

Radiocarbon dating of the Peruvian Chachapoya/Inca site at the Laguna de los Condores

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Abstract

In 1997 a new archaeological site was discovered in the Peruvian tropical rain forest. The site is located in an area which has been occupied by the Chachapoya, a pre-Incan people, from about 800AD on. The site comprises a large funerary place with several mausoleums built in the cliffs next to the Laguna de los Condores. More than 200 human mummies and funerary bone-bundles together with numerous grave artefacts have been found there. Although the site has been ascribed to the Chachapoya, the mummification method used is very similar to the one applied by the Inca. As part of an ongoing multidisciplinary project to explore the history of this site and of the Chachapoya people, twenty-seven (27) ¹⁴C-AMS age determinations were performed. Samples, bones and textile wrappings as well as samples from a funerary bone bundle plus associated grave artefacts were dated. The ¹⁴C data show that the site originates from the Chachapoya pre-Inca period and that in addition, it was used as a funerary place during the subsequent Inca occupation era. The radiocarbon results indicate that the Chachapoya may have changed their burial tradition due to the colonization by the Inca. © 2007 Elsevier B.V. All rights reserved.

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1. Introduction

The Laguna de los Condores (Lake of the Condors; Fig. 1(a)) is located in the eastern flanks of the Andean mountain range in Peru at a latitude of 6°51'15" S, and 77°41'20" W longitude. Laguna de los Condores is in the Huallaga River (Huallabamba affluent) drainage basin at the origin of the Chilchos valley. The lake is between the political regions of Amazonas and San Martin. The area lies in the "cloud forest" portion of the province of Huallaga, a tropical mountainous forest region between 1900 and 3000 meters above sea level, with mean temperatures between 12 and 17 °C, and annual mean rainfall between 2000 and 4000 mm. The topography of the zone includes

abrupt hills with soft soils rich in organic material. The vegetation is high and dense.

In 1997, an archaeological site with several funerary houses built in the cliffs of the lake was discovered accidentally. The site must have been known to people living in this area for some time and looters must have visited this place frequently (Fig. 1(b)). Conflicts between looters resulted in a word of mouth spread of the location which ultimately led to the report of the ancient funerary place to the Peruvian authorities. From the more than 200 mummies found in the funerary houses and nearby, only 3 of them were in their original location. The rest of the mummies had been disturbed and partly destroyed by the looters [1]. The funerary houses are attributed to the Chachapoya, Peruvian pre-Inca people, who occupied this region from the beginning of the 9th century AD. In a rescue campaign, the mummies, the funerary bundles and the

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Fig. 1(a). The Laguna de los Condores.

other archaeological objects have been transferred to Leymebamba, a village near the lake, where a museum has been specially built for the storage of the valuable artefacts.

2. The Chachapoya

Myths entwine around the origin of the Chachapoya people. Based on Spanish chroniclers the Chachapoya were described as “white”-skinned people and the women as “the most graceful Indians in all the Indies” [2]. These descriptions and the “blond” appearance of some modern inhabitants of this region led to speculations that the Chachapoya were the descendants of earlier European colonists (Phoenicians, Celts or Vikings), who crossed the Atlantic and moved through the Amazon into that area [3]. Studies of skeletal remains showed that- although taller than other coeval South American populations – the Chachapoya are of Andean stock [4]. The people are sometimes also called the “warriors of the clouds” [5] according to their bellicose traits, which are documented by the massive

resistance to the Inca who conquered the region around 1470 AD. The Inca later took advantage of the martial abilities of the Chachapoya by sending them to other parts of the empire as colonists. Likewise garrisons from other ethnic groups were located in the Chachapoya region. When the Inca themselves were defeated by the Spaniards in 1532 AD, the Chachapoya allied with the Spaniards, which finally resulted for them in a continued suppression but under new dominance [4].

