

Identifying the bones: a radiographic comparison of the cortical bone thickness in the radius of humans and kangaroos



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Introduction

It is important, yet often difficult, to identify whether a fragment of bone is human. This is especially true for fragments of the shaft of long bones as they may be:

- lacking distinguishing features
- durable, therefore more likely to be encountered



•similar in size to human bones

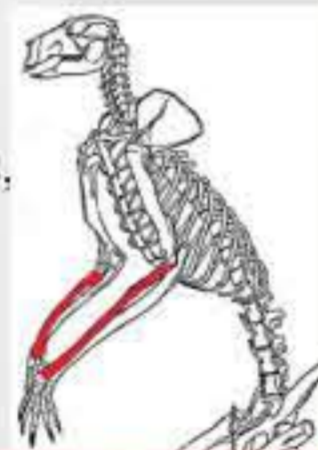
cortex

It has been proposed by some (Ubelaker, 1989; Wolf, 1986) that the thickness of the **cortex** may help distinguish between human and non-human long bone fragments - although it is not clear for which bones.

The thickness of the cortex is affected by many factors; one important factor being the amount and type of *load* acting on the bone (Nanyan et al., 2005; Ruff et al., 1991, Woo et al., 1981).

Would a difference in cortical bone thickness therefore depend more on the type of bone than whether it was human or not?

This study therefore compared the **radius** of humans and kangaroos, as this bone shows similarities in external appearance and function in both humans and kangaroos.

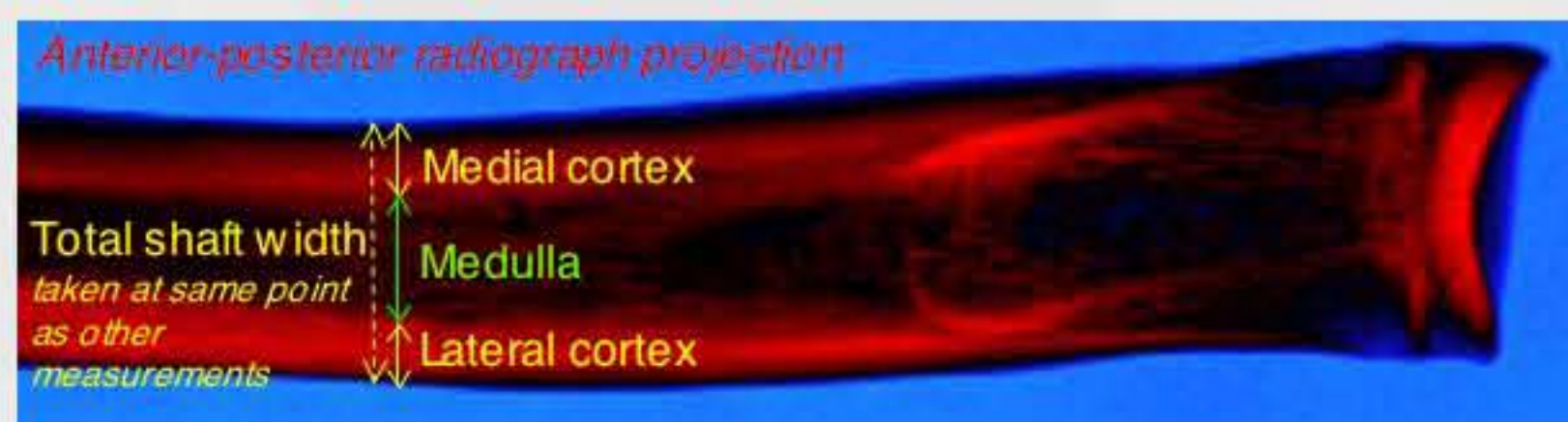


After Dawson, T.J. (1995) Kangaroos: the biology of the largest marsupial. University of New South Wales Press, Sydney.

