NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

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OBSIDIAN DATING : PRELIMINARY RESULTS

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The method of estimating the time since the surfaces of an obsidian sample were first struck and exposed to air, otherwise known as obsidian dating, is a relatively recent addition to the archaeologist's increasing kit of dating aids (Friedman and Smith 1960:476). The abundance of obsidian on New Zealand sites from the very earliest settlement to European intervention promises no lack of material for demonstrating the value of obsidian dating in New Zealand; its potential has already been pointed out (Green 1962:10).

Recently a preliminary series of tests was conducted on 100 obsidian specimens gathered from archaeological contexts from ten sites in the Auckland Province. The samples were cut in the normal petrological fashion but with slight modification to allow for the obsidian's brittleness and other factors mentioned below. Readings were made on a Leitz Ortholoux microscope fitted with a x10 screw micrometer ocular and a x100 objective; a single calibration on the ocular drum being equivalent to .1375 micron. It became clear from the outset that a measurable hydration layer could be expected from most samples; later work concentrated on effecting more rigorous control of the measuring procedures. As with C14 dating, great care must first be taken in selecting the specimens to be measured, since the hydration layer, which will probably be no thicker than one micron under New Zealand conditions, can be easily damaged. Then again, any one sample will exhibit several faces, not all of which may have been flaked at the same time, so that re-use of an artefact must be considered, this is especially important on any deeply stratified sites as our work has demonstrated. Each major flaked surface has been designated as a separate measurable entity and more relevance has been given to readings from the one or more faces most recently flaked. In producing the thin section most small flakes are likely to be destroyed, so that all flakes are drawn in plan and cross section and the important faces marked for later reference. A section must be cut normal to the surface or surfaces to be measured, for an oblique section will of course give an erroneous reading. Readings have to be made visually and as a check against bias toward the expected reading the finished slides are given a random designation until the measurements are completed. Certain obscuring chromatic effects which seem to be associated with viewing the hydration rim at high magnifications have been eliminated by using a sodium light source.

The practical limits of measuring procedures are all finally determined by the observer's visual acuity and the ability for his determinations to be accurately recorded. The human factor need not however lead to inaccuracy greater than a certain determinable amount, provided a sufficiently large sample of obsidian is being assessed; as Friedman and Smith (1960:481) say, 68 out of 100 measurements will not deviate more than 0.1 micron due to errors of measurement by a single observer, and not more than 0.2 micron due to errors of measurement between two people. The preliminary results indicate that hydration layers on obsidian from most New Zealand sites will fall within the range of thickness between .5 and 1.75 microns, with an upper limit of perhaps 2.0 microns. Thus it can be seen that though no high degree of dating accuracy in absolute terms can be expected, nevertheless the method does hold promise of being able to subdivide obsidians sufficiently well to make possible broad relative age assessments of whole sites or, more rarely, for stratigraphic subdivisions at any one site.

This first run of 100 specimens has been done under difficult conditions with borrowed equipment from various University Departments. The usefulness of obsidian dating has been proved on the ten sites whose relative ages, judged from general archaeological evidence, confirm the general range of hydration thicknesses. Before the method is used as a research tool the factors known, and thought, to affect variations in hydration rates must be thoroughly worked out. Obsidian composition has not been considered in the present sample though it is known that compositional differences have their expression in differing refractive indices, already pointed out as an important difference between samples from the several known sources. (Green 1962: 13). Temperature, the most important determinant of hydration rates, has in the present samples been treated as a constant, since most of the sites treated are in relative proximity on the Coromandel-Western Bay of Plenty Coast.

The next stage in the work will be to consider these two variables affecting hydration rates - that is, temperature and composition. This will be done by comparing a large number of samples, initially from two sites of known different age, whose contained obsidian can be divided into groups of different source.

Given the degree of accuracy imposed by the optical and mechanical limits, there still remains the necessity of having a set of obsidian samples, from one site or layer, numerically large enough to ensure the maximum statistical reliability. One sample of obsidian cannot be relied upon to yield a reliable age estimation any more than can one sample of C14.

At the present stage the results appear to be quite promising. It remains to be seen whether we are able to go ahead with a fuller programme which could finally lead to the use of obsidian hydration rates as a dating aid most useful to New Zealand archaeologists.

Bibliography:

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