Journal of Archaeological Science: Reports 13 (2017) 121–131

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

An often overlooked resource: Ostrich (*Struthio* spp.) eggshell in the archaeological record

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ARTICLE INFO

Article history:
Received 21 September 2016
Received in revised form 3 March 2017
Accepted 12 March 2017
Available online xxxx

Keywords:
Eggshell
Taphonomy
Fragmentation
Quantification
Burning
Actualistic research

ABSTRACT

Ostrich (*Struthio* spp.) eggshells are present in archaeological assemblages in many regions of Africa and Asia. However, and unlike other artifacts and ecofacts, there are no standardized guidelines for observing and recording non-ornamental ostrich eggshell. Here, we review prior research that focuses on facets of the taphonomic history of ostrich eggshell assemblages, and we document results from our actualistic studies of the changes in color that occur when ostrich eggshells are heated. We further propose some guidelines for recording ostrich eggshell in archaeological contexts, which include burning categories and quantification methods. These guidelines are intended to facilitate the development of large, comparative, and standardized ostrich eggshell data sets that will contribute to our understanding of site taphonomy and past human behavior.

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http://dx.doi.org/10.1016/j.jasrep.2017.03.036
2352-409X/

1. Introduction

Ostriches (*Struthio camelus*) are commonly seen today throughout the woodlands, savannas, and grasslands of sub-Saharan Africa. However, their geographic distribution was much wider in the past, and ostriches (*Struthio* spp.) additionally extended throughout northern Africa, the Arabian Peninsula, and southwestern, southern, and central Asia. Ostriches are the largest living bird, and they also lay the largest egg. The size and robustness of ostrich eggs made them an important resource for humans, providing both food and a durable technological material. Ostrich eggshell (OES) is commonly present in archaeological assemblages throughout these regions, likely as a result of both the nutritional value and technological utility associated with ostrich eggs (Blinkhorn et al., 2015; Janz et al., 2009; Kurochkin et al., 2010; McBrearty and Brooks, 2000; Mitchell, 1996; Wadley, 1993; Wang et al., 2009). The ubiquity of OES in archaeological assemblages suggests that the eggs, and their shells, were likely important resources for past peoples, and therefore fragments of OES should provide valuable data for reconstructing many past human subsistence practices, technological diversity, and potentially symbolic systems and social networks. However, aside from OES bead manufacturing and preservation (e.g. Kandel and Conard, 2005; Orton, 2008; Plug, 1982), there is currently no standard rubric for recording and reporting OES recovered from archaeological contexts. The absence of standardized recording procedures inhibits comparative research of OES assemblages, and their behavioral and taphonomic correlates, between different archaeological occupations from different sites.

Here we review the archaeological literature discussing OES, and present a preliminary guide for describing non-ornamental OES from archaeological assemblages. These suggestions include qualitative and quantitative descriptions of OES fragments and guidelines for identifying heat-mediated modifications. We propose these descriptions as a starting point to standardize the recording of archaeological OES with the aim of generating large, comparable datasets that will contribute towards understanding, and differentiating between, taphonomic agents and human action in the archaeological record (Dominguez-Rodrigo, 2008; Gifford-Gonzalez, 1991).

2. Background

2.1. Ostriches and their eggs

The following short summary follows from many (Bertram, 1979; Donegan, 2002; Maclean, 1985; Newman, 2002). Ostriches are well-known as distinctive, large, flightless birds that may stand up to 2 m tall, and can grow up to 130–160 kg. The males are territorial and compete for small flocks of females, whose number varies with the local environment. Often, the male and his females scrape out a communal nest, where collectively the females lay their eggs. Reports vary widely on the number of eggs each female may lay for each nesting, and some nests have been reported to have up to 40–60 eggs. The male and females share responsibility for incubation. However, Bertram (1979) recognized that one female can only incubate about 20 eggs at a time, with the others often being pushed out of the nest; the dominant female avoids pushing out her own. The eggs hatch in about 40–50 days.

