

X-ray computed tomography investigations of Cucuteni ceramic statuettes

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ABSTRACT – *Deciphering the internal structure of prehistoric artefacts can provide spectacular insights that might help us understand the people who made them. In order to preserve the integrity of these relics of past civilisations, it is desirable to make such investigations using non-destructive techniques. Recent decades have witnessed a growth in the X-ray computed tomography (CT) applications in the study of cultural heritage objects. This paper presents and discusses tomographic investigations of two Cucuteni ceramic statuettes discovered in Romania. The study was made with a CT device specially designed for archaeometric applications.*

IZVLEČEK – *Prepoznavanje notranje sestave prazgodovinskih artefaktov nudi osupljive vpoglede, ki nam pomagajo pri razumevanju ljudi, ki so te predmete izdelali. Zaželeno pa je, da so takšne analize opravljene z ne-destruktivnimi metodami, da bi obdržali integriteto teh ostalin preteklih civilizacij. V zadnjih desetletjih smo pričali vzponu uporabe rentgenske računalniške tomografije (CT) pri analizi predmetov kulturne dediščine. V članku predstavljamo in razpravljamo o tomografskih analizah dveh keramičnih figur kulture Cucuteni, ki sta bili odkriti v Romuniji. Analiza je bila opravljena z napravo CT, ki je bila posebej oblikovana za uporabo v arheometriji.*

KEY WORDS – *ceramics; Cucuteni; statuettes; X-ray Computed Tomography*

Introduction

Computed tomography (CT) is a technique that in recent years has been used with increasing frequency in archaeological and cultural heritage research (Ghysels 2003; Applbaum, Applbaum 2005; Casali 2006; Morigi et al. 2007; De Witte et al. 2008; Van der Linden et al. 2010; Haneca et al. 2012; Harvig et al. 2012; Lehmann et al. 2010; Tuniz et al. 2012).

CT provides information on the structure of objects that otherwise cannot be accessed in any way except through destructive investigations or sampling. CT examinations can be also useful for restoration and conservation procedures.

The X-ray tomographic machine used for the study reported in this paper was specially designed for archaeometric research, being the only one of its kind in Romania. The CT device and the software imple-

menting the reconstruction algorithm were developed in the Department for Applied Nuclear Physics at the 'Horia Hulubei' National Institute for Nuclear Physics and Engineering, Măgurele, Romania (Constantin et al. 2010) (Fig. 1). In the last two years, a large number of cultural heritage artefacts made of ceramics have been examined with this CT apparatus in the course of an on-going post-doctoral project.

In this paper, the results of the tomographic examination of two clay statuettes belonging to the Arad Museum Complex and Moldova National Museum Complex in Iași are presented. The objects were discovered in Romania, at the Ghelăiești-Nedeia settlement in Neamț County and the Ruginoasa-Dealul Draghici settlement in Iași County (Fig. 2), and are attributed to the Cucuteni culture.

The first object presented here was found at Ne-deia, a settlement located on a hill, 2km north-east of the village Ghelăiești. This site was first recorded by M. Cojocaru in 1933. However, systematic archaeological research started in 1969, being performed by Ștefan Cucuș, Dan Monah and A. Nițu. Two occupation levels belonging to the Cucuteni A and Cucuteni B1 periods respectively were identified at Ne-deia (Monah, Cucuș 1985.97).

The second statuette described here was found at Ruginoasa - Drăghici Hill. The first systematic archaeological study of this location was performed by H. Dumitrescu in 1926; excavations were resumed in 2001 and the team was led by Magda-Cornelia Lazarovici. Drăghici Hill is located approximately 250m from the village and 1.5km west of the railway station in Ruginoasa; it is on the north-western side of a hilly promontory. The Ruginoasa - Drăghici Hill site was attributed to the Cucuteni A period (Lazarovici, Lazarovici 2012.13, 21-26).

Methods and materials

CT machine and experimental procedures

The CT device used in this study was specially designed to study cultural heritage artefacts made from low - Z (low atomic number) materials - e.g., clay, bone, wood.

It comprises a compact X-ray source made by Spelman High Voltage Electronics Corporation (160kV maximum X-ray tube voltage, 3mA maximum current intensity), a home-made positioning system capable of rotation and translation movements and a Varian PaxScan® flat panel detector with large di-

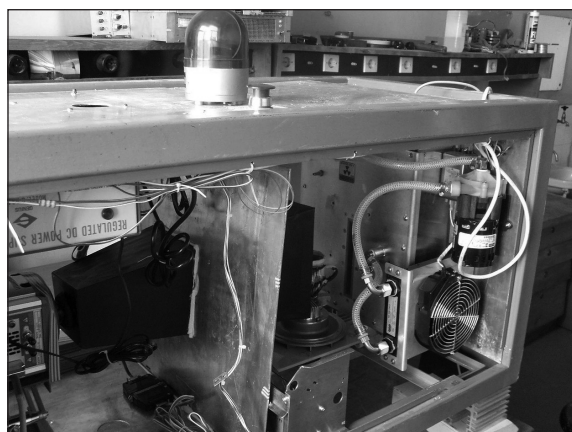


Fig. 1. The X-ray computed tomography device from 'Horia Hulubei' National Institute for Nuclear Physics and Engineering, Măgurele, Romania.

mensions (40 x 30cm²). The detector is amorphous silicon (127mm pixel pitch) engineered for high-speed radiographic imaging. The maximum spatial resolution of this CT machine is approx. 300μm. It can be used to study small objects with a maximum volume of 20 x 20 x 20cm³ (Constantin et al. 2010).

