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SAMPLE COLLECTION & SUBMISSION FOR OBSIDIAN HYDRATION DATING

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ABSTRACT

For the past 3 years the Centre for Archaeological Research (CAR), University of Auckland, has been conducting research to establish Obsidian Hydration Dating (OHD) as a viable dating system for use in New Zealand (Jones *et al.* 1996, Jones *et al.* n.d., Sheppard *et al.* 1996, Stevenson *et al.* 1996, Sutton & Sheppard 1994). The research programme has been successful and is now reaching completion. It is intended that OHD will be readily available for routine dating from mid 1997. The paper describes a sample collection protocol designed to maximise the accuracy of OHD, explains how to submit samples and notifies potential OHD clients of the sample cost.

INTRODUCTION

OHD is based around the chemical reaction of obsidian with the surrounding environment. This reaction begins when a fresh flake of obsidian is exposed to the atmosphere. By establishing the rate of the reaction and the extent to which the reaction has proceeded it is possible to determine how long ago the flake was produced. Thus OHD directly measures a cultural event, reducing any possible problems due to inbuilt age. Additionally the rate constants are specifically developed for New Zealand, allowing us to produce a single date for any flaking event (i.e. The OHD age directly corresponds to a single calendar age). Dating via Obsidian Hydration dating is possible for all obsidian flaked prior to 1940 A.D.

OHD is a useful chronometric tool for archaeologists. However, the dating process is complicated by the dependance of hydration rates on environmental variables. Significant variables in the hydration environment must be

modelled in order to produce accurate hydration rate estimates. Fortunately, the only environmental variable which has significant influence on the hydration rate in New Zealand is soil temperature, and this variable can be effectively controlled through use of a suitable sample collection protocol.

A basic soil temperature estimate can be produced for almost all New Zealand archaeological sites on the basis of a temperature survey conducted 1994-1996 (Jones *et al.* 1996, Jones *et al.* n.d.). Though research conducted in past two years has outlined a series of variables that will induce temperature variations over small spatial scales (<10 m). Small scale temperature variations can be controlled by collecting data on these variables and this makes it possible to increase the accuracy of OHD from specific sites.

The model used to produce estimates of the mean hydration temperature (EHT) of an artefact is based on a surface energy balance approach. A model of the net energy balance of the soil surface is produced. Then soil temperature regimes are estimated by modelling the heat flow through the soil matrix which is driven by this surface energy balance.

The main factors that introduce variation into the soil temperature regime are due to (Jones *et al.* n.d.):

- Depth of burial
- surface aspect
- Soil type
- Sky view
- Altitude

These factors will influence the surface energy balance of any location, primarily by affecting the incoming solar radiation. It follows that if they can be measured for the burial history of an artefact an accurate soil temperature estimate can be produced and a high resolution obsidian hydration date calculated. In some situations it will be impossible to produce a realistic estimate for all variables, but tolerance limits are broad. If the necessary variables cannot be reliably estimated the dates will be less accurate. However, our research has shown that data required to control for these variables can be collected during excavation and accurate dates produced.

SAMPLE COLLECTION

There are two important sample collection steps which should be observed:

1. Soil samples directly associated with the flake and from all overlaying layers should be collected. These samples should each be at least 200 ml. After collection the samples should be sealed in plastic bags and kept out of direct sunlight prior to submission.
2. Ideally 3-D coordinates of the flake and topography of the pre-excavation surface, both relative to a common datum, should be produced. Minimally sample depth below surface and a description of the immediate topography is required.

It is prudent to collect and submit multiple obsidian samples from each context to be dated. The primary reason for this is that some samples are unsuitable for dating, multiple samples from each context allow the best available sample to be dated. A secondary consideration is that multiple dates can be used to refine age estimates.

If relevant section diagrams are available it is possible to estimate the necessary soil properties in the absence of soil samples. However this will result in reduced dating precision.

SAMPLES

In general almost any obsidian sample can be processed, though simple flakes are preferred. The best sample for dating is a flake with an easily distinguished ventral surface. Cores, and flakes where the ventral surface is hard to detect, can pose problems as surfaces representing temporally distinct events may be present on the sample. If a flake with a distinct ventral surface is used then the date obtained will correspond to the most recent flaking event and be of most use in dating the specific archaeological context in which it was found.

