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DATING PRECOLUMBIAN MUSEUM OBJECTS

MARK J. Y. VAN STRYDONCK

Royal Institute of Cultural Heritage, Jubelpark 1, 1040-Brussels, Belgium

KLAAS VAN DER BORG and ARIE F. M. DE JONG

State University Utrecht, Princetonplein 5, 3508 TA Utrecht, The Netherlands

ABSTRACT. We have radiocarbon dated some Precolumbian artifacts. We have used both conventional beta counting and AMS to date textiles, bamboo from weaving looms, a feather carpet and straw from a clay mask. We discuss the particular problems in sample pretreatment.

INTRODUCTION

Radiocarbon dating museum objects differs in many ways from standard ^{14}C methods used in archaeology. These differences involve the materials themselves as well as the interpretation of the results. An art historian is not interested in the age of the material but in the period that the artist processed the material or reused it in a new work of art. ^{14}C dating can be a very unreliable and imprecise dating method in the field of art history. In some instances, however, only very broad ranges can be obtained by the classical art-historical methods, *i.e.*, stylistic interpretation and description in written documents. This is especially true if: 1) artistic style did not change over long periods of time, *e.g.*, as in the case of icons; 2) materials from different periods are mixed together, *e.g.*, early Medieval relics and contents of shrines (Van Strydonck, in press); 3) no written documents exist, *e.g.*, for Precolumbian cultures. Many Precolumbian or prehispanic cultural artifacts have been in museum collections for long periods of time with only very poor information about their origins. This also can lead to very unreliable dating.

We discuss here the ^{14}C dating of four different types of materials. The objects originate from Peru and are part of the collection of the Royal Museum for Art and History, Brussels, Belgium and of the Museo National de Antropologia e Arqueologia, Lima, Peru. Each type of material differs not only in chemical composition but also in possible sources of contamination and degradation during its stay in the museum. The objects were part of an exhibition at the Royal Museum for Art and History, Brussels, "Inca-Perú, 3000 Years of History" (Purin 1990).

We analyzed some samples using gas counting at the Royal Institute of Cultural Heritage (IRPA) (Dauchot-Dehon & Van Strydonck 1979), and others using accelerator mass spectrometry (AMS) at the State University Utrecht (Utc) (Van der Borg *et al.* 1987)

MATERIALS

Bamboo

We measured bamboo samples from three looms with fabrics on them, probably from the Chancay period (AD 1000–1450) (Laurencich-Minelli 1990). About 8 g of bamboo per sample were taken in a way that did not damage the appearance of the looms. The samples were treated by the conventional acid-base-acid method (ABA). Table 1 shows the results of the measurements made at IRPA.

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TABLE 1. ^{14}C Dates of Bamboo

Sample no.	Museum ref.	^{14}C age (yr BP)	$\delta^{13}C$ (‰)	cal AD* (1 σ range)
IRPA-620	AAM 65-13-6	1240 ± 55	–23.9	683–872
IRPA-621	AAM 65-13-4	1030 ± 65	–24.4	964–1029
IRPA-711	AAM 65-13-1	1330 ± 50	–24.0**	654–690

*We used the calibration curves of Stuiver and Pearson (1986) and the calibration program of Stuiver and Reimer (1986): method A.
**Estimated

Because the bamboo of the looms has no cultural value, it may have been replaced with new bamboo. This seems not to be the case in our samples. All the results are even older than expected. However, the old wood effect is unlikely. None of the poles of the looms were thicker than 1 cm, and showed no marks of intensive or long use. These primary results indicate that at least two of the three results overlap within ± 1 σ range, and that these looms belong most probably to the mid-horizon (AD 600–1000). Art historians dated the textiles based on their design. However, the ^{14}C dates are supported by the fact that historians have documented the use of looms from several centuries before the beginning of the mid-horizon (Laurencich-Minelli 1990).

Textiles

We took for analysis about 230 mg of fibers from a piece of polychrome textile (AAM 86-2) (Fig. 1) and an *Unku* (shirt) (AAM-46-7-343) from the central coastal area, Peru, probably from the Chancay period. Table 2 shows the AMS results obtained at the University of Utrecht.

TABLE 2. AMS ^{14}C Dates of Textiles

Sample no.	Museum ref.	^{14}C age (yr BP)	$\delta^{13}C$ (‰)	cal AD* (1 σ range)
UtC-1005	AAM 86-2	710 ± 70	–23.1	1259–1295
UtC-1006	AAM 46-7-343	510 ± 140	–24.4	1290–1480

*Stuiver and Pearson (1986), Stuiver and Reimer (1986): method A.

