

Study of the Mexican female mummy stored in the National Museum of Nature and Science, Tokyo

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Abstract According to the 100th anniversary history book of the National Museum of Nature and Science, Tokyo, the Mexican female mummy stored in the museum was donated by the Mexican government through the Japanese Ministry of Foreign Affairs in 1923, but was lost in the Great Kanto Earthquake that occurred shortly after it was shipped to Japan and was rediscovered in 1926. However, no other information is available in the museum's records. The purpose of this study was to investigate this information with other sources and obtain more information regarding the attribution of the mummy by performing carbon-14 dating and taking CT images of the mummy. A search of Ministry of Foreign Affairs records revealed that the mummy was intended to be given to the Imperial Museum by Mexico and was transported by a Japanese businessman, but the Great Kanto Earthquake and his death put an end to the donation. It was subsequently acquired by the staff of the Tokyo Museum. The appearance of the mummy also suggests that it was a natural mummy and was most likely given a Christian burial. This is consistent with the results of the radiocarbon dating between the mid-16th and mid-17th centuries. CT imaging revealed that the face and shoulders had been repaired with dense material, the internal organs were relatively intact, and calcification in the coronary arteries and uterus was evident.

Key Words: Mexican mummy, radiocarbon dating, Ct imaging, great Kanto earthquake

Introduction

In the field of physical anthropology, human remains other than skeletons are important scientific specimens of academic value. The National Museum of Nature and Science, Tokyo, presently preserves 13 mummies (Sakaue 2022). According to the 100th anniversary history book of the National Museum of Nature and Science, Tokyo, one of these, the Mexican female mummy, was donated by the Mexican government to the National Science Museum (then the Tokyo Museum) in 1923 (National Museum of Nature and Science, Tokyo ed., 1977).

This history book includes the following statement at page 264.

“The story of how the mummy came to be housed in our museum is one of the illustrations of the social turmoil at the time of the great Kanto earthquake disaster in Japan. In 1923, the mummy was donated by the Mexican government through the Japanese Ministry of Foreign Affairs and shipped from Mexico to Yokohama. The cargo ship arrived safely at the port of Yokohama and unloaded the mummy, but it appears that the Great Kanto Earthquake disaster shortly occurred thereafter. As a result, the specimen was lost in the confusion after the earthquake. In the fall of 1926, an inquiry from the Mexican government caused a great commotion, and a follow-up investigation quickly revealed that a man had acquired the specimen in Yokohama and had been touring all over the country with it as a

showpiece. After being passed around several times by entertainers, the specimen was finally found at a temple in Saitama Prefecture, where it had been deposited in the hope that it would be used to pray for the repose of mummy's soul. The mummy was then finally brought to our museum."

However, no other information or records regarding the exchange of specimens can be found within the museum, and primary information about the mummy, such as its period and place of origin, is unknown. The 100th anniversary history book also raises several questions: How could the mummy that went missing in Yokohama be found in a temple in Saitama, how could museum staff have tracked this information, and why did the mummy that had been left for several years in Japan, an inappropriate place for preserving mummies due to seasonal temperature differences, high humidity, and a large number of organisms such as dermestid beetles and rats, remain nearly fully intact?

Therefore, this study aimed to investigate the information on this mummy, confirm the information in the 100th anniversary history, and investigate how it came to be housed in the museum. We also sought information regarding the attribution of the mummy by performing carbon-14 dating and CT scans.

Material and Methods

Unfortunately, no record of this "Mexican female mummy" can be found in the specimen ledgers and property records kept at the National Museum of Nature and Science, Tokyo. It is possible that this mummy was not officially registered as a specimen, given the fact that the

National Museum of Nature and Science was destroyed by fire in the Great Kanto Earthquake of 1923 and all previous records were lost, and there was no researcher in charge of this mummy in the museum when it was acquired in 1926 (Nakayama, 1962), although it was on display the year after its acquisition. However, it is possible that the description of how the mummy came to be acquired can be found in an essay by Michio Nakayama (1962) titled "Various Works at the Museum."

Furthermore, as the 100th anniversary history book of the museum states that it was acquired "through the Japanese Ministry of Foreign Affairs," there was a possibility that the respective diplomatic records of the Ministry of Foreign Affairs still exist. Therefore, we investigated some records of the mummy in the Diplomatic Archives of the Ministry of Foreign Affairs of Japan and found the following documents: "Official Correspondence about the case of mummy donated to the Imperial Museum by the Mexican Museum No. 31" in "Miscellaneous records of gifts of money and goods, Vol. 2" (Class number 6.3.2.16) and "Official Correspondence about the case of mummy donated by the Mexican Museum No. 5" in "Miscellaneous records about museum, Vol. 2" (Class number 3.10.3.13).

