GRINDING TOOLS AT THE THIRD INTERMEDIATE PERIOD TELL EL-RETABA – A PRELIMINARY ANALYSIS

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Abstract: *Tell el-Retaba, an archaeological site situated in Wadi Tumilat in the eastern Nile Delta, some 35 km west of the modern city of Ismailia, has been excavated by the Polish- Slovak Archaeological Mission, directed by Dr. hab. Sławomir Rzepka, since 2007. Long-lasting archaeological excavations of the Third Intermediate Period settlement have yielded hundreds of ground stone artefacts, among them implements used for grinding activities. The diversity of these tools' forms and the material they are made of may imply their having been employed for various purposes and to treat a wide range of substances. This article presents a preliminary analysis of the grinding stone implements and their possible uses.*

Keywords: *Tell el-Retaba, Third Intermediate Period, settlement archaeology, ground stone tools, grinding tools*

1. Introduction

Research on movable artefacts yielded during archaeological excavations of settlements often leads to reconstructing former crafts and everyday activities. Ground stone tools, also known as "macro-lithic tools" or "non-flint implements", make for a numerous, although fairly underestimated, group of such artefacts. The term "ground stone tool", in a broad sense, refers to any stone implement used for grinding, abrading, polishing or impacting.[1] Only grinding tools, i.e. implements used for grinding, crushing or pounding – aimed at reducing the bulk of plant or animal matter, pigments, clay or admixtures and inclusions into a finer texture – will be analysed in the current paper.[2]

The Polish-Slovak Archaeological Mission in Tell el-Retaba has been excavating the Third Intermediate Period settlement there since 2007 and, thus far, has yielded copious ground stone material, among which implements used for grinding prevail. The principal aim of the following text is, therefore, to present a typology of the Tell el-Retaba grinding stones along with a provisional assignment of their functionality. The diversity of shapes raise the question of the tools' function. The identification of the working parts of a tool and the modes of prehension was analysed based on macroscopic observations. The direction of movement and shape of a tool might be useful in determining the type of substance processed with it.[3]

Ground stone implements make up one of the biggest groups of finds from Pharaonic Egyptian settlement sites, which is attested by the growing number of publications.[4] The Tell el-Retaba material, however, has been published only once and only to the extent of dealing with flint artefacts.[5] Other stone implements have been presented fairly rarely, usually as part of excavation reports, in so

	Total	Total %
Querns	**50**	**25 %**
type 1.1 querns	*16*	*32 %*
type 1.2 querns	*34*	*68 %*
Grinders	**106**	**53 %**
type 2.1 grinders	*49*	*46 %*
type 2.2 grinders	*57*	*54 %*
Non-classified	**43**	**18 %**
	199	

Table 1 Grinding tool assemblage at the Third Intermediate Period Tell el-Retaba

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1 Adams 2014, 3.

2 Research financed by the Polish National Science Centre, grant 2015/17/B/HS3/00597, and supported by the Polish Centre of Mediterranean Archaeology.

3 Dubreuil 2001, 74.

4 E.g. Eger 1994; Boyce 1995; Samuel 2010; Prell 2011, 2015, 2019; Jeuthe 2012, 2019; Stevens 2012, 223–283; Czerny 2015, vol. 1, 392–401; Lang 2016.

5 Buławka 2017.

	Total	Total %	Type 1.1 Quern	Type 1.2 Quern	Type 2.1 Grinder	Type 2.2 Grinder	Non-clasified
Building {**2147**}	34	17%	2	3	11	11	7
Building {**991**}	28	14%	2	6	10	8	2
Building {**1095**}	24	12%	3	7	1	6	7
Building {**2640**}	9	5%		1	4	4	
Building {**1607**}	9	5%	1	4			4
Building {**2196**}	7	4%		3	1	2	1
Building {**207**}	6	3%	1		3	1	1
Building {**1047**}	6	3%		2	2		
Building {**1539**}	5	3%	2		1	2	
Building {**1150**}	5	3%			1	2	2
Building {**2227**}	4	2%		1	2	1	
Building {**204**}	3	2%					3
Building {**2664**}	3	2%				3	
Building {**2622**}	2	1%				1	1
Building {**1528**}	1	1%			1		
Deposits unrelated to structures	53	27%	5	7	10	16	15
	199		**16**	**34**	**49**	**57**	**43**

Table 2 Frequency rates of grinding tool types within the specific buildings (floor and debris layers).

far as they were deemed conspicuous or outstanding specimens.[6]

2. Grinding tool assemblages

A total of 199 grindstones (see Table 1) have been found so far in Tell el-Retaba Third Intermediate Period settlement contexts. Most of them (n = 140) were found in debris layers within individual buildings, and 59 objects were found in floor layers (see Table 2).

