Figure S1. Binarised humeral/femoral mid-shaft cross-sections, extracted from Micro-CT scans focusing on this level with highest possible resolution. The femur of *Galagoides demidovii* FMNH 166977 (A) and *Myrmecophaga tridactyla* NMW B5964 (C) and the humerus of *Bradypus variegatus* ZMB Mam 35824 (B) and *Megaladapis* sp. MNHN MAD 7778 (D) are represented. Red boundaries enclose the region of interest (ROI), in which cortical compactness (CC) and cortical area (CA) were computed. B and D are examples of specimens with high percentage of porosities (CC= 98.412% and CC= 97.884%, respectively). A and C show low degree of porosity (CC= 99.738 % and CC= 99.822%, respectively). ROI selection aimed to include only cortical compact bone. Accordingly, medullary cavity had to be excluded. In most of the specimens (as in A), it was automatically performable through the 'Wand (tracing)' Fiji tool. However, as exemplified by B, C and D, several bones exhibit spongiosa on the medullary outer region, preventing automatic exclusion of it. Once identified the spongiosa – cortex interface, it was manually defined through the connection of most external holes, considered as non-compact bone. In doing this, straight lines connected the most external points on such holes ('Polygon selection' Fiji tool), sequentially encountered following the

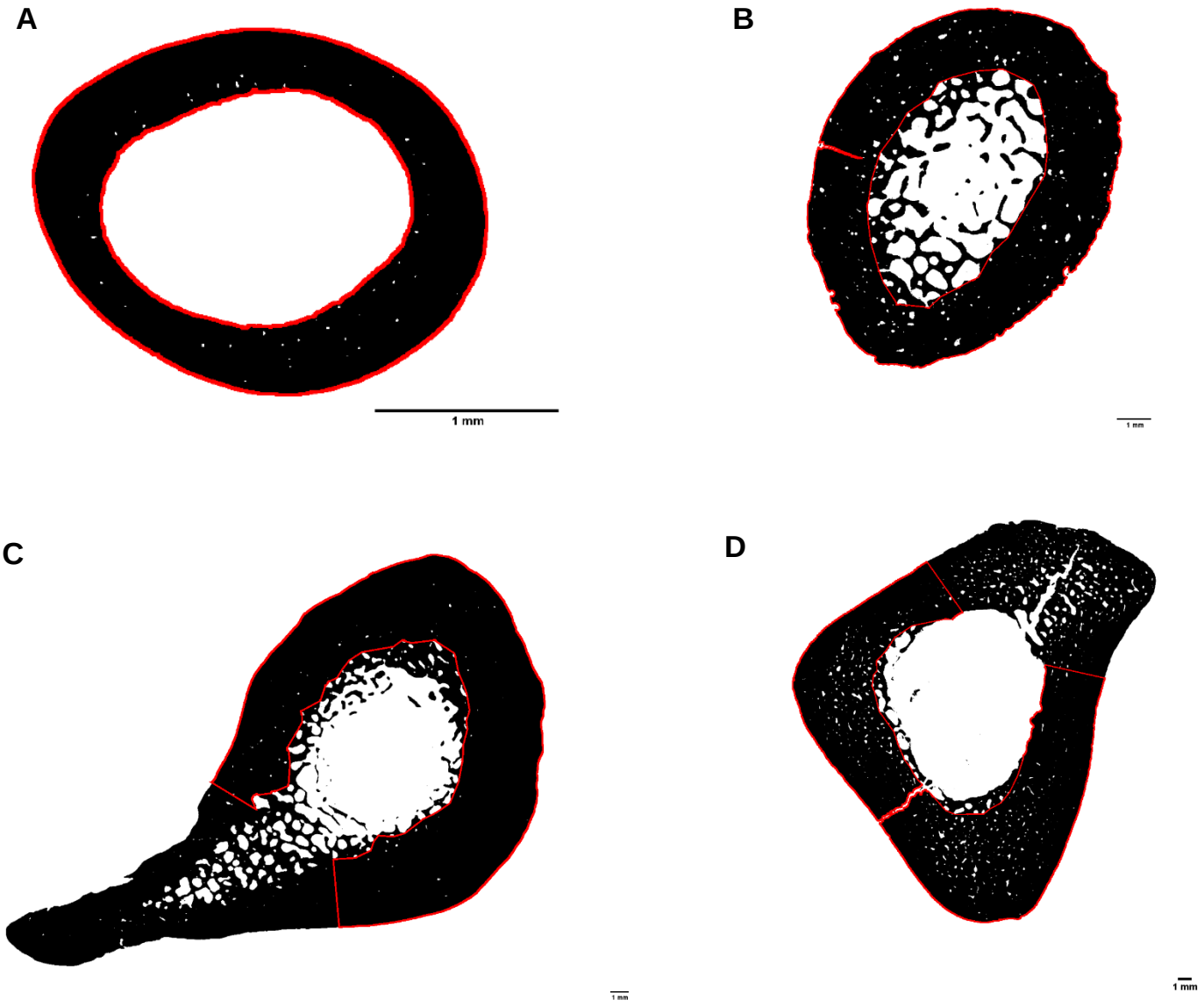
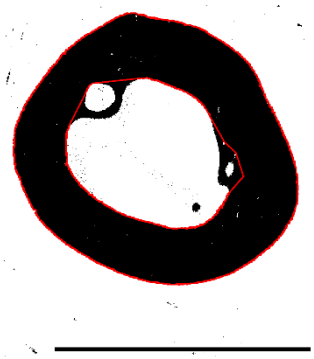


Figure S2. Humeral mid-shaft cross-sections, acquired with Micro-CT and analysed in this study. Scale bar of 3 mm in the bottom right. Regions of interest (ROI) are bounded in red. Institutional abbrevations: **ZMB Mam**: Museum für Naturkunde, Berlin, Germany; **SMNS**: Staatliches Museum für Naturkunde, Stuttgart, Germany; **ZFMK**: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; **ZSM**: Zoologische Staatssammlung, Munich, Germany; **NMW**: Naturhistorisches Museum, Wien, Austria; **MNHN**: Muséum national d'Histoire naturelle, Paris, France; **AMNH**: American Museum of Natural History, New York, NY, USA; **FMNH**: Field Museum of Natural History, Chicago, IL; **YPM-PU**: Yale Peabody Museum of Natural History, New Haven, CT; **DPC**: Division of Fossil Primates, Duke Lemur Center, Durham. NC, USA.

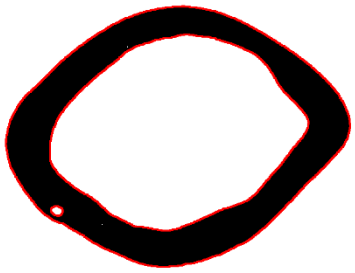
Analcitherium FMNH P13131



Arctocebus calabarensis AMNH 212576

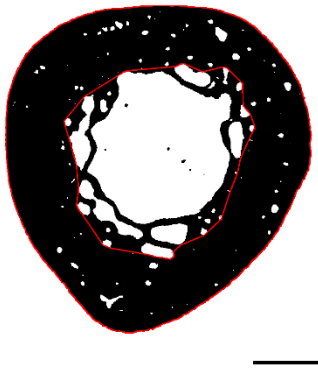
Avahi laniger AMNH 100637

Avahi laniger AMNH 170494

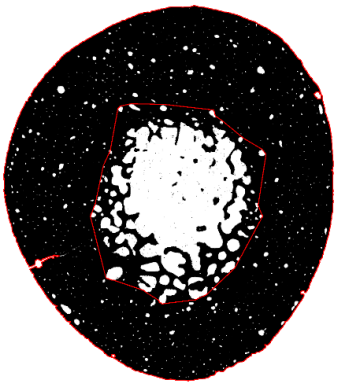


Avahi laniger FMNH 5654

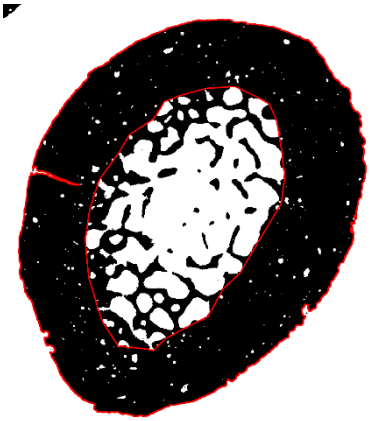
Babakotia DPC 11824



Bradypus sp. ZMB Mam 33806



Bradypus tridactylus ZMB MAM 76147



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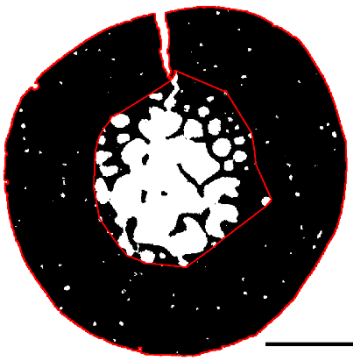

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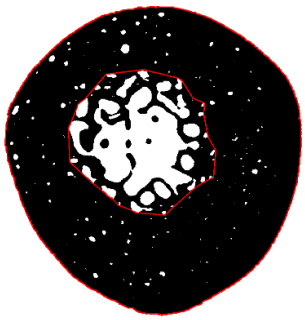

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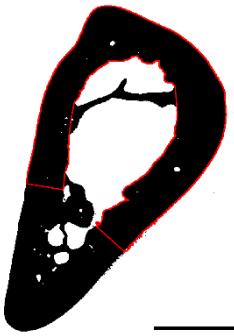
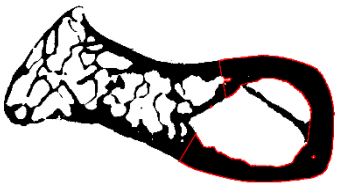
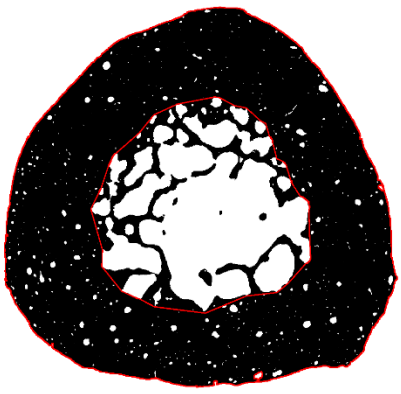


Chaetophractus vellerosus ZSM 1926_24

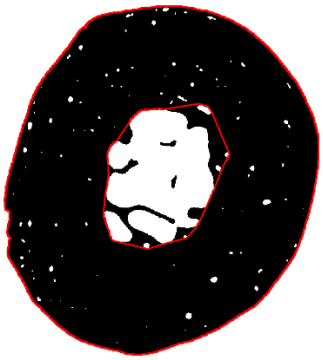


Chaetophractus villosus ZSM 1962_217

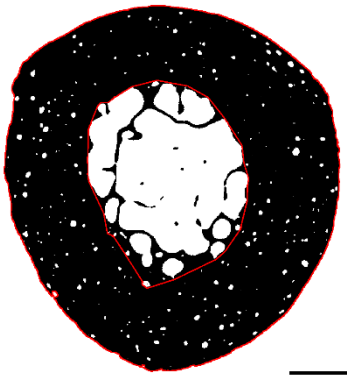
Chlamyphorus truncatus ZMB Mam 6007



Choloepus didactylus FMNH 95448



Choloepus didactylus NMW B5969



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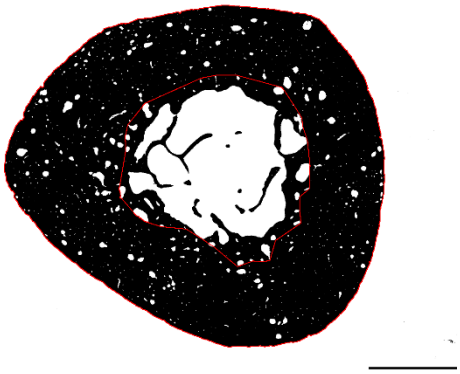

