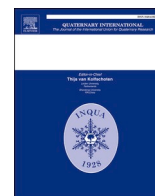


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Africa under the microscope: What's new in techno-functional analyses in archaeology?

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This Quaternary International special issue entitled 'Africa under the microscope: What's new in techno-functional analyses in archaeology?' is the result of session that was hosted by Giulio Lucarini and Sonja Tomasso during the 15th Congress of the PanAfrican Archaeological Association (PAA) (see [Fig. 1](#)).

The PAA was established in January 1947, when the 1st Pan-African Congress on Prehistory was organised in Nairobi (Kenya), under the impetus given by Louis Leakey. Since the very beginning, the organisation was characterized by a strong multidisciplinary character. The main aims of the PAA have always been to encourage exchange among researchers and students of prehistory, palaeontology and geology working in Africa, and to promote inter-African links and cooperation. This multidisciplinary soul was further reinforced during the 4th

Congress organised in 1959 in Kinshasa (then Léopoldville) in the Democratic Republic of the Congo, when the name was officially changed to Pan-African Congress of Prehistory and Quaternary Studies. The name was then further modified to PanAfrican Association for Prehistory and Related Studies at the 8th Congress, in Nairobi in 1977, when a new revised constitution for the organisation was also approved.

The 15th PanAfrican Congress was held at the faculty of Science in Rabat from 10th to 14th September 2018, and was organised by the University of Mohammed V (Rabat), the Institut National des Sciences d'Archéologie et du Patrimoine (INSAP, Rabat), and the Universities Mohammed I^{er} (Oujda) and Moulay Ismail (Meknès). The 'Africa under the microscope' session was held on Tuesday 11th September 2018.

The multidisciplinary character, which has inspired the PAA over 73 years of its history, was the same that moved us in the organisation of our session in Rabat. In recent decades, combining technological and functional approaches has become pivotal to archaeological research. Methods such as experimental archaeology, use-wear analysis, residue, petrographic and geochemical analyses, applied on stone tools, pottery or metal have created a broad spectrum of data. The combination of methods often provides important insight into the nature of an archaeological artefact, the way it was originally manufactured, used and modified, but also into the organic component of prehistoric technology, which has often not been visibly preserved. Their application to archaeological assemblages may also help address issues relating to evolutionary processes, subsistence strategies, human behavioural change and movements.

In Africa the potential of technological and functional analyses is now well-known. These approaches have become fundamental in the design of numerous archaeological projects. Functional approaches of analysis on stone tools appeared in African archaeology in the 70's and 80's (Beyries, 1987; Binneman and Deacon, 1986; Clark and Prince, 1978; Keeley and Toth, 1981; Sussman, 1987) and since then they have been widely adopted, and proven to be crucial to addressing specific research questions, such as the reconstruction of hafting techniques (De

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la Pena et al., 2018; Lombard, 2005, 2007; Rots and Van Peer, 2006; Rots et al., 2011, 2017; Tomasso and Rots, 2018; Van Peer et al., 2008; Wadley et al., 2009), or the formation and development of micro-wear on different types of raw materials (Bello-Alonso et al., 2019; Lemorini et al., 2014, 2019). In recent years, combined multianalytical approaches have allowed us to obtain high-resolution information on the use of ancient tools and diet that was unimaginable in the past. Scholars working on the organic and inorganic residue analysis extracted from pottery and stone artefacts, from MSA and Holocene sites in North, East and South Africa have had great success in better interpreting their use (Domínguez-Rodrigo et al., 2001; Dunne et al., 2012, 2016; Grillo et al., 2020; Langejans, 2012; Lombard and Wadley, 2007, 2009; Rots and Williamson, 2004; Rots et al., 2017; Wadley and Lombard, 2007). Recently, the possibility to radiocarbon-date the organic micro-residues extracted from pottery (Casanova et al., 2020) has also opened up new horizons for better exploring the fluid interactions, which linked humans, animals, plants, and artefacts through time. Equally, the development of geochemical approaches have allowed us to establish the technological requirements governing decision making processes relating to the choice of certain types of raw material over others, and to track the movements of human groups (Lucarini et al., 2018; Negash and Shackley, 2006).

