



ERASMUS+ and experimental archaeology

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ERASMUS+, as part of the ERASMUS MUNDUS international programme, is a great opportunity for students and lecturers to enrich their professional experience in several important aspects: knowledge, contacts, establishing new collaborations, initiating scientific fora etc. A good example of successful collaboration is the ERASMUS+ contract between the Bulgarian Academy of Sciences and the Polytechnic Institute in Tomar, Portugal. The initiative came from the National Institute of Archaeology with Museum (NAIM), BAS and the Earth and Memory Institute in Mação, where the branch of the Tomar Polytechnic Institute is located within the Museum of Prehistory and Rock Art, which has a specialised educational programme on Quaternary geology, prehistory and experimental archaeology. The Institute's President is Prof. Luiz Oosterbeek, one of the leading world specialists on prehistoric rock art and sustainable management of cultural heritage. In this respect, Mação is an ideal venue for ERASMUS+ activity for specialists from a broad scientific background, but especially for those focused on experimentation, not least because there is a Master's programme on Prehistoric Archaeology and Rock art that includes the teaching and didactics of archaeological experimentation, combining theoretical aspects (lectures) and a large spectrum of practical/empirical activities. The first stage of the programme between the above-mentioned institutions took place in Mação and Sofia in 2012–2013 involving exchange lecturers – Prof. Diana Gergova and Dr Maria Gurova (Bulgarian side) and Dr Sara Cura (Portugal side). The results of this cooperation consisted of a Session on Technology and Experimentation, organised at the XVI World Congress of the International Union of Prehistoric and Protohistoric Sciences (UISPP) in Florianopolis, Brazil, and a paper devoted to the challenge of prehistoric drilling and bead fashioning (Cura et al. 2014; Gurova et al. 2014).

In 2021 the contact was renewed and thus a new opportunity for effective and successful cooperation was re-established. The main goals for this renewal were as follows: i) to expand the collaboration at the experimental level and exchange of innovative techniques and technological procedures in the context of archaeological experimentation; ii) to offer IPT students conceptual and case-study examples of the topical subjects of Balkan prehistoric archaeology; iii) to offer the BAS lecturer the opportunity to learn about the successful strategy for cultural heritage management



Fig. 1. Experimental reconstruction of manufacture of a Thracian type bronze fibula from the copper smelting process to the obtaining of a semi-finished object (photos M. Stamberova)

Обр. 1. Експериментална реконструкция на производство на бронзова фибула тракийски тип от процеса на топене на медта до получаване на заготовка (снимки М. Стамберова)

in Portugal; and iv) to offer the Bulgarian archaeologists an opportunity to welcome lecturers from Portugal and to update the knowledge about the high level of archaeological research and heritage management there.

In 2022 two research visits were made by scholars from NIAM–BAS. Dr Miglena Stamberova (Exhibitions Department, NAIM–BAS) visited Mação for a week in June 2022 under the staff mobility scheme. During this period joint experimentation work was carried out in the courtyard of the Centre of Polytechnic Studies by Pedro Cura and supervised by Prof. Pierluigi Rosina. The aim of the experiment was to reconstruct the production of one of the most common bronze objects found in ancient Thrace in the Late Iron Age (5th–1st century BC) – the Thracian type fibula.

The experimental process comprised several main stages, and included the use of various pieces of equipment such as a kiln-type furnace, a bellows, a clay tuyère, a crucible, a sand mould, etc. The first stage included a simple two-step copper smelting process, starting with the preparation of the copper ore malachite by crushing it into small pieces (fig. 1.1). The stone furnace which was to be used was already dug into the soil and had a roughly cylindrical form of small dimensions. Its walls and bottom were covered with thick layers of clay (fig. 1.2). The manually-worked leather bellows was connected to the furnace body under the ground by means of a long pipe terminated by a clay tuyère. The kiln was filled with alternate layers of charcoal and malachite and the process of smelting was initiated (fig. 1.3–4). It continued for several hours. After cooling down, the smelted lumps of copper were collected by hand. It was clear that a significant part of the copper remained trapped in the slag (fig. 1.5). To achieve further separation of the metal, a second smelting was executed. The previously obtained copper prills were re-melted in a crucible and put in the kiln under oxidizing conditions (fig. 1.6). Afterwards, the smelted copper was removed from the furnace and cast into an ingot with rectangular shape (fig. 1.7). Meanwhile a wooden model of an unfolded Thracian type fibula and a two-component sand mould were produced (fig. 1.8). The wooden model was used for making negative impressions in the mould. The next phase of the experiment included the preparation of the bronze alloy by mixing the copper with tin and pouring the resulting bronze alloy into the mould containing the negative impression (fig. 1.9–10). The cast of the elongated fibula form was mechanically shaped and smoothed (fig. 1.11). The final step of the experiment would include employing various metalworking techniques such as forging out, bending the fibula into the required shape, and applying decoration.

