



Early Neolithic pottery of Ifri n'Etседda, NE-Morocco – Raw materials and fabrication techniques



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ABSTRACT

Ifri n'Etседda is a rock shelter in northeastern Morocco, at the southern flank of the Kbdana Mountains. The site was discovered in 2008 and excavated during three field campaigns between 2012 and 2014 and provides Epipalaeolithic and Neolithic deposits. From the Neolithic deposits we analyzed 30 pottery sherds by macroscopic determination, Infrared (IR) Spectroscopy, polarizing microscope and thermogravimetric analysis (TGA) in order to determine information about the clay and natural inclusions in the clay and temper materials used as well as the manufacturing process. In addition, we identified and sampled 12 potential raw materials sources during one survey campaign in 2015, which were analyzed by IR spectroscopy as well. We identified 8 groups by means of inclusions in the clay: extrusive igneous rocks (EIR), EIR with amphiboles, EIR with fragments of micro quartz, granite, dolerite or gabbro with fibrous quartz and unidentified spherulites, schist, organic limestone and grog. Trends in the succession of clay traditions could be identified. Most of the pottery was fired in an oxidizing atmosphere and were placed upside down in a pit. Burning temperatures range between 800 and 1000 °C. No local clay source seems to have been used for the pottery production at Ifri n'Etседda. With regard to the small artifact samples size as well as the incomplete raw material survey, further studies are needed to shed more light on Ifri n'Etседda pottery.

1. Introduction

The paper presents a pilot study, which deals with mineralogical and geochemical analyses on early pottery from Ifri n'Etседda, a rock shelter in NE Morocco (Fig. 1A). The site was discovered in 2008 and excavated during three field campaigns between 2012 and 2014 (Linstädter et al., 2016). Ifri n'Etседda provides Epipalaeolithic and Neolithic deposits dated between 10.0 and 6.0 ka calBP and thus embody the Neolithic transition. Neolithic deposits are preserved in situ only in the excavation of 2012. Epipalaeolithic sediment couldn't be determined in this part of the shelter. In contrast, Epipalaeolithic deposits are preserved in situ in the excavations of 2013 and 2014 (Linstädter et al., 2016; Fig. 2). Neolithic deposits with the two latter excavations are disturbed during later occupation. In total 11 layers could be determined for Ifri n'Etседda and labeled as INES-1 to INES-11 (Fig. 3):

The first Neolithic occupation is comprehensible in INES-5 due to the appearance of pottery, perforated snails and domesticated animals

and plants. INES-5 can be dated around 7.2 ka calBP, but is a very thin layer. The following layer INES-6 is dated around 6.8 ka calBP. In both layers ceramic sherds with *Cardium* decoration are present. INES-7 represents the largest occupation phase and can be dated between 6.7 and 6 ka calBP. The pottery of this layer show herringbone motives which were formed by marine shells. INES-8 is not absolutely dated, but pottery with comb impressions and undecorated, polished vessels suggest a late Neolithic occupation. Altogether the ceramic assemblage consists of 120 pottery units with focus on the late Early Neolithic phase ENC.

Only a few archaeometric studies on pottery are known from the area (Linstädter and Müller-Sigmund, 2012), so that the here-presented analysis allows to significantly further our knowledge about the mineralogy of the early Neolithic pottery of Morocco. The focus of our study lies on characterizing the used clay with natural inclusions and temper materials present, finding out their provenance, reconstructing the pottery production techniques and understanding the changes of these features through time. We aim to answer two questions: which

