Osteobiographic Analysis of Skeleton I, Sítio Toca dos Coqueiros, Serra da Capivara National Park, Brazil, 11,060 BP: First Results

Andrea Lessa*1 and Nêde Guidon2

1Departamento de Etnologia Samuel Pessoa, Escola Nacional de Saúde Pública/Fundação Oswaldo Cruz, Rio de Janeiro 21041-260, Brazil
2Fundação Museu do Homem Americano, São Raimundo Nonato, PI, Brazil 64770-000

KEY WORDS: Paleindian; osteobiography; paleopathology; Piauí; Brazil

ABSTRACT: This paper presents an osteobiographic analysis of a single skeleton found in a small rock shelter known as Toca dos Coqueiros, Piauí, Brazil. This find is of interest because of an exceptionally old radiocarbon date associated with it. The date (11,060 BP) was obtained from charcoal associated directly with the skeleton. This is an interesting find because of the rarity of osteobiographic studies of skeletons of such antiquity. Despite the existence of two projectile points in association with the burial, the morphological and molecular analyses of the skeleton demonstrated that this was a female. She was about 34–45 years of age at death. The skeleton exhibited acute and chronic bone lesions. Oral pathology was also observed, including an interproximal dental groove, probably caused by the therapeutic use of a cactus thorn. This could be one of the oldest cases of an analgesic plant used in the prehistoric Americas. Am J Phys Anthropol 118: 99–110, 2002. © 2002 Wiley-Liss, Inc.

In 1997, a team from the Fundação Museu do Homem Americano excavated a single burial from a site situated in a small rock shelter known as Toca dos Coqueiros. This shelter is located in a valley called Baixão das Mulheres in the Serra da Capivara National Park in the municipality of Coronel José Dias, in Piauí State, Brazil (Fig. 1) (Guidon et al., 1998). This was an intensively populated area in prehistory. A survey conducted of a small area of the park in 1986 revealed 244 sites, 209 of which contained rock art (Guidon, 1986).

There is much to be gained from publishing as much information as possible concerning this find in view of its exceptional antiquity and the rarity of osteobiographic studies of Brazilian Paleindians. The objective of the present work is to describe the skeleton exhumed at Toca dos Coqueiros by detailing its state of preservation, sex, age at death, stature, and pathology. This analysis contributes to the formation of a slightly wider outlook on the Paleindian groups, taking the skeletal biology of this example as a starting point for northeastern Brazil.

MATERIALS AND METHODS

Anatomical position of the burial and its state of preservation

The individual was exhumed by the removal of the entire block of sediment that surrounded the burial, thereby preserving the burial position (Guidon et al., 1998). In the field, the skeleton was consolidated with acrylloid B-72 and wrapped. It was then removed in a block of sediment. This procedure was essential for the safe removal of the skeleton from the site.

One goal of the laboratory work was to make a replica of the skeleton for permanent museum exhibition. During the first stage of laboratory work, the fragile skeleton underwent initial procedures of cleaning and restoration. It was cleaned until the upper portions were exposed. Then a technician made a mold of the skeleton. A cast of the mold was made and is currently on display in the Museu do Homem Americano, in São Raimundo Nonato, Piauí.

After the mold was made, the skeleton was fully excavated and disarticulated. The skeleton was

*Correspondence to Andrea Lessa, Departamento de Etnologia Samuel Pessoa, Escola Nacional de Saúde Pública/Fundação Oswaldo Cruz, Rua Lopes da Silva 1400, terreiro Viana, Rio de Janeiro, RJ 21041-210, Brazil. Email: lessa@focruz.br

Received: 22 August 2000, accepted: 27 December 2001.

DOI: 10.1002/ajpa.10884
Published online in Wiley InterScience (www.interscience.wiley.com)
found to be poorly preserved for several reasons. The burial was shallow, and blocks of arenite had fallen on it from the rock face of the shelter. Most importantly, the burial was disturbed by the intense movement of people and animals over the site prior to its being closed off by the archaeological team.

The individual was buried flexed on the left side, with the axial skeleton curved (Fig. 2). The right humerus formed an angle of approximately 45° in relation to the radius and the ulna. The right hand was placed against the face. The femurs were flexed, forming an angle of less than 45° in relation to the lower legs, and an angle of slightly more than 45° in relation to the spinal column.

Intact postcranial remains are limited to the right femur, right tibia, some right ribs, most of the hand and foot bones, and some vertebrae, principally the lumbar and the lower thoracic segment.

Postcranial remains with some fractures and/or absent regions include the left femur, left tibia, left and right fibula, left patella, right humerus, right radius, right ulna, scapula, mandible, maxilla, sternum, left clavicle, left hand, and left ribs.

