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ONLINE SUPPLEMENTARY INFORMATION

A new species of small-bodied sparassodont (Mammalia, Metatheria) from the Middle Miocene locality of Quebrada Honda, Bolivia

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TABLE 1S. Canine measurements of sparassodonts, the thylacinid *Thylacinus cynocephalus*, and the dasyurid *Sarcophilus harrisii*. Canine length/width ratio is calculated by dividing maximum anteroposterior length at the base of the canine by maximum mediolateral width at the same point. In *Arctodictis munizi*, the greatest length and greatest width of the canine is used instead of anteroposterior length and mediolateral width, respectively, as this taxon has canines that are oriented obliquely to the tooth row. Relative size of the canines is calculated by scaling the cross sectional area of the canine by the length of M3 squared. Anatomical abbreviations: AP, anteroposterior diameter; ML, mediolateral diameter. All measurements in millimeters.

Taxon	Specimen	Group	AP	ML	AP/ML Ratio	Length of M3	Relative Size
Acrocyon riggsi	FMNH P13433	Borhyaenidae	15.0	11.0	1.36	12.8	0.79
Acyon myctoderos	MNHN-Bol-V-003668 (l)	Hathliacynidae	8.8	6.3	1.40	12.5	0.28
Acyon myctoderos	MNHN-Bol-V-003668 (r)	Hathliacynidae	9.1	6.3	1.44	12.5	0.29
Arctodictis munizi	CORD-PZ 1210-1/5	Borhyaenidae	24.6	17.3	1.42	16.0	1.31
Arctodictis sinclairi	MLP 85-VII-3-1 (r)	Borhyaenidae	17.7	13.9	1.27	13.7	1.03
Arctodictis sinclairi	MLP 85-VII-3-1 (l)	Borhyaenidae	18.6	14.1	1.32	13.7	1.10
Arminiheringia auceta	MACN A 10972	Proborhyaenidae	19.6	13.2	1.48	15.5	0.85
Borhyaena tuberata	MACN A 6203-6265 (r)	Borhyaenidae	14.8	10.1	1.47	14.4	0.57
Borhyaena tuberata	MACN A 6203-6265 (l)	Borhyaenidae	14.9	10.2	1.46	14.4	0.58
Borhyaena tuberata	MACN A 5780	Borhyaenidae	15.5	10.2	1.52	N/A	N/A
Borhyaenidium riggsi	FMNH 14409	Hathliacynidae	4.0	2.8	1.43	7.30	0.17
Callistoe vincei	PVL 4187	Proborhyaenidae	20.0	14.5	1.38	13.3	1.29
Cladosictis centralis	MACN A 11639	Hathliacynidae	9.0	5.5	1.64	8.4	0.55
Cladosictis patagonica	MACN A 5927	Hathliacynidae	10.0	6.7	1.49	9.00	0.65
Hondadelphys fieldsi	UCMP 37960	Basal Sparassodonta	8.5	4.7	1.81	7.9	0.50
'*Lycopsis*' *longirostrus* (juvenile)	UCMP 38061	Basal Borhyaenoid	10.0	7.9	1.27	17.5	0.20
Pharsophorus antiquus	MACN A 52-532	Basal Borhyaenoid	24.5	16.7	1.47	N/A	N/A
Proborhyaena gigantea	MLP 79-XII-18-1	Proborhyaenidae	29.2	16.7	1.75	N/A	N/A
Prothylacynus patagonicus	MACN Pv 14453 (r)	Basal Borhyaenoid	11.4	7.7	1.48	12.5	0.44
Prothylacynus patagonicus	MACN Pv 14453 (l)	Basal Borhyaenoid	11.0	7.8	1.41	12.2	0.45
Prothylacynus patagonicus (juvenile)	MACN A 5931	Basal Borhyaenoid	9.2	7.3	1.26	12.3	0.35
Sipalocyon externa	MACN A 52-383	Hathliacynidae	5.6	3.9	1.44	6.5	0.41
Sparassodonta gen. et sp. nov.	UF 27881	Basal Sparassodonta	4.4	3.6	1.24	4.44	0.63

Thylacosmilus atrox	FMNH P14474	Thylacosmilidae	28.0	11.0	2.55	16.0	0.94
Thylacosmilus atrox	FMNH P14531	Thylacosmilidae	35.0	14.0	2.5	20.0	0.96
Thylacosmilus atrox	MLP 35-X-4-1	Thylacosmilidae	28.4	11.6	2.45	N/A	N/A
Thylacosmilus atrox	MMP 1470	Thylacosmilidae	21.0	8.0	2.63	15.5	N/A
Thylacinus cynocephalus (left)	CMNH 18916	Thylacinidae	11.7	8.3	1.41	14.8	0.35
Thylacinus cynocephalus (right)	CMNH 18916	Thylacinidae	11.7	8.7	1.34	14.6	0.38
Sarcophilus harrisii (left)	CMNH 18915	Dasyuridae	8.7	7.8	1.12	11.7	0.50
Sarcophilus harrisii (right)	CMNH 18915	Dasyuridae	8.8	7.8	1.13	11.4	0.53

TABLE 2S. Measurements of the infraorbital foramen (IOF) in UF 27881, didelphoids, and two additional sparassodonts. Measurements of *Prothylacynus patagonicus* and *'Lycopsis' longirostrus* are taken from Marshall (1979) and Marshall (1977a) respectively. All other measurements are taken directly from the specimens in question. Dietary information for living didelphoids is from Vieira and Astúa Moraes (2003). Abbreviations: X-Sec IOF, cross-section of infraorbital foramen; ML, mediolateral length of infraorbital foramen; DV, dorsoventral length of infraorbital foramen; PL, palatal length (from the posterior edge of the canine to the posterior end of the palate); R1, ratio calculated from palatal length; R2, ratio calculated from M1 length.

Species	**Specimen**	**X-Sec IOF**	**ML**			**DV**			**Diet**
			Left	**Right**	**Average**	**Left**	**Right**	**Average**	
Sparassodonta gen. et sp. nov.	UF 27881	5.39	2.71	2.43	2.57	2.54	2.80	2.67	Hypercarnivorous?
Caluromys derbianus	FMNH 69327	1.36	1.01	1.05	1.03	1.75	1.60	1.68	Frugivorous
Caluromys lanatus	FMNH 114649	1.23	0.91	1.08	0.995	1.67	1.49	1.58	Frugivorous
Caluromys philander	FMNH 92037	1.16	0.82	0.90	0.86	1.66	1.77	1.72	Frugivorous
Chironectes minimus	FMNH 19349	3.52	1.94	2.04	1.99	2.16	2.35	2.26	Hypercarnivorous/ Durophagous
Chironectes minimus	FMNH 69329	3.61	1.73	1.84	1.785	2.90	2.25	2.58	Hypercarnivorous/ Durophagous
Didelphis virginiana	CMNH 18880	3.57	2.27	2.65	2.46	1.95	1.75	1.85	Omnivorous
Didelphis virginiana	CMNH 19220	2.55	1.96	1.97	1.965	1.7	1.61	1.66	Omnivorous
Lutreolina crassicauda	FMNH 53944	2.03	1.32	1.12	1.22	2.09	2.14	2.12	Hypercarnivorous
Metachirus nudicaudatus	CMNH 18891	0.78	1.39	1.25	1.32	0.82	0.68	0.75	Omnivorous/ Insectivorous
Marmosa demerarae	CMNH 18894	0.60	1.09	1.15	1.12	0.65	0.72	0.69	Omnivorous

Marmosa murina	CMNH 18878	0.60	1.10	1.08	1.09	0.71	0.69	0.70	Omnivorous
Prothylacynus patagonicus	MACN Pv 14453	31.81	N/A	9.00	9.00	N/A	4.50	4.50	Hypercarnivorous?
'*Lycopsis*' *longirostrus*	UCMP 38061	36.13	N/A	11.50	11.50	N/A	4.00	4.00	Hypercarnivorous?

Species	**Specimen**	**PAL**	**R1**	**Length of M1**			**R2**	**Average Ratio**	**Diet**
				Left	**Right**	**Average**			
Sparassodonta gen. et sp. nov.	UF 27881	30.07	0.60	4.38	4.41	4.40	0.28	0.44	Hypercarnivorous?
Caluromys derbianus	FMNH 69327	25.15	0.21	2.54	2.65	2.60	0.20	0.21	Frugivorous
Caluromys lanatus	FMNH 114649	22.73	0.24	2.58	2.66	2.62	0.18	0.21	Frugivorous
Caluromys philander	FMNH 92037	23.24	0.21	2.54	2.49	2.52	0.18	0.20	Frugivorous
Chironectes minimus	FMNH 19349	33.16	0.32	3.91	3.96	3.94	0.23	0.27	Hypercarnivorous/ Durophagous
Chironectes minimus	FMNH 69329	35.30	0.29	4.02	4.01	4.02	0.22	0.26	Hypercarnivorous/ Durophagous
Didelphis virginiana	CMNH 18880	45.91	0.17	4.92	4.71	4.82	0.15	0.16	Omnivorous
Didelphis virginiana	CMNH 19220	34.95	0.21	4.86	4.76	4.81	0.11	0.16	Omnivorous
Lutreolina crassicauda	FMNH 53944	24.71	0.33	2.94	3.04	2.99	0.23	0.28	Hypercarnivorous
Metachirus nudicaudatus	CMNH 18891	20.75	0.18	2.46	2.41	2.44	0.13	0.16	Omnivorous/ Insectivorous

Marmosa demerarae	CMNH 18894	17.46	0.20	2.70	2.49	2.60	0.09	0.14	Omnivorous
Marmosa murina	CMNH 18878	17.73	0.19	2.37	2.35	2.36	0.11	0.15	Omnivorous
Prothylacynus patagonicus	MACN Pv 14453	90.00	0.39	9.80	9.90	9.85	0.33	0.36	Hypercarnivorous?
'*Lycopsis*' *longirostrus*	UCMP 38061	98.18	0.37	-	13.10	13.10	0.21	0.29	Hypercarnivorous?

