Late Bronze Age Ground Stone from Tell Sabi Abyad, Syria

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Cover image: after an image from the Tell Sabi Abyad archive

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Chapter 1

An introduction

1.1 Introduction

In this Master thesis, the Late Bronze Age (ca. 1225-1120 BC) ground stone assemblage of Tell Sabi Abyad will be discussed. Ground stone artefacts are often not intensively researched on an archaeological site. This is a result of many factors that will be discussed in chapter 2.2. The main reason however is that, generally, pottery and chipped stone are seen as the more important research categories. As a result the focus of research is directed away from the ground stone artefacts. Archaeologists can use pottery and chipped stone as markers in piecing together the chronology of a site. And other material categories such as (ritualistic) art and jewellery are often more appealing to one's imagination, and are as a result interesting study objects. Ground stone, however, is generally not seen as a very revealing or interesting study object. Apparently, it just does not speak to the imagination like other artefact categories do. And there is, possibly, a very good reason for this. These simple "everyday" objects' shape seems to have been purely dictated by functionality. Stylistic preferences seems to have been irrelevant in de production of ground stone tools. As a result, unlike with pottery and chipped stone, it shows little change over time typologically. Therefore they offer hardly any chronological value; as a result it is not possible to accurately date a grinder unless it is preserved *in situ*.

Nonetheless, grinders and other ground stone objects are abundant on the site of Tell Sabi Abyad during the Late Bronze Age. And perhaps unsurprisingly this specific dataset has only been hastily assessed. Because of this many of its intricacies are left unmentioned and its potential for further research unexplored. The reason for this is that researchers, in general, unjustly assume that ground stone tools are always used for the same purposes. And thus are static objects when it comes to analyses. Apparently, their usage is seen as self-evident, even though no actual scientific research has properly verified these generally accepted assumptions for (near eastern) ground stone.

There are in fact a multitude uses for ground stone objects and finding out for which a specific ground stone tool is used can be somewhat problematic. When you want to find out about the use of a grinder, residue analysis could be the way to go. But in order for this

to work, there needs to be a well preserved residue on the grinder. In addition, as Katherine Wright (1994, 241) states it is entirely possible that one grinder is used for multiple materials and purposes. This possibility of multiple ways of using ground stone tools is something that archaeologists generally assume not to be the case. Ground stone assemblages are seen as simple and self-explanatory (Rowan and Ebeling 2008, 2), which is yet another reason it is not given much attention in the form of further research.

Katherine Wright illustrates that it is in fact important to keep in mind that the association that we currently have with grinders, pestles and mortars is not necessarily correct. An example of a very basic assumption she gives is that grinding slabs were used for the processing of grain and that the pestle and mortar were used for processing nuts. However studies into the use of these pestles and mortars have, in fact, revealed that they were also used for the de-husking and grinding of grain (Wright 1994, 241). So the current assumptions used in interpreting ground stone objects are clearly not always correct. Rarely are attempts made to verify these basic assumptions on which so much of our relatively little knowledge of this material category is based. Underlining the fact that it is necessary to rethink all the assumptions made in forming the current "knowledge" of ground stone assemblages.

So, even though ground stone objects might not be useful in creating any chronological insight and most of the current knowledge about this category is built up around the above mentioned untested assumptions. This material category can still offer an insight into the functioning of a sites production economy. As staple items in the everyday life of the inhabitants of any community these objects can shed light on subjects such as the division of labour through time and space. It would seem a shame to keep on discarding these artefacts so easily when there is a wealth of knowledge still to be learned from them.

The Tell Sabi Abyad assemblage has the potential to add an enormous amount of insight to the current understanding of ground stone as a factor in the daily life in the settlement. Due to devastating fires (Akkermans and Wiggermann in press*,* 6) a relatively large portion of the artefacts have been preserved *in situ.* By looking at correlations between tool types and locations within the settlement, a connection between object and function is likely to become visible through the spatial clustering of specific types. The research potential at Tell Sabi Abyad not only lies in the *in situ* preservation of many ground stone artefacts. The well-defined different areas within the *dunnu* also provide an excellent

framework. By comparing working areas of multiple disciplines such as a brewery, potters workshop etc. and residential structures, correlations between preferential usage and tool type should become visible. Tell Sabi Abyad is the ideal test case because the *dunnu* area is entirely excavated and thus provides a more holistic view of a Late Bronze Age settlement where ground stone is concerned.