The most fragmented bones are the sacrum, right clavicle, and left arm. Of the left arm, only part of the diaphysis of the ulna, part of the diaphysis of the humerus, and the distal epiphysis of the radius remained. The segments between the 3rd and 7th cervical vertebrae and between the 5th and 7th thoracic vertebrae are absent.

The skull (Fig. 3) is badly fragmented, and in addition it is affected by compression. Therefore, the skull is laterally deformed. The compression was probably caused by the pressure of activities of animals and people in the rock shelter.

The right humerus (Fig. 4) has a curved diaphysis, angled sideways and forward. There is no sign of any infectious process or of degenerative disease of the joints, and radiography showed no traces of fractures or pathological alteration. The alteration of form of this bone was probably due to taphonomic processes similar to those that affected the skull.
OSSEOSTROBIOGRAPHY OF SKELETON DATED 11,000 BP

Fig. 5. Bifacial projectile point made of hyaline quartz.

**Mortuary context**

The sediment of the rock shelter was excavated to a depth of 40 cm in an area of 36 m², utilizing the decapage method. The material found, distributed between several stratigraphic levels, included the burial, lithic tools, bones of small animals, vegetal remains, human hair not associated with the skeleton, 10 distinct hearths, and several areas of burning (Guidon et al., 1998). Some of the hair, dated to 10,540 ± 50 BP (Beta 104571), was later found to be infected with louse eggs (Araujo et al., 2000).

The skeleton was laying in a prepared grave. The floor of the grave was constructed of large arenite slabs. Around the grave were hearths with bones of opossums and a species of armadillo not yet identified. Charcoal and sediments from the hearths were over the burial. The charcoal and hearth sediments were deliberately placed over the burial, apparently at the time of interment. Burial offerings included a variety of lithic artifacts; four plano-convex scrapers, 15 flakes, and two bifacial projectile points (Guidon et al., 1998).

One point (Fig. 5) was made of hyaline quartz, with an obsolescent triangular body, convex borders, and a concave base. In longitudinal cross section it is convex on one side and concave on the other. In plane view, it is asymmetrical with a tendency to be helicoidal. The length is 51.5 mm, the width is 36 mm, and the thickness is 9 mm.

The second point was made of flint, was stemmed, and is broken in the distal area. The medial and distal portions could have had a lanceolate form with convex, asymmetrical borders. The length is 48 mm, the width is 37 mm, and the thickness is 8.5 mm.

**Dating methods**

An attempt was made to directly date the burial by AMS testing of bone collagen. Also, radiocarbon dating was applied to carbon that was in contact with the right calcaneus.

**Sex and age estimation**

**Morphological determination of sex.** In determining the sex of the individual, we followed methods proposed by Bulsara and Ubelaker (1994), even though some of the indicators used by those authors were not present owing to the skeleton's state of preservation.

In order to determine the sex, the following pelvic bone structures were used: the ventral arc, the subpubic concavity, the surface of the ischiopubic ramus, the sciatic notch, and the preauricular sulcus. In analyzing the skull, the following indicators were used: the projection of the nuchal crest, the size of the mastoid process, the thickness of the supraorbital margin, and the projection of the mental eminence.

**Molecular determination of sex.** Two proximal phalanges of the right hand and a thoracic vertebra were submitted for DNA examination to Dr. Sidney Santos and Dr. Andrea Kelly R. dos Santos at the Laboratory of Human Genetic Medicine, Universidade Federal do Pará, who specialize in ancient DNA.

Special care was taken to reduce the possibility of contamination of ancient samples with modern DNA in the laboratory analysis of the skeleton. Latex gloves were worn during the laboratory processing of the skeleton. To further reduce the possibility of contamination, the bone samples for DNA analysis were removed directly from the sediment block with forceps as soon as they were visible. Therefore, in the field and in the laboratory, the bone samples for DNA analysis were not exposed to modern human contamination.

Santos and dos Santos also took precautions to prevent contamination. The following procedures were employed:

1. Gloves and surgical masks were used during sample manipulation, and pipette tips were blocked.
2. The outer bone surface was irradiated with ultraviolet (UV) light, and the material for DNA extraction was obtained from the interior spongy region of the bone through a small hole.
3. The extraction method utilized, as suggested by Bloom (1990), has a small number of steps utilizing silica and guanidine thiocyanate.
4. DNA extraction was carried out in duplicate for each sample. For each extraction, a "negative" extraction was carried out, using all the reagents except for the bone powder. This "negative" extraction was subsequently submitted to all procedures as a "negative" control.
5. Amplification for sequencing of the segments of the amelogenin gene, existing in the X and Y chromosomes, was carried out in two steps, each
of 35 cycles. The second PCR employed 5–10 μl of the product of the first reaction and a primer pair, which was internal in relation to the first PCR. At this step, “negative” controls were also used. Duplicate sequencing for different DNA extracts of the same sample were carried out for most of the samples. Sequencing was performed for both strands, and the results were concordant. Detailed procedures and results will be published elsewhere by Santos and dos Santos.