The mummy is shown in Figure 1. The maximum projected length from the top of the head to the heel is 1460 mm; the maximum projected shoulder width is 331 mm; the maximum projected sagittal diameter of the thorax is 191 mm; and the maximum projected sagittal diameter including the left hand is 247 mm. The presence of breasts and the external female genital organs indicates that the mummy was female. Although



Fig. 1. The appearance of "Mexican female mummy" stored in the National Museum of Nature and Science, Tokyo.

she is not clothed, she appears to have been clothed previously because the skin of her abdomen is narrower than the rest of her body, giving the impression that it has been squeezed. The color of her skin surface is brownish brown, and dark brown areas are observed on the face, parts of the chest, and the left shoulder. The hair on the head is light brown, with only a few hairs remaining on the back of her head. Her skin on the anterior surface shows little sagging; however, there are many wrinkles on the dorsal surface, with a flat area on her buttocks. Her right arm and legs are extended. These facts suggest that she was buried in a supine-extended position. This posture differs from the flexed postures of mummies found in the Aztec and Andean civilizations of the New World.

For radiocarbon dating, a portion of the scalp was excised and measured. Pretreatment and analysis were performed by the Institute of Accelerator Analysis, Ltd. First, acid treatment was used to chemically remove impurities. The samples were then diluted with ultrapure water until neutral and dried. The treatment was performed using 0.2 mol/L (0.2 M) hydrochloric acid (HCl). Next, the sample was burned to produce carbon dioxide (CO₂) and purified in a vacuum line. In the third step, the purified carbon dioxide was reduced with hydrogen using iron as a catalyst to produce graphite (C). Finally, the graphite was packed into a cathode with an inner diameter of 1 mm using a hand-pressing machine, which was then fitted into a wheel and mounted on a measuring device. An accelerator-based ¹⁴C-AMS dedicated instrument (NEC) was used to measure the ¹⁴C counts, ¹³C concentration (¹³C/¹²C), and ¹⁴C concentration (¹⁴C/¹²C). Oxalic acid (HOx II) provided by the US National Institute of Standards and Technology (NIST) was used as a standard sample. The ¹⁴C content was corrected by $\delta^{13}\text{C}$ measured by AMS. The conventional ¹⁴C age (BP) was calibrated to the calendar year (calBP) using the calibration program OxCal 4.3 with the IntCal 13 dataset (Bronk Ramsey, 2009; Reimer *et al.*, 2013).

Computed tomography (CT) imaging was per-

formed using a TOSHIBA Aquilion/LB helical scanner at the National Institute of Radiological Sciences. The images were acquired at 200 mAs and 120 kVp and axial images were obtained at 1 mm intervals. The 3D images were rendered using the AZE Virtual-Place (AZE Corporation, Tokyo, Japan) and RadiAnt DICOM Viewer (Medixant, Poznan, Poland) software.

Result and Discussion

The history of the Mexican female mummy after arriving in Japan

Nakayama's description (1962) in the essay is almost the same as that in the 100th anniversary history book.

"There was an incident about this mummy before it arrived at the museum. This mummy was originally intended to be donated by Mexico to our museum via the Ministry of Foreign Affairs. One day in 1923, a cargo ship from Mexico to Japan arrived in Yokohama, unloaded the goods including this mummy, and left them there after the Great Kanto Earthquake, or it may have left the cargo behind and sailed away amid the earthquake. The mummy entered the hands of some people and was not heard of for three years, until the autumn of 1926 when an inquiry from Mexico caused a stir. According to investigations, a man obtained it in Yokohama in the confusion after the earthquake and thought it would be a perfect spectacle, so he went around the country. It is said that because of this outrageous behavior, even though the show was a success, he and his family were beset with misfortune, and after being passed from one showman to another several times, this mummy was finally delivered to a temple in the countryside of Saitama Prefecture for the sake of praying for the repose of mummy's soul. The chief accountant of our museum went to the temple to negotiate, but there was no way to reveal its previous history, and at the temple the conversation was complicated for a while, as if there had been a sale for someone in the meantime. Finally, negotiations were successful, and the mummy was

safely delivered to our museum."