Given the increasing application of these multianalytical approaches, the organisation of this session was considered an opportunity to bring together scholars working in Africa who combine different techniques, so that they could exchange ideas, objectives, practical problems or constraints encountered during their studies, and to encourage multidisciplinary debate. The definition ‘under the microscope’ we adopted was intended *sensu lato* and in the most possible inclusive meaning, and it is not only related to the approaches of analysis which require proper microscopic equipment.

Eighteen oral communications and four posters were presented during the session organised at the 15th PanAfrican Congress in Rabat. This special issue includes eleven original contributions on functional (use-wear and organic micro-residue), technological (lithic reduction

processes, and petrographic and geochemical analysis of raw materials, both performed on lithics and ceramics), and ethnographic approaches, performed on stone tools or pottery assemblages, coming from archaeological contexts located in Mediterranean Africa, the Sahara, the Nile Valley and Southern Africa. The first group of six articles includes the contributions on knapped and ground stone tools; the second group of five articles includes the works carried out on pottery assemblages. Within each group, the articles are presented geographically and then chronologically.

The first four articles of the first group deal with functional and technological analysis carried out on knapped stone tools from three Middle Stone Age (hereafter MSA) and several Epipalaeolithic sites located in the Maghreb.

Ignacio Clemente-Conte and colleagues (Clemente-Conte et al., 2020, this volume) present the results of a use-wear analysis performed on a selection of artefacts from the rock shelter of Benzú, located on the North African coast, in the vicinity of the Strait of Gibraltar. From a technological and chronological point of view, the scrapers and points they analysed were attributed to the so-called ‘Mode 3’ (Mousterian or MSA). The results of functional analysis are interpreted as being an indication for seasonal occupation. Additionally, different patterns of activities were identified for different points in time at the site. Based on careful stratigraphic analysis, it has been determined that during some phases activities were more oriented to animal processing, and in other phases there was a focus on horticulture. Further functional evidences revealed that the points, identified as projectiles, were most likely used as scrapers for domestic tasks. These results make a significant contribution to our understanding of the utilisation of artefacts and activities at the site.

Sonja Tomasso and colleagues (Tomasso et al., 2020, this volume) discuss hafting practices during the MSA. Their article presents the results of functional analysis including a detailed use-wear and residue analysis, performed on tanged and non-tanged tools from the rock shelter of Ifri n’ Ammar in the Moroccan Western Maghreb. The results demonstrate that hafting played an important role within the various



Fig. 1. Participants of the ‘Africa under the microscope’ session at the PanAfrican Congress in Rabat (from left to right: Freda Nkirete, Elena A.A. Garcea, Julie Dunne, Giulio Lucarini, Thomas Pelmoine, Christine Sievers, Rym Khedhayer, Nadia Bahra, Giacomina Petruccio, Sonja Tomasso, Dries Cnuts, Annalisa Christie, Jörg Linstädter (photo: Asmae El Kacimi).

technical systems of Ifri n' Ammar. Hafting was not restricted to specific tool types, or specific gestures or tasks, but concerned a broader range of morphologies and tool functions. Moreover, the examination of hafting traces on the tanged and non-tanged tools revealed the recurrent presence of animal materials within the process of stone tool hafting, which is interpreted as a key factor that affected changes in stone tool morphologies during the Aterian.

The article by Nadia Bahra and colleagues (Bahra et al., 2020, this volume) discusses the exploitation of raw materials and the technological characteristics of the MSA assemblage at the rock shelter of Oued Bousmane in the Algerian Eastern Maghreb. The results of their detailed analysis suggest a preference for utilising local flint, which was accessible and widespread around the rock shelter. Their study of the technological aspects of tool production highlighted the diversity of reduction methods, including a recurrent centripetal Levallois, a discoid, and a non-Levallois laminar technology. The typological analysis also revealed diversity, highlighting the variability of the MSA lithic pattern in Eastern Algeria and particularly in the Tebessa region.

Bernard Gassin and colleagues (Gassin et al., 2020, this volume) present the results of a functional and technological analysis carried out on a large collection attributed to the Epipalaeolithic, from several sites in the Eastern and Central Maghreb. Their analysis was focused on unretouched blades and bladelets from the Columnnarian horizon, blades and backed blades from the Typical Capsian, and notched blades and bladelets from the Upper Capsian. The study, which was aimed at investigating the role of lithic tools in the exploitation of plant resources, provided new insights into methods of plant harvesting, the technological characteristics of the artefacts and their design. The results of this work demonstrate the importance of integrating functional studies in the examination of the composition of lithic assemblages.

