Restudying the Beveled Rim Bowls: new preliminary data from two Uruk sites in the Syrian Middle Euphrates[1]

Jorge Sanjurjo Sánchez
Instituto Universitario de Xeoloxía, Universidade da Coruña

Juan Luis Montero Fenollós
Facultade de Humanidades e Documentación, Universidade da Coruña

1. Introduction

The artefacts found on archaeological sites can be of a different nature depending on the material used for their manufacture. In general, these materials can be divided between natural materials (for example stone tools or rocks used in the construction of buildings) or artificial materials (such as ceramics or metals). The composition of archaeological artificial materials depends on the origin of the raw material used (which will sometimes depend on the different geological characteristics of the area from where they are extracted) and the processes of transformation to which they have been subject (application of processes of compression, heating, mixing etc). As a function of this, some artificial materials can be studied as if they were natural objects if one considers that the manufacturing processes are similar in settlements belonging to similar periods. Thus the raw mate-

[1] This work is part of the projects "Expedición Arqueológica de la Universidad de A Coruña en el Medio Éufrates Sirio" (Grant 10 PXIB 167197PR) funded by the Dirección Xeral de Investigación, Xunta de Galicia (Spain) and "Investigaciones arqueológicas en el Medio Éufrates" (Grant HAR2010-15866/HIST) funded by the Ministry of Economy and Competitiveness (Spain).

rial of the same origin and composition will give artificial material of a similar composition during a set period or in an archaeological site. The most typical example is ceramic material which can be studied via geochemical techniques usually employed to study the origin of natural stone materials. In fact, ceramic materials can actually be considered like artificial rocks; they could be considered as sediments metamorphosed at high temperatures and low pressure due to the process of firing clay needed for their manufacture[2].

There are different geochemical techniques which can be used for the characterisation study of the origin and correlation of natural stone material. These methods have also been applied to archaeological material and mainly to ancient ceramics given the similarity with some rocks, to identify their raw materials (type of clay used and place of extraction)[3], to obtain information on the manufacturing processes (separation processes and later selection of materials of finer grain, processes and technologies of baking clay, etc.) and check the existence of exchange between sites of the same period. The study of ceramics provides information on the cultural evolution of human groups, social change and commercial exchange between populations in time and space[4]. The information on a whole that this study provides on the typology of ceramics and the geochemical composition of these materials is crucial for obtaining complete information on the importance of ceramics, migrations or exchange existing in the past.

2. Archaeological frame of the study

The period of Uruk is one of the most fascinating and brilliant steps of Universal Ancient History. Uruk represents the birth of civilisation, an incomparable experience which will transform prehistoric

---

[2] V. Szilágyi *et al.* 2012.

[3] See the various geochemical studies on archaeological ceramics: Blackman 1999; Bolger and Stephen 1999; Stephen and Peltenburg 2002, 173-190; Clop, Álvarez and Hatert 2004; Morgenstein and Redmount 2005; Alden, Minc and Lynch 2006; and Szilágyi *et al.* 2012.

[4] See Blackman 1999; Bolger and Stephen 1999; Alden; Minc and Lynch 2006; Szilágyi *et al.* 2012.

societies into more complex ones. In this historical period, Mesopotamia experienced the formation of the first state or "archaic state" which totally modified the economy and society of that period. This was the start of History, a period marked by great inventions[5]. There were undoubtedly two factors which better defined this new historical period. On one hand, the appearance of the first cities and, on the other, the invention of the first known system of writing which nowadays we call proto-cuneiform[6].

Archaeology in the Near East has helped us prove that the culture of Uruk in the middle of the 4th Millennium B.C. staged a process of geographical expansion which went from the south of Mesopotamia to the north (northern Syria and eastern Turkey) and the east (Iran). In this way, a vast territorial base unified by the same horizon was born.