2.1 Material

Grinding tools were mainly made of quartzite (n = 118), quartzitic sandstone (n = 25),[7] flint pebbles (n = 27), granite (n = 17) and granodiorite (n = 6) (see Table 3). Implements made of other types of raw material are fairly rare: limestone (n = 3), basalt (n = 2) and gneiss (n = 1). Among the above, only flint pebbles are endemic to the Nile Delta. Implements made of other stone, unencountered in this area, might have been acquired from other sources, for example, from nearby temples – a hypothesis which appears justified by some other types of finds from a Third Intermediate Period site attesting the reuse of blocks from a Ramesside temple as tethering stones in stables.[8] However, it should be noted that petrographic investigation has yet to be carried out. Thorough analyses of the sources of raw material or potential quarries need to be undertaken in future research.

The said raw material types differ regarding their composition and structure (Fig. 1). Be they smooth or, on the contrary, rough and gravely, the choice of any given stone type for a particular activity is never incidental, as ethnographical studies demonstrate. Examples from Ethiopia or

[6] Reports from previous excavations of Third Intermediate Period remains in Tell el-Retaba can be found in Rzepka and various colleagues 2009, 2011, 2014, 2015, 2017.

[7] Analogies from other sites in the Nile Delta also indicate quartzite as the most popular raw material for grinding tools production (Prell 2011, 73; Czerny 2015, vol. 1, 395).

[8] Rzepka *et al*. 2011, 153–155; Jarmużek 2013, 284.

Kenya clearly show that the choice of raw material of a given texture has always been determined by the type of substance to be treated. Based on experimental research and some functional analyses conducted at other sites, for example, it is clear that the grinding tools (both passive and active[9]) with fine-grain rock structure were preferred in the case of grinding cereals.[10] On the other hand, when it comes to grinding seeds, coarse-grain rocks tend to be used more often.[11]

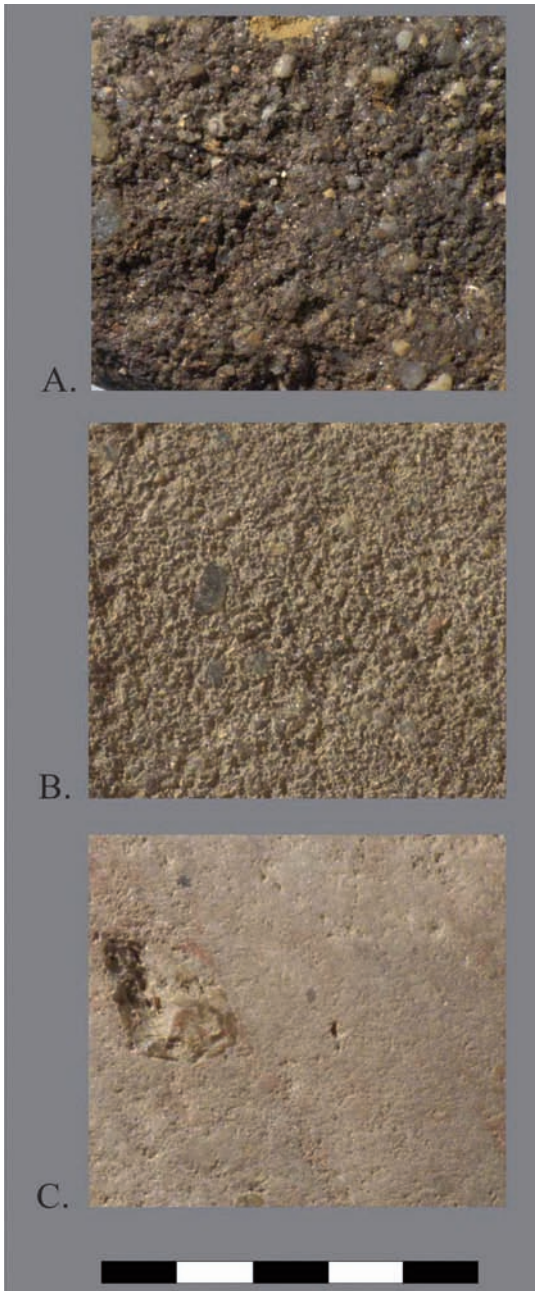

Fig. 1 Examples of the different structure and compostion of the raw material: working part of a quern made of quartzite: A. S3060, B. S3148, C. S3136