For image reconstruction, home-made software based on a modified Filtered Back Projection algorithm was written using Microsoft Visual C++ 2005 (Constantin et al. 2010).

The working procedure consists of two main steps:

- Adjusting the position of the object with respect to the incoming X-ray beam;
- The actual CT scan of the object using the parameters previously optimised for the tomographic examination of ceramic objects (70kV X-ray tube voltage; 700μA X-ray tube current).



Fig. 2. Map of the northern part of Romania showing the locations mentioned in the text: 1 Ghelăiești; 2 Ruginoasa; 3 Iași; 4 Piatra Neamț; 5 Arad.

The entire volume of the object is scanned in 120 steps, entailing a 360° rotation of the object around its central axis. The partial images are summed up to obtain the final projection.

The acquisition time for a full tomographic scan is roughly five minutes, while image reconstruction takes less than four minutes. These relatively short times needed allowed the screening of a large number of ceramic objects from various Romanian museums. Thus, over one hundred ceramics artefacts were scanned in 2012 alone.

Description of the artefacts and context of their discovery

The first object approached in this study is a clay statuette belonging to the Arad Museum Complex (inv. no. 4463). This artefact is one of a larger group of Cucutenian ceramic statuettes that were investigated using CT, but the only one that yielded interesting scan results.

There is no precise information about how these Cucutenian clay objects were added to the inventory of the Arad Museum Complex. Taking into account the lack of notes and/or any other documents, one can only hypothesise about how these clay objects found their way into the collection of a museum located 450km away from the Cucuteni area. The most plausible explanation is that they were brought to Arad in an exchange of artefacts with other Romanian museums (in this case, the most likely candidate is Piastra Neamţ Museum) sometime during the 1990s.

The labels of these objects still bear some old identification details. Thus, the statuette with inv. no. 4662 has another number on its tag (probably the old inv. no.), namely 174. The statuette with inv. no. 1473 was found in Costeşti.

The subject of our study (inv. no. 4463) has the following inscription on its ancient label: "GEL ÇEA; 1969; L2; INV 172". This can be interpreted as follows: the object was found at a site whose name begins with 'Gel', zone EA, dwelling no. 2, in 1969 (Fig. 3). It seems that the statuettes numbered 4662 and 4463 were discovered in the same place. Our further

investigations identified this unknown site as Ghelăieşti in Neamţ County.

To support the attribution to the Ghelăieşti Cucutenian site, we note the following facts: there is no other Cucuteni settlement with a name beginning with 'Gel'; this site was excavated in 1969 (Niţu et al. 1971; Monah, Cucuş 1985.207); the objects with inv. nos. 4662 and 4463 have several similarities to other objects that were definitely found at Ghelăieşti (4662 – Monah 1997.Fig. 132/1–4, Fig. 190/1, Fig. 149/9; 4463 – Monah 1997.Fig. 160/7, 10, 11, Fig. 165/9). Moreover, the statuette with inv. no. 4663 is identical to one that was published by Anton Niţu et al. (1971.Fig. 24/4) and Dan Monah (1997.Fig. 165/9).

The statuette under discussion (Fig. 4) is in a fragmentary condition, the head and lower part of the legs being absent. The height of the statuette is 10.3cm; the pelvis is 3.5cm wide, while the width between the armpits is 3.7cm. The vulva is indicated by a 1.4cm vertical incision. The breast is denoted by two small buttons. The statuette has a flat abdomen; the buttocks are very slightly contoured; an incision demarcates the legs. A line incised around the waist descends towards the hips in the dorsal region. The statuette is orange, the clay very fine. When first published, the Ghelăieşti statuette was attributed to Cucuteni AB1 or B1 stages, being connected to "the divine and magical practice of fecundity and fertility" (Niţu et al. 1971.57).

The second object discussed in this paper belongs to the Moldova National Museum Complex in Iaşi (inv. no. 21109). It was excavated from zone E2 of the Ruginoasa site, hovel no. 5, at 1.6m depth below ground level (Fig. 5). Hovel no. 5 is 3.8 x 3.4m² in area, including the porch. The eastern, southern and western walls were probably made of wood erected on stone foundations. The other objects found at the site are: six antropomorphous statuettes (of which only one represented a male), four zoomorphic statuettes, two conical idols, one bead, one altar and one shell. The whole settlement was attributed to the Cucuteni A3 period (Lazarovici, Lazarovici 2012).

The Ruginoasa statuette (Fig. 6) has no special decoration whatsoever. If the navel is clearly visible, the breast

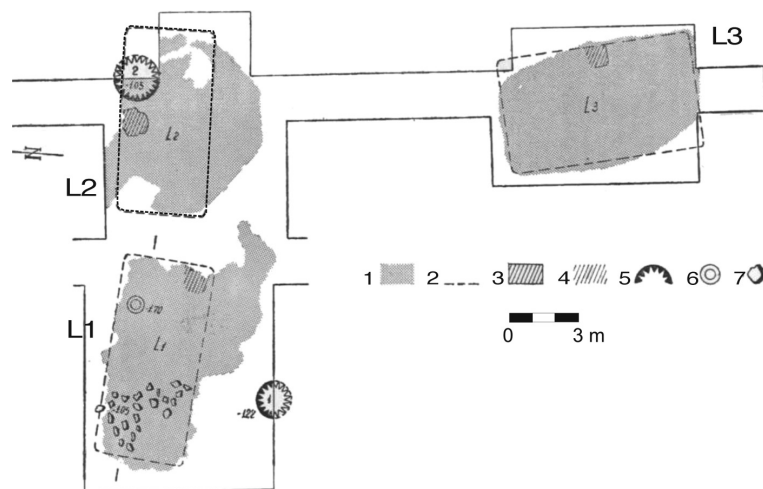


Fig. 3. The layout of the 1969 archaeological excavations at Ghelăieşti. 1 adobe surfaces; 2 the limits of dwelling floors; 3 intact hearths; 4 damaged hearths; 5 Cucuteni A pits; 6 vessel buried under the dwelling; 7 stones; L1 – dwelling 1; L2 – dwelling 2, L3 – dwelling 3 (Niţu et al. 1971. Fig. 2).