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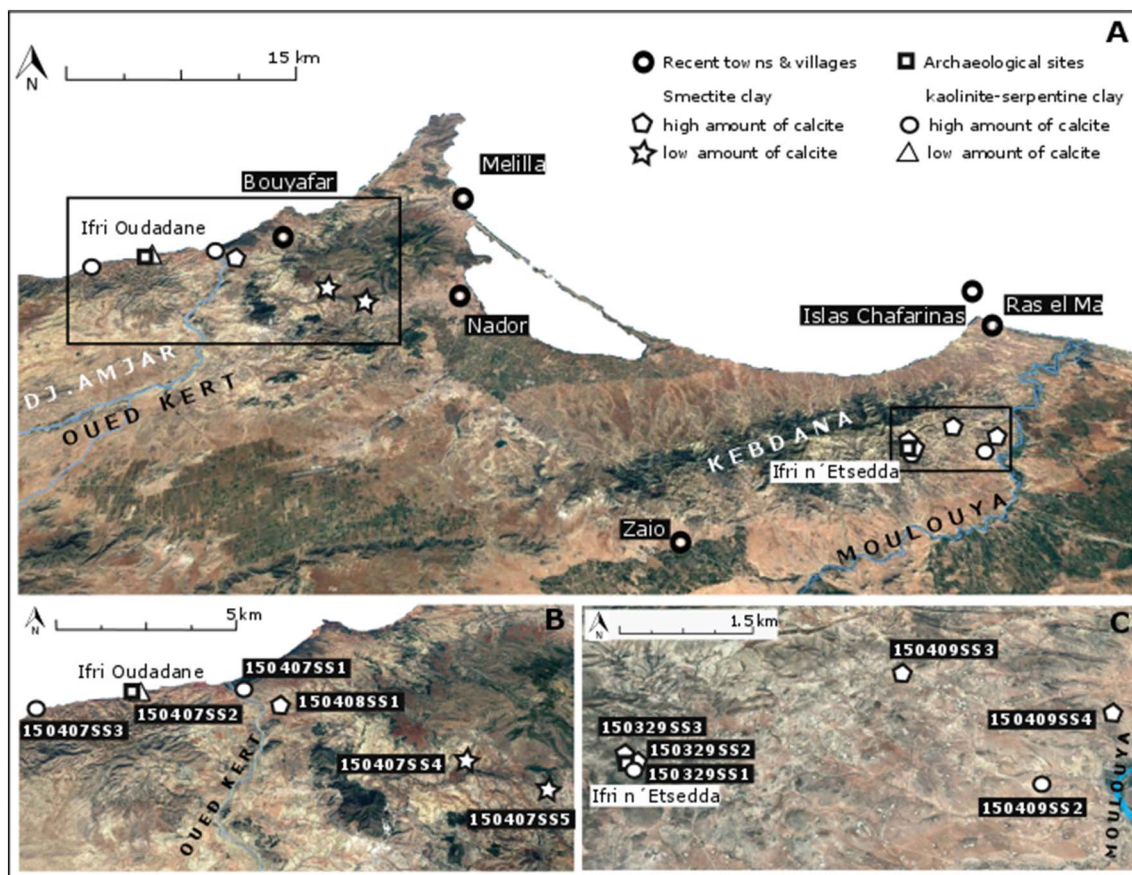


Fig. 1. Map of the research area with the raw material sources sampled. Close-up on the two regions around Ifri Oudadane and Ifri n'Etsedda.

kind of raw materials were used and where did they come from? How was the pottery produced? To answer these questions we undertook systematic survey and sampling and applied a set of archaeometric analyses. A systematic stylistical study of the Ifri n'Etsedda pottery assemblage is still ongoing.

The Neolithic transition, understood here as a concept describing the transition to food production, is one of the most interesting phenomena in archaeology, providing far-reaching consequences for human societies. The Western Mediterranean, or so-called Alboran Territory, provides a fascination laboratory to study this process since it includes rather diverse ecological zones spanning from temperate Western Europe to semi-arid Northwest Africa.

Based on the studies of the lithic industries of Ifri Oudadane one can assume that no population exchange occurred (Linstädter et al., 2015). Raw material supply, technology and tool composition of Epipalaeolithic and Neolithic assemblages are rooted in the same tradition. The transitional process however is marked by the appearance of domesticated plant and animal species. In northwestern Maghreb the cultivation of domesticated crops and animal husbandry is estimated to appear at around 7.5 ka calBP (Morales et al., 2013; Zapata et al., 2013). However, the composition of the various new food components is not homogeneous. A concomitant analysis of multiple Neolithic sites shows the combination of species (e.g. crop species) differs from assemblage to assemblage (Morales et al., 2016). Furthermore, the percentage of domesticated species varies and amounts often < 50%. Hunting and gathering (Hutterer et al., 2014) as well as the use of marine resources still play an important role. Thus, in large part of northwestern Maghreb food production can be considered a risk minimizing facet, rather than a dominant economy.

Beside its impact on diet, the transition to food production has indirect influence on the environment (Linstädter et al., 2016), fuel

supply (Lehndorff et al., 2014) and material culture. Pottery, one of the first synthetic materials known, is one of the most eye-catching features of this transitional process. In general, pottery is one of the most frequent find categories at archaeological excavations dating from the Neolithic onwards. The study of shapes and decorations of ceramic objects plays an important role for the development of chronologies and mobility hypotheses. Recent studies on early pottery from the Mediterranean Maghreb attest of an affiliation of this region to the Western Mediterranean circle (Linstädter, 2004; Linstädter and Wagner, 2013).

While typological studies allow the identification of transregional relations, the use of chemical and physical analyzes provides new possibilities for the study pottery, its technical development and its provenance (Maggetti, 2008; Wagner, 2007). The analysis of raw material provenances is at the basis of several other studies, such as land use and mobility pattern reconstruction (Basso et al., 2006; Kibaroglu, 2008; Pappmehl-Dufay et al., 2013). However, within northwestern Maghreb such analyses have rarely been applied until now. A few examples are the study of Neolithic material discovered in the Oukaimeden Valley, Moroccan High Atlas (Maicas et al., 2014), and the analysis of pottery from divers sites of the eastern Rif (Linstädter and Müller-Sigmund, 2012).

2. Materials and methods

2.1. Samples and sample preparation

Since no systematic stylistical study of the pottery of Ifri n'Etsedda could be used for sample selection, we selected 30 sherds of different stratigraphic origin based on macroscopic criteria like clay color, wall thickness and macroscopic inclusions (Fig. 3). It was not possible to analyze a larger samples size, but to be representative of the site's

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