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# Surveying *Batavia's Graveyard*:

Geophysical Controlled Experiments and Subsurface Imaging  
of Archaeological Sites on Beacon Island

**Professor Jeffrey Shragge**

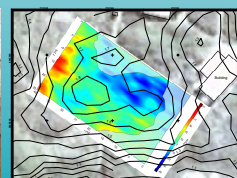
Woodside Professor in Computational Geoscience  
Assoc. Prof. School of Earth & Environment, and School of Physics, UWA

*AND*

New Evidence For Long-distance Trade In  
Fossiliferous Chert Across Southern  
Australia

**Dr Michael O'Leary**

Department of Environmental and Agricultural Sciences, Curtin University



**Monday 16<sup>th</sup> May 2016**

7.00 pm Kings Park Administration Building, 1 Kattidj Close, Kings Park



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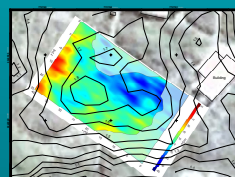
# Surveying *Batavia's Graveyard*:

Geophysical Controlled Experiments and Subsurface Imaging  
of Archaeological Sites on Beacon Island

## Professor Jeffrey Shragge

Woodside Professor in Computational Geoscience  
Assoc. Prof. School of Earth & Environment, and School of Physics, UWA

As part of the *Shipwrecks of the Roaring 40s: A Maritime Archaeological Reassessment of some of Australia's Earliest Shipwrecks* research project, we conducted geophysical surveys on Beacon Island in the Houtman Abrolhos archipelago offshore Western Australia. Our surveys were designed to help investigate areas of archaeological interest related to the 1629 Batavia shipwreck, mutiny and massacre. We used three complementary near-surface geophysical survey techniques (total magnetic intensity, electromagnetic induction mapping, and ground penetrating radar), the combination of which has demonstrably added value in a number of archaeological and forensic surveys through the identification of anomalous target zones for excavation. Interpreting near-surface geophysical anomalies is often complex and non-unique, though it can be significantly improved through achieving a better understanding of site-specific factors including background conditions, natural variability, detectability limits, and the geophysical response to, and spatial resolution of, buried targets. These site-specific geophysical factors are generally not well understood for Beacon Island nor indeed for the Australian coastal environment. We present the results of controlled experiments on Beacon Island where we buried known calibration objects at representative depths and analysed the geophysical responses in terms of an ability to both detect and discriminate targets from natural background variability. A key finding is that the maximum depth of detectability of calibration targets on Beacon Island is limited to approximately 0.5 m due to significant variations in background physical properties between a thin (< 1.3 m) dry sand, shell and coral layer of variable thickness and an underlying sea-water-saturated sandy half space. Our controlled measurements have significant implications for calibrating and quantifying the interpretation of geophysical anomalies in areas of archaeological interest, particularly in coastal and island environments similar to that encountered on Beacon Island. The presented geophysical analyses assisted in part with the discovery of three historical burials associated with the 1629 Batavia shipwreck, mutiny and massacre.





# Biography

## Dr. Jeffery Shragge



**Dr. Jeffrey Shragge** is the Woodside Professor in Computational Geoscience, and an Associate Professor jointly appointed in the School of Earth and Environment and School of Physics at the University of Western Australia. Jeffrey received a BScH (Physics) from Queen's, an MSc (Geophysics) in earthquake seismology from the University of British Columbia, and a PhD (Geophysics) in 3D exploration seismology from the Stanford Exploration Project at Stanford University. He currently serves as the Assistant Director of the UWA Centre for Energy Geoscience, a Co-Director of the UWA Reservoir Management Industry Research Consortium, and is an Assistant Editor of the journal *Geophysics*. In 2010, he was awarded the J. Clarence Karcher Award by the Society of Exploration Geophysicists. While Jeffrey's research efforts mainly focus on 3D computational seismology (seismic modelling, imaging and inversion) and scientific high-performance computing, he has over 15 years of experience in using near-surface geophysics to address a variety of problems, including archaeology, forensics, environmental, security, and geological and geotechnical investigations.

### PROJECT BACKGROUND

In a remarkable ten-year period between 1971–1981, seven European shipwrecks off the Western Australian coast were investigated by a newly formed group of archaeologists and conservators at the Western Australian Museum. These historic events placed Australia at the forefront of maritime archaeology globally, and led to Western Australia enacting the world's first underwater heritage legislation, followed by the Commonwealth in 1976. Between 2014-16, the Australian Research Council (ARC) Linkage Project *Shipwrecks of the Roaring 40s: A Maritime Archaeological Reassessment of some of Australia's Earliest Shipwrecks* aims to make a significant contribution to our understanding of Europeans active in the Indian Ocean and our region during the 17th and 18th centuries through the unique window into the past provided by these maritime archaeological sites. To accomplish this we will return to shipwreck sites excavated over 40 years ago to examine how approaches to maritime archaeological sites have changed over time in terms of both new research questions and new technologies.





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# New Evidence For Long-distance Trade In Fossiliferous Chert Across Southern Australia

## Dr Michael O'Leary

Department of Environmental and Agricultural Sciences, Curtin University

Surface artefact scatters comprise the main archaeological site type in the SW of Western Australia (WA), and are usually present in the form of concentrated primary- and secondary-flaked and unflaked material in dune depressions created by sand deflation. Raw material types typically include locally sourced, quartzite, mylonite, amygdaloidal basalt and Proterozoic chert. Another widespread but more distinctive raw material type is fossiliferous (bryozoan) Eocene age chert. Despite the relative abundance of fossiliferous chert artefacts in the SW of WA, extensive geological surveys within both the Perth and Carnarvon Basins have yet to reveal any Eocene age outcrop or formation that might potentially hosts fossiliferous chert rock.

However several archaeological peculiarities of the fossiliferous chert artefacts led Glover (1975) and Quilty (1978) to propose that fossiliferous chert flakes of the Swan Coastal Plain were locally sourced. They argued that cherty sediments were exposed along the inner continental shelf during glacial low stands (i.e., west of the present coastline), but that access was subsequently cut off when the sediments were submerged during post-glacial sea level rise, the so-called "offshore hypothesis".

Over the last 40 years the offshore hypothesis has become an accepted central concept within the West Australian archaeological community. It has been used extensively by researchers and archaeological consultants to provide a relative chronology for dating archaeological sites to > 6,500 BP, based on the presence or absence of fossiliferous chert in artefact assemblages. It has also provided a template for ethnographic investigations of Aboriginal culture in the SW of Western Australia, i.e., limited trade or movement between Aboriginal groups across southern Australia.

For the first time in 40 years, this study revisits the offshore hypothesis, and challenges the notion that chert was sourced from quarries on the continental shelf that were subsequently drowned during post-glacial sea level rise. Instead we use a range of methodologies, including geochemical and faunal fingerprinting, to argue for an eastern source for fossiliferous chert with material being traded over many hundreds to over a thousand kilometres; a theory first proposed by Glover and Cockbain, (1971) and subsequently abandoned. This finding will have significant implications for our current understanding of Aboriginal ethnographies and may require a revision of the long accepted chronological sequences of archaeological sites in Australia's southwest regions.

Glover, J.E. & Cockbain, A.E., 1971. Transported Aboriginal artefact material, Perth Basin, Western Australia. *Nature* 234, 545-546.

Glover, J.E. 1975a. Aboriginal chert artefacts probably from quarries on the continental shelf, Western Australia. *Search*: 6, 392 – 394.

Quilty, P.G., 1978. The source of chert for aboriginal artefacts in southwestern Australia. *Nature* 275, 539-441.