

# Another possible complication in the use of Harris lines as an indicator of growth disruption

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## Introduction

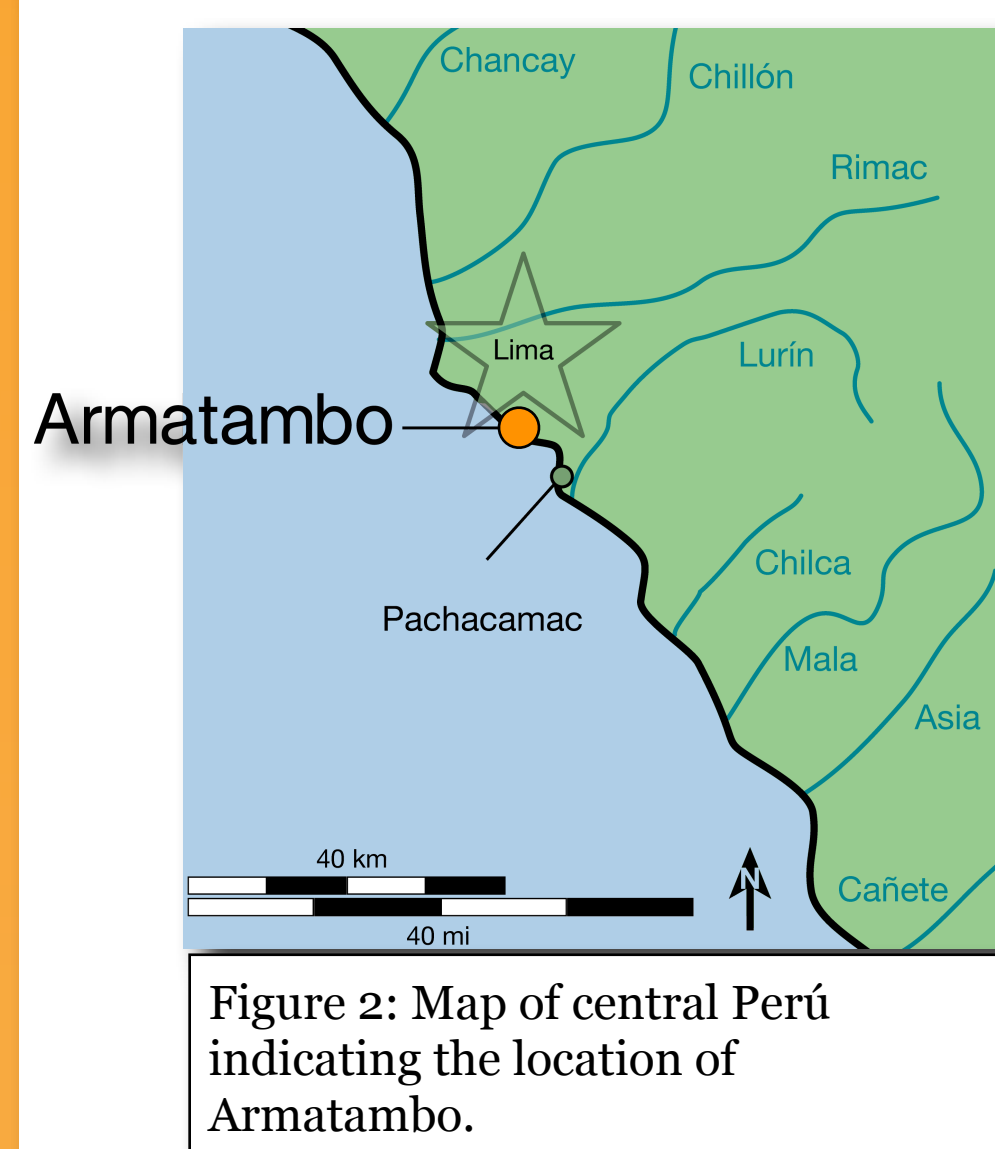
Harris lines are a bone formation linked to many types of physiological stress in subadulthood. Since the 1960s, researchers have attempted to use the prevalence of Harris lines in past populations to gauge health (Wells 1963) (Figure 1). This study uses Harris lines to look for differences in subadult health between the sexes within a population from a central Andean state.

The hypothesis is that males and females who lived in a state level society should have different Harris line counts since the sexes likely experienced dissimilar upbringings due to entry into sexually-divided labor forces.



Figure 1: Radiograph of a tibia with visible Harris lines.