2.2 Querns

What merits a mention is that none of the 50 querns has been preserved complete, which, however, is not unusual. Research in this respect often reports on incomplete querns or a low ratio of intact querns compared to a total number of preserved tools.[12] An explanation could be that once out of use (broken or otherwise destroyed), querns were often reused for other purposes. Apart from practical everyday implementation, querns, as stipulated in many ethnographical studies on African cultures, also display a significant cultural and household status-related value. Quern production may be a costly and resource-consuming enterprise, as contemporary examples from Ethiopia and Kenya prove.[13] Nonetheless, a quern, cautiously used and properly taken care of, can serve its owner as long as 35–45 years.[14] Querns are prone to damage, most commonly by abrasion or cracking, upon which, nonetheless, they still can be used for other purposes, for example, for grinding non-food substances or for pounding. It is also not uncommon that querns from archaeological sites are used by contemporary local communities.[15]

With the above in mind, the absence of complete querns preserved at Tell el-Retaba can be explained as follows:

1. well-preserved querns might have, still in antiquity, been part of movables taken by inhabitants when they abandoned a settlement. Otherwise, they might have been acquired from an already abandoned settlement and reused later, which could account for the

[9] Grinding tools are divided into two groups: 1) so-called active grinding tools, or upper tools/implements, i.e. implements being moved against the passive tool, and 2) querns – so-called passive grinding tools (sometimes also called lower tools/implements) – stationary implements, i.e. which themselves do not move throughout the grinding activity.

[10] Dubreuil and Savage 2014, 140–141, Table 1 – references of experiments include functional analysis of grinding and pounding tools.

[11] *Ibidem.*

[12] E.g. Samuel 1989, 260; Adams 2008; Wright 2013, 372; Stroulia et al. 2017, 3.

[13] E.g. Arthur 2014, 135–137; Robitaille 2016, 432.

[14] Nixon-Darcus and D'Andrea 2014, 206.

[15] Shoemaker et al. 2017, 432.

absence of completely preserved querns yielded from Third Intermediate Period contexts;
2. damaged (e. g. broken) querns were, already in antiquity, employed in other functions, (e. g. as grinders,[16] or building material[17]) and have been registered in catalogues of artefacts as such.

Based on the preserved fragments, two types of querns are distinguished:
Type 1.1: Querns with elevated ends and a concave use surface (Fig. 2),
Type 1.2: Querns with straight ends and a flat use surface (Fig. 3).

The quern assemblage from the Tell el-Retaba is in a very poor condition, as mentioned above, and there are no completely preserved examples. In most cases, only small pieces have been pre-

