SUPPLEMENTARY MATERIAL

Table S1. Sample used in this study.

	SPECIES	NUMBER	ORDER	FAMILY
1	*Acinonyx jubatus*	AMNH 119656	Carnivora	Felidae
2	*Acinonyx jubatus*	AMNH 119682	Carnivora	Felidae
3	*Acinonyx jubatus*	AMNH 119655	Carnivora	Felidae
4	*Acinonyx jubatus*	AMNH 80172	Carnivora	Felidae
5	*Acinonyx jubatus*	MCZ 13667	Carnivora	Felidae
6	*Acinonyx jubatus*	MCZ 59279	Carnivora	Felidae
7	*Alouatta beizebuc*	AMNH 133544	Primates	Atelidae
8	*Alouatta palliata*	MCZ 47261	Primates	Atelidae
9	*Arctictis binturong*	MCZ 35594	Carnivora	Viverridae
10	*Arctictis binturong*	MCZ 5107	Carnivora	Viverridae
11	*Arctogalidia trivirgata*	MCZ 35899	Carnivora	Viverridae
12	*Arctogalidia trivirgata*	MCZ 35915	Carnivora	Viverridae
13	*Arctogalidia trivirgata*	MCZ 35927	Carnivora	Viverridae
14	*Ateles geoffroyi*	MCZ 45145	Primates	Atelidae
15	*Ateles paniscus*	AMNH 35709	Primates	Atelidae
16	*Bassaricyon alleni*	MCZ 37922	Carnivora	Procyonidae
17	*Bassiriscus astutus*	MCZ 42161	Carnivora	Procyonidae
18	*Bradypus variegatus*	MCZ 5015	Pilosa	Bradypodidae
19	*Canis adustus*	AMNH 114174	Carnivora	Canidae
20	*Canis adustus*	AMNH 216334	Carnivora	Canidae
21	*Canis adustus*	AMNH 33322	Carnivora	Canidae
22	*Canis adustus*	AMNH 52049	Carnivora	Canidae
23	*Canis adustus*	AMNH 80662	Carnivora	Canidae
24	*Canis aureus*	AMNH 187144	Carnivora	Canidae
25	*Canis aureus*	AMNH 27741	Carnivora	Canidae
26	*Canis aureus*	AMNH 54516	Carnivora	Canidae
27	*Canis latrans*	AMNH 123036	Carnivora	Canidae
28	*Canis latrans*	AMNH 131833	Carnivora	Canidae
29	*Canis latrans*	AMNH 136419	Carnivora	Canidae
30	*Canis latrans*	AMNH 99653	Carnivora	Canidae
31	*Canis lupus*	MCZ 62196	Carnivora	Canidae
32	*Canis lupus*	AMNH 134940	Carnivora	Canidae
33	*Canis lupus*	AMNH 244144	Carnivora	Canidae
34	*Canis lupus*	AMNH 98225	Carnivora	Canidae
35	*Canis lupus*	AMNH 98226	Carnivora	Canidae
36	*Canis lupus*	AMNH 98230	Carnivora	Canidae
37	*Canis lupus*	MCZ 56612	Carnivora	Canidae
38	*Canis lupus*	MCZ 50518	Carnivora	Canidae
39	*Canis lupus*	MCZ 56610	Carnivora	Canidae
40	*Canis lupus*	MCZ 62506	Carnivora	Canidae

