

Workshop

Séance à l'étranger de la Société Préhistorique Française

"Matières à Penser" : Raw materials Acquisition and Processing in Early Neolithic Pottery Productions

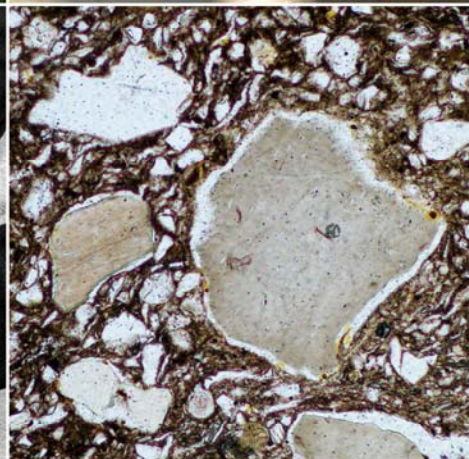
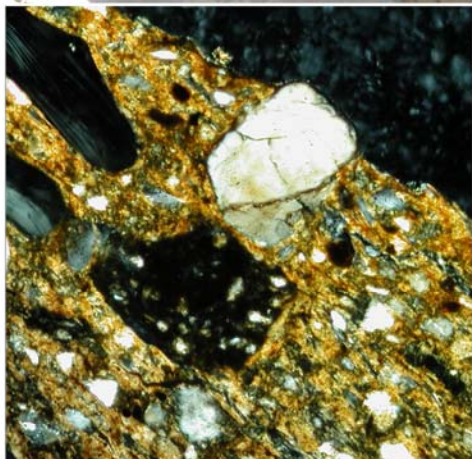
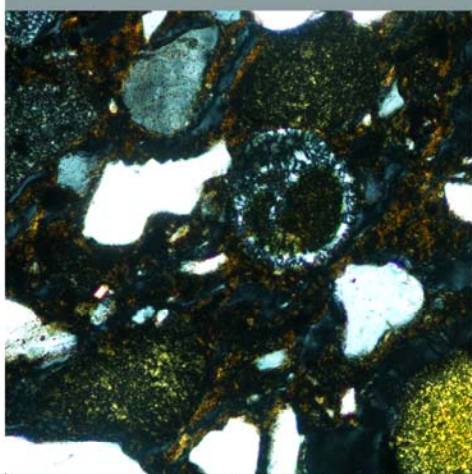
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Ceramics are one of the most emblematic remains left by Early Neolithic farming communities in northwestern and central Europe. They have, as such, received considerable attention over the last century. Yet for a long time the focus of research has mainly been on morpho-stylistic attribute variation. Pottery manufacturing processes have, in comparison, been more rarely investigated.

Gradually however, pottery technology, in particular raw material acquisition and processing techniques, has gained an increased interest. This is mostly due to the progressive refinement of theoretical models in ethnoarchaeology and to the extraordinary development, over the last decades, of analytical methods in archaeometry (namely in descriptive petrography, instrumental geochemistry, electron microscopy, X-ray crystallography, tomography), now enabling very fine-grained technological reconstructions. The informative potential of this type of technological approach is emphasized in a growing number of studies devoted to Early Neolithic cultures. New data on exploitation territories and their management, technical performances, cultural and/or symbolic dimensions of raw materials, transmission of knowledge and know-how, and, ultimately, interaction networks linking producing and consuming communities, are indeed now becoming available.

The aim of this workshop is to sum up current research, methods and models relating to raw material acquisition and processing practices, specifically (but not exclusively) in northwestern and central European Early Neolithic pottery productions (ca. 6500-4500 BC). Bringing together young and senior researchers, and adopting cross-disciplinary and cross-regional perspectives, this workshop aims at encouraging dialogue and interaction amongst scholars working in the field of ancient pottery technology. The discussions and presentations will be specifically structured around the following topics:

1. *Ethnoarchaeology and technology reconstructions*
2. *Technological traditions in Early Neolithic Europe*
3. *Production modes and models : a household perspective*
4. *Temper, clays and tools : methodological perspectives*

This event has been organised by Barbara van Doosselaere and Laurence Burnez-Lanotte (University of Namur, **LIATEC**), and was supported by the University of Namur (Belgium), the *Société préhistorique française* and Trajectoires (UMR 8215)-Paris 1 University (France).

Organising committee: *Bosquet D. (SPW DG 04, Belgium); Burnez-Lanotte L. (University of Namur, Belgium); Goemaere E. (Royal Belgian Institute of Natural Sciences, Belgium); Gosselain O. (Free University of Brussels); Livingstone Smith A. (Royal Museum for Central Africa, Belgium); van Doosselaere B. (University of Namur, Belgium)*

Scientific committee: *Bosquet D. (SPW DG 04, Belgium); Burnez-Lanotte L. (University of Namur, Belgium); Giligny, F. (Paris 1 University, France); Goemaere E. (Royal Belgian Institute of Natural Sciences, Belgium); Golitko M. (Field Museum, USA); Ilett M. (Paris 1 University, France); Gosselain O. (Free University of Brussels); Livingstone Smith A. (Royal Museum for Central Africa, Belgium); van Doosselaere B. (University of Namur, Belgium); Yans J. (University of Namur, Belgium)*