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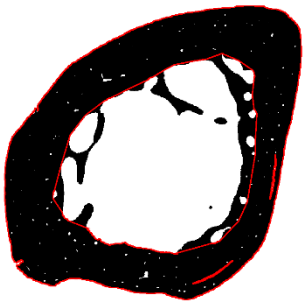
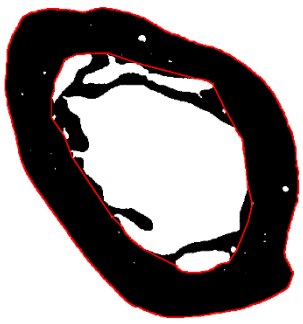
Choloepus hoffmanni ZFMK MAM 1979.0525



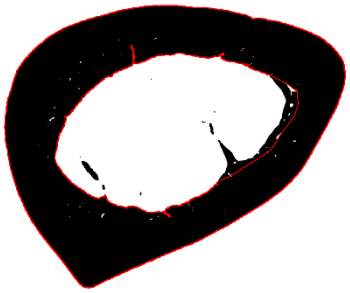
Cyclopes didactylus FMNH 61853

Cyclopes didactylus FMNH 61854

Cyclopes didactylus FMNH 69971



Cyclopes didactylus ZMB MAM 3913

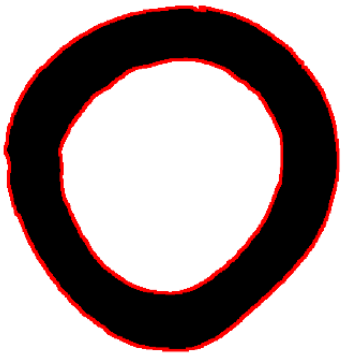


Dasypus novemcinctus ZMB Mam 85937

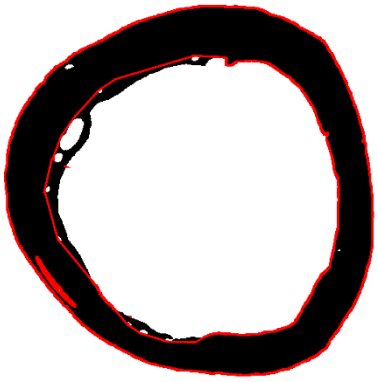
Dasypus septemcinctus ZSM 1954-536

Eucholoeops FMNH P13125

Eucholoeops FMNH P13280



Eulemur albifrons ZMB Mam 44661



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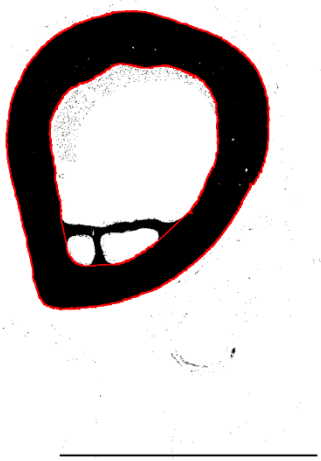
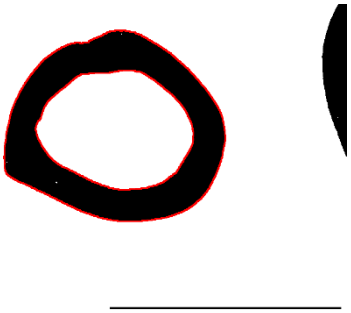
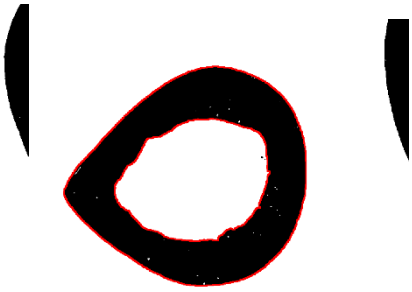


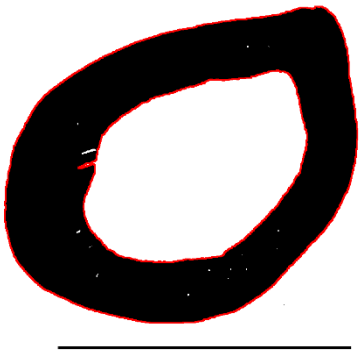
Euoticus elegantulus AMNH 241147



Galago matschiei FMNH 148985



Galago senegalensis FMNH 205317



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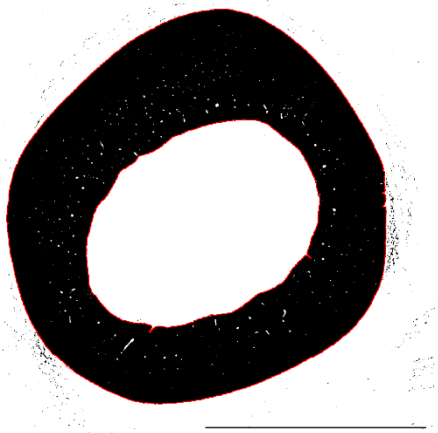
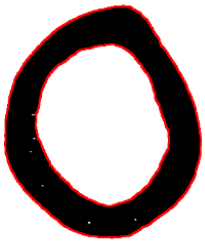
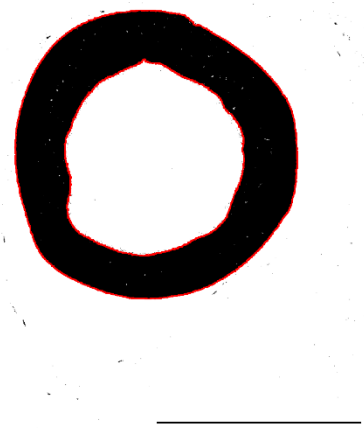


Galago sp. ZMB Mam A209 I

Galago sp. ZMB Mam A209 II



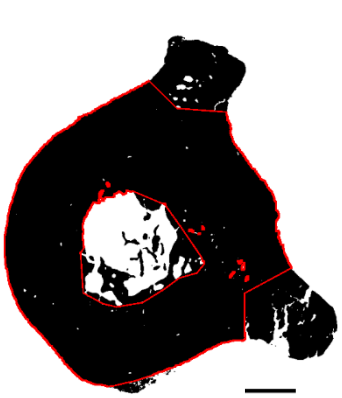
Galagoides demidovii FMNH 166977



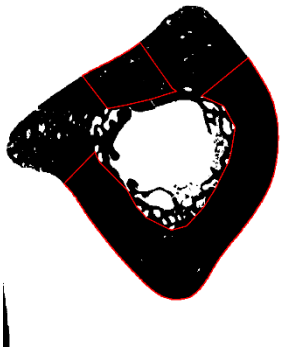
Hapalemur griseus griseus AMNH 170675

Hapalemur griseus griseus AMNH 170680

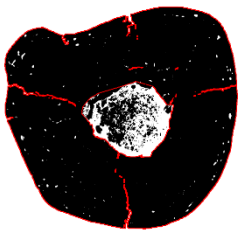
Hapalops FMNH P13130



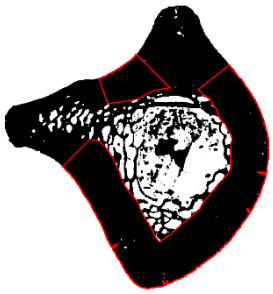
Hapalops FMNH P13133



Hapalops FMNH P13143

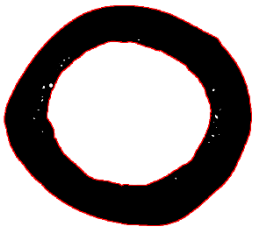


Hapalops MNHN.F. SCZ 162

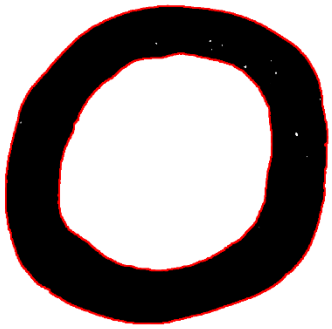


Hapalops YPM-VPPU 15160

Indri indri ZMB Mam 84272



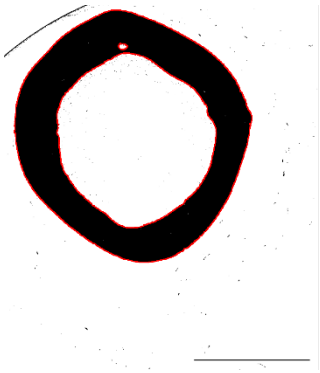
Indri indri ZMB Mam 84278



Indri indri ZMB Mam 84286

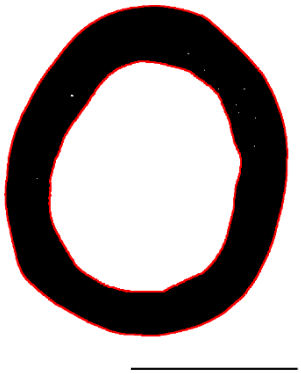
Indri indri ZMB Mam 84288

Lasiorhinus latifrons ZSM 1984_67

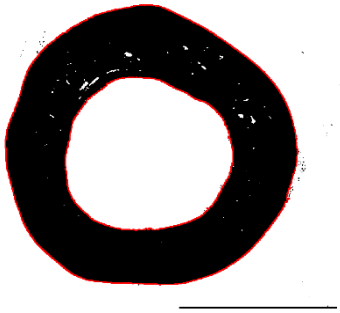


Lemur catta AMNH 170739

Lemur catta AMNH 170740



Lemur sp. ZMB Mam 83963



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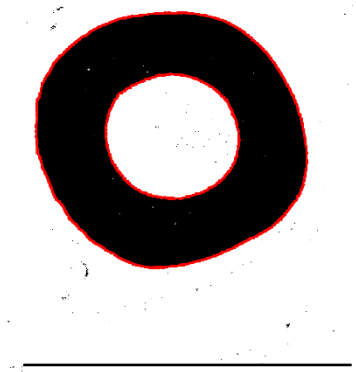
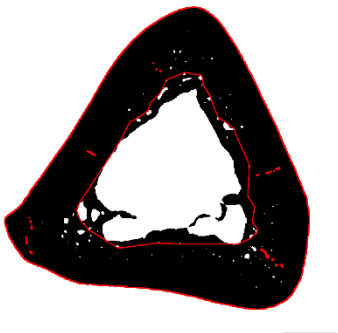
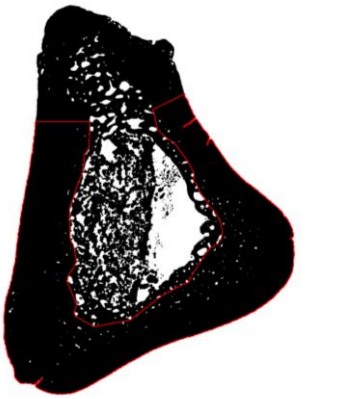


