CT scan and 3D reconstruction of the pre-dynastic child mummy 527 B* (Museum of Anthropology and Ethnography of Turin)

Raffaella Bianucci[1], Rosa Boano[1], Gino Carnazza[2], Rudy Lallo[2], Grazia Mattutino[3], Carlo Torre[3] and Emma Rabino Massa[1]

[1] Department of Animal and Human Biology, University of Turin.
[2] Fondazione Pinna Pintor & Studio Futura, Via Amerigo Vespucci, 61, 10128 Turin - Italy.
[3] University of Turin - Department of Anatomy, Pharmacology and Legal Medicine, Laboratory of Forensic Sciences, C.so Galileo Galilei, 22, 10126 Turin - Italy

Abstract

Mummy 527 B* belongs to the "Giovanni Marro" Egyptian Collection of the Museum of Anthropology and Ethnography of the University of Turin. This mummy of a one-year-old pre-dynastic child was found in Gebelein in 1935 in a small necropolis discovered during excavations of the "Missione Archeologica Italiana" led by G. Farina, the new Director of the Egyptian Museum of Turin, with the participation of Prof. G. Marro as anthropologist. A whole body spiral CT scan with thin slices (1,00 mm thickness, 0,5 mm reconstruction interval) was followed by multiplanar and 3D reconstruction. The aim was to evaluate the child's age at death and the presence of lethal pathologies. This study confirms the fundamental role of non-invasive techniques in the study of such rare pre-dynastic specimens.

Introduction

The child mummy 527 B*, dating to 3200 BC, was found in a small pre-dynastic necropolis in Gebelein (Upper Egypt) in 1935. The necropolis was discovered during excavations carried out by the "Missione Archeologica Italiana" led by Prof. Giulio Farina, Director of the Egyptian Museum of Turin, with the participation of Prof. Giovanni Marro as anthropologist (Marro, 1936).
The child mummy belongs to the "Giovanni Marro" Egyptian Collection of the Museum of Anthropology and Ethnography of the University of Turin. It is partially wrapped in a bundle of linen bandages and a calcareous crust is observable at the abdominal level.

Material and Methods

A whole body spiral CT scan performed with a multidetector spiral CT (Philips Aura, Netherlands) yielded 289 1,0-mm thick slices with a reconstruction interval of 0,5 mm. The images were transferred to a Vitrea 2 workstation (Version 3.3.1, Vital Images, USA) for post-processing and 3D reconstruction.
Six reconstructions were divided into three anterior-posterior and three posterior-anterior. It was possible to enhance the various depth levels of the mummy using the tissue-air interface and soft tissue-hard tissue algorithms without unwrapping and damaging it.
A small formation found in the linen bandages was observed with a stereomicroscope and analysed with a LEO 1430 VP scanning electron microscope (LEO Electron Microscopy Ltd, Cambridge, UK) with a Link ISIS 300 dispersive X-ray analyser (EDX) equipped with the Cameo™ program for X-ray colour imaging (Oxford Instruments, High Wycombe, UK) directly in variable pressure (Torre and Mattutino, 2000).

Results

The 3D reconstructions showed that the child was laid in a prone position with the legs bent on each side of the body and the arms folded on the chest. The length of the femoral diaphysis is 111 mm and, according to the Ubelaker tables, the child was nearly one year old when he died (Pacciani and Chiarelli, 1993). There is no evidence of lethal congenital malformations or fractures prior to death.
Two pyriform formations of 12,9 x 10,2 mm (upper right) and 5 x 4 mm (lower left) were found level with the left thigh (Fig. 1). The upper formation was taken out of the linen bandages and observed by stereomicroscope and scanning electron microscope followed by microanalysis; the lower formation was not recovered to avoid damaging the specimen.
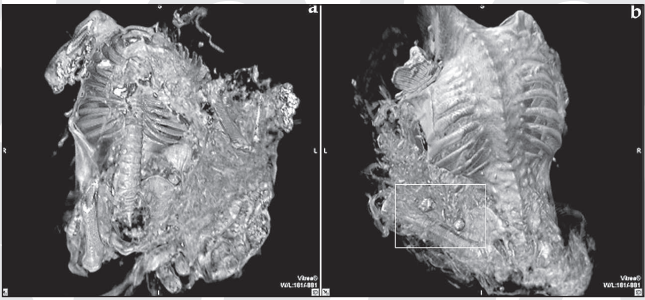
Fig. 1 - 3D reconstruction results. a: frontal image; b: dorsal image. The two pyriform formations are indicated by a square.