is not marked in any way. The proportions of the different body parts are well-balanced. The head is stylised, executed in *'bec d'oiseau'* technique. A wide incision divides the buttocks (Lazarovici, Lazarovici 2012). The statuette has striking steatopygic features, the frontal side being almost flat, with no detail apart from traces of careless finishing. The object is 91.1mm high; the length between the shoulders is 26.6mm, while the pelvis is 33.5mm wide. The stern circumference is 10.9mm, and the abdominal 20.7mm. The head is 12.7mm long (neck including) and 9.1mm in diameter. This object was as carefully finished as many other Cucuteni clay statuettes.

Results and first interpretations

Results

The tomographic study of the Ghelăiești statuette (Fig. 7) revealed the existence of a piece of clay that was initially modelled precisely in the way a rope is twisted. The upper part was twisted clockwise, while the lower part was twisted counter-clockwise. This lower part is actually the region surrounding the womb, exactly under the incised line representing the vulva. It can be concluded that it was deliberately modelled to indicate the existence of a pregnancy. The whole statuette was formed around this initial piece of clay. On the other hand, the statuette has no external marking to indicate pregnancy.

The tomographic examination indicates the existence of two stages in the shaping of this statuette. Thus, each of these two pieces – the upper and lower – was modelled separately, a fact also shown by the different consistency of the clay pieces, clearly resulting from two different moments of execution and drying.

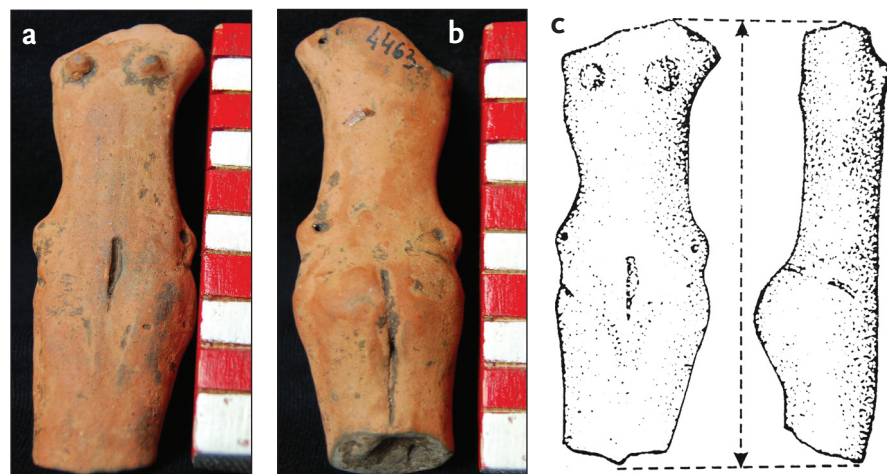


Fig. 4. Ghelăiești statuette (inv. no. 4463): a, b – photos 2011; c – drawing from Nițu et al. 1971. Fig 22; Monah 1997. Fig. 165/9.

The tomographic investigations of Ruginoasa statuette (Fig. 8) indicates that the object was made from two pieces – the left and the right – which were tied together later. The head was modelled after these two halves had been combined, a detail that cannot be seen with the naked eye.

The clay from which the object was modelled was carefully selected, being very compact. Using the CT images, a small stone was found on the left side of the statuette in the central zone of the thoracic region (precisely at heart level), next to the contact zone of these two halves. The CT examinations support the idea that this pebble was added deliberately in this precise spot.

This conclusion was reached by also taking into account the results obtained from the tomographic examination of some 108 other Neolithic and Eneolithic statuettes from Romanian museums – measurements that were taken with the same CT device – which indicated that ancient craftsmen paid special attention to the selection of clay; moreover, not a single big stone/pebble was ever noticed in the ceramic paste of other similar Neolithic statuettes. This small stone in the heart region was visible in the area where these two parts were joined together, supporting the idea of an intentional addition.

First interpretations

At first glance, the Ghelăiești statuette seems quite unremarkable: it is not painted and the external finishing is far from perfect. Similar conclusions can be also reached from a visual examination of the Ruginoasa statuette, which also has a rough finish. Both objects were found in archaeological contexts which had no obvious ritual significance, at least in the current meaning of the term.

The statuettes present no apparent sign indicating their use for cultic or ritual purposes. However, the way in which these objects were manufactured, their structure and the details revealed through tomographic investigation, suggest that they were used in connection with religious or magical practices.