TABLE 3S. Upper (M1-3) and lower (m1-4) molar row measurements of sparassodonts used in Figure 7. In specimens for which either the upper or lower molar row length is unknown, these values are estimated based on a regression equation of all sparassodonts (except proborhyaenids) for which associated upper and lower molar dentitions are known. Estimated values are highlighted in yellow. The regression equation for upper molar row length (M1-3) based on lower molar row length (m1-4) is

$$y = 1.2196x + 1.858$$

whereas the regression equation for lower molar row length (m1-4) based on upper molar row length (M1-3) is

$$y = 0.8216x - 1.2317$$

Specimen	Group	Reference	Average Length of M1-3	Average Length of m1-4
Acrocyon riggsi				
FMNH P13433	Borhyaenidae	Marshall, 1978	34.30	43.69
Average			34.30	43.69
Acyon ?herrerae				
FMNH P13521	Hathliacynidae	Marshall, 1981	29.08	37.30
Average			29.08	37.30
Acyon myctoderos				
MNHN-Bol-V-003668	Hathliacynidae	Forasiepi et al., 2006	31.71	37.80
Average			31.71	37.80
Acyon tricuspidatus				
MACN 11-64	Hathliacynidae	Marshall, 1981	28.43	36.50
Average			28.43	36.50
Arctodictis munizi				
MLP 11-65	Borhyaenidae	Marshall, 1978	47.00	60.60
MACN A 5915	Borhyaenidae	Marshall, 1978	53.21	67.00
MACN A 5919	Borhyaenidae	Marshall, 1978	50.77	64.00
MLP 11-85	Borhyaenidae	Marshall, 1978	49.96	63.00
Average			50.24	63.65
Arctodictis sinclairi				

MLP 85-VII-3-1	Borhyaenidae	Forasiepi, 2009	34.70	44.00
Average			34.70	44.00
Arminiheringia auceta				
MACN A 10970-10972	Proborhyaenidae	Present Study	48.00	56.00
Average			48.00	56.00
Borhyaena macrodonta				
MACN A 52-390	Borhyaenidae	Marshall, 1978	40.30	50.00
Average			40.30	50.00
Borhyaena tuberata				
MACN A 9341-9342	Borhyaenidae	Marshall, 1978	39.80	50.50
MACN A 9344-9349	Borhyaenidae	Marshall, 1978	40.95	51.50
MACN A 5870	Borhyaenidae	Marshall, 1978	38.50	48.81
MACN A 5922	Borhyaenidae	Marshall, 1978	40.30	51.01
MACN A 6203-6265	Borhyaenidae	Marshall, 1978	41.00	51.86
MACN A 9340	Borhyaenidae	Marshall, 1978	40.30	51.01
Average			40.14	50.78
Borhyaenidium musteloides				
MLP 57-X-10-153	Hathliacynidae	Marshall, 1981	15.50	22.45
Average			15.50	22.45
Borhyaenidium riggsi				
FMNH P14409	Hathliacynidae	Marshall, 1981	18.20	24.20
Average			18.20	24.20
Callistoe vincei				
PVL 4187	Proborhyaenidae	Babot et al., 2002	35.35	51.27
Average			35.35	51.27
Cladosictis centralis				
MNHN col. 4	Hathliacynidae	Marshall, 1981	23.00	29.20
Average			23.00	29.20
Cladosictis patagonica				
MACN A 5927-5928	Hathliacynidae	Marshall, 1981	24.35	30.50
MACN A 86	Hathliacynidae	Marshall, 1981	25.00	32.35

MACN A 2079	Hathliacynidae	Marshall, 1981	23.00	29.91
MACN A 5950	Hathliacynidae	Marshall, 1981	23.40	30.40
MACN A 6280	Hathliacynidae	Marshall, 1981	23.00	29.91
MACN A 9350	Hathliacynidae	Marshall, 1981	22.20	28.93
AMNH 9134	Hathliacynidae	Marshall, 1981	24.80	32.10
MACN A 674	Hathliacynidae	Marshall, 1981	24.12	31.20
AMNH 9548	Hathliacynidae	Marshall, 1981	23.11	29.95
MLP 11-10	Hathliacynidae	Marshall, 1981	24.61	31.80
MLP 11-13	Hathliacynidae	Marshall, 1981	24.12	31.20
MACN A 6288	Hathliacynidae	Marshall, 1981	25.58	33.00
MACN A 9360	Hathliacynidae	Marshall, 1981	22.74	29.50
MLP 11-63	Hathliacynidae	Marshall, 1981	23.15	30.00
Average			23.80	30.77
Hondadelphys fieldsi				
UCMP 37960	Basal Sparassodonta	Marshall, 1976a	21.80	31.00
IGM 253049	Basal Sparassodonta	Goin, 1997a	21.85	28.40
IGM 253079	Basal Sparassodonta	Goin, 1997a	20.55	26.80
IGM 253030	Basal Sparassodonta	Goin, 1997a	20.87	27.20
Average			21.27	28.35
***?Hondadelphys* sp.**				
IGM 184041	Basal Sparassodonta	Goin, 1997a	20.30	26.50
Average			20.30	26.50
Lycopsis torresi				
MLP 11-113	Basal Borhyaenoid	Marshall, 1979	40.55	49.70
MACN A 5930	Basal Borhyaenoid	Marshall, 1979	39.40	50.00
Average			39.97	49.85
'Lycopsis' longirostrus				
UCMP 38061	Basal Borhyaenoid	Marshall, 1979	45.60	58.00
Average			45.60	58.00
'Lycopsis' viverensis				
MMH 87-6-1	Basal Borhyaenoid	Forasiepi et al., 2003	34.77	44.26
MMH 95-6-1	Basal Borhyaenoid	Forasiepi et al., 2003	33.39	42.60

Average			34.08	43.43
Notictis ortizi				
MACN Pv 3996	Hathliacynidae	Marshall, 1981	14.21	19.00
Average			14.21	19.00
Notogale mitis				
SAL 668	Hathliacynidae	Villarroel and Marshall, 1982	22.33	29.00
Average			22.33	29.00
Patagosmilus goini				
MLP 07-VII-1-1	Thylacosmilidae	Forasiepi and Carlini, 2010	39.21	49.68
Average			39.21	49.68
Patene coluapiensis				
AMNH 28448	Basal Sparassodonta	Marshall, 1981	21.40	27.96
Average			21.40	27.96
Patene simpsoni				
PVL 2618	Basal Sparassodonta	Goin et al., 1986	11.69	15.90
MNRJ 1331-V	Basal Sparassodonta	Marshall, 1981	15.20	20.40
DGM 324-M	Basal Sparassodonta	Marshall, 1981	14.61	19.49
MNRJ 1351-V	Basal Sparassodonta	Marshall, 1981	15.75	20.90
Average			14.31	19.17
Perathereutes pungens				
MACN A 684	Hathliacynidae	Marshall, 1981	15.02	20.00
Average			15.02	20.00
Pharsophorus lacerans				
MACN A 52-391	Basal Borhyaenoid	Patterson and Marshall, 1978	43.95	55.60
MACN A 11653	Basal Borhyaenoid	Marshall, 1978	41.84	53.00
Average			42.89	54.30
Pharsophorus tenax				
AC 3192	Basal Borhyaenoid	Marshall, 1978	35.50	45.15
AC 3004	Basal Borhyaenoid	Marshall, 1978	37.77	48.00
Average			36.64	46.58
"Plesiofelis" schlosseri				

MLP 11-114	Basal Borhyaenoid	Marshall, 1978	46.39	58.60
Average			46.39	58.60
Proborhyaena gigantea				
MLP 79-XII-18-1	Proborhyaenidae	Bond and Pascual, 1983	64.70	80.77
MACN A 52-382	Proborhyaenidae	Present Study	72.06	90.20
Average			68.38	85.48
Procladosictis anomala				
MACN A 10327	Hathliacynidae	Marshall, 1981	21.28	27.81
Average			21.28	27.81
Prothylacynus patagonicus				
MACN A 706-707	Basal Borhyaenoid	Marshall, 1979	36.00	47.30
MLP 11-38	Basal Borhyaenoid	Marshall, 1979	37.37	47.50
MACN A 5926	Basal Borhyaenoid	Marshall, 1979	38.99	49.50
MACN A 5931	Basal Borhyaenoid	Marshall, 1979	36.50	46.37
MACN Pv 14453	Basal Borhyaenoid	Marshall, 1979	33.90	43.20
Average			36.55	46.78
Pseudonotictis pusillus				
MLP 11-26	Hathliacynidae	Marshall, 1981	13.56	18.20
Average			13.56	18.20
Pseudothylacynus rectus				
MACN A 52-369	Hathliacynidae	Marshall, 1979	32.41	41.40
MNHN col. 5	Hathliacynidae	Marshall, 1979	33.47	42.70
Average			32.94	42.05
Sallacyon hoffstetteri				
MNHN SAL 93	Hathliacynidae	Petter and Hoffstetter, 1983	15.83	21.00
Average			15.83	21.00
Sipalocyon externa				
MACN A 52-383	Hathliacynidae	Marshall, 1981	18.40	24.30
Average			18.40	24.30
Sipalocyon gracilis				
MACN A 691-703	Hathliacynidae	Marshall, 1981	20.50	25.95

PU 15373	Hathliacynidae	Marshall, 1981	18.60	23.00
MACN A 5952-5953	Hathliacynidae	Marshall, 1981	19.45	25.58
MACN A 5958	Hathliacynidae	Marshall, 1981	22.00	28.69
MACN A 5959	Hathliacynidae	Marshall, 1981	19.80	26.01
MACN A 9352	Hathliacynidae	Marshall, 1981	21.60	28.20
FMNH P13777	Hathliacynidae	Marshall, 1981	22.60	29.42
PU 15418	Hathliacynidae	Marshall, 1981	22.00	28.69
AMNH 9254	Hathliacynidae	Marshall, 1981	19.40	25.52
MLP 11-25	Hathliacynidae	Marshall, 1981	17.95	23.60
MLP 11-7	Hathliacynidae	Marshall, 1981	18.60	24.40
MACN A 5957	Hathliacynidae	Marshall, 1981	19.90	26.00
MACN A 5964	Hathliacynidae	Marshall, 1981	19.00	24.90
MACN A 5965	Hathliacynidae	Marshall, 1981	19.08	25.00
MACN A 5938-5949	Hathliacynidae	Marshall, 1981	17.25	22.75
Average			19.85	25.85
Sipalocyon obusta				
MACN A 686	Hathliacynidae	Marshall, 1981	18.84	24.70
Average			18.84	24.70
Sparassodonta gen. et sp. nov.				
UF 27881	Basal Sparassodonta	Present Study	14.18	19.15
Average			14.18	19.15
Sparassodonta aff. *Stylocynus*				
PVL 4651	Basal Sparassodonta	Babot and Ortiz, 2008	38.26	48.60
Average			38.26	48.60
Stylocynus paranensis				
MLP 11-94	Basal Sparassodonta	Marshall, 1979	44.27	56.00
Average			44.27	56.00
Thylacosmilus atrox				
FMNH P14474	Thylacosmilidae	Marshall, 1976b	44.00	55.52
FMNH P14344	Thylacosmilidae	Marshall, 1976b	41.43	52.50
Average			42.71	54.01

TABLE 4S – Second lower molar (m2) measurements of middle Miocene-late Pliocene (Laventan-Marplatan SALMAs) sparassodonts and didelphoids used in Figure 11. Species for which m2 is not known had their values estimated based the proportions of other teeth and/or m2 of related taxa. These estimated values are highlighted in yellow. The holotype of *Borhyaenidium riggsi* has been regarded as either Chapadmalalan (Prevosti et al., 2013) or Montehermosan (Reguero and Candela, 2011) in age, and this uncertainty has been taken into account in this table and the corresponding figure in the paper (Figure 8). All measurements are in mm.