The Chachapoya culture is characterized by typical features in the architecture and the decoration of their buildings, the style of their pottery, etc. They built funerary houses for their dead, often at very hard to reach places – e.g. the cliffs of Laguna de los Condores – and decorated the defleshed bones with red paint. Afterwards the remains were wrapped into textile bundles and these funerary bundles were placed in tombs. During the Inca occupation, it seems that the Chachapoya changed their treatment of the dead to an artificial mummification method similar to the one used by the Inca. This may be the result of the colonization program of the Inca and is reflected by the two different burial patterns found in the cliff houses at the Laguna de los Condores (see Figs. 2(a) and (b)). Another explanation for the different burial pattern might be that after conquering the Chachapoya, the Inca took over the burial cliff houses and used them for their own burials and for the members of other ethnic groups which (by the population policy of the Inca) were brought to settle in this region. Based upon some of the grave artefacts found at the site, the funerary houses have been used post Spanish colonization.

3. The mummies of the Laguna de los Condores

All of the mummies recovered at the site were artificially prepared as hinted by the simple fact that none of the



Fig. 1(b). Looted Chachapoya site at the cliff houses.



Fig. 2(a). Chachapoya burial bundle.

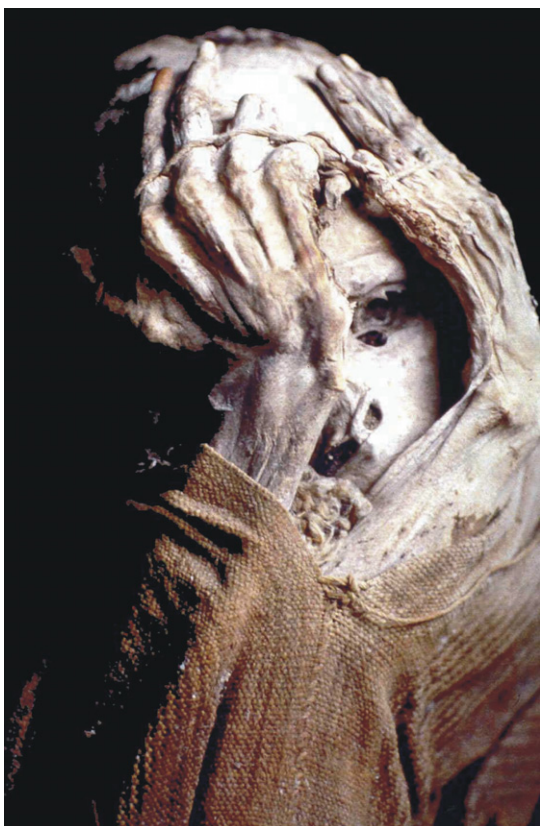


Fig. 2(b). Artificially prepared Chachapoya/Inca mummy.

bodies had the usual smell of a natural mummy, with some of the mummies having an antiseptic smell. The corpses had been dried and forced into a very tightly bound position. Such a treatment produced a very light and compact package that would be easy to transport in the rough terrain of this area. The preparation of the bodies must have involved a lengthy process suggested by the large accumulation of blue fly pupae implying that the flies had the time to set over the untreated parts of the body and lay their eggs. Nevertheless, insects usually did not cause extensive damage. Furthermore, there is no single presence of dermestid beetles which would suggest advanced decomposition. The artificial procedure was able to control the natural course of decomposition. At the site, there was neither space nor the available conditions to prepare the bodies. Therefore, the mummies must have been transported over some distance or even from the small ancient and contemporaneous settlement of Llaqtacocha at the other side of the lake. The most drastic step of the mummification process was to enlarge the anus in order to remove the intestinal cavity contents. This area was cleaned and allowed to dry, although it was not closed up. A cloth plug was placed to close the enlarged opening and in most cases the plug was replaced until a final clean cloth plug remained. The thoracic cavity was left intact above the diaphragm. This will allow important observations on health conditions among these people to be assessed.

We infer that the process of artificial mummification must have taken a long time in order to prepare the skin. Most hair on the body and the head was lost with this procedure. The materials used to cure the skin have not been fully identified. There is a strong possibility that native plants such as *poleo* and *muña* were used. Small packages containing odorous leaves of these plants were placed near the mummies. Facial features were conserved using raw cotton to fill in the nostrils, underneath the cheeks and inside the mouth. The prepared dry and light body was dressed and a cloth was usually placed around the neck to keep the head vertical. The exterior wrappings include a series of cotton cloaks. A large number of the exterior wrappings were embroidered with typical Chachapoya designs used in Chachapoya friezes and some exhibit embroidered faces, a very unique feature. The mummies from the Laguna de los Condores are the only artificially prepared Chachaopoya mummies known to date. Mummies of men and women, adults and children indicated that neither a distinction by age nor by gender had been made in the application of this elaborate mummification method.