Loris tardigradus AMNH 269

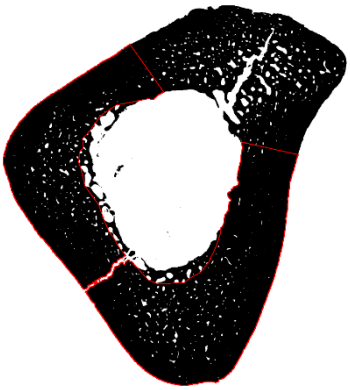


Megaladapis MNHN MAD 1562

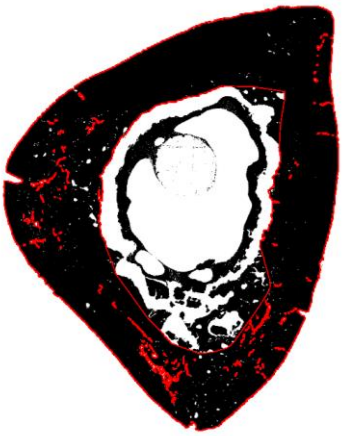


Megaladapis MNHN MAD 7775

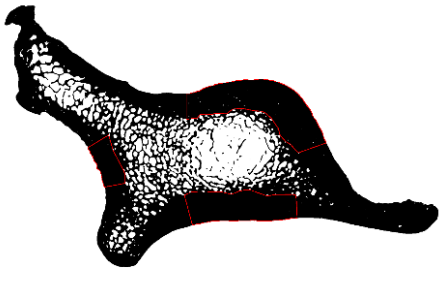
Megaladapis MNHN MAD 7777



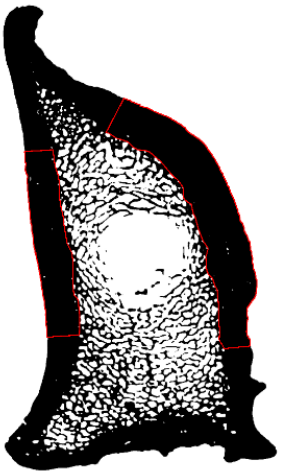
Megaladapis MNHN MAD 7778



Mesopropithecus sp. DCP 9903

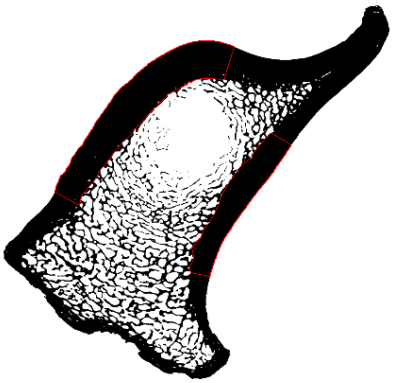


Myrmecophaga tridactyla NMW B5964

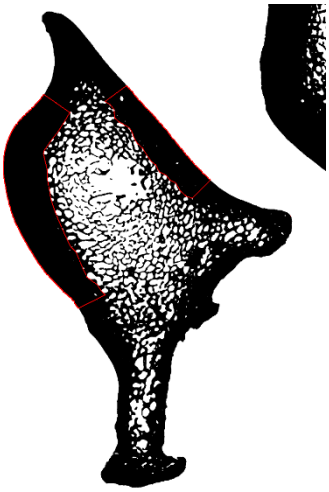


Myrmecophaga tridactyla NMW B5966

Myrmecophaga tridactyla NMW B5967

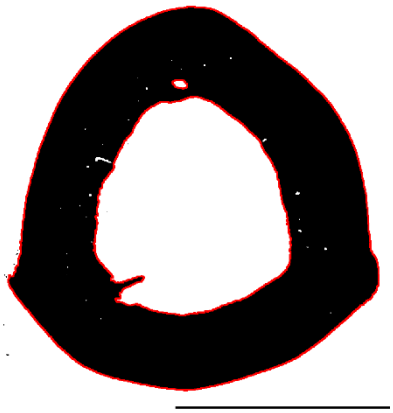


Myrmecophaga tridactyla ZMB Mam 77024

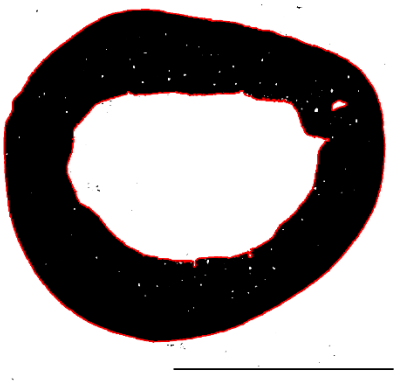


Myrmecophaga tridactyla ZMB Mam 77025

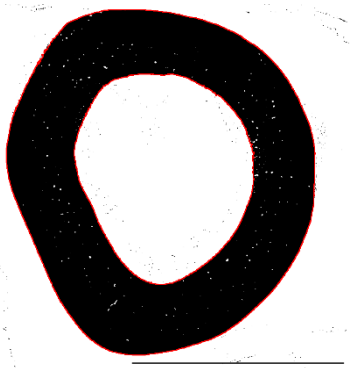
Nematherium YPM-VPPU 15374



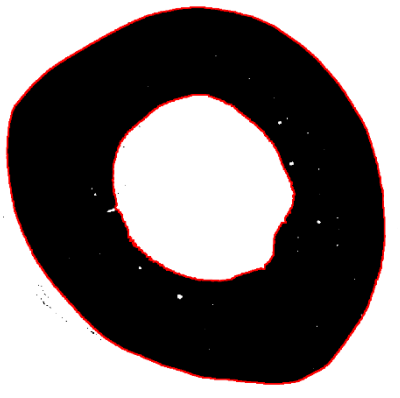
Nycticebus bengalensis ZFMK Mam 1986.0419



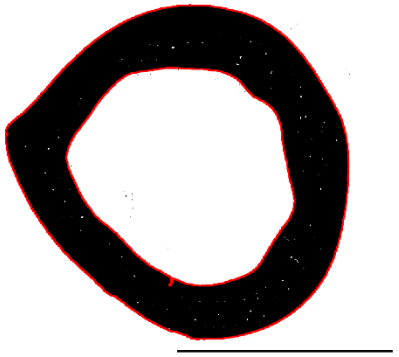
Nycticebus coucang NMW 849



Nycticebus coucang ZMB Mam 2718

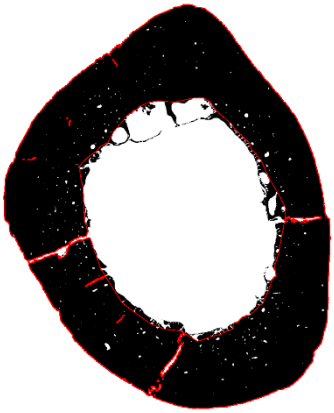


Nycticebus coucang ZMB Mam 84333



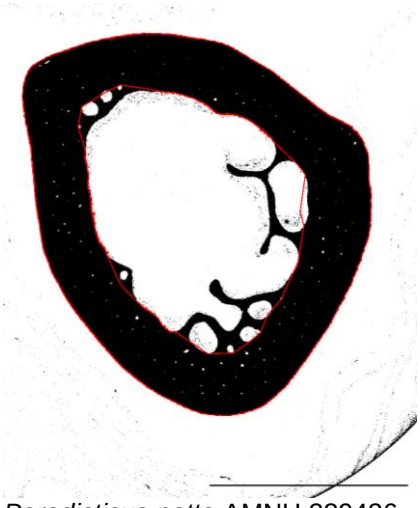
Otolemur crassicaudatus FMNH 198178

Palaeopropithecus DPC 11861

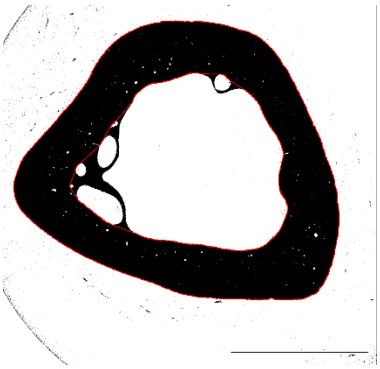


Palaeopropithecus DPC UA5474

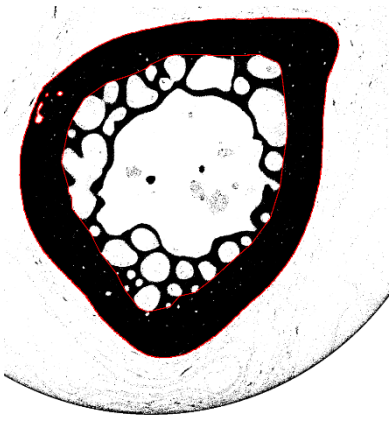
Palaeopropithecus DPC UA5465



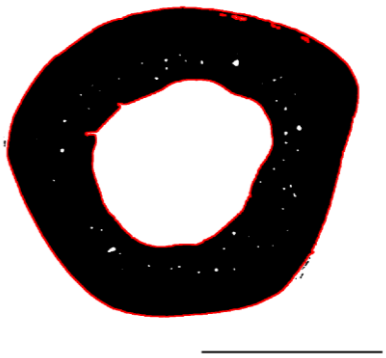
Perodicticus potto AMNH 239436



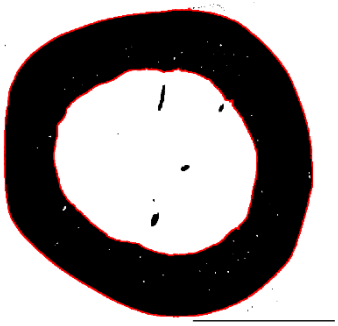
Perodicticus potto AMNH 52698



Perodicticus potto AMNH 52717

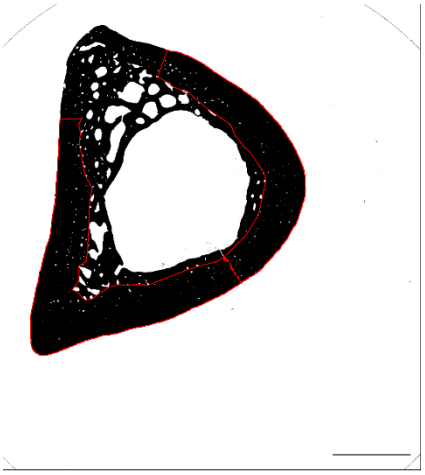


Perodicticus potto NMW 32674

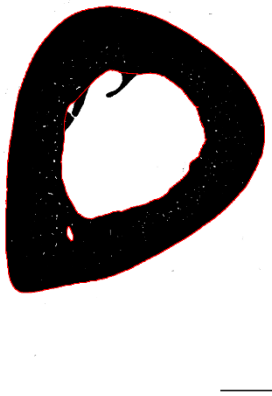


Perodicticus potto ZMB Mam 17260

Phascolarctos cinereus AMNH 107805



Phascolarctos cinereus AMNH 65607



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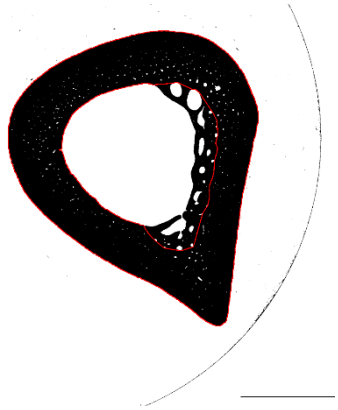