Given this overlap, the description of the 100th anniversary history book must be based on this essay. In addition, the fact that there was no further information in the 100th anniversary history book suggests that no further information was available in 1977.

Based on the descriptions in the diplomatic records of the Ministry of Foreign Affairs and the 100th anniversary history book, the following background can be considered regarding how this mummy came to be kept at the National Science Museum:

- (1) In 1923, through the efforts of Toshikazu Hase, an employee of the Matsuura Company in Yokohama City and a business expatriate in Mexico, mummies were donated to the Imperial Museum (now the Tokyo National Museum) by the Mexican Museum under the condition that the compensatory specimens were sent to the Mexican Museum. Transport and donation procedures were undertaken by Hase, and the ship set sail on August 10, 1923.
- (2) On September 1, 1923, around the time the ship arrived in Yokohama, the Great Kanto Earthquake occurred. Afterwards, Hase kept the mummies (probably in Aichi Prefecture, where his home and parents lived).
- (3) In February 1924, Hase requested that the Imperial Museum pay for the transportation and purchase of compensatory specimens for the donation of the mummy, but the museum refused.
- (4) Between 1923 and 1924, Hase took the mummies to various places for public viewing in order to obtain money.
- (5) In April 1924, the Ambassador of Japan in Mexico wrote to the Minister of Foreign Affairs of Japan, "The Director of the Mexican Museum is distrustful of the fact that he has not received any compensatory specimens. I hope you will take care to ascertain the present situation and secure the donation and compensations."
- (6) In June 1924, in response to an inquiry from

the Foreign Ministry of Japan, Hase stated that he was in the process of donating the mummy and securing compensatory specimens.

- (7) In September 1924, Toshikazu Hase died. The mummies were to be kept by Hase's older brother, who lived in Aichi Prefecture.
- (8) In February 1925, the Ambassador of Japan in Mexico wrote again to the Minister of Foreign Affairs of Japan, "There is a risk that Mexico's confidence in Japan will fall because the circumstances of the donation of the mummy and the return of the price are still unknown. I hope that this will be taken into consideration as soon as possible."
- (9) In 1925, the specimens of the Tensanbu (Department of Natural History) of the Imperial Museum were transferred to the Tokyo Museum (now the National Science Museum of Nature and Science, Tokyo). Therefore, it is possible that the donation destination of this mummy was also changed to the Tokyo Museum.
- (10) In May 1925, the Minister of Foreign Affairs of Japan wrote to the ambassador of Japan in Mexico that "We were aware of the current situation. We approached the Ministry of Home Affairs, and two representatives from Aichi Prefecture were sent to the home of Hase's brother, where the mummy is kept, in order to ask him to donate the mummy." This was the last piece of information on the mummy in the diplomatic records of the Ministry of Foreign Affairs.
- (11) The 100th anniversary history book states that an inquiry was made by the Mexican Government in the autumn of 1926, but this has not survived in the diplomatic records. It is assumed that the Japanese government (the Ministry of Foreign Affairs or Ministry of Home Affairs) confirmed the status of the mummy to the Tokyo Museum.
- (12) In 1926 or 1927, an investigation by the Tokyo Museum revealed that the mummy was housed in a temple in Saitama Prefecture. Presumably, this tracing was made pos-

sible by the information obtained from a government official about Hase's brother. Also, since only one year had passed since May 1925, when the storage of the mummy by Hase's brother was confirmed, it is possible that the mummy was not "*passed from one showman to another several times*," but was delivered to a temple in Saitama Prefecture by Hase's brother.

- (13) In 1927, the mummy was finally delivered to the Tokyo Museum.

There are some matters that remain unclear, such as whether the compensatory specimens were delivered to the Mexican Museum and why they were moved to a temple in Saitama Prefecture instead of a temple in Aichi Prefecture. Additionally, the origin of the mummy remains unknown.

Radiocarbon dating

The calibrated ages of this mummy assigned were 1523–1573 calAD (52.6%), 1630–1644 calAD (15.6%), as presented in Table 1. These results indicate that this mummy lived between the mid-16th and mid-17th centuries. This period corresponds to the colonial era of Mexico, just after the beginning of Spanish rule.