Table of Contents

Session 1 : Ethnoarchaeology and technology reconstructions	3
<i>Raw material selection, landscape, engagement, and paste recipes: insights from ethnoarchaeology</i> Dean E. Arnold.....	3
<i>Clay pastes and recipes: relating people to landscapes and territories in ceramic studies</i> Alexandre Livingstone Smith, Olivier Gosselain, Agnes Vokaer	4
<i>Traditions techniques et artisanat potier chez les groupes Woloyta et Oromo d'Éthiopie. Des référentiels actualistes pour le perfectionnement des protocoles analytiques des céramiques préhistoriques</i> Jessie Cauliez, Claire Manen, Vincent Ard, Joséphine Caro	5
Session 2 : Raw materials acquisition and processing from east to south	7
<i>Continuity and change : the Neolithic ceramics of south and southern-eastern Europe</i> Michela Spataro	7
<i>Ceramic raw material preferences from the Early to the late Neolithic in Hungary (6000-4500 BC)</i> Attila Kreiter	8
<i>Ceramic raw materials acquisition and transfer of technological ideas among the Early Neolithic communities around the Western Carpathians</i> Agnieszka Czekaj-Zastawny, Anna Rauba-Bukowska, Sławomir Kadrow	9
<i>Pottery making recipes at the dawn of the Metal Age : selection and processing of raw materials at Belovode and Pločnik</i> Silvia Amicone, Patrick Quinn, Miljana Radivojević, Thilo Rehren	10
<i>Matières premières et technologie : l'exemple de la Céramique Imprimée à Colle Santo Stefano (Italie)</i> Lucia Angeli, Cristina Fabbri	11
Session 3 : Production modes and models : a household perspective	13
<i>Ceramic fabrics as indicators of household identity? The multicoloured pots of the Starcevo-Criş settlement at Tăşnad, Romania</i> Ulrike Sommer, Silvia Amicone, Patrick Quinn, Hannah Woodfield	13
<i>Ceramic production and village communities during the Early Neolithic in France and Belgium : questions about tempers and forming processes</i> Louise Gomart, Claude Constantin, Laurence Burnez-Lanotte	14
<i>Compositional analysis of LBK ceramics from the Hesbaye region of Belgium: Progress, problems, and prospects</i> Mark Golitko.....	15
<i>Exploring compositional variability of Early Neolithic pottery: a case study from Vaux-et-Borset (Blicquy/Villeneuve-Saint-Germain, 4950 - 4650 cal BC, central Belgium)</i> Barbara van Doosselaere, Mark Golitko, Laurence Burnez-Lanotte, Damien Deldicque	16
Session 4 : Temper, clays and tools : methodological perspectives	17
<i>The use of microtomography for studying LBK pottery samples from Bylany and Tesetice sites (Czech Republic)</i> Klara Neumannova, Jan Petrik	17
<i>Etude pétrographique des dégraissants ajoutés dans les céramiques du Néolithique ancien et moyen en Basse-Normandie</i> Denis Jan, Xavier Savary.....	18
<i>Connecting paste recipes with other activities: middle Neolithic pottery in the Paris basin</i> Mélodie Barry	20
<i>Chemical signatures of mineral inclusions as a tracer of the origin of ceramics: the contribution of LA-ICP-MS analysis</i> Benjamin Gehres, Guirec Querré, with the collaboration of Jean-Christophe Le Bannier and François Pustoc'h	21
List of Contributors	22

RAW MATERIAL SELECTION, LANDSCAPE, ENGAGEMENT, AND PASTE RECIPES: INSIGHTS FROM ETHNOARCHAEOLOGY

*Dean E. Arnold
The Field Museum of Natural History, Chicago, USA*

Ancient ceramics are not self-interpreting and understanding their meaning is the most central issue facing the archaeologists that study them. Some assume that compositional analysis by various methods can provide this meaning, whereas others assume that the notion of 'choice' explains potters' behavior. Both approaches, however, result in abstractions that need to be related to a variety of social, behavioral, technical, and environmental factors. Ancient ceramics, however, are usually interpreted with reference to archaeologists' inexplicit assumptions about the nature of pottery, and its relationship to society. Are ceramics simply the product of culture and tradition, or are they more complex showing interrelationships between indigenous knowledge, landscape, mineralogy and performance characteristics?

After decades of publications showing the limitations and constraints of mineralogy, fabrication technique, and climate on pottery production, some archaeologists still believe that pottery, because it consists of fired plastic clay, reflects the mental template of the potter with no environmental or material constraints. Ethnoarchaeological research over the last 50 years in Latin America, however, reveals that potters use their indigenous knowledge in various ways to engage their landscape, its raw materials, and their performance characteristics in selecting and mixing raw materials. The resulting pastes change over time because they must be congruent with changing raw material sources and particular forming technologies and different vessel sizes, uses, and shapes.

Using ethnoarchaeological examples from Latin America, this paper enumerates some probabilistic generalizations that elucidate the relationship of raw materials to landscape, performance characteristics, paste recipes, vessel shape, and use. It examines some of the factors that influence potters' raw material selection and suggests that the choices potters make are not necessarily driven by tradition, a mental template, or non-technological criteria. Rather, all choices are multi-causal and linked to the potters' engagement of their indigenous knowledge with a variety of different external factors.

CLAY PASTES AND RECIPES : RELATING PEOPLE TO LANDSCAPE AND TERRITORIES IN CERAMIC STUDIES

Alexandre Livingstone Smith, Agnes Vokaer**, Olivier Gosselain***

**Royal Museum for Central Africa, Belgium*

***Free University of Brussels, Belgium*

Provenance studies have generalized since the end of the 1960s, in the aftermath of Peacock's seminal study of British pottery. Yet, beyond their exploitation in the identification of ancient contacts, trade, or the location of pottery manufacture, the results of paste analyses are often difficult to interpret. While the characterisation of raw materials and their preparation is part of the ceramological routine, it remains difficult to exploit the results in social and historical interpretation. This is not so surprising as pottery studies are still lacking a general analytical grid allowing for the comparison and interpretation of variations at the different steps of the *chaîne opératoire*. Yet for the last 25 years at last, a series of analytical tools have been developed in that regard or borrowed from other fields. In this paper, we would like to unify and order them, in order to propose an analytical grid liable to help archaeologists making sense of the spatial distributions of potting practices. This analytical grid will seek to explain *and* relate micro and macro scales observations.

TRADITIONS TECHNIQUES ET ARTISANAT POTIER CHEZ LES GROUPES WOLOYTA ET OROMO D'ÉTHIOPIE. DES REFERENTIELS ACTUALISTES POUR LE PERFECTIONNEMENT DES PROTOCOLES ANALYTIQUES DES CERAMIQUES PREHISTORIQUES

Jessie Cauliez, Claire Manen*, Vincent Ard*, Joséphine Caro***

**CNRS, UMR 5608 Traces, Maison de la Recherche, Toulouse, France*

*** Université Toulouse Le Mirail-Jean Jaurès – UMR 5608 Traces, Maison de la Recherche, Toulouse, France*

En archéologie préhistorique, s'interroger sur les matières premières argileuses employées dans le façonnage des céramiques revient à questionner les sources d'approvisionnement et par suite la localisation et l'étendue des territoires exploités, à travailler sur les traditions techniques aux premières étapes de la chaîne opératoire comme marqueur identitaire d'un groupe social, à pister les phénomènes de mixités techniques entre attributs typologiques propres à un groupe et techniques spécifiques à un autre, à mesurer l'évolution des procédés techniques dans la diachronie, et enfin à évaluer les contraintes physiques et chimiques de la matière dans les choix de l'artisan potier.

Pour le Néolithique, notre équipe, sur ses terrains en Méditerranée nord occidentale ou dans la Corne de l'Afrique, vise la documentation de trois types de processus historiques complémentaires, pour lesquels les travaux sur les matières premières et leurs traitements sont des informateurs essentiels.