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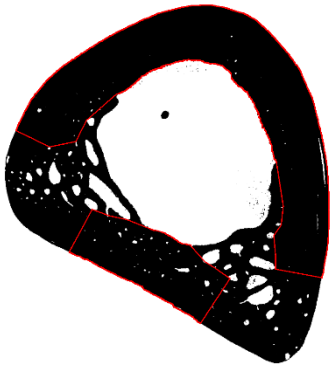
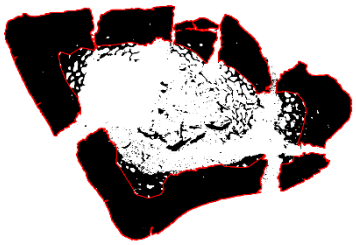
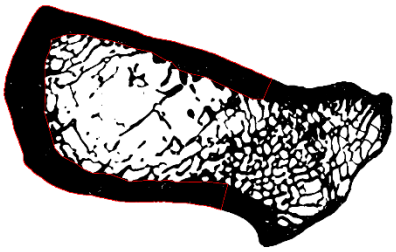


Phascolarctos cinereus NMW 2027

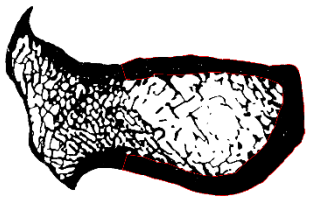
Phascolarctos cinereus ZMB Mam 36035



Prepotherium YPM-VPPU 15345

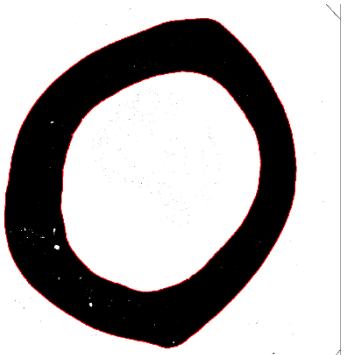


Priodontes maximus ZMB Mam 108167

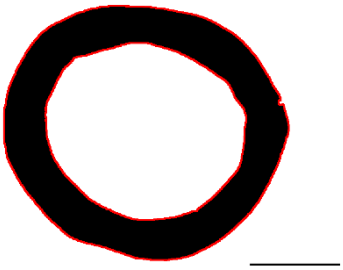


Priodontes maximus ZMB Mam 6163

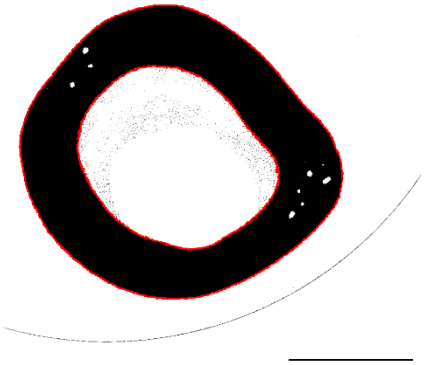
Priodontes maximus ZSM 1931-293



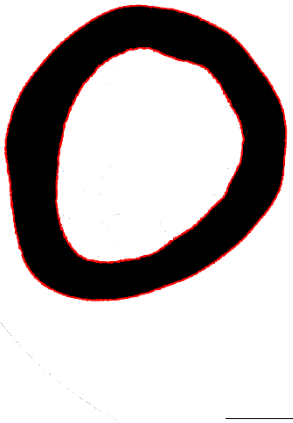
Propithecus diadema AMNH 100633



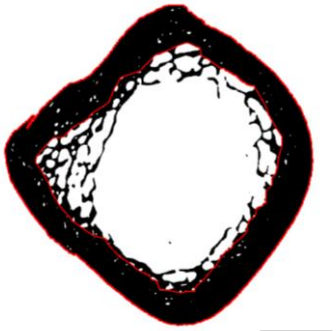
Propithecus sp. ZMB Mam 44771



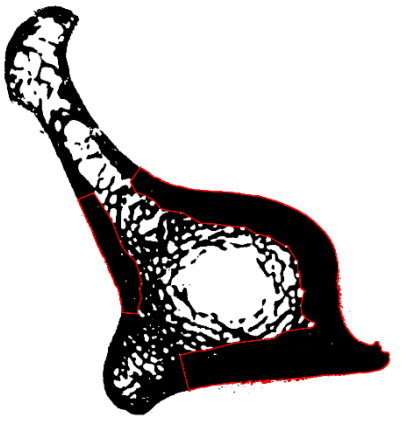
Propithecus verreauxi AMNH 170463



Propithecus verreauxi AMNH 170474

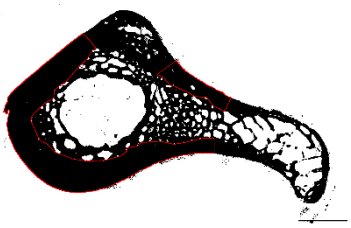


Tamandua mexicana FMNH 123994

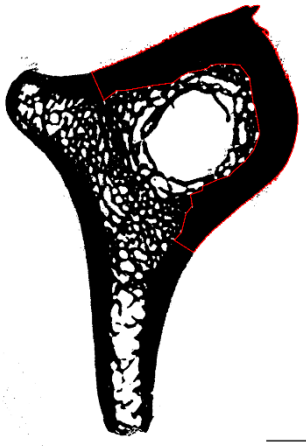


Tamandua tetradactyla ZMB Mam 81441

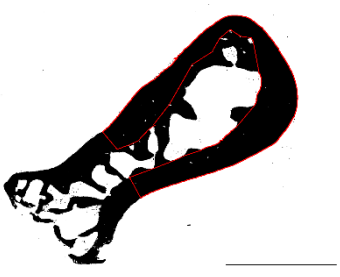
Tamandua tetradactyla ZMB Mam 1925



Tamandua tetradactyla ZMB Mam 35212

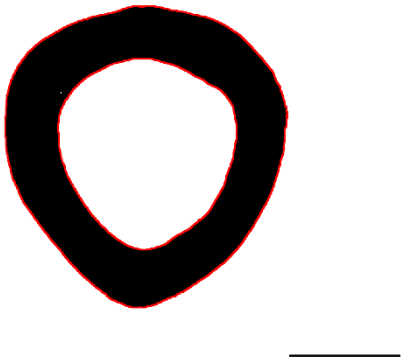


Tamandua tetradactyla ZMB Mam 81448

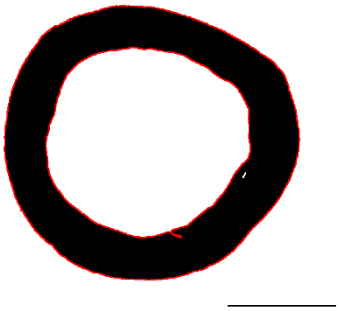


Tolypeutes matacus ZSM 1925_592

Tolypeutes matacus ZSM 1925_595

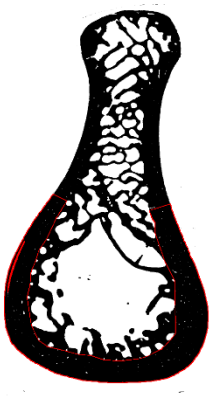


Varecia sp. ZMB Mam 44475

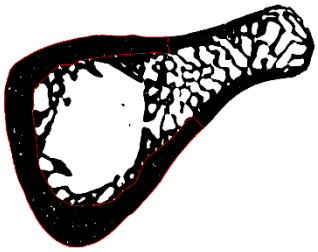


Varecia variegata ZMB Mam 44474

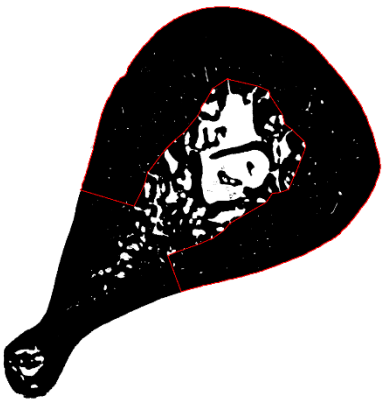
Vombatus ursinus AMNH 65622



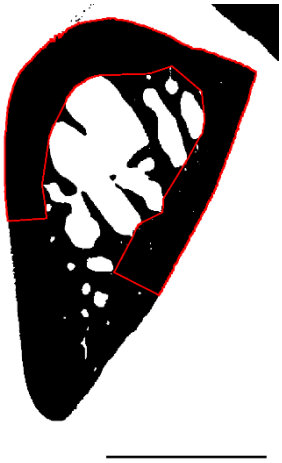
Vombatus ursinus AMNH 65619



Vombatus ursinus SMNS 26510

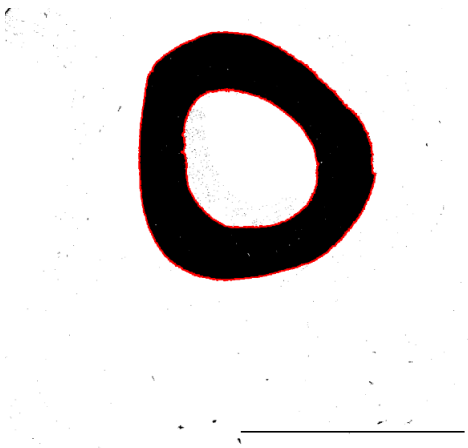


Vombatus ursinus ZMB Mam 5872

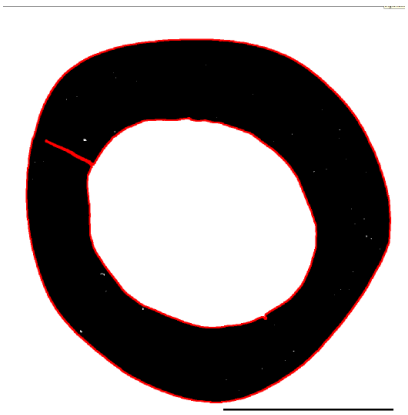


Zaedyus pichiy ZMB Mam 38732

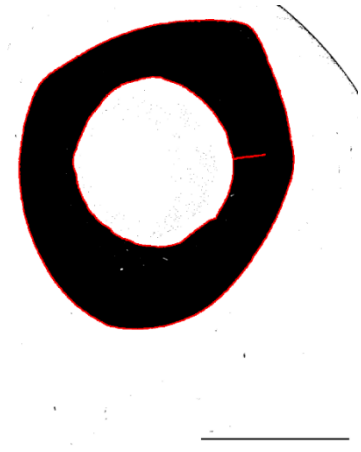
Figure S3. Femoral mid-shaft cross-sections, acquired with Micro-CT and analysed in this study. Scale bar of 3 mm in the bottom right. Regions of interest (ROI) are bounded in red. Institutional abbrevations: **ZMB Mam**: Museum für Naturkunde, Berlin, Germany; **SMNS**: Staatliches Museum für Naturkunde, Stuttgart, Germany; **ZFMK**: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; **ZSM**: Zoologische Staatssammlung, Munich, Germany; **NMW**: Naturhistorisches Museum, Wien, Austria; **MNHN**: Muséum national d'Histoire naturelle, Paris, France; **AMNH**: American Museum of Natural History, New York, NY, USA; **FMNH**: Field Museum of Natural History, Chicago, IL; **YPM-PU**: Yale Peabody Museum of Natural History, New Haven, CT; **DPC**: Division of Fossil Primates, Duke Lemur Center, Durham. NC, USA. *Megaladapis* MNHN MAD 1567 represents an example of cortical vacuities spatial distribution in subfossil lemurs reminiscent of 'tree sloths'. *Vombatus ursinus* SMNS 26510 represents a particularly poorly compact wombat's bone with vacuities widespread in the cortex.



