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SUPPLEMENTARY ONLINE MATERIAL FOR

**Structural constraints in laminar bone of large-bodied dinosaurs and mammals?**

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**Supplementary Online Material**

**Table S1.** Samples of dinosaur taxa used for this study with measured lamina density.

**Table S2.** Lamina density data obtained from literature sources.

**References**

**Table S1.** Samples of dinosaur taxa used for this study with measured lamina density. Taxa are arranged according to phylogenetic relations (Allain and Aquesbi 2008; Royo Torres et al. 2006; Yates 2007, for Sauropodomorpha, and Murphy et al. 2001 for placental mammals). Mammal grouping variables: A, artiodactyls, C, carnivorans, E, elephantids, and P, perissodactyls. Sauropodomorph grouping variables: BS, basal sauropodomorphs, S, sauropods. "Centre of cortex" refers to the transition of innermost to outermost cortex. Abbreviations: LD, lamina density; l/mm, laminae/mm; l., left; r., right.

Taxon	Group	Specimen no.	Element	Inner cortex (l/mm)	Centre of cortex (l/mm)	Outer cortex (l/mm)	Mean LD (l/mm)	First histological description
<i>Plateosaurus</i>	BS	SMNS F27	Femur, l. 810 mm		6 7		6.5	Klein and Sander 2007
	BS	Compactus Tübingen	Femur, l. 740 mm		8		8	Klein and Sander 2007
	BS	MSF m, Frick	Tibia, r. 510 mm		9.5 10	8.5	9.3	Klein and Sander 2007
	BS	SMNS F14 A	Femur			8	8	Klein and Sander 2007
	BS	SMNS F29 A	Femur				10	Klein and Sander 2007
	BS	SMNS F29	Femur, r.				8	Klein and Sander 2007
	BS	SMNS F14 A	Tibia, 545 mm				8	Klein and Sander 2007
	BS	SMNS F48 Teil 1	Femur, l. 775 mm				7	Klein and Sander 2007
	BS	SMNS F14A	Femur, l. 655 mm				8	Klein and Sander 2007
Basal sauropod	S	PC.DMR CH8-66	Humerus prox	8 8	8	7.5	7.9	
	S	PC.DMR CH8-67	Long bone?	8		6.5	7.3	
<i>Isanosaurus</i>	S	PC.DMR L3-1	Femur, 750 mm	8		8 8	8	Sander et al. 2004
cf. <i>Mamenchisaurus</i>	S	SGP 2006/10	Ulna >960 mm				3.9	Sander et al. 2011
	S	SGP 2006/9	Humerus				4.0	
<i>Dicraeosaurus</i>	S	MFN 02	Femur, 980 mm	6 6	5 5.5	6	5.7	Sander 2000
	S	MFN dd 3032	Femur, 1140 mm	7	7	6.5	6.8	Sander 2000
	S	MFN ab2	Humerus, 620 mm			5 5.5	5.3	Sander 2000
	S	MFN ab10	Humerus, 580 mm			7	7	Sander 2000
	S	MFN 03	Humerus, 610 mm (drilled anteriorly)			6 6	6	Sander 2000

