EVOSHEEP: the makeup of sheep breeds in the ancient Near East

Emmanuelle Vila1,*, Philippe Abraham2, Moussab Albesso1, Agraw Amane3,4, Camille Bader5, Rémi Berthon5, Sofiane Bouzid1, Daniel Bradley6, Catherine Breniquet7, Jwana Chahoud1,8, Thomas Cucchi5, Hossein Davoudi9, Bea de Cupere10, Gilles Escarguel11, Oscar Estrada12, Lionel Gourichon13, Daniel Helmer1, Wei Huangfu14, Joséphine Lesur5, Marjan Mashkour5,9, Cécile Michel15, Azadeh Mohaseb5,9, Ludovic Orlando12, François Pompanon16, Jacqueline Studer17 & Manon Vuillien13

1 Archéorient, CNRS, University of Lyon 2, France
2 HALMA, CNRS, University of Lille, France
3 Department of Microbial, Cellular and Molecular Biology, Addis Ababa University, Ethiopia
4 ILRI, Livestock Genetics Program, Addis Ababa, Ethiopia
5 AASPE, Muséum national d’Histoire naturelle, CNRS, Paris, France
6 Smurfit Institute of Genetics, Trinity College, Ireland
7 University Clermont Auvergne, CHEC, Clermont-Ferrand, France
8 Department of Archaeology, Lebanese University, Lebanon
9 Archaeozoological section, Bioarchaeological laboratory, University of Tehran, Iran
10 Directorate Earth and History of Life, Royal Belgian Institute of Natural Sciences, Belgium
11 LEHNA, CNRS, University of Lyon 1, ENTPE, France
12 AMIS, CNRS, University of Toulouse III, France
13 CEPAM, CNRS, University Côte d’Azur, France
14 Maison de l’Orient et de la Méditerranée, CNRS, University of Lyon 2, France
15 ArScAn, CNRS, Nanterre, France
16 LECA, University Grenoble Alpes/CNRS, France
17 Department of Archaeozoology, Natural History Museum, Geneva, Switzerland

* Author for correspondence: ✉ emmanuelle.vila@mom.fr

The EVOSHEEP project combines archaeozoology, geometric morphometrics and genetics to study archaeological sheep assemblies dating from the sixth to the first millennia BC in eastern Africa, the Levant, the Anatolian South Caucasus, the Iranian Plateau and Mesopotamia. The project aims to understand changes in the physical appearance and phenotypic characteristics of sheep and how these related to the appearance of new breeds and the demand for secondary products to supply the textile industry.

Keywords: Africa, Levant, Near East, sheep, archaeozoology, geometric morphometrics, textile production

Introduction

The Near East is the cradle of sheep domestication. Since the ninth millennium BC, sheep have played a major role in societal development, and have been an important element in
many different spheres of human activity (Vigne et al. 2005, 2017). Despite numerous studies on the domestication of a variety of plants and animals using a range of bioarchaeological methods, few have investigated the development of breeding and zootechnical practices by the first herders (e.g. Zeder et al. 2006; Colledge et al. 2013; Cucchi et al. 2016; Pöllath et al. 2019; Balasse et al. 2019). This is partly due to the difficulty in obtaining evidence of such activities using traditional zooarchaeological methods, for example, in the identification of phenotypical or physiological features transmitted from one generation to the next, and related to a particular domesticated population.

The domestication process resulted in behavioural, functional and anatomical changes in sheep. Due to the ethological and eco-physiological characteristics of this species, it can tolerate a broad range of geo-climatic conditions (Ryder 1983). Both natural and artificial selection have played important roles in producing adaptive traits, resulting in breeds that have been selected for specific climates, available vegetation and resistance to local diseases and parasites (Pilling & Rischkowsky 2007).

Sheep provide diverse food products (meat, fat and milk) and craft materials (hide, fleece, tendons, horn and bone), as well as manure fertiliser. Some products (called secondary products) can be obtained repeatedly throughout the animal’s life, such as milk, which has high nutritional value, and wool, a raw material with exceptional properties (Sherratt 1983).
Figure 2. Uruk-Warka (Iraq), Uruk period. Lower register: row of sheep; rams with horizontal spiral horns and a mane (detail of Warka Vase, Iraq Museum); available at: https://commons.wikimedia.org/w/index.php?curid=78821078 (accessed 4 December 2020); CC BY-SA 4.0).
The origins of sheep breeds: the zooarchaeological and textual clues

Approximately 1000 ovine breeds are present today throughout the world, resulting from a complex history of natural and human selection that has enriched the phenotypic diversity in sheep (Scherf & Pilling 2015). The process of breed emergence is still poorly understood, however, particularly regarding the diversity of domestic phenotypes, the role of environmental conditions and zootechnical innovations responsible for the emergence of breeds, as well as the role of secondary products. To address these issues, the EVOSHEEP project—funded by the French National Research Agency—launched in autumn 2018.