Consequently, despite their apparent simplicity

and lack of any special finishing, we favour an interpretation of the statuettes as objects used in religious rituals. In the following discussion, we make further arguments to support this interpretation – in spite of the strong doubts raised by post-processualist archaeology, whereby the importance of religion in the everyday life of prehistoric communities is not so easily accepted. This may be related to an inability of the modern world, over-technologised and secularised, that so often fails to understand the significance and importance of faith. The following quotation illustrates this very well:

“But to return to post-processual approaches and religion, perhaps then, many western archaeologists are from the pool of what Eliade (1978.12) has defined as “the agnostic and atheistic masses of scientifically educated Europeans”. We need to recognise the potentially embedded nature of religion as a key building block, if not sometimes the key building block of identity. For as has been stressed, such an approach allows religion to be seen as part of a holistic package possibly structuring all aspects of life, with “religious” material culture being seen as a very ambiguous category which is very difficult to define” (Insoll 2004.5)

Discussion

It is beyond the scope of this article to review all the hypotheses that have been advanced to interpret Neolithic and Eneolithic clay statuettes. Detailed and critical analyses of these different interpretations, also related to the roles that such objects played in prehistoric communities, were recently made by Douglass Bailey (2005) and Dan Monah (2012), with the authors reaching different conclusions.

Many examples of foundation rituals, home sanctuaries, communitarian sanctuaries, and

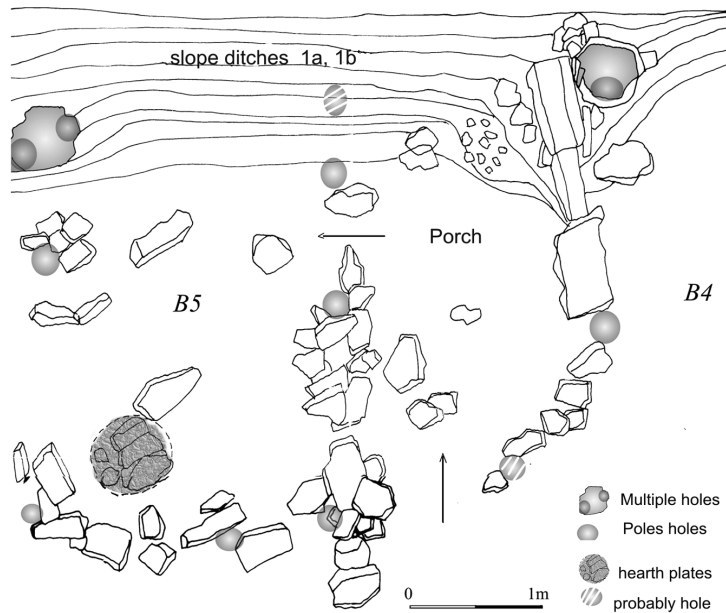


Fig. 5. Ruginoasa-Dealul Drăghici – the layout of hovel no. 5 (reproduced from Lazarovici, Lazarovici 2012.Fig. IV.50 a).

small-scale sanctuaries have been found in the Cucuteni-Trypolie area (Lazarovici, Lazarovici 2007. 158–236), e.g., finds that suggest that the Cucutenian people enjoyed a complex religious life. In the Cucuteni area, figurines with an external representation of pregnancy are encountered relatively rarely (Mateescu, Voinescu 1982).

We cannot proceed with this discussion without mentioning an exceptional statuette from Podurile – Dealul Ghindaru (Fig. 9), also attributed to the Cucuteni culture; its swollen abdomen can easily be interpreted as a sign of pregnancy. This steatopygic statuette turned out to contain 25 small balls of clay (Monah et al. 2003.192). Unfortunately, the manner in which these clay balls were separated from the sta-

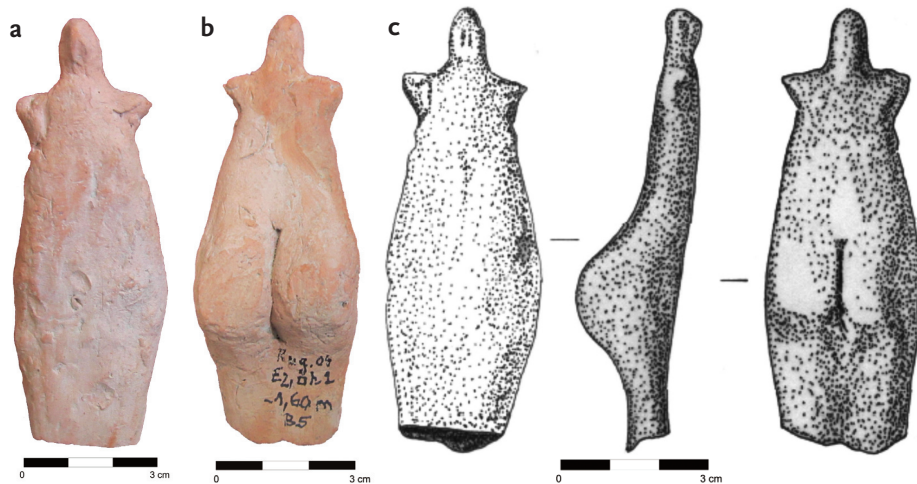


Fig. 6. Ruginoasa statuette (inv. no. 21109): a, b – photos 2011; c – drawing from Lazarovici, Lazarovici 2011.Fig. VII. 5.

tulette's body is not stated – namely, whether the statuette had been cut or broken, or if the internal cavity had a hole or crack through which the small objects could be easily removed by its modern discoverers. In any case, this spectacular find can be connected to complex religious manifestations.

A recent study of Cucuteni statuettes claims that the small number representing pregnant women can be explained in correlation with female and natural fertility (*Monah 2012.236*). The tomographic data reported in this paper show that these representations could be much more numerous than has hitherto been believed. Thus, the identification of a hidden pregnancy in a statuette, as in the case of the Ghelăiești artefact which was tomographically (and non-destructively) investigated, is absolutely remarkable.

