# DATE COLLECTIONS IN NEW WORLD ARCHAEOLOGY

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## Introduction

This paper has two goals. One is to examine how archaeologists have used large collections of archaeologically derived "dates" to illustrate general principles about how these collections should be interpreted. The other is to review the collection of archaeomagnetic dates now on record from Hohokam archaeological sites in southern Arizona, in light of the conclusions provided by the first part of the paper.

It seems that there is a significant pattern in the series of Hohokam hearth dates from Classic Period sites. This pattern may be the result of systematic changes in the prehistoric behavior underlying these dates, or it may be the result of systematic laboratory problems. In either case, attention is drawn to the uneven distribution of Hohokam hearth dates in order to pose research questions. The bar graph treatment of dates used here has precedent in similar treatment by archaeologists of other date collections. Some examples are reviewed below to provide background to this series analysis of an archaeomagnetic date collection.

## Date Collection

Typically, archaeologists use dating information to refine local and regional chronologies by bringing diverse data to bear on the dating of a particular structure, site, phase, or similar object of archaeological interest. Dean (1978) has developed a model which generalizes how one uses various dating techniques to establish the time of a particular phenomenon or "target event." Dates provided by different techniques may be brought singly or in groups to bracket the time of each target event. This is the most common use of archaeologically derived dates.

Less frequently, archaeologists take an inventory of all dates provided by a particular technique in a study area to find patterns in the dates and to show general trends in the past behavior associated with the technique. It is not typical for archaeologists to see a series of dates as the object of study. Yet, by examining a date collection, one might illuminate a trend in past behavior which spans more than one phase or period. Or, one might find a problem with the dating technique.

As Story and Valastro point out in an examination of a large collection of radiocarbon dates from a single site: "It should be clearly recognized that radiocarbon dates can be used to evaluate radiocarbon dates. . ."(Story and Valastro 1977:88). This statement applies to other dating techniques as well. I show below how archaeomagnetic dates can be used to evaluate archaeomagnetic dates.

The idea that a radiocarbon date collection can be used to evaluate radiocarbon dates is not new. By graphing 1600 radiocarbon dates from Europe and North America, Jelinek (1962) was able to detect consistent differences between gas-carbon dates and solid-carbon dates. Jelinek attributed this problem to inadequacies with the solid-carbon method. In this way, he used radiocarbon dates to evaluate radiocarbon dates.

In the same study, Jelinek was also able to find a pattern in dates with a possible prehistoric behavioral interpretation. In his graph of 850 radiocarbon dates from North America, Jelinek (1962:Fig. 1d) shows a 500 year "gap" between 4,000 and 3,500 B.C. Jelinek rules out sample size as the cause and suggests the gap is a real phenomenon, the result of ". . .either depositional problems involving sites of this period (erosion or deep burial), or an actual decrease in cultural activity and population. . ." (Jelinek 1962:452).

This gap became apparent only after the entire mass of dates available at that time had been compiled in a bar graph. Regardless of which interpretation is ultimately favored, Jelinek's treatment of radiocarbon dates provided important research questions (see Addendum).

With Jelinek's study as a key example of a date collection, I define "date collection" as a series of dates, each often associated with an uncertainty factor, which is the product of a single dating technique and which informs the archaeologist about trends above the level of sampling bias. No formula is given here for adequate date collection sample size. Sample size adequacy is somewhat subjective. The date collection concept must allow for different dating techniques, length of time under consideration, method of grouping and presentation of "dates", and strength of trends within a collection. One is either impressed by the seeming pattern in a date collection, or one is not.

Archaeologists have already examined date collections, though not by that name, based on radiocarbon dates and written records. One study in particular compares between these techniques for samples taken from the Maya area. Some examples are discussed below in order to show what is meant by "date collection."

## Written Records

A long series of well dated written records is generally outside the realm of archaeology. Two cases, however, are available to archaeologists working in the Western Hemisphere. One case involves citation analysis of an archaeological journal and the other is the study of Maya stela dates.

Working with well dated material, Sterud (1978) has compiled a frequency graph of the most often cited publications appearing in American Antiquity bibliographies during the 30 year period from 1946 to 1975. Several trends are apparent, including a low in site report citation in 1970-71 compared to a peak in processual publication citation at the same time (Sterud 1978:Fig. 1). Sterud (1978:300) suggests that this trend is partly the result of a change in the broadening scope of archaeological research and in the structure of site reports in general. Sterud provides a clear example of how a compilation of a series of dates (in this case, dates on current writings) can provide insight into long-term behavioral trends when something is already known about the behavior which results in the dated material.