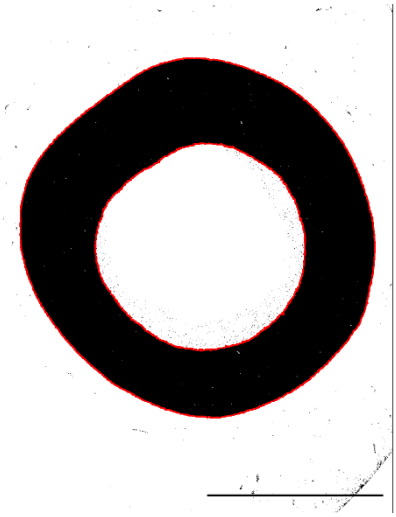
Arctocebus calabarensis AMNH 212576



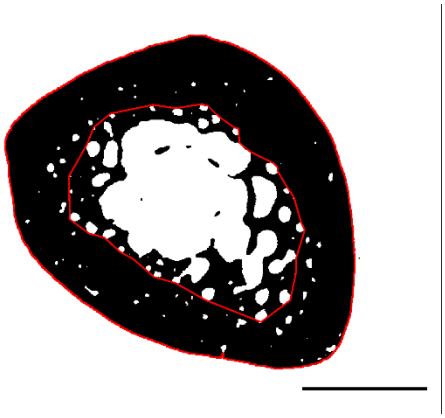
Avahi laniger FMNH 5654



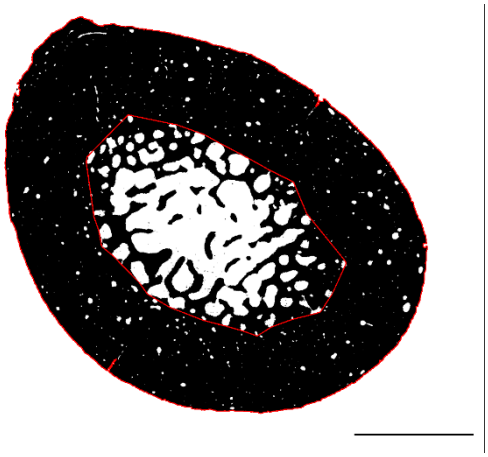
Avahi laniger AMNH 100637



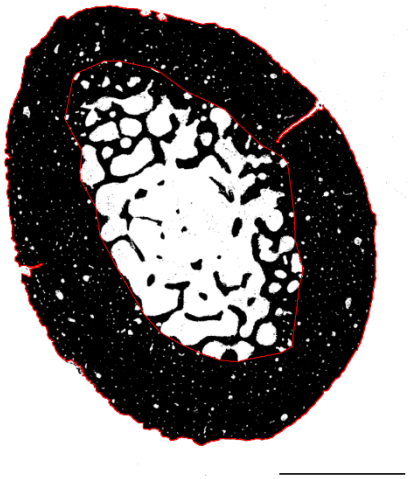
Avahi laniger AMNH 170494



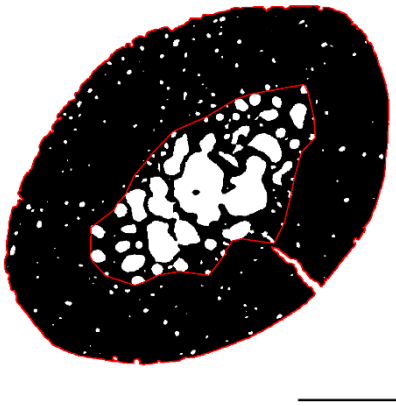
Bradypus sp. ZMB Mam 33806



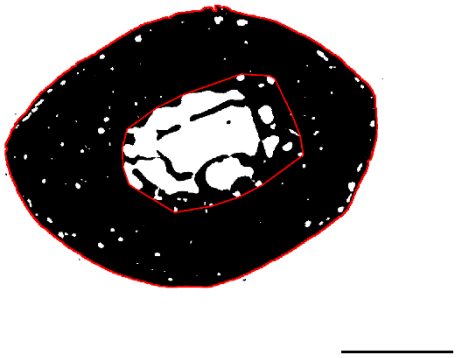
Bradypus tridactylus ZMB Mam 76147



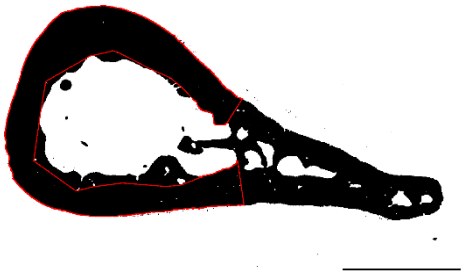
Bradypus variegatus ZMB Mam 35824



Bradypus variegatus ZMB Mam 38389

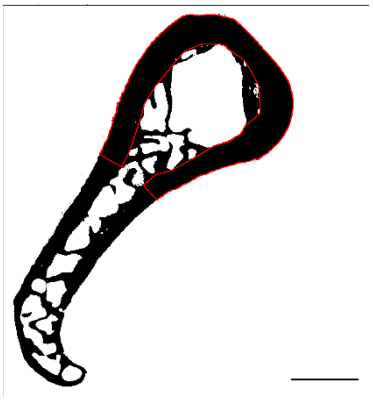


Bradypus variegatus ZMB Mam 91627

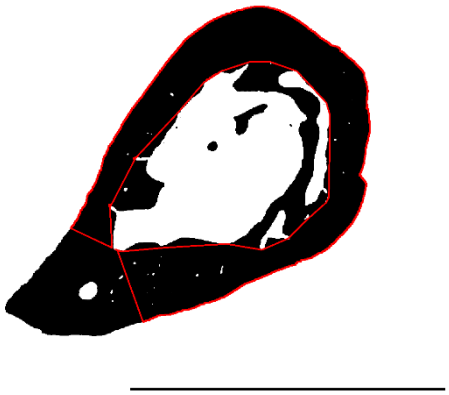


Chaetophractus vellerosus ZSM 1926-24

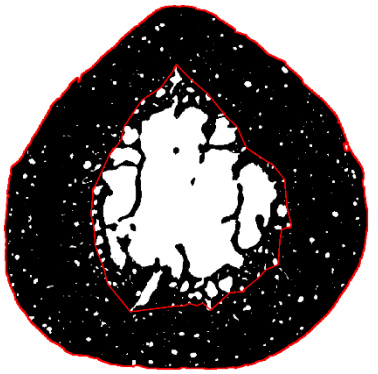
Chaetophractus villosus ZSM 1925 598



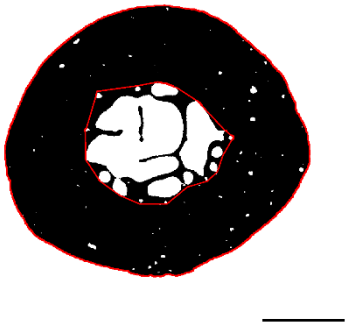
Chaetophractus villosus ZSM 1962 217



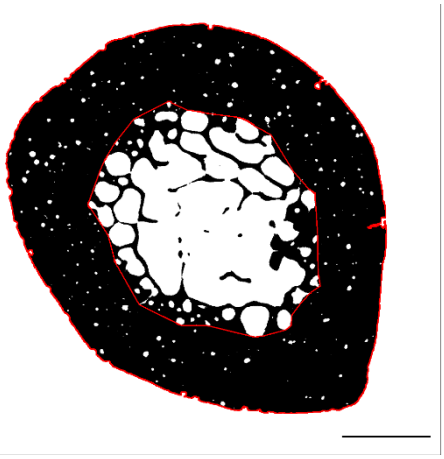
Chlamyphorus truncatus ZMB Mam 6007



Choloepus didactylus FMNH 95448



Choloepus didactylus NMW B5969



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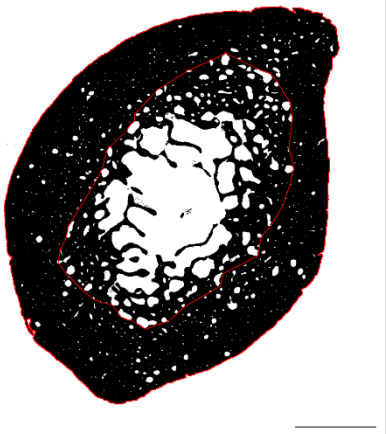
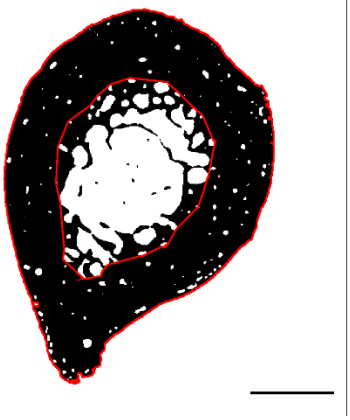
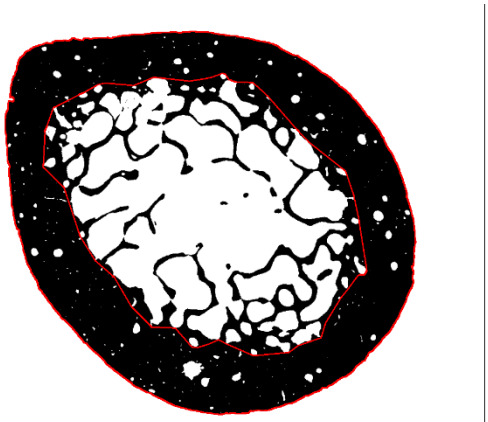