We now review some facts about the circumstances in which the two statuettes were discovered, which can provide some insights for our subsequent interpretation of the tomography results.

A protome shaped like a bird's head and a miniature throne (of an older tradition) were found in dwelling no. 1 at Ghelăiești (*Nițu et al. 1971.58–59*). A painted cult vessel shaped like a crater (Cucuteni AB stage) containing two other smaller painted vessels was also discovered in the same dwelling. The archaeologists who excavated the site (*Nițu et al. 1971. 58–59*) believed that the adobe remains actually came from an altar that was used for ritual purposes and then broken after being burnt ritually, together with smaller vessels subsequently placed in the larger one. All these objects were buried before the construction of the dwelling began.

In dwelling no. 2 at Ghelăiești, a bowl fragment was found, with painted decoration, from which a sheep or goat protome protrudes (*Nițu et al. 1971.58–59*). Later, two cultic complexes constructed from sanctuary models were discovered (Fig. 10) Thus, in dwelling no. 5/1970, a first complex composed of six vessels of different shapes and sizes arranged in a circle was identified. In the centre of this ensemble, a large ordinary vessel had been placed upside down to protect a pear-shaped vessel, which, in turn was painted and covered with a lid in the form of a Swedish helmet. The pear-shaped vessel was buried up to the decoration limit. In this last vessel, four anthropomorphic figurines – three intact, one heavily corroded – were found. These figurines were leaning on the vessel walls, being placed in a vertical position, and oriented to the cardinal points (*Cucoș 1973.207*).

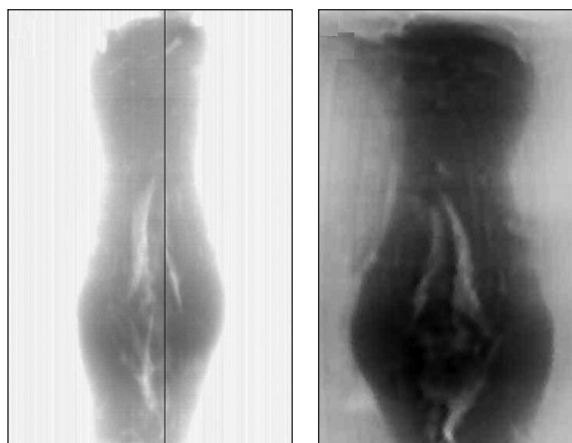


Fig. 7. Images obtained through the CT examination of the Ghelăiești statuette (inv. no. 4463): left: projection; right: reconstructed slice image – slice coordinates: $\rho = 7$; $\theta = 137^\circ$; $\varphi = 192^\circ$.

A recent interpretation of this find has confirmed that the statuettes were arranged in the form of a cross, but showed that the items were possibly not disposed in relation to the cardinal points, simply because the archaeologist who made the discovery had not used a compass when the complex was found. Moreover, it was claimed that the statuettes were deposited on a bed of straw – the straw was not being used for its usual function of protecting grain, but also had the power to partially transmit its sacred power to items deposited on them (*Monah 2012.59*). In the same dwelling (no. 5/1970), a large vessel containing 497 pig and sheep astragals was found, supporting the archaeologist's claim that this was a ritual complex (*Cucoș 1973.207, note 1*).

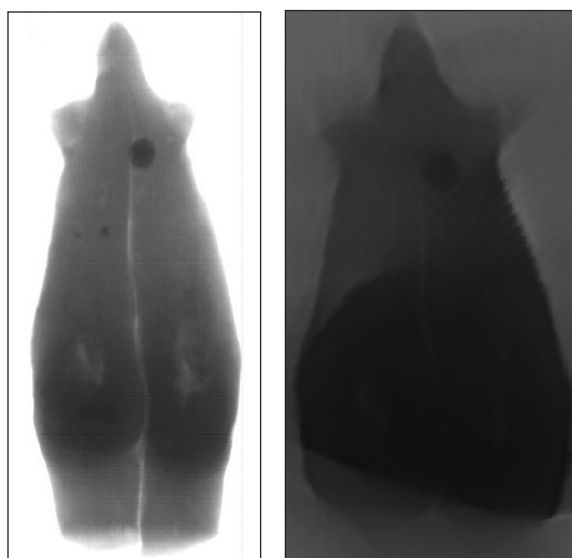


Fig. 8. Images obtained through the CT examination of the Ruginoasa statuette (inv. no. 21109): left – projection; right – reconstructed slice image, slice coordinates: $\rho = 32$, $\theta = 189^\circ$, $\varphi = 202^\circ$.

Ștefan Cucuș (1973.212–213) assumed that such depositions were connected to some magical or religious practices, and that this dwelling had been used solely as a sanctuary. The reasons for this hypothesis are that there were no common ceramic finds in this location, nor any implements or clay weights, while the dwelling had no floor or platform, and the hearth showed no signs of serious fire damage. The very siting of this dwelling within the inhabited area also supports this interpretation.

Two models of the painted sanctuaries in which anthropomorphic statuettes were placed were found in dwelling 33/1983 (Fig. 11). Dwelling 33/1983 at Ghelăiești was also centrally placed in a group of other dwellings, also suggesting its use as a sanctuary. Supporting evidence for such a function is the absence from the inventory of dwelling 33/1983 of any object similar to those discovered in every other house. The structure does not have a platform of wooden beams – unlike all the surrounding dwellings – suggesting that it was used seasonally (Cucuș 1993.59–60, 65–68).

Homo religious belief in gods involves unconditional faith and a religious object that is alive and charged with divinity. Religion is manifested through symbols, myths being just another facet of the communitarian spirit.