The last two articles of the first group report two study cases from the Egyptian Sahara and Red Sea coast.

Giulio Lucarini and Anita Radini (Lucarini and Radini, 2020, this volume) examine the grinding implements from the 8000-year-old site of Hidden Valley, in the Farafra Oasis, Egyptian Western Desert. The general assumption of a direct link between grinding tools and plant exploitation was tested, and challenged, using an integrated method, combining low- and high-power use-wear and plant micro-residue analyses. The grinding stones analysed showed very developed wear, mainly consistent with plant processing activities. The same artefacts also yielded starch granules together with a small number of phytoliths. A number of Poaceae tribes (grasses) were represented in the micro-remain assemblage. Their results integrate previous archaeobotanical work carried out on the plant macro-remains from the site and stress the important role played by wild grasses in the economy of the Holocene communities of the Eastern Sahara.

The last article of the first group, by Giulio Lucarini and colleagues (Lucarini et al., 2020, this volume), presents the results of the geochemical analysis carried out on the obsidian artefacts discovered at the Egyptian harbour site of Mersa/Wadi Gawasis, along the Red Sea coast. During the early 2nd millennium BC, the site hosted a port city from where Egyptian expeditions set sail directed to the South, on both edges of the Red Sea. Obsidian artefacts discovered at the site were geochemically analysed, together with geological samples from the obsidian Kusrale source in Eritrea. The major element concentrations were determined by SEM-EDS analysis and the trace element concentrations were obtained by LA-ICP-MS method. A comparison of geochemical results obtained on the archaeological artefacts and geologic samples, together with published data on different geological obsidian outcrops from the Horn of Africa and the Southwestern Arabian peninsula, allowed a determination of the provenance of the Mersa/Wadi Gawasis obsidian artefacts in both the Kusrale source of Eritrea, and the volcanic area of Dhamar Reda in Yemen.

The second group of articles addresses techno-functional and ethnographic analyses carried out on pottery assemblages from the Western Maghreb, the Nile Valley and Southern Africa.

The article by Julie Dunne and colleagues (Dunne et al., 2020, this volume) investigates the timing and extent of the adoption of herding and cultivation during the Early Neolithic in the Western Maghreb. Their study was conducted on the Northeastern Moroccan coastal and inland sites of Ifri Oudadane, Ifri n'Etsedda and Hassi Ouenzga. The examination of lipid residues extracted from potsherds was combined with faunal and archaeobotanical data. Their results provide new information about the subsistence strategies adopted during the transition to the so-called Neolithic practices in this area. The residue analysis correlates with the faunal and archaeobotanical information, indicating that the subsistence strategies were complex and flexible, including a broad spectrum of resources, combining exploitation of cereals and animal products (including meat and milk), gathering wild plants and marine shellfish, and hunting small and large sized game.

The article by Elena A. A. Garcea and colleagues (Garcea et al., 2020, this volume) presents the results of a multidisciplinary analysis performed on the pottery assemblage from the Mesolithic, Early Khartoum site of Sphinx in the Sudanese Nile Valley. The selected pottery assemblage was classified, and manufacturing techniques were determined, in order to understand if a correlation between production, cultural change and chronological variability existed. Additionally, petrographic, chemical analyses and the examination of absorbed organic residues were performed. The results show that production techniques and choice of raw materials remained stable over time, suggesting that the hunting-fishing-gathering groups preserved conservative ceramic traditions. Conversely, the fact that the decorative styles and techniques seemed to have been evolved through time is interpreted as an indication of development in cultural traditions/identities of the local groups. Finally, the analysis of residual remains provided consistent information about the use of the vessels for processing wild animal products. In sum, the adoption of a multianalytical approach allowed new insights about consistency and change in ceramic traditions in Mesolithic central Sudan.

Joshua Emmitt (Emmitt, 2020, this volume) examines the pottery from Kom W, one of the most important sites on the Fayum North shore in Egypt, which was firstly investigated in the 1920s by G. Caton Thompson and E. Gardner. The Fayum North shore sites are best-known for being among the earliest sites in Egypt at which domestic cereals are found, but also for the in-situ preservation of basket-lined storage pits at Kom K. The ceramic assemblage from Kom W includes both intact vessels and pottery sherds. For long time Kom W has been always considered as a village associated with the introduction of domestic species from the Levant. Thanks to the reanalysis carried out on the pottery assemblages found during the 1920s excavations, currently stored in a number of museums in the UK, based on computer aided design software, and on the comparison with the material from other Fayum sites, vessel shape, size and volume were reconstructed, as well as placement of the vessels within the site. The results of the analysis suggest that a number of vessels found at Kom W were used for storage, showing that, similarly to other roughly contemporary sites in the Nile Valley, a range of different storage solutions were utilised by the inhabitants of this region in the Neolithic.