<i>Apatosaurus</i>	S	BYU 725-17014	Femur, 970 mm		6	$\frac{5}{5}$	5.3	Klein and Sander 2008
	S	BYU 681-11940	Femur, 1330 mm			5	5	Klein and Sander 2008
	S	BYU 681-4749	Humerus, 880 mm			4.5	4.5	Klein and Sander 2008
	S	SMA „Jaques“	Femur, 1640 mm			$\frac{4.5}{5}$	4.8	Klein and Sander 2008
	S	MM 33976	Femur, 725 mm			6	6	Klein and Sander 2008
	S	OMNH 1278	Humerus, 258 mm			5	5	Klein and Sander 2008
	S	CM 21715	Humerus, 792 mm			3.5	3.5	Klein and Sander 2008
	S	BYU 601-17328	Femur, 1580 mm			$\frac{5}{5}$	5	Klein and Sander 2008
	S	CM 3378	Humerus, 980 mm			4.5	4.5	Klein and Sander 2008
	S	SMA „Chris“ M4/10-1	Femur, ca. 1440 mm			5	5	Klein and Sander 2008
<i>Barosaurus</i> sp.	S	MFN G91	Humerus			4	4	Sander 2000
<i>Barosaurus africanus</i>	S	MFN Röm. 16 5/ röm. 17 5	Femur, 790 mm		$\frac{5.5}{6}$ 6	6	5.9	Sander 2000
	S	MFN NW4	Femur, 1350 mm		6	$\frac{5}{5}$	5.3	Sander 2000
	S	MFN Nr.76	Femur, 1350 mm			5	5	Sander 2000
	S	MFN Ki 4	Femur, 1200 mm			5	5	Sander 2000
	S	MFN K 10	Femur, 1100 mm		5		5	Sander 2000
	S	MFN Ki 71a	Femur, 1020 mm	$\frac{5}{5}$			5	Sander 2000
	S	MFN A1	Humerus, 990 mm		$\frac{5.5}{5.5}$		5.5	Sander 2000
	S	MFN Röm.11 a7	Humerus, 805 mm			$\frac{5.5}{6}$	5.8	Sander 2000
	S	MFN Röm.16 641	Humerus, 730 mm			$\frac{4}{4.5}$	4.3	Sander 2000
	S	MFN Röm.9 94	Humerus, 640 mm			$\frac{4}{5.5}$	4.8	Sander 2000
	S	MFN T25a	Humerus, 610 mm			5	5	Sander 2000
<i>Diplodocid</i>	S	SMA „Max“	Femur, r. 1490 mm			5	5	Klein and Sander 2008
	S	SMA 650/91-1	Humerus, r. 735 mm			$\frac{4.5}{4.5}$ 4.5	4.5	Klein and Sander 2008
	S	SMA „Aurora“	Femur, r. 1100 mm		$\frac{5.5}{6}$	6	5.8	Klein and Sander 2008
	S	BYU 725-11421	Femur, 990 mm		5	4.5	4.8	Klein and Sander 2008
	S	SMA M16/12-3	Femur, l. 1250 mm		4.5	$\frac{5}{5}$ 5.5	5	Klein and Sander 2008

	S	SMA 647/87-1	Femur, l. 1200 mm		5.5	4 5 5	4.9	Klein and Sander 2008
	S	SMA „XL“	Tibia, 980 mm			5	5	Klein and Sander 2008
	S	SMA 646/87-1	Humerus, l. 7150 mm	5.5	5 5.5 6	5	5.4	Klein and Sander 2008
	S	BYU 725-16569	Femur, 1136 mm	4.5 5	5 5	5 5.5	5	Klein and Sander 2008
	S	BYU 725-12155	Femur, 1345 mm		5 5.5	5 5.5	5.2	Klein and Sander 2008
	S	BYU 725-4889	Femur, 1121 mm		5		5	Klein and Sander 2008
	S	OMNH 01793	Femur, 610 mm			5 5	5	Klein and Sander 2008
	S	BYU 725-9026	Femur, 1246 mm	5	4.5 5	5 5	4.9	Klein and Sander 2008
	S	OMNH 01781	Humerus, 1060 mm		4.5 4.5 5	5 5	4.8	Klein and Sander 2008
	S	BYU 725-13369	Femur, 1420 mm	5 5	5 5 5	4.5 5 5.5	5	Klein and Sander 2008
	S	BYU 681-9033	Femur, 1230 mm		4.5 5	4.5	4.7	Klein and Sander 2008
<i>D. longus</i>	S	CM 33991	Femur, 800 mm			4.5 5 5	4.8	Klein and Sander 2008
<i>Camarasaurus</i>	S	SMA „Toni“	Femur, l. 248 mm			6.5	6.5	Klein and Sander 2008
	S	SMA „ET“	Tibia, l. 615 mm			4	4	Klein and Sander 2008
	S	OMNH 02115	Humerus,227mm			5.5	5.5	Klein and Sander 2008
	S	BYU 725-16776	Humerus, 819 mm			4.5	4.5	Klein and Sander 2008
	S	CM 36664	Femur, 1452 mm			4	4	Klein and Sander 2008
	S	BYU 681-4742	Humerus, 615 mm			5	5	Klein and Sander 2008
	S	BYU 725-11714	Humerus, 925mm			5	5	Klein and Sander 2008
	S	CM 36664	Humerus, 1172 mm			4.5 5	4.8	Klein and Sander 2008
	S	OMNH 02113	Humerus, 1204 mm			4.5	4.5	Klein and Sander 2008
<i>Camarasaurus lentus?</i>	S	CM 38320	Humerus, 1040 mm			4.5	4.5	Klein and Sander 2008
	S	CM 33963	Humerus, 508 mm			5	5	Klein and Sander 2008
<i>Camarasaurus lentus</i>	S	CM 21772	Femur, 550 mm			4	4	Klein and Sander 2008
	S	CM 11393	Femur, 1566 mm			4.5 4.5	4.5	Klein and Sander 2008