In a more traditional vein, Morley (1938:Fig. 149) shows the frequency of katun ending stela dates throughout the Maya Classic Period, c. A.D. 250-900. His compilation shows that "elite activity" is represented in the Early Classic Period, expanded almost at a geometric pace during the Late Classic Period, and then fell off abruptly at the close of the Classic Period. This pattern provides strong evidence for the apparently sudden demise of the Classic Maya political structure (Culbert 1974:105-106). Again, the behavior behind each date must be known for one to generalize the trend in that behavior on the basis of a mass of dating information.

Morley's compilation has been up-dated from time to time as more stela dates become available. The most recent of these is provided by Sidrys and Berger (1979), whose additions strengthen the pattern in stela dates noted by Morley.

A significant decline in Maya stela date frequency occurs between A.D. 534 and 593. This is known as the "Classic Maya Hiatus" (Willey 1974). Morley (1938:333) interprets this as either the result of inadequate sample size or the result of a growth in building activity and a temporary redirection of effort somehow leading to a decline in number of monuments erected during the hiatus.

Willey (1974, 1981:341) prefers the opposite interpretation that the society suffered a serious growth setback. He finds this trouble spot reflected not only in stela date frequency but also in art and architecture of the period. Increased sample size has bolstered, not masked, the trends discussed by Morley and Willey (Sidrys and Berger 1979:Fig. 2). Thus, the pattern is real, though interpretation may not yet be clear. The hiatus can be seen only within an array of dates. In the Maya area, dated written records do not inform so much on target events as they do on general trends.

## Radiocarbon Dates

Sidrys and Berger (1979) have found that the graphed distribution of "elite context" radiocarbon dates from lowland Maya Classic sites convincingly parallels that of graphed stela dates. Here, sample size of radiocarbon dates is a serious problem. They have only 122 radiocarbon dates from "elite contexts" compared to 415 stela dates for the same period. The pattern in the small (n=122) sample of radiocarbon dates shown by Sidrys and Berger (1979, Fig. 3a) might be rejected altogether if it were not for the fact that the pattern in radiocarbon dates does, in fact, approximate the pattern in stela dates for the same period.

The behavior underlying stela dedication is quite different than the behavior underlying deposition, recovery, and processing of radiocarbon datable material. Yet for whatever reasons, the series in lowland Maya radiocarbon dates given by Sidrys and Berger is uneven, and it is uneven in the same way that stela dates are unevenly distributed. Sidrys and Berger conclude that the significance of this observation is that selected radiocarbon dates can be seen as an index of cultural activity in the same way that stela dates show cultural activity.

They examine a series of dates (n=31) from "commoner contexts" and conclude that general activity in the study area represented by "commoner" dates continued well into the Post-classic Period for several centuries after the end of "elite" activity marked by stela and elite-context radiocarbon dates. Although this conclusion has been challenged on the basis of sampling problems, the example is important here because it shows the direction that date collection analysis can take.

The last example reviewed in this section is treatment by Story and Valastro (1977) of a collection of 79 radiocarbon dates obtained from the George C. Davis site, eastern Texas. This example illustrates both applications of date collection analysis: 1) finding problems with a technique, and 2) outlining general patterns in past behavior. This example concerns a single site rather than a broader study area and shows the range of possibilities in using a date collection.

Story and Valastro (1977:Fig. 3a) use the bar graph approach in dealing with an array of radiocarbon dates. They find that the overall distribution in dates helps in identifying genuine outliers. They eliminate 16 dates partly on the basis of their anomalous appearance in their Fig. 3 bar graph. The idea that radiocarbon dates can inform on radiocarbon dates justifies this manoeuvre. Among those dates eliminated from further consideration are 10 dates on corn and cane materials, which they feel do not reflect true ages because of fractionation problems. In this case, examination of a date collection leads to the identification of a possible limitation in the dating technique which produced the collection.

The remaining dates from the site form an interesting pattern of dips and peaks when graphed. These are interpreted as a reflection of prehistoric behavioral trends. On this basis, they divide the sequence of dates into three culturally meaningful periods: 1) initial settlement, 2) peak of occupation, and 3) abandonment (Story and Valastro 1977:Fig. 4).