It would not be until the nineties of the last century that the first monographs were published. These tried to explain the territorial expansion of Uruk culture[7]. These put special emphasis on the conception of a theoretical system, on the causes of this expansion, on their chronology and on the identification and definition of a "Uruk genuine" material culture. In this context, the so-called beveled rim bowls (henceforth BRB) have been the axis of scientific discussion as this type of ceramic production has been usually interpreted as "diagnostic fossil" of Uruk culture (fig. 1). BRB are a type of very basic, hand-made, mass-made pottery. Despite the thousands of BRB buried in the sites linked to the expansion of Uruk culture, today we are not totally sure of their exact function. Various different hypothesis have been presented : measure the rations of grain for workers of a state, contain offerings, make yoghurt, do commerce with salt, moulds to make bread, to name but a few[8].

---

[5] Liverani 1998.

[6] Glassner 2000.

[7] See for example, Algaze 1993 and Butterlin 2003.

[8] See for example, Le Brun 1980. More recently, Potts 2009, Márquez Rowe 2009 and Montero Fenollós 2012.

The question of the function of BRB is by no means uninteresting, quite the contrary, as it illustrates the difficulties encountered by researchers when evaluating what the introduction of this mass produced pottery can represent (on a social, economic and also cultural level) in the peripheral regions of the south of Mesopotamia. Until now, several hypotheses have been presented on the production of these types of bowl, characterised by the standardisation of their shape and volume:

– Production and distribution by the large centres controlled by a state institution. This theory is directly linked to the use of BRB as recipients to measure state workers' rations.

– Production and distribution by a regional or even local institution in the field of the periphery of Uruk: Iran, Syrian Middle Euphrates and Turkish Upper Euphrates.

Are BRB the result of a process of colonisation? This question is closely linked to the complex question for the various models of habitat adopted by the Uruk culture, of which there is no consensus between archaeologists. One of these theories differentiates four types of enclaves: colonies with a complete combined southern material (i.e. from Uruk), establishments with a significant proportion of southern culture but also local, sites with a primacy of local culture and some presence of southern culture and finally sites of exclusively local material culture[9].

The application of the modern techniques of laboratory analysis can be a useful way to shed new light on the production and, more exactly, on the social-cultural significance of BRB. In this study, geochemical analysis of BRB samples from two Uruk sites located in the Syrian Middle Euphrates were carried out, obtaining a quantitative spectrum of all the elements.

[9] Schwartz 1988, 11.

3. Sites studied

Tell Humeida is an archaeological site situated on the left bank of the Euphrates, 75 km to the North of Deir ez-Zor (Syria). Between 2006 and 2011, the archaeological Syrian-Spanish mission in Deir ez-Zor carried out a survey and an excavation in the main hill of the site. This work allowed us to document a stratigraphic unity (UE.1006) characterised by an abundant presence of charcoal, ash, animal bones and especially Uruk pottery, amongst which one must highlight the finds of numerous BRB. The first results of 14C dating, performed on charcoal, showed a calibrated dating of 3700-3500 B.C., i.e. from the Middle Uruk period or Late Chalcolithic 4, depending on the terminology used[10].

Tell Ramadi is an archaeological site situated on the right bank of the Euphrates, 12 km to the northeast of the ancient city of Mari. Excavations carried out by French people and Syrians have allowed us to document a significant occupation of the period of Uruk[11]. BRB are well represented amongst the ceramics found.

A sample of 21 fragments of BRB from Tell Humeida (10) and from Tell Ramadi (11), sites located in the middle valley of the Syrian Euphrates (and separated approximately 150 km away from one another) has served as a base to carry out this preliminary study (fig. 2).

4. Research methods

The research on the origin and production of archaeological material, and in particular ceramics, requires the comparison of geochemical data of the samples taken from at least two physically separated sites or the same site with a temporal separation between groups of studied materials. In this case, the research was carried out on two coetaneous sites.

---

[10] Montero Fenollós 2011.

[11] Geyer and Monchambert 2003, 77 (vol. I) and 15 (vol. II).

The study of the mineralogy of ceramics can be interesting for establishing differences due to some minerals whose presence can reveal different raw materials and thus different centres of extraction and probably production. These types of studies can be done through petrographic analysis of thin sections of the samples, visualising these through a petrographic microscope. This technique provides most information but it is also more tedious and subjective. As alternatives, one can study mineralogy through X-Ray Diffraction (XRD) of pulverised samples or alternative techniques such as Fourier Transform Infrared spectrometry (FT-IR). Both techniques provide qualitative information of major minerals but not of minor minerals, above all the XRD due to the fact that very crystalline minerals can disguise other less crystalline and abundant ones.