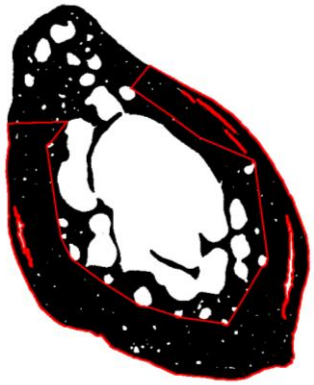
Choloepus didactylus ZMB Mam 102636



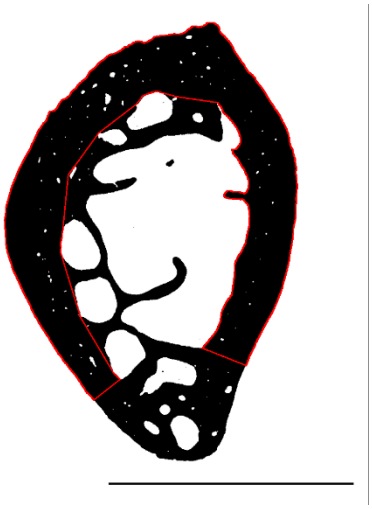
Choloepus hoffmanni NMW 3996



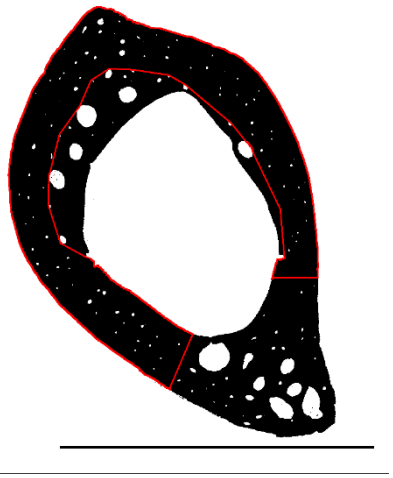
Choloepus hoffmanni ZFMK Mam 1979.0525



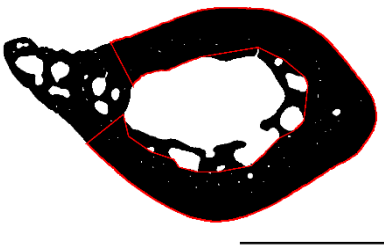
Cyclopes didactylus FMNH 61853



Cyclopes didactylus FMNH 61854



Cyclopes didactylus FMNH 69971



Cyclopes didactylus ZMB Mam 3913

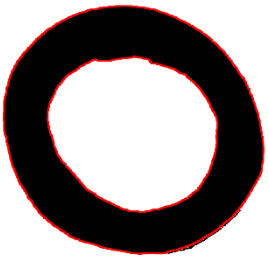
Dasypus novemcinctus ZMB Mam 85937

Dasypus novemcintus texanus FMNH 39307

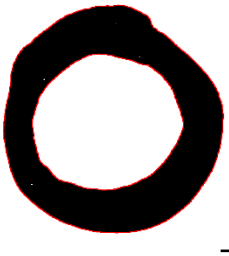
Dasypus septemcinctus ZSM 1954-536

Eucholoeops FMNH P13125

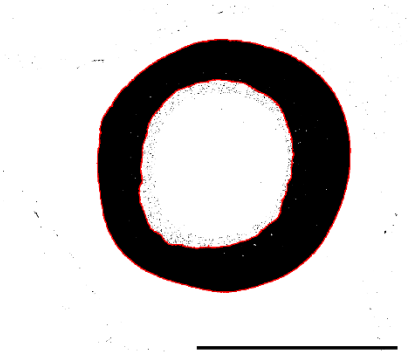
Eucholoeops MNHN.F.SCZ 239



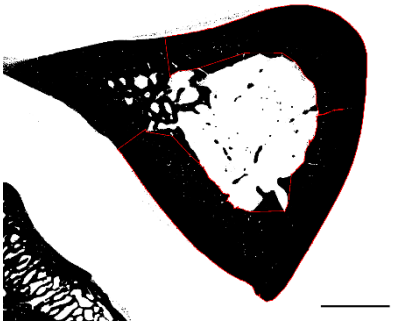
Eulemur albifrons ZMB Mam 44661



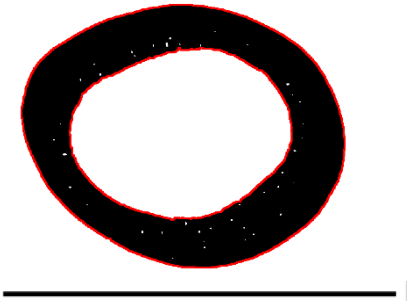
Eulemur albifrons ZMB Mam 44662



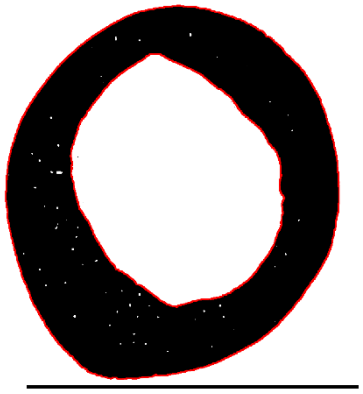
Euoticus elegantulus AMNH 214127



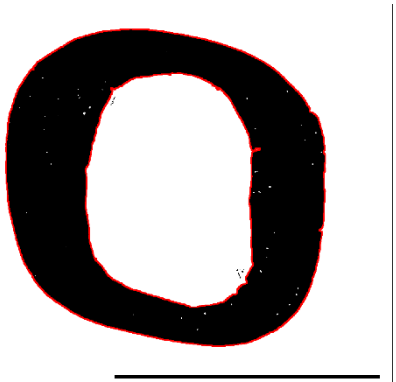
Euphractus sexcinctus ZSM 1926-373



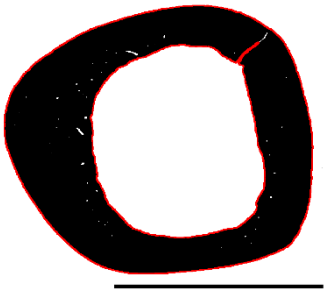
Galagoides demidovii FMNH 166977



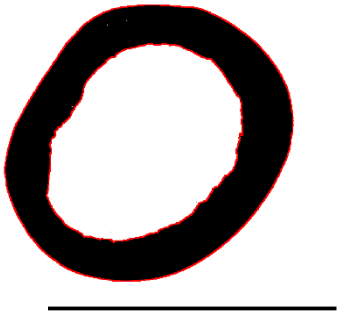
Galago matschiei FMNH 148985



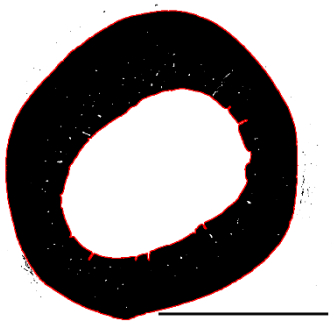
Galago senegalensis FMNH 205317



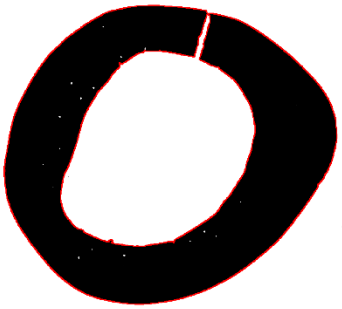
Galago senegalensis ZMB Mam 60601



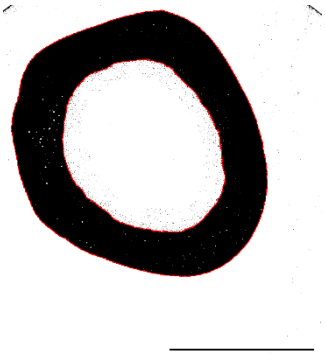
Galago sp. ZMB Mam 86042



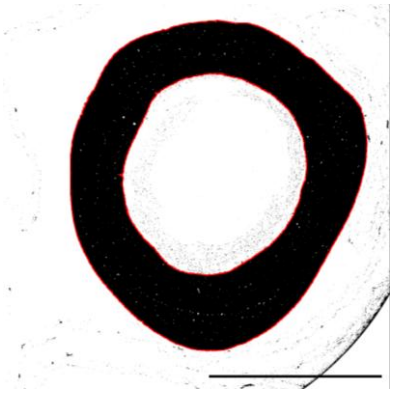
Galago sp. ZMB Mam A209 I



Galago sp. ZMB Mam A209 II

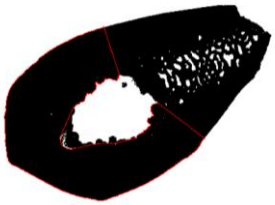


Hapalemur griseus AMNH 170675

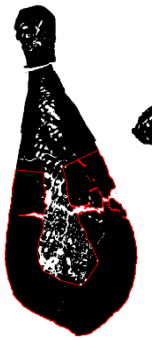


Hapalemur griseus AMNH 170680

Hapalops FMNH P13209



Hapalops MNHN.F.SCZ 238



Hapalops sp. FMNH P13128

Hapalops sp. YPM-PU 15045

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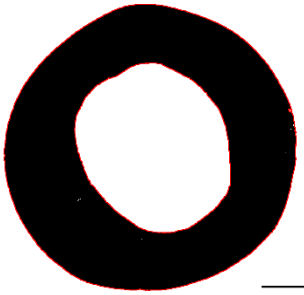

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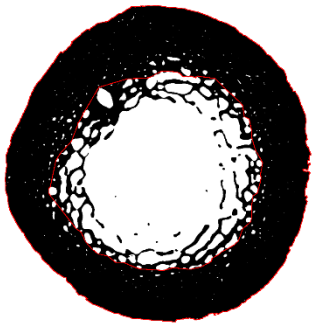
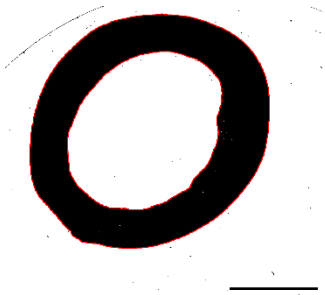
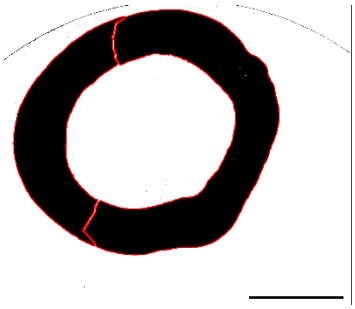


