 1912.

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Paper discusses evolutionary trends and taxonomic problems

LÖNNBERG, E. 1924. On a new fossil porcupine from Honan with some remarks about the development of the Hystricidae. Palaeont. Sin. Ser. C, 1 (3) : 1-15.

Hystrix (Acanthion) lagrelli n. sp. p.1 Figs.1-4 (p.15) (including H.(A.) javanicum). Cranial measurements p.2. Excellent description. Evolutionary trends within the Hystricidae are discussed. Important taxonomic paper.

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Genus Hystrix discussed pp.98-100. H. sivalensis n.sp. pp.98-100. Dental measurements, not illustrated.

LYDEKKER, R. 1880. A sketch of the history of the fossil vertebrata of India. J. Asiatic Soc. Bengal 49 (2) : 8-40

Hystrix sivalensis discussed on p.33.

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Hystrix sivalensis discussed on pp.84, 91

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Pages 110-111 important. Hystrix sivalensis p.98, discussed pp.109-111, 126. Illustrated Figs. 4,5 and Pl.13. Specimen BM15923 illustrated (Fig. 5) as H. sivalensis has been placed in H. cf. leucura (Black 1972).

LYDEKKER, R. 1885a. Catalogue of Siwalik Vertebrata in the Indian Museum. Part I. Mammalia. Calcutta.

Hystrix sivalensis discussed on p.13 (possibly H. cf. leucura, in part)

LYDEKKER, R. 1885b. Catalogue of fossil Mammalia in the British Museum Part I. London

Pages 233-249 important. Hystrix sivalensis discussed pp.248-249, illustrated Figs. 31-33 (the particular specimen under discussion now referred to H. cf. leucura).

LYDEKKER, R. 1886. Indian Tertiary and post-Tertiary vertebrata. The fauna of the Karnul Caves. Mem. geol. Surv. India (Palaeont. Indica) Ser. 10 4 (1) : 37-38.

Hystrix crassidens n. sp. described and illustrated Pl. 8, figs. 16-23a. Illustrations poor.

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Old World porcupines divided into two subfamilies: Hystricinae and Atherurinae. Acanthion Cuvier revived. Thecurus new genus p.582 and T. sumatrae n. sp. p.583. Key to the genera of Malayan porcupines p.576, list of diagnostic characters. All local species listed, with synonyms. Plates 54-57 illustrate crania of Thecurus, Atherurus, Trichys Hystrix and Acanthion. Important taxonomic comments.

MAJOR, P.H. 1878. On the Mammal fauna of the Val d'Arno. Quart. J. geol. Soc. Lond. 41 : 1-8

Hystrix etrusca initially mentioned as Hystrix sp.

MALEZ, M. 1963. Die quartare Fauna der Höhle Veternica Medvednica-Kroatien. Palaeont. Jugosl. Zagreb. 5 : 1-198
12 text figs. 40 Pls. 34 tables, 1 map.

German summary. Histrix cristata minor n. sp. or ssp. described, illustrated. Tav. V figs 1a-c. Not seen, after Mottl, 1967 p.307.

MARSDEN, W. 1810. History of Sumatra (3rd. Ed.). Kuala Lampur. Oxford University Press.

Hystrix longicauda n. sp. illustrated (poor sketch) Pl. 13 p.118. No description.

MATTHEW, W.D. 1929. Critical observations on Siwalik mammals. Bull. Am. Mus. nat. Hist. 56 (7) : 437-560

Hystrix sivalensis Lydekker and H. cf. leucurus discussed pp.444, 559, 560. Fig. 55 shows dentition of skull BM15923.

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Hystrix primigenia (Wagner) discussed pp.321-323. Fig. 8 p.322 occlusal plan of lower molars. Table 2 provides dental measurements.

MELENTIS, J.K. and SCHNEIDER, H. 1966. Studien über fossile Vertebraten Griechenlands. 17. Eine neue Pimermifauna in der nähe der ortschaft Alifaka in Thessalien (Griechenland) Ann. Géol. des pays Helléniques Ser. 1, 18, : 267-288.

Hystrix primigenia (Wagner) discussed pp.282-284. Illustrated Text fig. 4 and Pl. 2 fig. 1.

MERREM ? 1786. Title untraceable. Hystrix torosa? Leske's Magazine zur Naturk und Oekonomie 1786, P.ii : 197-198

Hystrix torosa, discussed on pp.197-198. Not seen. After Kerr 1792 p.216.