As an alternative or complement to mineralogical analysis, there are techniques which provide the spectrum of elements which make up the ceramic matrices, providing quantitative and comparable data. Some of these techniques provide quantitative information on major and minor elements, such as X-Ray Fluorescence (XRF) of ground samples. This technique is the most decisive and used in this type of analysis and currently there are even portable spectrometers which allow us to carry out a non-destructive analysis and which have been applied successfully to ceramics for the study of their origin[12]. The technique presents, however, limitations when measuring elements which are seen in trace proportions. Another technique of interest in this type of study is Inductively Coupled Mass Spectrometry (ICP-MS) which allows one to measure the concentration of minor and trace elements from small samples (1-2 g) after a short acidic treatment. It permits obtaining quantitative information of elements present in very low proportions such as Rare Earth Elements (REE). An alternative technique is Neutron Activation Analysis (NAA) which provides information on a limited number of minor and trace elements but from a minimum sample (>200 mg).

[12] Morgenstein and Redmount 2005.

In this study, the use of FRX and ICP-MS were combined to obtain a quantitative spectrum of major, minor and trace elements of samples. For this, a thin layer of inner and outer surfaces of the fragments of ceramics was removed and the samples were ground down to obtain a fine powder using an agate mill and avoiding possible contamination between samples. A total of 21 ceramic fragments of BRB were analysed: 11 corresponding to Tell Ramadi (TR) and 10 to Tell Humeida (TH)[13].

For the evaluation of results, one can consider two types of approximations. Distribution and concentration of major and minor elements can provide similar information to the mineralogical study, by indicating significant differences between sites or groups of samples when these are very clear. If the composition of the ceramic paste is very similar, the use of trace elements is more decisive.

Once the elements to be compared have been chosen, different types of analysis of results can be applied. On one hand, there are statistical methods (for example, analysis of similar components, cluster analysis) which provide very objective tools for comparisons between few elements. When there are important quantitative differences between elements, they are a tool which allows one to obtain objective and reproducible results. Where there are no clear differences and multiple elements need to be analysed, the use of graph analysis tools is preferable. The most common in geochemistry are ternary plots, spider plots, and element patterns or normalised plots. All these provide visual information which is easy to analyse. In this study, results were compared using various multi-elemental graphs of major and minor and trace elements. Comparative graphs of average patterns of distribution of elements for samples from studied sites were prepared. For this, the average and the standard deviation of the concentration of each element in the groups of samples were calculated (Group TH is Tell Humeida and TR is Tell Ramadi).

---

[13] The analysis was carried out in the laboratories of the *Servicios de Apoyo a la Investigación* (SAI) of the Universidade da Coruña.

5. Results and discussion

The data obtained has been compared in three categories: main elements, minor elements and trace elements. Two plots which indicate the average pattern of each sample and its deviation have been constructed using these three categories (fig. 3 and 4). The graphs show great uniformity in the basic composition of the samples, both between one another and between the sites. There are hardly any variations in the composition of some elements. For the major elements (fig. 3), the greatest variability between both sites is seen in losses due to calcinations (loss on ignition, LOI) and the content in CaO (calcium oxide). The LOI are also valuable between samples of the same site given that they depend on organic material used as a degreaser, on porosity and on the content in environmental water. The CaO, on the other hand, is rather soluble so other differences could simply be due to different rates of meteorisation (dissolution) of the ceramics in both sites.

As for the minor elements (fig. 3), the greatest variations are observed in the P_2O_5 content. Phosphorus is a rather soluble element so one cannot attribute this variability to differences between ceramics. What is more striking is the difference in the content in TiO_2, not very soluble, which is too small to be taken as proof of the different composition between ceramics. Trace elements (fig. 4) show a very uniform pattern for all samples, with differences for some elements such as Ba, Cr, Ni, Sr and V. As Cr, Ni and Sr are not soluble, so can be used as a reference, these differences are relatively low and not very significant if we consider the averages for each site and the standard deviation. Therefore we cannot confirm there are significant differences between the composition of the ceramics of Tell Humeida and Tell Ramadi, which could come from the same centre of production.