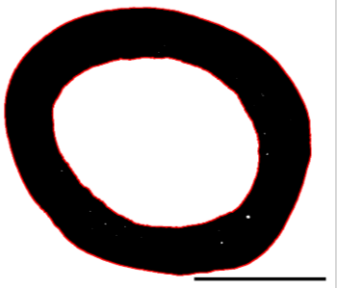
Lasiorhinus latifrons ZSM 1984-67



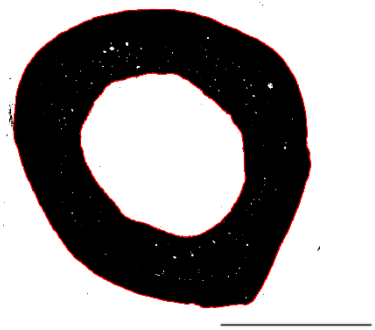
Lemur catta AMNH 170739



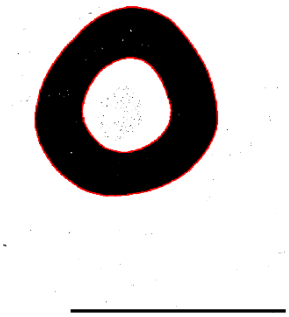
Lemur catta AMNH 170740



Lemur sp. ZMB Mam 83963

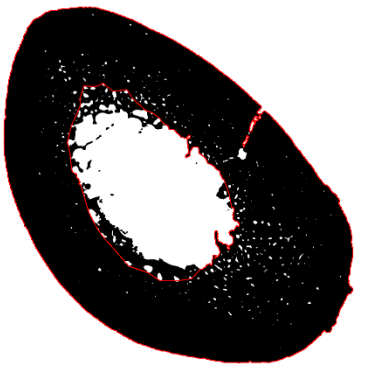


Lemur sp. ZMB Mam 83964

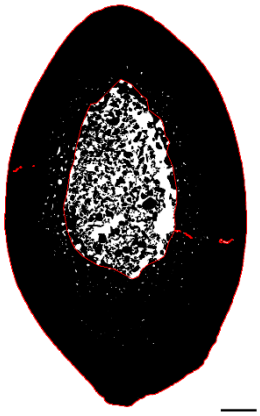


Loris tardigradus AMNH 269

Megaladapis MNHN MAD 1567

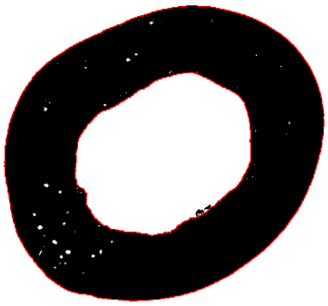


Megaladapis MNHN MAD 7403

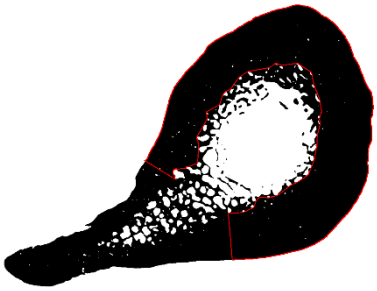


Megaladapis MNHN MAD 7405

Mesopropithecus DCP 11788



Mesopropithecus DCP 9903



Myrmecophaga tridactyla NMW B5964

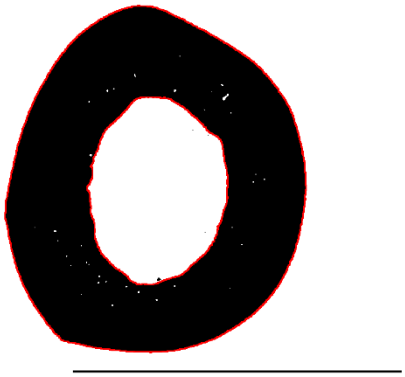
Myrmecophaga tridactyla NMW B5966

Myrmecophaga tridactyla NMW B5967

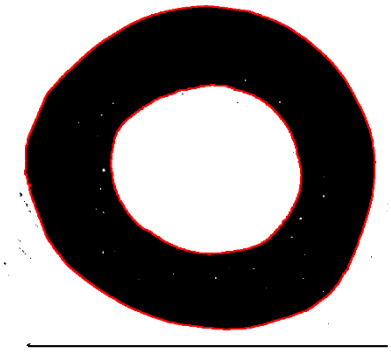
Myrmecophaga tridactyla ZMB Mam 77024

Myrmecophaga tridactyla ZMB Mam 77025

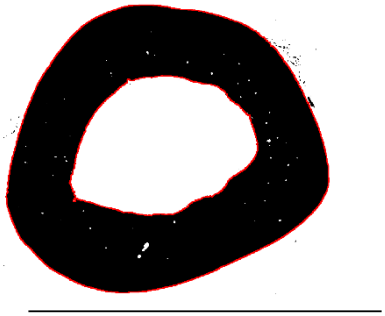
Nycticebus bengalensis ZFMK Mam 1986.0419