Mortality profiles provide the earliest indirect evidence of sheep-milk production, which can be dated to the eighth millennium BC, and fleece production dating to the seventh millennium BC (Helmer et al. 2007). By the sixth millennium BC in the Near East, an increase in artefacts related to fleece handling, such as spindle whorls, is indicative of textile fibre-processing of both animal and vegetal origin (Rooijakkers 2012).

In northern Mesopotamia, an important increase in sheep husbandry during the fourth millennium BC (Uruk period) can be identified (Vila & Chahoud 2019). Zooarchaeological studies have shown that these animals are larger than earlier sheep (Vila & Helmer 2014). Their horns form horizontal spirals, which are similar in shape to those of contemporaneous Levantine and Egyptian sheep (Figure 1a & Figure 2). At the beginning of the third millennium BC (Early Bronze Age), the average sheep size was smaller, and the horns were coiled.

Figure 3. Detail of a seal from Mozan (Syria), third millennium BC: ram with coiled horns and woolly coat (taken from Buccellati & Kelly-Buccellati 1995–1996: fig. 4b).
Iconographic depictions from this period often show a well-developed woolly coat (Figure 3) (Vila & Helmer 2014). Mesopotamian texts mention a diversity of sheep types of various origins as early as the third millennium BC (Figure 4), and later textual descriptions of wool quality and colour in the Near East and Aegean regions also confirm this diversity (Breniquet & Michel 2014). One hypothesis, therefore, is that woolly sheep breeds were favoured by urban development and the associated increasing demand for textile production.
Research questions

EVOSHEEP is a multidisciplinary project combining archaeozoology, geometric morphometrics and genetics to study archaeological sheep assemblages that date from the sixth to the first millennia BC in eastern Africa, the Levant, the Anatolian South Caucasus, the Iranian Plateau and Mesopotamia. In addition, the project incorporates a historical approach based on Sumerian-Akkadian texts and ancient Near Eastern iconography.

The following research topics will be investigated:

1) How did environmental factors and husbandry practices play a role in the biological and physical modifications of sheep compared with their wild ancestors?
2) When and where did major phenotypic characteristics, such as a fat tail, woolly fleece, pigmentation and lack of moulting, appear?
3) Did the herders’ interest in secondary products (e.g. fleece, milk) contribute to the selection of new phenotypic traits?
4) Is there a relationship between regional variation in sheep size and horn-core morphology and the emergence of different varieties or breeds?
5) How did the development of the textile industry during the third millennium BC affect sheep herding and urban development in South-west Asia?

6) Were fleece quality and pigmentation critical factors in the development of the textile industry and dyeing techniques?

To address these issues, EVOSHEEP will perform three-dimensional geometric morphometric analysis of selected bones with discriminating morphological markers (the humerus, astragalus, calcaneus and petrous bone). The genetic approach, based on the study of present-day genetic variation in a large range of breeds and populations, will be used to identify key genomic regions associated with important phenotypic traits (e.g. tail, coat, horns and colour), followed by palaeogenetic analyses of archaeological bones. EVOSHEEP also aims to create an osteological reference collection of present-day sheep breeds from the Middle East (Iran, Lebanon) and Africa (Ethiopia) (Figure 5). An online, open-access database is currently under development on a dedicated website.

Acknowledgements

The project is coordinated by a consortium of five partner laboratories: Laboratoire Archéorient—Environnements et Sociétés de l'Orient Ancien (coordinated by E. Vila); Archéozoologie, Archéobotanique: Sociétés, Pratiques et Environnements (coordinated by M. Mashkour); Anthropobiologie Moléculaire et d’Imagerie de Synthèse (coordinated by L. Orlando); Laboratoire d’Écologie Alpine (coordinated by F. Pompanon); and the Smurfit Institute of Genetics (coordinated by D. Bradley). It also benefits from collaborations with French archaeological missions of the Ministry of Europe and Foreign Affairs, other European archaeological expeditions, the General Directorates of Antiquities, as well as academic institutions in Armenia, Azerbaijan, Georgia, Ethiopia, Lebanon, Iran, Iraq, Sudan, Syria and Turkey.

Funding statement

The EVOSHEEP project is funded by the French National Research Agency (ANR PRC Project: ANR-17-CE27-0004).

References


© The Author(s), 2021. Published by Cambridge University Press on behalf of Antiquity Publications Ltd