The time available was not sufficient to complete all the aforementioned steps, and the experiment will be finished in 2023. Nevertheless, the experimentation that was conducted and its results were valuable, and increased our knowledge of the production of fibulae in Ancient Thrace. The experiment showed that the process was extremely cost-effective because by means of a single mould it is possible to make many fibulae, whose feet and bows are subsequently shaped according to the craftsmen's skills and the users' preferences. The use of non-durable models and moulds also explains the absence of stone and ceramic moulds for such metal objects. A joint publication with all steps and results of the experimentation is currently in preparation.

The second research visit for teaching was carried out in October by Dr Maria Gurova (Pre-history Department, NAIM–BAS). Four lectures were prepared and presented in Sala Mundus of the Earth and Memory Institute, Mação. Three of them were integrated into a Workshop, combining lectures, archaeological experiments and a Museum visit (fig. 2). Invited as guest lecturers were Prof. Clive Bonsall (Edinburgh University) and Dr Davide Delfino (Molise State Museum, Italy). Master students from the Polytechnic Institute of Tomar and PhD students from the department of Cultural heritage of the Extremadura University (Spain) took part in this workshop.



Instituto Politécnico de Tomar – Centro de Estudos Politécnicos de Mação

PROGRAMA DE PÓS-GRADUAÇÃO / RESEARCH DEGREES PROGRAMME

Mestrado em Arqueologia Pré-Histórica e Arte Rupestre – Mestrado Erasmus+ em Quaternário e Pré-História IMQP

Mestrado em Técnicas de Arqueologia – Mestrado Erasmus+ em Gestão de Paisagens Culturais DYCLAM+

Doutoramento em Património, Tecnologia e Território (UAL-IPT)

Centro de Geociências (cluster de Quaternário e Adaptações Humanas)

CONFERÊNCIAS 2022-2023 CONFERENCES

Sala Mundus do Instituto Terra e Memória

18 a 20 de outubro de 2022

EXPERIMENTAL ARCHAEOLOGY WORKSHOP

MARIA GUROVA

Senior Research Fellow, Prehistory Department at National Institute of Archaeology and Museum, Bulgaria

CLIVE BONSALE

Professor Emeritus of Early Prehistory, University of Edinburgh, UK

PEDRO CURA

Museu de Arte Pré-Histórica de Mação, Portugal

DAVIDE DELFINO

Direzione Regionale Musei Molise, Italy



October 18, 9h30

- Maria Gurova: *Experimentation on prehistoric drilling and bead manufacturing*

- Clive Bonsall: *Early Neolithic bead production at Schela Cladovei in the Iron Gates*

October 18, 14h30

- Experimental archaeology activity

October 19, 9h30

- Maria Gurova: *Petrographic and geochemical analyses of flint raw materials from Bulgaria: a reliable combination for provenance studies of archaeological flint*

- Experimental archaeology activity

October 19, 14h30

- Experimental archaeology activity

October 20, 9h30

- Maria Gurova: *Chalcolithic superblades from Bulgaria: Raw material and functional connotation*

- Experimental archaeology activity

October 20, 14h30

- Visit to the Museum of Abrantes

- Davide Delfino: *Socialization of knowledge bridging experimental archaeology and experimentation, in the State Museums of Molise (Italy)*



Nota: Serão atribuídos certificados aos alunos dos cursos de Mestrado e Doutoramento do programa e aos candidatos à Pós-Graduação IPT-UAL de Arqueologia Experimental.

