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Measuring Iron Concentrations in Individuals with Cribra Orbitalia and Porotic Hyperostosis Using XRF

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Measuring Iron Concentrations in Individuals with Cribrra Orbitalia and Porotic Hyperostosis Using p-XRF



Eduardo Maya - Biological Anthropology

Introduction

- Research has supported and refuted the theory that iron deficiency anemia (IDA) causes porotic hyperostosis (PH) and cribrra orbitalia (CO)
- CO and PH are two pathological conditions that are identified by porosities along different areas of the human skull (see fig. 1) and are used to estimate the overall health of archaeological human remains.
- Many of the current research methods used to test the IDA hypothesis destroy irreplaceable human skeletal samples.
- Portable X-Ray Fluorescence (p-XRF) has the capability to conduct this research in a nondestructive manner and was used in this study to take the iron element concentrations from 12 human crania.
- Results will assess the effectiveness of p-XRF as a method for evaluating the IDA hypothesis in future research.

Materials and Methods

- Standard methods were first used to determine the sex, age, and pathology of each sample. Methods visually analyze features along the crania of each sample and compare them to known characteristics.
- Features used include the eyebrow ridge used to determine sex and dental wear used to determine age. CO and PH are both rated depending on severity, ranging from 1-3, with 1 signifying no presence while 3 was a severe case.
- p-XRF took 90 seconds to collect data (see fig.2) and once it completes its cycle, we are given a parts per million element concentration reading.
- Students t-test and varied graphs were used to determine if iron concentration differences existed based on pathology.



Fig 1. Individual with Cribrra Orbitalia



Fig 2. p-XRF being used to collect data at UNC

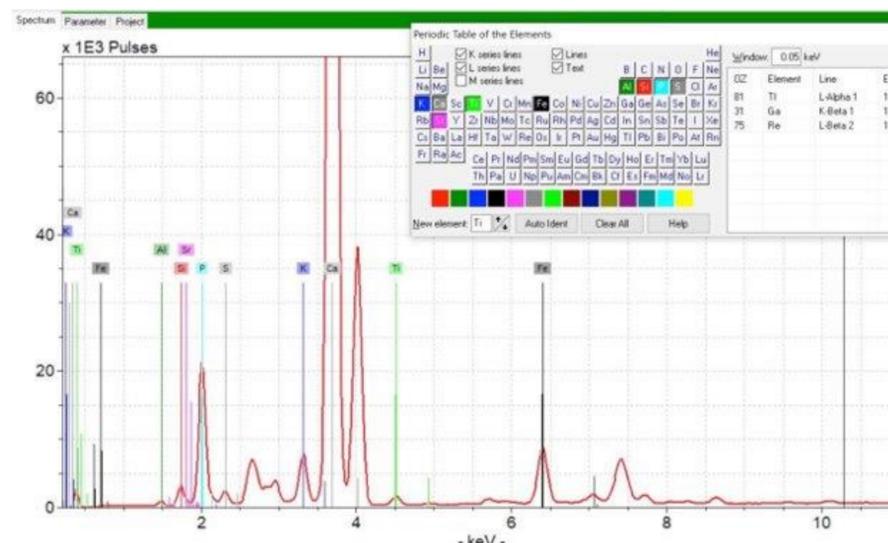


Fig 3. Example of element spectral analysis also done by p-XRF

Results

- Calculations done using students t-test found no significant difference in iron concentration between the individuals in the collection who had PH and those that did not (N1=4 N2=8, p=0.26)
- When data is compared statistically and through varied graphs it shows that iron concentrations are higher in our collection with PH.
- In order to account for the contamination our samples could have undergone during internment, common contaminants such as potassium, silica, and aluminum were accounted for. Students t-test showed no difference in all concentrations between groups with PH and those without.

Conclusion

- Results generated from the p-XRF using the collection housed at UNC failed in showing support for the IDA
- Iron concentrations in our samples were higher in groups with PH. This is on the contrary of what is expected according to the IDA. This difference is not explainable with the information known and more extensive element analysis using the data already gathered is warranted.
- The effectiveness of p-XRF as a method for future testing has been proven through this research. Future research where the provenience and possible contamination of samples is without doubt and accounted for would greatly benefit from implementing p-XRF.

Acknowledgements:

Literature Cited:

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