41	*Canis lupus (Dingo)*	MCZ 21591	Carnivora	Canidae
42	*Canis lupus (Dingo)*	MCZ 21590	Carnivora	Canidae
43	*Canis mesomelas*	AMNH 187711	Carnivora	Canidae
44	*Canis mesomelas*	AMNH 114228	Carnivora	Canidae
45	*Canis mesomelas*	AMNH 34731	Carnivora	Canidae
46	*Canis mesomelas*	AMNH 34732	Carnivora	Canidae
47	*Canis mesomelas*	AMNH 54209	Carnivora	Canidae
48	*Canis simensis*	AMNH 214799	Carnivora	Canidae
49	*Choloepus hoffmani*	MCZ 12348	Pilosa	Megalonychidae
50	*Chrysosyon brachyurus*	AMNH 120999	Carnivora	Canidae
51	*Chrysosyon brachyurus*	AMNH 133940	Carnivora	Canidae
52	*Civettictis civetta*	MCZ 37950	Carnivora	Viverridae
53	*Crocuta crocuta*	AMNH 187781	Carnivora	Hayenidae
54	*Crocuta crocuta*	AMNH 114227	Carnivora	Hayenidae
55	*Crocuta crocuta*	AMNH 27765	Carnivora	Hayenidae
56	*Crocuta crocuta*	AMNH 27767	Carnivora	Hayenidae
57	*Crocuta crocuta*	AMNH 52097	Carnivora	Hayenidae
58	*Crocuta crocuta*	MCZ 13232	Carnivora	Hyaenidae
59	*Crocuta crocuta*	MCZ 20968	Carnivora	Hyaenidae
60	*Crocuta crocuta*	MCZ 5227	Carnivora	Hyaenidae
61	*Crocuta crocuta*	MCZ No Nº	Carnivora	Hyaenidae
62	*Cryptoprocta ferox*	AMNH 10046	Carnivora	Eupleridae
63	*Cuon alpinus*	AMNH 102083	Carnivora	Canidae
64	*Cuon alpinus*	AMNH 54842	Carnivora	Canidae
65	*Cuon alpinus*	AMNH 54976	Carnivora	Canidae
66	*Cyclopes tridactylus*	MCZ 7287	Pilosa	Cyclopedidae
67	*Dasyurus maculatus*	AMNH 66162	Dasyuromorphia	Dasyuridae
68	*Dendrolagus dorianus*	AMNH 192143	Diprotodontia	Macropodidae
69	*Dendrolagus lumholtzi*	AMNH 65248	Diprotodontia	Macropodidae
70	*Dendrolagus lumholtzi*	AMNH 65261	Diprotodontia	Macropodidae
71	*Eira barbara*	MCZ 15915	Carnivora	Mustelidae
72	*Eira barbara*	MCZ 30492	Carnivora	Mustelidae
73	*Eira barbara*	MCZ 485	Carnivora	Mustelidae
74	*Felis caracal*	AMNH 113794	Carnivora	Felidae
75	*Felis caracal*	AMNH 90105	Carnivora	Felidae
76	*Felis caracal*	AMNH 187788	Carnivora	Felidae
77	*Felis cattus*	AMNH 244096	Carnivora	Felidae
78	*Genetta genetta*	MCZ 14537	Carnivora	Viverridae
79	*Genetta genetta*	MCZ 38068	Carnivora	Viverridae
80	*Genetta genetta*	MCZ 8555	Carnivora	Viverridae
81	*Gulo gulo*	MCZ 52977	Carnivora	Mustelidae
82	*Gulo gulo*	MCZ 48566	Carnivora	Mustelidae
83	*Gulo gulo*	MCZ 5131	Carnivora	Mustelidae
84	*Hyaena hyaena*	AMNH 05	Carnivora	Hyaenidae
85	*Hyaena hyaena*	AMNH 24436	Carnivora	Hyaenidae
86	*Hyaena hyaena*	AMNH 54512	Carnivora	Hyaenidae