The results confirm the Chancay origin of the textiles. Textiles are a reliable dating material, but many historical textiles do not survive the ABA pretreatment (Mook & Waterbolk 1985) and disintegrate. One could question the necessity of these harsh chemical procedures in sample preparation. The aim of the pretreatment is to remove the components with a $^{14}C/^{12}C$ isotopic ratio that, after normalization, differs from that of the textile fibers. The traditional ABA pretreatment was originally developed to prepare geological and archaeological samples that were, for a long time, in contact with the earth and groundwater, and altered by local chemical conditions, *e.g.*, absorption of humic acids, sulfides, chlorides and pH of the groundwater. Materials that have been kept in tombs and temples and later transferred to museums have not been in contact with foreign carbon-containing soil matter or carbonate. Analyses of the Shroud of Turin and other textiles revealed no significant difference in ^{14}C ages depending on the pretreatment (Damon *et al.* 1989) for well-preserved textiles. This confirms the hypothesis that dust is the major contaminant of museum objects, in general, and textiles, in particular. Even organic dyes used on textiles will not have a different $^{14}C/^{12}C$ isotopic ratio, as they originate from natural plants and insects. However,

Fig. 1. Painted textile, Chancay culture, from central coastal Peru

careful examination is necessary, in as much as carbon from other sources may be a component of paints and ink (*e.g.*, "ivory black" (Housley *et al.* 1989) and soot-based inks).

Our pretreatment consists of washing with a neutral detergent and repeated rinsing with demineralized water, sometimes in combination with ultrasonic cleaning. The sample is then examined for remaining inclusions and stains under a stereomicroscope. We select clean fibers for analyses. We use ABA treatment only if the sample remains stained.

More serious contamination may occur in the museum during conservation and restoration. Sample submitters should inform the laboratory about the possible use of organic products during restoration and conservation. Most organic restoration products (*e.g.*, polymers, glues, varnishes) and solvents contain carbon without any ^{14}C. The presence of these components in the sample, even in minor quantities, will effect the ^{14}C date. Thus, dry cleaning is to be avoided because of long retention times for some of the products (Masschelein-Kleiner & Deneyer 1981; Landi 1981).

A second important source of contamination is fibers foreign to the original textile, such as reused parts of older textiles and modern (restoration) threads and support fabrics.

Feather

A feather carpet (Museum ref.: AAM-56-8), probably from the Huari culture (AD 600–1000), was found at Ocona-La Victoria in a grave, where it was stored with other carpets in a storage vessel.

Ninety-six of these carpets are known. They are believed to be older than the Inca period and seem to be associated with the Tiahuanaco style (Longhena 1990).

One small feather was ultrasonically cleaned. Microscopic inspection revealed dust particles stuck between the feather's barbs. Thus, only the quill of the feather (10 mg) was dated. No organic fractions were separated; we used the total carbon content because we had no fear of contamination. The feathers were not treated with dyes nor glued, but sewn to the underlying fabric. We obtained a ^{14}C age of 1110 ± 70 BP (UtC-1165) and a $\delta^{13}C$ of −8.5‰. The calibrated age, cal AD 880–1000 at 1 σ range (Stuiver & Pearson 1986; Stuiver & Reimer 1986: method A), is consistent with the Huari origin of the carpet. Unfortunately, this result was misinterpreted (Longhena 1990). Longhena quoted a calibrated age range cal AD 880–1100 and concluded that this was not in agreement with the supposed Huari (AD 600–1000) origin of the carpet.

Straw

Figure 2 shows a mask (MNAA/ANT.1-86/G) made of straw and earth from a sarcophagus of the Chachapoyas culture (AD 1100–1460) (Kauffmann-Doig & Ligabue 1990).

During sample preparation, we encountered unexpected problems in the separation of the straw fraction from the sandy clay of the mask. The object hosted a lot of insects, such as beetles, so we

Fig. 2. Mask from sarcophagus, Chachapoyas culture, from Peru

had to handpick straw fibers from the organic bulk sample. We pretreated the straw fibers using the ABA-method. A second possible additional contamination may have come from the restoration products (Paraloïd B72) used to consolidate the mask. We consulted restoration records to find what part of the mask had been consolidated. This is a typical problem of museum objects. It is difficult to retrace all restorations. Of course, recent restorations are more easily retrieved because most restoration treatments are extensively documented, and we can use analytical techniques, such as infrared spectrometry, gas chromatography and mass spectrometry. Earlier restorations, especially those carried out before World War II, are not very well documented, and earlier restorers more often used natural products with chemical compositions close to the original material (*e.g.*, animal-based glues). This complicates detection by analytical techniques. Old restorations can be retraced only by carefully examining the objects for changes in style, color and texture, which mark the work of the restorer.

We obtained a ^{14}C age of 580 ± 50 BP (UtC-1441) and a $\delta^{13}C$ of −20.3‰. The calibrated age, cal AD 1300–1410 at 1 σ range (Stuiver & Pearson 1986; Stuiver & Reimer 1986: method A), is consistent with the expected age.

Conclusions

This study has shown the possibilities and the limitations of ^{14}C dating of Precolumbian museum artifacts.

Because of the small-sample capability of AMS dating, damage during sampling is no longer of great concern. This makes it possible to date the object itself and not the organic material, such as charcoal and wood, found in the same context. Dating the context can give misleading conclusions. At Galgada, in the region of Ancash, feathers and organic material were found in a location that served first as a ritual site and later as a sepulchral chamber. Although different phases of occupation were recognized, the feathers were only indirectly dated by charcoal found in association with them (Longhena 1990). Dating the object itself is also the only possible way to date museum objects of uncertain origin.