MILLER, ? 1903. Title untraceable. Proc. U.D. Nat. Mus. 26 : 469

Trichys macrotis n. sp. described p.469.

MOHR, E. 1965. Altweltliche Stachelschweine. Die Neue Brehm-Bucherei Wittenberg Lutherstadt: A. Ziemsen Verlag. 164 p. 115 Figs.

In two sections, the first dealing with porcupine natural history, the second with systematics. The general section contains chapter devoted to fossil porcupines (pp.61-67), apparently taken from Landry 1957. Excellent general reference. All modern Old World species well illustrated. Good bibliography.

MOLINA, J.E. 1808. Geogr. Nat. and Civil History of Chile. 'Translated from the original Italian by an American' (Isaac Riley?). Place and name of publisher untraceable.

H. chilensis n. sp. described p.205

MOTTL, M. 1967. Neuer Beiträg zum Hystrix - Horizont Europas Annln. naturh. Mus. Wien 71 : 305-327

Porcupine evolution in Europe discussed, several species mentioned and illustrated. Deals with Middle and Upper Pleistocene localities.

MÜLLER F. 1910a. Eine neue Hystrix - art aus dem Nordwesten Deutsch-Ostafrikas. Arch. f. Naturgesch. Berlin 1 : 180-188.

Hystrix stegmanni n. sp. pp.181-186. Tables I and II give cranial measurements, and of compared species (H. cristata, H. africaeaustralis, H. galeata and H. g. ambigua). Figs. 1-6 (photographs) show views of the cranium and mandible.

MÜLLER, F. 1910b. Besprechung einiger Hystrix-schädel aus Deutsch Ost-Afrika. Sber. Ges. naturf. Freunde Berlin, 8 : 309-315.

Hystrix africaeaustralis prittwitzi n. ssp. p.311, fig. 2. H. stegmanni n. sp. p.312 fig. 3. Müller described this species previously (1910a). H. galeata conradsi n. ssp. p.314, H. galeata lademanni n. ssp. p.314, H. galeata lönnbergi n. ssp. p.315, fig. 4 p.314. Fig. 1 shows H. galeata.

MÜLLER, F. 1911. Beiträge zur Kentnis der Stachelschweine Asiens, inbesondere Palästinas. I. Sber. Ges. naturf. Freunde Berlin, 9 : 110-130.

Hystrix hirsutirostris satunini n. ssp. p.117; H. hirsutirostris blandfordi n. ssp. p.121; H. hirsutirostris mersinae n. ssp. p.122; H. hirsutirostris aharonii n. ssp. 123 and H. hirsutirostris schmitzi n. ssp. p.126. Fig. 1, p.122 shows cranium of H. hirsutirostris mersinae, fig. 2, p.125 cranium of H. hirsutirostris aharonii. Two tables, cranial measurements, key.

MÜLLER, F. 1919. Beiträge zur Kenntnis der Stachelschweine Asiens inbesondere Palestinas. II. Sber. Ges. naturf. Freunde Berlin, 1919 : 61-70.

Hystrix narynensis n. sp. described pp.67-69. Other species occupying the region considered. Two tables (pp.62, 63) provide cranial and dental measurements.

MÜLLER, F. 1920a. Eine neue Stachelschweinart aus Turkestan. Zool. Anz., 51 : 190-194.

Hystrix narynensis n. sp. p.190, fig. 1, p.190, cranial view; fig. 2, p.193 cranial view; cranial measurements of H. narynensis, H. hirsutirostris and H. cristata p.191. Müller mentioned H. narynensis n. sp. in an earlier publication (1919).

MÜLLER, F. 1920b. Beiträge zur Kenntnis der Stachelschweine Asiens, inbesondere Palestinas. III Zool. Anz., 51 : 195-200. Hystrix mesopotamica n. sp. p. 198, Fig. 1. cranial view;Fig. 2, p.199. Cranial measurements of n. sp. and locally occurring porcupines given p.197.

OKEN, L. von 1816. Lehrbuch der Zoologie. Place and name of publisher untraceable.

Oken gives Hystrix paragayensis, new name for H. prehensilis, lists H. brasiliensis, H. mexicana as synonyms. (pp.870-873). After Tate 1935, p.209.

OLFERS, ?. 1818 and 1820. No information concerning these publications (except as in Tate 1935, p.308) available.

Hystrix tortilis and H. pollicaris n. ssp. described p.211. After Tate 1935, p.308.

