# A REVIEW OF ARCHAEOLOGICAL GEOPHYSICS IN AUSTRALIA

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## Finding faded or Covered rock art

In her Masters degree thesis, Jennifer Mirani (Flinders University) attempted to remotely detect rock art that had been covered with layers of simulated silicates or carbonates.

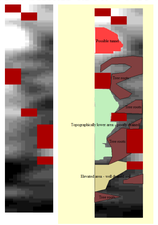
Mirani used magnetic susceptibility survey to remotely detect ochre, a mineral commonly used in Aboriginal rock art, with resounding success. Mirani undertook the survey using a Bartington Instruments MS2 magnetic susceptibility meter, using a 2cm line interval and a 2cm reading interval, but concluded that a higher resolution survey would have a greater likelihood of success.

See Jennifer Mirani's thesis, 'Unveiling Rock Art Images: A Pilot Project Employing A Geophysical Technique To Detect Magnetic Signatures', June 2010, for more details.

## The Army Tunnels Survey

The 'Tunnel Rats' is a group of volunteer excavators investigating a series of alleged military tunnels believed to lie beneath Melbourne and its suburbs. A particular site, the Oldis Gardens in Northcote, along the Merri Creek, is believed to have been an entrance into the tunnel network, which was supposedly back-filled after World War II.

Hunter Geophysics undertook a twin-probe direct-contact electrical resistivity survey of a small area believed to be the location of the tunnel entrance (Hunter, D., 2010: '2010/4 - Oldis Gardens Northcote.'). Despite extensive noise in the dataset caused by topographic conditions and tree roots, a possible target was identified and later excavated by the Tunnel Rats. The excavation uncovered a narrow cavity leading into the surrounding basalt, which had been back-filled with domestic rubbish.



Excavations will continue throughout 2011.

## The Archaeological Prospection Group

The Archaeological Prospection Group at the University of Sydney undertakes geophysical surveys of archaeological sites and cemeteries in order to fund its objective: to provide education in archaeological prospection (including geophysics) to archaeology students at the University.

The APG has surveyed a great number of sites, including the Wilberforce Cemetery, in Wilberforce, New South Wales. Here, a ground penetrating radar survey and a twin-probe direct-contact electrical resisivity survey were undertaken in order to ascertain the areas within cemetery property that were devoid of any human graves, so that the cemetery could begin to allow interments in the seemingly empty land. The survey was able to locate possible unmarked graves in the surveyed area; the remaining space was made available to the cemetery for new interments (Gibbs, M. and Sonnemann, T., 2010: 'Geophysical Survey St John's Church of England Cemetery (Wilberforce Cemetery), Wilberforce', survey report for Hawkesbury City Council).

Geophysics provides a means of remotely detecting buried archaeological features. Using the appropriate technique and survey methodology, most features can be remotely detected. While geophysics has been used in archaeology for the best part of half a century, its use in Australian archaeology has been seldom at best. This poster will review some of the geophysical surveys that have been undertaken in Australia and will examine the benefits of further use of the technology on Australian sites.

## The Kinnoull Homestead Survey

'Nerrena' was a homestead in inner Melbourne, originally built in c. 1855 by the Lord Mayor of Melbourne, Sir James Palmer. The property changed hands numerous times and, in the 1920s, Sir Alexander Stewart purchased the property and renamed it 'Kinnoull' after Kinnoull Hill, his birthplace in Ireland. On Easter Monday, 1953, the De La Salle Brothers bought the property and it became the junior campus of the nearby boy's high school.

In 1959, the extensive gardens of Kinnoull were removed to create a flattened playing field that is still present at the site today. The house itself was demolished in 1967, and newer school buildings are situated on the house's former location.

Hunter Geophysics undertook ground penetrating radar, electrical conductivity, metal detecting, near-infrared photography and twin-probe direct contact electrical resistivity surveys in May through July, 2010.

Data is still being interpreted, although a number of features, including garden beds, wall foundations, gravel paths, modern pipes and probable rubble from the demolition of a gazebo have been discovered so far in the collected data.

The survey was funded entirely by Hunter Geophysics. De La Salle College and La Trobe University students volunteered on the project.