**Morphological estimation of age at death.** To estimate the age of the individual, a morphological analysis was undertaken of the preserved pubic symphysis of the left side, using the Todd scoring system. An examination of the right side auricular surface was also used, using the Bedford criteria (Buikstra and Ubelaker, 1994). The fusion of the cranial and palatal sutures could not be used to estimate age, due to their state of preservation.

**Stature estimation**

Only the right femur and tibia were intact. Therefore, only these bones were measured for stature estimation. However, according to Seiuli et al. (1990), the lengths of the femur and tibia used individually, as well as their sum, should provide accurate stature estimates.

Selection of a formula for estimating stature of living adults from the lengths of bones requires considering the similarity between the population represented by the archaeological sample and the population represented by the formula (Ubelaker, 1978). Unfortunately, we do not have stature equations developed specifically for people from this part of South America or for Paleoindians.

Thus, for stature estimation, we used two equations developed for American Indians, just for comparison. The Genoves regression formula (Genoves, 1967), developed for the study of Mesoamericans remains, is based on the measurement of bones from the lower extremities. This method is widely used in studies of prehistoric American populations.

We also used an approach developed by Seiuli et al. (1990) and Seiuli and Gisewn (1993). They developed a linear regression equation for Ohio Valley Native Americans which estimates living stature by using the relationships between various bone lengths and skeletal height. They compared two methods of estimating stature. The first was based on skeletal height. The second was estimation of stature from regression equations developed for East Asian or East Asian-derived populations. The comparison of these two methods shows that the latter consistently overestimates the average stature of prehistoric Ohio Native Americans by 2–8 cm.

**Paleopathological analysis**

Analysis of pathological changes to the skeleton was done by visual examination of the bones, by microscopic examination with a binocular microscope, and with radiography of certain skeletal elements to make a secure diagnosis.

Pathological changes that we recorded included abnormalities in bone texture, form, and dimensions based on knowledge of normal bone anatomy. We made particular quantitative analysis of new bone formation such as vertebral osteophytes, destructive processes such as abscesses, and fracture lines. We did not include in the paleopathological analysis perimortem lesions, because they could not be diagnosed with certainty.

Oral pathology was identified based on the criteria suggested by Buikstra and Ubelaker (1984). We recorded the presence of supragingival and subgingival calculus, based on the scale proposed by Brothwell (1981). Dental wear was analyzed just for the teeth that were represented by two thirds of the crown or more, using the level diagrams developed by Murphy (Hillson, 1996).

**Results**

**Dating**

Attempts to directly date the skeleton by AMS methods proved unsuccessful due to the absence of collagen in the sample. Dating of the skeleton was achieved through the analysis of carbon originating from one of the hearths, found in contact with the right calcaneus. The dating was carried out using the radiometric technique, which indicated a date of 11,060 years BP (intercept of radiocarbon age with calibration curve/Beta 108944). The approach yielded a conventional radiocarbon age estimated at 9,870 ± 50 years BP. Based on calibrated results (2 sigma, 95% probability), the individual died 11,120–11,025 years BP.
OSTEOBIOGRAPHY OF SKELETON DATED 11,060 BP

Sex estimation

Most skeletal indicators are consistent with female morphology. These include the presence of a ventral arc, the broad morphology of the greater sciatic notch, the presence of a wide and deep preauricular sulcus, the concave morphology of the inferior border of the subpubic concavity, and the presence of a narrow ridge in the ischiopubic ramus (Fig. 6). Although these are the best sex indicators, one characteristic is inconsistent with female morphology: the thickness of the supraorbital margin. In addition, the analysis of the greater sciatic notch was problematic because of the poor state of preservation of this segment.

We believed that the morphological analysis of sex could be ambiguous. It would be difficult to resolve this ambiguity with morphological comparison because of the absence of other skeletal material from the same group, or even groups dated to a similar time horizon in the study region. From the archaeological perspective, the finding of projectile points in association with the burial suggested that the skeleton is male. For these reasons, an additional technique was used which would enable confident sex identification. In this case, we chose DNA analysis. The DNA analysis showed that the individual is a female.