1.2 Tell Sabi Abyad

Tell Sabi Abyad is an archaeological site in Syria that has been excavated since 1986 (Akkermans 2006, 201). The site itself consists of four separate tells (Duistermaat 2007, 23). The most important of which, Tell Sabi Abyad I, encompasses four hectares. The site has a long occupation history reaching from the Late Neolithic up to the eighteenth century AD (Duistermaat 2007, 26).

Figure 1. The Balikh valley in Syria from www.sabi-abyad.nl

The Balikh valley, in which the site is located, is crossed from east to west by the current 250mm isohyet. The climate of the region is semi-arid. Going from the southern to the northern side of the valley the annual rainfall becomes gradually higher. As a result rain-fed agriculture is high-risk in southern side of the valley making irrigation a necessity. This means that the settlement was located on the edge of the dry-farming zone (Duistermaat 2007, 23). It is likely that during the Bronze Age small canals would have led from the river to the fields belonging to the Sabi Abyad settlement. However, up until now these have not been found. It is only at the end of the first millennium BC that these canals have actually

shown up in excavations and surveys (Duistermaat 2007, 23). The valley surrounding the tell has been inhabited for many centuries. According to survey evidence, however, there is a fluctuation in population density during the first half of the Late Bronze Age (Duistermaat 2007, 23).

1.3 The Late Bronze Age on Tell Sabi Abyad

Starting from the late 14th / early 13th century BC, the Mitanni period, there is evidence of Late Bronze Age architecture on the site (Duistermaat 2007, 51). During the second half of the Late Bronze Age a shift in settlement preferences took place and the nucleated Middle Bronze Age centres were traded in for smaller rural settlements (Duistermaat 2007, 23). These smaller rural settlements were often newly founded; this is thought of as a clear indication of a renewed interest of agricultural exploitation in the marginal areas. In the second half of the Late Bronze Age new Middle Assyrian settlements appeared in the Balikh valley, the Assyrians colonized the Balikh. Up until then there are no indications of any significant power structures in, or claims of ownership over, this particular region.

1.3.1 The *dunnu*, a rural fortress

At the start of the 14th century BC Tell Sabi Abyad was located in the kingdom of Mitanni/Ḫanibalgat. At this period in time the city of Aššur was a vassal kingdom paying tribute to the kingdom of Ḫanibalgat (Duistermaat 2007, 24). Over the course of the following years the alliances between Aššur and Mitanni/Ḫanibalgat started to shift. King Shuttarna II of Ḫanibalgat forged a closer bond with the Assyrians which, in their turn, no longer had to pay tribute. Shuttarna II also planned to murder his rival to the throne, Shattiwazza. Shattiwazza, however, fled to Ḫatti where he signed a treaty with Hittite King Shuppiluliuma in exchange for protection. This treaty had far reaching repercussions; all the cities along the shores of the Euphrates up to the Balkih river now belonged to Carchemish and Ḫatti. As a result Mitanni/Ḫanibalgat now only comprised of the Balikh and Khabur valleys. Many military confrontations followed and as a result the situation in the region was unstable (Duistermaat 2007, 24). So it is safe to state that between the 14th and early 12th century BC there were some serious political changes in the Balikh area. Eventually, due to extensive Assyrian expansion the Ḫanibalgat province came under the rule of the Assyrian

Empire (Duistermaat 2007, 24). It is at this stage that the Tell Sabi Abyad fortress, the *dunnu*, was erected. As a result the site became a small scale, fortified settlement. The fortress was initially constructed in the late thirteenth century during the reign of Tukulti-Ninurta I, 1233-1197 BC (Akkermans 2006, 209). The *dunnu* was the private property of Aššur-Iddin and after him, his son, IllĪ-padă the grand vizer and king of Ḫanibalgat (Akkermans 2006, 201).