4. Radiocarbon dating

In order to shed light on the still unknown history of the funerary cliff houses at the Laguna, and more generally on the history of the Chachapoya people which is also not very well known, a large multidisciplinary project was started a few years ago. VERA contributed to this study with AMS- ^{14}C age determinations of grave artefacts, tex-

tiles from the mummy wrappings, and of bones originating from some of the two different types of body disposal found at this burial site.

After ultrasonication in double-distilled water all samples, except the bones, were pretreated with our standard acid-base-acid (ABA) method using 1 M HCl and 0.1 M NaOH solutions for the respective chemical step. In order to test the clean-up ability of the ABA method for the textiles, for comparison, a sub-sample of VERA-3001 (VERA-3001B, see Table 1) was extensively bleached with NaClO₂ in addition to the ABA treatment.

The bone samples were prepared using VERA's pre-treatment for the isolation and clean up of collagen of archaeological bone samples. This is in essence an ABA treatment followed by a gelatinization step of the thus obtained residue (collagen). All bone samples were in an excellent preservation state with high collagen yields which almost correspond to recent bones and are thus well above the minimum level suggested in the literature for reliable bone ¹⁴C dating [6]. The further processing of the samples and the AMS ¹⁴C measurement was performed as described in [7,8].

Table 1
Radiocarbon AMS data determined for samples from the funerary cliff houses

Lab number	Sample name	Sample material	$\delta^{13}\text{C}$ (‰)	¹⁴ C age ^a (years BP)	Calibrated date ^b
VERA-1568	MUCMA 302	Insect remain	-16.9 ± 1.3	360 ± 30	1450AD (95.4%) 1640AD
VERA-2506	CH2002-2	Corn	-9.4 ± 0.4	265 ± 35	modern
VERA-1570	MUCMA 150	Corn husks	-9.9 ± 1.3	375 ± 35	1440AD (55.3%) 1530AD 1540AD (40.1%) 1640AD
VERA-1569	MUCMA 139	Straw	-6.5 ± 1.5	430 ± 35	1410AD (88.2%) 1520AD 1590AD (7.2%) 1620AD
VERA-2998	CMA 208	Twigs	-27.4 ± 0.5	315 ± 35	1470AD (95.4%) 1650AD
VERA-2990	CMA 36	Textile fragments	-24.0 ± 0.6	380 ± 35	1440AD (58.5%) 1530AD 1550AD (36.9%) 1640AD
VERA-2991	CMA 45	Textile fragments	-26.0 ± 0.7	380 ± 40	1440AD (95.4%) 1640AD
VERA-1567	MUCMA 253	Textile	-16.8 ± 1.3	350 ± 30	1450AD (95.4%) 1640AD
VERA-2994	CMA 69	Textile fragments	-25.0 ± 0.3	340 ± 30	1460AD (95.4%) 1640AD
VERA-2996	CMA 88	Textile fragments	-25.6 ± 0.6	360 ± 35	1450AD (95.4%) 1640AD
VERA-2508	CH2002-4	Textile	-23.8 ± 0.4	290 ± 30	1490AD (95.4%) 1670AD
VERA-2997	CMA 163	Exterior textile wrapping	-26.1 ± 0.7	290 ± 35	1490AD (91.9%) 1670AD 1780AD (3.5%) 1800AD
VERA-2999	CMA 214	Interior textile wrapping	-25.6 ± 0.7	335 ± 35	1460AD (95.4%) 1650AD
VERA-3001	CMA 233	Interior textile wrapping	-24.4 ± 0.6	295 ± 35	1480AD (95.4%) 1670AD
VERA-3001B	CMA 233	Same material as VERA-3001, see text	-25.0 ± 1.2	320 ± 35	1470AD (95.4%) 1650AD
VERA-3002	CMA 238	Exterior textile wrapping	-24.4 ± 0.6	285 ± 40	1480AD (92.1%) 1670AD 1780AD (3.3%) 1800AD
VERA-2993	CMA 66	Human rib	-17.9 ± 4.6	325 ± 30	1470AD (95.4%) 1650AD
VERA-2995	CMA76	Human rib	-17.8 ± 0.3	370 ± 35	1440AD (95.4%) 1640AD
VERA-3003	CMA 265	Human rib	-20.0 ± 0.4	340 ± 30	1460AD (95.4%) 1640AD
VERA-3004	LC 18–10	Fragment with soft tissue	-15.2 ± 0.4	435 ± 30	1410AD (92.5%) 1500AD 1600AD (2.9%) 1620AD
VERA-3000	CMA 218	Human rib	-15.6 ± 2.1	430 ± 30	1420AD (91.4%) 1520AD 1600AD (4.0%) 1620AD
VERA-1565	CMA 307a	Bone, Individuo 11	-10.6 ± 1.4	425 ± 35	1410AD (86.2%) 1530AD 1590AD (9.2%) 1620AD
VERA-1566	CMA 307b	Bone, Individuo 11	-13.2 ± 1.1	375 ± 40	1440AD (95.4%) 1640AD
VERA-2992	CMA 64	Human rib	-20.1 ± 1.0	355 ± 35	1450AD (95.4%) 1640AD
VERA-2507	CH2002-3	Bone	-18.3 ± 0.4	515 ± 30	1320AD (7.6%) 1350AD 1390AD (87.8%) 1450AD
VERA-1571	MUCMA 313	Gourd remains	-23.3 ± 1.5	580 ± 30	1290AD (63.4%) 1370AD 1380AD (32.0%) 1420AD
VERA-2505	CH2002-1	Wood	-21.3 ± 0.5	820 ± 35	1160AD (95.4%) 1280AD