Age estimation

Age at death was estimated from several skeletal elements. The left pubic symphysis (Fig. 7) has a well-defined edge, with a complete contour visible, and is clearly lipped on the dorsal and ventral edges. These characteristics are compatible with phases 7 (35–39 years old) and 8 (40–44 years old) of the Todd scoring system (Buikstra and Ubelaker, 1994).

The examination of the right auricular surface exhibited the following morphology. There is no transverse organization. There is granularity and microporosity all over the surface. These characteristics are compatible with phase 5 (40–44 years old) of the Bedford criteria (Buikstra and Ubelaker, 1994). The indicators used to estimate age from osseous structures suggest, therefore, that the individual had probably died at an age of between 35–45 years.

Unfortunately, the state of fusion of the cranial suture and the palate could not be analyzed. However, other complementary data, such as the presence of vertebral osteophytes and accentuated wear of the dental enamel, are compatible with an age of 35–45 years.

Stature estimation

The application of different methods of stature estimation produced very different results. This is understandable, given the findings of Sciulli and Gieszen (1993), whose regression formulae consistently overestimated stature.

Based on the femur, stature = 2.59 (41.3) + 49.74 = 156.7 cm ± 3.81. Based on the tibia, stature = 2.72 (34.5) + 63.78 = 157.6 cm ± 3.51. According to the linear regression equation developed by Sciulli et al. (1990), the stature estimation results are as follows. Based on the femur, stature = 2.86 (41.3) + 22.10 = 140.2 cm ± 2.56. Based on the tibia, stature = 3.41 (34.5) + 24.19 = 141.8 cm ± 3.02. The age-adjusted stature estimate was not calculated because only an approximate age for the individual could be determined within a large time interval (35–45 years of age).

Paleopathology

The skeleton shows acute and chronic pathology. However, as some bones are absent or highly fragmented, the lesions described below cannot be assumed to be the only lesions suffered during the individual's life. A radiological examination of the whole skeleton has not been made.

Among the acute traumas, a healed Colles' fracture of the distal epiphysis of the left radius was observed, with no line of fracture. On the anterior surface of the distal epiphysis, a callus formation of dense bone was observed, indicating total healing of the fracture. The affected segments were misaligned, and a lateral deformity at the distal extremity of the bone was observed. Also noticeable was a remodeling of the distal articular surface of the radius as a consequence of the misalignment of the affected segments.

In the left foot, the first proximal phalanx shows an old fracture with signs of healing, situated at the
point of articulation with the metatarsus. The line of the fracture is semicircular in shape, and is situated in the plantar region of the left side of the articular surface. The area adjacent to the line of the fracture had been pressed on, and the formation of osteophytes has occurred on the edge of the articular surface that surrounds the depressed area.

All chronic lesions observed were found in the vertebral structures. These do not represent a complete picture of vertebral disease, however, since some vertebrae or their edges are either absent or destroyed.

The following lesions were observed in the lumbar and thoracic vertebrae: L2, slight depression of the upper edge on the right side, with a deposit of bone on the centrum just below the depressed area, and a very slight lipping (less than 1 mm) on the lower edge on the right side; L3, slight depression of the upper edge on the left side, with a deposit of bone on the centrum just below the depressed area, and a slight lipping (1 mm) on the lower edge on both the left and right sides; L4, osteophytes (between 1–2 mm) on the upper edge and around the whole body of the vertebrae; L5, osteophytes (1 and 1.5 mm) on the lower edge and throughout the central region; D3, lipping (2 mm) on the lower edge, central region; and D8, lipping (1.5 mm) of the upper edge, central region.

These lesions corresponding to level 1, according to the classification of Nathan (1962). However, it is important to highlight the absence of some vertebrae, and the destruction of the edges of others, which could have contained more serious lesions.

Oral pathology

Analysis of the bone structures and of the teeth was heavily constrained by their state of preservation. There were missing teeth and fractures that had occurred after death. These fractures were observed in the alveolus and in the dental enamel. They presented a clear diagnosis of the presence of caries. The first left upper premolar and the first left upper molar show possible various lesions on the mesial surfaces.

An external healing inflammatory lesion in the lower jaw was observed in the region of the left incisors. Also observed was the loss, prior to death, of the two central incisors, the left lateral incisor, the first left premolar, and probably of three right molars. Most of the lower teeth had been lost following the death of the individual (Fig. 8).

In the upper jaw, the loss during the individual's life of the left central incisor and of the first and second left molars was also observed (Fig. 9).

Periodontal disease was observed in the form of horizontal alveolar reabsorption, with all teeth displaying a distance in excess of 1.5 mm measured from the buccal surface of the alveolus and the cementum-enamel junction.