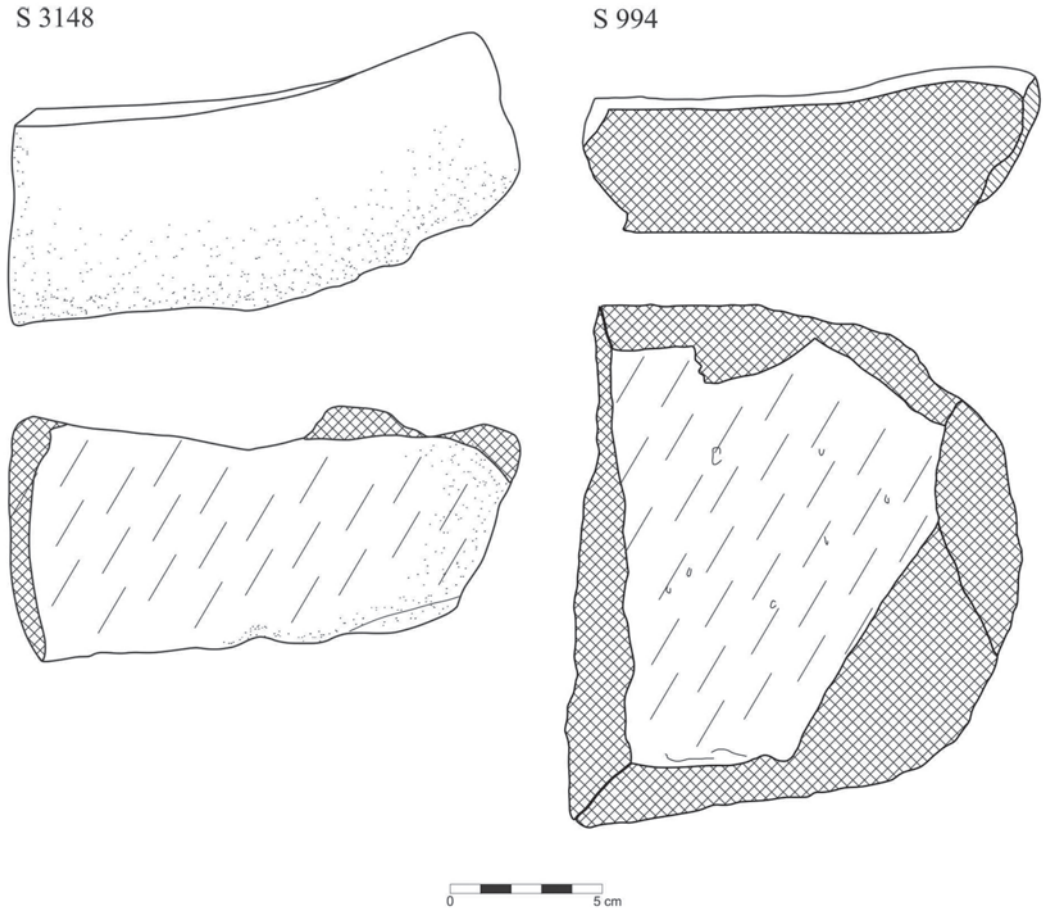

Fig. 2 Type 1.1 quern – a. S3343 (photo O. Bagi); b. S3148, S994 (drawing B. Adamski)

[16] Czerny 2015, vol. 1, 395.

[17] Prell 2015, 44; however, there is no evidence for querns having been used as building material in Tell el-Retaba.

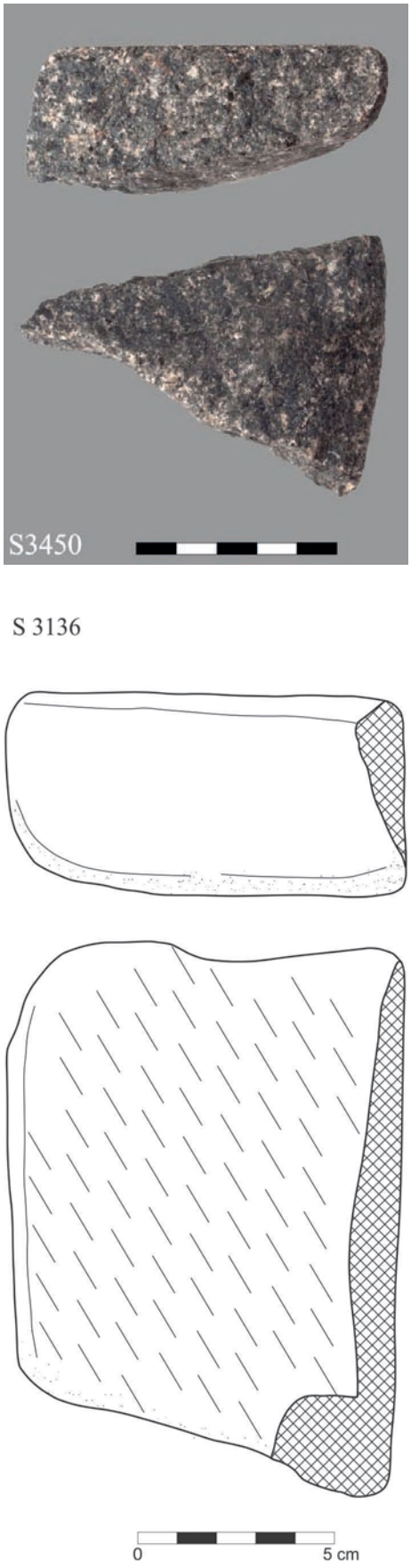

Fig. 3 Type 1.2 quern – a. S3450 (photo O. Bagi); b. S3136 (drawing A. Ryś)

served, which makes their reconstruction almost impossible, although, in some cases, based on analogies from other ancient Egyptian sites, their shape may be recreated. The Tell el-Amarna research by Samuel showed that nearly half of the querns tested display a slightly convex curve across the width of the working surface, while the surface along the quern's longitudinal axis is usually flat and slightly concave.[18] This type of quern is known as a saddle type and is attested at the other ancient Egyptian sites.[19] Querns of this type are also well attested in ancient Egyptian reliefs and models, where large and long querns, often set up on an emplacement, are usually depicted. However, the Tell el-Retaba fragments, as well as a lack of emplacement remains, suggest that massive querns were unknown at this site. Since small, portable querns are also known, for example, from New Kingdom Piramesse,[20] or Tell el-Amarna,[21] it might be possible that the same type of tool was also present in Tell el-Retaba during the Third Intermediate Period.