Story and Valastro point out that had they conserved their funds by processing only a few samples, their money would have been wasted because they would not have had a reliable sample with which to evaluate the dates and on which to base their conclusions. Story and Valastro state that the money spent in producing a date collection for one site was well worth it, for a few dates can be misleading.

## Summary

The date collection examples reviewed above show that one can come to general conclusions about a dating technique and prehistoric behavior when a sufficient number of dates produced by a technique are available for compilation and examination. Unfortunately, when dealing with archaeological material, sample size and sample bias are constant problems -- in fact, these are givens. Therefore, one possible use of an array of dates is to identify areas which need more sampling.

If sampling error explains the seeming pattern in an array of dates, then it is not a "date collection" as defined above. On the other hand, once a (subjectively defined) large sample of dates has been obtained, one can make trial interpretations in order to suggest directions for future research beyond filling in sample gaps. Awareness of date patterning may lead to insights regarding the behavior underlying the dating process, or it may alert archaeologists to a problem within the dating process or technique. With this in mind, the following discussion examines archaeomagnetic hearth dates from the Hohokam area as a possible date collection.

## Archaeomagnetic Dates from the Hohokam Area

There are nearly 100 archaeomagnetic dates on record for samples taken from Hohokam sites. Archaeomagnetic samples are most often taken from hearths, but the archaeomagnetic inventory also includes dates from walls, floors, and features. Some of these have been rejected by individual investigators for dating use because of disturbance in and around the spot from which the samples were taken, or because of ambiguities in the secular curve used in the dating process.

Behavior associated with a hearth date is better known than that associated with other kinds of archaeomagnetic dates. Therefore, I consider here only hearth dates and the behavior inferred from those dates. The behavior for an archaeomagnetic date from a hearth is best interpreted as a hearth abandonment date, as outlined below.

Schiffer (1982) has compiled all published and unpublished archaeomagnetic dates reported from Hohokam sites. Fifty-one of these dates are acceptable hearth dates for the period between A.D. 1051 and 1451. The distribution of these dates is given in Figure 1. The distribution of hearth dates in Figure 1 might constitute a date collection. In any case, Figure 1 shows a pattern which requires interpretation.

There are a number of problems addressed below in seeing this as a date collection and in making interpretations of past behavior from it. These problems include: sampling inadequacies, the calibration process used in determining each date, and hearth use-life. There is a gap in dates between A.D. 1270 and 1330 which might have cultural or behavioral significance. This gap may also be the result of systematic laboratory problems or sampling bias. Various interpretations are considered below.

## Sampling Inadequacies

Two sampling problems exist with regard to Hohokam hearth dates. One is sample size, the other is sample bias. The 51 hearth dates in Figure 1 constitute a small sample compared to the much greater number of prehistoric hearths which must undoubtedly be available for sampling. As sample size increases, the pattern in Figure 1 will either be strengthened or diluted. One is either impressed with the pattern now available, or one is not. I know of no statistical test which validates or invalidates the pattern and sample size discussed here. At this point, conclusions are impressionistic rather than quantitative. I feel there is a definite pattern in hearth dates which requires some sort of interpretation beyond sample size. No doubt, some readers will choose to reserve judgement until a larger sample is obtained. At the moment, nothing more can be said.