Taxon	Specimen	Group	Family	SALMA	Length of m2	Reference
Acyon myctoderos	MNHN-Bol-V-003668 (l)	Sparassodonta	Hathliacynidae	Laventan	10.05	Forasiepi et al., 2006
Acyon myctoderos	MNHN-Bol-V-003668 (r)	Sparassodonta	Hathliacynidae	Laventan	9.70	Forasiepi et al., 2006
Anachlysictis gracilis	IGM 184247	Sparassodonta	Thylacosmilidae	Laventan	10.20	Goin, 1997a
Dukecynus magnus	IGM 251149	Sparassodonta	Basal Borhyaenoid	Laventan	15.50	Goin, 1997a
Hondadelphys fieldsi	IGM 250833	Sparassodonta	Basal Sparassodonta	Laventan	6.80	Goin, 1997a
Hondadelphys fieldsi	IGM 253050	Sparassodonta	Basal Sparassodonta	Laventan	6.90	Goin, 1997a
Hondadelphys fieldsi	IGM 253049	Sparassodonta	Basal Sparassodonta	Laventan	6.80	Goin, 1997a
Hondadelphys fieldsi	IGM 253078	Sparassodonta	Basal Sparassodonta	Laventan	8.00	Goin, 1997a
Hondadelphys fieldsi	IGM 253079	Sparassodonta	Basal Sparassodonta	Laventan	6.80	Goin, 1997a
Hondadelphys fieldsi	UCMP 39251 (r)	Sparassodonta	Basal Sparassodonta	Laventan	7.80	Marshall, 1976a
Hondadelphys fieldsi	UCMP 39251 (l)	Sparassodonta	Basal Sparassodonta	Laventan	7.70	Marshall, 1976a
?*Hondadelphys* sp.	IGM 250942	Sparassodonta	Basal Sparassodonta	Laventan	5.58	Goin, 1997a
'Lycopsis' longirostrus	UCMP 38061	Sparassodonta	Basal Borhyaenoid	Laventan	13.80	Marshall, 1977a

Marmosa laventica	IGM 184151	Didelphoidea	Didelphidae	Laventan	2.95	Goin, 1997a
Marmosa laventica	IGM 184336	Didelphoidea	Didelphidae	Laventan	2.60	Goin, 1997a
Marmosa laventica	UCMP 39273	Didelphoidea	Didelphidae	Laventan	3.00	Marshall, 1976a
Sparassodonta gen. et sp. nov.	UF 27881	Sparassodonta	Basal Sparassodonta	Laventan	4.52	Present Study
Thylamys columbianus	IGM 251010	Didelphoidea	Didelphidae	Laventan	1.85	Goin, 1997a
Thylamys columbianus	IGM 253034	Didelphoidea	Didelphidae	Laventan	1.90	Goin, 1997a
Thylamys minutus	IGM 253032	Didelphoidea	Didelphidae	Laventan	1.43	Goin, 1997a
Thylamys minutus	IGM 253042	Didelphoidea	Didelphidae	Laventan	1.43	Goin, 1997a
Unknown Thylacosmilid	IGM 251108	Sparassodonta	Thylacosmilidae	Laventan	7.70	Goin, 1997a
Chasicostylus castroi	MLP 57-XI-9-2	Sparassodonta	Hathliacynidae	Chasicoan	8.20	Marshall, 1981
'Lycopsis' viverensis	MMH 95-6-1	Sparassodonta	Basal Borhyaenoid	Chasicoan	10.60	Forasiepi et al., 2003
Pseudolycopsis cabrerai	MLP 57-XI-9-1 (l)	Sparassodonta	Basal Borhyaenoid	Chasicoan	9.60	Marshall, 1976c
Pseudolycopsis cabrerai	MLP 57-XI-9-1 (r)	Sparassodonta	Basal Borhyaenoid	Chasicoan	9.60	Marshall, 1976c
Borhyaenidae indet.	MACN Pv 13207	Sparassodonta	Borhyaenidae	Huayquerian	10.50	Marshall, 1978
Borhyaenidium altiplanicus	ACH-243	Sparassodonta	Hathliacynidae	Huayquerian	5.00	Villarroel and Marshall, 1983
Borhyaenidium musteloides	MLP 57-X-10-153 (l)	Sparassodonta	Hathliacynidae	Huayquerian	5.40	Marshall, 1981
Borhyaenidium musteloides	MLP 57-X-10-153 (r)	Sparassodonta	Hathliacynidae	Huayquerian	5.40	Marshall, 1981

Didelphidae sp. indet.	LACM 135346	Didelphoidea	Didelphidae	Huayquerian	1.51	Czaplewski, 1996
Didelphis solimoensis	UFAC 5180	Didelphoidea	Didelphidae	Huayquerian	4.00	Cozzuol et al., 2006
Hesperocynus dolgopolae	MHNSR-PV 1046	Didelphoidea	Sparassocynidae	Huayquerian	2.90	Forasiepi et al., 2009
Hesperocynus dolgopolae	GHUNLPam 8629	Didelphoidea	Sparassocynidae	Huayquerian	2.74	Goin et al., 2000
Hesperocynus dolgopolae	GHUNLPam 14368	Didelphoidea	Sparassocynidae	Huayquerian	2.57	Goin et al., 2000
Hesperocynus dolgopolae	MLP 86-VII-10-1	Didelphoidea	Sparassocynidae	Huayquerian	2.86	Goin and Montalvo, 1988
Hyperdidelphys pattersoni	FMNH P14455	Didelphoidea	Didelphidae	Huayquerian	4.40	Goin and Pardiñas, 1996
Hyperdidelphys pattersoni	FMNH P14519	Didelphoidea	Didelphidae	Huayquerian	4.50	Goin and Pardiñas, 1996
Hyperdidelphys pattersoni	PVL 3316a	Didelphoidea	Didelphidae	Huayquerian	4.13	Goin and Pardiñas, 1996
Hyperdidelphys pattersoni	MACN Pv 8199	Didelphoidea	Didelphidae	Huayquerian	4.40	Simpson, 1974
Hyperdidelphys pattersoni	IL 3317	Didelphoidea	Didelphidae	Huayquerian	4.60	Simpson, 1974
Hyperdidelphys sp.	GHUNLPam 19614	Didelphoidea	Didelphidae	Huayquerian	3.80	Abello et al., 2002
Lutreolina materdei	LACM 135345	Didelphoidea	Didelphidae	Huayquerian	4.21	Goin and Los Reyes, 2011
Notictis ortizi	MACN Pv 3996	Sparassodonta	Hathliacynidae	Huayquerian	4.80	Marshall, 1981
Stylocynus paranensis	MLP 11-94	Sparassodonta	Basal Sparassodonta	Huayquerian	12.41	Marshall, 1979
Thylacosmilus atrox	MMP 1470	Sparassodonta	Thylacosmilidae	Huayquerian	10.60	Goin and Pascual, 1987
Thylacosmilus atrox	FMNH P14344	Sparassodonta	Thylacosmilidae	Huayquerian	11.80	Marshall, 1976b
Thylacosmilus	MACN Pv 9163	Sparassodonta	Thylacosmilidae	Huayquerian	10.00	Marshall, 1976b

atrox						
Thylamys pinei	GHUNLPam 2404	Didelphoidea	Didelphidae	Huayquerian	1.66	Goin et al., 2000
Thylamys pinei	GHUNLPam 9075	Didelphoidea	Didelphidae	Huayquerian	1.49	Goin et al., 2000
Thylamys pinei	GHUNLPam 2222	Didelphoidea	Didelphidae	Huayquerian	1.89	Goin et al., 2000
Thylamys zettii	MLP 66-XII-13-3	Didelphoidea	Didelphidae	Huayquerian	1.90	Goin, 1997b
Thylatheridium hudsoni	PVM 1001	Didelphoidea	Didelphidae	Huayquerian	2.40	Goin and Montalvo, 1988
Thylatheridium hudsoni	GHUNLPam 300	Didelphoidea	Didelphidae	Huayquerian	2.49	Goin et al., 2000
Thylatheridium hudsoni	GHUNLPam 5129	Didelphoidea	Didelphidae	Huayquerian	2.32	Goin et al., 2000
Thylatheridium hudsoni	GHUNLPam 2195	Didelphoidea	Didelphidae	Huayquerian	2.66	Goin et al., 2000
Thylatheridium hudsoni	GHUNLPam 312	Didelphoidea	Didelphidae	Huayquerian	2.66	Goin et al., 2000
Thylatheridium hudsoni	GHUNLPam 2314	Didelphoidea	Didelphidae	Huayquerian	2.90	Goin et al., 2000
Unknown Sparassodont aff. *Stylocynus*	PVL 4651	Sparassodonta	Basal Sparassodonta	Huayquerian	11.70	Babot and Ortiz, 2008
Zygolestes paranensis	MACN Pv 8889	Didelphoidea	Didelphidae	Huayquerian	1.51	Reig, 1957
Zygolestes tatei	GHUNLPam 5310	Didelphoidea	Didelphidae	Huayquerian	1.58	Goin et al., 2000
Zygolestes tatei	GHUNLPam 8076	Didelphoidea	Didelphidae	Huayquerian	1.49	Goin et al., 2000
Borhyaenidium riggsi	FMNH P14409	Sparassodonta	Hathliacynidae	Montehermosan/ Chapadmalalan	5.90	Marshall, 1981
Chironectes sp.	MACN Pv 2464	Didelphoidea	Didelphidae	Montehermosan	4.49	Marshall, 1977b
Hyperdidelphys	MACN A 1615	Didelphoidea	Didelphidae	Montehermosan	4.95	Goin and Pardiñas,