“From this basic fact of the sensuous realism of the image, in the presence of the autonomy of the sense impression, springs the belief in spirits, and not from any need of explanation on the part of the savage, which is merely a European imputation. For the primitive, thought is visionary and auditory, hence it also has the character of revelation. Thus the magician, i.e. the visionary, is always the thinker of the tribe who brings to pass the manifestation of spirits or gods. This is the source of the magical effect of thought; it is as good as action, just because it is real. In the same way, the word, the outer covering of thought, has ‘real’ effect, because the word calls up ‘real’ memory images. Primitive superstition surprises us only because we have very largely succeeded in de-sensualizing the psychic image, i.e. we have learnt to think ‘abstractly’, always, of course, with the above-mentioned limitations.” (Jung 1953.43).

Transubstantiation is especially known from the Christian milieu and is one of the few religious rites



Fig. 9. Statuette of large dimensions (19cm high) from Poduri – Dealul Ghindaru, Muzeul de Istorie Piatra Neamț (inv. no. 13214), from Monah et al. 2003.192, Fig. 204.

that are practised and are still alive: a large number of people still believe in such divine transformation. Briefly, transubstantiation¹ means the transformation of divine substance in the sense of spiritualisation, being at the same time a sacrifice and sacred meal offered to a god or gods. This miracle happens continuously, because it involves the transformation of some common elements that are known to all – namely, bread and wine. The priest is just an ordinary person invested with the power to offer the sacrifice. The most important moment is when Christ, playing the roles of both the subject and object of the sacrifice, speaks through the priest. This instant marks the point at which Christ is present in both time and space. *“In so far, then, as the Mass is an anthropomorphic symbol standing for something otherworldly and beyond our power to conceive, its symbolism is a legitimate subject for comparative psychology and analytical research.” (Jung 1958.203–207).*

Carl Gustav Jung found this type of analogy in some pre-Christian civilisations, in Aztec populations, in the cult of Mithra and in alchemy.

“...so [I] must content myself with mentioning the ritual slaying of the king to promote the fertility of the land and the prosperity of his people, the renewal and revivification of the gods through human sacrifice, and the totem meal, the purpose of which was to reunite the participants with the life of their ancestors. These hints will suffice to show

1 We present here C. G. Jung's opinion on this matter, one of the most objective thoughts on this matter (Jung 1958).

how the symbols of the Mass penetrate into the deepest layers of the psyche and its history.” (Jung 1958.222–246).

The transubstantiation ritual is partially supported by Dan Monah, who mentions the addition of crushed cereals and flour in the ceramic paste from the Tripolie A area and the human sacrifices practised by Cucuteni people, but also the possible existence of ritual anthropophagy or tearing bodies to pieces (Monah 2012.235–236). Dumitru Boghian recalls that transubstantiation and consubstantiation are characteristic features of the Cucutenian statuettes (Boghian 2000.222). One can also mention here the 16000 ceramic objects found at Gravettian and Pavlovian sites of Central Europe, dating from the Upper Paleolithic. These include figurines and statuettes that were deliberately fragmented, not only mechanically, but also by thermal shock. Mihael Budja suggests that they were deliberately destroyed, insisting that the first ceramic statuettes used in rituals appeared millennia before ceramic vessels and agriculture, implying strong religious motivations. The emergence of agriculture will modify these beliefs (Budja 2007.41–44).

“Religious creativity was spurred not by the empirical phenomenon of agriculture, but by the mystery of birth, death and re-birth identified in the vegetal cycles.” (Eliade 1991.50).

The transubstantiation of wet clay into a brittle object that can be spectacularly broken is a process that might induce a very powerful feeling. Transubstantiation is a concept that is also widely documented in ethnographic research, being associated with changes in the human body (conception, gestation, death) and rites of passage (birth, initiation, marriage and funerary rites) (Taylor 2009.311). The link between cereal cultivation, sacred bread and rebirth as a continuation of certain agrarian and funeral rituals need not be argued further (Naumov 2008; Eliade 1991). It is worth recalling *coliva* (*Kölliva* – in Greek) here, a dish made of boiled and sweetened wheat that is offered at funerals and commemorations (Eliade 1991) in the Balkans. *Coliva* signifies the body of the dead while wheat is a human staple. In some regions of Romania, *coliva* is eaten on the first Saturday of Lent (which has a different date in the Chri-

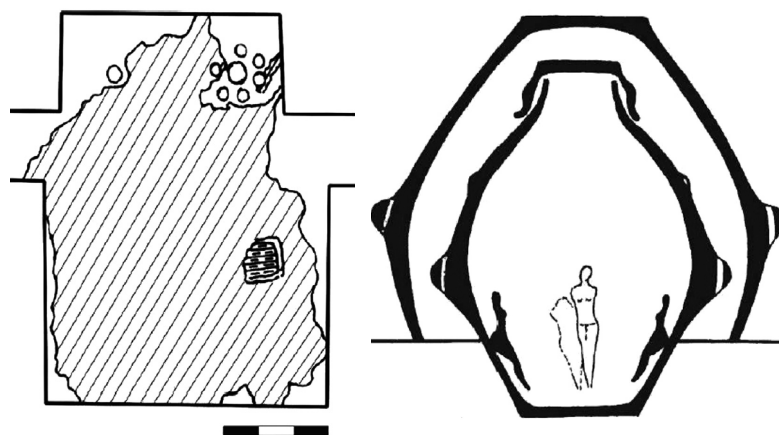


Fig. 10. Ghelăiești-Nedeia: left – the lay-out of dwelling no. 5/1970 showing details of the ritual deposits; right – cross-section through the central section of the ritual deposit (from Monah 2012.Fig. 3).

stian Orthodox calendar). This moment also corresponds to the celebration of Saint Teodor Tiron and the institutionalisation of *coliva* in the Eastern Christian church. The moment is naturally correlated with the rebirth of plants, clearly a pre-Christian custom (Marian 1994.239–243).