87	*Herpestes ichneumon*	MCZ 60113	Carnivora	Herpestidae
88	*Hyaena brunea*	MCZ 57136	Carnivora	Hayenidae
89	*Indri indri*	AMNH 100504	Primates	Indriidae
90	*Lagothrix lagothricia*	AMNH 188153	Primates	Atelidae
91	*Lagothrix lagothricia*	AMNH 70404	Primates	Atelidae
92	*Lycaon pictus*	AMNH 82085	Carnivora	Canidae
93	*Lycaon pictus*	AMNH 82086	Carnivora	Canidae
94	*Lycaon pictus*	AMNH 82087	Carnivora	Canidae
95	*Lycaon pictus*	AMNH 82088	Carnivora	Canidae
96	*Lycaon pictus*	AMNH 85154	Carnivora	Canidae
97	*Lynx pardina*	AMNH 169492	Carnivora	Felidae
98	*Macaca Mulatta*	AMNH 41999	Primates	Cercopithecidae
99	*Macrotis lagotus*	MCZ 31095	Peramelemorphia	Thylacomyidae
100	*Martes pennati*	MCZ 64713	Carnivora	Mustelidae
101	*Nandinia binotata*	AMNH 51469	Carnivora	Nandinidae
102	*Nasua nasua*	MCZ 999	Carnivora	Procyonidae
103	*Paguma larvata*	MCZ 36767	Carnivora	Viverridae
104	*Paguma larvata*	MCZ 36769	Carnivora	Viverridae
105	*Pan paniscus*	AMNH 86857	Primates	Hominidae
106	*Pan troglodytes*	MCZ 20041	Primates	Hominidae
107	*Pan troglodytes*	AMNH 201658	Primates	Hominidae
108	*Pan troglodytes*	AMNH 51278	Primates	Hominidae
109	*Pan troglodytes*	AMNH 51377	Primates	Hominidae
110	*Panthera leo*	AMNH 54995	Carnivora	Felidae
111	*Panthera leo*	AMNH 54996	Carnivora	Felidae
112	*Panthera leo*	AMNH 52078	Carnivora	Felidae
113	*Panthera onca*	AMNH 135928	Carnivora	Felidae
114	*Panthera onca*	AMNH 135929	Carnivora	Felidae
115	*Panthera onca*	AMNH 139959	Carnivora	Felidae
116	*Panthera onca*	AMNH 22919	Carnivora	Felidae
117	*Panthera pardus*	AMNH 34946	Carnivora	Felidae
118	*Panthera pardus*	AMNH 34475	Carnivora	Felidae
119	*Panthera tigris*	AMNH 100024	Carnivora	Felidae
120	*Panthera tigris*	AMNH 113743	Carnivora	Felidae
121	*Panthera tigris*	AMNH 113744	Carnivora	Felidae
122	*Panthera tigris*	AMNH 113748	Carnivora	Felidae
123	*Panthera tigris*	AMNH 135846	Carnivora	Felidae
124	*Panthera tigris*	AMNH 54605	Carnivora	Felidae
125	*Panthera tigris*	AMNH 135847	Carnivora	Felidae
126	*Panthera uncia*	AMNH 100110	Carnivora	Felidae
127	*Panthera uncia*	AMNH 166952	Carnivora	Felidae
128	*Panthera uncia*	AMNH 207704	Carnivora	Felidae
129	*Panthera uncia*	AMNH 35476	Carnivora	Felidae
130	*Papio hamadryas*	AMNH 82096	Primates	Cercopithecidae
131	*Paradoxurus hermaphroditus*	MCZ 5017	Carnivora	Viverridae
132	*Phalanger carmelitae*	MCZ 61727	Diprotodontia	Phalangeridae