inexpectata						1996
Hyperdidelphys inexpectata	MACN A 421 (l)	Didelphoidea	Didelphidae	Montehermosan	5.25	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MACN A 421 (r)	Didelphoidea	Didelphidae	Montehermosan	5.20	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MACN 7940	Didelphoidea	Didelphidae	Montehermosan	4.95	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MACN Pv 7949	Didelphoidea	Didelphidae	Montehermosan	5.05	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MACN Pv 7951	Didelphoidea	Didelphidae	Montehermosan	4.95	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MLP 91-III-1-57	Didelphoidea	Didelphidae	Montehermosan	5.28	Goin and Pardiñas, 1996
Hyperdidelphys inexpectata	MACN Pv 7939	Didelphoidea	Didelphidae	Montehermosan	4.92	Goin and Pardiñas, 1996
Hyperdidelphys parvula	MLP 76-IV-21-3	Didelphoidea	Didelphidae	Montehermosan	4.95	Goin and Pardiñas, 1996
Hyperdidelphys parvula	MLP 91-III-1-86a	Didelphoidea	Didelphidae	Montehermosan	4.87	Goin and Pardiñas, 1996
Hyperdidelphys parvula	MMP 633S	Didelphoidea	Didelphidae	Montehermosan	4.44	Goin and Pardiñas, 1996
Lutreolina biforata	MACN Pv 7952	Didelphoidea	Didelphidae	Montehermosan	4.50	Reig, 1952
Lutreolina tracheia	MACN Pv 7914	Didelphoidea	Didelphidae	Montehermosan	4.00	Simpson, 1972
Notocynus hermosicus	MLP 11-91	Sparassodonta	Hathliacynidae	Montehermosan	5.82	Marshall, 1981
Sparassocynus bahiai	MLP 11-119	Didelphoidea	Sparassocynidae	Montehermosan	3.50	Reig and Simpson, 1972
Sparassocynus bahiai	MACN Pv 17909	Didelphoidea	Sparassocynidae	Montehermosan	3.40	Villarroel and Marshall, 1983
Sparassocynus heterotopicus	UM-250	Didelphoidea	Sparassocynidae	Montehermosan	3.20	Villarroel and Marshall, 1983
Thylacosmilus	MACN Pv 7916	Sparassodonta	Thylacosmilidae	Montehermosan	10.00	Marshall, 1976b

atrox						
Thylacosmilus atrox	MACN A 5892	Sparassodonta	Thylacosmilidae	Montehermosan	9.50	Marshall, 1976b
Thylophorops perplanus	MLP 64-XI-12-1	Didelphoidea	Didelphidae	Montehermosan	5.47	Goin et al., 2009
Didelphis crucialis	CS 634	Didelphoidea	Didelphidae	Chapadmalalan	4.80	Reig, 1952
Didelphis crucialis	CS 170	Didelphoidea	Didelphidae	Chapadmalalan	4.90	Reig, 1952
Didelphis crucialis	MMP 634S	Didelphoidea	Didelphidae	Chapadmalalan	5.10	Simpson, 1972
Didelphis reigi	MMP 752S	Didelphoidea	Didelphidae	Chapadmalalan	5.60	Simpson, 1972
Didelphis reigi	MMP 748S	Didelphoidea	Didelphidae	Chapadmalalan	6.60	Simpson, 1972
Hyperdidelphys dimartinoi	MBB 11248 (l)	Didelphoidea	Didelphidae	Chapadmalalan	4.81	Goin and Pardiñas, 1996
Hyperdidelphys dimartinoi	MBB 11248 (r)	Didelphoidea	Didelphidae	Chapadmalalan	4.68	Goin and Pardiñas, 1996
Hyperdidelphys parvula	MACN Pv 10557	Didelphoidea	Didelphidae	Chapadmalalan	4.54	Goin and Pardiñas, 1996
Hyperdidelphys parvula	MLP 328	Didelphoidea	Didelphidae	Chapadmalalan	4.93	Goin and Pardiñas, 1996
Lutreolina cf. *crassicaudata*	MMP 663M	Didelphoidea	Didelphidae	Chapadmalalan	3.80	Simpson, 1972
Lutreolina cf. *crassicaudata*	MMP 1043M	Didelphoidea	Didelphidae	Chapadmalalan	3.80	Simpson, 1972
Sparassocynus derivatus	MMP 1048M	Didelphoidea	Sparassocynidae	Chapadmalalan	3.00	Reig and Simpson, 1972
Sparassocynus derivatus	MMP 340S	Didelphoidea	Sparassocynidae	Chapadmalalan	3.10	Reig and Simpson, 1972
Sparassocynus derivatus	MMP 851M	Didelphoidea	Sparassocynidae	Chapadmalalan	3.50	Reig and Simpson, 1972
Thylacosmilus atrox	MMP 1443	Sparassodonta	Thylacosmilidae	Chapadmalalan	11.50	Goin and Pascual, 1987
Thylatheridium cristatum	MACN Pv 6444	Didelphoidea	Didelphidae	Chapadmalalan	2.70	Reig, 1952
Thylatheridium cristatum	MACN Pv 10904	Didelphoidea	Didelphidae	Chapadmalalan	2.70	Reig, 1952

Thylatheridium cristatum	CS 169	Didelphoidea	Didelphidae	Chapadmalalan	2.60	Reig, 1952
Thylophorops ?chapalmalensis	MMP 576M	Didelphoidea	Didelphidae	Chapadmalalan	9.00	Simpson, 1972
Thylophorops chapalmalensis	CS 354	Didelphoidea	Didelphidae	Chapadmalalan	7.00	Reig, 1952
Thylophorops chapalmalensis	CS 189	Didelphoidea	Didelphidae	Chapadmalalan	6.20	Reig, 1952
Thylophorops chapalmalensis	MMP 354S	Didelphoidea	Didelphidae	Chapadmalalan	7.70	Simpson, 1972
Sparassocynus derivatus	MMP 1041M	Didelphoidea	Sparassocynidae	Marplatan	3.10	Reig and Simpson, 1972
Thylamyini indet.	PVL 6375	Didelphoidea	Didelphidae	Marplatan	1.63	Ortiz et al., 2012
Thylamyini indet.	PVL 6374	Didelphoidea	Didelphidae	Marplatan	1.78	Ortiz et al., 2012
Thylophorops chapalmalensis	MMP 558M	Didelphoidea	Didelphidae	Marplatan	6.70	Simpson, 1972
Thylophorops lorenzinii	MLP 08-III-10-1	Didelphoidea	Didelphidae	Marplatan	8.45	Goin et al., 2009

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APPENDIX 1S. Predatory marsupial specimens and sources of comparative data used in this study.

Taxon	Group	Specimen(s)	References
Acrocyon riggsi	Borhyaenidae	-	Marshall, 1978
Acyon myctoderos	Hathliacynidae	MNHN-Bol-V-003668	Forasiepi et al., 2006; Forasiepi, 2009
Arctodictis munizi	Borhyaenidae	MLP 11-85	Marshall, 1978; Forasiepi, 2009
Arctodictis sinclairi	Borhyaenidae	MLP 85-VII-3-1	Forasiepi, 2009
Arminiheringia auceta	Proborhyaenidae	MACN A 10970-10972	Babot et al., 2002
Borhyaena macrodonta	Borhyaenidae	MACN A 52-390	Marshall, 1978
Borhyaena tuberata	Borhyaenidae	MACN A 5780; MACN A 6203-6265	Sinclair, 1906; Forasiepi, 2009
Borhyaenidium musteloides	Hathliacynidae	MLP 57-X-10-153	Marshall, 1981
Borhyaenidium riggsi	Hathliacynidae	FMNH 14409	Marshall, 1981
Callistoe vincei	Proborhyaenidae	-	Babot et al., 2002; Argot and Babot, 2011
Caluromys derbianus	Caluromyidae	FMNH 69327	Voss and Jansa, 2009
Caluromys lanatus	Caluromyidae	FMNH 114649	Voss and Jansa, 2009
Caluromys philander	Caluromyidae	FMNH 92037	Voss and Jansa, 2009
Cladosictis centralis	Hathliacynidae	-	Marshall, 1981
Cladosictis patagonica	Hathliacynidae	MACN A 5927; MACN A 5950	Marshall, 1981; Forasiepi, 2009
Chironectes minimus	Didelphidae	FMNH 19349, FMNH 69329	Voss and Jansa, 2009
Dasycercus crassicaudata	Dasyuridae	CMNH 18911	-
Dasyurus maculatus	Dasyuridae	CMNH 18912	-
Dasyurus viverrinus	Dasyuridae	CMNH 18913	-
Didelphis virginiana	Didelphidae	CMNH 18880, CMNH 19774, CMNH 19220	Voss and Jansa, 2009
Hesperocynus dolgopolae	Sparassocynidae	-	Forasiepi et al., 2009
Hondadelphys fieldsi	Basal Sparassodont	UCMP 37960	Marshall, 1976; Goin, 1997;