Supragingival and subgingival calculus were observed on the first left molar, the first and second left premolars and the left canine, and on the first and second right molars and second right premolar. These varied between levels 2–3 (medium and severe) in the scale proposed by Brothwell (1981).

The wear of tooth enamel was not analyzed in the canines because of their postmortem fractures. The other teeth exhibited stages of wear from levels 1–7, based on the diagrams developed by Murphy (Hillson, 1996). On the left side, the first molar displayed wear corresponding to stage 7, the first premolar corresponded to stage 6, and the second premolar corresponded to stage 5. On the right-hand side, the second molar showed wear indicative of stage 3, the first molar indicated stage 7, and the two premolars corresponded to stage 5 (Fig. 9).
OSTEOBIOGRAPHY OF SKELETON DATED 11,060 BP

The first left molar shows an interdental groove (Fig.10) on the distal surface situated on the dental neck and measuring 4 mm in width, starting from the buccal surface, by 3.5 mm in height. The groove has a rounded shape and is slanted slightly in a buccal-lingual direction. In addition, the most heavily depressed region is in the center of the surface, forming a horizontal line situated at the point of contact between the cementum and the enamel. The surface has become smooth and brown in color, noticeably different in texture and coloring from the cementum and dental enamel. No ridges were observed on the surface of the groove, even when a binocular microscope was used to examine it. However, the orientation of the deepest line in the center of the surface suggests that the groove was made by the attritive action of an object inserted horizontally, starting from the buccal surface and in the direction of the distal surface. In the area immediately adjacent to the fissure, a cavity of irregular shape was observed, measuring approximately 3.5 mm in width by 1.5 mm in depth and displaying exposure of the cementum. This cavity may have been produced through procedures aimed at cleaning the teeth. Therefore, the hypothesis that there was wear in this region cannot be discounted. Such caries may have contributed to the removal of the surface during cleaning (Fig.10).

THE CULTURAL HORIZON OF SKELETON I

Pessis (1999) provided a cultural and environmental context for this study region, and our discussion below is derived from her synthesis. The date of this burial coincides with the transition to the Holocene period, when the climate of the region changed from humid tropical to semiarid. This transition was accompanied by a reduction in rainfall and a vegetational transformation, which resulted in the development of the semiarid scrubland ecological system that typifies the region today. Also, this transition is associated with the extinction of megafauna and of species associated with humid ecosystems.

The population that lived in the area of the Serra da Capivara National Park at that time is known as the Northeastern Tradition. These peoples maintained the same economic structure which is observed in the Pleistocene strata, based on gathering and hunting of small animals such as those found in the hearths of the site.

The methods of manufacture of lithic tools transformed slowly but markedly in this period. Although the population continued to use the same raw materials as in the Pleistocene, the number and diversity of tools increased. The manufacture of tools became more specialized and suitable for specific functions.

The use of clay artifacts, only sun-dried, that characterized the Pleistocene technology also became more complex. Sun-drying was replaced by burning technologies that gave rise to ceramics. In the site of Toca do Meio, in the park region, a sherd was found that dates to 8,960 ± 70 years BP (Beta 47493).

The settlement pattern of the area remained the same, with small-scale settlements situated close to sources of water in the open valleys. The use of rock shelters occurred continuously and accompanied the establishment of regularly visited camps.

An important cultural characteristic for the groups of the Northeastern Tradition was rock art. They developed a system of social communication through graphic records of a narrative character, formed of rock paintings. Dating of rock art is based on chemical analysis of calcite deposits over the painting and stratigraphic association of rock art panels with archaeological strata. The first paintings of the Northeastern Tradition have been dated to 12,000 years ago, and painting continued until 6,000 years ago. In the site of Toca do Meio, the base of a rock art panel coincided with an archaeological stratum that was dated by analysis of carbon from a hearth to 10,530 ± 100 years BP (Beta 32971) (Pessis, 1992). The themes of the paintings are hunting of small animals, sexual representations, ritual ceremonies, dances, series of animals, and mystical scenes.

BRAZILIAN HUMAN REMAINS CONTEMPORANEOUS WITH SKELETON I

Other skeletons have been found in semiarid region of Brazil that have similar dates. Because burials of this period tend to be associated with fire, in some cases radiocarbon dates have been derived from hearths associated with the skeletons. In other cases, dates have been derived for strata generally associated with skeletons. Below is a summary of
finds of Palaeoindian skeletons in Brazil, with comments on the security of their dates. The majority of the sites cited had multiple occupations containing human remains. However, we review only the burials from the oldest periods. In most cases, osteological analysis has not been done. A notable exception is the skeleton found at the site Toça da Janela da Barra do Antônio, a large rock shelter in ites and the topography is formed by mountains cut by the river Serido and its tributaries (Martín, 1986). This burial is securely dated.