The Ghelăiești statuette can be clearly linked to very ancient agrarian and fertility rites, adopting birth and re-birth, the real conception of the foetus and the transubstantiation of the divine, which is clearly present in this clay statuette. The bread oven can be seen as part of the uterus of the Great Goddess as observed in some types of anthropomorphic oven found in the Balkans (Naumov 2010.232–233, Fig. 5). Ethnographic analogies further indicate clear similarities between birth and mortuary rituals (Gennep 1996.57). The presence of the heart, represented by a round pebble placed in the anatomically correct position, a detail provided by the tomographic investigation of the Ruginoasa statuette, is quite extraordinary and revealing about the religious imagination of Cucutenian people.

Conclusions

The present study presents the results of a tomographic investigation of two Cucuteni clay statuettes. The analysis of the images obtained, and the internal structures and manufacturing details revealed by the CT scans support the idea that the sacred was a concept very much present in prehistoric communities to an extent which might barely be understood and/or accepted nowadays.

Both statuettes reported in this archaeometric study were rather carelessly finished, at least compared to

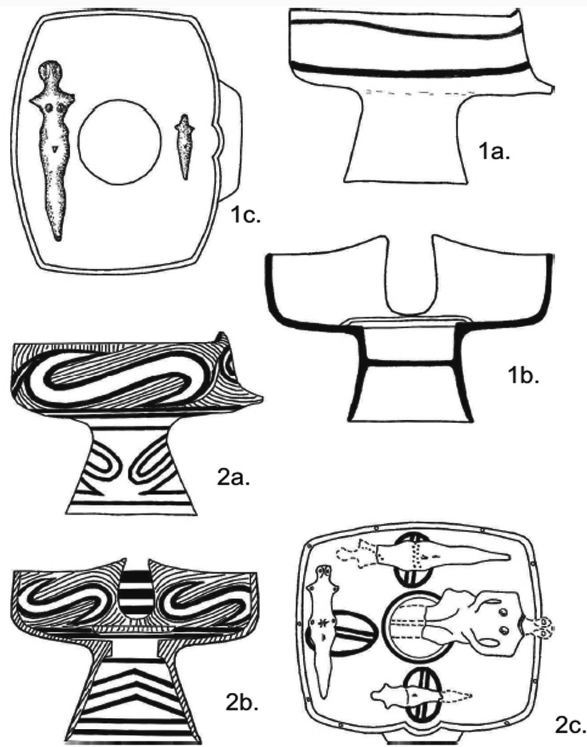


Fig. 11. Ghelăiești–Nedeia. 1, 2 Sanctuary models with statuettes discovered in dwelling 33 (from Monah 2012.Fig. 12).

other clay statuettes discovered in the Cucuteni area and/or dating from the same period. It may be readily concluded that in such cases the external appearance of the objects was not important, but what was hidden inside them and what these figurines repre-

sented in spiritual and/or religious terms. Both statuettes contained deliberately hidden objects that may be linked to religious manifestations – the transubstantiation of divinities in ceremonies related to the Cucutenian religious universe, birth and fertility.

The results reported in this paper prove that non-destructive and non-invasive X-ray computed tomography investigations can be extremely useful for understanding the structure of intact ceramic statuettes and/or rattles.

ACKNOWLEDGEMENTS

Our special thanks go to Dr. Magda Lazarovici (Institute of Archaeology Iași), Dr. Senica Țurcanu (Moldova Museum Complex Iași), Dr. Victor Sava (Arad City Museum) and to Professor Sabin Adrian Luca (Lucian Blaga University of Sibiu) for facilitating access to the samples for tomographic examination. We are grateful to Professor Gh. Lazarovici, Dr. Dan Buzea and Dr. Magda Lazarovici for the fruitful discussions of religion and statuettes, as well the bibliography they placed at our disposal.

This work was performed in the framework of the post-doctoral project 'X-ray tomography for Romanian cultural heritage' (PN II RU-PD-2011-3-0100-49), financed by the Romanian Ministry of Education, Research, Youth and Sport – The Executive Agency for Higher Education, Research, Development and Innovation.

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References

- Applbaum N., Applbaum Y. H. 2005. The Use of Medical Computed Tomography (CT) imaging in the study of ceramic and clay archaeological artifacts from the ancient Near East. In M. Uda, G. Demortier and I. Nakai (eds.), *X-rays for Archaeology*. Springer. Dordrecht: 231–245.
- Bailey D. 2005. *Prehistoric figurines, Representation and Corporeality in the Neolithic*. Routledge. London.
- Boghian D. 2000. La plastique du complexe. Précucuteni-Cucuteni dans le bassin de Bahlui. *Studia Antiqua et Archaeologica*. VII: 221–245.
- Budja M. 2007. The dawn of Ceramics. In M. Blečić, M. Črešnar, B. Hänsel, A. Hellmuth, E. Kaiser and C. Metzner-Nebelsick (eds.), *SCRIPTA praehistorica in honorem Biba Teržan*. Situla 44. Dissertationes Musei Nationalis Sloveniae. Ljubljana: 41–55.
- Casali F. 2006. X-ray Digital Radiography and Computed Tomography for Cultural Heritage. *Archaeometriai Műhely 1*: 24–28.
- Constantin F., Pavel C., Bugoi R. and Toderaș M. 2010. An X-ray tomograph based on a flat panel detector. *Nuclear Instruments and Methods in Physics Research A 621*: 685–689.
- Cucoș Ș. 1973. Un complex ritual cucutenian descoperit la Ghelăiești (jud. Neamț). *Studii de Istorie Veche și Arheologie 24(2)*: 207–216.
1993. Complexe rituale cucuteniene de la Ghelăiești, jud. Neamț. *Studii și cercetări de Istorie Veche și Arheologie 44*: 59–80.