			Forasiepi, 2009
Lutreolina crassicaudata	Didelphidae	FMNH 53944	Voss and Jansa, 2009
Metachirus nudicaudatus	Didelphidae	CMNH 18891	Voss and Jansa, 2009
Marmosa demerarae	Didelphidae	CMNH 18894	Voss and Jansa, 2009
Marmosa murina	Didelphidae	CMNH 18878	Voss and Jansa, 2009
Monodelphis domestica	Didelphidae	DAC Teaching Collection	Voss and Jansa, 2009
'Lycopsis' longirostrus	Basal Borhyaenoid	UCMP 38061	Marshall, 1977a; Goin, 1997; Forasiepi 2009
Lycopsis torresi	Basal Borhyaenoid	MLP 11-113	Marshall, 1979
Notogale mitis	Hathliacynidae	-	Marshall, 1981
Notictis ortizi	Hathliacynidae	-	Marshall, 1981
Notocynus hermosicus	Hathliacynidae	-	Marshall, 1981
Patagosmilus goini	Thylacosmilidae	-	Forasiepi and Carlini, 2010
Perathereutes pungens	Hathliacynidae	-	Marshall, 1981
Proborhyaena gigantea	Proborhyaenidae	MLP 79-XII-18-1	-
Prothylacynus patagonicus	Basal Borhyaenoid	MACN A 706; MACN A 5931; MACN Pv 14453	Marshall, 1979; Forasiepi, 2009
Pseudonotictis chubutensis	Hathliacynidae	-	Martín and Tejedor, 2007
Pseudonotictis pusillus	Hathliacynidae	MACN A 666; MLP 11-26	Marshall, 1981
Sarcophilus harrisii	Dasyuridae	CMNH 18915	-
Sipalocyon gracilis	Hathliacynidae	MACN A 692	Marshall, 1981; Forasiepi, 2009
Sparassocynus derivatus	Sparassocynidae	-	Reig and Simpson, 1972
Stylocynus paranensis	Basal Borhyaenoid	MACN A 5893	Marshall, 1979; Forasiepi, 2009
Thylacinus cynocephalus	Thylacinidae	CMNH 18916	Forasiepi, 2009
Thylacosmilus atrox	Thylacosmilidae	MLP 35-X-4-1	Riggs, 1934; Goin and Pascual, 1987; Forasiepi, 2009

APPENDIX 2S – List and description of 307 characters used in the phylogenetic analysis. Characters marked by an asterisk (*) represent ordered characters. Changes in coding from Forasiepi (2009) are noted at the bottom of this appendix.

1. Length of the skull

    0 Short (Less than twice width at level of zygomatic arch)

    1 Long (Greater than twice width at level of zygomatic arch)

2. Length of rostrum*

    0 Less than 1/3 total length of skull

    1 Between 1/3 and 1/2 total length of skull

    2 More than 1/2 total length of skull

3. Width of braincase versus maximum postorbital width

    0 Braincase wider than maximum postorbital width

    1 Braincase narrower than maximum postorbital width

4. Dimensions of braincase

    0 As wide as long, or slightly wider than long

    1 Much wider than long

5. Level of the palate relative to the basicranium

    0 Palate lower than basicranium

    1 Palate and basicranium at the same level

6. Paracanine fossa

0 Formed by both maxilla and premaxilla

1 Formed solely by premaxilla

7. Precanine notch

0 Absent

1 Present

8. Lateral palatal process of premaxilla

0 Anterior to or just reaches anterior border of canine alveolus

1 Posterior to anterior border of canine alveolus

9. Posterior border of incisive foramen

0 Anterior to or just reaches anterior border of canine alveolus

1 Posterior to anterior border of canine alveolus

10. Position of medial palatal process of premaxilla

0 Horizontal

1 Inclined dorsally, forming an incisive fossa

11. Dorsal process of premaxilla in narial platform

0 Absent

1 Present

12. Posteriormost point of premaxilla-nasal contact*

0 Anterior or at the level of the canine

1 Posterior to the canine

2 Posterior to p2

13. Anterior extent of nasals

0 Protrude anteriorly, obscuring the nasal opening in dorsal view

1 Retracted posteriorly, exposing the narial opening in dorsal view

14. Shape of naso-frontal suture

0 Open W-shape or posteriorly convex

1 Acute W or V-shaped

15. Postorbital processes

0 Absent or indistinct

1 Well-developed

16. Fronto-maxillary or naso-lacrimal contact

0 Naso-lacrimal contact

1 Fronto-maxillary contact

17. Angle of maxillo-jugal contact

0 More than 140 degrees

1 Between 95 and 140 degrees

18. Location of the infraorbital foramen*

0 Anterior or dorsal to the anterior root of P3

1 Dorsal to the posterior root of P3

2 Dorsal to M1

3 Posterior to M1

19. Flaring of maxillary "cheeks" behind infraorbital foramen

0 Present

1 Absent

20. Palatal length/width ratio

0 Less than or equal to 1.5

1 Greater than 1.5

21. Number of palatal pits*

0 None

1 One (between M3-M4)

2 Two (between M2-M3 and M3-M4)

3 Three (one between each pair of molars)

22. Maxillopalatine fenestrae

0 Absent

1 Present

23. Major palatine foramen

0 One pair opening in maxilla, palatine, or maxillo-palatine suture

1 Many small foramina on the surface of the maxilla

24. Minor palatine foramen*

0 Large

1 Small

2 Incomplete or absent

25. Posterior extent of palatines

0 Extend to the level of the last molar

1 Extend beyond the level of the last molar

26. Posterior end of palatines

0 Concave posteriorly (single-arched)

1 Concave posteriorly (double-arched)

2 Straight due to presence of a palatine torus

27. Palatine reaches level of infraorbital canal

0 Present

1 Absent

28. Position of sphenorbital foramen

0 Posterior to the level of the posterior border of lacrimal

1 Anterior or at the level of the posterior border of lacrimal

29. Development of pterygoids*

0 Well-developed and expanded on medial side, with midline contact

1 Well developed and expanded on medial side, but no midline contact

2 Reduced, not expanded on medial side

30. Anterior extent of lacrimal

0 Restricted to orbit

1 Extending onto rostrum

31. Lacrimal tubercle

0 Present

1 Absent

32. Position of lacrimal foramina

0 Within orbit

1 Exposed on face

33. Number of lacrimal foramina

0 Two

1 One

34. Glenoid process of jugal

0 With articular facet

1 Without articular facet

35. Orbital crest

0 Absent

1 Present

36. Interparietal

0 Present

1 Absent

37. Shape of fronto-parietal suture

    0 Formed by posterior wedge of frontals

    1 Straight

    2 Formed by anterior wedge of parietals

38. Parietal-alisphenoid or fronto-squamosal contact

    0 Parietal-alisphenoid

    1 Fronto-squamosal

39. Width of glenoid cavity

    0 Less than twice anteroposterior length

    1 More than twice anteroposterior length

40. Distinct preglenoid process of squamosal

    0 Absent

    1 Present

41. Morphology of postglenoid process*

    0 Wide and low

    1 Wider than high

    2 As wide as high

42. Location of postglenoid foramen

    0 Behind postglenoid process

    1 Medial to postglenoid process

43. Suprameatal foramen

    0 Above squamosal crest

    1 Below squamosal crest

44. External acoustic meatus

    0 Longer than wide

    1 Wider than long

45. Paracondylar process of exoccipital and post-tympanic process of squamosal

    0 Paracondylar process larger

    1 Both processes similar in length

46. Orientation of the post-tympanic and/or paracondylar processes

    0 Ventrally projecting

    1 Anteroventrally projecting

47. Alisphenoid glenoid process

    0 Absent

    1 Present

48. Optic foramen and sphenorbital fissure

    0 Separate (orbital foramen present)

    1 Joined (orbital foramen absent)

49. Transverse foramen

    0 Absent

1 Present

50. Tympanic process of alisphenoid

0 Absent

1 Present

51. Hypotympanic sinus

0 Absent

1 Formed by squamosal, petrosal, and alisphenoid

2 Formed by alisphenoid and petrosal

52. Medial process of the squamosal

0 Absent

1 Present

53. Concave process of alisphenoid contributing to antero-dorsal portion of hypotympanic sinus

0 Present

1 Absent

54. Extra sinuses posterior to the hypotympanic sinus

0 Absent

1 Present

55. Pneumatization of squamosal

0 Absent

1 Present

56. Eustachian foramen

    0 No impression

    1 Notch on the alisphenoid

    2 Foramen on petrosal

57. Composition of foramen ovale

    0 Between petrosal and alisphenoid

    1 On alisphenoid

58. Secondary foramen ovale

    0 Absent

    1 Present

59. Foramen for the greater petrosal nerve

    0 Distinct notch or foramen

    1 Without distinct notch or foramen

60. Position of carotid foramen

    0 Anterior to the basisphenoid-basoccipital suture

    1 At the level of the basisphenoid-basoccipital suture

61. Hypoglossal foramina

    0 Two or more

    1 One

62. Groove between hypoglossal foramina and foramen for inferior petrosal sinus

0 Shallow or absent

1 Well-defined with prominent lateral borders

63. Size of jugular foramen relative to fenestra vestibuli

0 Subequal

1 Larger

64. Jugular fossa

0 Absent

1 Present

65. Median keel in basioccipital

0 Absent

1 Present

66. Median crest of basisphenoid/presphenoid (sphenoid crest)

0 Present

1 Absent

67. Dorsal margin of the foramen magnum

0 Formed only by exoccipitals

1 Formed by both exoccipitals and supraoccipital

68. Mastoid foramen

0 Present

1 Absent

69. Connection between condylar articular facets in ventral view

    0 Absent

    1 Present

70. Inclination of the major axis of the condyle in posterior view

    0 Inclined (less than 55 degrees)

    1 Vertical to subvertical (between 90 and 55 degrees)

71. Supraoccipital in posterior view

    0 Concave

    1 Convex or flat

72. Sagittal crest*

    0 Prominently developed (extending to frontals)

    1 Weakly developed (not extending to frontals)

    2 Absent

73. Position of nuchal crest

    0 At or posterior to the level of the condyles

    1 Anterior to the condyles

74. Morphology of the stapes

    0 Columelliform (not perforated by stapedial foramen)

    1 Bicrurate (perforated by stapedial foramen)

75. Ectotympanic shape

0 Ring-shaped

1 Expanded

76. Position of petrosal

0 At the level of the ventral margin of the braincase

1 Dorsal to the ventral level of the braincase

77. Mastoid portion of the petrosal

0 Contributes to the occipital shield

1 Excluded from the occipital shield

78. Petrosal-squamosal fusion

0 Absent

1 Present

79. Cavum epiptericum

0 Floored by petrosal and alisphenoid

1 Floored primarily or exclusively by alisphenoid

80. Internal acoustic meatus

0 Deep with thick prefacial commissure

1 Shallow with thin prefacial commissure

81. Subarcuate fossa

0 Deep

1 Shallow

82. Deep sulcus for carotid artery on anterior end of promontorium

    0 Absent

    1 Present

83. Epitympanic wing of petrosal

    0 Present

    1 Absent

84. Prootic canal

    0 Present

    1 Absent

85. Rostral tympanic process of petrosal*

    0 Absent or low ridge

    1 Tall ridge restricted to the anterior half of the promontorium

    2 Tall ridge reaching anterior half of promontorium

86. Paroccipital process of petrosal

    0 Distinct process

    1 Indistinct or absent

87. Position of hiatus fallopii

    0 At a distance from the anterior edge of the petrosal

    1 On the anterior edge of the petrosal

88. Stylomastoid foramen

0 Absent

1 Present

89. Floor of cavum supracochleare

0 Absent

1 Present

90. Stapedial ratio

0 Rounded, less than 1.8

1 Elliptical, more than 1.8

91. Contribution of squamosal to epitympanic recess

0 Small

1 Extensive

92. Fossa incudis

0 Continuous with epitympanic recess

1 Separated from the epitympanic recess

93. ‘Petrosal crest’ (sensu Muizon, 1999)