Tout d'abord, des processus de diffusion au moment par exemple de l'émergence des premières sociétés de production. Les travaux sur la néolithisation méditerranéenne nous entraînent en effet à s'interroger sur les mécanismes de diffusion des nouveautés techno-économiques et sur les transferts à longues distances de savoir-faire céramique. Sont également questionnés d'un point de vue socio-économique, les structures de production (domestiques ?) de même que l'usage de certains dégraissants comme signatures culturelles. A la fin du Néolithique, des processus liés au déplacement de communautés hors de leurs limites sont également clairement avérés ; ils aboutissent parfois à la recomposition progressive du système de fonctionnement de sociétés voisines comme c'est le cas avec l'extension du groupe languedocien de Ferrières dans le Jura sur les sites lacustres de Chalain ou au coeur de la Provence lorsque des filiations culturelles italiennes sont sans équivoques dans les productions céramiques et témoignent des puissants courants de circulation liés à la métallurgie du cuivre. Pour ces processus de diffusion, l'analyse des matières premières (localisation des sources, sources d'approvisionnement uniques ou multiples ? ...) est indispensable afin de mesurer si ce sont des canons esthétiques et techniques qui ont diffusé, et qui par la suite ont été adoptés ou au contraire si il y a eu mobilité de personnes.

Ensuite, des processus de cohabitation, par exemple à la fin du Néolithique, lorsque le phénomène Campaniforme inonde toute la Méditerranée. Des situations de métissages sont en effet avérées dans tout le sud de la France avec des vases affiliés aux groupes locaux (comme le Fontbouisse) fabriqués à l'aide de dégraissant à la chamotte, technique dominante dans le Campaniforme et, dans le même temps, des contenants campaniformes présentant du dégraissant à la calcite, caractéristique première des

produits des styles régionaux de Provence. Ces situations traduisent des phénomènes d'emprunt et d'assimilation que seule l'analyse des modalités de préparation de la pâte est susceptible de documenter.

Enfin, des processus de maintien d'isolats culturels, dans des zones en marges, conservatrices qui vont se traduire par la résistance de communautés hybrides réinterprétant leurs produits selon les codes de leur temps, tout en faisant perdurer les caractéristiques typiques de ce qui était la norme à la période précédente. Là encore, la prise en compte des actions sur la matière est fondamentale pour régler cette question.

Un des moyens d'alimenter notre réflexion archéologique sur ces processus historiques et d'affiner notre discours au moment de proposer des interprétations de nos assemblages céramiques néolithiques est sans aucun doute de faire appel à des données actualistes. Dans le cadre de cette communication, nous proposons de présenter les recherches que nous conduisons depuis 2011 avec des communautés de potières en Éthiopie, dans la vallée du Rift, en région Oromiya. Cette recherche, accréditée et financée par un programme Fyssen, poursuit plusieurs objectifs parmi lesquels : constituer des référentiels des procédés techniques pour décupler l'efficacité des protocoles analytiques sur les séries archéologiques préhistoriques et, dans le cadre d'un projet ANR piloté par V. Roux (UMR 7055 Préhistoire et Technologie, Nanterre), travailler sur les phénomènes d'emprunt ou de non emprunt de traits techniques et stylistiques céramiques. Il s'agit ici d'offrir des modèles pour interpréter en Préhistoire les processus de diffusion archéologique et, dès lors, les dynamiques à l'œuvre dans l'évolution des traits culturels et des sociétés. En accord avec la thématique de la séance, nous concentrerons notre présentation sur le premier axe de notre recherche et sur les observations réalisées sur les premières étapes de la chaîne opératoire. Il s'agit surtout de soumettre à la collectivité nos protocoles d'études et nos questionnements archéologiques sur ces référentiels ethnographiques.

CONTINUITY AND CHANGE : THE NEOLITHIC CERAMICS OF SOUTH AND SOUTHERN-EASTERN EUROPE

Michela Spataro

*Department of Conservation and Scientific Research, The British Museum
Institute of Archaeology, UCL London, United Kingdom*

One of the aims of large-scale diachronic research strategies is to see which aspects of pottery production are most persistent, in time and space, and which are replaced regularly. The fact that clay is such a plastic medium permits almost infinite variation in pottery style (form and decoration), allowing archaeologists to construct detailed typochronological schemes for Neolithic Europe. These subdivisions may easily correspond to different technical traditions, as pottery design and manufacture must be directly connected, through the practice of learning the craft of making pottery, but technical traditions are not infinitely variable, due to the physical attributes of the raw materials.

In comparing pottery technology across southern Neolithic Europe, we see both examples of adaptively neutral traditions – persistent differences which have no obvious functional explanation – and of changes in technology that are functionally advantageous, if not essential, for the production of new styles of pottery. Such adaptive changes may be expected to cross existing cultural boundaries, whereas we would not expect potters to replace one adaptively neutral tradition with another, or for adaptively neutral innovations to spread once pottery-making had become established.

In seeking to understand prehistoric potters, we are fortunate that most aspects of pottery production leave traces in potsherds, which can be interpreted using a suite of archaeometric techniques. We can therefore observe continuity and change in raw material procurement, clay preparation, tempering, forming, firing and decoration, on the same spatial and temporal scale as the evolution of pottery styles. The paper will consider which aspects of Neolithic pottery production in south-eastern Europe reflect cultural continuity and which are technical innovations that confer functional advantages but do not imply cultural transformation.

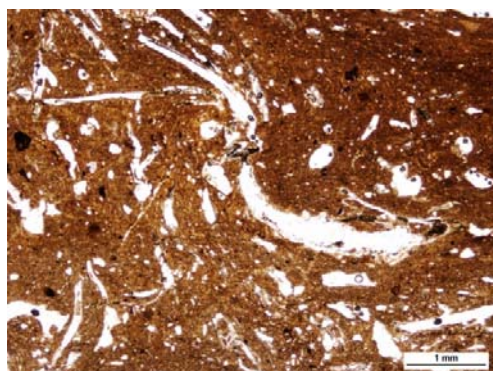
CERAMIC RAW MATERIAL PREFERENCES FROM THE EARLY TO THE LATE NEOLITHIC IN HUNGARY (6000 – 4500 BC)

*Attila Kreiter
Hungarian National Museum, Budapest, Hungary*

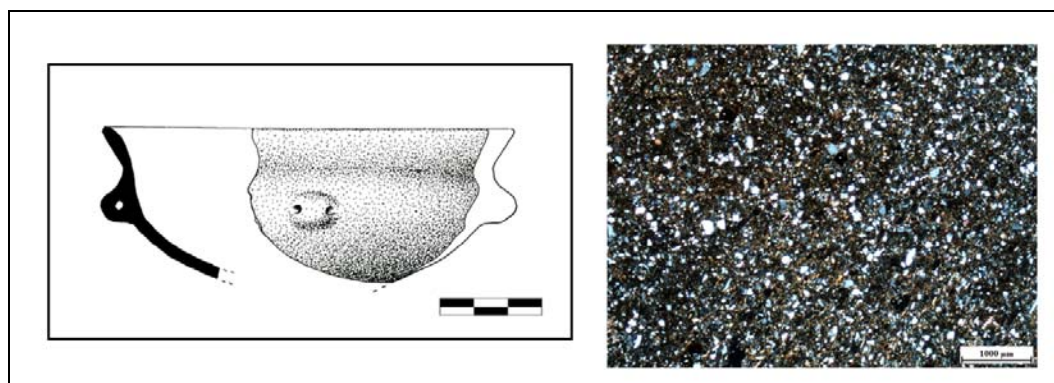
This study compares raw material preferences from the Early to the Late Neolithic in Hungary and assesses the nature of preferences, continuity, and changes in the use of raw materials for potting.