Note: Certificates will be given to Master and PhD students of the programme and candidates to the IPT-UAL post-grad in Experimental Archaeology

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Fig. 2. Announcement and programme of the workshop (courtesy L. Oosterbeek)

Обр. 2. Обява и програма на семинара (предоставена от L. Oosterbeek)

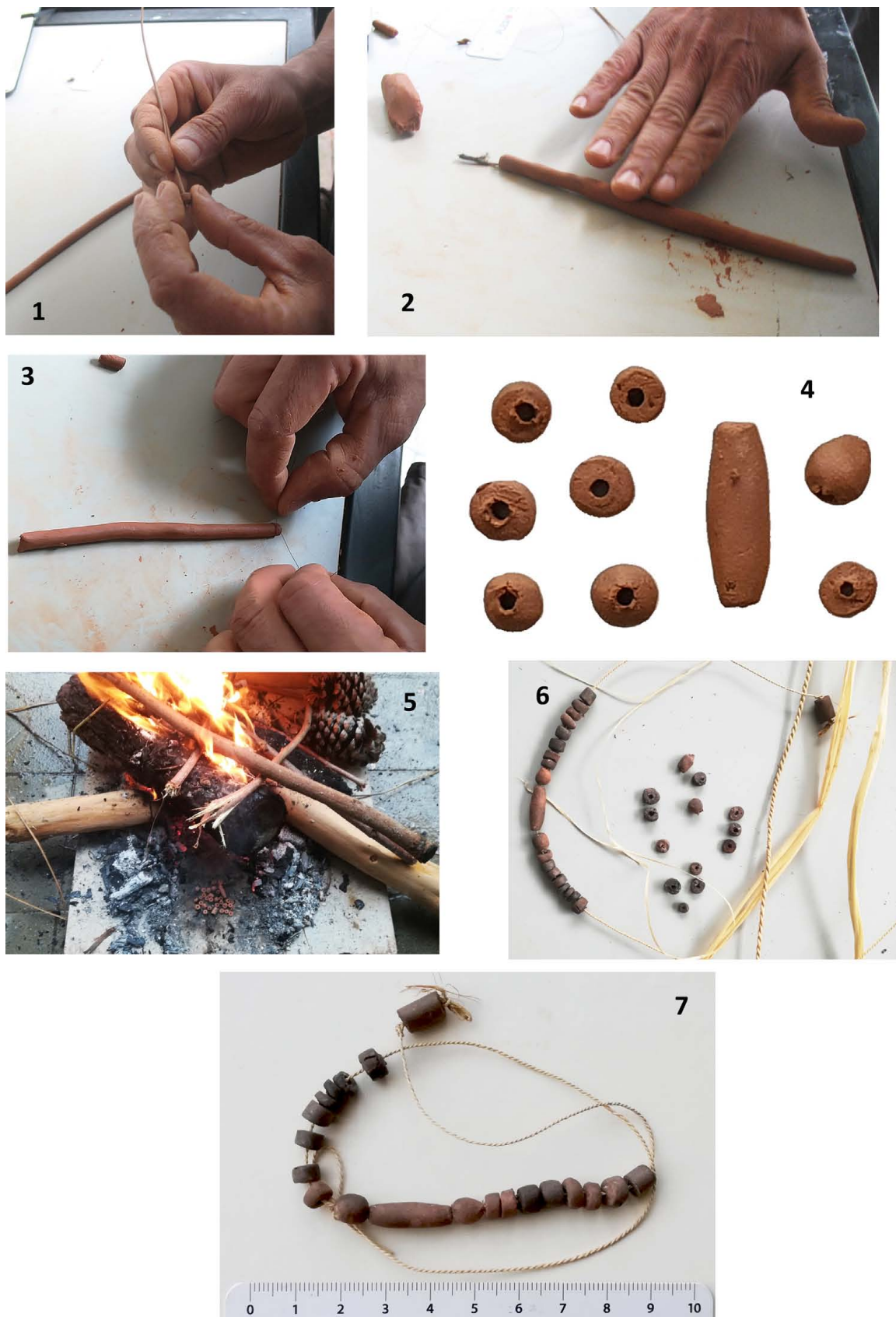


Fig. 3. Experiment of clay beads fashioning (photos M. Gurova)
Обр. 3. Експеримент по изготвяне на керамични мъниста (снимки М. Гюрова)



