

Further evidence to confirm the ‘pregnant mummy’: A reply to Saleem (2021)

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ABSTRACT

Prof. Sahar N. Saleem (2021) in a discussion with Ejsmond et al., “Pregnant Mummy” (2021), provides several points undermining the interpretation of the feature within the pelvic cavity of the 1st century BCE mummy as a fetus. The discussion and feedback present an opportunity to provide more evidence of the discovery made by the Warsaw Mummy Project. The current paper extends clarifications and provides further evidence proving that there is a fetus inside the pelvic cavity of the mummy.

We read with interest the reply by Prof. Sahar N. Saleem (2021) to the paper presenting the discovery of the first known case of an ancient Egyptian pregnant mummy (Ejsmond et al., 2021). The research team would like to thank her for her interest and numerous comments that allowed us to elaborate on the case.

Prof. Saleem writes: “The first pregnant mummy was in fact reported in 2004. Using a CT study, a fetus was found inside a naturally mummified mummy in Paju, Gyeonggi-Korea. The woman died giving birth in year 1665 A.D. (Jeong et al., 2004).” In fact, she had died ca. 1566 (Chang et al., 2008). Her autopsy was made and there is no information that the fetus was detected thanks to CT (Jeong et al., 2004; Chang et al., 2008). It is hard to talk about the CT of the body since no radiological images of the deceased were published. Furthermore, this was a natural mummy (Jeong et al., 2004). The discovery is reported as being of a woman in the second of the four stages of birth, when the head of the baby is visible from outside. It can be debated whether a woman in the middle of birth can be considered pregnant. For the clarity of our report, focusing on intentionally made ancient mummies, we did not mention this case.

With regard to the references to what Prof. Saleem calls “mummified fetuses daughters of King Tutankhamun,” (in fact, it is uncertain whether or not they are still-born or newborn and, since they were born, they cannot be called fetuses – the latter refers to unborn offspring), they do not bring to much new to the discussion, since they were mummified after birth. In the case of Tutankhamun’s and other mummified children, the entire process of preserving the remains through intentional mummification, i.e. tissue dehydration and mineralization, was carried out in the same way as in the mummies of children and adults. The conservation status of these mummies and their CT images are therefore no different from other Egyptian mummies.

In the case of the fetus that was left untouched inside the uterus of the so called Mysterious Lady (National Museum in Warsaw 236805/3), the mummification process can be divided into two phases: (1.) taphonomic processes - affecting the bones’ mineral content; (2.) drying up of the soft tissues during the mummification process of the mother’s body. In the case of the mummy in question, the hermetic-like, post-mortem uterus was of significant importance. Blood pH in corpses falls significantly, concentrations of ammonia and formic acid increase with time

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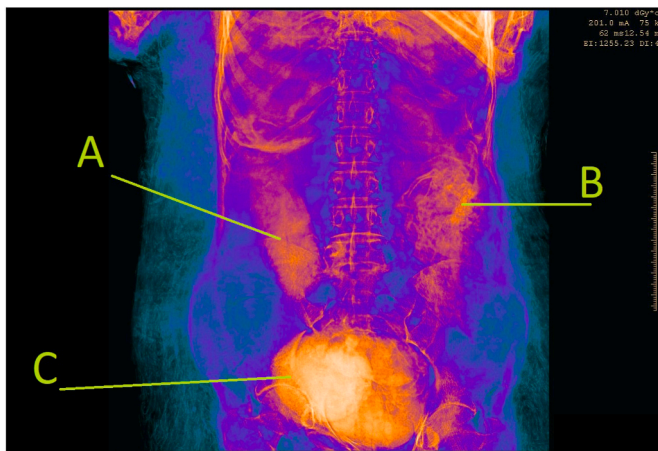


Fig. 1. X-ray of the abdominal part of the mummy 236805/3 at the National Museum in Warsaw, the so called Mysterious Lady (A and B - mummified organs returned to the body cavity, C - fetus) (image by M. Jaworski, M. Ożarek-Szilke, and General Electric/Warsaw Mummy Project using Media Viewer GE Healthcare, X-ray protocol: 7010 dGy*cm²; 201.0 mA; 75 kVp; 62 ms12 mAs).

(Donaldson and Lamont, 2013). Thus, the acidified environment in the uterus after death most probably affected the bones' mineral content. The process of fetal mummification in this case was unique. As we wrote: "This mummy opens a new possibility for studying (...) the taphonomic processes of fetuses as well as uteruses." The process of fetal mummification that took place in our case was complex and, up to that point, unknown. One can only speculate, that, as in the case of "boneless" bog mummies, the bones had partly dissolved, i.e. lost some of their mineral content, due to the acidic environment (Villa and Lynnerup, 2012), and thus cannot be clearly detected in CT and X-ray images, for example, as in the case of the bog mummy known as the Clonycavan Man (Villa and Lynnerup, 2012). We are currently preparing an article in which this process will be described in detail.