## The Glenrowan Surveys

The excavation of the Ann Jones Inn in Glenrowan (the site of the Kelly Gang siege) in May-June 2008 by DIG International and La Trobe University involved a metal detecting survey prior to excavation and an amateur surveyor undertook a ground penetrating radar survey during the excavations. The metal detector survey provided invaluable data and helped to direct the excavations; the ground penetrating radar survey did not.

A metal detector survey was undertaken by Bob Sheppard as part of the official project prior to the commencement of excavation. The survey was continued with a second survey, using a discriminating metal detector, the Minelab Explorer SE, which is able to distinguish between ferrous and non-ferrous metallic artifacts.

This discriminating survey greatly reduced the large number of metallic targets, allowing the excavation to focus on bullet shells and coins, rather than non-diagnostic metallic artifacts (Ford, A., 2010: 'Glenrowan Siege Archaeological Project 2008 - Excavation Report', pp. 61-70).

A Ground Penetrating Radar survey was undertaken by a volunteer using an OKM Future 2005 GPR unit. Unfortunately, this particular system has a very low transmitting frequency, the ramifications of which the surveyor did not appreciate.

Radiowave signals of such a low frequency are capable of penetrating tens of metres below the ground, but are incapable of detecting even the largest archaeological features (short of an underground bunker).

The survey failed to detect any archaeological targets. The survey methodology used was also inappropriate for archaeological prospection.

## Wybalenna Cemetery survey

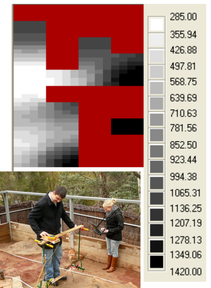
1985 saw the undertaking of a twin-probe direct-contact electrical resistivity survey by Don Ranson and Brian Egloff (Ranson, D., and Egloff, B., 1988: 'The Application of Earth-Resistivity Surveys to Australian Archaeological Sites' in the Australian Journal of Historical Archaeology, vol. 6: 57-73). The survey, undertaken at the Wybalenna Cemetery on Flinders Island, sought to locate unmarked Aboriginal graves dating from the period when Wybalenna was used as a place of incarceration when the indigenous population was removed from the Tasmanian mainland.

The resistivity survey was undertaken using a half-metre electrode separation distance, which was observed as being a borderline inadequate survey methodology for the particular use of finding unmarked graves. A quarter-metre electrode separation distance was believed to have a greater likelihood of success (Ranson and Egloff, p. 63).

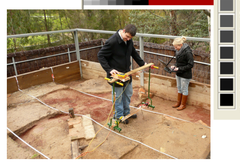
Regardless, the survey was able to locate an area of unmarked graves, believed to be the Aboriginal burials sought by the survey.

## The Tardis Survey

TARDIS is a purpose-built archaeological training site at La Trobe University (Melbourne), featuring strata of various ages and civilisations. The site consisted of an archaeologically sterile soil layer separating the (surface) Australian historic stratum from a deeper Mesoamerican stratum. Hunter Geophysics undertook a twin-probe direct-contact electrical resistivity survey in September, 2010, to identify any archaeological features present ahead of student excavations (Hunter, D., 2010: '2010/5 - Geophysical survey of La Trobe University's TARDIS facility.').




The survey revealed two areas of possible interest: a high-resistance and a low-resistance feature. The survey was severely limited by the presence of extant archaeological features, preventing the collection of data from 50% of the survey area. The high resistance feature was interpreted as possibly reflecting a hardened, dried paedological or archaeological feature, a prediction which was proven correct upon excavation. The low resistance feature is believed to be a saturated soil caused by a back-filled ditch or a cracked water pipe from the historical phase of archaeology or some other nutrient-rich archaeological depost (such as rotting timbers), but will not be excavated until 2011.



## Flinders University

Flinders University's Archaeology Department provides a short, two week course in archaeological geophysics. Students are taught basic physical principals involved in the various techniques available to surveyors, how to undertake geophysical surveys and how to interpret data. The students are required to undertake their own geophysical survey (often tying in with the Department's research projects) and so gain practical field experience.

The course is taught primarily by Ian Moffat, a PhD candidate at the Australian National University. He has directed successful geophysical surveys of cemeteries, a World War II bomb shelter in a park in South Australia and a survey at the NASA space tracking facility in the Orroral Valley, south of Canberra.

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A copy of this poster, which was presented at the 2010 Australian Archaeological Association conference, may be downloaded from www.huntergeophysics.com