Fig. 4. 1–7. Experimental knapping and tool fashioning, mineral drilling and experiments in rock art; 8. Visit at the museum in Abrantes (photos M. Gurova)

Обр. 4. 1–7. Експериментална обработка на кремъчни сечива, пробиване на минерали и скално изкуство; 8. Посещение в Музея в Abrantes (снимки М. Гурова)

The experiments logistically prepared and lead by Pedro Cura¹ were partially related to the lectures, thus shedding complementary light on the challenging problem of prehistoric bead manufacture and jewellery making. A complete *chaîne opératoire* of clay bead making and necklace fashioning was carried out. The clay, prepared in advance by P. Cura, was plastic and very suitable for use, including sculpting. The experiment aimed to test empirically two practical approaches to this category of beads, suggested in a paper about Neolithic clay beads from the site of Ilindentsi, Bulgaria (Grębska-Kulow et al. 2021). We aimed to test the efficiency of various methods of bead shaping – rolling a clay lump into a long thin cylinder and then cutting it into segments and perforating (fig. 3.1) vs. rolling with a pine needle inside and then cutting the clay cylinder into segments (beads) already ‘perforated’ (fig. 3.2–3). The first method of bead shaping proved to be more efficient. The following became clear: i) the cutting of a thin delicate (or whatever) bead is much easier and keeping the beads correctly shaped when the segmentation/cutting is performed using horse hair (fig. 3.3) rather than the fresh, sharp edge of thin obsidian flake; ii) cutting a clay cylinder already perforated by a pine needle produced deformed beads, because of the hole inside which makes the cylinder more fragile. When cut with horse hair and then perforated, the beads show a ‘lip-like’ deformation at the exit hole, a detail mentioned as a terminal on some of the archaeological beads from Ilindentsi, studied and published by the first author (Grębska-Kulow et al. 2021, 15). In this way, we proved that the model of production of Çatalhöyük clay beads by wrapping clay around a perforating material is not the best or only way of delicate clay bead fashioning (ibid., 15). After preparing a series of beads (mostly discoid, with single biconical/cylindrical and spheroidal examples), all beads were placed near a fire – on a fine charcoal layer – for firing (fig. 3.4–5). The beads withstood the heat treatment with only one which cracked. The last operation consisted of making a fine string using straw, and thus we made a nice necklace of variously coloured clay beads (fig. 3.6–7).

Apart from this extremely pleasant and instructive experiment, P. Cura made a demonstration of flint knapping and tool manufacturing, in the course of preparing small borers that were needed for the next experiment (fig. 4.1–2).

Challenging experiments involved drilling various minerals using wooden pump-drills with flint tips (borers) fashioned by P. Cura. He succeeded in making a hole in a button-like piece of amazonite (6–6.5 on the Mohs scale) – a task that had been unsuccessful during our previous experiments in 2013. To create this small hole P. Cura needed almost 3 hours of intensive drilling, using and resharpening 5 small flint drills (fig. 4.3–4). Master and PhD students participated actively on this occasion, retouching flint blanks into borers in order to achieve drilling and fashioning of beads of marble (3 on the Mohs scale).

One of the most spectacular experiments concerned imitating prehistoric rock engraving and painting, using natural pigments prepared by P. Cura (fig. 4. 5–7).

An additional attraction was the visit to the Museum of Archaeology and Arts in Abrantes, which has small, but very rich and informative exhibition. On this journey into the past we were guided by Prof. L. Oosterbeek and Dr D. Delfino (fig. 4.8).

In conclusion: an ERASMUS+ mobility in Mação is a great opportunity for important scientific activity and represents a valuable format for successful international collaboration.

References

Cura, S., Cerezer, J., Gurova, M., Santander, B., Oosterbeek, L., Cristóvão, J. (eds). 2014. Techno-

1 His experimental repertoire and performances could be seen at [prehistoricskills](#) in Instagram.

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