Potting during the Early Neolithic is characterised by very similar preferences in raw materials over a wide geographical area. Potters almost exclusively chose very fine-grained raw materials and tempered them with organic material (chaff). The Middle Neolithic exhibits more variability in raw material preferences; potters seem to have been open to using a wide range of materials for potting. Not only raw material variability increased during this period, but the most stable ceramic technological characteristic of the Early Neolithic, organic tempering, seems to decrease in frequency towards the end of Middle Neolithic. In the Late Neolithic, similar raw material preferences can be identified as during the Middle Neolithic. However, during the Late Neolithic, grog tempering became ubiquitous, and the frequency of organic tempering decreased further, and seems to almost completely disappear by the end of this period.

This study considers that changes in raw material preferences are closely related to increased ceramic production towards the Late Neolithic, and in turn, changes in social relationships that may have resulted in specialisation in ceramic production.



Characteristic Early Neolithic fabric, Gellénháza, Hungary, 1N



Specialised Late Neolithic bowl, Szemely-Hegyes, Hungary, +N

CERAMIC RAW MATERIALS ACQUISITION AND TRANSFER OF TECHNOLOGICAL IDEAS AMONG THE EARLY NEOLITHIC COMMUNITIES AROUND THE WESTERN CARPATHIANS

Agnieszka Czekaj-Zastawny*, Anna Rauba-Bukowska**, Sławomir Kadrow*

****Institute of Archaeology and Ethnology Polish Academy of Sciences,
Centre for Mountains and Uplands Archaeology***

*****Archeometria, ul. Staszica 10/7, Kraków***

In the Early Neolithic two new cultural traditions developed in the East-Central European area: the Linear Band Pottery Culture (LBK) which emerged out of the Starčevo Culture in Transdanubia, and the Eastern Linear Pottery Culture (Alföld Linear Pottery and Bükk Culture) which evolved from the Körös-Criş tradition in the Tisza basin. The formation processes of these Linear complexes took place between 5 600 and 5 300 cal BC.

In the new areas early farmers maintained technological traditions of pottery production passed on from generation to generation. However during this process they used locally available raw materials. Thus local differences are visible in the ceramic technology. On this basis it is possible to study the movements of pottery and technical innovations between various settlement regions. In this paper we want to show this kind of relation between neighbouring settlements and between regions on both sides of the Western Carpathians - Lesser Poland and Eastern Slovakia.

Technological analyses were carried out on pottery and raw materials samples (almost 400 thin sections). During our research a number of different features were examined: sourcing and selection of materials, preparation and composition of pottery paste, forming and firing methods.

POTTERY MAKING RECIPES AT THE DAWN OF THE METAL AGE : SELECTION AND PROCESSING OF RAW MATERIALS AT BELOVODE AND PLOČNIK

Silvia Amicone, Patrick Quinn*, Miljana Radivojević*, Thilo Rehren***

**Institute of Archaeology, University College London, London, United Kingdom*

***UCL Qatar, Hamad bin Khalifa University, Doha, Qatar*

The Serbian Neolithic/Chalcolithic sites of Belovode and Pločnik have recently yielded some of the earliest known evidence for copper smelting and metal artefacts in Eurasia, dated at c. 5000 BC, thereby significantly increasing our understanding of the rise of metallurgy in this part of the world. This study focuses on the development of pottery production technology leading up to and following the emergence of copper metallurgy at these important sites (c. 5400 – 4600 BC).

To achieve this, a representative selection of pottery sherds representing the different techno-stylistic groups present at the sites from the Gradac phase, that records the beginnings of metalworking as well as from pre-metal Vinča A-B phases have been sampled. These specimens are currently under study with an integrated analytical approach including thin section petrography, X-ray fluorescence (XRF), X-Ray powder diffraction (XRPD) and Scanning Electron microscopy (SEM).

All conclusions given here are results of this ongoing research that highlights the plethora of choices applied during the pottery production, reflecting the use of different clay sources and technological procedures across different phases. Our results in particular elucidate on aspects connected to the procurement and processing of raw material. This research makes a significant contribution to the study of late Neolithic and early Chalcolithic communities in the Balkans at a time of the major technological change demonstrating the remarkable craftsmanship.

MATIERES PREMIERES ET TECHNOLOGIE : L'EXEMPLE DE LA CERAMIQUE IMPRIMEE A COLLE SANTO STEFANO (ITALIE)

*Lucia Angeli, Cristina Fabbri
Università di Pisa, Dipartimento di Civiltà e Forme del Sapere, Italia*

Nous prendrons ici l'exemple du site représentatif du Néolithique ancien du versant adriatique de la péninsule italienne : Colle Santo Stefano (AQ, Abruzzes). Nous envisagerons les aspects typologiques et ainsi que les éléments technologiques pour mettre en évidence des changements au sein de la production céramique.

L'occupation du site de Colle Santo Stefano au Néolithique ancien (Céramique Imprimée medio adriatique) s'étend sur une période de quatre siècles (entre 5840-5460 en chronologie calibré). La présence de structures significatives a permis d'identifier au moins trois phases d'occupation (Radi et Verola, 1996 ; Radi et Danese, 2001).