AMS dating has also enabled us to measure new types of samples, previously undatable, such as feathers and straw embedded in clay masks.

However, dating of museum objects requires a different approach to pretreatment procedures, especially when textiles are concerned. We think that it is unrealistic to propose a standard pretreatment method because of the many factors involved, such as the chemical composition of the fibers and the nature of the contamination. So, we recommend analytical as well as microscopic analyses of each sample.

In some cases, the results agreed with the estimated age, in others, they did not. The ^{14}C dating of the looms has shown that despite the imprecision of radiometric dating, we arrive at a result that questions the art-historical date. At the present state of this investigation, it is too early to draw any conclusions, except for the fact that a more systematic dating project seems necessary.

References

Damon, P. E., Donahue, D. J., Gore, B. H., Hatheway, A. L., Jull, A. J. T., Linick, T. W., Sercel, P. J., Toolin, L. J., Bronk, G. R., Hall, E. T., Hedges, R. E. M., Housley, R., Law, I. A., Perry, C., Bonani, G., Trumbore, S., Woelfli, W., Ambers, J. C., Bowman, S. G. E., Leese, M. N. and Tite, M. S. 1989 Radiocarbon dating of the Shroud of Turin. *Nature* 337: 611–615.

Dauchot-Dehon, M. and Van Strydonck, M. 1979 A new methane synthesis unit at the radiocarbon dating laboratory. *Bulletin van het koninklijk instituut voor het kunstpatrimonium* t.XVII: 194–200.

Housley, R. A., Srdoč, D. and Horvatinčić, N. 1989 AMS and radiometric dating of an Etruscan linen book and associated mummy. *In* Long, A., and Kra, R. S., eds., Proceedings of the 14th International ^{14}C conference. *Radiocarbon* 31(3): 970–975.

Kauffmann-Doig, F. and Ligabue, G., 1990 Het gebied van de Peruaanse Amazone-Andes. *In* Purin S., ed., *Inca-Perú, 3000 jaar Geschiedenis: Catalogue,* Museum voor Kunst en Geschiedenis, Brussel. Imschoot, Gent 1: 330–349.

Landi, S. 1981 The practice of dry-cleaning in the United Kingdom. *In* van Asperen de Boer, J. R. J. and Berends-Albert, M., eds., Proceedings of the 6th Triennial Meeting, *ICOM* 9(2): 8.

Laurencich-Minelli, L. 1990 Artistieke en technische aspecten van de oude Peruaanse textielen. *In* Purin, S., ed., *Inca-Perú, 3000 jaar Geschiedenis: Catalogue,* Museum voor Kunst en Geschiedenis, Brussel. Imschoot, Gent 1: 316–329.

Longhena, M. 1990 De kunst van het Verenwerk in het oude Peru. *In* Purin, S., ed., *Inca-Perú, 3000 jaar Geschiedenis: Catalogue,* Museum voor Kunst en Geschiedenis, Brussel. Imschoot, Gent 1: 330–349.

Masschelein-Kleiner, L. and Deneyer, J. 1981 Contribution à l'étude des solvents utilisés en conservation. *In* van Asperen de Boer, J. R. J. and Berends-Albert, M., eds., Proceedings of the 6th Triennial Meeting, *ICOM* 20(2): 10.

Mook, W. G. and Waterbolk, H. T. 1985 Radiocarbon dating. *Handbook for Archaeologists,* No. 4. European Science Foundation, Strasbourg, 65 p.

Purin, S., ed. 1990 *Inca-Perú, 3000 jaar geschiedenis: Catalogue,* Museum voor Kunst en Geschiedenis, Brussel. Imschoot, Gent, 2 volumes.

Stuiver, M. and Pearson, G. W. 1986 High-precision calibration of the radiocarbon time scale, AD 1950–500 BC. *In* Stuiver, M. and Kra, R. S., eds., Proceedings of the 12th International ^{14}C conference. *Radiocarbon* 28(2B): 805–838.

Stuiver, M. and Reimer, P. J. 1986 A computer program for radiocarbon age calibration. *In* Stuiver, M. and Kra, R. S., eds., Proceedings of the 12th International ^{14}C conference. *Radiocarbon* 28(2B): 1022–1030.

van de Borg, K., Alderiesten, C., Houston, C. M., De Jong, A. F. M. and Van Zwol, N. A. 1987 Accelerator Mass Spectrometry with ^{14}C and ^{10}Be in Utrecht. *In* Gove, H. E., Litherland, A. E. and Elmore, D., eds., Proceedings of the 4th International Symposium on Accelerator Mass Spectrometry. *Nuclear Instruments and Methods,* B29: 143-145.

Van Strydonck, M. J. Y. (ms.) 1990 Radiocarbon dating of relics and kindred artefacts. Paper presented at the International Conference on Medieval Textiles, Particularly in the Eurgio Meuse-Rhine. Alden Biesen, Belgium, May 21–25.

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