Aufderheide (2002), in his magisterial work on mummy research, provides the following sites of mummies in Mexico: the cemetery of Guanajuato in the State of Guanajuato (111 mummies of the 19th–20th centuries were excavated), the cave of Chihuahua in the state of Chihuahua (2 mummies of the 7th–10th centuries), the church of San Mateo in the state of Yucatan (4 mummies of the 16th–18th centuries), the cave of Durango

in the state of Durango (a mummy of the 7th–13th centuries from the Chalchihuites culture), the church of San Juan of Tlayapacan in state of Morelos (3 mummies of the 19th century), the cave of the mountains of Sierra Madre Occidental (2 mummies from the pre-Hispanic era), and the cave of the mountains of Sierra Tarahumara (3 mummies from the pre-Hispanic era).

Ruis-Gonzalez and Serrano-Sánchez (2020) indicate 26 locations in Mexico where human and animal mummies have been found, and categorized human mummies as "pre-Hispanic," "Colonial," or "Modern." It is to be noted that there are eight locations with mummies from the same colonial period as this Mexican female mummy. It has also been pointed out that most of the pre-Hispanic mummies were found in caves with crouched burials, while the "Colonial" and "Modern" mummies were found in churches with extended burials. In this respect, the present Mexican female mummy is consistent with the radiocarbon dating of colonial Mexican mummies and is a valuable example from this era in Mexico.

CT imaging analysis

CT scan images revealed that the dark brown areas on the mummy's face, chest, shoulder, and fingers were not soft tissue but substances with a density close to that of bone, which are spread areally over the face and left shoulder area, with some localized spots on the anterior wall of the thorax and left hand (Figure 2). There is no dense area on the dorsal surface of this mummy except for the left shoulder, which was covered laterally and dorsally. These are presumed to be traces of

Table 1. Result of radiocarbon dating for Mexican female mummy

	$\delta^{13}\text{C}$ (‰) (AMS)	^{14}C age with $\delta^{13}\text{C}$ correction (yrBP $\pm 1\sigma$)	Calibrated age 1σ (calAD)	Calibrated age 2σ (calAD)
Mexican female mummy (IAAA-182896)	-13.90 ± 0.44	303 ± 21	1523 calAD–1573 calAD (52.6%)	1499 calAD–1503 calAD (0.7%)
			1630 calAD–1644 calAD (15.6%)	1513 calAD–1600 calAD (70.0%)
				1616 calAD–1649 calAD (24.7%)



Fig. 2. Upper body part of the mummy (left image), and 3D image of dense material constructed from CT images (right image).

In the right image, some material areas showing density similar to that of bone are seen in the left and right orbits, nasal area, cheek-to-mouth area, left neck, anterior right shoulder, lateral to posterior left shoulder, anterior wall of the left thorax, dorsal left wrist, dorsal left hand, dorsal left third to fifth fingers, and other areas. Corresponding dark brown areas can be observed on the mummy surface in the left image.

mummy restoration with a colored homogeneous material (probably plaster). The possibility that these were restored in Mexico cannot be ruled out. However, considering that, as mentioned above, the natural environment in Japan is not suitable for the preservation of mummies that these restoration areas are concentrated on the front part of the mummy, especially the face, where it might affect its appearance, and that there are no scientific reports of such restoration on Mexican mummies, it is more likely that the mummy was restored by the staff of the Tokyo Museum. The parietal bone was pitted with a circular hole approximately 4mm in diameter, but most of the cerebral dura mater remained in situ, and material that appears to be brain parenchyma

also remained at the base of the cranium. In addition, the parietal hole shows a fresh color in cross-section. Therefore, it is presumed that this opening occurred after mummification. It is not known whether this was done in Mexico or Japan.

The facial area of the mummy is covered with dense material; however, in lateral view, her mandible shows a lack of teeth and recession of the alveolar bone (Figure 3). This suggests that the age at death of this mummy was middle-aged to old. The total length of the mummy is 1460mm, but the height estimated from Pearson's female height estimation formula (1898, $72.885 + 1.945 F$) using the maximum length of the left femur of 386mm (right side) measured

from the CT image was 1479mm. This height falls within the category of the average height of ancient Mexican women (1450–1550mm, McCaa 2000). As the facial area is covered by the dense material, it is difficult to infer the

attributed group from facial morphology. The uncovered nasal root area is relatively flat, as seen in Figure 3. The brain, heart, lungs, intestines, and other organs remain inside this mummy, but are generally degenerated. It can be

