INTRODUCTION

The Chaminade 1A (CH-1A) Middle Stone Age (MSA) site, near Karonga, Malawi, was excavated by J. Desmond Clark and colleagues in 1965. > 2 kg of ochre artefacts were recovered from the site and are now curated at the Stone Age Institute. Several artefacts exhibit evidence of abrading and incising (below right) consistent with pigment production.

In 2011 the Malawi Earlier Middle Stone Age Project opened new excavations near the CH-1A site and began sampling geological sources of ochre in the region through collaboration with local guides.

Conducting a provenance study of ochre artefacts will facilitate the study of procurement preferences, transport patterns, and early material symbolism.

Rather than forming in situ, Malawian sources identified thus far are challenging-to-characterize sedimentary deposits with detrital minerals from multiple parent rocks.

Research Questions

What is the most effective method of distinguishing among ochre from different geological sources?

What parent rocks weathered to form the extant sources of ochre in Malawi?

RESULTS

Sources Sampled and Neutron Activation Analysis Results

- 7 ochre sources were identified during the 2011 field season; the 3 most thoroughly sampled are used here as a case study.
- 1 bulk analysis of homogenized ochre was conducted per sample for 22 analyses total.

- Long count INAA element data used in Principal Components Analysis (PCA), below left
- 33 elements detected by INAA, 30 used in PCA, data normalized to ratio with Fe-content, then log10 transformed
- 90% confidence ellipse for each group shown (left)
- Intra-source variation in the Mulowe-Mutowa group is too great to separate it from the Malama source group.

Materials and Methods

Three Geochemical Approaches to Ochre Pigment Provenance in northern Malawi

Andrew M. Zipkin1,2, Alison S. Brooks2,3, John M. Hanchä4, Jessica C. Thompson5, and Elizabeth Gomani-Chindebu6


CONCLUSIONS

- INAA is not precise enough nor does it detect enough elements to distinguish between multiple sources of ochre in which each source has a substantial detrital mineral component. The Kayelekera source may be distinctive due to the Permian Karoo rocks (N. Rukuru Sandstone and Shale Formation) which underlie it, while the other 2 sources are situated in recent lacustrine, alluvial, and colluvial deposits.
- Plots of immobile element ratios indicate that the Malama source is the most heterogeneous, reflecting diverse parent rocks and variability in each paint chip. The Kayelekera and Malama groups are more homogeneous and indicate strongly alkaline and subalkaline parents, respectively.
- Paint Chip LA-ICP-MS generated a 225 spot dataset; by reducing the ‘5 ablations per chip to an average for each chip and running a PCA on the means, 3 very distinct groups appeared and ~99.4% of variation in the data was explained by PC1 and PC2.
- Data processing rather than the data collection technique may be the key to characterizing heterogeneous ochres. Technique development should focus on reducing sample size to facilitate analysis of artefacts.
- For the first time, refractory mineral grains (zircon) have been isolated from an ochre sample and analyzed for Heavy Rare Earth Element composition. LA-ICP-MS targeted at zircon crystals may not be applicable to artefact sourcing due to the large sample mass of ochre required (0.5 – 1.0 kg). However, this technique may eventually facilitate the distinguishing of ochre sources from one another on the basis of the age of crystallization for zircons found in each source.

REFERENCES

A list of references is available in hard copy or by e-mail upon request.

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Funding Agencies

- National Science Foundation: IGERT DGE-0802164 and Graduate Research Fellowship 201111638
- Australian Research Council: Discovery Projects Grant and Australian Postdoctoral Fellowship
- Cosmos Club Foundation: Cosmos Scholars Grant - “Identification of Archaeologically Relevant Malawian Ochre Deposits”
- Explorers Club Washington Group: Exploration and Field Research Grant - “Ochre Exploitation in the Middle Stone Age of northern Malawi”

Collaborators

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- Mr. Wilfried Diegor and Ms. Erin Mundy (Department of Earth Sciences, Memorial University of Newfoundland)
- Professors Jeffrey Ferguson and Michael Glazic (Archaeometry Laboratory, University of Missouri Research Reactor)
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