0 Present

1 Absent

94. Stapedial fossa

0 Twice the size of fenestra vestibuli

1 Small and shallow

95. Foramina for temporal rani

0 On parietal or squamosal

1 Absent

96. Post-temporal canal or notch

0 Present

1 Absent

97. Shape of dentary (depth below m3/m4 embrasure/total length of dentary)*

0 Shallow (less than 0.15)

1 Intermediate (between 1.5 and 2.0)

2 Deep (greater than 2.0)

98. Ventral margin of jaw behind m4

0 Straight

1 Curved

99. Mandibular symphysis

0 Unfused

1 Fused

100. Posteriormost mental foramen*

0 Below p3

1 At p3/m1 embrasure

2 Below m1

3 Posterior to m1

101. Retromolar space

0 Absent

1 Present

102. Labial mandibular foramen inside masseteric fossa

0 Absent

1 Present

103. Shape of the angular process*

0 Shelf-like (ASL/AL > 0.81)

1 Intermediate (0.72 < ASL/AL < 0.81)

2 Rod-like (ASL/AL < 0.72)

104. Angle between anterior edge of coronoid process and tooth row*

0 Between 95 and 105 degrees

1 Between 106 and 125 degrees

2 Greater than 126 degrees

105. Position of the mandibular foramen*

0 Posterior to the mid-point of the coronoid process

1 At the mid-point of the coronoid process

2 Anterior to the mid-point of the coronoid process

106. Morphology of mandibular condyle

0 Subspherical

1 Cylindrical

107. Position of mandibular condyle relative to tooth row

0 Below or at level of tooth row

1 Above level of tooth row

108. Number of upper incisors*

0 Five

1 Four

2 Three

3 Two or fewer

109. Shape of first upper incisor*

0 Enlarged

1 Subequal to or smaller than remaining incisors

2 Absent

110. Size of I4 versus I3

0 I4 subequal to I3

1 I4 larger

111. Size of I5 versus I4*

0 I5 subequal to I4

1 I5 smaller than I4

2 I5 absent

112. Shape of upper incisor arcade*

0 Parabolic

1 Slightly anteriorly convex

2 Transverse

113. Number of lower incisors*

0 Four

1 Three

2 Two or less

114. Staggered lower incisor

0 Absent

1 Present

115. Shape of canines*

0 Relatively small

1 Enlarged

2 Hyper-developed and saber-like

116. Roots of canines

0 Closed in adults

1 Open on the upper canines only

2 Open in both pairs of canines

117. Surface of the roots of the canines

0 Smooth

1 With small grooves and ridges

118. Number of premolars

0 Three

1 Two or less

119. Orientation of P1/p1 relative to tooth row*

0 Parallel to tooth row (less than 19 degrees)

1 Obliquely oriented to tooth row (20 degrees or more)

2 Transversely oriented to tooth row

120. Diastema anterior to P1

0 Absent

1 Present

121. Diastema posterior to P1

0 Present

1 Absent

122. Diastema posterior to p1

0 Present

1 Absent

123. Shape of premolars

0 Uninflated

1 Inflated, with apical wear strongly developed

124. Cusp on the posterior heel of P3

0 Absent or vestigial

1 Well-developed

125. Size of p2

0 Smaller than p3

1 Larger than p3

126. Change in height of lower premolars

0 Increase gradually in height

1 Abrupt change in size between p1 and p2-3

2 Abrupt change in size between p1-2 and p3

127. Roots of lower premolars*

0 Flat (as wide as crown)

1 Bulbous on only one premolar

2 Bulbous on all premolars and some molars

128. Anterolabial cingulum or cingulid cusp on m2

0 Absent

1 Present

129. Symmetry of main cusp on p3

0 Anterior edge of cusp more convex than posterior edge

1 Both edges similar in curvature

130. Timing of eruption between dP/p3 and M/m3-4

0 P3/p3 and M3/m3 erupt almost simultaneously

1 P3/p3 and M4/m4 erupt almost simultaneously

131. Morphology of dp3

0 With trigonid and talonid

1 With a main cusp and smaller accessory cusps

132. Size of molars increasing posteriorly

0 Moderate posterior increase in size

1 Marked posterior increase in size

133. Width of M4 relative to M3

0 Narrower than M3

1 Wider than M3

134. Size of metacone relative to paracone (based on M2 when possible)*

0 Slightly smaller

1 Subequal to slightly larger

2 Larger

135. Position of the metacone relative to paracone (based on M2 when possible)

0 Approximately at the same level

1 Lingual

136. Shape of paracone and metacone

0 Conical

1 Subtriangular with a flat labial face

137. Bases of paracone and metacone

0 Adjoined

1 Separate

138. Centrocrista

0 Straight

1 V-shaped

139. Metacone on M4*

0 Present and distinct

1 Extremely reduced

2 Absent

140. Number of roots on M4

0 Three

1 Two or less

141. Size of protocone*

0 Vestigial or absent

1 Small and without basin

2 Small, with basin

3 Somewhat expanded anteroposteriorly

4 Greatly expanded anteroposteriorly

142. Height of protocone*

0 Less than 60% of para/metacone height

1 Between 60 to 80% para/metacone height

2 Greater than or equal to 80% of para/metacone height

143. Paraconule and metaconule

0 Present

1 Absent

144. Wing-like cristae associated with para- and metaconules

0 Absent

1 Present

145. Relative position of para- and metaconule (based on M2 when possible)

0 At or lingual to the midpoint between protocone and para/metacone

1 Closer to the paracone or metacone

146. Orientation of the preparacrista (based on M2 when possible)

0 Nearly perpendicular to long axis of tooth

1 Oriented anterobucally to long axis of tooth

2 Absent

147. Lengths of preparacrista on M3 and M4

0 M4 preparacrista shorter

1 M4 preparacrista subequal or longer than M3 preparacrista

148. Postmetacrista (based on M3 if possible)

0 Strongly developed (longer than preparacrista)

1 Weakly developed (shorter than preparacrista)

149. Preparacingulum (based on M3 if possible)*

0 Expanded

1 Short

2 Absent

150. Postcingulum

0 Absent or weakly developed

1 Present

151. Stylar shelf (based on M3 if possible)*

0 Uniform in width, 50% or more of total transverse width

1 Uniform in width, but less than 50% of total transverse width

2 Slightly reduced labial to protocone

3 Strongly reduced labial to protocone

4 Vestigial to absent

152. Deep ectoflexus on upper molars*

0 On M2 and M3

1 On M3 only

2 Strongly reduced or absent

153. Stylar cusp A

0 Smaller than stylar cusp B

1 Large, subequal to stylar cusp B

154. Stylar cusp B

0 Large

1 Small or forming an ectocingulum

2 Vestigial or absent

155. Stylar cusp C

0 Absent

1 Present

156. Stylar cusp D

0 Absent

1 Present, smaller than stylar cusp B

2 Present, larger than stylar cusp B

157. Stylar cusp E

0 Present and distinct

1 Indistinct or absent

158. Size of m4

0 m4 subequal or smaller tham m3

1 m4 larger than m3

159. Posterior lobe of the crown lower than anterior lobe*

0 Absent

1 Present only on m1-2 and slightly developed

2 Present on m1-3 and strongly developed

160. Talonid of m4 relative to m3

0 Talonid of m4 reduced and narrower than m3

1 Talonid of m4 similar to m3

161. Alignment of the main cusps of m1

0 Reverse triangle acute

1 Single longitudinal row

162. Trigonid configuration posterior to m1*

0 Open, with paraconid anterolingual

1 Acute, with paraconid more posteriorly placed

2 Anteroposteriorly compressed

163. Metaconid position

0 Aligned with paraconid

1 Metaconid at extreme lingual margin of tooth

164. Orientation of postprotocristid/metacristid

0 Transverse to lower jaw

1 Parallel or oblique to lower jaw

165. Trigonid versus talonid length (m1-m3)*

0 Trigonid subequal to talonid

1 Trigonid larger than talonid

2 Trigonid smaller than talonid

166. Trigonid versus talonid width (m1-m3)*

0 Very narrow (subequal to the base of the metaconid or protoconid)

1 Narrow (but wider than the base of the metaconid or protoconid)

2 Subequal to wider than the trigonid

167. Trigonid versus talonid height (based on m2-3)*

0 Talonid less than 20% of trigonid height

1 Talonid 25-35% of the trigonid height

2 Talonid 40-60% of trigonid height

168. Metaconid on m1

0 Present

1 Absent

169. Metaconid on m2-4

0 Present

1 Absent

170. Paraconid height relative to metaconid (m2-4)*

0 Taller

1 Subequal

2 Lower

171. Height of protoconid

0 Tallest cusp of the trigonid

1 Subequal to metconid or paraconid

172. Mesiolingual vertical crest of the paraconid

0 Rounded

1 Forming a keel

173. Anterolabial cingulum*

0 Well-developed, extending from the protoconid to paraconid basins

1 Reduced, extended only on the base of the paraconid

2 Absent

174. Paraconid of m1

0 Distinct

1 Low and confluent with cingulum

175. Length versus width of talonid basin (based on m2 when possible)*

0 Longer than wide

1 Subequal

2 Wider than long

176. Location and presence of hypoconid

0 Appoximately at the middle of the buccal margin of the talonid

1 At the posterobuccal corner of the tooth

2 Absent

177. Shape of the entoconid

0 Conical

1 Labio-lingually compressed

2 Vestigial or absent

178. Height of entoconid

0 Smaller than the hypoconid

1 Subequal to larger than the hypoconid

179. Location of entoconid

0 At the posterolingual corner of the tooth

1 Between the metaconid and posterior tooth margin

180. Position of hypoconulid

0 In posteromedial position

1 Lingually placed and twinned with entoconid

181. Hypoconulid of m4*

0 Tall

1 Short

2 Absent

182. Pre-entocristid

0 Present

1 Absent

183. Direction of the pre-entocristid

0 To the base of the trigonid

1 Lingual to the trigonid

184. Cristid obliqua*

0 Lingual to the carnassial notch

1 To the carnassial notch

2 Labial to the carnassial notch

185. Lower molar hypoflexid

0 Deep (40-50% of talonid width)

1 Shallow or absent

186. Carnassial notch in cristid obliqua

0 Absent

1 Present

187. Labial postcingulum

0 Absent

1 Present