Materials and methods

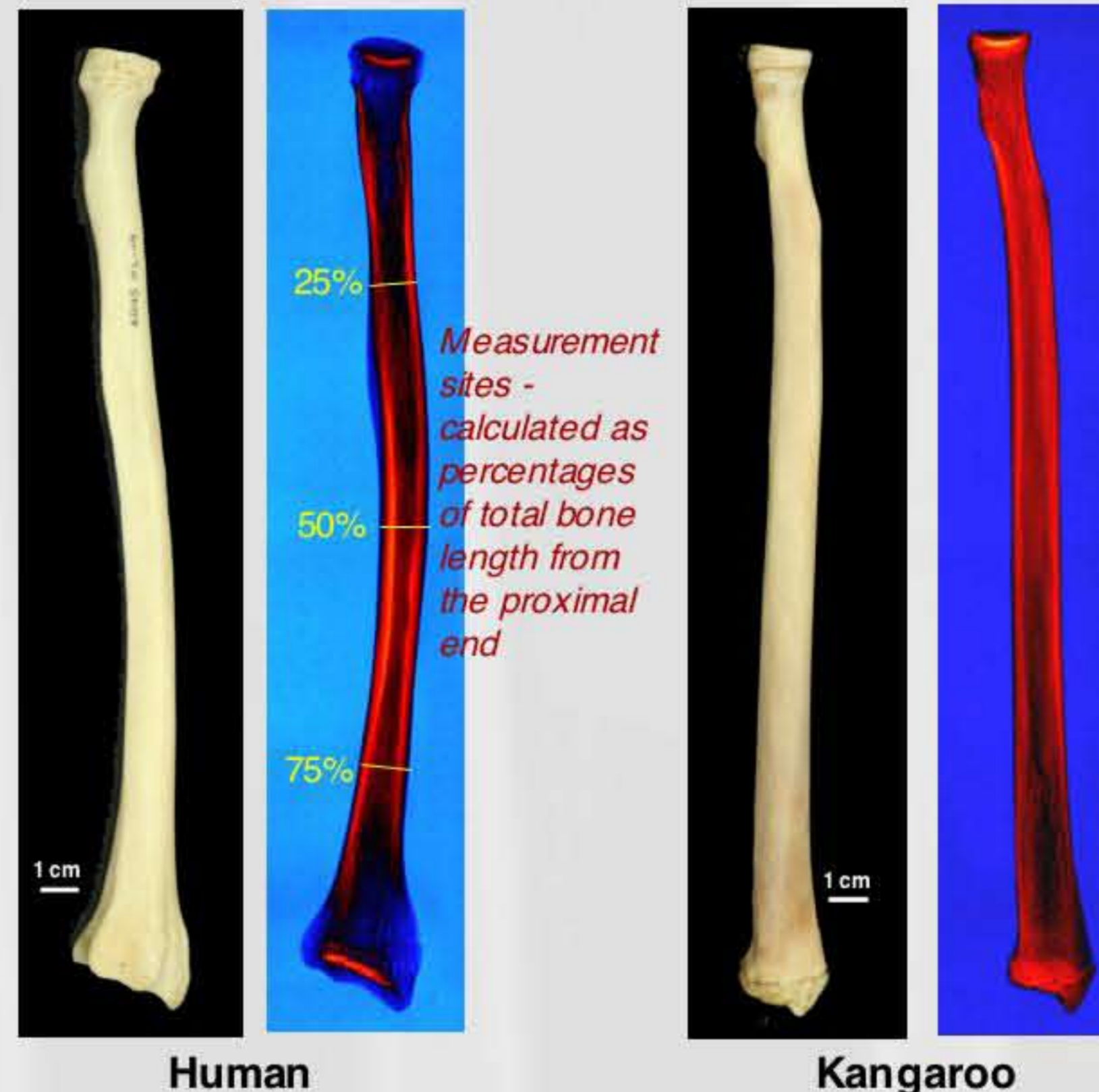
Radii from 20 Caucasoid adult humans, and 22 kangaroos (subadult or older) were compared. Kangaroo species used were Red kangaroo (*Macropus rufus*), Eastern Grey (*Macropus giganteus*) and Western Grey (*Macropus fuliginosus*).