## Materials



I examined skeletons from the Late Intermediate Period (AD 1000 - 1478) site of Armatambo to test the hypothesis.

Armatambo was one of the major settlements of the Ychsma state on the central coast of Peru (Figure 2) (Díaz 2004; Díaz and Vallejo, 2002, 2003, 2004).

## Acknowledgements

I would like to thank Kathy Forgey, Dawn Sturk, and the students of the 2007 and 2009 bioarchaeology field schools for their important roles in this project. Maritza Perez Ponce was very gracious in allowing me access to this skeletal collection. Robert Benfer and Deborah Pearsall provided invaluable guidance.

## Methods

A radiography field school led by Kathy Forgey and Dawn Sturk took anterior-posterior radiographs of the femur and tibia of a sample of adults in the Armatambo collection (Figure 3). The developed radiographs were placed on a light box and photographed using a digital camera on a tripod.

I then counted Harris lines from the digital images while manually adjusting the tonal levels in Adobe Photoshop (Figure 4). Lines had to be roughly perpendicular to the long axis of the diaphysis and extend at least 1/4" across the width of the bone.

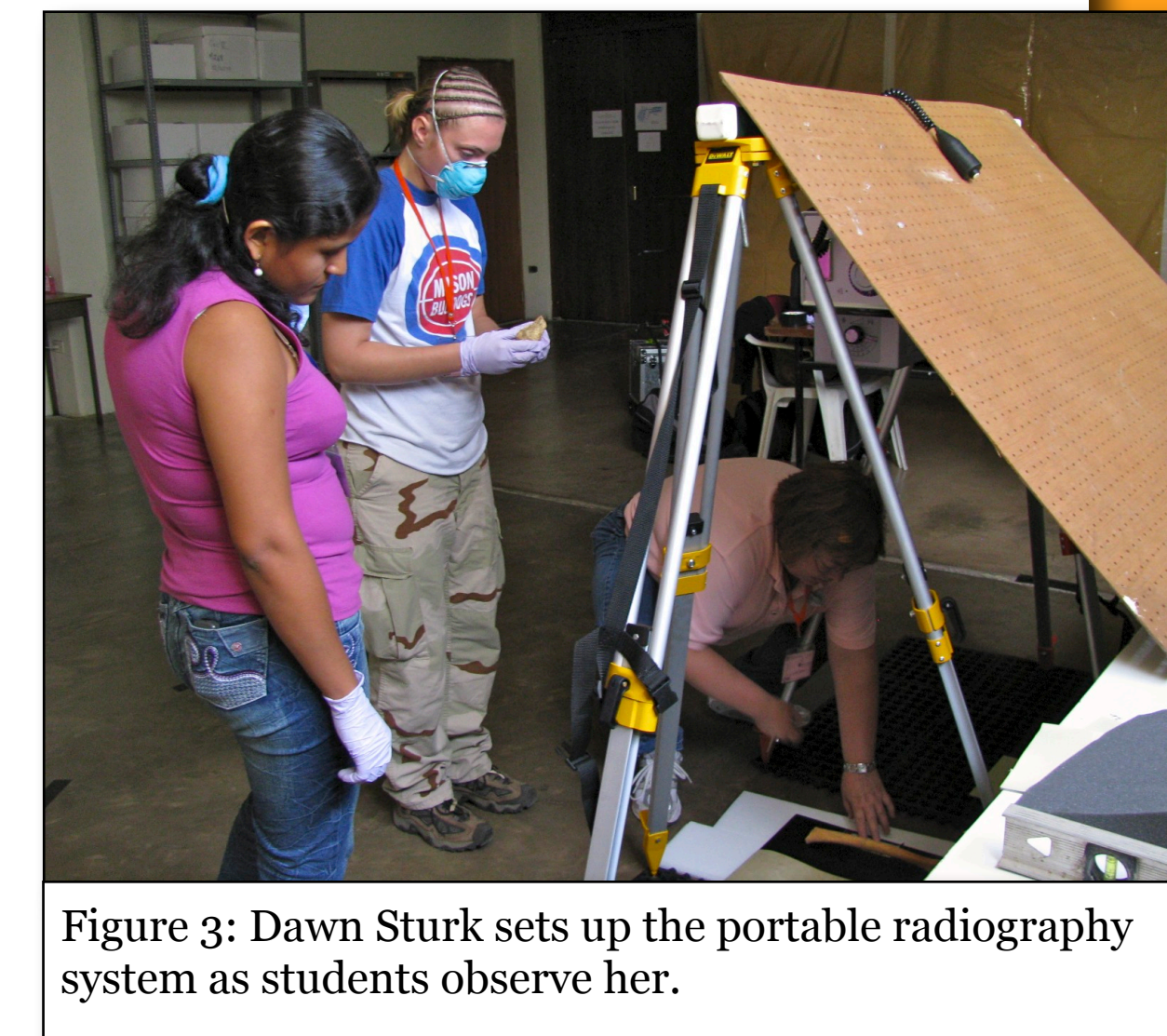


Figure 3: Dawn Sturk sets up the portable radiography system as students observe her.