ORLOV, Yu. A. (ed.) 1962. Osnovy paleontologii Vol. XIII. (Fundamentals of Palaeontology - a manual for the palaeontologists and geologists of the USSR in fifteen volumes). Moscow 1962 : 441p. Translated into English by Israel Progiam for Scientific Translations, Jerusalem 1968.

Excellent general reference. Illustrations, stratigraphic and locality maps of all mammalian fossils occurring within Greater Russia. Russian and non-Russian references given.

PEI, W.C. 1936. On the mammalian remains from Locality 3 at Choukoutien. Palaeont. Sinica, Ser. C, 7 (5) : 1-108.

Teeth from Locality 3 are referred to Hystrix cf. subcristata p.81, illustrated Pl. 5, figs 23, 24

PEI, W.C. 1940. Note on a collection of Mammal fossils from Tanyang (Kiangsu). Bull. geol. Soc. China 19 : 147-188.

Hystrix cf. subcristata described from this locality.

PETERS, W.C.H. 1852. Naturwissenschafliche Reise Nach Mossambique. Zoologie I. Saugethiere. Berlin : Georg Reimer. i-xvi, 202pp. 44 Pls.

H. africaeaustralis n. sp. p.170-171. Body and cranial measurements, illustrations of cranium Pl.32 figs.6,7.

PILGRIM, G.E. 1910. Preliminary note on a revised classification of the Tertiary freshwater deposits of India. Rec. geol. Surv. India 40 (3) : 185-205.

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Hystrix sivalensis discussed p.293.

PIVETEAU, J. 1958. Traité de Paléontologie. Vol. 6, Part 2, Mammifères Evolution. Paris : Masson and Co. : 707-708.

General reference. Hystrix sivalensis p.707, Fig. 62. H. cristata Fig. 63, p.707. Sivacanthion complicatus and Trichys macrotis p.708 Figs. 64,65.

QUENSTEDT, ? 1882-1885. Handbuch der Petrefactenkunde. Vol. 3 : 57-58. Place and name of publisher untraceable.

Hystrix suevica (as Hystrix sp.?) pp.57,58; illustrated Taf. 3, figs. 25,26,53,54. H. refossa p.57, illustrated Taf. 3, fig. 55. After Schlosser 1885, p.46; 1902 p.138.

RAJ. (?) 1693. Abbreviated surname, no initials traceable, probably an alternative spelling of Ray (see below).

RAY, J. 1693. Sym. meth. Anim. Quadr. Place and name of publisher untraceable.

Hystrix americanus p.208. After Tate 1935, p.297

RJABININ, A.N. 1929. Taraklijskaya fauny mlekopitajuscich I Carnivora vera, Rodentia, Subungulata. Trudy. geol. Muz. Nauk. SSR. 5 : 75 - 115 (127-134 fv.)

Hystrix bessarabica n. sp. pp.112-115. Pl.10, figs.1,1a. After Sulimski 1960 pp.329,332.

ROBERTS, A. 1936. Report on a survey of the higher vertebrates of north-eastern Zululand. Ann. Transv. Mus. 18 (3) : 240

H. africaeaustralis zuluensis n. ssp. p.240.

ROBERTS, A. 1951. The mammals of South Africa. Published by the 'Mammals of South Africa Book Fund', distrib. C.N.A. x/viii 700p. Plates (colour) I-XXIII; (photographic) I-LIV

General reference. Descriptions of and key to living southern Africa porcupine.

ROGER, O. 1885. Kleine paläontologische Mittheilungen. II. Säugethierreste aus der Reischenau. Ber. Naturwiss. Ver. Augsburg, 28 : 99-110.

Hystrix suevica and H. wiedemanni n. sp. p.109, illustrated Taf. 1, fig. 12. H. lamandini and H.primigenia mentioned p.110.

ROGER, O. 1888. Hystrix wiedemanni, Säugethierreste aus der Reischenau. Ber. Naturwiss. ver. Schwäben u. Neuburg, 28 : 109, Taf. 1 fig. 12. Vide Schlosser 1902, p.138(24).

Apparently the same as Roger 1885, possibly misquoted by Schlosser.

ROGER, O. 1898. Wirbelthierreste aus dem Dinotheriumsände. Ber.Naturwiss. Ver. Schwäben u. Neuburg, 1898 : 7, Taf. 3, figs. 9,10.

