Messages in Paint

An archaeometric analysis of pigment use in Aboriginal Australia focusing on the production of rock art

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This thesis is submitted for the Degree of Doctor of Philosophy
of the University of New England

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I certify that any help received in the preparing this thesis and all sources used have been acknowledged herein.

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

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December 2014

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For Fred, Astro-Charlie and Bella Bug.

With thanks to the Mikes (Smith and Morwood) for helping engage the 'big picture'.

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Abstract:

Anthropogenically modified pigments are held to be some of the earliest, most unambiguous and persistent evidence for behavioural modernity, frequently (and often tenuously) invoked as material expression of symbolic thought and action. Recent finds, increases in the sophistication of analytic techniques and theoretical frameworks have renewed interest in ochre, reflected by a spike in actualistic studies, investigations of pigment morphology and geochemistry. Archaeological studies continue a bias towards Pleistocene pigments, while archaeometric research continues to focus on ochre from known source locations, and in Australia, ethnographically documented mines. Here I take a different tack, targeting Holocene ochres, focusing on pigments with at least one known, indisputably symbolic function—the production of rock art. As part of the physical and metaphorical (cultural) landscape, rock art offers a unique pigment archive as it remains in the location in which it was created.

A decade since the first published application of portable X-ray Fluorescence (pXRF) to rock art there has been an absence of critical scrutiny and methodological development. Aiming to redress this, I use conventional and Synchrotron X-ray Diffraction, Micro Computed Tomography and Scanning Electron Microscopy to explain and evaluate pXRF. I develop novel methods of using geochemical data to identify paint mineralogy (including differentiating between paints of the same colour), recognise the chemical signatures of taphonomy and compare ochres from excavated contexts with rock art. Interpreting the resultant elemental profiles relies on understanding the complex taphonomy of pigments and the chemical expression of non-cultural phenomena, something not adequately addressed previously. This work therefore offers a non-invasive means by which large scale studies of archaeological pigments can be undertaken.

By expressly separating characterisation from the assignment of provenance, I describe and interpret pigment geochemistry within the frameworks of object biography and intentionality. I demonstrate how pigment characterisations make available additional strands of chronological and behavioural evidence within regional prehistories. In the Sydney Basin, I report the first archaeological identification of calcite rock art paint at Yengo 1 shelter, where I show calcite pigments are present from 1,500 BP. I provide the first archaeological description of a mulberry ochre quarry in northern Australia—showing these pigments are available locally within the King Leopold formation of the northwest Kimberley and that ochre quarries occur in sites with large rock art assemblages. Ultimately, this work demonstrates that it is not always the highest resolution scientific data that produces the most insightful archaeological findings.

KEYWORDS: pigment characterisation; geochemical analysis; rock art; ochre; mineral pigment; pXRF; Sydney Basin; Northwest Kimberley

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They say it takes a village to raise a child. Based on my experience, it takes an academic community to facilitate the completion of a successful PhD. From inception, either knowingly or unwittingly, a large number of the discipline's community help to shape the project. This research has been influenced by the disciplines of Archaeometry, Australian Archaeology, Rock Art Research, Conservation Science and Analytical Chemistry. Acknowledging every individual who has inspired and influenced the project would be a thesis in itself and I mean no offence by omission. I have received support and encouragement from many people since April 2009 when this all began (especially as I have had two children in that time). I have singled out those who have had the greatest overt affect on the work chronicled, but point out that the very act of becoming part of a vibrant academic community continually informs and inspires my evolving research practice. The journal articles and book chapter that form part of this document (Chapters Three to Six, Appendices C and D) contain additional, specific acknowledgements.

I would like to thank supervisor June Ross for inviting me to participate in the research program in the northwest Kimberley. I appreciate June's support, encouragement, logistical guidance and candour. Perhaps the most critical role of a PhD supervisor is advocacy within the academy and associated spheres. I have had a supportive advocate in June and I would like to express my gratitude for the opportunities she has help create for me and her efforts in disseminating my research. I have no doubt that June has performed countless acts of advocacy on my behalf, of which I have no firsthand knowledge, that have had, and will continue to have, beneficial consequences for me beyond my PhD project. June's influence on my scholarship (particularly my writing) has been warmly welcomed. I am not the easiest student to have supervised. I thank June for meeting my fierce independence with patience.

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Excluding the previously published chapters and appendices, this thesis was proof read by Julie Taylor, David Hume and Phillip Huntley. Julie Taylor and David Hume provided formatting assistance. Typesetting and graphic elements for the forward and title pages were undertaken by Lucas Huntley.

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Finally, and most importantly, I acknowledge the Aboriginal peoples of the lands in which I have worked – the traditional owners of the northwest Kimberley and the Aboriginal stakeholders of the Sydney Basin including the Woronora Plateau, Yengo National Park and MacPherson State Forest (Mangrove Creek Catchment). The continuing cultural traditions of the Warnabul, Dharawal, Wanarua, Darugh, and Darkagin peoples are represented in the archaeological materials studied and I thank the Kandiwal Aboriginal Community, Warnanbul Gunmbera Aboriginal Corporation, the Kimberley Land Council, and the Illawarra, Metro, Mindaribba, Wanaruha and Darkinjung Local Aboriginal Land Councils as well as the Wonaruha Nation Aboriginal Corporation for their time in considering and reviewing my research methods and outputs. It has been a privilege to have been allowed to work with the rock art and ochres discussed in this thesis and I am grateful to the indigenous custodians who have shared their knowledge with me in this endeavour, in turn allowing me to share my results a broad scientific and general audience.

