



REVIEW

of the Master thesis ***The tale of volcanic rocks. Assessing the grinding stones and their chaîne opératoire in 2nd Millennium BC Western Anatolia*** submitted to the Institute of Classical Archaeology, Faculty of Arts, Charles University Prague by Kristina Doležalová BA

Since the past years studies on grinding stones have increasingly become the focus of research – not least because the enormous potential for (economic) archaeological studies has been recognised. However, depending on the geographical region and chronological timeframe this field of research is insufficiently investigated. With a few exceptions, unfortunately, this also applies to the region of Western Anatolia. Therefore, Ms. Doležalová's commitment to this issue is particularly important to emphasise. The grinding stone assemblage from the Middle to Late Bronze Age site of Kaymakçı in the western Turkish province of Manisa form the basis of this work. The site is located on Lake Marmara and has been investigated since 2014 by an international team of researchers under the direction of the Koç University, İstanbul. With this study, the author broadens the topic of her previous bachelor thesis (*Ground stone tools from the Aegean Bronze Age*).

The work consists of two volumes: a text part as well as supplementary data part with illustrations. The main text is divided into six chapters followed by a bibliography and references of the figures and tables. The second volume contains the data of the associated database and plates.

The **first** chapter clarifies the framework of the thesis and explains the project. For this purpose, different research questions are defined, addressing different aspects of the archaeological material: the *chaîne opératoire*, the raw material used for production, the secondary use of the objects, specialized production features of the Kaymakçı assemblage, and more general aspects of the *chaîne opératoire* in Bronze Age Western Anatolia. In the first part of the thesis, the focus will be set on the theoretical background. This includes terminological problems but also the history of research as well as the application of new methods and analyses. This is followed by a description of the development of grinding stones and their *chaîne opératoire* since the Neolithic period onwards, based on published studies. The second part concentrates on grinding stones of the 2nd mill. BC in Western Anatolia and focuses on the find assemblage from Kaymakçı. The study comprises an examination of morphotypology, provenance, use-wear, and contextual as well as spatial analyses. The author justifiably compares the material with the published contemporaneous finds from Troy and Aphrodisias. Despite the different quality of data, these two excavations provide the best data basis for comparisons in the region to date. Finally, the thesis includes a summary and the assessment of the *chaîne opératoire* of the Kaymakçı finds with a discussion of patterns in Bronze Age Western Anatolia.

The **second** chapter introduces the topic and starts with a definition of the artefact group of grinding tools (2.1). In this context, it is positive to note that Ms Doležalová deals specifically with the terminology of the recorded finds of the Kaymakçı inventory. Despite the efforts of different research groups, such as the »Association for Ground Stone Tools Research« (AGSTR), it is still used inconsistently. Regarding the grinding stones, she follows the current

state of research by referring to them as »macrolithic artifacts« and correctly divides them into a »lower« and »upper« part. After clarifying the terminology, Ms Doležalová summarises the history of research (2.2) and provides an overview of all important and relevant publications on the subject, including ethnography, provenance analyses, and use-wear studies. This sub-chapter is concluded by a summary of previous research in Western Anatolia and the Aegean. The next sub-chapter (2.3) is devoted to the general development of grinding and milling technology from Greece to the Levant. The author highlights the importance and basic function of »macrolithics« for food preparation since the Palaeolithic and continues with their further development up to the Iron Age. In this part Ms Doležalová shows her broad knowledge of the state of research beyond the primary geographical region of her work (Western Anatolia) and the chronological framework (Bronze Age). The in-depth and detailed study of the published literature in this branch of research goes beyond the normal requirements of a Master thesis and forms the basis for such a close examination of her research topic. Therefore, this enormous amount of work must be credited to Ms Doležalová to a very high degree.

The **third** chapter deals in detail with the topic of the *chaîne opératoire*. At the beginning, the basics of sequence models (3.1) are presented, from the theoretical background with behavioral chains and object biographies to the transfer and application for ground stone studies. The second sub-chapter is dedicated in detail to the *chaîne opératoire* of grinding stones from the procurement, the production, and the use to the disposal of the objects (3.2). In addition to the clear structure, the author's well-founded expertise displayed in the introduction of this topic should again be emphasised. The very detailed presentation and the range of research approaches included at the individual stages of the *chaîne opératoire* provide a perfect basis for the subsequent embedding of the grinding stone assemblage from Kaymakçı. In the third part, the focus is set on the chronological and cultural context of the Bronze Age sites with internal and external connections (3.3). At this point, Ms Doležalová correctly refers to the Early Bronze Age communication networks of the 3rd mill. BC and the already known routes of the *Anatolian Trade Network*, which provided trade connections between the Aegean the western Anatolian hinterland via the large waterways of the valleys. To a certain extent, these networks can also be assumed for the later periods. After the general presentation of the political and geographical conditions in the 2nd mill. BC, the location and research history of the three sites of Kaymakçı, Aphrodisias, and Troy are presented as an introduction to the material studies following in the next chapter.