2.3 Grinders

The majority of the 84 grinders classified here bear traces of grinding visible on one surface only; some specimens feature smoothed patches attesting to grinding activities and, additionally, also traces of striations and abrasions.

Regarding their shape and the morphology of the working part, the grinders are classified into two groups:

Type 2.1 – sizeable and heavy grinding tools, with only one, flat and slightly sloping, working surface. Upper surface flat or concave. Length oscillates between 6 and 12.3 cm, width between 5.9 and 11.7 cm, thickness between 3.6 and 6.3 cm. (Fig. 4)

Type 2.2 – small, cubical or spherical in shape, with one or more working surfaces, flat or concave. Length, width and thickness, practically identical, oscillates between 3 and 6 cm. (Fig. 5)

Since the two types of grinders described differ significantly regarding form, it only stands to reason they must have been employed for diverse activities. The active tools' working surfaces of Type 2.1 are flat with a discernible slope, which

[18] Samuel 1989, 262.
[19] Samuel 1989, 262; Lang 2016, 281.
[20] Prell 2011, 72–80.
[21] Samuel 1989, 262.

Fig. 4 Type 2.1 grinders – S3448, S3384, S3405 (photo O. Bagi)

might result from repeated movements – back and forth – of the active grinding tool along the longer axis of the passive tool. Given that the pressure exerted concentrated along the proximal part, this was the section of the tool to have worn out faster, resulting in an incline. Should this presumption be correct, then this would imply that Type 2.1 hand-stones were used in querns to process a certain type of substance on a mass scale, for example, grinding cereal grain to flour.

Fig. 5 Type 2.2 grinders – S3323, S3339, S3408, S3387 (photo O. Bagi)

Fig. 6 Grinder S3402 (photo O. Bagi)

Nineteen cases out of the Type 2.1 specimens suggest their prior use as parts of some other, bigger implements, which is generally suggested by their typical semicircular (when looked at from above) shape and one straight edge, contrary to the other rounded ones (Fig. 6). Their average length is about 12 cm, which implies the original device could have been about 25 cm long, suggesting, in turn, this could have been the lower stone. The above hypothesis suggests that as long as the appliance was in good condition, it served as a quern, and once it was damaged (e. g. broken), it received its secondary function (as grinder).

Type 2.2 grinders come in a very characteristic, cuboid-spherical shape which makes them quite unique among artefacts from other sites in Egypt and elsewhere.[22] They are generally described as hammers or pounders, depending on the traces visible on the surface.[23] Although their function remains unspecified so far, their use as tool is generally advised to be secondary, with their primary functionality presumably of a different type. Many researchers are inclined to classify them as sling-stones; however, their considerable weight and size defy such a supposition.[24] David Eitam is of the opinion that they may have functioned as balance weights, their reuse as tools being only derivative.[25] This hypothesis seems to comply with Petrie's suggestion, who, back in 1934, identified the cuboid objects from the Old Kingdom Saqqara graves as weights.[26]

This type of object is also known from ethnographic sources. Research in Ethiopia provide meaningful parallels to the use of small, symmetrically formed tools for grinding peppers or onions.[27] Grinding activities thereof are conducted in small square or round querns by applying circular movements. The morphology of the working parts of type 2.2 grinders confirms that method of use.

Based on their working part, in combination with data from comparative ethnological studies, a hypothesis can be advanced that they were used less frequently and operated with a circular kind of movement required for treating some other specific substances on a smaller scale, such as blending spices, legumes or seeds. This type of grinder must have been used with querns with a circular or elliptical grinding surface. The type, unfortunately, has not been recorded in Tell el-Retaba.[28] However, it is most likely that these tools were used in a combination with mortars. There has been only one complete limestone mortar preserved at the Third Intermediate Period Tell el-Retaba, although there are a lot of fragments of a stone vessel, presumably fragments of mortars. Thick walls and smoothed internal surfaces might suggest they were used for pulverizing. Type 2.2 grinders might also have been used as a pestle for the initial cereal processing phase – dehusking. Firstly, grain was stripped off its tightly enclosing chaff, which prepared grain for the next process-

[22] For examples from Israel, see Eitam 2019, 179–183; for examples from Egypt, see below.