Presuming the existence of a single production centre of BRB for the two sites studied, this result partially coincides with other studies carried out previously based on similar analytical techniques and other techniques. A comparative study between at least three sites of

Uruk[14] revealed similarities and differences between the BRB, which confirms the hypothesis of the existence of regional divisions of the production centres. This hypothesis defends a division between the south of Mesopotamia and the north and the existence of various areas in this latter region.

Other similar studies have been carried out through the analysis of stable isotopes of coal ($^{12}C/^{13}C$) and deuterium (^{2}H) in tarmac (bitumen) which cover the inside of the BRB found on the site of Hacinebi in Anatolia[15]. These studies propose the existence of two phases of local production and exchange of ceramics in the site distinguishing a "Pre-contact" phase (before the appearance of the Uruk phase in the site) and another "Contact" phase (Uruk), with bitumen from different sources. This second phase, corresponding to the Uruk period, would imply the existence of different production centres.

The results obtained in these previous studies, although seemingly opposite, could be classified in a more complex outline than the simple distinction between a centralised production and distribution as compared to one of local character. The data from these studies point towards the existence of entities of character (at least regional), in the field of the periphery of Uruk: Iran, Syrian Middle Euphrates and Turkish Upper Euphrates. To obtain more concluding results, one must carry out more detailed analysis and, above all, analyse an extensive number of samples of other types of ceramics, existing in the sites considered here as well as covering other sites in different areas of Mesopotamia.

6. Conclusions

The expansion of Uruk culture in the middle of the 4th Millennium B.C. meant the foundation of different establishments from the south of Mesopotamia to the north of Anatolia and Iran. BRB, used as an indicator to identify Uruk culture sites, are considered to be extremely

[14] Bolger and Stephen 1999.

[15] Schwartz and Hollander 2008, 3144-3158; Stein, Hollander and Schwartz 1999.

interesting for the study of exchange and commercial and colonial expansion in this key period of Mesopotamian history. In this sense, geochemical analysis is presented as a very useful way of exploration.

These ceramics were made by hand and *en masse*, but we do not know if they were produced and distributed by centres controlled by a state or regional institution. Geochemical analysis of BRB and two coetaneous sites in the valley of the Syrian Middle Euphrates (Tell Humeida and Tell Ramadi), located 150 km from one another, indicate great homogeneity between samples. For this reason, it does not appear that BRB found in both archaeological sites of Uruk come from different production centres. Although the analysis of this data of individual samples does not let us conclude if the production and distribution were controlled by large state centres or regional institutions (due to the relatively short distance, i.e. 150 km, existing between the two sites studied) one can affirm that the production of BRB was not a strictly local matter.

The combination of the new data obtained with other previous studies indicates that it is highly possible that regional centres of production existed, at least in the north of Mesopotamia (Middle Euphrates). To summarise, we can conclude, in the light of new geochemical data from Tell Humeida and Tell Ramadi, that BRB of the section of the southern Middle Euphrates, demarcated between the gorges of Khanuqa and Baghuz, come from the homogeneity of their composition of the same centre of production. This preliminary data will need to be confirmed with new laboratory research which includes samples from other sites of Uruk (in particular of Qraya, situated in the north of Ramadi) and other types of pottery from the same period.

Bibliography

ALDEN, J. R.; MINC, L. and LYNCH, T. F. 2006. "Identifying the sources of Inka period ceramics from northern Chile: results of a neutron activation study". *Journal of Archaeological Science* 33: 575-594.

ALGAZE, G. 1993. *The Uruk World System. The Dynamics of Expansion of Early Mesopotamian Civilization*. Chicago: The University of Chicago Press.

BLACKMAN, M. J. 1999. "Chemical Characterization of Local Anatolian and Uruk Style Sealing Clays from Hacinebi". *Paléorient* 25: 51-56.

BOLGER, D.; STEPHEN, F. 1999. "Scientific analysis of Uruk ceramics from sites of the Syrian and Southeast Anatolian Euphrates: preliminary results". *Aula Orientalis – Supplementa* 15: 301-310.