^a 1- σ uncertainty.

^b 2- σ confidence interval.

5. Results and discussion

The ^{14}C ages of the individual samples are given in Table 1 together with the calibrated calendar time ranges. The ^{14}C -ages are converted into calendar time ranges with OxCal 3.10 [9] and the INTCAL04 calibration curve [10].

As described above, one textile sample was treated with two different preparation methods, the standard ABA (VERA-3001) and ABA plus additional bleaching (VERA-3001B), respectively. The ^{14}C data of both subsamples agree very well (see Table 1) and confirm that the textiles are readily cleaned by the ABA method.

For a bone sample originating from a funerary bundle and two organic burial objects, ages older than the samples originating from the mummies were determined (see last three rows in Table 1). The burial objects show features ascribed to the pre-Inca Chachapoya culture. The ages of these objects and of the bone confirm that the Laguna de los Condores funerary houses originate from the time period before the Chachapoya had been conquered by the Inca. The calibrated ^{14}C ages determined for the bones originating from the mummies, the textile wrappings and other associated materials, largely overlap with the time period, when the Chachapoya people had been subdued by the Inca, and with the beginning of the Spanish colonization time. The ^{14}C data support the assumption that the change in the burial rite documented by a change in the preparation method of the dead, was performed during the Inca occupation time. Although the calibrated ^{14}C ages of the mummies and of the associated grave goods fall in the Inca/Spain colonization time period of the Chachapoya people, it can be excluded that this change to the mummification method of the Inca was made after the Spaniards took over. The ^{14}C data indicate that these mummies originate from the Inca occupation time period.

Due to the unfavourable form of the calibration curve, calibration of the conventional ^{14}C ages results in broad calibrated time ranges. Fig. 3 shows as an example of this

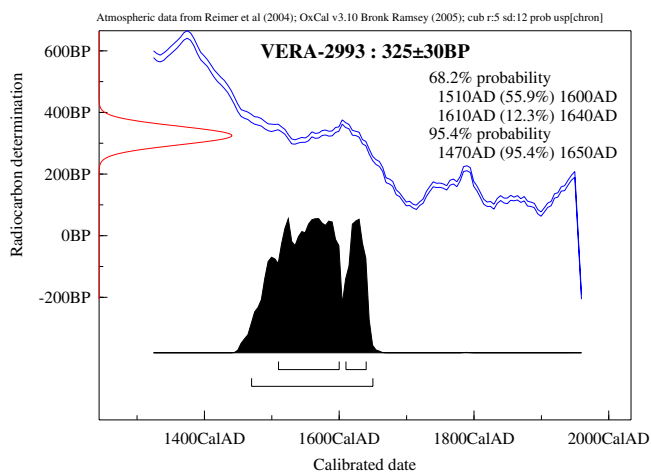


Fig. 3. Calibration of the ^{14}C age determined for the human rib fragment CMA 66.

effect the calibration plot of the sample VERA-2993. It therefore is not possible to determine, when the site was abandoned. A Christian cross and several other post-European contact artefacts found in the large collection of grave goods may indicate that the site was used for some time after the Spanish conquest.