Another child’s skeleton was found in the site of Toça da Janela da Barra do Antônio, a large rock shelter in limestone in the Parque Nacional Serra da Capivara. It has been dated to 9,670 ± 140 years BP (Cs10051). This radiocarbon date came from a hearth directly associated with the skeleton. The skeleton is almost complete and is in a good state of preservation, due to the fact that a large block of stone weighing 6,000 tons fell to one side of the skeleton. As a result, the block formed a microenvironment that protected the skeleton from rainwater. The individual was about 30 years old at death, and was flexed on its right side under 20 cm of sediment. The sex was estimated based on the pelvic morphology, and stature was estimated to be 154 ± 2.5 cm, based on Fally’s regression equations. The only pathology observed in this individual was a dental caries (Peyre, 1993). There was no mention of a defined grave or burial artifacts. The direct association of the hearth with this skeleton makes this a securely dated individual.

A series of 10 individuals was found at Lapa do Varal, in the municipality of Varzealândia, Minas Gerais State. They were dated between 10,100 ± 110 and 8,286 ± 70 years BP. The analysts did not state how the dates were associated with the skeletons. This area is characterized by an environmental transition from caatinga to scrubland, and offers various patterns of subsistence. The area is rocky and features limestone walls that have a great quantity of caves and rock shelters. The walls of the rock shelter Lapa do Varal are covered with paintings. Associated with the burials were hearths and lithic artifacts. Following the terminology presented by Reinhard and Fink (1982), two of the burials were primary cremations. (Machado and Sone, 1997). A series of 15 individuals was recovered at Gruta do Gentio II Site, in the municipality of Unani, Minas Gerais State. The skeletons were dated between 7,295 ± 150 BP and 10,190 ± 120 BP (S1 6387). This cave is located in a limestone wall; the ecology of this region is predominantly scrubland. Associated with the burials were many hearths, lithic artifacts, and dietary remains. The majority of individuals were cremated. (Bird et al., 1991). Carbon from the hearths associated with the skeletons was used for dating.

The skeleton of a child was found at Site Pedra do Alexandre, in the municipality of Caruaru dos Dantas, Rio Grande do Norte State. This secondary burial is dated to about 9,400 years ago by two radiocarbon analyses. One date comes from carbon associated with the stratigraphic level of the burial, 9,400 ± 90 BP (Cs10051), and the second comes from carbon from the burial itself, 9,400 ± 35 BP (Cs10057). The climate of the region is semiarid, and the topography is formed by mountains cut by the river Serido and its tributaries (Martín, 1986). This burial is securely dated.

A skeleton of an adult was found at the shelter of Santana do Rancho, in the municipality of Córrego, Minas Gerais State. This is a large rock shelter formed in the base of the hill, with more than 100 m in length and 8 m in average width, and is entirely covered with paintings. It is dated by stratigraphic association between 9,460 and 11,960 ± 250 BP (Gif 5089). Three periods of cemetery use were identified in this site. The date of 9,460 corresponds to a stratum above the burial. Below this level was a sterile layer, and below the sterile layer, the burial was found. Four centimeters below the burial was a hearth that was dated to 11,960 ± 250 BP (Gif 5089). The burial was isolated, and the bones were destroyed by the acid soil and by erosion due to water movement. However, it was possible to see some bones in the form of a yellow powder. This provided enough evidence to discern that the individual had been buried in a flexed position within a grave lined with blocks of stone (Prous, 1978/1980, 1992/1993, 1992). Because the skeleton cannot be dated directly, it is impossible to know exactly when it was buried. In the upper layer, dated between 9,460–8,100 BP, 16 skeletons of adults and children were found. Most of the burials were flexed, and the burial offerings were composed basically of lithic artifacts, such as alterite and flaking made of quartz and quartzite. Carbon from the hearths associated with the skeletons was used for dating.