- De Witte Y., Cnudde V., Pieters K., Masschaele B., Dierick M., Vlassenbroeck J., Van Hoorebeke L. and Jacobs P. 2008. X-ray micro-CT applied to natural building materials and art objects. *X-Ray Spectrometry* 37: 383–387.
- Eliade M. 1991. *Istoria credințelor și ideilor religioase I*. Editura Științifică. București.
- Gennep A. 1996. *Riturile de trecere*. Polirom. Iași.
- Ghysels M. 2003. CT Scans in Art Work Appraisal. *Art Tri- bal* 4: 116–131.
- Haneca K., Deforce K., Boone M. N., Van Loo D., Dierick M., Van Acker J. and Van Den Bulcke J. 2012. X-Ray sub-micron tomography as a tool for the study of archaeological wood preserved through the corrosion of metal objects. *Archaeometry* 54(5): 893–905.
- Harving L., Lynnerup N. and Amsgaard Ebsen J. 2012. Computed tomography and computed radiography of Late Bronze Age cremation urns from Denmark: an interdisciplinary attempt to develop methods applied in bioarchaeological cremation research. *Archaeometry* 54(2): 369–387.
- Insoll T. 2004. Chapter 1. Are Archaeologists Afraid of Gods? Some Thoughts on Archaeology and Religion. In T. Insoll (ed.), *Belief in the Past*. The Proceedings of the 2002 Manchester Conference on Archaeology and Religion. BAR S1212. Archaeopress. Oxford: 1–6.
- Jung C. G. 1953. *Psychological Types or the Psychology of Individuation*. Pantheon Books. New York.
1958. *Psychology and Religion: West and East*. Bollingen Series XX. Pantheon Books. New York.
- Lazarovici C. M., Lazarovici G. C. 2012. *Ruginoasa, Dealul Drăghic*. Monografie Arheologică. Academia Română – Filiala Iași, Institutul De Arheologie, Muzeul Bucovinei Suceava. Editura Karl A. Romstorfer. Suceava.
- Lehmann E., Deschler-Erb E. and Ford A. 2010. Neutron tomography as valuable tool for the non-destructive analysis of historical bronze sculptures. *Archaeometry* 52(2): 272–285.
- Marian S. F. 1994. *Sărbătorile la Români Studiu Etnografic*. Colecția Fundamente. Editura Fundației Culturale Române. București.
- Mateescu N. C., Voinescu I. 1982. Representation of Pregnancy on Certain Neolithic Clay Figurines on Lower and Middle Danube. *Dacia N.S.* 26: 47–58.
- Monah D. 1997. *Plastica antropomorfă a Culturii Cucuteni-Tripolie*. Constantin Matasă. Piatra Neamț.
2012. *Plastica antropomorfă a Culturii Cucuteni-Tripolie*. Constantin Matasă. Piatra Neamț.
- Monah D., Cucuș Ș. 1985. *Așezările culturii Cucuteni din România*. Junimea. Iași.
- Monah D., Dumitroaia G., Monah F., Preoteasa C., Munteanu M. and Nicola D. 2003. *Poduri – Dealul Ghindaru, O Troie în Subcarpații Moldovei*. Muzeul de Istorie. Piatra Neamț.
- Morigi M. P., Casali F., Bettuzzi M., Bianconi D., Brancaccio R., Cornacchia S., Pasini A., Rossi A., Aldrovandi A. and Cauzzi D. 2007. CT investigation of two paintings on wood tables by Gentile da Fabriano. *Nuclear Instruments and Methods in Physics Research A* 580: 735–738.
- Naumov G. 2008. Imprints of Neolithic mind – clay stams from Republic of Macedonia. *Documenta Praehistorica* 35: 185–204.
2010. Neolithic anthropocentrism – the principles of imagery and symbolic manifestation of corporeality in the Balkans. *Documenta Praehistorica* 37: 227–238.
- Nițu A., Cucuș Ș. and Monah D. 1971. Ghelăiești (Piatra Neamț) I, Săpăturile din 1969 în așezarea cucuteniană de la “Nedeia”. *Memoria Antiquitatis III*: 11–64.
- Taylor T. 2009. Materiality. In R. A. Bentley, C. Chippindale and H. Maschner (eds.), *Handbook of Archaeological Theories*. Rowman & Littlefield. Lanham: 927–320.
- Tuniz C., Bernardini F., Turk I., Dimkaroski L., Mancini L. and Dreoss D. 2012. Did Neanderthals play music? X-Ray Computed Micro-Tomography of The Divje babe ‘Flute’. *Archeometry* 54(3): 581–590.
- Van der Linden V., Van de Castele E., Thomas M. S., De Vos A., Janssen E. and Janssens K. 2010. Analysis of micro computed tomography images; a look inside historic enamelled metal objects. *Applied Physics A – Materials Science and Processing* 98: 385–392.