133	*Phalanger celebensis*	AMNH 146805	Diprotodontia	Phalangeridae
134	*Phalanger orientalis*	AMNH 80933	Diprotodontia	Phalangeridae
135	*Phalanger orientalis*	AMNH 80934	Diprotodontia	Phalangeridae
136	*Phascolarctos cinereus*	AMNH 42903	Diprotodontia	Phascolarctidae
137	*Phascolarctos cinereus*	AMNH 107805	Diprotodontia	Phascolarctidae
138	*Phascolarctos cinereus*	AMNH 65607	Diprotodontia	Phascolarctidae
139	*Phascolarctos cinereus*	AMNH 65609	Diprotodontia	Phascolarctidae
140	*Pongo pygmaeus*	AMNH 200898CA	Primates	Hominidae
141	*Pongo pygmaeus*	MCZ 50960	Primates	Hominidae
142	*Potos flavus*	MCZ 62043	Carnivora	Procyonidae
143	*Prionodon linsang*	MCZ 36576	Carnivora	Prionodontinae
144	*Procolobus badius*	MCZ 37932	Primates	Cercopithecidae
145	*Puma concolor*	AMNH 183357	Carnivora	Felidae
146	*Puma concolor*	AMNH 244616	Carnivora	Felidae
147	*Puma concolor*	AMNH 80451	Carnivora	Felidae
148	*Puma concolor*	AMNH 87803	Carnivora	Felidae
149	*Sarcophillus harrisi*	MCZ 6342	Dasyuromorphia	Dasyuridae
150	*Strigocuscus pelengensis*	AMNH 108000	Diprotodontia	Phalangeridae
151	*Symphalangus syndactylus*	AMNH 106581	Primates	Hylobatidae
152	*Tachypithecus cristatus*	MCZ 35636	Primates	Cercopithecidae
153	*Tamandua mexicana*	MCZ 28014	Pilosa	Myrmecophagidae
154	*Thylacinus cynocephalus*	NHM 1963.8.30.1	Dasyuromorphia	Thylacinidae
155	*Thylacinus cynocephalus*	NHM 72.666	Dasyuromorphia	Thylacinidae
156	*Thylacinus cynocephalus*	NHM 83.8.22.1	Dasyuromorphia	Thylacinidae
157	*Thylacinus cynocephalus*	MCZ 36797	Dasyuromorphia	Thylacinidae
158	*Thylacinus cynocephalus*	AMNH 42259	Dasyuromorphia	Thylacinidae
159	*Thylacinus cynocephalus*	AMNH 35244	Dasyuromorphia	Thylacinidae
160	*Thylacinus cynocephalus*	AMNH 35504	Dasyuromorphia	Thylacinidae
161	*Thylacinus cynocephalus*	AMNH 35866	Dasyuromorphia	Thylacinidae
162	*Trichosurus arnhemensis*	AMNH 197668	Diprotodontia	Phalangeridae
163	*Trichosurus caninus*	AMNH 65535	Diprotodontia	Phalangeridae
164	*Trichosurus caninus*	AMNH 65537	Diprotodontia	Phalangeridae
165	*Trichosurus vulpecula*	MCZ 5106	Diprotodontia	Phalangeridae
166	*Ursus americanus*	AMNH 45149	Carnivora	Ursidae
167	*Ursus americanus*	AMNH 70357	Carnivora	Ursidae
168	*Ursus americanus*	AMNH 90334	Carnivora	Ursidae
169	*Ursus americanus*	AMNH 99655	Carnivora	Ursidae
170	*Ursus tibethanus*	AMNH 15578	Carnivora	Ursidae
171	*Ursus tibethanus*	AMNH 35496	Carnivora	Ursidae
172	*Ursus tibethanus*	AMNH 57076	Carnivora	Ursidae
173	*Viverra zibetha*	MCZ 35916	Carnivora	Viverridae
174	*Vombatus ursinus*	MCZ 24974	Diprotodontia	Vombatidae
175	*Vombatus ursinus*	AMNH 146850	Diprotodontia	Vombatidae
176	*Vombatus ursinus*	AMNH 35512	Diprotodontia	Vombatidae
177	*Vombatus ursinus*	AMNH 35701	Diprotodontia	Vombatidae
178	*Vombatus ursinus*	AMNH 35798	Diprotodontia	Vombatidae

179	*Vulpes macrotis*	AMNH 131834	Carnivora	Canidae
180	*Vulpes velox*	AMNH 100190	Carnivora	Canidae
181	*Vulpes velox*	AMNH 100215	Carnivora	Canidae
182	*Vulpes vulpes*	AMNH 128486	Carnivora	Canidae
183	*Vulpes vulpes*	AMNH 128488	Carnivora	Canidae
184	*Vulpes vulpes*	AMNH 128490	Carnivora	Canidae
185	*Vulpes vulpes*	AMNH 166938	Carnivora	Canidae
186	*Vulpes vulpes*	AMNH 98163	Carnivora	Canidae
187	*Wallabia bicolor*	AMNH 65125	Diprotodontia	Macropodidae
188	*Thylacoleo carnifex*	SAMP 12384a	Diprotodontia	Thylacoleonidae
189	*Thylacoleo carnifex*	SAM 12384b	Diprotodontia	Thylacoleonidae
190	*Thylacoleo carnifex*	SAM 12384c	Diprotodontia	Thylacoleonidae

Figure S1. Principal Components Analysis (PCA) performed on the residuals extracted from the multivariate regression analysis of shape on size (Fig.4B) of the distal humerus (the proximal portion of the elbow joint) of living mammals and Thylacoleo. A, Morphospace depicted from the scores of the species on the first two eigenvectors. The 95% confidence ellipses for placentals and marsupials are also shown. B, Projection of the phylogenetic tree topology of Figure 3 onto the phenotypic space depicted from the first two principal components (PCs) of elbow shape. C, Thin plate spline diagrams representing the shape changes accounted for each PC are shown as deviations from the average or consensus shape (0.0) in each PC (grey straight lines) to the target shapes (black dots). The warping outline of each reconstructed elbow shape is also shown for clarity.

