

# Study of the firing temperature of Marajoara archaeological ceramics by electron paramagnetic resonance associated to INAA data



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## INTRODUCTION

The Marajó island is located in the Pará State and east part of Amazon.

The ceramic samples analyzed in the present work belong to the *Marajoara phase* which occupied the island from 400 BC to 1350 BC. It is a quite expressive phase, due to the large amount of archaeological material, exuberance and variety in its decoration.

It is relevant to carry out systematic research for obtaining information about distribution, duration and interactions of the Marajoara populations. From the archaeological point of view, there are several works published in this aspect.

However, the scarcity of the information about chemical and physical analysis of Marajoara pottery, such as determination of its firing temperature, still dominates.

## EXPERIMENTAL

→ *Analytical techniques: INAA and EPR*

• 109 Marajoara ceramic samples were analyzed by Neutron activation analysis (INAA - Figure 1)

• 49 samples were provided by the Museum of Archaeology and Ethnology (MAE), 45 by Marajó Museum and 15 contemporary samples from Marajó island.

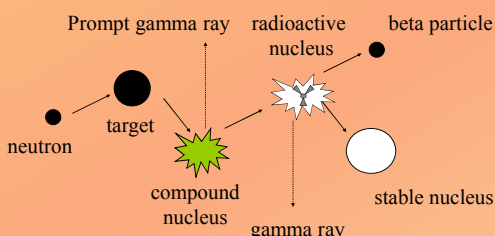


Figure 1: Sequence of events in INAA: analytical procedure

• 9 ceramic samples were analyzed by Electron paramagnetic resonance (EPR – Figure 2).

→ *Do chemically different ceramics also have different firing temperatures?*

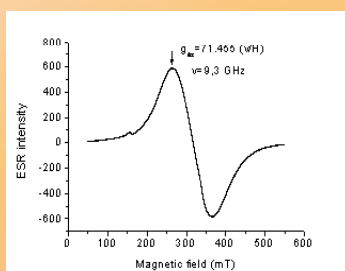


Figure 2: EPR – Analytical procedure

- Group 1 – 5 samples
- Group 2 – 1 sample
- Group 3 – 3 samples

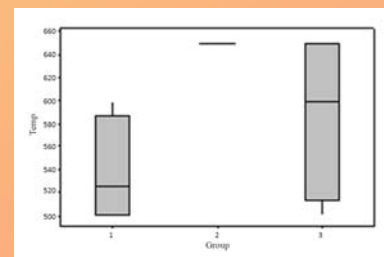


Figure 4: Boxplot for the firing temperatures of Marajoara ceramics separated by compositional groups

## RESULTS AND DISCUSSION

• Ce, Cr, Cs, Eu, Fe, Hf, K, La, Lu, Na, Sc, Tb, Th, U e Yb were used.

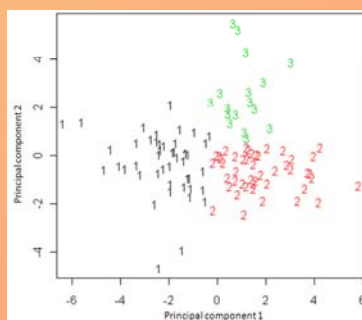


Figure 3: Principal component analysis 1 vs principal component analysis 2 of the Marajoara ceramics

## CONCLUSIONS

INAA allowed the determination of several chemical elements in Marajoara archaeological ceramics with precision and accuracy. The three groups of ceramic are chemically distinct. By this way, there is one raw material source used for ceramic production of each group.

From determination of the firing temperature, it is not possible to distinguish between Marajoara archaeological and contemporary ceramic samples. It is necessary to complete the analysis with more studies.

## REFERENCES

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- Kinoshita A, Brunetti A, Avelar, WP, Mantelatto FLM, Simões MG, Fransozo A, Baffa O (2002) ESR dating of a subfossil shell from couve island Appl Radiat Isot 57:497-500
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Groups - chemical different compositions:

- Group 1 - 52 ceramic samples from MAE and 28 from Marajó Museum.
- Group 2 - 21 ceramic samples from MAE and 21 from Marajó Museum.
- Group 3 - 15 contemporary ceramic samples from Marajó island. The group 3 is a little bit far from the other groups.