Prof. Saleem (2021) writes that the fetus of the Mysterious Lady was detected by CT study. As it was described in the paper, the combination of both X-rays and CT allowed the discovery to be made. The X-ray presented in Fig. 8D in Ejsmond et al. (2021) (see Fig. 1 in the current paper) shows a dense object in the pelvic cavity (C in Fig. 1) and four objects above it in the abdomen (two under ribs, poorly visible and two below, well visible: A and B in Fig. 1). The latter objects are mummified viscera, which were returned to the body. They have oblong shapes and at least four can be distinguished. The feature interpreted as the mummified fetus has a distinguishably different form (both in shape and cross-section) and much greater density than mummified viscera. Thus, it is something unlike internal organs. Moreover, it has a completely nonidentical structure and presents itself in a clearly contrasting image than mummified viscera.

Prof. Saleem suggests that this may be a cancer or a litopedion (a so-called 'stone child,' i.e. a calcified fetus). A fetus cannot be confused with a uterine tumor because uterine tumors do not grow inside the uterus. Moreover, a tumor does not form a separate structure, as it grows as a part of the endometrial tissue. The uterus of the mummy in question has a homogeneous, unchanged structure, and it surrounds the fetus (a separate feature), which, in the case in question has a distinguishable head, hands, crossed legs, and feet (Fig. 4). A tumor most likely would be taken out, along with uterus and other viscera in the course of the embalming procedures. As for the lithopedions, it is not the case. These are very rare pathologies that only occurs in 1.5–1.8% of extrauterine pregnancies and in 0.00045% of all pregnancies and usually concern older women (Moshiri et al., 1996; Sossa et al., 2019). As expected in this kind of anomaly, the shape of the fetus and individual limbs would be clearly visible due to their density. This type of pathology usually is related to an ectopic pregnancy (see: Sossa et al., 2019). If, in the case of

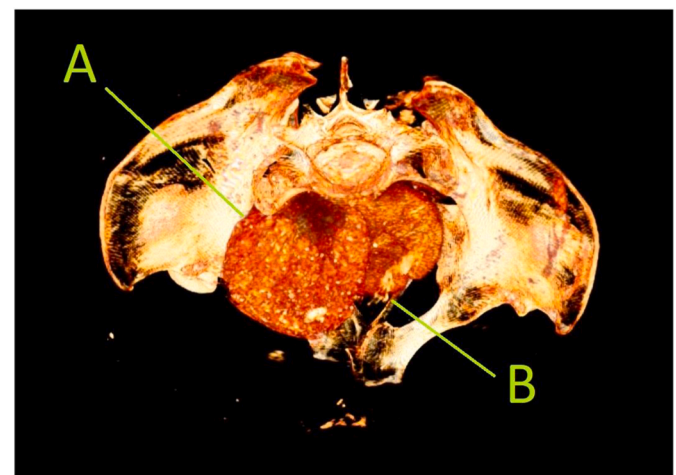
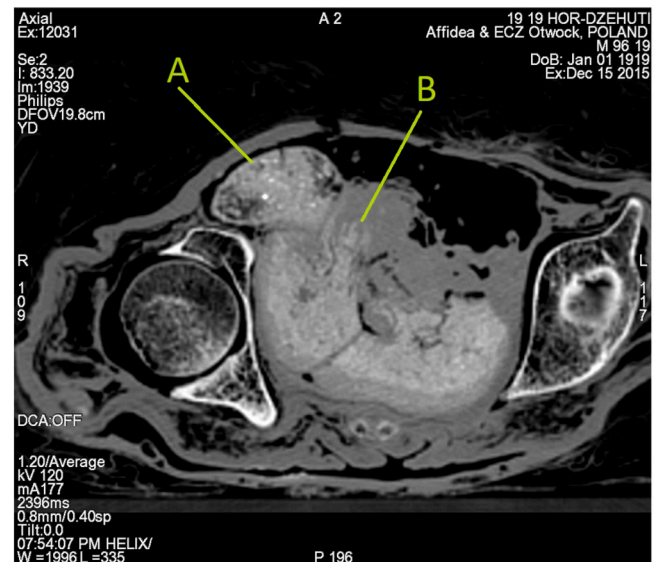