Radiographs were taken (by the second author, WR) of each bone in two projections (anterior-posterior and medial-lateral), and the digital images measured using OsiriX program version 1.7.1. Measurements (shown below) were taken at three points along the shaft on each projection.



Results

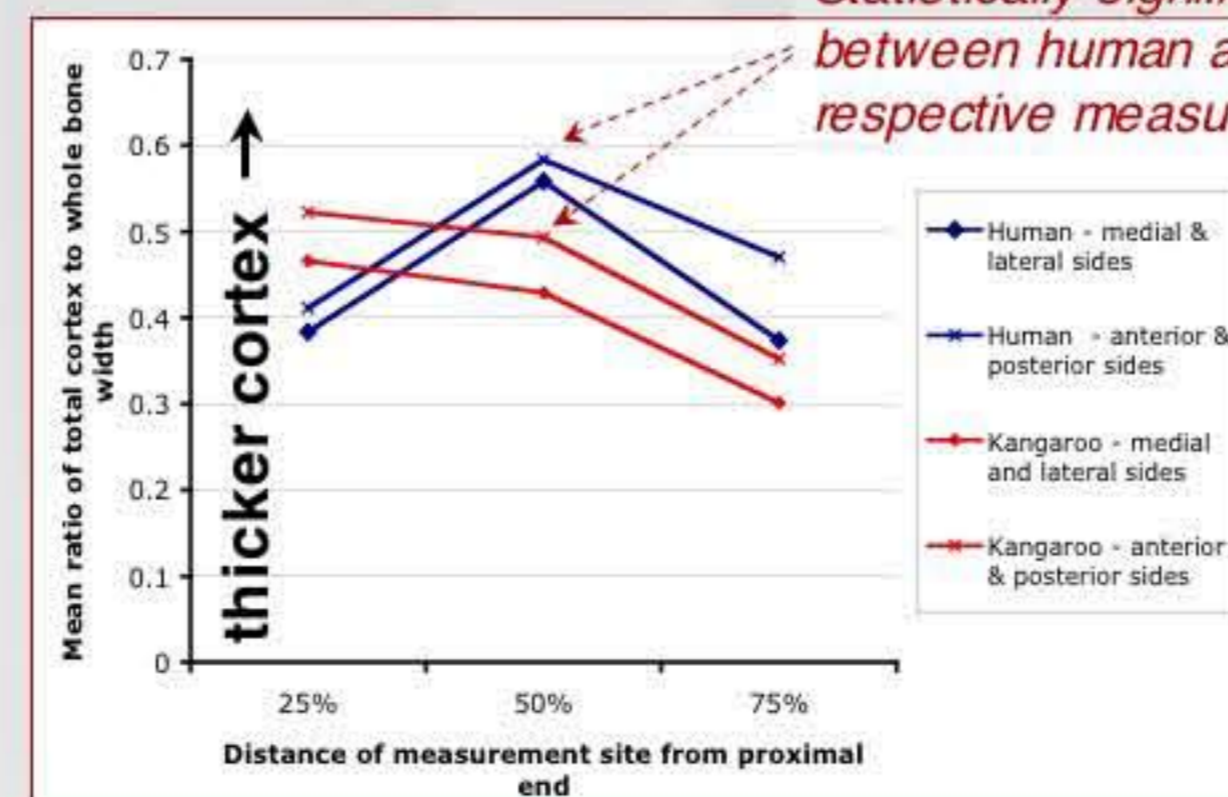
Examples of radii used and their corresponding radiographs:



The first figure considered was the **cortical thickness ratio**. This is determined by:

$$\frac{\text{total cortical thickness}}{\text{total shaft width}}$$

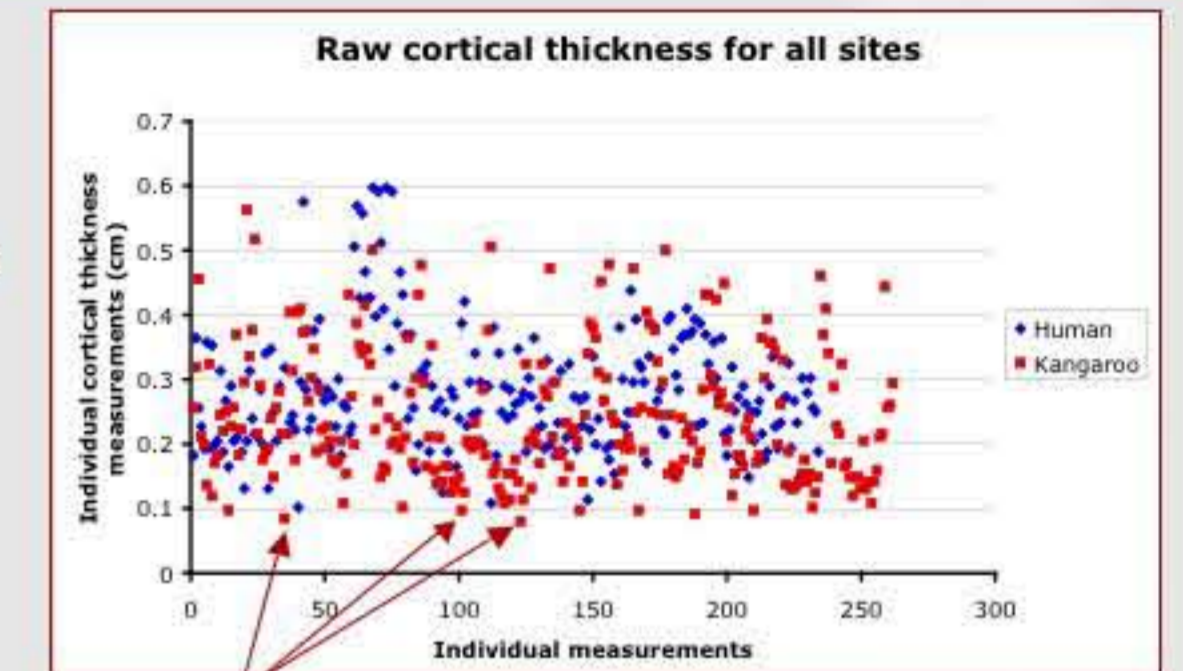
therefore taking into account the size of the bone and the obvious effect this has on the thickness of the cortex. *Statistically significant differences between human and kangaroo at respective measurement sites -*



indicating differences in structure along radius

Yet in many cases, bone fragments may not give much indication of total shaft width. Can the raw cortex measurements be used to distinguish human from kangaroo radii?

Looking at individual measurements of cortical thickness - as would be the case with a small fragment - shows no clear distinction between human and kangaroo measurements



More measurements reflecting a thinner cortex for kangaroos as several kangaroo bones used were smaller than human

Conclusions

Using cortical thickness measurements in the identification of bone fragments is not straightforward. The cortical thickness of the two types of radii used in this study overlap when all sites are observed together. However, as differences between human and kangaroo radii were apparent when considering the sites individually, further work in this area is warranted. This may lead to, if not a definitive method for identifying bone fragments, at least a useful tool that may be combined with other methods to assist in this difficult but important field.

If the emphasis of future research can be placed on **mapping the boundaries of cortical thickness for the human**, this could be used to at least eliminate fragments which fall outside these parameters. In doing this, assessing the ratio of cortical thickness to the shaft as a whole would still prove the most workable; whereas other methods again may have to be explored for those fragments from which shaft width measurements are unobtainable.



References

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Acknowledgments

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