L'étude typologique de la céramique a permis de reconnaître une large gamme des types caractéristiques. L'étude technologique de la céramique a, quant à elle, permis de reconnaître trois groupes de pâte (grossière, épurée et fine) qui se différencient par leurs caractéristiques minéralogiques et granulométriques. La fréquence de ces groupes évolue au cours des trois phases d'occupation du site : dans la première phase, la pâte grossière, caractérisée par un dégraissant calcaire ou volcanique, domine nettement, tandis que dans les phases suivantes elle diminue progressivement comme la céramique épurée en faveur de la céramique fine (Fabbri, 2006 ; Angeli, Fabbri, 2010 ; Fabbri, 2011). En ce qui concerne les techniques de décor, on observe que pour les trois types de pâte, l'incision et l'impression sont employées dans des proportions quasi similaires. Toutefois on relève une certaine prédominance de la technique de l'incision en association avec les pâtes grossières, en revanche, l'emploi de l'impression seule ou des deux techniques combinées paraît plus fréquemment associé aux pâtes fines (seul le décor au doigt est plus fréquent sur la pâte grossière).

Une étude archéométrique de ces productions est en cours. Un ensemble de treize échantillons a fait l'objet d'une étude pétrographique en lames minces : 7 échantillons constitués d'une pâte grossière, dont un tesson décoré à segments incisés et 6 échantillons à pâte épurée, dont deux tessons spécifiques, l'un correspondant à une petite casserole et l'autre à une tasse globulaire. Une étude au microscope électronique à balayage a également été réalisée dans le but de répondre à quelques questions soulevées lors de l'observation des lames minces et pour préciser la composition des pâtes. Quelques tessons au décor chromatique ont enfin été analysés par la technique du LIBS. Dans ce cas, nous avons sélectionné les tessons pour lesquels la couleur était suffisamment épaisse pour ne pas avoir été contaminée par les composants de la pâte.

Les auteurs discuteront en particulier les questions suivantes :

a. L'analyse archéométrique a montré que l'argile était choisie en fonction des produits que les artisans souhaitaient réaliser. Nous avons mis en évidence une différence entre les pâtes du *groupe traditionnel* à « impression et incision » et celles du *groupe méridional* à « rocker, microrocker, *sequenza* », qui rappelle les modèles méridionaux soit par leur décor soit par leur exécution. Nous évoquerons aussi les quelques fragments de poterie peinte rappelant la production céramique méridionale (*Lagnano da Piede*). A Colle Santo Stefano comme dans certains sites du Sud-est italien (Trasano et Trasanello, MT Basilicate) pour le décor peint de couleur brune des pigments d'origine organique et inorganique (oxyde de fer) sont utilisés.

b. Pour élargir notre propos, nous présenterons également une étude réalisée sur des outils céramiques interprétés comme des estèques. Huit pièces archéologiques ont fait l'objet d'un examen au microscope binoculaire. Des reproductions expérimentales ont été menées en parallèle. L'approche expérimentale a permis de confirmer et compléter les observations faites sur le matériel archéologique. L'étude a ainsi permis de formuler certaines hypothèses sur leur utilisation en fonction des différents matériaux reconnus.



Colle Santo Stefano (L'Aquila) décor à « impression et incision »



Colle Santo Stefano (L'Aquila) décor à « rocker, microrocker et sequenze »

CERAMIC FABRICS AS INDICATORS OF HOUSEHOLD IDENTITY? THE MULTICOLOURED POTS OF THE STARCEVO-CRIȘ SETTLEMENT AT TĂȘNAD, ROMANIA

*Ulrike Sommer, Silvia Amicone, Patrick Quinn and Hannah Woodfield
Institute of Archaeology, University College London, London, United Kingdom*

The Criș Site of Tășnad Sere (Satu Mare Province, Romania) is well known by previous rescue excavations, which have uncovered the remains of three post-built-houses, as well as possible pit-houses.

A small research excavation aims at uncovering an occupation surface as well as sub-surface features in greater detail in order to understand the internal organization of the village and the relationship between households. The three-dimensional recording of finds shows that in the occupation layers, sherds of one pot seem to have often been deposited together in discrete dumping events.

Pots are only sparsely decorated by applied ornaments and finger-pinched decoration, but show very different surface and fabric colours.

The present study looks at a sample of sherds via ceramic petrography and p-XFR and EDS-SEM analysis in order to characterise the raw materials employed to produce the pottery at the site, the technological processes through which the colouring was achieved and to ascertain how it was influenced by taphonomic factors.

The general aim of the study is to shed light on whether individual households inside one settlement tried to achieve different identities and how this is reflected in pottery fabric and potentially a different chaîne opératoire.

In this work we discuss the preliminary result of this study and investigate the relation between shape and thickness as well as temper, in order to work out fabric groups. In a later phase of our study, we will map these groups and see how they are related to different dumping events and different households. The results will be compared with raw material spectra of lithic artefacts (Obsidian vs. flint from different sources) and other types of artefacts as well as plant remains.

CERAMIC PRODUCTION AND VILLAGE COMMUNITIES DURING THE EARLY NEOLITHIC IN FRANCE AND BELGIUM: QUESTIONS ABOUT TEMPERS AND FORMING PROCESSES

Louise Gomart, Claude Constantin*, Laurence Burnez-Lanotte* ***

**UMR 8215 Trajectoires Paris 1 Panthéon-Sorbonne CNRS, France*

***University of Namur, LIATEC, Belgium*

Many studies have emphasized the morphologic and dimensional uniformity of the Linear Pottery (LBK) in central-western Europe. With the most variable element at first sight being decoration patterns, a large number of studies have focused on this parameter. This enabled the development of very fine chronologies, which are so far the most accurate sequences for the European Neolithic with a precision of nearly fifty years.

While formal features of western LBK pottery are very stable, one category stands out by shape and decoration: the so-called “Limburg pottery”. These vessels are found in some LBK settlements in north-eastern France, Belgium and the Netherlands. The reason of their presence in LBK sites has been much debated over the past twenty years. Based on their unusual shape and decoration patterns, some researchers suggest that they were made by indigenous Mesolithic groups, partially acculturated by Neolithic communities. For other researchers, these vessels correspond to a functional category of LBK pottery and were produced by LBK communities themselves. These questions lead to the issue of the recognition of archaeological ceramic traditions and their interpretation in terms of cultural and social identities. Does the morphologic and dimensional uniformity of LBK pottery come with a homogeneity of technical behaviours? How was ceramic production organized within the villages and at the micro-regional level? Do the LBK and Limburg vessels imply common know-how or do they represent rather distinct technical entities?

To address these issues from the perspective of this workshop, we will examine the variability structure of two stages of the *chaîne opératoire*: the process of clay treatment by addition of non-plastic elements (based on analysis of tempers by one of us: C. Constantin) will be thus confronted with the forming methods implemented on the key sites of Cuiry-lès-Chaudardes (Picardy, France) and Rosmeer (Limburg, Belgium). In Cuiry-lès-Chaudardes, the large number of buildings (33 well-preserved houses) and finds (2000 recognized vessels), as well as the short duration of occupation (about one hundred years) facilitate the recognition of domestic units, enabling a detailed study of the structure of production of the LBK pottery in the village, from its foundation to its desertion. In Rosmeer, the large number of Limburg vessels recognized within the assemblage (34 vases) enables a comparative analysis of the technical behaviours implemented for the manufacture of the vessels of LBK style on the one hand, and of Limburg style on the other hand.