Ostrich eggs are large: each weighs between 1 and 1.5 kg, contains roughly 2000 cal (equivalent to about 24 domestic hen eggs), and provides a rich source of protein and fat (including important monounsaturated, saturated, and polyunsaturated fatty acids) (Di Meo et al., 2003; Sales et al., 1996; Sinanoglou et al., 2011). In this regard, ostrich eggs were likely an important food source for hunter-gatherers. Moreover, and provided that the ostriches were not guarding the nest, the eggs would have been a gatherable resource that would not have required additional technology. Only minimal technology, a hammerstone, is necessary for breaking into the shells.

Interestingly, while ostrich eggs appear to have been a widely used resource, bones of ostriches themselves are rarely found in archaeological sites. For example, only isolated finds are documented in Middle Stone Age assemblages of Ysterfontein 1 (Avery et al., 2008) and Varsche Rivier 003 (Steele et al., 2016) and from the Late Acheulean assemblage of Duinefontein 2 (Cruz-Uribe et al., 2003), all in the Western Cape Province, South Africa. Ostrich bones are virtually absent in Asian assemblages (Janz et al., 2009). The lack of evidence for ostrich carcass processing is surprising, because ostriches would provide a large package of nutrient-rich meat and associated tissues (Belichovska et al., 2015; Horbanczuk et al., 2003; Horbańczuk et al., 2004).

2.2. In archaeological assemblages

2.2.1. OES beads and other uses as ornamentation

Beads are perhaps the best known OES artifacts. They are ubiquitous throughout many regions of Africa and Asia during the Terminal Pleistocene and the Holocene (Mellars et al., 2013; Miller, 2012; Miller and Willoughby, 2014; Wang et al., 2009). They begin appearing in eastern Africa after 50,000 years ago or so (Ambrose, 1998; Miller and Willoughby, 2014), although a more extensive dating program, including direct dating, is needed to assess their antiquity in southern Africa (Steele et al., 2016; Villa et al., 2012).

The manufacturing of OES beads has been ethnographically recorded and extends into the present. OES beads have been documented as important exchange items in southern Africa (Wiessner, 1977, 1984, 2002), providing archaeologists with potential insight into past social networks (Ambrose, 1998; Miller and Willoughby, 2014; Mitchell, 1996; Sadr, 2003; Smith et al., 2001; Wadley, 1993; Wang et al., 2009), although Pargeter et al. (2016a, 2016b) challenge the validity of this kind of analogy, particularly as we move further back in time.

As cited above, OES beads have been frequently discussed in the literature, and therefore we focus on other aspects of ostrich eggshells here. In summary, Plug (1982) provided an early recording scheme for OES beads based on their type, manufacturing stage and completeness. Subsequently, Kandel and Conard (2005) and Orton (2008) offered more detailed descriptions, including standardized coding schemes, of all stages of the OES bead manufacturing process. Kandel and Conard (2005) and Miller (2012) provide detailed outlines for recording many additional aspects of OES beads, including size, mass, color, and preservation. Wilmsen (2015) provides a recent discussion of the behavioral, natural, analytical, and taphonomic factors affecting bead sizes and their distributions.

Apart from OES beads, OES pendants, painted OES, and engraved OES have also been identified in the Middle and Later Stone of southern African. OES pendants are known from Later Stone Age contexts in Namaqualand (Dewar, 2008). Decorated and painted OES pieces have also been recovered from late Middle Stone Age contexts at Apollo 11 in Namibia (Vogelsang et al., 2010). Engraved OES is present (but rare) in the archaeological record from ~60,000 years ago (Texier et al., 2010, 2013), and appears much more frequently in Later Stone Age and historical contexts (Humphreys and Thackeray, 1983; Rudner, 1953). It is suggested that these engravings generally occur on OES flasks.

2.2.2. OES containers

OES flasks are containers made from eggs that have been perforated and emptied. One perforation at the tapered end of the egg is the most common form, although some OES flasks demonstrate a perforation along the middle, and some display multiple perforations. The perforation(s) are achieved by using one or a combination of drilling, punching,