Hystrix wiedemanni (possibly as Anchitheriomys wiedemanni) discussed and illustrated. After Schlosser 1902, p.138(24)

ROGER, O. 1900. Wirbelthierreste aus dem Dinotheriensände der Bayerisch-schwäbischen Hochebene. Theil II. Ber. Naturwiss. Ver. Augsburg, 33 : 1-46

Hystrix wiedemanni Roger 1885 from the above locality changed to Anchitheriomys. An upper jaw fragment and and humerus form the same locality referred to H. suevica. After Mohr 1965, p.63.

ROTH and WAGNER , A. 1854. Title untraceable. Abh. d. K. bayer. Akad. 7 (2) : 414.

Hystrix primigenia (as Castor atticus) discussed and illustrated Pl. 4, figs. 5,5a. Note: Schlosser 1885 p.45 quotes the page ref. as 44 and the plate as Pl.10 fig. 93. After Bosco 1898, p.151.

SCHLOSSER, M. 1884. Die Nager des europäischen Tertiärs nebst Betrachtungen über die Organization und die geschichtliche Entwicklung der Nager überhaupt. I Theil. Beschreibung der Nager aus den Phosphoriten und dem suddeutschen Tertiär nebst kritischer Zusammentstellung sammitlicher tertiärer Nagerreste Europas. Palaeontographica, Folge 7, 31 (3) : 19-162 Taf. 7 (3).

Hystrix primigenia, H. refossa, H. suevica n. sp. and H.(?) lamandini and their synonyms on pp.45(27), 46(28) 47(29) and 48(30). H. suevica and H (?) lamandini illustrated Taf. 7(3) figs. 27,32,34,35,36,39,40 and 41

SCHLOSSER, M. 1902. Beiträge zur Kenntnis der Säugethierreste auf den süddeutschen Bohnerzen. Geol. u. Paläont. Abh. n.f. 5, 3 : 115-258, Taf. 1(6).

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Hystrix malabarica n. sp. pp.353-355, illustrated Pl.16 Dorsal and palatal views of cranium p.355.

SCLATER, P.L. 1871. Animals in the menagerie. Proc. zool. Soc. Lond. 1871 : 233-236.

Several synonyms mentioned.

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Hystrix orientalis cristata, n.sp. p.75, Pl.50 fig. 1; H. malaccensis n. sp. p.81, Pl.51 fig. 1; H. orientalis singularis n. sp. p.84 Pl.52 fig. 1. These species form the basis of two Linnaean species, H. cristata and H. brachyura. After Tate 1935.

SEEMAN, I. 1938. Die Insektenfresser, Fledermäuse und Nager aus der Obermiocänen Braunkohle von Viehhausen bei Regensburg. Palaeontographica, Abt. A, 89 : 1-56.

Anchitheriomys wiedemanni (Roger 1885) discussed. A jaw fragment showing molar pattern figured. After Landry 1957 p.61.

SELYS-LONGCHAMPS, de. 1839. See De Selys-Longchamps

SHAW, G. 1801. General Zoology, or Systematic Natural History.London G. Kearsley, Fleet Street. Vol. 2 (1) : 1-18.

Hystrix fasciculata n. sp. p.11, illustrated Pl.124. Several species (many pre-Linnaean) listed with synonyms, external characters illustrated. H. cristata p.1 Pl.122; H. prehensilis p.7 Pl.123; H. mexicana p.8; H. macroura p.9 Pl. 124; H. fasciculata p.11 Pl.124; H. dorsata p.13 Pl. 125; H. orientalis singularis p.14. Body measurements only.

SIMPSON, G.G. 1945. The principles of classification and a classification of the Mammals. Bull. Am. Mus. nat. Hist., 85 : 1-350.

Excellent general taxonomic reference. Excellent bibliography.

STIRTON, R.A. 1935. See General References.

ST. LEGER, ?. 1932. Title untraceable. Ann. Mag. Nat. Hist. 6 (15) : 89

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SULIMSKI, A. 1960. Hystrix primigenia (Wagner) in the Pliocene fauna from Weze. Acta Palaeont. Pol. 5 (3) : 319-333 Pl. I figs. 1-3; Pl. II figs 1-5.

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Hystrix leucurus n. sp. p.103. External characters only given.

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Each genus treated historically. Many synonyms listed. Good bibliography. Important taxonomic publication.

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Hystrix galeata n. sp. described p.230. Cranial measurements given p.231

THOMAS, O. 1895. On the genera of rodents: an attempt to bring up to date the current arrangement of the order. Proc. zool. Soc. Lond. 1895 : 1012-1028. (Journal Zoology = J. Zoology)

Atherurus centralis n. sp. described.

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