[23] Silvia Prell classified these objects as "*H*ämmer *mit ovaler Kontur*" (Prell 2015, 38–39), while Clara Jeuthe categorised these as "grinding stones", labelling them as "grinding balls" (Jeuthe 2019, 58–59). By contrast, Lisa Giddy described these objects as "grinder of cuboid or spherical shape", suggesting that one form might have resulted from the other (Giddy 1999, 205–206).

[24] Daviau 2002.

[25] Eitam 2019.

[26] Petrie 1934.

[27] E.g. Arthur 2014, 142.

[28] This type of querns is known from Qantir, Sylvia Prell classified it as "*Reibplatten mit zusätzlicher Mulde*" or "*Reibplatten mit multiplen Mulden*" (Prell 2011, 76–77, 78–81).

	Total	Total %	Type 1.1 Quern (n=16)	Type 1.2 Quern (n=34)	Type 2.1 Grinder (n= 57)	Type 2.2 Grinder (n=49)	Non-clasified (n=43)
quarzite	118	59%	11	23	32	26	26
flint pebble	27	14%				27	
quarzitic sandstone	25	13%	1	6	6		12
granite	17	9%	3	4	5		5
granodiorite	6	3%	1	1	4		
limestone	3	2%			3		
basalt	2	1%			1		
gneiss	1	1%			2		

Table 3 Raw materials of grinding tools and their frequency rates within the individual types.

ing step. It should be noted that Samuel's research supported by ethnographic evidence showed that cracking grains could also be processed on the querns, without a separate step.[29] This way of pounding with the Type 2.2 grinder would not be very effective because of small sizes. A hypothesis that these tools were using as a pestle in cereal processing needs further research.

3. General observations and further research

Grinding stones, most numerous among the movable artefacts found at the Third Intermediate Period settlement in Tell el-Retaba, were unearthed in contexts associated with individual households rather than workshops, which indicates their use for domestic purposes (see Table 2). Based on the morphology of their working parts, the way they might have worked – back-and-forth or circular movements – could be determined.

Because querns and grinders are used together, the tool design is useful for understanding the relationship between them.[30] The two main types of grinding tools recovered at the site indicate how they were employed: Type 2.1 could have been used in combination with querns with a flat or convex surface (such as Type 1.1 or 1.2), along which it was moved – to-and-fro – as the most economical way of grinding a substance, for example, grain to flour – on a mass scale. An archaeobotanical assemblage from Third Intermediate Period contexts is dominated by emmer wheat chaff, but there are also remains of barley, durum and spelt.[31] However, since most of the ancient Egyptian bread preserved is made from emmer wheat,[32] it is this cereal type which was most probably processed into flour in Tell el-Retaba. On the other hand, the smaller size Type 2.2 grinder was used in a circular mode, suggesting its use for grinding non-cereal plants. Which of the two was actually used for non-food processing is research which needs to be undertaken in future.

The assemblage is dominated by the quartzite in many varieties (see Table 3). Common use of quartzite or quarzitic sandstone – in a hard, fine-grained variant – for the production of grinding tools was not accidental, as has been proved by other research on the subject. The hardness and porosity of quartz-like minerals is a preferred combination for cereal processing.[33] Tools made of coarse and medium grain variants have also been attested. Tools of this structure could have been preferred for grinding substances of significant granulation, for examples, seeds. Flint pebbles are common in the Type 2.2 grinder, especially in spherical ones. By contrast, cuboidal ones are often made of quartzite. However, a pattern in the relationship between the shape of Type 2.2 grinders and material selection is hard to determine at the present stage of research.

Analyses of the ground stone assemblage, grinding tools being only a part of it, from the Tell

[29] *Ibidem*.

[30] Adams 2014, 104.

[31] Malleson 2015, 177–178.

[32] Samuel 2010, 458.

[33] Dubreuil and Savage 2013, Tab. 2.

el-Retaba is still at a very preliminary stage. The results of the above analysis have raised a few intriguing questions so far, opening up new vistas for further study. Future research will focus on the petrographic and use wear analyses, which might be helpful in determining the nature of the material processed, leading to a better understanding of the choice of raw material and processing techniques.

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