BUTTERLIN, P. 2003. *Le temps proto-urbaines de Mésopotamie. Contacts et acculturation à l'époque d'Uruk au Moyen-Orient*. Paris: Éditions du Centre national de la recherche scientifique.

CLOP, X.; ÁLVAREZ, A. and HATERT, F. 2004: "Characterization Study of Halaf Ceramic Production at Tell Amarna (Euphrates Valley, Syria)", in Tunca, Ö.; Molist, M. and Cruells, W. (eds.), *Tell Amarna (Syrie) I. la période de Halaf*. Louvain: Peeters, 201-212.

GEYER, B.; MONCHAMBERT, J. Y. 2003. *La basse vallée de l'Euphrate syrien du néolithique à l'avènement de l'islam* (2 vols.). Beyrouth: Institut Français du Proche-Orient.

GLASSNER, J.-J. 2000. *Écrire à Sumer. L'invention du cunéiforme*. Paris: Les Éditions du Seuil.

LE BRUN, A. 1980. "Les écuelles grossières. État de la question" in M.-Th. Barrelet (org.), *L'Archéologie de l'Iraq du début de l'époque néolithique à 333 avant notre ère*. Paris: Editions du Centre national de la recherche scientifique, 59-66.

LIVERANI, M. 1998. *Uruk, la prima città*. Roma: Laterza.

MÁRQUEZ ROWE, I. 2009. "Pain, bière et la culture d'Uruk. De Gilgamesh au bol à bord biseauté". *Aula Orientalis – Supplementa* 25: 133-146.

MONTERO FENOLLÓS, J. L. 2011. "Le site urukéen de Tell Humeida au Moyen Euphrate syrien. Premières recherches archéologiques". *Res Antiquitatis* 2: 205-216.

—— 2012. "Le Moyen Euphrate avant Mari. L'expansion urukéenne entre les verrous de Khanuqa et Baghuz". *Bibliotheca Euphratica* 1: 177-194.

MORGENSTEIN, M.; REDMOUNT, A. 2005. "Using portable energy dispersive X-ray Fluorescente (EDXRF) analysis for on-site study of ceramic sherds at El Hibeh, Egypt". *Journal of Archaeological Science* 32: 1613-1623.

POTTS, D. 2009. "Bevel-Rim Bowls and Bakeries", *Journal of Cuneiform Studies* 61: 1-23.

SCHWARTZ, G. 1988. "Excavations at Karatut-Mevkii and Perspectives on the Uruk-Jemdet-Nasr Expansion". *Akkadica* 56: 1-41.

SCHWARTZ, M.; HOLLANDER. D. 2008. "Bulk stable carbon and deuterium isotope analyses of bitumen artifacts from Hacinebi Tepe, Turkey: reconstructing broad economic patterns of the Uruk expansion". *Journal of Archaeological Science* 35: 3144-3158.

STEIN, G. J.; HOLLANDER, D. and SCHWARTZ, M. 1999. "Reconstructing Mesopotamian Exchange Networks in the 4th Millennium BC: Geochemical and Archaeological Analyses of Bitumen Artifacts from Hacinebi Tepe, Turkey". *Paléorient* 25: 67-82.

STEPHEN, F. M. K.; PELTENBURG, E. 2002. "Scientific analyses of Uruk ceramics from JerablusTahtani and other Middle-Upper Euphrates sites" in J. N. Postgate (ed.), *Artefacts of Complexity. Tracking the Uruk in the Near East*. London: British School of Archaeology in Iraq, 173-190.

SZILÁGYI, V. *et al.* 2012, "Petro-mineralogy and geochemistry as tools of provenance analysis on archaeological pottery: Study of Inka Period ceramics from Paria, Bolivia". *Journal of South American Earth Sciences* 36: 1-17.

