Reconstructing Societal Dynamics of the Ancient Maya: Insights from Nd Isotopes

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Ethnoarchaeological studies of cultures, such as the Maya, suggest that technical choices, such as the selection of clay and temper for pottery production, are socially informed actions that are among the strongest indicators of a group's social identity. Yet, archaeologists typically carry out stylistic analyses of artifacts (e.g. examining the painted designs on pottery), and fail to analyze the technological aspects of the material culture. Geochemical studies offer a valuable method for examining the fabric of ceramic production that can reveal changes in local pottery manufacture and exchange and can also point to significant shifts in long-distance trading activity over time. Current methods for chemical sourcing use statistical analyses to group ceramics based on elemental compositions derived from Instrumental Neutron Activation Analysis and Inductively Coupled Plasma Mass Spectrometry. Both techniques yield data that can be analyzed statistically to determine differences within and between groups in order to generally distinguish the proportion of locally made pottery from those that appear to be imports. This approach is problematic in terms of its sample preparation and study and limiting in terms of its degree of accuracy. Strontium isotopes have been commonly used in many locations in Belize watersheds, but their interpretations for sourcing local clay deposits are complicated by overprinting by carbonate-based temper. Here, we present new Nd isotope data that appear to be especially useful for isolating imported pottery and determining shared provenance for specific types of local ceramics from ancient Maya sites in the eastern Belize Watershed. The Maya pottery shows a range of up to 6 ε_{Nd} units, enabling the detection of specific production locales and shifting trade orientation consistent with changes in socioeconomic organization, likely resulting from new social groups entering the eastern Belize Watershed during different periods of Maya history. The Nd isotopic data, integrated with the stylistic analyses of the artifacts, clearly reveal the complexity of ancient patterns of mobility and trade, particularly at the time of the collapse at the end of the Classic period, and afford new insights into the societal dynamics of the ancient Maya.

Can mineral inclusions in metamorphic rutile help to constrain P-T conditions of formation?

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Peak metamorphic temperatures of rutile can already be determined using the Zr-in-rutile geothermometer [1], however little work has been carried out to develop rutile as a geobarometer.

We therefore aim to investigate the use of rutile as a single grain geothermobarometer by analysing mineral inclusions found within rutile. This work will be used in conjunction with average P-T calculations using THERMOCALC 3.3, providing a novel way of constraining conditions of rutile formation.

Rutile grains from a number of localities been characterised using EPMA. Raman spectroscopy will be used to analyse quartz inclusions in UHP rocks, e.g. Dora Maira, to determine if coesite is present.

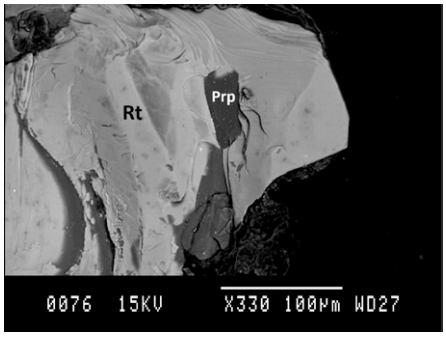

Figure 1: Back-scattered image of a rutile grain with a pyrope mineral inclusion from the Dora Maira Massif.

Preliminary EPMA data shows that inclusions in rutile comprise minerals useful for determining geothermobarometric conditions, e.g. glaucophane, omphacite and phengite. Pyrope and almandine garnet inclusions have also been discovered in UHP rocks from the Western Alps (fig. 1).

[1] Zack e*t al* (2004) *Sedimentary Geology*, **171**, 37-58.

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