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NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER



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RADIOCARBON DATING

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A new set of "Radiocarbon forms" has just been designed and are at present being printed. These will be distributed to the major users as soon as they are available. Each pad will have an instruction sheet with it giving advice on how to fill in the form. The forms are primarily designed for use with stratigraphic-type studies whether they be archaeological or geologic.

The information on these forms is regarded as confidential between the laboratory and the collector until either a formal date list is published or the collector publishes it. It should be realised that our laboratory which is the oldest continuously operating laboratory in the world has considerable experience in using radiocarbon dates, and has a vested interest in helping to ensure that carbon ages are used effectively. To this end the more information that is given about what the collector wishes to date the easier it will be for us to advise him about modifications of approach that may permit a more accurate ageing of the event of interest.

Ages

The reported age is given as years before 1950 AD. Ages are now being reported in three ways:

- (1) Old Half-life of 5570^{+40} yrs
- (2) New Half-life of 5730^{+40}
- (3) New Half-life adjusted by MASCA correction factors.

Proceedings of the 8th International Conference on Radiocarbon Dating October 1972 Lower Hutt New Zealand (H.N. Michael and E.K. Ralph) p A11 et seq.

Only the old half-life was reported in the past and therefore when using an age it is very necessary to refer to the method of calculation, as shown below.

Mr H. Jansen of the Radiocarbon Dating Laboratory is at present recalculating all past ages into the new terms and a complete list will be published.

A NZ14C number is assigned with letter postscripts as follows:

NZ xxx A old half-life

NZ xxx B new half-life

NZ xxx C new half-life with MASCA correction

No age should ever be referred to without a NZ number including the appropriate letter postscript.

At present no secular correction for marine samples can be given, so ages on shell and fish samples cannot be given NZ xxx C ages.

Methods of Collection

The shorter the time scale the more careful the sampling must be, and the smaller the number of kinds of material that are suitable. Many ages on archaeological coastal sites have been determined on charcoal. It is fair inference that much of the wood burned is driftwood, some of it from relatively substantial logs. There must then be considerable uncertainty as to the age of the charcoal compared with the age of the event to be dated. If the charcoal is the inner part of the wood used in the fire, the age determined cannot be the age of the fire, but is instead an older limit so that the event that was to be dated, i.e. the making of the fire, is younger than the reported age by an unknown amount. About a dozen results on charcoal for archaeological sites have ranged from 1000 to over 9000 years. Although it is possible that the youngest of these might possibly date occupation it is more likely that the wood burnt was of substantial age, while the oldest must certainly be. If charcoal has to be used, fragments that retain twig form are really the only suitable material if precision is to be achieved, but even so their relationship to the event to be aged must be assured.

Comparisons of ages from single sites using various materials are given by Dr T.A. Rafter in Fig.1 p.H61 in the Proceedings of the 8th International Conference on Radiocarbon Dating 1972. This shows that, as one might expect, charcoal is frequently appreciably older than shell or bone in the same deposit.

The best material for ageing is obviously short-lived material that had a more direct part with the event to be aged, shell or bone are examples but flax cordage would also be good.

The method of collection itself should provide an in-built check on the age without duplicating samples, e.g. in a stratigraphic sequence, samples from each of several layers, will not only date each layer but also check ages on adjacent layers.

In occupation areas there are frequently greasy zones associated with particular house sites. Although low in carbon these may well provide good ageing material for occupation of the structure, but substantial quantities may be required to permit a determination.

Nature of Material for Dating

Charcoal and Wood: should be from twigs.

Shell: Although all shell will yield carbonate, and most molluscs lay down the shell as the crystal form aragonite a few groups, e.g. pectens, mussels and oysters deposit calcite. Aragonite is metastable in the normal surface environment, and any interference with the aragonite crystal structure results in a change to calcite. Both aragonite and calcite have clearly different x-ray diffraction patterns. Therefore if we use species of molluscs that normally deposit aragonite we can easily detect contamination by the presence of calcite. For many years we have sorted shells into aragonite depositing forms, and tested them before dating, by diffraction x-ray. If there is no calcite we consider that they will give completely reliable results. Pectens, mussels and oysters can not be tested for recrystallisation and the other groups are to be preferred as dating material. Recently we have found that the estuarine mudflat gasteropod Amphibola appears to ingest fossil carbon which can give it a false age. Therefore this species may also be unsuitable.

Human and Moa Bone: We have found that although bone contains carbonate this carbonate can readily and rapidly exchange with the atmosphere. Bone carbonate is no longer used as a dating material and instead the bone protein, collagen, is extracted and used for dating. In New Zealand so far collagen has given no problems although Mr H. Polach of ANU Radiocarbon Dating Laboratory has reported some difficulties with collagen-like contamination.

Soil: Soils are notoriously difficult materials to date. Some soils, particularly the uppermost parts of A horizons give results that might be considered to be the mean age of development. However some products of soil processes appear to accumulate, and the older the soil the less interpretable the result will be. They must be considered to be not suitable for dating on a basis of New Zealand Archaeological time spans, and the dating of Maori gardens must be carried out on the basis of inferential relationships of other organic materials.

Fish: Most of the fish in coastal waters of New Zealand have depth ranges from near shore to about 80-100 metres. Although our current shell standards may not always be appropriate for dating fish, it is possible that we could devise appropriate standards that would give reasonable ages. Before dating, identification of the fish should be made. This is best done on vertebrae from which age of the fish at death can also be determined. Providing that there is a limited number of samples of this kind I think that I should be able to arrange for identifications but there will have to be some kind of screening process to keep the numbers down and the sites for which such work is done will have to be confined to either sites where there is multiple layer stratigraphy, or important artifacts or other features.

Whale Bone: Because some whales range into Antarctic waters which are depleted in C14 to an extent that gives an apparent age of 1000 years or more it is unlikely that whale bone would provide a useful dating material for archaeological projects.

Seal Bone: Such seal bone as has been determined suggests good correspondence with other apparently reliable dating materials.

General Rules

It is obvious there must be a set of guidelines for radiocarbon dating of archaeological sites, so that the maximum usefulness of the results and effort is obtained.

- (1) The date must be part of a substantial project.
- (2) Isolated single layer sites are not suitable subjects unless they contain regionally important artifacts or other features.
- (3) Sites sampled for dating should generally have multi-layer stratigraphy.
- (4) Samples should be collected if possible from all horizons.
- (5) Because of possible substantial age, larger pieces of wood or charcoal are not the most satisfactory of materials, and collections should be confined to identifiably small twigs.
- (6) Shells of Mollusca that were used for food are likely to be among the most satisfactory dating material, but in some places e.g. Cook Strait-Kaikoura coast, anomalies that may be due to upwelling of deep water appears to have some disturbing effect. It is however hoped to obtain better controls in the near future.
- (7) Fish bone, particularly vertebrae can be identified and the depth range of the species are known. The age of fish can be determined from vertebral discs.
- (8) Moa bone is a satisfactory dating material and in many situations can give a direct date on moa hunting.
- (9) Small bird bone should be identified to species and sea birds should be kept separate from land birds, because birds will take the aspect of their food.

- (10) Care should always be taken to ensure that the dating material is in primary association with the event or horizon to be dated.
- (11) Always show a diagrammatic stratigraphic column marking the position of each sample on it.
- (12) If it appears that there are problems or uncertainties about materials or methods it is better to ask me, before dating, rather than afterwards.
- (13) If there are problems after the date has been reported do not hesitate to ask, giving a full statement of the nature of the problem.