At VERA the fast sequential injection of the ^{12}C , ^{13}C and ^{14}C beams into the accelerator with subsequent isotope analysis and detection enables the simultaneous determination of the $^{14}\text{C}/^{12}\text{C}$ and the $^{13}\text{C}/^{12}\text{C}$ ratio of the sample. From the $^{13}\text{C}/^{12}\text{C}$ data determined for the samples and for reference standard materials (IAEA C-3, C-6 and C-5 standard) with known nominal $\delta^{13}\text{C}$ values, the $\delta^{13}\text{C}$ values of the samples are calculated. Although the uncertainties of the thus obtained $\delta^{13}\text{C}$ values are larger than the uncertainties which are achievable with conventional stable isotope ratio mass spectrometers, this method is advantageous for the isotope fractionation correction in ^{14}C dating, because fractionation effects introduced during the sample processing in the laboratory are also included in the correction. But one has to consider the sample processing when the $\delta^{13}\text{C}$ values determined by AMS are used for the assessment of naturally occurring fractionation effects of the stable carbon isotopes in the original sample. Nevertheless inspecting the $\delta^{13}\text{C}$ values given in Table 1 shows that most of the values lie in the range expected from natural fractionation. Therefore it can be assumed that fractionation in the laboratory was of minor effect. Under this assumption and considering the fact that the applied chemical method for the isolation of collagen is very similar to the extraction methods used in palaeodietary studies, some speculation on the palaeodiet of the individuals may be drawn from our data. The $\delta^{13}\text{C}$ values of both samples from individual 11 (samples VERA-1565 and VERA-1566) are significantly higher (less negative) than most of the values determined for the other bone samples and may reflect nutrition by mainly C-4 plant derived food, e.g. corn (compare $\delta^{13}\text{C}$ for samples VERA-2506 and VERA-1570). Another cause for such $\delta^{13}\text{C}$ values could be an almost 100% marine diet, when the collagen was predominantly synthesised. A marine diet signature in the stable isotopes would be expected when people from coastal regions migrated into the rain forest, but in this case also a considerable reservoir age as the second effect of a marine dominated diet should have been detected (see e.g. [11]). As the age of this individual does not deviate from the ages determined for the textiles associated with the mummies and also from the ages of mummy bones with more negative $\delta^{13}\text{C}$ values, a coastal origin of this individual is highly improbable. Therefore the interpretation that the $\delta^{13}\text{C}$ value of Individual 11 may reflect an abundant fraction of C-4 plant (corn) based food seems reasonable. The $\delta^{13}\text{C}$ values of some other mummy samples may indicate a partial C-4 diet, but this assumption is tentative considering the above discussion of the possible contribution from laboratory fractionation and the relatively large uncertainties of the AMS values. A precise paleodiet assessment

needs to be verified by (conventional) stable isotope mass spectrometry.

6. Conclusion

The ^{14}C data confirm the assumption that the Chachapoya people were the architects of the funerary cliff houses and that the cliff houses were used during the time of Inca occupation. Furthermore the ^{14}C dating results support the archaeologically assessed chronology of the burial style sequence at the Laguna de los Condores funerary houses. Older ages were determined for a bone sample originating from a funerary bundle containing defleshed bones (see Fig. 2(a)) and for two organic burial objects, whereas the samples from the mummies exhibit younger ages and attribute the mummies to the Inca period. Whether the artificially prepared mummies are the remains of Chachapoya people or if they are the dead bodies of Inca and/or members of other ethnic groups, brought by the Inca population policy to the Chachapoya region would be clarified by further scientific investigations, e.g. DNA analysis. In the near future a study of the stable nitrogen and carbon isotope ratios will be performed in order to determine the nutrition behaviour of the “cloud forest” human population at this time period in more detail.

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