Applied Clay Science 141 (2017) 316–333

Contents lists available at ScienceDirect

Applied Clay Science

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

Research paper

# Geochemical characterization of clay deposits in the Amuq Valley (Southern Turkey) and the implications for archaeometric study of ancient ceramics

Pınar Gutsuz [a], Mustafa Kibaroğlu [b,*], Gürsel Sunal [a], Sinem Hacıosmanoğlu [a]

[a] Istanbul Technical University, Department of Geology, TR-34390 Istanbul, Turkey
[b] Eberhard-Karls University of Tübingen, Institute for Pre- and Protohistory and Medieval Archaeology, D-72070 Tübingen, Germany

ARTICLE INFO

*Article history:*
Received 15 August 2016
Received in revised form 3 March 2017
Accepted 5 March 2017

*Keywords:*
Chemical analysis
Reference material
Provenance study
Amuq Valley
SE Turkey

ABSTRACT

Clay-rich deposits of the Amuq Valley (Southern Turkey) were investigated using chemical methods to explore compositional characteristics of the clays within the valley and for distinguish chemical groups that can be used as reference materials in archaeometric studies of the ancient ceramic materials in this region. A total of 63 clay samples were collected from different spots throughout the valley and analyzed by X-ray fluorescence and inductively coupled plasma mass spectrometry (ICP-MS) techniques.

Analytical results demonstrated that the clay-rich basin deposits show compositional variation both in stratigraphic and spatial levels. Parent rocks exposed within the catchment area of the basin deposit (transported to the basin through the main drainage systems of the Orontes, Afrin, and Karasu Rivers), seems to be one of the major factors affecting the compositional characteristics of the basin deposits. Four different geochemical reference groups were identified: the Orontes clay group, Afrin clay group, Karasu clay group and Kırıkhan clay group. Established reference groups provide opportunities for a better understanding of the local ceramic production and the exchange pattern within the valley and between the adjacent regions.

© 2017 Elsevier B.V. All rights reserved.

## 1. Introduction

In the exploration of the provenance of archeological ceramics, identifying the source of raw materials of the vessels is one of the key issues in archaeometric ceramic analysis. Information on the origin of a specific pottery type provides archeologists valuable information in order to understand the pathways linking ancient societies in different regions, indicating trade routes and cultural, political, and cultic relations and more (e.g., Rice, 1987; Pollard and Heron, 1996; Tite, 2008). Application of chemical analysis to identification of provenance and to search the procurement patterns of the raw materials of a ceramic type is based on a simple assumption that the elemental composition of the ceramic under investigation reflects the composition of the clay deposit that was used for its production. In other words, the investigated ceramic will be chemically identical to the clay from which the ceramic was produced. This simple assumption, which is known as the *provenance postulate* (Weigand et al., 1977, see also Pollard and Heron, 1996; Glascock et al., 2004; Hein et al., 2004) is well-established and verified by numerous archaeometric investigations in the last four decades. In an attempt to enable the assignment of the ceramic of unknown origin to a distinct geographical region or source, the reference materials (also control group) of known origins play an important role (Neff and Bove, 1999; Garrigós et al., 2001). A common approach to such an endeavor is the comparison of the chemical composition of the ceramic of unknown origin with a reference material of known origin. For this purpose, several materials can be used among them, such as a) ceramic group of known origin that was determined by archeological criteria (Widemann et al., 1975), b) specific ceramic group whose origin was determined by archaeometric analysis, c) kiln waste, and d) clay deposits from the distribution area of the unknown ceramics (e.g., Hancock, 1984; Adan-Bayewitz and Perlman, 1985).

In the strict sense, elemental composition of an ancient ceramic represents the composition of the clay material at the time (stratigraphic level) of its production. However, the original source used for the production is often not available in the present day (e.g., due to the sedimentation process or other environmental or anthropogenic activities). Therefore, kiln waste (e.g., over-fired waste or unfired raw clay) is generally considered a useful reference material in the provenance identification (see e.g., Belfiore et al., 2007), but such kiln waste is seldom unearthed during excavations. On the other hand, kiln waste may not be representative of the compositional diversity of all clay deposits available in the study area; rather it represents the specific composition of a workshop. One of the best method of provenance identification is to use both material groups; kiln waste and clay sources from the study area. However, in the case of the lack of such reference

* Corresponding author.
*E-mail address:* mustafa.kibaroglu@uni-tuebingen.de (M. Kibaroğlu).

http://dx.doi.org/10.1016/j.clay.2017.03.004
0169-1317/© 2017 Elsevier B.V. All rights reserved.

materials or if they are not available for the study, local clay deposits around the location where the artifacts were found are well suited as reference materials and were used in previous archaeometric studies (e.g., Hein et al., 2004; Montana et al., 2011).

For a meaningful application of the local clay sources as reference materials and likewise for correct interpretation of the chemical data, it is essential to know the compositional features of the clay deposits available in the study area as well as the geology of the catchment of the clay deposits. Natural clay deposits often show inhomogeneity in elemental composition depending on the geological and environmental setting (see e.g., Hein et al., 2004). Clay sources, for example in a large basin, can display elemental and mineralogical inhomogeneity in both spatial and temporal (stratigraphic) levels. Such inhomogeneity may be controlled by the hinterland lithology, and geology, the depositary and post-depositional processes, weathering conditions or different drainage networks of the basin. These are the issues that should be considered in archaeometric studies of ancient ceramics.

In this paper, we report the results of chemical analysis carried out on clay samples ($n = 63$) collected from the alluvial deposits of the Amuq Valley, located in South-Central Anatolia (Fig. 1a). The study has two major aims. The first is to explore the chemical characteristics of the clay deposits in the Amuq Valley, the stratigraphic (temporal) and spatial variation and their relation to the major drainage network of the basin (i.e., Orontes River, Afrin River, and Karasu River) and to the geology (lithology) of the hinterland of the basin catchments. The second aim is to establish a clay reference group for the Amuq Valley and surroundings, which can be used in archaeometric provenance studies of clay artifacts in the region, particularly ceramics recovered in the Amuq Valley and surrounding area. For these purposes, we identified major and trace elements contents of the clay samples from different stratigraphic levels from 0.10 m to 5.3 m, which were collected from three different sedimentary profiles from the basin (ALL-1, ALL-3 and ALL-8) and 44 clay samples from different locations throughout the Amuq Valley (Fig. 1a and b). Then, we discussed the temporal (stratigraphic) and spatial variation of major and trace element concentrations throughout the basin and its relation to the major drainage and lithological characteristics of the catchment areas of the major rivers.

### 1.1. Geographic and archeological setting of the Amuq Valley

The Amuq Valley is located in South-Central Anatolia to the northeast of the city of Antakya (ancient Antioch; Fig. 1a). It is a well-watered and fertile plain. It is about 40 km in size from north to south and 35 km from east to west and is about 80 to 100 m above sea level (Wilkinson et al., 2004). The valley is bounded by the Amanos Mountains to the west-northwest with an elevation up to 2250 m, and to the east by the relatively low topography of the Kurd mountains with a height of 800 m. To the northeast, the plain passes into the Karasu and to the southwest into the Hatay depressions (Fig. 1a). The region is tectonically active; several tectonic structures such as the Dead Sea fault, the East Anatolian fault, and the Cyprus Arc system intersect in the region, forming a triple junction between the Arabian Plate, African Plate, and Anatolian Block (e.g., Jackson and McKenzie, 1988; Mahmoud et al., 2013; Yüce et al., 2014).

The three major rivers draining into the Amuq Valley are the Orontes (Asi Nehri), the Afrin, and the Karasu Rivers (Fig. 1a). The largest (~600 km) and most important river is the Orontes. It arises in Lebanon, drains across western Syria through the cities of Homs and Hama and into the Amuq Plain and then reaches the Mediterranean about 30 km downstream of Antakya (Bridgland et al., 2012). The Afrin River arises from the Kartal Mountains in Gaziantep in Turkey, flows through the city of Afrin in Syria and then drains into the Amuq Plain. The third important river is the Karasu, which arises from Kahramanmaraş region and flows to southwest through the Karasu Graben, draining into the Amuq Valley. A noteworthy feature of the plain is the Lake of Antioch, which existed until the 1960s and later disappeared as a result of drainage for agricultural purposes. It was an extensive shallow lake within the western part of the basin (Wilkinson, 1997; Casana, 2003).

Historically, the Amuq Valley played an important role due to its strategic position at the intersection of a number of important ancient trade and communication routes linking the Anatolian Highlands, the Syro-Mesopotamian lowlands, and the eastern Mediterranean littoral. In this geographic and historical zone, it interacted with several ancient cultures of Anatolia (Hittite), Eastern Mediterranean (Aegean and Cyprus), Levante and Palestinian (Egyptian and Canaanite), and

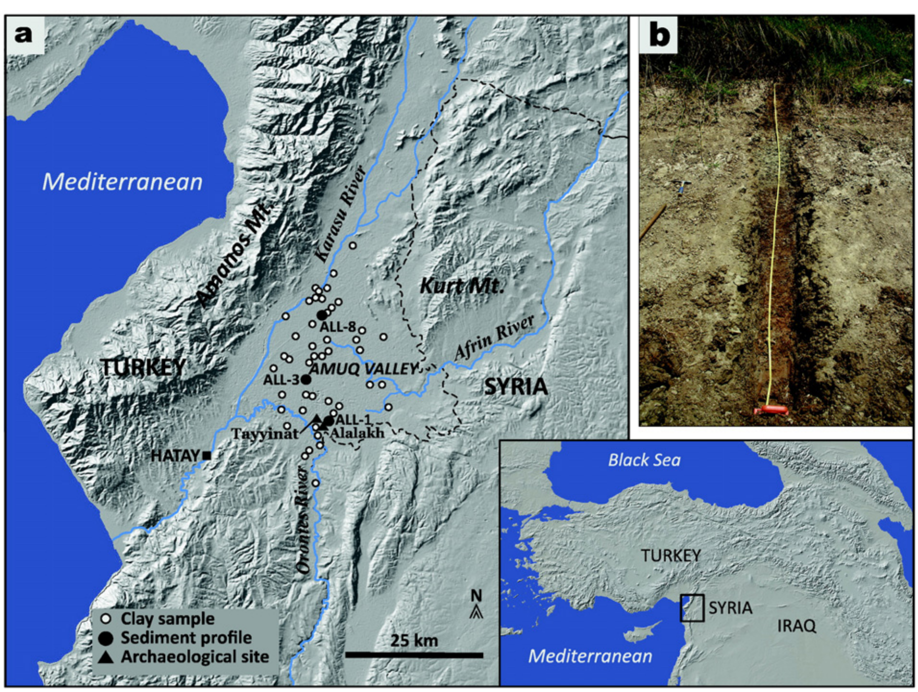


**Fig. 1.** a) Topographic map of the Amuq Valley and location of the clay samples and sediment profiles ALL-1, ALL-3, and AL-8. Archeological sites Alalakh and Tayyinat as well as the three main river networks of the valley are shown. b) An example of the image view of the sediment profile ALL-1. The section is 5.30 m long.

Download English Version:

https://daneshyari.com/en/article/5468654

Download Persian Version:

https://daneshyari.com/article/5468654

Daneshyari.com