Figures

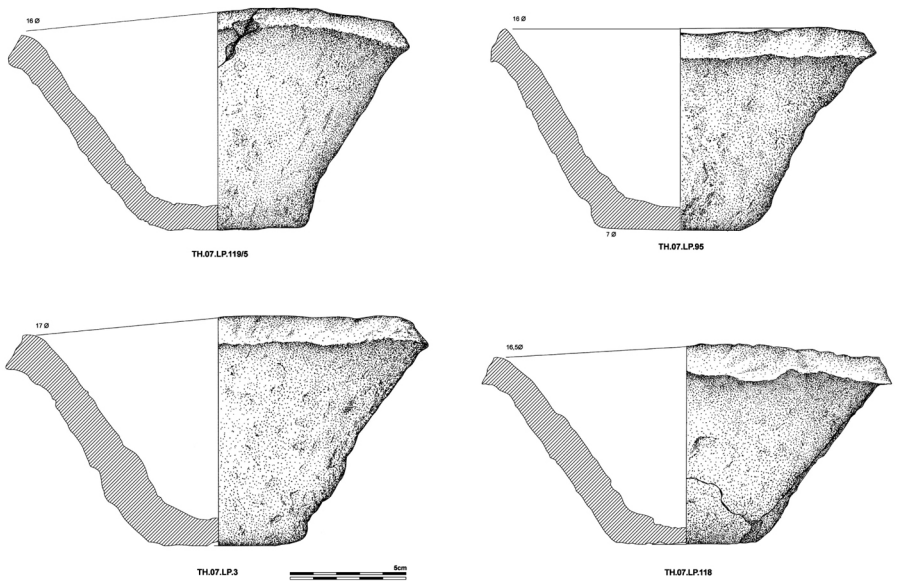

Fig. 1. BRB from Tell Humeida (Syria).

