

Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: List of archaeological sites and available chronometric dates included in this study. OSL ages are shown with 1σ uncertainties. Samples studied from sites Mlawula I and II, Nsangwini, Hlalahahle, Mphaphati I, Muti Muti, and Ndhlozane shelter lack chronometric dates due to various site-specific contexts, detailed in Extended Data 2 and Supplementary Notes section 2.

File Name: Supplementary Data 2

Description: Inventory of artifacts and source material, including site data, stratum, region, assigned chemical group, and qualitative group.

File Name: Supplementary Data 3

Description: Neutron Activation Analysis data. Elements are presented in parts per million.

File Name: Supplementary Data 4

Description: PCA calculations and Mahalanobis Distance Group membership probability scores for NAA FeOx data.

File Name: Supplementary Data 5

Description: LA-ICP-MS data on FeOx artifacts and sources. Element concentrations are shown in parts per million (ppm).

File Name: Supplementary Data 6

Description: LA-ICP-MS element concentration data for all MnOx artifacts and sources. All data are shown in parts per million (ppm).

File Name: Supplementary Data 7

Description: PCA and Mahalanobis Distance group membership probability scores for LA-ICP-MS, both FeOx and MnOx datasets.

File Name: Supplementary Data 8

Description: Average concentrations, standard deviations, and relative standard deviations (%) of NAA and ICP-MS data for all earth mineral sources included in this study. All source data are provided in Supplementary Data files 2, 4, and 5.

File Name: Supplementary Data 9

Description: Averages, Standard deviations, and relative standard deviations (%) for LA-ICP-MS data for manganese-oxide groups. All elements are reported in ppm unless otherwise indicated.

File Name: Supplementary Data 10

Description: Summary of identified mineral phases in artifact and source samples using XRD and Raman spectroscopy. Samples marked with an asterisk (*) indicate Raman-generated data.

File Name: Supplementary Data 11

Description: Average reported standard values for LA-ICP-MS data reported in parts per million unless otherwise indicated. Consensus values for NIST 612 and NIST 610 are from Pearce et al. 1996. Consensus

values for Fe-Mn-Ox are from Jochum et al. 2016. Consensus values for NIST 690 are averaged from NIST certificate, GeoRem reported values, and in-house measurements by NAA.

File Name: Supplementary Data 12

Summary of Ochre Artifacts and sources, organized by compositional group, site, and temporal phase.