Statement of Authorship:

This thesis is composed of my original research. The nature of scientific enterprise such that it is, often takes many people to pull together a successful program of archaeometric investigation. Consequently, a number of the published chapters in this thesis required the input of various colleagues involved in the C&C Project. Credit, in the form of co-authorship and/or acknowledgement has been given where credit is due. Two forms appear at the end of co-authored chapters (**Chapters Two** to **Six**). One contains a statement of originality, the other a statement of contribution by others (quantifying the contribution of co-authors).

Unless otherwise stated in the form of co-authorship, citations and acknowledgements contained within this thesis, authorship is entirely my own. As the primary author of all published materials I accept responsibility for any errors or omission (if contained) within.

The content of this thesis (including the appendices) result from work I have carried out since the commencement of my research higher degree candidature at UNE. None of the material presented has been previously submitted (in whole nor part) for a degree at this, or any other, institution. I have clearly stated which parts of this thesis have drawn on published data from research submitted for my previous qualification (BA Hons, Australia National University – c.f. in **Chapter Two** and **Chapter Five**, published data is presented as Appendix C).

Jillian Huntley
December 2014

Forward

'nani gigantum humeris insidentes'

I have felt the presence of an ANU/UNE academic heritage through my short research career. This is particularly evident to me in the work of Isabel McBryde and Mike Smith. Here I want to single out the two key papers that have shaped my understanding of archaeological pigment use, long distance trade and exchange, and the material expression of cultural landscape. These articles have been an anchor whenever I have felt like I am drowning in the complexity of archaeological ochre use. Their conceptual richness and depth of narrative exemplify why the analytical effort required in investigating archaeological ochres is so worthwhile:

'The cultural landscapes of Aboriginal long distance exchange systems: can they be confined within our heritage registers?' (McBryde, 1997a)

The theoretical concepts woven into this manuscript have been the single biggest influence on my conceptualisation of the behavioural implications of archaeological ochre use. McBryde's work humanised the provenance postulate for me, articulating the archaeological value of understanding trade and exchange and perhaps more importantly, how we might recognise archaeological expression of conceptual spaces such as cultural landscapes.

'The Changing Provenance of Red Ochre at Puritjarra Rock Shelter, Central Australia: Late Pleistocene to Present' (Smith et al., 1998)

This seminal paper has rippled throughout archaeometric ochre research globally because of its clarity in not only demonstrating, but also clearly communicating, the archaeological importance of ochre research. This study was the first to prove the potential outlined by Mulvaney (1976) in regards to accessing insights from the material indices of trade and exchange. That Smith could draw such a well reasoned narrative from the archaeometric analysis of just 4% of the Puritjarra ochre assemblage is a testament to the central place of archaeology within this style of research. The reach and longevity of this paper, its continued global impact, speaks to the fact that the strength of its archaeological stance is yet to be replicated.

A Note on Nomenclature:

The nomenclature of rock art styles, specific graphic motif forms, sites, site complexes and landscapes used in this thesis is the end product of consultation with the Aboriginal stakeholders of the Sydney Basin and the Traditional Owners in the northwest Kimberley. Aboriginal custodians of the respective case study regions have reviewed and approved all publication outputs prior to their submission.

The terminology adopted for the northwest Kimberley is in accordance with the Memorandum of Understanding between members of the C*hange & Continuity: Chronology, Archaeology and Art in the Northwest Kimberley, Northwest Australia* (ARC Linkage Grant No. LP0991845) project team and the Wunambal Gaambera Aboriginal Corporation.

I thank the Kandiwal Aboriginal Corporation, the Native Title Group at Kalumburu and the Wunambal Gaambera Aboriginal Corporation for their guidance. I am indebted to Chief Investigators: the late Michael J. Morwood and June Ross for initiating and coordinating the Aboriginal consultation. I owe June particular thanks for her continued management of all consultation for the project.

The following is adapted from terminology complied by Donaldson (2012:13):		
Welch (1996a, 1999)	**Walsh (2000)**	**Present Nomenclature**
Archaic Period	Irregular Infill Animal	Irregular Infill Animal
Tasselled Figures	Tassel Bradshaws	Mambi Gwion
Bent Knee Figures	Sash Bradshaw	Yowna Gwion
Dynamic Figures	Elegant Action Figures	Dynamic Gwion
Straight Part Figures	Clothes Peg Figures	Wararrajai Gwion
Painted Hands	Clawed Hands	Painted Hands
Wandjina	Wandjina	Wanjina
Contact Period	-	Contact Period

List of Abbreviations:

AINSE	Australian Institute of Nuclear Science and Engineering
AIATSIS	Australian Institute of Aboriginal and Torres Strait Islander Study
ANSTO	Australian Nuclear Science and Technology Organisation
C&C	Change and Continuity Project (ARC LP LP0991845)
D&HA	Dingo and Horned Anthropomorph Rockshelter
ENSO	El Niño-Southern Oscillation
FTIR	Fourier Transform Infrared spectrometry
LA-ICPMS	Laser Ablation-ICPMS
LGM	Last Glacial Maximum
ICPMS	Inductively Couple Plasma Mass Spectrometry
µCT	micro-Computed Tomography
MURR	Missouri Nuclear Rector, University of Missouri
NAA	Neutron Activation Analysis
NPA	Neat Peak Area (Relative Abundance)
MSA	Metropolitan Special Area (Chapter Two)
PCA	Principle Components Analysis
PIXE/PIGE	Particle Induced X-Ray Emission/Particle Induced Gama-Ray Emission Analysis
PD	Powder Diffraction
pXRF	portable X-Ray Fluorescence spectrometry
SEM-EDXA	Scanning Electron Microscopy-Energy Dispersive X-Ray Analysis
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence spectrometry
Y1	Yengo 1 Rockshelter