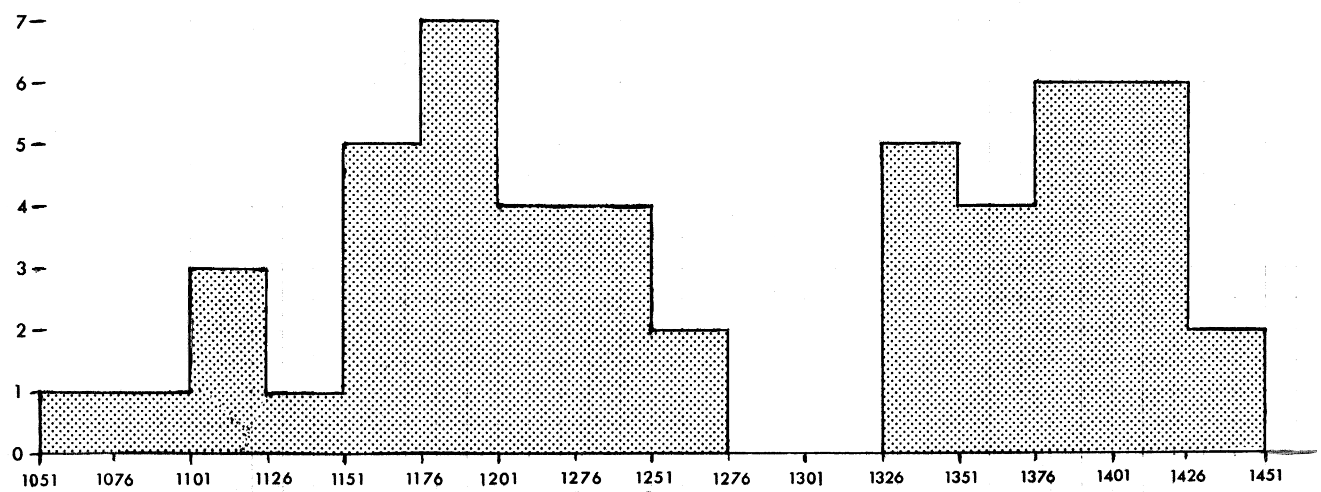
Another problem is sample bias. Those sites with good ceramic association do not ordinarily require additional archaeomagnetic sampling. Excavators often choose among potential archaeomagnetic samples as differences in other kinds of dating appear. As is the case of sample size, I have no quantitative means of controlling for sample bias. Instead, I hold that decisions made during particular excavations tend to cancel each other out as sample size increases. I suggest that the pattern in Figure 1 is more of an approximation to laboratory or hearth reality than to excavator bias.

## Archaeomagnetic Calibration

It is possible that patterns are more apparent than real in the distribution of hearth dates shown in Figure 1 as a result of systematic laboratory errors in the dating process. One might explain the gap in dates between 1270 and 1330 by postulating some sort of weakness in the dating process which would deflect dates away from the A.D. 1300 line. Evidence for this possibility has recently been presented by University of Arizona archaeologists and geoscientists concerned with the reliability of Dubois-Oklahoma dates (Sternberg and McGuire 1981). It appears that dates falling into the A.D. 1100 to 1200 range given by Dubois are questionable and may be in error by as much as 100 years. This is a serious problem which cannot be mastered here but might be reflected in Figure 1.

Nearly all the dates in Figure 1 have been determined by a single researcher, Robert Dubois. If there is a systematic laboratory problem in his handling, then it ought to show up somehow, perhaps as the 60 year gap centering on A.D. 1300. In spite of this possibility, the following discussion proceeds on the assumption that the dates now available are basically accurate. This exercise gives trial interpretations to an archaeomagnetic date collection and not final conclusions.

Figure 1. Fifty-one hearth dates for the 400 year period from A.D. 1051 to 1451.*




* This bar graph groups dates by twenty-five year intervals. Numbers along the horizontal axis give the beginning date for each interval. Numbers along the vertical axis index the frequency of hearth dates for each interval. No dates have been reported for the period between 1270 and 1330. All dates are given in Schiffer (1982).

## Hearth Use-Life

If there is any behavioral conclusion to be drawn from the date collection summarized in Figure 1, it is that hearth use-life did not remain constant during the Hohokam Classic Period. An archaeomagnetic date on a hearth represents a "last use" date at high temperature (Eighmy et al. 1980:509; Wilcox 1977:38-39; Dean 1978:227-228). Thus, hearth dates may be seen as hearth abandonments. Abandonment dates ought to be represented as a cluster near the end of the Classic Period, or sometime in the early to mid-1400's, when Hohokam compounds are believed to have been abandoned.

However, there is no clear clustering of dates in Figure 1 in the 1400's. Even so, there is a clear and abrupt termination of the date collection at 1450, the traditional ending date for the Hohokam Classic Period. This pattern in late Civano dates tells two things: 1) the 1450 date for the end of the Classic Period is basically accurate, and 2) the process of compound abandonment was not sudden. Both conclusions are important in understanding the Classic Period as a whole.

The apparent gap in dates between 1270 and 1330 is more difficult to interpret. Not only must one consider the possibility of systematic laboratory problems, but one must also consider possible prehistoric cultural trends affecting the behavior underlying each date. There is no reason to assume that a gap in dates means a gap in activity. In fact, a gap could mean the opposite. Activity continuity rather than activity decline may well underlie this sixty year "gap."