188. Atlas intervertebral foramen

0 Absent

1 Present

189. Atlas transverse foramen

0 Absent

1 Present

190. Ventral foramen on transverse process of axis

0 Absent

1 Present

191. Posterior extent of atlantal transverse processes

0 Anterior or just reaches caudal facets for axis

1 Extend caudally beyond level of caudal facets for axis

192. Anterior extent of atlantal transverse processes

0 Does not reach level of atlantal foramen or groove

1 Extends anterior beyond atlantal foramen or groove

193. Shape of cranial facets

0 Only concave

1 Dorsal edge curved

194. Atlas and intercentrum

0 Unfused

1 Fused

195. Axis transverse foramen

0 Absent, represented by a notch

1 Present, enclosed

196. Axis posterior spinous process extension

0 Extends beyond the level of the postzygapophyses

1 Extends to the level of the postzygapophyses

197. C3-C4 ventral sagittal process

0 Absent

1 Present

198. C5 transverse process heads overlap transversally

0 Absent

1 Present

199. C5 and T1 body length

0 C5 subequal or longer than T1

1 C5 shorter than T1

200. C6 spinous process

0 Protuberance

1 Lamina

201. C7 transverse foramen

0 Absent

1 Represented by a notch

2 Complete foramen

202. Shape of anterior face of C7 centrum

0 Circular to ovoid

1 Rectangular to trapezoidal

203. Position of tallest spinous process of thoracic vertebrae

0 On T1

1 On T2

2 On T3

204. Anticlinal vertebra

0 On lumbar

1 On thoracic

2 No anticlinal vertebra

205. Foramen on dorsal arch of last lumbar vertebra

0 Present

1 Absent

206. Metapophyses in third lumbar vertebra anterior to last

0 Absent or weak

1 Present

207. Ventral median keel on lumbar vertebra

0 Absent

1 Present

208. Auricular process of sacrum

0 Developed on two sacral vertebrae

1 Developed on one sacral vertebra

209. Size of sacral spinous process

0 Shorter than last lumbar

1 Taller than last lumbar

210. Length of the tail

0 Shorter than twice the length of the precaudal vertebral column

1 Greater than twice the length of the precaudal vertebral column

211. Angle between scapular spine and dorsal border of scapula

0 Acute or almost straight (between 80 and 95 degrees)

1 Obtuse (between 100 and 110 degrees)

212. Coracoid process

0 Large (extends beyond medial border of glenoid cavity)

1 Small (just reaches medial border of glenoid cavity)

213. Ventral extension of acromion process

0 Extends ventrally below glenoid cavity

1 Does not extend ventrally below glenoid cavity

214. Width of infraspinous fossa

0 Less than 1/4 its length

1 More than 1/4 its length

215. Width of the acromion process at the level of the neck*

0 Wider than infraspinous fossa

1 Subequal

2 Narrower than infraspinous fossa

216. Infraspinous/supraspinous fossa width at the level of the neck

0 Supraspinous fossa subequal or wider

1 Supraspinous fossa narrower

217. Scapular notch

0 More than 130 degrees

1 Between 90 and 130 degrees

218. Clavicle

0 Present

1 Absent

219. Medial process for teres major

0 Absent

1 Present

220. Tricipital line of humerus*

0 Absent

1 Ridge or crest

2 Massive crest continuous with deltopectoral crest

221. Capitulum for radius on humerus

0 Spherical

1 Cylindrical

222. Entepicondylar foramen

0 Present

1 Absent

223. Olecranon fossa or foramen

0 Large fossa

1 Foramen

224. Laminar supinator crest/ectepicondylar crest*

0 Large

1 Intermediate

2 Absent

225. Greater tuberosity height relative to humeral head height

0 Greater tuberosity subequal or lower in height to humeral head

1 Greater tuberosity is higher

226. Development of greater tuberosity in proximal view

0 Small (less than half the anteroposterior length of head)

1 Large (greater than or equal to half the anteroposterior length of head)

227. Extension of the deltoid crest

0 Restricted to proximal half of humerus

1 Reaches distal half of humerus

228. End of deltoid crest

0 Merging with diaphysis

1 Forming a distinct angle or process

229. Relative heights of trochlea and capitulum in lateral view*

0 Longer proximal extension of capitulum

1 Subequal

2 Longer proximal extension of trochlea

230. Humerus medial epicondyle size

0 Large

1 Small

231. Humerus distal end size

0 Large

1 Small

232. Lateral extension of capitulum

0 Rounded

1 Straight

233. Depth of intercondylar notch in posterior view

0 Wide and relatively shallow concave

1 Narrower and concave posteriorly

234. Curvature of the posterior border of the humeral shaft

0 Curved

1 Straight

235. Medial development of the ulnar anconeal process

0 Does not protrude beyond medial border of olecranon process

1 Medially protruding

236. Medial curvature of the ulna

0 Present

1 Absent

237. Posterior border of the ulna

0 Anteriorly curved

1 Straight or posteriorly curved

238. Shape of articular facet for humerus

0 Anteroposteriorly compressed

1 Circular

239. Distal shaft of radius

0 Oval (wider than long)

1 Rounded (almost as wide as long)

240. Prepollex

0 Absent

1 Present

241. Distolateral process of scaphoid*

0 Absent

1 Present, does not separate lunate from magnum

2 Present, separates lunate from magnum

242. Number of plantar tubercles (distal heads) on trapezium

0 Two

1 One

243. Angle between transverse axis of proximal and distal epiphyses of metacarpal I

0 Absent

1 Present

244. Orientation of ilium relative to ischium

0 Prominent dorsally

1 Aligned with ischium

245. Tuberosity for rectus femoris muscle

0 Absent

1 Protuberance

2 Depression

246. Length of iliac neck*

0 Longer than 15% total pelvis length

1 Between 6 and 15% total pelvis length

2 Less than 6% total pelvis length

247. Greater sciatic notch

0 Greater than 120 degrees

1 Between 90 and 115 degrees

248. Iliac and gluteous fossa

0 No fossa

1 Two fossa subequal in size

2 Gluteous fossa larger

249. Epipubic bones

0 Present

1 Absent

250. Proximal size of epipubic bones

0 Short

1 Long

251. Torsion between proximal and distal epiphyses of femur

0 Present

1 Absent

252. Relative heights of greater trochanter and femoral head

0 Greater trochanter lower or equal in height to femoral head

1 Greater trochanter higher than femoral head

253. Lesser trochanter of femur

0 Present

1 Vestigial or absent

254. Femoral condyles*

0 Lateral condyle wider than medial condyle

1 Subequal

2 Medial condyle wider than lateral condyle

255. Ossified patella

0 Absent

1 Present

256. Parafibula

0 Present

1 Absent

257. Femoro-fibular articulation

0 Present

1 Absent

258. Tibia length relative to femur length

0 Tibia subequal to or longer than femur

1 Tibia shorter than femur

259. Proximal dimensions of tibia*

0 Larger mediolaterally than anteroposteriorly

1 Subequal

2 Larger anteroposteriorly than mediolaterally

260. Tibia shape

0 Sigmoid

1 Straight

261. Torsion between proximal and distal epiphyses of tibia

0 Present

1 Absent

262. Type of distal articulation of tibia

0 Spiral

1 Sagittal

263. Posterior shelf of tibia

0 Present but does not extend posteriorly beyond the medial astragalotibial facet

1 Present and extends posteriorly beyond the medial astragalotibial facet

264. Distal malleolus of tibia

0 Indistinct or absent

1 Distinct

265. Angle between medial and lateral astragalotibial facets*

0 90 degrees

1 Intermediate

2 180 degrees

266. Astragalonavicular facet extends onto ventromedial side of head

0 Absent

1 Present

267. Width and height of navicular facet in distal view

0 Transversely wider

1 Dorsoventrally wider

268. Visibility of medial plantar tuberosity in dorsal view

0 Not visible

1 Visible

269. Angle between lateral tibial and fibulal facets

0 No angle

1 With angle

270. Medial extent of sustentacular facet

0 Does not reach the medial edge of neck

1 Reaches the medial edge of neck

271. Astragalar canal

0 Present

1 Absent

272. Width of astragalar neck

0 Neck wider than head

1 Neck narrower or as wide as head

273. Major orientation of posterior astragalocalcaneal facet

0 Anteromedial-posterolateral

1 Posteromedial-anterolateral

274. Malleolar shelf of astragalus

0 Absent

1 Present

275. Astragalo-distal tuber

0 Absent

1 Present

276. Connection between astragalonavicular facet and sustentacular facet

0 Present

1 Absent

277. Longest dimension of sustentacular facet

0 Anteromedial-posterolateral

1 Sagittally longer

2 Transversely longer

278. Orientation of the calcaneoastragalar facet*

0 Medial

1 Intermediate

2 Dorsal

279. Calcaneal peroneal tubercle

0 Protuberance

1 Crest-like

280. Position of peroneal tubercle

0 Anterior, non-protruding

1 At a distance from the anterior end of the calcaneus

281. Calcaneal peroneal groove for the peroneous longus

0 Indistinct or weakly developed

1 Distinct, deep separation

282. Position of sustentaculum

0 Reaches anterior end of calcaneus

1 Subterminal

283. Outline of sustentacular process

0 Triangular or rounded

1 Rectangular

284. Mesiolateral orientation of sustentacular facet

0 Medial

1 Dorsal

285. Anteroposterior orientation of sustentacular facet

0 Dorsal

1 45 degrees dorsoanteriorly

286. Sustentacular facet morphology

0 Slightly concave or flat

1 Posteriorly convex

287. Secondary distal calcaneoastragalar facet

0 Absent

1 Present

288. Sustentacular and posterior calcaneoastragalar facets

0 Separate

1 Merged

289. Calcaneal facet for fibula

0 Present

1 Absent

290. Orientation of calcaneal facet for fibula

0 Dorsal

1 Lateral

291. Length of the tuber calci