Fig. 2. Top: Remains of the mummified fetus *in utero* on a CT image (axial plane): lower abdominal area of the Mysterious Lady mummy with the mummified remains of the fetus *in utero* (CT protocol: Slice thickness 0.4 mm; KV 120; mA 177; 2396 ms; 0.8mm/0.40sp; Helical). Bottom: CT of the pelvic area. Interpretations: A - head, B - hand. (images by Warsaw Mummy Project/Affidea made in OsiriX DICOM Viewer).

the mummy that we examined, the fetus inside her uterus was petrified, then not only would we have the world's first pregnant Egyptian mummy, but also a very rare pathology. It must be emphasized that this type of pathology directly affects fetuses and the affected individual can still be regarded as pregnant. The mineralization of the fetus in the mummy of the Mysterious Lady is not as large as would be expected in the case of a 'stone child.' However, the entire uterus with its contents has relatively larger density of tissues due to the taphonomic processes, something which will be discussed in another paper. It needs to be highlighted that their density is much lower than that of pathological tissue calcifications.

Before being identified as a fetus, the feature in the pelvic cavity was in the course of the study compared with numerous types and forms of tumors in the female urogenital system, with uterine tumors particularly in focus, as they are the scientific interest of our medical expert, M.D. Katarzyna Jaroszewska, who is an experienced obstetrician gynecologist and a specialist in uterine pathology. The aforementioned uterine congestion specialist have ruled out the presence of structures other than the fetus, including all kinds of tumors. Moreover, a tumor of this size

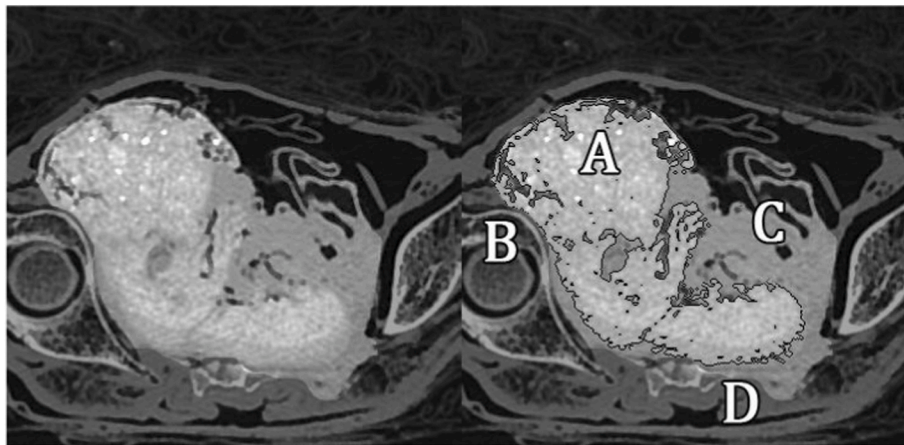


Fig. 3. Original slice (left) and outline drawn enhancing the recognizable parts of the fetal body (right) on a CT image (axial plane): head (A) resting by the hip (B), the torso and legs at the back of the cavity with the hand toward front (C), vertebral of the host mummy below (D); CT protocol: Slice thickness 0.4 mm; KV 120; mA 177; 2396 ms; 0.8mm/0.40sp; Helical (image by Warsaw Mummy Project/Affidea, made in OsiriX DICOM Viewer i postprocessing w Adobe Photoshop CS6).