<i>Europasaurus</i>	S	DFMMh/FV 492.9	Femur	6 7 7 7.5			6.9	Sander et al. 2006
	S	DFMMh/FV 415	dist. Femur	6 6.5		7	6.5	Sander et al. 2006
	S	DFMMh/FV 153	Femur shaft >350 mm	7		6	6.5	Sander et al. 2006
	S	DFMMh/FV 001	Tibia		7		7	Sander et al. 2006
	S	DFMMh/FV 495.9	Dist. femur >310 mm			7	7	Sander et al. 2006
<i>Brachiosaurus</i>	S	MFN cc2	Humerus		5.5	7	6.3	Sander 2000
	S	MFN T8	Humerus		5 6	5.5 7	5.9	Sander 2000
	S	MFN t7	Humerus		5.5	5	5.3	Sander 2000
	S	MFN dd 452	Femur		6	5 6 6	5.8	Sander 2000
	S	MFN Röm.9 1	Femur		7.5	5.5 6	6.3	Sander 2000
<i>Phuwiangosaurus</i>	S	PC.DMR K16-20	Femur, l.			7 7.5	7.3	Klein et al. 2009
	S	PC.DMR K4 428	Humerus, l.			7.5 8	7.8	Klein et al. 2009
	S	PC.DMR PWSA-2	Femur, r.			8 8 8.5 9	8.4	Klein et al. 2009
	S	PC.DMR no No	Femur, r. 103 mm			8 7.5	7.8	Klein et al. 2009
	S	PC.DMR PWSA-1	Femur, l.			9	9	Klein et al. 2009
	S	PC.DMR K4-366	Femur, r.		7 7 7		7	Klein et al. 2009
	S	PC.DMR K11-1	Femur, l.			6 6	6	Klein et al. 2009
	S	PC.DMR K/6-23	Femur, l.			6.5 7	6.8	Klein et al. 2009
	S	PC.DMR KD2-1	Humerus, l.		7		7	Klein et al. 2009
<i>Janenschia</i>	S	MFN Nr.22	Femur, 1270 mm		4.5		4.5	Sander 2000
<i>Alamosaurus</i>	S	TMM 43600-2	Humerus, r.		4 4	3.5	3.8	Klein et al. 2012
	S	TMM 43090-1	Humerus, r.			5 4	4.5	Klein et al. 2012
<i>Ampelosaurus</i>	S	MDE C3270	Humerus, l.			6 8.5 9	7.8	Klein et al. 2012
	S	MDE C3638	Femur			5 5.5 6	5.5	Klein et al. 2012
<i>Mammuthus primigenius</i>	E	MQB RHK 02.1	Tibia?			3 3.5	3.3	Sander and Andrassy 2006
<i>Astrapotherium</i>	?	IPB M4468	Tibia		3	3	3	