The characterization of the pottery manufacturing processes in terms of clay recipes and forming methods enables the study of these assemblages from the angle of their producers and consumers. Ultimately, it raises many questions that we will submit to the audience as part of this workshop. Based on the links observed between clay recipes and forming methods, we will investigate the context of production (domestic? specialized?) of the LBK and Limburg pots and the organization of apprenticeship networks at the scale of domestic units. We will then examine the differential rhythms of evolution of the two analysed ceramic parameters and will raise the issue of the transmission mechanisms of technical know-how. Finally, we will discuss the possible interactions between contemporary producers (imitation, borrowing?) and between domestic units (vessels exchanges between households?).

COMPOSITIONAL ANALYSIS OF LBK CERAMICS FROM THE HESBAYE REGION OF BELGIUM : PROGRESS, PROBLEMS, AND PROSPECTS

Mark Golitko
The Field Museum of Natural History, Chicago, USA

This paper presents the results of chemical and petrographic analysis of nearly 400 ceramic vessels from five early Neolithic (LBK/Rubané) villages (c. 5200-5000 BC) in the Hesbaye region of eastern Belgium, as well as an intensive clay survey of the diverse geological units present beneath the loessic soils that blanket the area.

Compositional analysis by LA-ICP-MS and petrographic examination indicates the existence of eight distinct chemical/mineralogical types within the studied sherds, some very likely indicative of local production, and others plausibly obtained from afar. Most of the studied vessels appear to have been produced from widely distributed locally available pre-Pleistocene geological formations, but even these locally produced vessels exhibit a very large amount of chemical and mineralogical diversity.

Possible environmental and social reasons for this diversity are discussed. Changes in production over time are discussed both in relation to typical models of Neolithic ceramic production (i.e., the “domestic mode of production” versus specialist production) as well as evidence for an increase in competition and violence during later stages of LBK settlement in the Hesbaye region.

**EXPLORING COMPOSITIONAL VARIABILITY OF EARLY NEOLITHIC
POTTERY : A CASE STUDY FROM VAUX-ET-BORSET
(BLICQUY/VILLENEUVE-SAINT-GERMAIN,
4950 - 4650 CAL BC, CENTRAL BELGIUM)**

*Barbara van Doosselaere**, *Mark Golitko***,
*Laurence Burnez-Lanotte**, *Damien Deldicque****

**University of Namur, Belgium*

***The Field Museum of Natural History, USA*

****ENS-Laboratory of Geosciences, Paris, France*

Early Neolithic pottery of Belgium commonly exhibits significant compositional variability both at the intra- and inter-site scales. While this has long been acknowledged, the exact reasons for such variability are still poorly understood. This variability has generally been taken to indicate household production and consumption (i.e., pots being made locally, at the family-level, and transported over short distances). Several studies have however questioned this assumption, providing evidence of inter-site pottery circulation and the possible existence of potting specialists.

As a contribution to this debate, we present preliminary results of an ongoing petrographic and geochemical analysis of selected ceramic samples from the Early Neolithic site of Vaux-et-Borset (Blicquy/Villeneuve – Saint-Germain, 4950 - 4650 cal BC, central Belgium). In order to characterise the technical know-how of early Neolithic potters and address provenance issues, thin section petrography, SEM-EDS, EMPA and LA-ICP-MS analyses were carried out. Results are compared to local and regional geology, as well as petrographic and geochemical data available from previous ceramic studies.

Our analysis reveals that significant compositional diversity exists in the ceramic assemblage of Vaux-et-Borset. Based on petrographic examination and geochemical analyses, ten non-calcareous compositional groups with variable micaceous content have been defined. A large number of outliers, either petrographically or geochemically distinct, also occur amongst the studied sherds. Differences in both clay recipes and provenance explain this diversity, indicating that several kinds of clayey raw materials as well as tempering agents were selected by potters and that local as well as imported products were possibly utilized at Vaux-et-Borset. These results provide new insights into Early Neolithic pottery production and distribution in central Belgium and lead us to reappraise the prevailing household-based production model.

THE USE OF MICROTOMOGRAPHY FOR STUDYING LBK POTTERY SAMPLES FROM BYLANY AND TESETICE SITES (CZECH REPUBLIC)

Klara Neumannova, Jan Petrik***

**Czech Academy of Sciences, Czech Republic*

***Masaryk University, Czech Republic*

The early Linear Pottery culture (LBK) ceramic production is characterized by the use of organic temper. Our aim was to identify the properties and the origin of the voids left by the burnt out organic particles. μ CT analysis allows the spatial visualization of the shape and sort of inclusions.

An experimental reference collection was made combining different quantities and types of organic materials mixed with natural clay. Especially tempering by cow dung produced samples with void morphology very similar to the LBK pottery. Different shaping techniques were also tested in these experiments. The μ CT analysis allowed us to recognize organization of the pores and consequently recognize shaping techniques in the inner structure of the experimental artefacts as well as of the LBK potsherds.

Microtomography is especially well adapted to the study of void and temper spatial organization as a non-destructive three dimensional analysis, but the pottery of latter occupation phases, which contains mostly mineral inclusions, is studied rather by different analytical tools (thin section petrography and SEM) than by μ CT. For a complex technological study a combination of complementary methods is crucial.

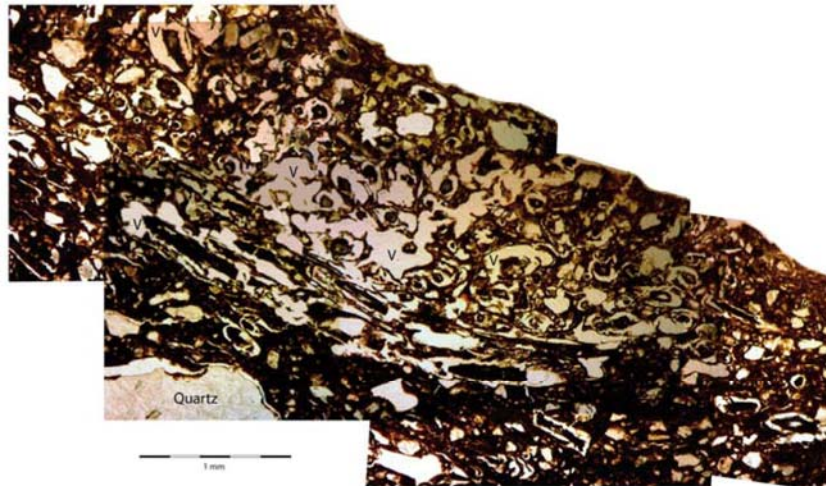
ETUDE PETROGRAPHIQUE DES DEGRAISSANTS AJOUTES DANS LES CERAMIQUES DU NEOLITHIQUE ANCIEN ET MOYEN EN BASSE-NORMANDIE