An adult female skeleton, known in the popular press as "Luzia," the earliest known American, was found at Lapa Vermelha IV, in the Lagoa Santa region, Minas Gerais State. The vegetation of this region is predominantly scrubland, and the area contains caves and rock shelters. Lapa Vermelha is a cave with characteristics of a large subterranean cavern, whose lower chambers stay inundated with water during the rainy season. The cranium, mandible, some teeth, and a few very fragmented long bones were vertically and horizontally dispersed in a layer of Holocene sediments (Cunha and Guimarães, 1978). The cranium was in the low-
Osteobiography of Skeleton Dated 11,060 BP

Discussion

Our critique of putative ancient skeletons in Brazil, the majority of which have secure dates, shows indubitably the presence of Paleoindian groups in the northeastern and southeastern regions. These regions include the states of Rio Grande do Norte, Piauí, and Minas Gerais. The archaeological data associated with the burials indicate that Paleoindians in this area had well-developed mortuary rituals, with diverse mortuary practices including cremation, secondary burial, and stone-lined graves. These skeletons are associated with impressive cultural developments, of which complex rock art is the most noteworthy. The oldest rock art is associated with the time period of the Paleoindian skeletons, 12,000–10,000 years ago. In addition, the material culture associated with this time period included jewelry and specialized stone tools (Martin, 1996). The associated material culture, and the evidence of mortuary ritual, suggest that these groups had a complex social organization.

One could ask, “Why are ancient remains preserved in Brazil?” We noted the topographical formations and the vegetation for each site. The vegetation is typified by the caatinga bioma. This environment typifies the semiarid region of northeastern Brazil. Also called “sertão,” this semiarid region has dry periods of about 7 months, low annual precipitation (600 mm), and a broad thermal range (12–45°C) (Laming-Emperaire, 1983). The topography is typified by escarpments of limestone or arenite that contain many dry caves. As a point of reference for North Americans, this region is somewhat similar to the lower Pecos region of Texas, and to the Colorado Plateau of the Four Corners area. In this semiarid environment, biological remains preserve well if protected from seasonal runoff. It is because of this Brazilian semiarid environment that very ancient remains have been found.

Unfortunately, it is impossible to perform comparative cultural studies of the two Paleoindian skeletons found in Parque Nacional Serra da Capivara, which are the only skeletons available for osteobiographic study. This is due to the fact that artifacts and a prepared grave were found only with the skeleton from Toca dos Coqueiros. No artifacts were found with the skeleton from Toca da Janela da Barra do Antônio. In actuality, the skeleton from Toca da Janela da Barra do Antônio may not have been an intentional burial. There is some evidence that she was the victim of an accidental death associated with rock fall. Therefore, there are few points for cultural comparison between these burials, or for burials from other parts of Brazil.

Neither was it possible to do a comparative analysis of the osteological data because of the differing states of preservation between the two skeletons. The skeleton from Toca dos Coqueiros is in a poor state of preservation that limited the pathological...
analysis and prevented morphological analysis. The skeleton from Toca da Janela da Barra do Antonião was in a good state of preservation, but did not exhibit pathology (Pyrus, 1995). Furthermore, the cranium of this skeleton was missing, but not the mandible. Therefore, the analysis of this skeleton focused on metric analysis of postcranial morphology. The poor state of preservation of the Toca dos Coqueiros skeleton prohibited extensive postcranial measurements. Because we knew that both skeletons were female, it would have been interesting to compare the morphology of the supraorbital margin, since this region was anomalous with regard to sex identification. However, because the frontal region is absent in the Toca da Janela da Barra do Antonião skeleton, not even this comparison could be made.

The analysis of the Toca dos Coqueiros skeleton provides some insight into the lives of Paleoindians in the sertão. Colle’s fracture, well-diagnosed in clinical cases, has been frequently observed in archaeological specimens (Ortner and Putschar, 1985). These fractures commonly result from falls involving hyperextension of the hand (Adams, 1976), in which the individual reacts by extending the arm in order to minimize impact with the ground. In this specific case, this fracture may be associated with the region’s highly uneven relief, composed of ridges, canyons, and valleys.

The chronic lesions located at the vertebrae are indicative of points of tension in periarticular ligaments, caused by significant movements that stimulated osteophytes development (Hoyle and Endlow, 1966). This may have occurred as a functional adaptation, by which a larger area would be created for dispersal of loads upon the bone (Steele and Bramblett, 1988). This process, which apparently has an adverse effect on articulation and relates to age due to its cumulative effect, indicates areas of functional overload.

The existence of a single specimen and the absence of a more revealing archaeological context, however, preclude the establishment of associations among biomechanical models in environmental and cultural contexts. Consequently, it is not possible to infer the specific physical activities that caused the observed pathology.

The analysis of oral pathology provides evidence of subsistence patterns. With relation to the secure diagnosis of oral pathology, we call attention to the fact that all of the complete teeth exhibit moderate to severe dental wear. Various authors have related dental wear with subsistence strategies and the preparation of food (Danielson and Reinhard, 1998; Martin and Goodman, 1984; Martin et al., 1992; Molnar, 1972; Rodrigues, 1997). They suggest a higher prevalence of wear among populations whose subsistence is based mainly on foraging. This model appears suitable for the individual analyzed, considering the grave-goods accompanying the burial, which indicate the importance of hunting for her group. However, in dealing with only one individual, it is not possible to make inferences about populational standards or conclusively establish a correlation between the pathology observed and food supply or other practices.