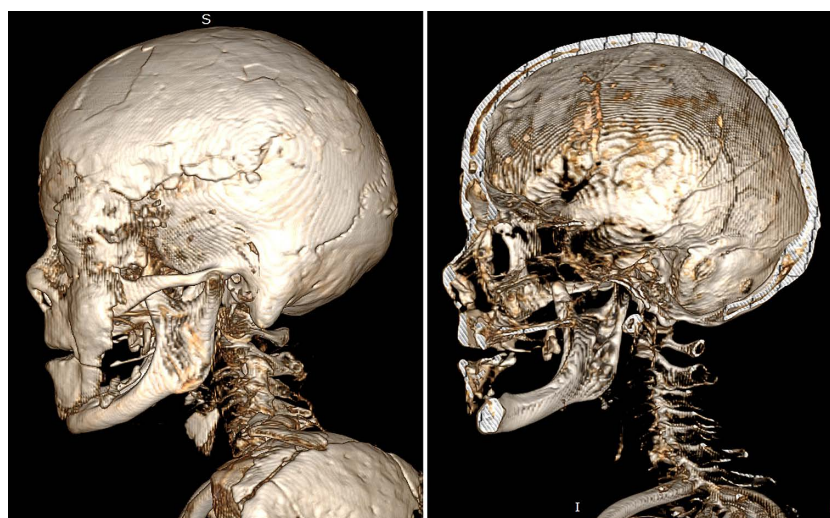


Fig. 3. 3D image of the face constructed from CT images (left image) and a sagittal section of the face (right image).

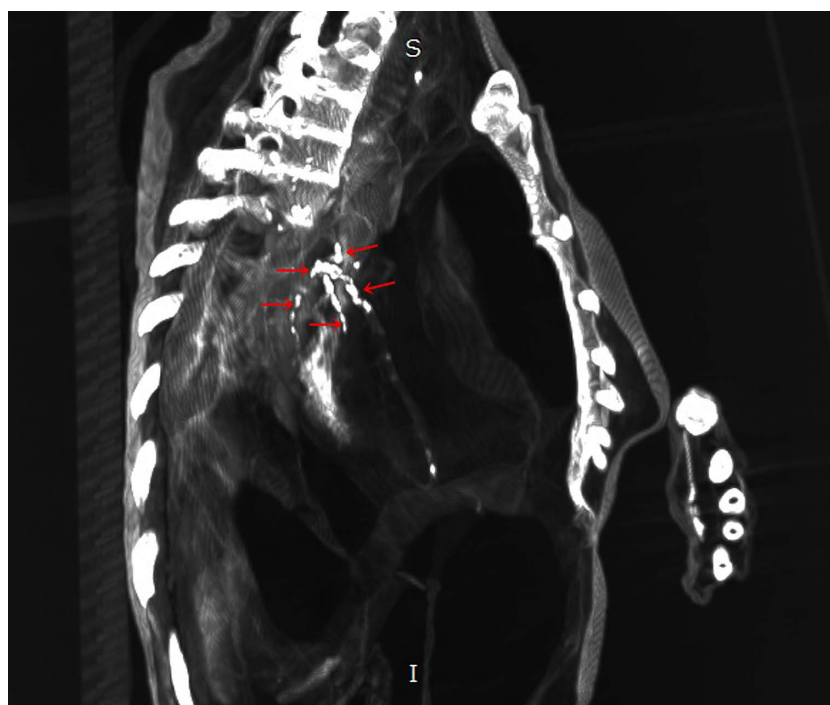


Fig. 4. Calcifications of the coronary arteries.

Red arrows indicate the calcification points of the coronary arteries.