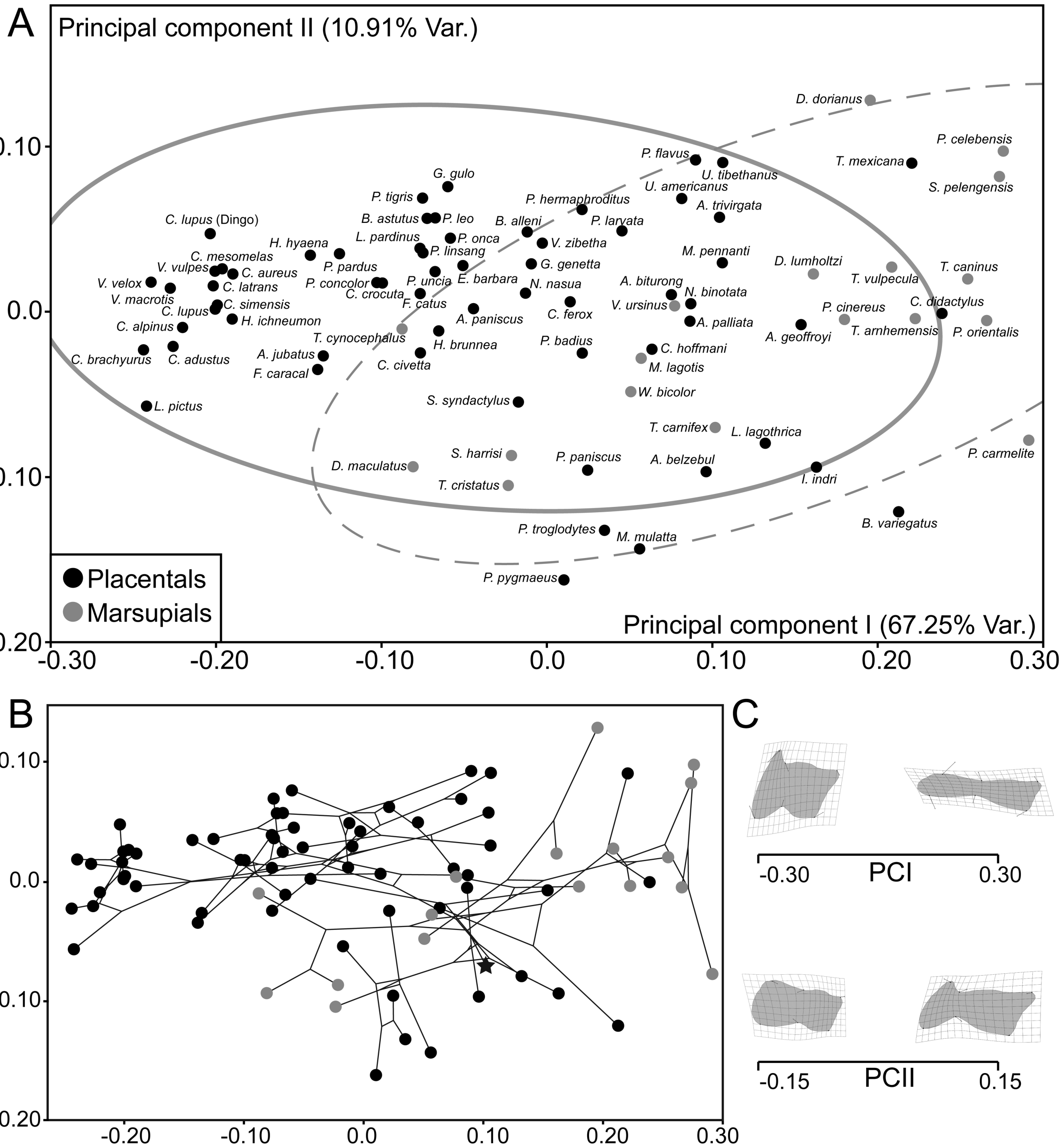

Figure S2. Principal componentes scores of the species on the first two eigenvectors mapped onto the phylogeny shown in Figure 3 using squared-changed parsimony and assuming Brownian motion.