During the Soho-Civano transition, hearths may have been used continuously throughout an unusually long time, resulting in non-abandonment of hearths during that period and resulting in a commensurate lack of hearth abandonment dates given by archaeomagnetic measurements. A long list of speculations may be offered to account for this period of extended hearth use-life, some of which have already been offered by Andresen (1981:22-27). For example, the period lacking hearth dates may be interpreted as a time in which people were not moving as much as compared to other periods. This is consistent with the idea that above-ground solid-walled caliche structures made an appearance near the beginning of the Classic Period. It should come as no surprise, then, to find evidence that hearths were used longer during the middle Classic as a result of more permanent house structures. It may also be no coincidence that this period of seeming household stability falls right on the Soho-Civano transition line. On the other hand, the period under consideration is very near a possible trouble spot in laboratory processing. Therefore, ultimate resolution of the problem rests with future research.

## Conclusion

The array of archaeomagnetic dates now on record from Hohokam sites deserves consideration as a date collection. Since patterns in behavior were and are constantly changing, one should not expect that a series of archaeologically or historically derived "dates" will remain evenly distributed through time. Changes in behavior underlying the production of "dates" are reflected in graphic compilation of those dates. The problem is to decide what the dips and peaks in a date collection mean. Large sample sizes provided by continued research will tell archaeologists studying the Hohokam whether or not the suggestions offered here are valid.

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Addendum

Wendland and Bryson use a larger sample of radiocarbon dates than available to Jelinek for a study of trends during the same period (Wayne M. Wendland and Reid A. Bryson, "Dating Climatic Episodes of the Holocene" Quaternary Research vol. 4, pp. 0-24, 1974). They find evidence in a radiocarbon date collection for discontinuities noted by Jelinek (see their Tables 3, 4, and 7). They also point out a major, world-wide cultural discontinuity evidenced by radiocarbon dates (Table 5) occurring about A.D. 1120.

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Bibliography

Andresen, John M.
1981 Radiocarbon dates from the Casa Grande. Purchase order PX 8100-0-0076. Western Archaeological Center, Tucson.

Culbert, T. Patrick
1974 The lost civilization: the story of the Classic Maya. Harper and Row, New York.

Dean, Jeffrey S.
1978 Independent dating in archaeological analysis. In Advances in archaeological method and theory, volume 1, edited by M.B. Schiffer, pp. 223-255. Academic Press, New York.

Eighmy, J.L.; Sternberg, R.S.; and R. F. Butler
1980 Archaeomagnetic dating in the American Southwest. American Antiquity 45(3):507-517.

Jelinek, Arthur J.
1962 An index of radiocarbon dates associated with cultural materials. Current Anthropology 3(5):451-477.

Morley, S.G.
1938 The inscriptions of the Peten, volume IV. Carnegie Institute of Washington Publication 437.

Schiffer, Michael B.
1982 Appendix E: Archaeomagnetic dates pertaining to the Hohokam occupation of southern Arizona. In, Hohokam and Patayan: Prehistory of southwestern Arizona, edited by R. McGuire and M. Schiffer, pp. 529-532. Academic Press, New York.

Sidrys, Raymond V. and Rainer Berger
1979 Lowland Maya radiocarbon dates and the Classic Maya collapse. Nature 277(5694):269-274.

Sternberg, R.S., and R.H. McGuire
1981 Archaeomagnetic secular variation in the American Southwest. Paper presented at the annual fall meeting of the American Geophysical Union, San Francisco, December 7-11.

Sterud, Eugene L.
1978 Changing aims of Americanist archaeology: a citations analysis of American Antiquity, 1946-1975. American Antiquity 43(2): 294-302.

Story, Dee Ann, and S. Valastro
1977 Radiocarbon dating and the George C. Davis Site, Texas. Journal of Field Archaeology 4(1):63-89.

Wilcox, D.R.
1977 Archaeomagnetic dating in compounds A and B, Casa Grande Ruins National Monument. Contributions to Archaeology 1. Gila Press, Tempe.

Willey, Gordon R.
1974 The Classic Maya hiatus: a rehearsal for the collapse? In Mesoamerican archaeology: new approaches, edited by Norman Hammond, pp. 417-430. University of Texas Press, Austin.

1980 The Maya. In The encyclopedia of ancient civilizations, edited by Arthur Cotterell, pp. 336-342. Rainbird Publishing Group, London.