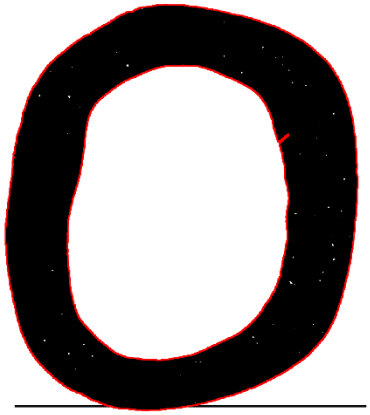
Nycticebus coucang NMW 849



Nycticebus coucang ZMB Mam 2718

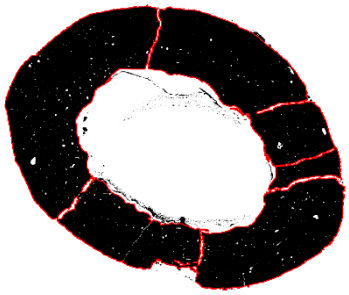


Nycticebus coucang ZMB Mam 84333

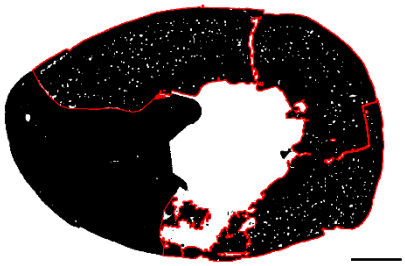


Otolemur crassicaudatus FMNH 198178

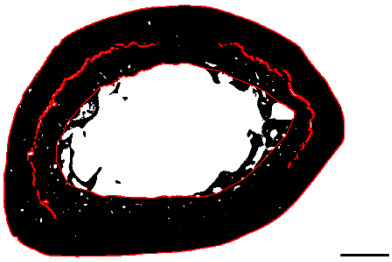
Palaeopropithecus DCP 17342



Palaeopropithecus DCP UA5469



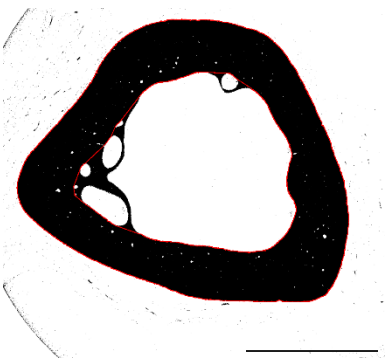
Palaeopropithecus MNHN MAD 8551



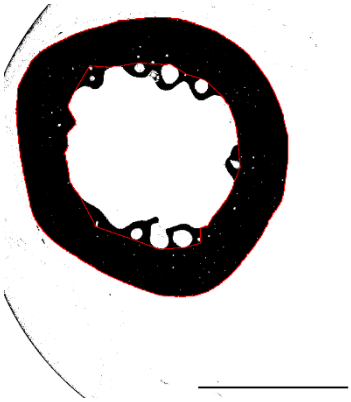
Palaeopropithecus MNHN MAD 8795

Palaeopropithecus MNHN MAD 8808

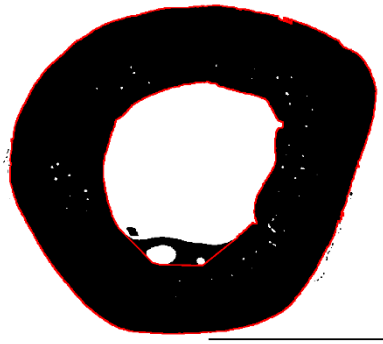
Perodicticus potto AMNH 239436



Perodicticus potto AMNH 52698

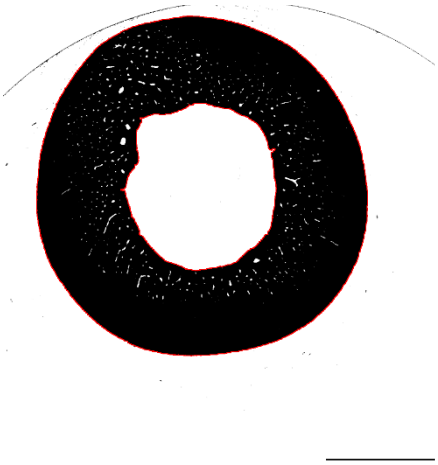


Perodicticus potto AMNH 52717

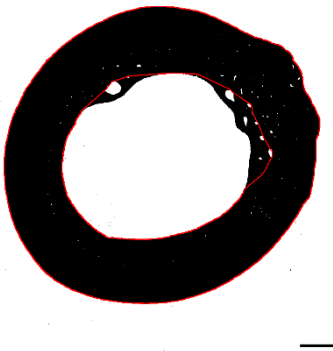


Perodicticus potto NMW 32674

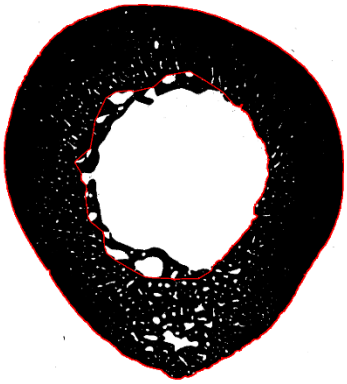
Perodicticus potto ZMB Mam 17260



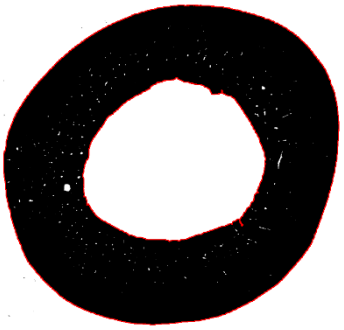
Phascolarctos cinereus AMHN 65610



Phascolarctos cinereus AMNH 107805



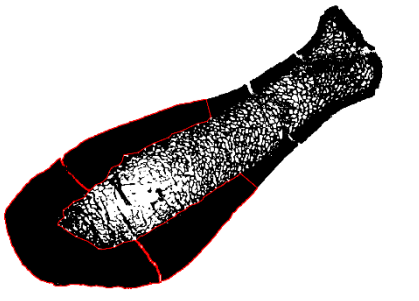
Phascolarctos cinereus AMNH 65607



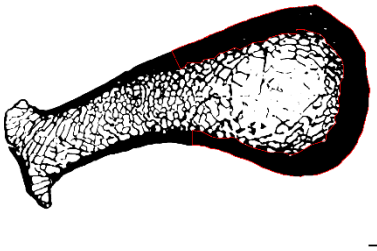
Phascolarctos cinereus AMNH 65608

Phascolarctos cinereus NMW 2027

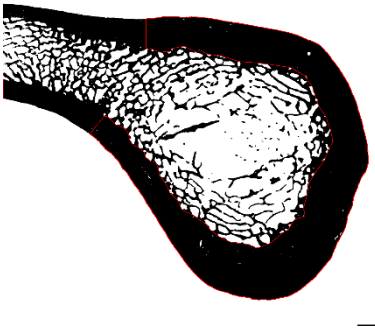
Phascolarctos cinereus ZMB Mam 36035



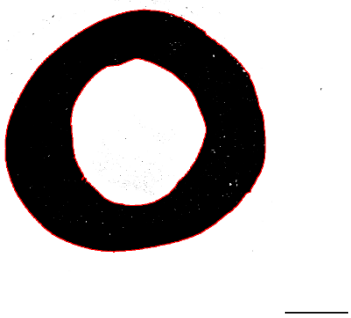
Prepotherium potens YPM-PU 15345



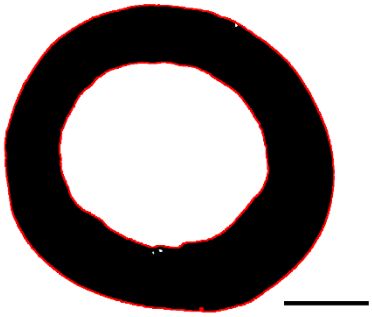
Priodontes maximus ZMB Mam 6163



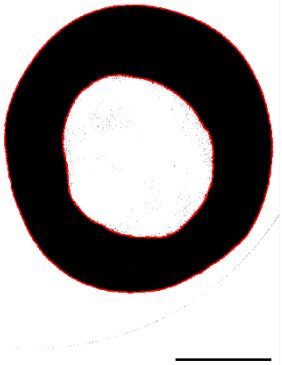
Priodontes maximus ZSM 1931-293



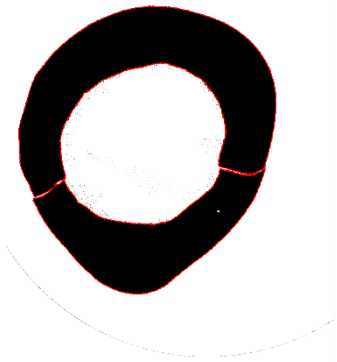
Propithecus diadema AMNH 100636



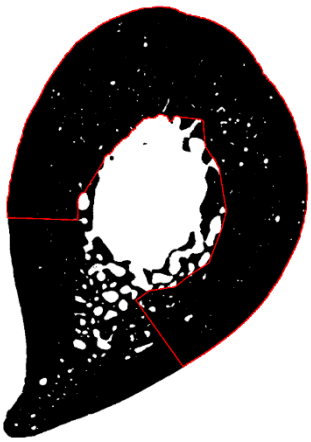
Propithecus sp. ZMB Mam 44771



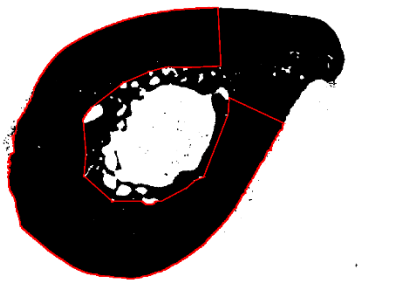
Propithecus verrauxi AMNH 170463



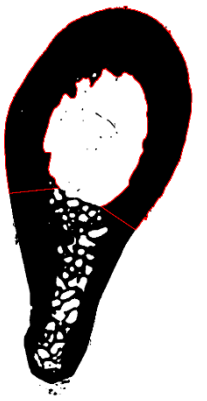
Propithecus verreauxi AMNH 170474



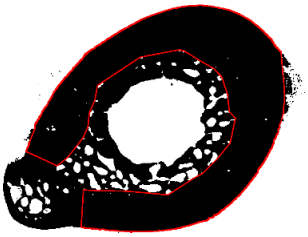
Tamandua mexicana FMNH 123994



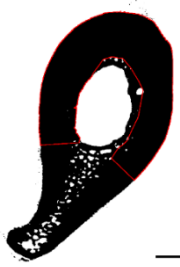
Tamandua tetradactyla ZMB Mam 81441



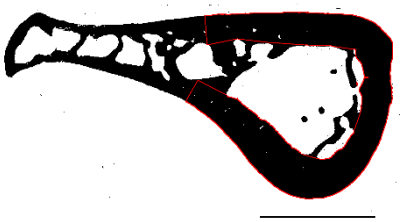
Tamandua tetradactyla ZMB Mam 1925



Tamandua tetradacyla ZMB Mam 35312

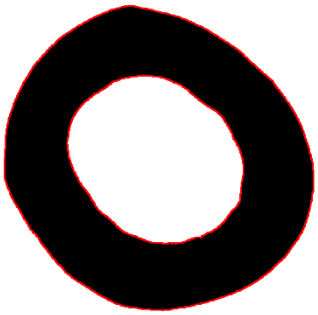


Tamandua tetradacyla ZMB Mam 81448

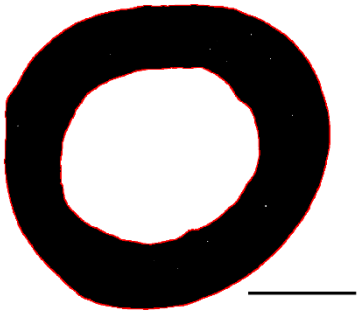


Tolypeutes matacus ZSM 1925-592

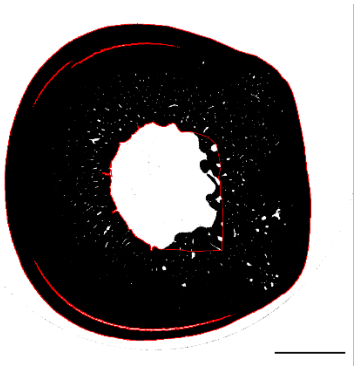
Tolypeutes matacus ZSM 1925-595



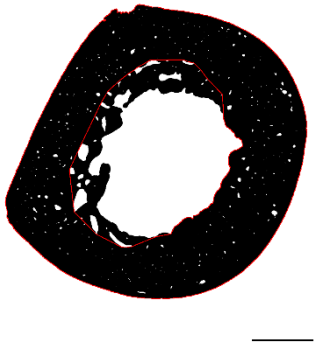
Varecia sp. ZMB Mam 44475



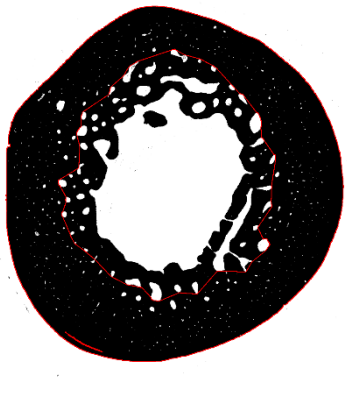
Varecia variegata ZMB Mam 44474



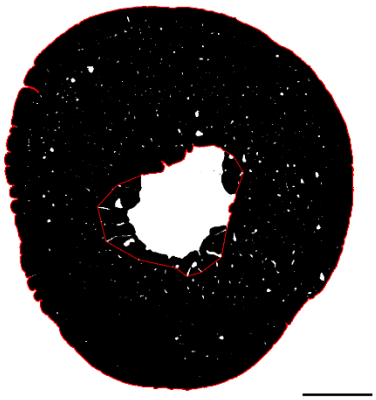
Vombatus ursinus AMNH 65622



Vombatus ursinus SMNS 26510



Vombatus ursinus AMNH 65619



Vombatus ursinus ZMB Mam 5872

Fig. S4. Example of post-binarisation manual correction performed on the humerus of *Propithecus verreauxi* AMNH 170463. In some specimens as the one here presented, because of CT scanning noise, after the automatic thresholding in FIJI (from A to B) some vacuities resulted to be partially filled with black pixels (i.e. 'foreground', wrongly recognised as 'bone'). It can be easily detected at a closer inspection (C). A comparison with the image before thresholding (A) allows to identify such intra-vacuity pixels as noise (e.g. the same type of noise is widespread around the bone section as visible within the medullary cavity). Since cortical compactness (CC) is computed as the percentage ratio between bone area and total cortical area, such noise pixels would bias CC values. They were thus manually deleted, as shown in D.

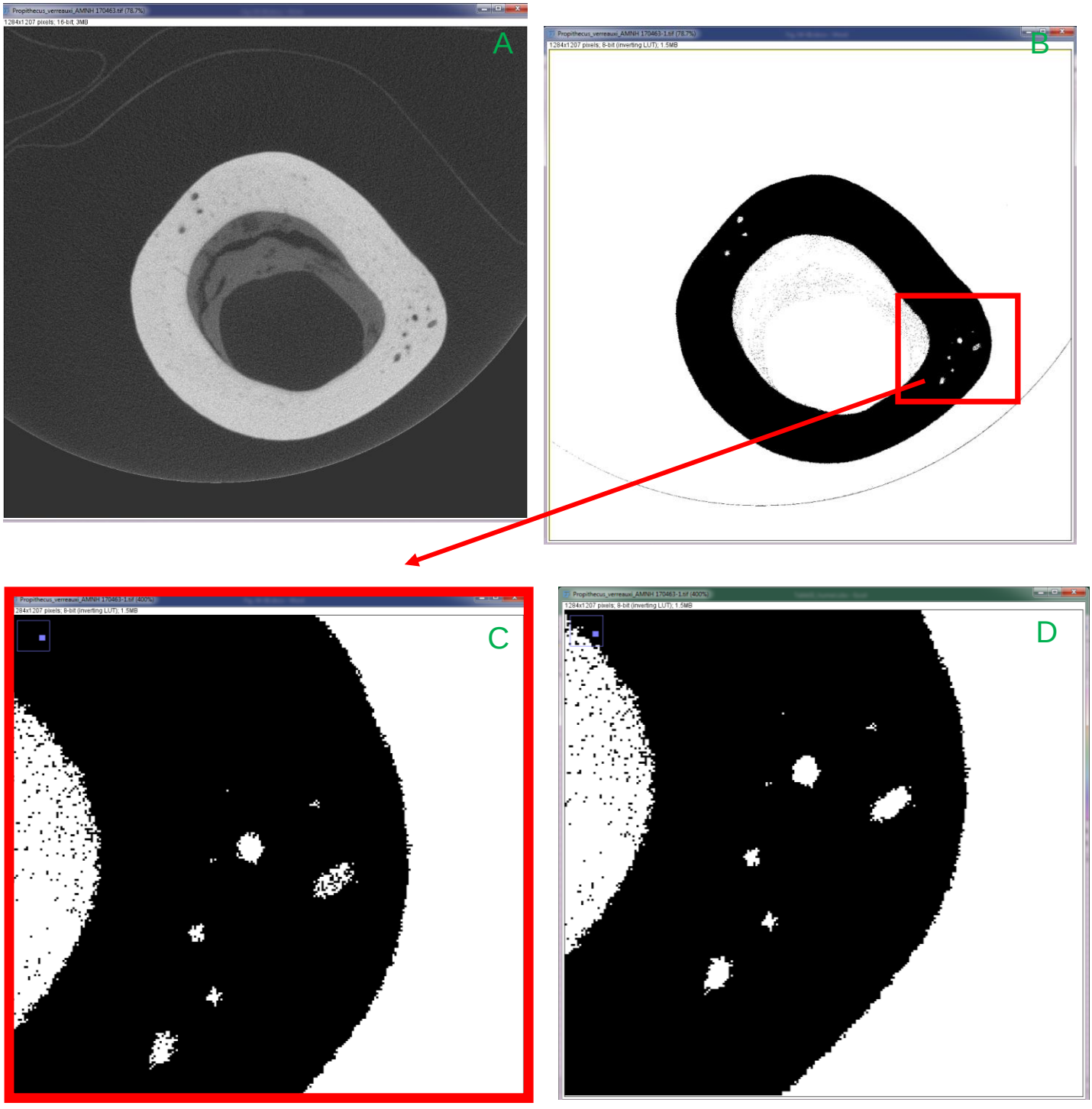


Fig. S5. Example of post-binarisation manual correction performed on the femur of *Dasypus septemcinctus* ZSM 1954-536. In some specimens as the one here presented, after the automatic thresholding in FIJI (from A to B) some black pixels (i.e. 'foreground', wrongly recognised as 'bone') were remaining around the periosteal region because of CT scanning noise. It can be easily detected at a closer inspection (C). A comparison with the image before thresholding (A) allows to identify such signal as noise. Since compactness (CC) is computed as the percentage ratio between bone area and total cortical area, such improper 'bone' pixels would bias CC values. They were thus manually deleted, as shown in D.