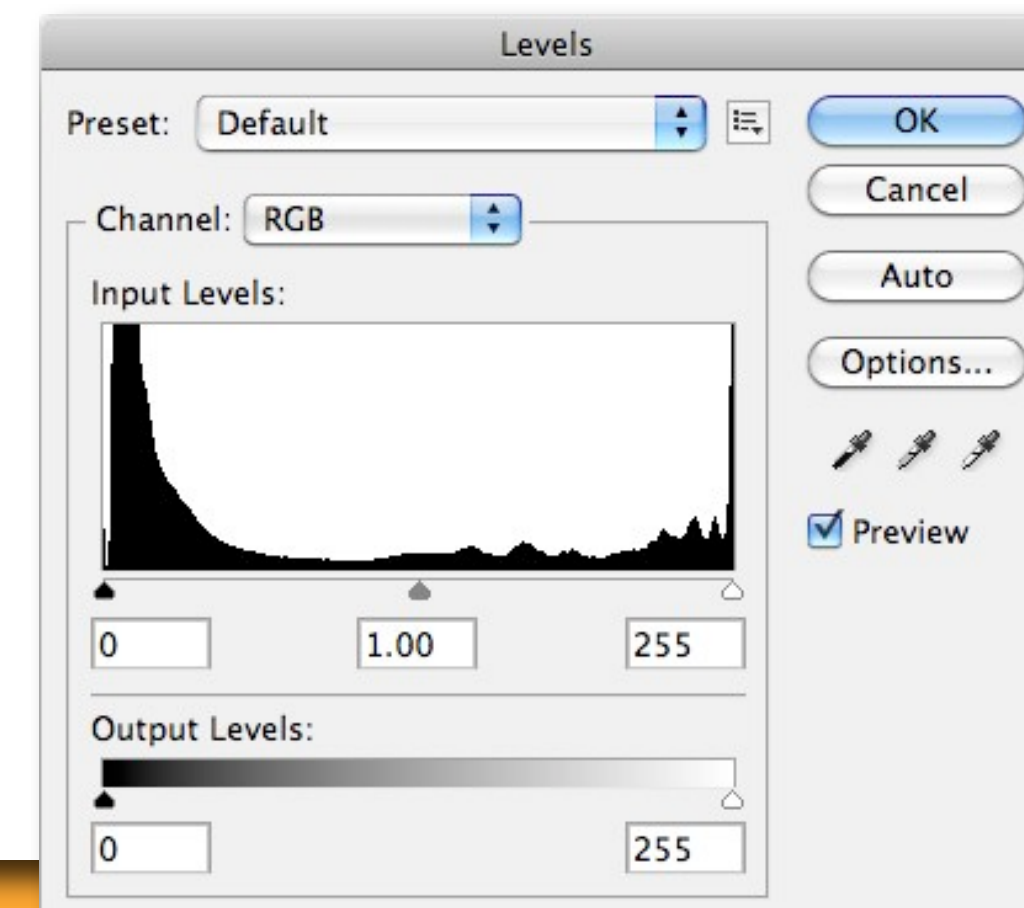


Figure 4: Levels controls in Adobe Photoshop.

Statistical analysis used the general linear model. Harris line count was set as the dependent variable. Age-at-death in years was set as a covariate, in case there was a negative association with Harris line counts. Femoral and tibial Harris line counts were analyzed separately.

## Results

When unadjusted for age, the female mean Harris line counts was several times greater than the males' (Figure 5). However, this difference did not reach statistical significance ( $p = 0.20$  for femoral lines and  $p = 0.27$  for tibial lines). Also, when age-at-death was set as the covariate, there was an even less significant difference in femoral or tibial Harris line counts between males and females ( $p = 0.74$  for femoral lines and  $p = 0.55$  for tibial lines).