<i>Equus</i>	P	MQB 4.8.516	Juvenile Metatarsal	4	4		4	Sander and Andrásy 2006
	P	MQB 4.4.733	Tibia	3.5	4		3.8	Sander and Andrásy 2006
	P	MQB 4.4.657	Metatarsal	3.5	3.5 3.5		3.5	Sander and Andrásy 2006
	P	MQB 4.4.634	Metatarsal		3		3	Sander and Andrásy 2006
	P	IPB M 2042		4 4 4.5	4 4.5 4.5		4.3	Sander and Andrásy 2006
<i>Hypotherium gracile</i>	A	IPB M4198	Metacarpal, r.		4 4	3	3.7	
<i>Sus scrofa</i> (domestic)	A	IPB no nr.			6.5 7 7 8 8 8 8.5	6.5 6.5 7.5	7.4	
	A	IPB no nr.	Humerus			7 7.5	7.3	
<i>Sus scrofa</i> (feral)	A	IPB M12	Femur		7.5 8.0 8.5 8.5		8.1	
<i>Bison priscus</i>	A	MQB 4.8.351	Metatarsal		5		5	Sander and Andrásy 2006
	A	MQB 4.8.344	?			4 4.5	4.3	Sander and Andrásy 2006
	A	MQB 4.8.72	Metatarsal			3.5 5	4.3	Sander and Andrásy 2006
<i>Bos</i>	A	IPB M26	Tibia		4.5 5	5.5	5	Sander and Andrásy 2006
<i>Megalocerus giganteus</i>	A	MQB 4.8.308			5.5		5.5	Sander and Andrásy 2006
	A	MQB 4.8.309			5.5 5.5		5.5	Sander and Andrásy 2006
	A	MQB 4.8.304			4		4	Sander and Andrásy 2006
	A	MQB 4.8.315			5		5	Sander and Andrásy 2006
<i>Alces alces</i>	A	IPB M6582	?		4.5 4.5 5 5	4.5	4.7	
<i>Cervus elaphus</i>	A	MQB 4.8.299	Metatarsal		5 5	5.5	5.2	Sander and Andrásy 2006
	A	IPB M6007	Humerus	7.5	7 7 7.5		7.3	
<i>Canis l. familiaris</i>	C	IPB no number	Humerus		5 6 7	5.5	5.9	
<i>Ursus spelaeus</i>	C	IPB M809	Femur			5	5	

**Table S2.** Lamina density data obtained from literature sources. Abbreviations: T, theropod; E, elephantid; l/mm = laminae/mm.

Taxon	Group	Specimen no.	Element	Inner cortex (l/mm)	Centre of cortex (l/mm)	Outer cortex (l/mm)	Mean LD (l/mm)	Source
<i>Herrerasaurus</i> sp.	T	MCZ 7064, section 99-22 H 3T	Humerus			17 17	17	Ricqlès et al. 2003
<i>Herrerasaurus ischigualastensis</i>	T		Femur		13	10 10.5	11.2	Starck and Chinsamy 2002
<i>Coelophysis</i> sp.	T	UMMP 129618, section 88-24 CF 3T	Femur		17 19 19		18.3	Ricqlès et al. 2003
<i>Allosaurus</i>	T						8 8.5 8.3	Padian et al. 2004
<i>Loxodonta africana</i>	E	F3	Femur, 395 mm				3.3	Curtin et al. 2012
	E	F23	Femur, 303 mm				2.7	Curtin et al. 2012
	E	F24	Femur, 452 mm				3.3	Curtin et al. 2012
	E	T5	Tibia, 315 mm				3.8	Curtin et al. 2012
	E	T23	Tibia, 264 mm				3.2	Curtin et al. 2012
	E	T24	Tibia, 444 mm				3.3	Curtin et al. 2012
<i>Elephas maximus</i>	E	F26	Femur, 510 mm				3.1	Curtin et al. 2012
	E	T26	Tibia, 433 mm				2.6	Curtin et al. 2012
<i>Mammuthus columbi</i>	E	F4	Femur, 479 mm				2.3	Curtin et al. 2012
	E	T3	Tibia, 445 mm				2.0	Curtin et al. 2012
	E	T0	Tibia, 437 mm				2.2	Curtin et al. 2012
<i>Mammuthus exilis</i>	E	F13	Femur, 266 mm				2.8	Curtin et al. 2012
	E	F6	Femur, 234 mm				2.9	Curtin et al. 2012
	E	F5	Femur, 253 mm				3.6	Curtin et al. 2012
	E	T6	Tibia, 335 mm				2.8	Curtin et al. 2012

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