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Building Object Reference Datasets for Copper and Tin Sources in Southern Africa

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Effective provenance projects in archaeology often weave independent lines of evidence together to form strong “cables”, allowing for robust reconstructions of where an object originated in the geological landscape. For non-ferrous metals, a combination of isotopic systems (e.g., Pb or Sn isotopes) and trace elements has proven effective at inferring this origin, particularly in geological environments with significant heterogeneity in the age, type, and/or mineral assemblage of ore deposits. However, unlike isotopic data, trace element data from archaeological objects cannot be directly compared to data from ores, as elements differentially partition between the metal or slag phase in a metal smelt based on their reduction potential. As a result, trace elements primarily play a supporting role, as certain characteristic combinations of trace elements can be useful indicators of the type(s) of ore smelted. Of substantial importance in these efforts, therefore, are primary unalloyed ingots, which can serve as a reference for the chemical pattern of specific deposits or geological districts.

Over the last 10 years we have expended substantial effort to identify and analyze copper and tin ingots to serve as references for important precolonial copper and tin deposits in southern Africa. These include primary planoconvex ingots from smelting and secondary ingots cast into several standardized shapes, such as H- and X-shaped, *lerale*, *musuku* and “nailhead” ingots, many of which are associated with specific metal producing communities or geological deposits in oral histories. This presentation focuses on our work to identify the geological sources for more than 60 of these ingots, and demonstrates how we exploit their characteristic chemical signatures as references, essentially creating strong cables for inferences of provenance for objects further along the *chaîne opératoire* of metal production.