Denis Jan, Xavier Savary
Conseil général du Calvados

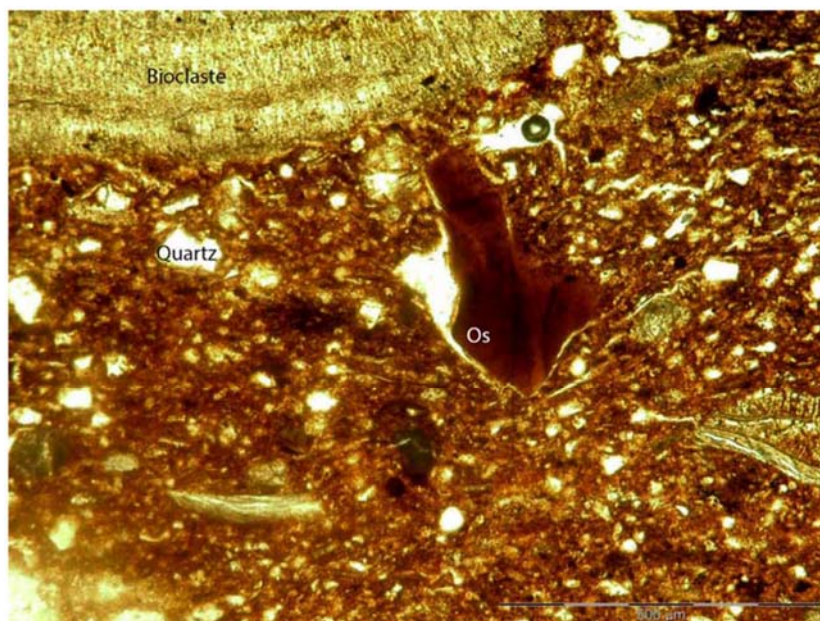
La céramique est le résultat de plusieurs opérations qui intègrent des choix spécifiques de la part du potier. L'utilisation d'un dégraissant organique d'origine végétale est bien observée pour le Néolithique du nord de la France et de Belgique, bien qu'il ne soit pas toujours possible de statuer entre un apport accidentel ou volontaire. Les observations macroscopiques du matériel végétal conservé dans les céramiques permettent d'identifier l'emploi courant de mousses, notamment *Neckera crispa*, et plus rarement de graines de plantes à fleurs comme celles du pavot sauvage. Un corpus de trois cent cinquante-six lames minces de céramiques, provenant de trente sites de Basse-Normandie et couvrant l'ensemble de la période Néolithique, a été réalisé afin d'identifier quelles espèces végétales sont mises en œuvre et de préciser les périodes d'apparition de leur utilisation (160 lames minces du Néolithique ancien, 182 du Néolithique moyen et 14 du Néolithique final).

Un procédé de reconnaissance des végétaux en lames minces a été élaboré afin d'identifier les empreintes observées au microscope polarisant. Des briquettes d'argiles dégraissées avec différentes espèces végétales ont été réalisées et cuites pour constituer une base de données de lames minces expérimentales. Ces briquettes permettent alors d'observer, au microscope polarisant, les empreintes laissées par des mousses, du pavot, du lin, des céréales et d'établir des critères de différenciation entre ces espèces. Les caractères morphologiques observés à partir du protocole expérimental ont ensuite été comparées aux inclusions végétales présentes dans les lames minces issues de céramiques néolithiques. Il a été possible d'identifier dans les tessons les empreintes très fines produites par les mousses du référentiel, sans pourtant pouvoir discerner les genres et les espèces. Les céramiques dégraissées avec des mousses renferment souvent des inclusions circulaires vides ou contenant du matériel carbonisé dont il est parfois possible de distinguer les tissus cellulaires. Ces tissus montrent de fortes analogies avec ceux des tiges de mousses actuelles, il s'agirait vraisemblablement d'un tissu parenchymateux. Quelques inclusions présentent des sections longitudinales avec les insertions des feuilles et parfois des coupes de feuilles. Ces dernières inclusions permettent de pousser la détermination des mousses au genre voir à l'espèce. Les observations au microscope polarisant ont permis de mettre en évidence la présence de fragments de bois dans une lame mince.

Enfin, d'autres dégraissants ajoutés dans la pâte ont été remarqués pendant l'analyse pétrographique. Il s'agit le plus souvent d'esquilles osseuses calcinées et pilées, parfois accompagnées d'inclusions végétales. Certaines pâtes céramiques renferment des esquilles de silex qui pourraient avoir été utilisées comme dégraissant. La chamotte est également identifiée de façon plus ou moins fiable sur plusieurs sites. Elle se présente généralement comme une masse argileuse et ferrugineuse fine, bien délimitée et contenant des minéraux qui ne sont pas ou peu présents dans la pâte. L'identification de ce dégraissant est délicate puisqu'il peut également s'agir de grumeaux d'argile imputable au malaxage de l'argile ou encore d'agrégats résiduels inclus accidentellement dans la pâte.



Microphotographie de la pâte d'un vase du Néolithique moyen 1 du site d'Ernes (Calvados, Basse-Normandie). La présence de végétaux induit une abondante porosité contenant souvent des restes carbonisés (V).



Microphotographie de la pâte d'un vase du Néolithique moyen 1 du site de Condé-sur-Iffs (Calvados, Basse-Normandie). Une esquille osseuse carbonisée est visible auprès des bioclastes.

CONNECTING PASTE RECIPES WITH OTHER ACTIVITIES: MIDDLE NEOLITHIC POTTERY IN THE PARIS BASIN

Mérodie Barray
Paris 1 Panthéon-Sorbonne university
UMR 8215 Trajectoires

Compared to earlier periods, the middle Neolithic (4600-3800 BC) sees an intensification in the supply of many categories of raw material. It is therefore a particularly interesting period for the study of the acquisition and processing of clays and tempers by Neolithic potters.

My study focuses on 20 sites, mostly located in the Paris Basin and reflecting cultural diversity through the middle Neolithic (Cerny, Roessen, Chasséen, Michelsberg, Spiere...). The aim is to investigate exchange and transmission of know-how, through an examination of pottery paste recipes at site, regional and cultural levels.