Another notable observation is the interdental groove. This type of groove, interproximal and situated on the dental neck, has been observed in archaeological specimens in North America, and its presence has been frequently associated with carious lesions and alveolar reabsorption resulting from periodontal disease. This suggests that an object was inserted in an effort to alleviate discomfort caused by these pathologies (Olszewski, 1978).

In Brazilian prehistoric material, descriptions of similar cases are rare. The only examples are a specimen recovered at Sítio Corumbó, Rio de Janeiro State, with an occupation beginning at 4,200 BP till 3,000 BP (Machado, 1984), and another recovered at Toca dos Osos Humanos in the region of Central, Bahia State, dated at 1,530 ± 70 BP. In the latter case, the use of castra thorns was inferred, based on the pattern of the groove, its orientation, and location. These plants have characterized the vegetation (stunted sparse forest) of this part of Bahia for at least 3,000 years. The use of such thorns as tools for various purposes among indigenous groups and recent Brazilian populations is well-documented. Even today, they are used as needles (Mendonça de Souza et al., 1994).

In the case described here, confirmation of what material was used for picking teeth will only be made possible by analysis using a scanning electron microscope, since among prehistoric populations other objects were used as toothpicks besides thorns, such as wooden splinters and vegetable fibers. Bearing in mind the fact that for at least 10,000 years the region of the Serra da Capivara National Park has possessed vegetation similar to that observed in the study mentioned above, and considering the similarity between the fissures studied, the hypothesis that a thorn had been used as a toothpick is certainly plausible.

This skeleton exhibited no evidence of infectious disease. However, there is good evidence of human parasites in the region. Human hair with attached louse eggs was found in a stratigraphic layer below the burial at Toca dos Coqueiros, dating to 10,640 ± 50 years BP (uncalibrated date/10571). Coprofugotes that are 7,230 ± 80 years BP (Forreia et al., 1988) have been found in upper layers of Pedra Furada site in Parque Nacional Serra da Capivara. These coprofugotes are positive for hookworms, which are still one of the only intestinal worm parasites present in people of the sertão. Whipworms seem to have entered the area much later and have been found with hookworms in later coprofugotes from Minas Gerais dating to 3,490 ± 130 years BP (Forreia et al., 1980). Therefore, there appears to be a progressive increase in pathogen diversity through time.
in the region. This is similar to the pattern of parasitism documented for the area west of North America (Reinhardt, 1992). For this time, we can infer that Brazilian Paleoindians were infected with lice (Araujo et al., 2000).

Although restricted in the information obtainable from a single skeleton, some interesting data contribute to our understanding of the way of life of Paleoindians in northeastern Brazil.

One interesting aspect was the presence of two bifacial projectile points associated in a funerary context with the skeleton. According to Martin (1996), there are no bifacial projectile points in northeastern Brazil in an archaeological context. There are private collections from Rio Grande do Norte, of a diversity of bifacial points made of quartz, chalcedony, arente, and flint. However, none of these have an archaeological context. Thus this burial presents the first glimpse of the morphology of projectile points of Paleoindians of the Northeastern Tradition.

The analysis of skeleton I from Terra dos Coqueiros allows us to look back at least 11,060 years to the activity of specific cultural practices, such as the manufacture of bifacial projectile points and the use of tools for possible therapeutic purposes. Most importantly, it reveals elaborate burial practices involving stone-lined burials and mortuary rituals involving fire. This latter aspect of the study is consistent with other Paleoindian burials from Brazil. Perhaps in the use of mortuary fire and rock art are the first complex ceremonial aspects of Brazilian Paleoindians that define them as a distinct Paleoindian culture.

ACKNOWLEDGMENTS

Our thanks to Dr. Sheila Mendonça de Souza (ENSP/FIOCRUZ) for her invaluable critics and suggestions; to Claudine Rodrigues (Museu Nacional / UFRJ) for discussions on dental pathology; to Dr. Karl Reinhardt (University of Nebraska) for critical revision and preparation of the English-language version; to the technicians Eliete de Souza Silva and Maria Aparecida Pereira for their good will and camaraderie during the laboratory stages; to all the staff at FUMDHAM whose support was essential to the research; and to the Radiography Section of Hospital Evandro Chagas/FIOCRUZ.

LITERATURE CITED