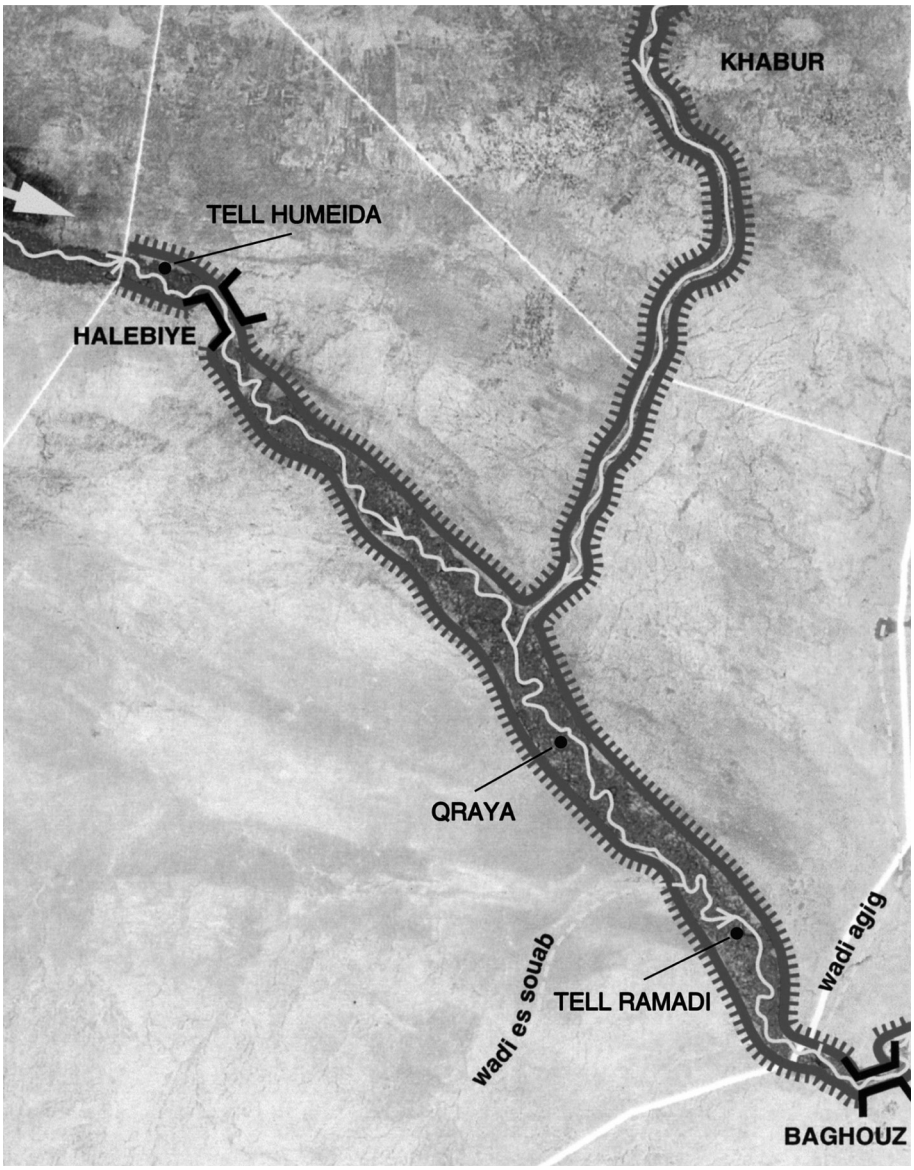

Fig. 2. Situation of the sites studied: Tell Humeida and Tell Ramadi (Syria).

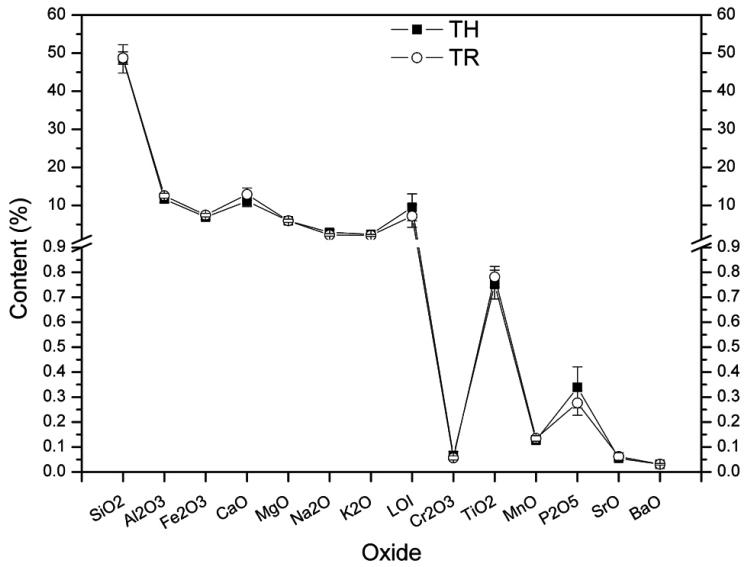

Fig. 3. Comparative plot of mean content (in ppm) on major and minor elements with standard deviation (TH, Tell Humeida; TR, Tell Ramadi).

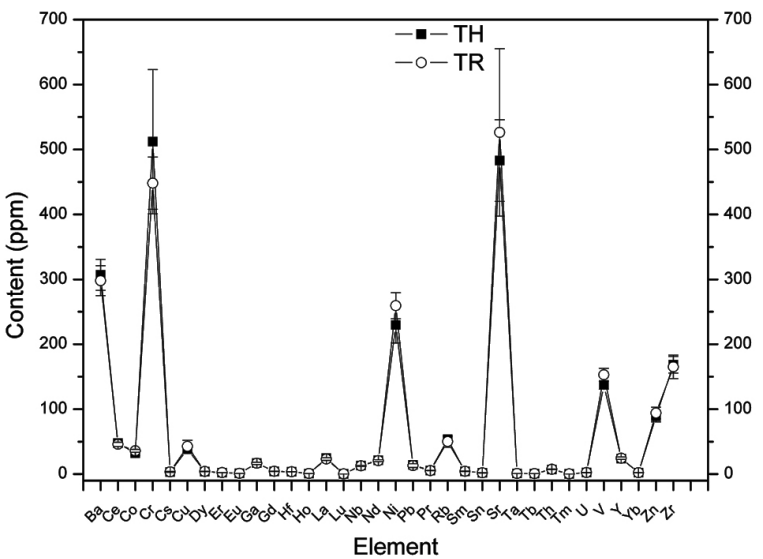

Fig. 4. Comparative plot of mean content (in ppm) on trace elements with standard deviation (TH, Tell Humeida; TR, Tell Ramadi).