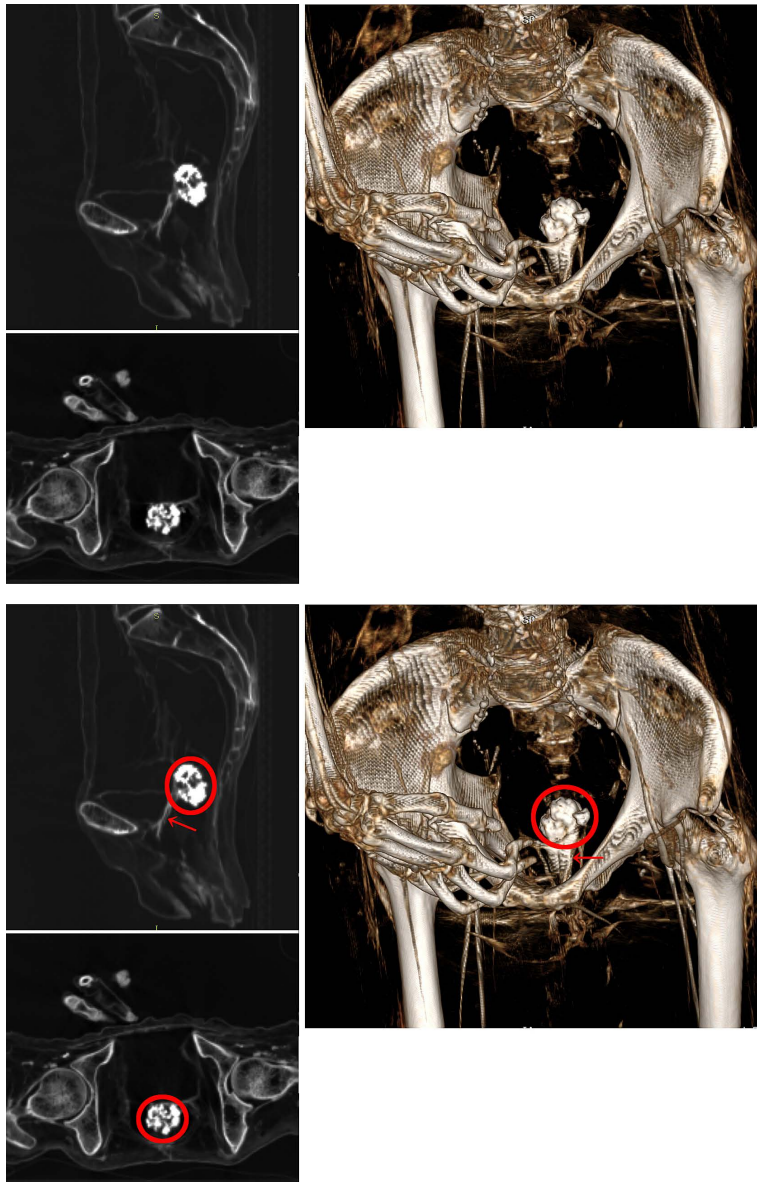


Fig. 5. Popcorn calcification and a relatively high intensity thin structure inside the pelvis.

The upper-left and lower-left images show the sagittal and horizontal sections of the pelvis, respectively. The image on the right is a 3D image of her pelvis. Red circles indicate the popcorn calcification, and red arrows does relatively high intensity structure regarded as uterus.

said that the brain and abdominal viscera were not artificially removed.

The pathological features of this mummy include calcification of the coronary arteries (Figure 4) and popcorn calcification and a relatively high intensity thin structure in contact with this calcification (Figure 5) in the pelvic cavity, which

can be judged to be calcified uterine leiomyoma and uterus (Tantipalakorn *et al.*, 2023). An object was also observed in the bronchi, located below the vocal cords, suggesting that it was caused by aspiration before or around death (Figure 6).

In the future, we plan to add more information on this mummy through dating and dietary anal-

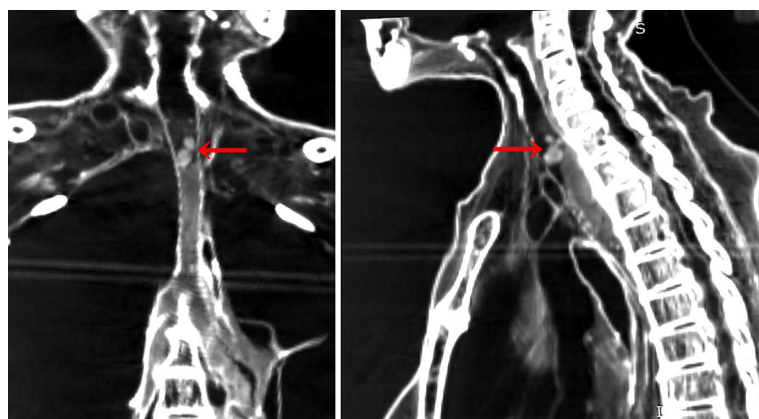


Fig. 6. Object inside the bronchi.

The left and right images show the coronal and sagittal sections of the trunk, respectively. Red arrows indicate the object inside the bronchi.

ysis of the bone and DNA. We will also explore the status of the excavations and discoveries in Mexico.

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