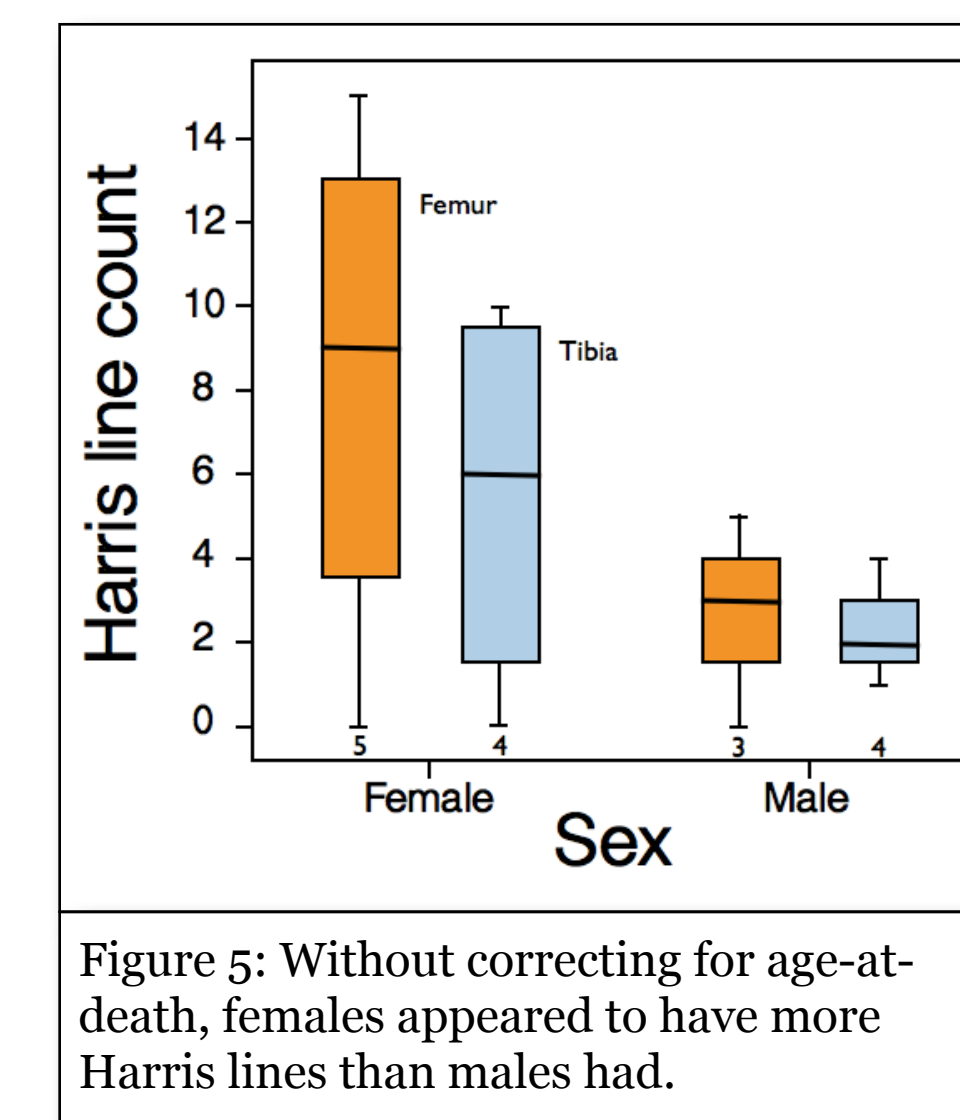


Figure 5: Without correcting for age-at-death, females appeared to have more Harris lines than males had.

## Discussion

The results of the analysis suggests that males and females in this sample from the Ychsma state did not experience subadulthoods disparate enough to cause different levels of bone growth interruption.

The GLMs found positive associations between Harris line counts and age-at-death, puzzling since Harris line counts should decrease with age-at-death due to remodeling. Student investigators in this project noted on the skeletal data forms that certain skeletons were unusually lightweight. These bones tended to belong to older females. Based on these observations, it is possible that cortical thinning with old age is another confounding variable in Harris line analysis. This explanation accounts for the higher count of Harris lines in older individuals, especially females.

## Conclusion

No statistically significant differences were found in Harris line counts between males and females in this sample. Harris lines were positively correlated with age-at-death in females, an unexpected result that may indicate a confounding variable in Harris line count analysis that has not been considered before: the uncovering of Harris lines in old age due to loss of cortical bone.

## References

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## Supplemental Material



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Anthropotron:  
Mobile stature  
estimation!