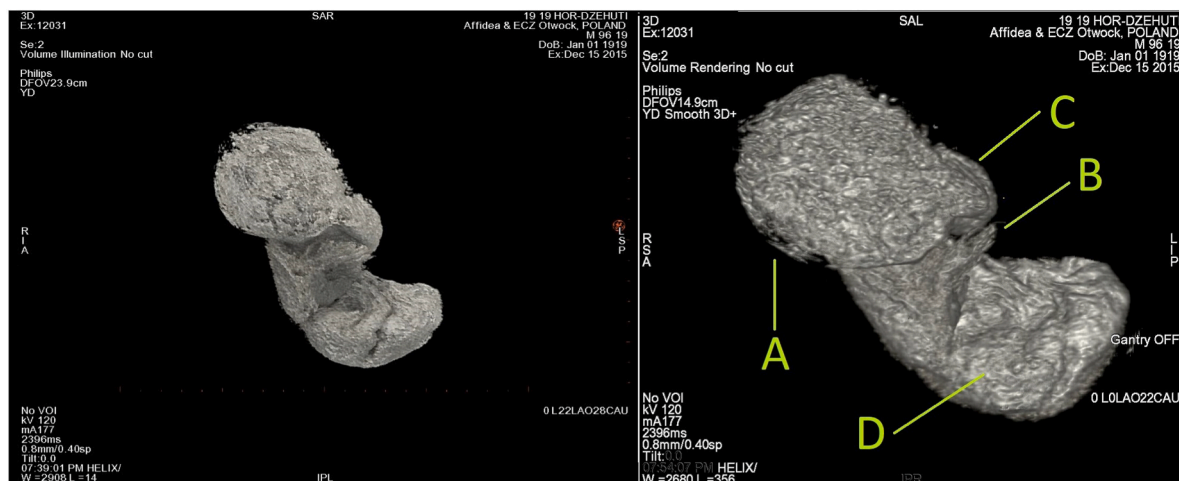


Fig. 4. Left: volumetric rendering of the fetus from the CT data. Right: interpretation: A – head, B – right hand, C – left hand, D – right leg (image by Warsaw Mummy Project/Affidea/General Electric – Antonina Andrzejewska using Media Viewer GE Healthcare made in GE-AW 4,7 and GE-AW server 3.2).

would most likely tear the organ apart, and would not be “coated” in uterine soft tissue as visible in our CT imagery. In addition, in our experts’ assessment, the images show a closed cervix, which is also a sign of pregnancy.

During an investigation of CT images it was observed that the object has the shape of a fetus remaining in the embryonic position. One can recognize the body of the fetus, distinguish the head and hands (A,B and C respectively in Figs. 2–4). We present here further visualizations of the pelvic cavity, which enhance the interpretation presented in Ejsmond et al. (2021) (Fig. 3). The Fig. 3 shows the mummified remains of the fetus *in utero*, head (A) resting by the hip (B), the torso and legs at the back of the cavity with the hand towards the front (C), and the vertebra of the mummy of the mother below (D).

Prof. Saleem continues, “Ejsmond et al. interpreted a structure located within the pelvic region of the mummy as a fetus. The article based this assumption on the external configuration of the pelvic mass that resembled a rolled up fetus but without being able to detect any bones.” and “The article based the diagnosis on the external appearance of a pelvic mass that resembled a rolled up fetus but without being able to detect any anatomical configuration or bones”. It must be underlined that during the first two trimesters, bones and tissues are poorly mineralized (DeLise et al., 2000), which makes their detection very difficult or even impossible after taphonomic processes, such as in the

case of our mummy. It is even difficult to find fetus bones during archaeological excavations (Han et al., 2018). Furthermore, taphonomic processes described earlier contributed to their demineralization.

As Prof. Saleem correctly observes, the object has an external appearance of a “rolled up fetus.” What we achieved in our research is to establish the spatial distribution of the soft tissue in the uterus. The head is coated with the contracted tissue of the uterus on one side and from its other side one can observe an empty space and then a hand of the fetus (Figs. 2–4). Thus, since:

- the object has a shape of a fetus, as Prof. Saleem agrees,
- features resembling a hand and head can be distinguished within the uterus,
- the whole feature is located in the pelvic cavity, the place where one would expect a fetus during pregnancy,
- the woman was of reproductive age,
- possibilities of tumors and litopedion can be ruled out,
- as well as any artificial filling of the pelvic cavity,

it is difficult to propose other interpretation than of an unborn child.

As Prof. Saleem rightly observes, “The multi-disciplinary approach in mummy studies, with consultation from different specialties, proved to be very valuable and helped in correcting misdiagnosed cases.” That is

why the discovery was primarily consulted with medical doctor Katarzyna Jaroszevska. Furthermore, it must be stated that the discovery (especially Fig. 4) was recently presented at General Electric Poland's ImaGENalia 2021 radiological conference and workshop in Warsaw, which was attended by ca. 300 radiologists. None of the specialists present at the meeting objected to our interpretation, which in turn received noticeable acclaim.

Prof. Saleem rightfully wrote that the radiological protocols are missing. These are:

- CT protocol: slice thickness 0.4 mm; KV 120; mA 177; 2396 ms; 0,8mm/0,40sp; Helical.
- X-ray protocol: 7.010 dGy*cm2; 201.0 mA; 75 kVp; 62 ms12 mAs.

It was impossible to provide all information on this mummy in one paper, thus only a selection of the most important observations was provided.

Once again, we would like to thank Prof. Sahar N. Saleem for bringing up technical issues and providing feedback from the perspective of an experienced radiologist. The discussion is valuable and encouraging, especially since the fetus is the subject of our ongoing research and the results of following inquiries are to be presented in upcoming publications. We welcome this and any further comments.

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