As far as temper is concerned, petrographic analysis shows that the rule seems to be diversity (shells, flint, grog, limestone, sand...). However certain practices vary according to the site under consideration. It is therefore necessary to study the sites' petrographic environment. This includes both the geological environment and the materials used for other craft activities. My hypothesis is that the choice of raw materials used for pottery-making was linked to other activities taking place in or around the sites.

This hypothesis can be tested using reference collections. For each site, work in progress involves crushing samples from flint, shell, and limestone artefacts, which are then added to industrial clay in order to be able to produce thin-sections for analysis. Guided by observations made on the archaeological material, existing reference collections for clay and flint resources (*argilothèques*, *lithothèques*) in the Paris basin are being expanded with more samples from survey in the field. Research will also involve linking pottery and the macrolithic industry through experimental and use-wear studies on temper manufacture.

CHEMICAL SIGNATURES OF MINERAL INCLUSIONS AS A TRACER OF THE ORIGIN OF CERAMICS: THE CONTRIBUTION OF LA-ICP-MS ANALYSIS

Benjamin Gehres *, *Guirec Querré***
*with the collaboration of Jean-Christophe Le Bannier****
*and François Pustoc'h***

* *Rennes 2 University, France*

** *Rennes 1 University, France*

*** *CNRS, Rennes, France*

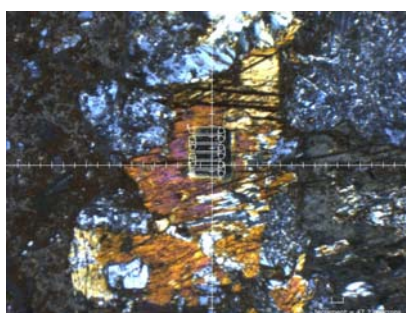
The application of Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) to ceramics has recently led to major advances in raw materials characterization, for example in sourcing fluvial shell temper (Peacock *et al.*, 2007), U/Pb dating of detrital zircon in ceramic pastes (Tochilin *et al.*, 2012) or distinction between shell naturally present in clay and shell intentionally added as temper (Gehres *et al.*, in press).

In this paper we outline a new approach, based on LA-ICP-MS analysis of mineral inclusions, that offers finer identification of compositional groups. A case study of two Iron Age pottery workshops from Brittany (western France) is presented. LA-ICP-MS analysis of amphibole inclusions in ceramic samples from these workshops reveals that the potters used gabbro-granitic clays derived from two different gabbro massifs. Previously, neither petrographic observation nor chemical analysis by P-XRF had been able to distinguish these two sources. It was generally considered that the gabbro-granitic ceramics were mainly produced by a single workshop at Trégomar. However, the existence of a second source was suggested by the discovery that Middle Neolithic (Giot & Querré, 1987) and Bell Beaker vessels (Morzadec, 1995) from the Barnenez monument had been made with clay from the massif of Saint-Jean-du-Doigt. This could also have been a major source of gabbro-granitic clays during the Iron Age - a hypothesis reinforced by the fact that ceramics with a gabbro-granitic composition are extremely common in prehistoric and protohistoric assemblages in this region (Giot *et al.*, 1986; Daire *et al.*, 2012).

Lastly, recent progress in this sourcing method is described. Amphiboles are not the only minerals that can be used as a geological tracer. Other elements can be analysed, making it possible to determine precisely the geological origins of clays and thus improve understanding of exchange networks.



System of laser ablation ICP-MS at the Laboratoire Archéoscience (Rennes)



Laser ablation of an amphibole

List of Contributors

AMICONE Silvia	University College London, UK silvia.amicone.10@ucl.ac.uk
ANGELI Lucia	University of Pisa, Italia luciaangeli78@yahoo.it
ARD Vincent	CNRS, France vincent.ard@univ-tlse2.fr
ARNOLD Dean E.	The Field Museum of Natural History, USA darnold@fieldmuseum.org
BARRAY Mélodie	University Paris 1, France Melodie.Barray@univ-paris1.fr
BURNEZ-LANOTTE Laurence	University of Namur, Belgium laurence.burnez@unamur.be
CARO Joséphine	University of Toulouse Le Mirail-Jean Jaurès, France josephinecaro@hotmail.fr
CAULIEZ Jessie	CNRS, France jessie.cauliez@univ-tlse2.fr
CONSTANTIN Claude	CNRS, France
CZEKAJ-ZASTAWNY Agnieszka	Polish Academy of Sciences, Poland aczekajzastawny@gmail.com
FABBRI Cristina	University of Pisa, Italia cristina.fabbri1@virgilio.it
GEHRES Benjamin	University Rennes 2, France benjamin.gehres@gmail.com
GOLITKO Mark	The Field Museum of Natural History, USA mgolitko@fieldmuseum.org
GOMART Louise	University Paris 1, France louise.gomart@gmail.com
GOSSELAIN Olivier	Free University of Brussels, Belgium olivier.gosselain@africamuseum.be
JAN Denis	Conseil général du Calvados, France jan.denis@ymail.com
KADROW Sławomir	Polish Academy of Sciences, Poland slawekkadrow@gmail.com
KREITER Attila	Hungarian National Museum, Hungary attila.kreiter@gmail.com
LIVINGSTONE SMITH Alexandre	Royal Museum for Central Africa, Belgium alexandre.smith@africamuseum.be
MANEN Claire	CNRS, France claire.manen@univ-tlse2.fr
NEUMANNOVA Klara	Czech Academy of Sciences, Czech Republic neumannova.klara@gmail.com

PETRIK Jan	Masaryk University, Czech Republic petrik.j@mail.muni.cz
QUERRÉ Guirec	University Rennes 1, France guirec.querre@univ-rennes1.fr
QUINN Patrick	University College London, UK patrick.quinn@ucl.ac.uk
RADIVOJEVIĆ Miljana	University College London, UK m.radivojevic@ucl.ac.uk
RAUBA-BUKOWSKA Anna	Archeometria, Poland a.rauba@yahoo.pl
REHREN Thilo	University College London, Qatar th.rehren@ucl.ac.uk
SAVARY Xavier	Conseil général du Calvados, France Xavier.SAVARY@calvados.fr
SOMMER Ulrike	University College London, UK u.sommer@ucl.ac.uk
SPATARO Michela	The British Museum, University College London, UK MSpataro@britishmuseum.org
VAN DOOSSELAERE Barbara	University of Namur, Belgium barbara.vandoosselaere@gmail.com
VOKAER Agnes	Free University of Brussels, Belgium agvokaer@ulb.ac.be
WOODFIELD Hannah	University College London, UK hannah.woodfield.12@ucl.ac.uk