Flake size is not an important consideration. Any flake larger than a 5 cent piece can be processed although larger samples are particularly useful, as these allow more choice in which portion of the flake is read. This increases the chance of finding an undamaged surface. Thus sample rejection rates are

low for large flakes.

A final point on suitable samples is the importance of context. As obsidian hydration is influenced by the environment, the better the archaeological provenance of the sample the more accurate the date produced. This means that (in general) surface samples are not suitable for dating, nor are samples that have been extracted from spoil. These samples can be dated but the resultant date errors will be large. The best samples are those that have been extracted from a primary context within well controlled stratigraphy.

We wish to emphasise the point that samples can be submitted and successfully dated from existing collections. Additionally it may be possible, by prior arrangement, to have dates produced while an excavation is in progress.

SAMPLE SUBMISSION

To submit a sample for dating send the samples and, where possible, soil samples with the site record and sample submission forms to:

Obsidian Hydration Laboratory,
Centre for Archaeological Research,
University of Auckland,
Private Bag 92019,
Auckland.

Contact: Martin Jones
ph: (09) 3737-599 ex 8541
email: mdj@antnov1.auckland.ac.nz

Peter Sheppard
ph: (09) 3737-599 ex 8572
email: pjs@antnov1.auckland.ac.nz
fax: 3737-441

If you have any queries please contact the laboratory.

The CAR laboratory will produce Obsidian Hydration dates on the basis outlined above from November 1997. Dates will be supplied at $50 each. This fee will be reviewed annually. Our intention is to keep fees low, making it possible for people to date sites and collections intensively when they wish, while covering the operational costs of the laboratory.

CONCLUSION

This brief paper is intended to give archaeologists prior notice of the ready availability of OHD, it's protocols and cost. Enquiries are most welcome.

REFERENCES

Jones, M., Sutton, D., Jones, G. & McLeod, C. 1995. Measuring soil temperatures for Obsidian Hydration Dating in northern New Zealand. *Archaeology in New Zealand* 38(1):9-16.

Jones, M. Sheppard, P. & Sutton, D. in press. Soil temperature and obsidian hydration dating: a clarification of variables affecting accuracy. *Journal of Archaeological Science.*

Sheppard, P.J., Barker, P., Irwin, G.J., Jones M., Stevenson, C. & Sutton, D.G. 1996. The Development and application of New Zealand Obsidian Hydration Dating 1996-1998. *Archaeology in New Zealand* 39(1):16-29.

Sutton, D.G & Sheppard, P. 1994. Dating New Zealand prehistory using Obsidian Hydration. *Archaeology in New Zealand* 37(4):272-81.

Stevenson, C., Sheppard, P., Sutton, D., & Ambrose, W. 1996. Advances in Obsidian Hydration dating. *Journal of Archaeological Science* 23(2):233-42.

Center for Archaeological Research Obsidian Hydration Laboratory Site Record Form

Only submit one form per site, samples submitted on separate sample form.

1.SUBMITTER:

ADDRESS:

2. SITE LOCATION:

National grid ref: Lat: Long:

Site Number: Site Name:

3. SITE ORIENTATION:

Height above mean sea level (m):

General site aspect:

Horizon angle

North: South: West: East:

4. SITE DETAILS

description of site and excavation:

Vegetative history of site:

Environment: *(geology, chemistry, soil water content)*

Site Plan: please provide a plan of the site with sample locations indicated

Stratigraphy: please provide a general stratigraphic outline of the site
(statement and diagram, identify soil samples if submitted)

5. AGE

Age estimate: limits From: To:

Basis of estimate:

Other dates from this site:

Center for Archaeological Research Obsidian Hydration Laboratory Sample Record Form

Please use a separate form for each sample. A site record form must accompany sample forms.

Lab use only

AKU/

1. SAMPLE

Sample ID#:

Source (if known):

Basis:

2. LOCATION

Depth:

Surface description:

Aspect :

Geometry:

Slope angle:

Vegetative cover:

Matrix: *(description of immediate matrix):*

Overlaying stratigraphy: *(describe, and identify appropriate soil samples if submitted)*

3. ARCHAEOLOGICAL IDENTIFICATION

LAB USE: