SEDIMENTARY GEOCHEMICAL APPROACH TO THE PROVENANCE OF THE NON-CALCIFEROUS NORTH MESOPOTAMIAN METALLIC WARE

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Abstract

A korabronzkori észak-mezopotámiai fémedényhatású kerámia jelentős területeken terjedt el Szíria északkeleti és Anatólia délkeleti részén. Ez a fajta kerámia jelentős változatosságot mutat forma és szín tekintetében. A cikk a jellegzetes kerámia petrográfiai és geokémiai vizsgálatával foglalkozik. A geokémiai jellemzők szerint ehhez a kerámiához speciális kalcitszegény agyagot használtak a délkelet-anatóliai Derik-Telbesim formációból, amely prekambriumi korú muszkovit-palából, fillitből, agyagos üledékekből és alárendelten homokkőből áll.

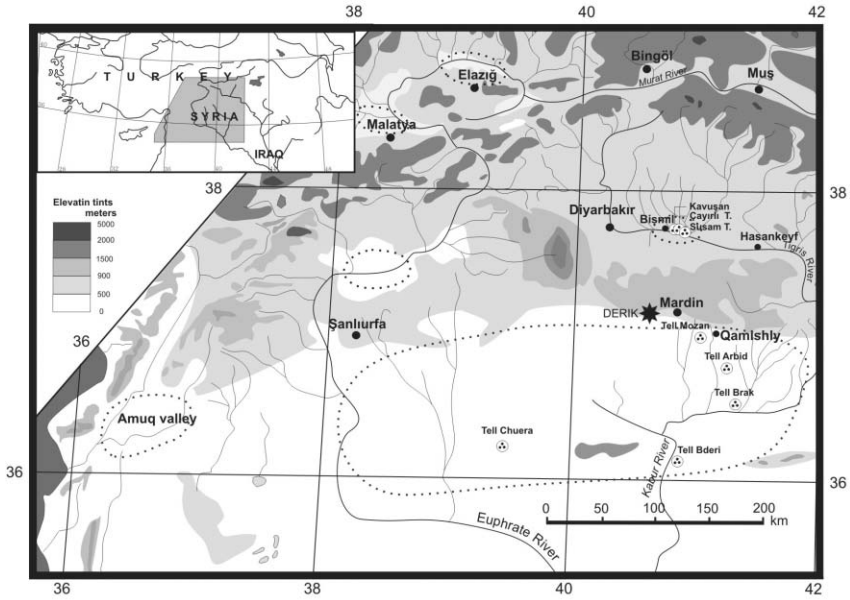
KEYWORDS: POTTERY, ANATOLIA, SYRIA, ANALYSES

KULCSSZAVAK: KERÁMIA, ANATÓLIA, SZÍRIA, ANYAGVIZSGÁLAT

Introduction

The Early Bronze Age North Mesopotamian Metallic Ware, which is dated as Early Dynasty II (Oates, 2002), shows up in the North Mesopotamian Bronze Age ceramic tradition by its fineness, high density, hardness and burning temperature. The ware exhibits an extensive variation of form and colour, ranging from black, blue-purple, light gray, brown to reddish gray, brown, orange red and olive-green. Different colours can also appear on the same vessel (Kühne, 1976; Oates, 2002). The main forms are bottles, bowls, and pots with different internal forms. According to the large amount of finds, north east Syria was considered as the centre of the production of the wares. However, other regions in Anatolia, such as Amuq valley, Malatya and Elazığ regions are also known as distribution areas of this ware (**Fig. 1**).

In the archaeometric investigations of Kühne and Schneider (1988), it was asserted firstly that the North Mesopotamian Metallic ware was made of two completely different clays. One of them is characterised by high CaO, Sr, MgO, Ni, Cr and relatively low Al_2O_3 content. Pottery made of this type of clay is called calciferous North Mesopotamian Metallic Ware, while pottery made of the other type of clay, containing small amounts of CaO, Sr, MgO, Ni, and Cr is called non-calciferous North Mesopotamian Metallic Ware.



Map of the distribution area of the North Mesopotamian Metallic Ware in north-east Syria and Anatolia.

Fig. 1.

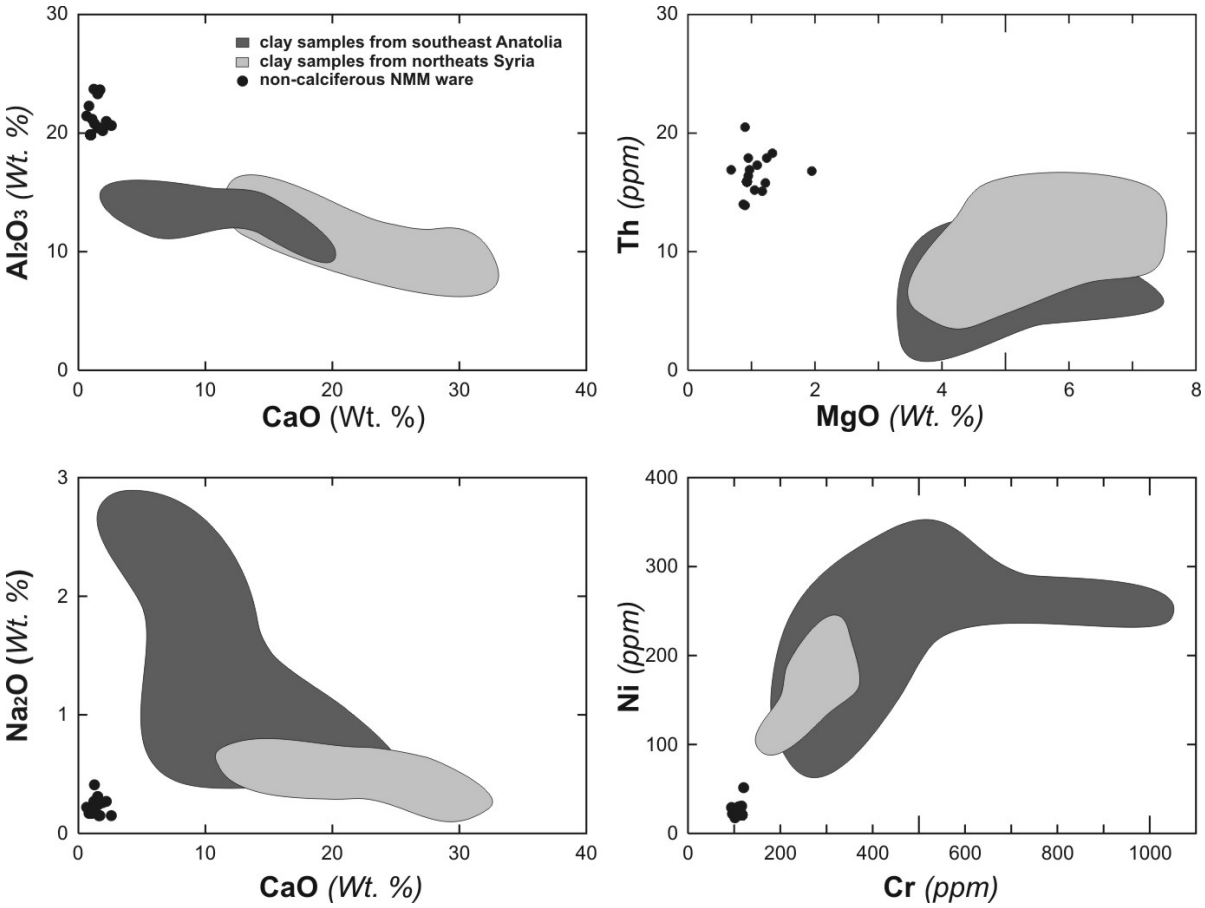


Fig. 2. Variation diagrams of CaO vs. Al_2O_3, MgO vs. Th, CaO vs. Na_2O and Cr vs. Ni of clay samples from south-east Anatolia, north-east Syria and non-calciferous North Mesopotamian Metallic Ware.

However, these two types of wares have similar features in terms of archaeology, indicating the same pottery-workshop (Oates, 2002). Chemical composition of the non-calciferous North Mesopotamian Metallic Ware (NMM Ware) discussed here is very different from the chemical composition of clays both from north-east Syria and south-east Anatolia (see **Fig. 2.**).

The provenance of this clay has remained enigmatic until today. In this study, sedimentary geochemical approach is applied for reconstructing the geology of the source area and the depositional environment of sedimentary rocks (see Taylor and McLeannan, 1985; Bhatia 1985a, b; Bhatia and Crook 1986; McLennan *et al.,* 1990; Floyd *et al.,* 1991).

For petrographic analysis, two thin-sections were prepared. For chemical analysis totally 14 non-calciferous NMM-Ware sherds from Tell Brak and Tell Mozan sites from north-east Syria and Kavuşan and Susamtepe sites from south-east Anatolia were selected on basis of wall thickness and colour. Major and trace elements have been measured using X-ray Fluorescence Analysis.

In the evaluation stage, previously published data on the same ware were also considered.

Discussion and Conclusion

Because of the fine texture of the wares, thin section analysis did not reveal any information on the geology of the source area of the non-calciferous clay. In this study, only quartz inclusions were observed. In previous studies, however, Kühne and Schneider (1988), Schneider and Daszkiewicz (2002a, b) reported presence of microcline, muscovite and calcite inclusions as a single grains. Especially microcline gives some important evidence about the source rock type of the clay deposit (raw material) of non-calciferous NMM Ware. Microcline and muscovite are typical rock forming minerals of granodioritic rocks. On the other hand, low MgO, Cr, and Ni contents suggest the absence of mafic rocks in the source area. In addition, very low CaO content indicates the absence of limestone in the source region. High concentrations of incompatible trace elements, such as Thorium (Th) and Cerium (Ce) –, enriched in granitic (acidic) rocks – suggest that the source rocks of the clays consist of granitic or geochemically equivalent rocks.

Especially Th conserves the chemical characteristic of the source rock and therefore it is known as a good indicator of the provenance of sedimentary rocks (Taylor and McLennan, 1985; Bhatia and Crook, 1986; McLennan, 1989; McLennan *et al.,* 1993; Roser and Korsch, 1986; Lahtinen 1996). High Al_2O_3 (~21 wt. %) concentration of the non-calciferous NMM Ware emphasises one of the distinctive chemical features. High Al_2O_3 concentration, which indicates most probably high clay mineral content, shows strong alteration of the source rock of the clay. The so called Chemical Index of Alteration (CIA) values (Nesbitt and Young, 1982) allow the estimation of the alteration grade of the source rocks. Re-alteration of sedimentary rocks (especially fine sediments) increases clay mineral content in the newly deposited sediments and thereby Al_2O_3 content, thereupon CIA-values. Taking into account these it is plausible to suppose that the high Al_2O_3 concentration of the non-calciferous clay was a result of the re-alteration of fine sedimentary rocks in the source area. If it is true, the source rocks of clay of the non-calciferous NMM Ware were sedimentary in origin, derived from granitic rocks or rocks with equivalent chemical composition. In the distribution area of the NMM Ware in North Syria, there is no such rock type. Only in Derik region in south-east Anatolia, west of the city Mardin, there are correspondiong rock types available, known as Derik-Telbesim formation. The formation consists of 750 m thick muscovite-slates, phyllites, clayey sediments and partly sandstones of pre-Cambrian and Cambrian age, considered as remnants of the Proto-Tethian Ocean (Brew *et al.,* 2001). According to thin-section study and geochemical data summarised above, the Derik-Telbesim formation located in Derik and its surrounding area (see Fig.1), is the probable source region for the non-calciferous clay which reflects the provenance of raw material of the non-calciferous NMM Ware. Another possible source of clay for non-calciferous NMM Ware is the so-called Bitlis-Pötürge Massive, outcropping in a wide range in northern part of south-east Anatolia, consisting of various metamorphic rocks, also slate and flysch.

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