The **fourth** chapter forms the core of the thesis and is dedicated to Kaymakçı's grinding stone assemblage. The first part begins with an introductory section on the methodology of the approximately 300 recorded artefacts (4.1). In addition to the shape, cross sections, information on manufacture and wear, ergonomic features were included. The determination of the raw material was performed by standard geological classification and supported by a kappameter. Especially the exact classification of igneous rocks is difficult without thin sections or further geochemical analyses, therefore, the author used this approach to obtain the maximum information for the non-invasive analysis of the rock types. The second sub-chapter deals with the important question of the origin of the used rocks (4.2). For this approach, in a first step the geology of western Anatolia – in particular the Menderes Massif – is introduced, in whose region the Kaymakçı site is located in a geological graben situation. The immediate vicinity of the site is characterised by sedimentary rocks, schists, and fluvial

deposits. However, most of the grinding stones are made of volcanic rocks (basalt to rhyolite), which is why it must be assumed that the raw materials or the devices were imported. In addition to the volcanic rocks, this is also evidenced by the gneisses, both rock types are only accessible at a distance of more than 25 km. Regarding the volcanic rocks, the author therefore extends the catchment area to a radius of 100 km in order to locate potential rock sources and defines nine geological regions for closer examination. At this point, once again, the detailed research of the mainly remotely published literature must be emphasised, which forms the basis for such a consideration and the performance of a geological survey. Ms Doležalová presents in detail and precisely the various regions where the different types of volcanic rocks are located and discusses them based on their colour and matrix. The next sub-chapter deals with the production, transport, and distribution of grinding stones (4.3). With regard on their manufacture, no evidence of workshops was found in Kaymakçı, which is why the production probably took place outside the settlement or nearby the quarries. In this context, it would be interesting to ask to what extent the preserved rock surfaces indicate the use of secondary raw material deposits, i.e. boulders or gravels with a suitable shape, instead of primary rock sources (»collecting versus mining«)? Traces of use are considered in the fourth sub-chapter (4.4). In the first section, the general shape, type of sets and ergonomic adjustments for handling the upper grinding stones are discussed. For the understanding and the precise analysis of use-wear related traces, experimental archaeological studies with replicas were conducted. These form the basis for a close examination of use-wear on preserved artefacts from Kaymakçı. The last sub-chapter deals with spatial analyses and disposal patterns of the grinding stones (4.5). Since the majority of the assemblage is preserved in fragments, it is obvious that the grinding stones were not detected within the context of their primary use. Additionally, no indications related to material/food processing were recorded during the excavations. However, it turned out that completely preserved grinding stones were mostly located inside rooms. In general, such a picture is not surprising in a settlement, since most of these implements are frequently found in a secondary context and were thus often used as building material in structures or disposed as filling/levelling material.

The **fifth** chapter deals with the inventories of Middle and Late Bronze Age grinding stones from Aphrodisias and Troy that were used for comparison. Due to terminological differences, a total of 40 grinding stones are available from Aphrodisias (5.1) after the evaluation of the 98 grinding tools. The bulk of the grinding stones were made from local metamorphic rocks – this shows a certain pragmatism in rock selection. In contrast to Kaymakçı, only about a quarter of the objects consist of volcanic rocks, which must be regarded as imports based on the local geology. Apart from the material, the inventory does not differ much from the Kaymakçı assemblage. From Troy (5.2), a total of 41 grinding tools can be used for comparison, of which 31 are grinding stones. Of these, however, only 10 objects were geologically determined. The majority was made of volcanic rocks, which is locally available. Only one object made of granite can be considered an import, as such a rock type is available at least 20 km away from the site. In this chapter, Ms Doležalová brings together all the available information from the two sites and thus illustrates the problem of an inconsistent data set of different sites, which limits comparability.

The **sixth** chapter summarises the most important results of the investigations (6.1-2) and embeds them in the context of Western Anatolia in the 2nd mill. BC. The results of the

conducted studies in Kaymakçı are compared with the Middle and Late Bronze Age grinding stones from Aphrodisias and Troy. When looking at both inventories used for comparison, only the raw material shows differences to Kaymakçı's inventory. Based on the existing data, the communities in Aphrodisias and Troy seem to have predominantly used the local/regional material. Therefore, the question arises what in particular led the inhabitants of Kaymakçı to make such an enormous effort to procure suitable rock types or devices from far away? In order to answer this question, further detailed studies of grinding stones in Western Anatolia are mandatory to create a broader database, as Ms. Doležalová states aptly in the last paragraph. The author's studies on the Kaymakçı assemblage are to be regarded as exemplary in this respect. This is also underlined by the extended bibliography, which bears witness to the extent of the work done in this thesis.

The data and catalogue volume provide the interested person with all the information needed to verify the author's statements and to pursue various questions. The quality of the photographic and graphic documentation is of the highest standard and gives a very good impression of the nature of the various grinding tools.

If one wants to look for any suggestions for improvement in this excellent work, one only will notice that from page 60 onwards the numbering of the illustrations no longer corresponds to the chapters. However, this does not affect the content of the work at all. Therefore, it remains to be said that the excellent concept, structure, and content of the work clearly exceed the normal quality of a Master thesis. **Ms Doležalová's contribution cannot be valued high enough** as different facets form a perfect overall picture, including: (1) the excellent study of the Kaymakçı grinding stone assemblage and the published literature (i.e. theoretical, historical, geological background, and methodology) as fundamental basis for the conducted work, (2) the geological determination of the used rocks, (3) the initiation of geological surveys in selected volcanic regions with sampling, (4) the experimental-archaeological approach, (5) the microscopic use-wear studies, and (6) the spatial analysis. All together forms an exemplary approach for a comprehensive analysis of a grinding tool assemblage. Therefore, the submitted thesis fulfils all requirements for a Master thesis and provide an ideal basis for a defence. I hereby classify the work as:

Excellent (1)

Mainz (Germany), 14th of August 2023

(Dr. Christoph Schwall M.A.)