0 Longer than the body

1 Shorter than the body

292. Medial curvature of the tuber calci

0 Present

1 Absent

293. Ventral curvature of the tuber calci

0 Present

1 Absent

294. Proximal calcaneocuboid facet

0 Absent

1 Present

295. Angle between proximal and distal areas of calcaneocuboid facet

0 No angle

1 Oblique calcaneocuboid facet

296. Spatial relationship between navicular and entocuneiform

0 Entocuneiform anterior to navicular

1 Entocuneiform extends proximally medial to the distal area of the navicular

297. Angle between navicular and distal metatarsal facets of ectocuneiform

0 Oblique

1 Parallel to the distal facet

298. Prehallux

0 Absent

1 Present

299. Metatarsal V proximal process

0 Does not extend ventral to cuboid

1 Extends ventral to cuboid

300. Proximal ends of metatarsal II and III

0 Subequal in length

1 Mt II extends more proximally than Mt III

301. Ridge on proximal articular facet of metatarsal I

0 Absent

1 Present

302. Mt III thickness relative to that of Mt IV

0 Mt III thicker or subequal to Mt IV

1 Mt III thinner

303. Mt III thickness relative to that of Mt I

0 Mt I thicker than Mt III

1 Mt III thicker than Mt I

304. Median keel on palmar/plantar surface of metapodials

0 Sharp

1 Blunt

305. Foot ungual phalanx of digit IV in proximal view

0 Larger dorsoventrally than mediolaterally

1 Larger mediolaterally than dorsoventrally

306. Groove on dorsal surface of tip of ungual phalanges

0 Absent

1 Present

307. Dorsal border of ungual phalanges

0 Forming a crest-like border

1 Rounded

Changes in Character Coding from Forasiepi (2009)

General Changes

- Character 21 (number of palatal pits) has been reordered and state “3” (Three palatal pits) has been added to incorporate UF 27881 and *Sipalocyon*.
- Character 22 (maxillopalatine fenestrae) was termed “palatal vacuities” in Forasiepi (2009). However, several types of palatal vacuities are present in marsupials, the presence or absence of some of which have been considered phylogenetically informative (Voss and Jansa, 2009; Travouillon et al., 2010). On the other hand, none of the species coded “present” for this character in Forasiepi (2009) lack the maxillopalatine fenestrae, and as a result the character has been changed to reflect this feature.
- Character 24 (minor palatine foramen) which represents a clear morphocline, has been considered ordered in this analysis.
- Character 72 (sagittal crest), which represents a clear morphocline, has been reordered and is considered ordered in this analysis.
- Character 103 (shape of the angular process), represents a clear morphocline and has been coded ordered in this analysis.
- Characters 104 (angle between anterior edge of coronoid process and tooth row) and 105 (position of mandibular foramen) represent a clear morphocline, and therefore have been reordered and are considered ordered in this analysis.
- Character 108 (number of upper incisors), state “3” (no upper incisors) is changed to “two or fewer”, after the work of Churcher (1985).
- Characters 109 (shape of first upper incisor) and 111 (size of I5 versus I4) were coded as inapplicable for those taxa where the I1 or I5 were absent, as opposed to making their absence a separate character states. Both characters were coded as unordered.
- Character 116 (roots of canines) was coded as unordered, as it is still uncertain how sparassodonts acquired rootless canines. Coding this character as ordered would imply that rootless upper canines came first, which is not certain.
- Character 134 (size of metacone relative to paracone), represents a clear morphocline and has been coded ordered in this analysis.
- Character 141 (size of protocone), represents a clear morphocline and has been coded ordered in this analysis.
- Character 142 (height of protocone), represents a clear morphocline and has been coded ordered in this analysis.

- Character 152 (deep ectoflexus on upper molars), represents a clear morphocline and has been coded ordered in this analysis.
- Character 165 (trigonid versus talonid length), which represents a clear morphocline, has been reordered and is considered ordered in this analysis.
- Character 166 (trigonid versus talonid width), represents a clear morphocline and has been coded ordered in this analysis.
- Character 167 (trigonid versus talonid height), which represents a clear morphocline, has been reordered and is considered ordered in this analysis.
- Character 170 (paraconid height relative to metaconid on m2-4), represents a clear morphocline and has been coded ordered in this analysis.
- Character 184 (cristid obliqua), which represents a clear morphocline, has been reordered and is considered ordered in this analysis. Taxa for which the cristid oblique is indistinct or absent have been coded as "- ".
- Character 201 (C7 transverse foramen), represents a clear morphocline and has been coded ordered in this analysis.
- Character 220 (tricipital line of humerus), represents a clear morphocline and has been coded ordered in this analysis.
- Character 254 (femoral condyles), represents a clear morphocline and has been coded ordered in this analysis.
- Character 259 (proximal dimensions of tibia), represents a clear morphocline and has been coded ordered in this analysis.
- Character 265 (angle between medial and lateral astragalotibial facets), represents a clear morphocline and has been coded ordered in this analysis.
- Character 278 (orientation of the calcaneoastragalar facet), represents a clear morphocline and has been coded ordered in this analysis.

Specific Changes

- Character 75 (ectotympanic shape) for *Pucadelphys andinus* was coded "0" based on Horovitz et al. (2009) and Beck (2012), character 79 (cavum epiptericum) was coded "0 & 1" based on Ladevèze and Muizon (2007) and

Beck (2012), and characters 193, 203, 265, 268, 269, 270, and 271 were coded based on Horovitz et al. (2009) and Beck (2012).

- Characters 1, 4, 8, 9, 18, 20, 22, 24, 27, 29, 30, 36, 43, 58, 61, 67, 79, 83, 97, 107, 112, 119, 120, 126, 168, 181, 188, 189, 191, 192, 193, 195, 200, 216, 221, 222, 225, 227, 229, 245, 252, 253, 258, 266, 268, 269, 270, 271, 272, 276, 300 were coded for *Andinodelphys cochabambensis* were coded or modified based on Muizon et al. (1997) Ladevèze and Muizon (2007) and cross-referenced with Beck (2012).
- Characters 265, 268, 269, 270, 271, and 276 were coded for *Mayulestes ferox* based on Horovitz et al. (2009) and Beck (2012).
- Characters 57, 79, 83, 84, 89, 96, 108, 143, 215, 216, 220, 225, 231, 245, 252, 253, 257, 258, 259, 262, 263, 265, 266, 267, 268, 269, 270, 271, 272, 273, 276, 279, 280, 282, 284, 285, 286, 288, 289, 290, and 294 for *Herpetotherium* were coded or modified based on Horovitz et al. (2009) and Beck (2012).
- Characters 1, 2, 3, 5, 8, 9, 15, 18, 30, 32, 37, 38, 49, 50, 52, 57, 60, 72, 73, 79, 80, 81 (Beck), 82, 83, 84, 85, 86, 88, 89, 90, 92, 93, 96, 134, 138, 143, 157, 184, 224, 258 for the composite taxon Peradectidae were coded or modified based on Horovitz et al. (2009) and Beck (2012).
- Characters 97, 99, 100, 107, 113, 115, 118, 119, 122, 125, 126, 158, 168, and 181 for *Patene simpsoni* were coded based on Goin et al. (1986)
- *Hondadelphys* has only three lower incisors according to Goin (1997), not four, and as a result character 113 (number of lower incisors) has been modified accordingly.
- For *Notogale mitis*, characters 119 (orientation of P1/p1), 120 (diastema anterior to P1), and 121 (diastema posterior to P1) were coded as “0”, “1”, and “1”, respectively, based on observations of YPM VPPU 021871
- Additional characters for *Notogale mitis*, specifically characters 100 (posteriormost mental foramina), 113 (number of lower incisors), 114 (staggered lower incisor), 115 (size of canines), 118 (number of premolars), 119 (orientation of P/p1 relative to tooth row), 122 (diastema posterior to p1), 125 (size of p2), and 168 (metaconid on m1), were coded based on Villarroel and Marshall (1982).
- Character 100 (posteriormost mental foramina) for *Sallacyon hoffstetteri* was coded “2/3” based on Villarroel and Marshall (1982)
- Character 194 (fusion between atlas and intercentrum) is here coded as polymorphic for *Acyon myctoderos*, based on additional undescribed specimens of this species in the collections of the Florida Museum of Natural History.

- Character 119 (orientation of first premolar to the toothrow) for '*Lycopsis*' *longirostrus* is changed from state "0" (parallel to tooth row) to "1" (obliquely oriented to tooth row), as discoveries of additional specimens of "*L.*" *longirostrus* have shown that the parallel orientation of the first premolar in the specimen described by Marshall (1977a) is due to ontogeny (Goin, 1997).
- Characters 7, 12, 13, 17, 98, 108, 111, 124, 126, 135, and 141 for *Pharsophorus lacerans* were coded or modified based on Patterson and Marshall (1978), Petter and Hoffstetter (1983), or direct observations of specimens of this species by the authors.
- Character 113 (number of lower incisors) was coded "2" (two pairs of incisors or less) for *Paraborhyaena boliviana*, based on specimens mentioned in Shockey and Anaya (2008).
- Characters 2 (length of rostrum) and 73 (position of nuchal crest) for *Paraborhyaena* were coded based on Petter and Hoffstetter (1983).
- Character codings of *Patagosmilus goini* (Carlini and Forasiepi, 2010) and *Callistoe vincei* (Babot et al., 2002; Argot and Babot, 2011) were taken directly from the literature.