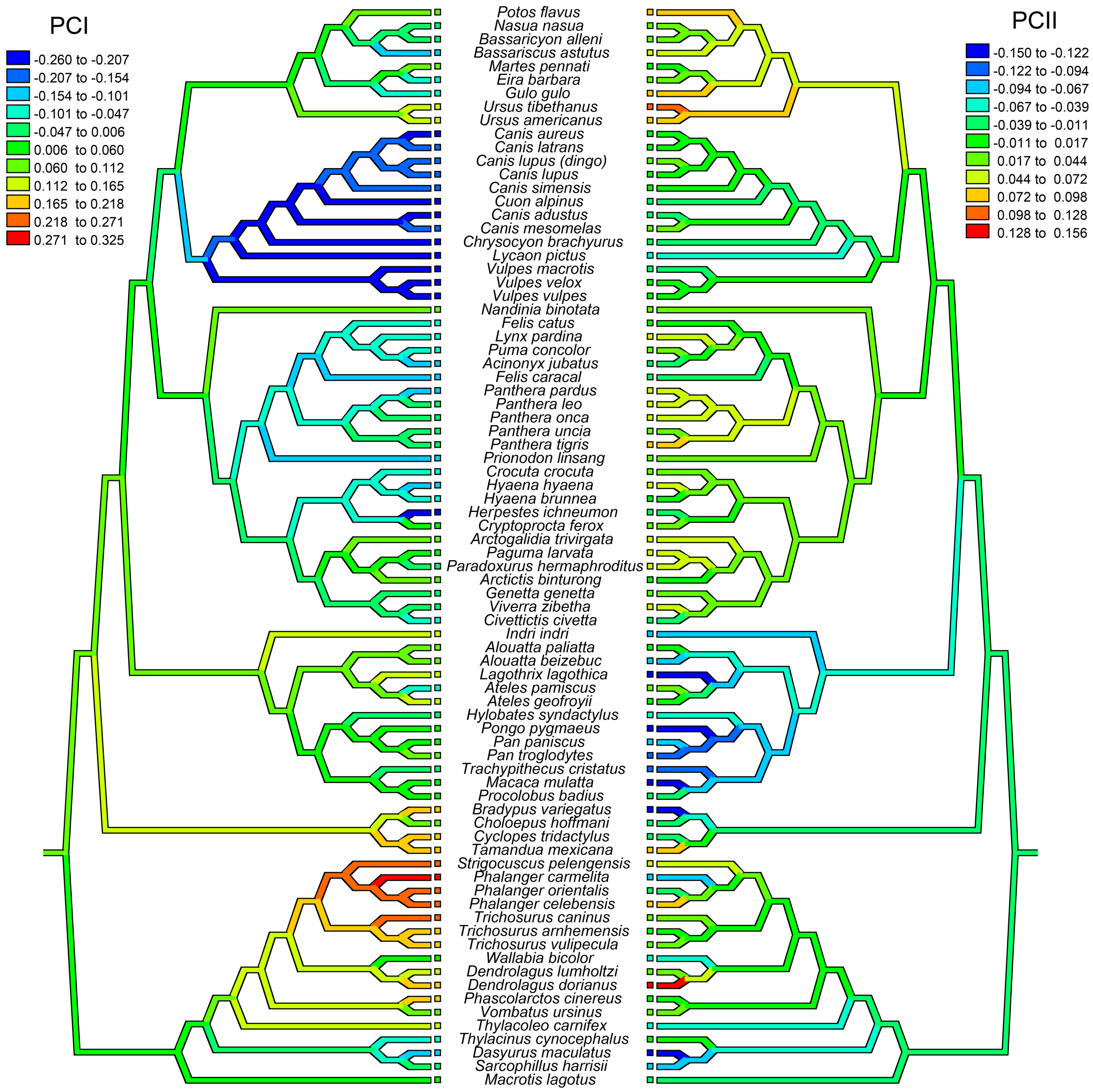

Figure S3. Canonical variates analysis (CVA) performed from the residuals extracted from the evolutionary allometry regression analysis of elbow shape on size to determine shape features of the distal humerus that best distinguish mammals with high mobility of the forearm from those with medium mobility and low mobility. A, Pairwise plot depicted from the scores on both canonical axes obtained for the CVA. B, The thin plate spline diagrams for each canonical function are shown as deviations from the average or consensus shape (0.0) in each discriminant function (grey straight lines) to the target shapes (black dots). The warping outline of each reconstructed elbow shape is also shown for clarity.

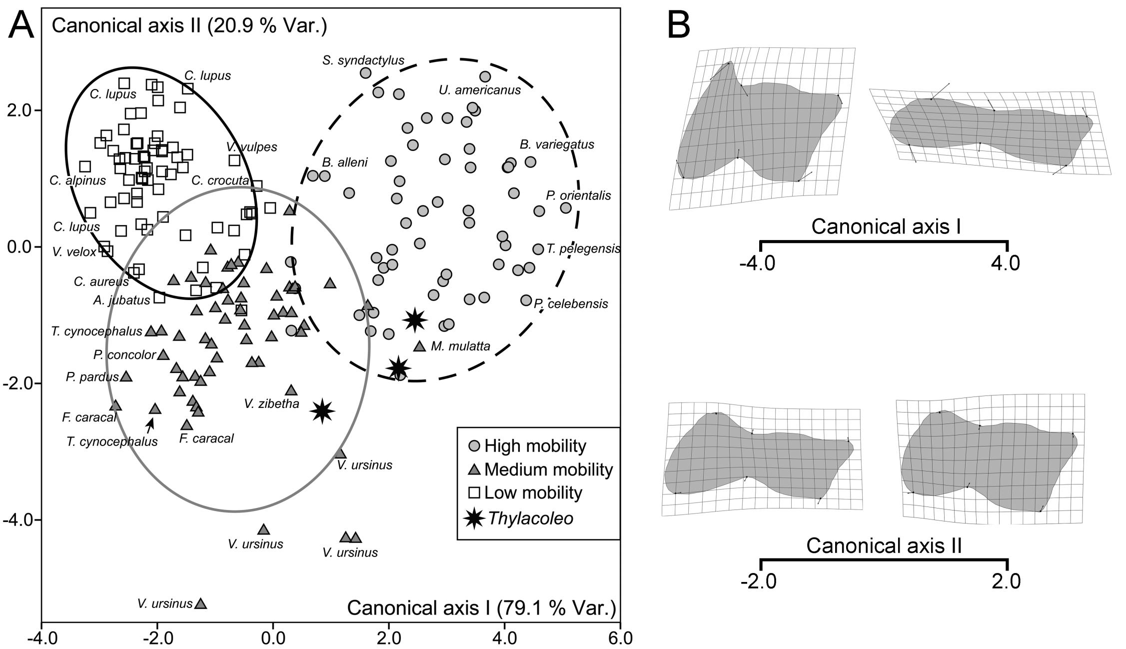

Figure S4. Linear Discriminant Analyses (LDA) performed from the residuals extracted from the evolutionary allometry regression analysis of elbow shape on size to investigate the most probably substrate use of T. carnifex. A, Discriminant function obtained from the LDA performed from the elbow shape of marsupials only, excluding the wombats from the analysis (included as unknowns), to discriminate between arboreal and terrestrial forms. B, Discriminant function obtained from the LDA performed from the elbow shape of marsupials including the wombats as known terrestrial species into the function to discriminate between arboreal and terrestrial forms. C, Thin plate spline diagrams for arboreal and terrestrial forms shown as deviations from the consensus shape (grey dots) to the target shapes (black dots) obtained from the analysis of B. The warping outline of each reconstructed elbow shape is also shown for clarity.