The article by Jade Bajeot and colleagues (Bajeot et al., 2020, this volume) presents the results of a multidisciplinary study on ceramic vessels that can be attributed to the Lower Egyptian Predynastic period. In order to understand the function and diffusion of oval basins, the authors combined experimental, petrographic, use-wear and residue analyses on two specimens from the Predynastic site of Maadi. This multidisciplinary approach allowed verification of hypotheses about the function of these vessels, suggesting that they were used for grinding and pounding oily substances, and proposed at the same time a new method of studying function of Egyptian Predynastic ceramics.

In the last article of the issue, Robert Tendai Nyamushosho and Shadreck Chirikure (Nyamushosho and Chirikure, 2020, this volume) discuss the functional and stylistic variables of pottery from Nyanga, Northeastern Zimbabwe. Based on a combination of experimental

archaeology, ethnographic and archaeological data, they suggest that for the recent past, vessel shapes were strongly correlated with names and functions of the pottery, and that this approach can inform interpretations of the function and style of ancient pottery. Always being aware that similar forms found in the past and in the present may not necessarily mean similar functions, the experimental study demonstrated the potential of this approach for offering new insights into the range of uses and functions of pottery in the past, in this region. The conclusion is that functional classifications, when combined with style, are a strong alternative to the traditional classification approaches.

The following articles are the ones who were presented during the session of the PanAfrican Congress in Rabat, but that are not included in this special issue:

Oral presentations (in alphabetical order)

Christie, A. *Cowrie shell modification practice: experimental archaeology and microscopical analysis.*

Cnuts, D., Tomasso, S., Mikdad, A., Rots, V. *Assessing the preservation of residues on the Aterian stone tools from Ifri n' Ammar, Morocco.*

Djellal, Y., Bouzouggar, A. *An experimental approach to the functional studies on the non-flint tools in Morocco.*

Khedhayer, R., Mekki, H. *Analyse fonctionnelle des industries lithiques du site d'Ain El Guettar (Meknassy, Tunisie).*

Lucarini, G., Linstädter, J., Mikdad, A. *A techno-functional analysis of the Early-Mid Holocene ground stone and pebble assemblages from Mediterranean Morocco.*

Monod, H., Ollé, A., Nespoulet, R. *Contribution à la compréhension du Middle Stone Age en Afrique du Nord par l'analyse tracéo-fonctionnelle d'assemblages lithiques ateriens.*

Pelmoine, T. *Ethnoarchéologie de l'architecture vernaculaire au Sénégal oriental: des chaînes opératoires de construction.*

Petrullo, G. *Analyse technologique et fonctionnelle dans l'industrie osseuse du Maghreb.*

Safi, I., Beyries, S., Petrullo, G. *Techniques et outils perforants des coquilles d'escargots terrestres en Afrique du nord durant le Capsien.*

Sghari, B., Khedhayer, R., Belhouichet, L., Aouadi, N. *Entrechasse et cueillette: le statut fonctionnel des trapèzes d'El Mekta (Gafsa, Tunisie).*

Sievers, C. *The taphonomy of Sclerocarya birrea (marula) at Bushman Rock Shelter: roasted nuts, rubbish or fuel?*

Posters (in alphabetical order)

Hamdan, M.A., Jeuthe, C. *The potential geographic origins of chert implements during the dynastic periods in Egypt.*

Mutri, G., Borgia, V., Jones, S., Barker, G. *The emergence and function of backed tools in the Dabban phase (c. 43–17 ka BP) of the Haua Fteah cave, Cyrenaica.*

Poti, A., Mikdad, A. *The utilisation of the microburin technique in the Iberomaurusian of Ifri El Baroud (NE Morocco).*

Rega, F.M. *An ongoing study on macro-lithic tools in the Gash Delta (Eastern Sudan): limits and possibilities.*

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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on one hand and the pacifier on the other.

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