Stereomicroscopic observation showed that the upper formation, whose morphology is similar to a small bag, is completely covered by concretions. A piece of rope, made out of plant fibre (probably linen), was also observed; this piece of rope forms a small knot at 1/3 the length of the formation from its apex (Fig. 2a). Moreover, on the formation's right side, 1/4 the length from its bottom, a crevice is observable; through the crevice, a dark green area appears on the surface (Fig. 2b).
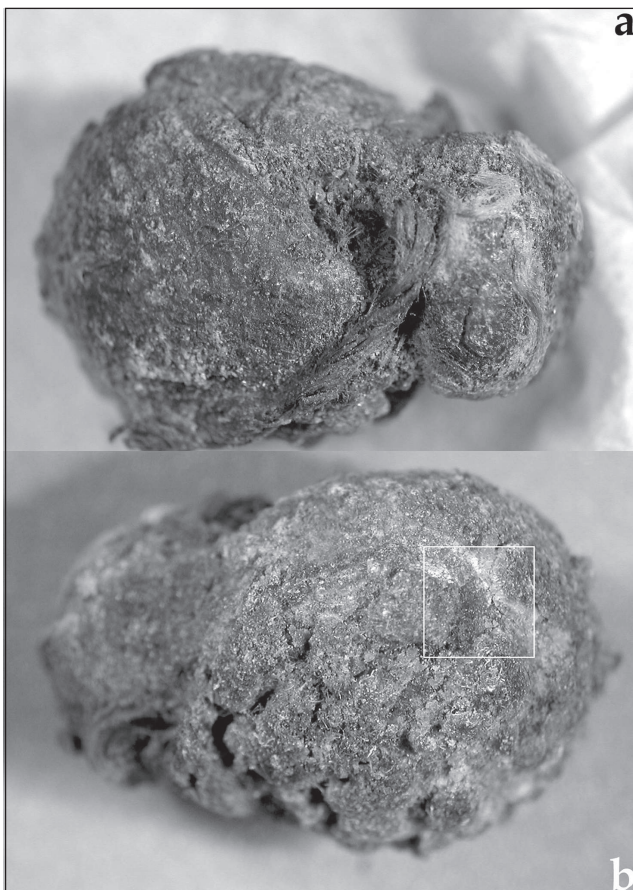

Fig. 2 - Stereomicroscopy shows that the upper formation is completely covered by concretions. a: a knotted piece of rope; b: the crevice from which a dark green area appears (square).
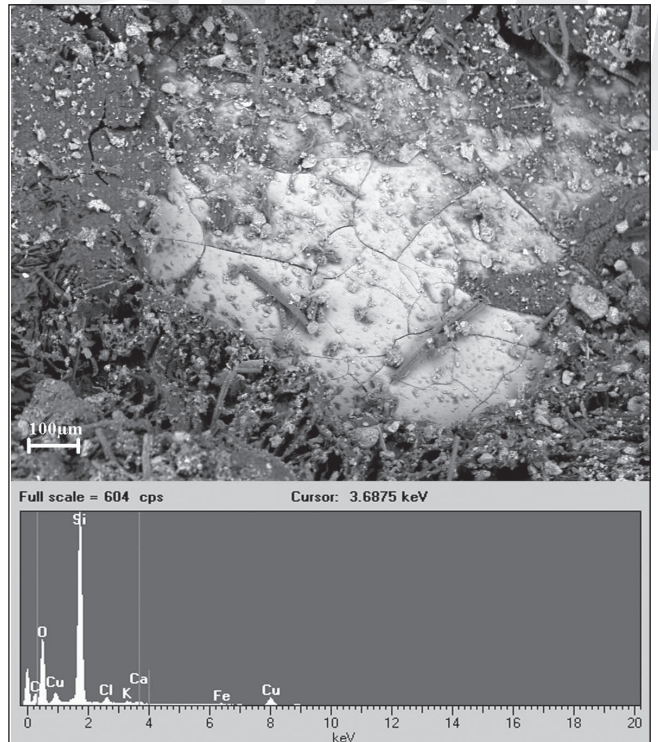

Fig. 3 - Scanning electron microscope image of the dark green area and its microanalytical spectrum.

Under the scanning electron microscope, this area appears as an amorphous material whose surface is traversed by fissures. The microanalysis spectrum shows that it is composed of silicon, oxygen and copper with traces of iron (Fig. 3).
This evidence indicates that the material kept inside the upper formation is a silicate, specifically a copper silicate. Further analyses are required to ascertain what kind of copper silicate was used and to understand its significance as funerary equipment.

Literature Cited

Marro G. 1936. "Sull'Antropologia e sull'Etnografia dell'Egitto Predinastico". Discorso pronunciato in occasione della XXIV Riunione della S. I. P. S, Palermo, 12-18 Ottobre 1935, XIII ed estratto dagli "ATTI" della Società (vol. 4). Pavia, Premiata Tipografia Successori Fratelli Fusi, p. 4-10.

Torre C, Mattutino G. 2000. Application of true color X-ray vision for electron microscopy in fired bullets and gunshot residue investigation. Journal of Forensic Sciences 45 (4): 865-871.

Pacciani E, Chiarelli B. 1993. La determinazione del sesso e dell'età di morte. Analisi paleodemografica. In: Borgognini Tarli S., Pacciani E. I resti umani nello scavo archeologico - Metodiche di recupero e studio. Roma, Bulzoni Editore, p. 82-83.