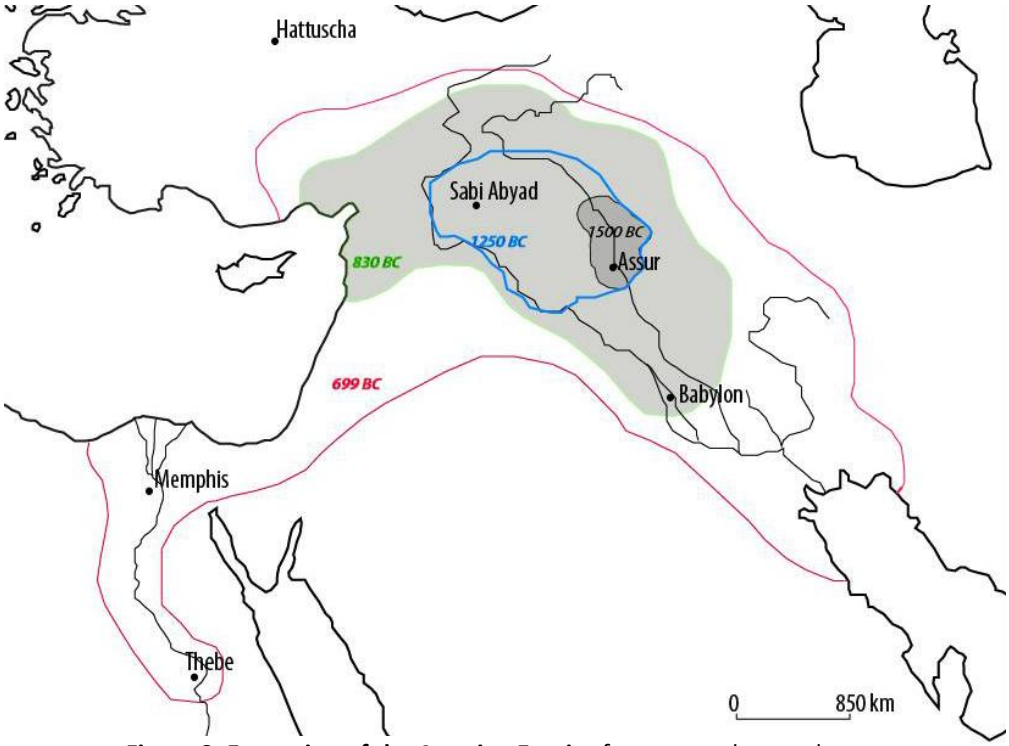

Figure 2. Expansion of the Assyrian Empire from www.dunnu.nl

The five to six meters high defensive walls (Akkermans 2006, 209) stood on highest part of the mound, offering an extensive view of the settlements surroundings. Judging from the height and width, up to two meters (Akkermans and Wiggermann in press, 2) of the walls and some recovered staircases it is safe to say that the fortress had one or more upper floors (Akkermans and Wiggermann in press, 3).

The reason that the Tell Sabi Abyad fortress was so well fortified is that it was a military outpost at Assyria's western frontier, the province of Ḫanibalgat (Duistermaat 2007, 26). The agricultural estate became an administrative centre which was in control of the most western province of the Assyrian kingdom. The settlement also functioned as a customs facility on the route between Carchemish and Aššur, the capital of the empire. Clearly, Tell Sabi Abyad was a small but extensively fortified frontier settlement of the

Middle Assyrian Empire. And functioned as a local hub for administration, politics and trade[1]. The Late Bronze Age is spread along five excavation levels.

Table 1. Excavation levels after (Akkermans and Wiggermann in press, 2-8)

Level	Period	Date
Level 4 and 3	Reconstruction and decay of the *dunnu*, the *dunnu* was only partially in use → Abandonment	1180 – 1125 BC
Level 5	Period of renovation →*Dunnu* partially destroyed by a fire	1197 – 1180 BC Fire in 1180 BC
Level 6	Construction of Middle Assyrian fortress, *dunnu* → Middle Assyrian fortress in disrepair	1225 - 1197 BC
Level 7	Mitanni tower → Abandonment	1500 - 1350 BC

The first and earliest is level 7, which represents either the late fourteenth or first half of the thirteenth century BC; the Mitanni period. In the Mitanni period a square building called a *dimtu* (a tower of some sorts) was built. In order to build this tower the mount was partially levelled at the time. Various rooms of the *dimtu* were fitted with lime-plastered floors, simple loam and mud-brick floors were also used. It is clear that an effort was made to maintain the tower; this can be seen in the renewal of floors. The end of level 7 is marked by a fire that damaged parts of the tower and most likely meant the end of its occupation. Not only is there a 31cm layer of burnt material at the end of level 7 there is also a mud-brick and debris fill of about 25cm, suggesting that the *dimtu* was abandoned for some time after the fire.

[1] For a more detailed image of the Late Bronze Age chronology and architecture of the Tell Sabi Abyad site visit: http://dunnu.nl/the-dunnu/ and take a look at *Fig. 3. Chronology and phase plans: archaeology, history and epigraphy* at the bottom of the page.

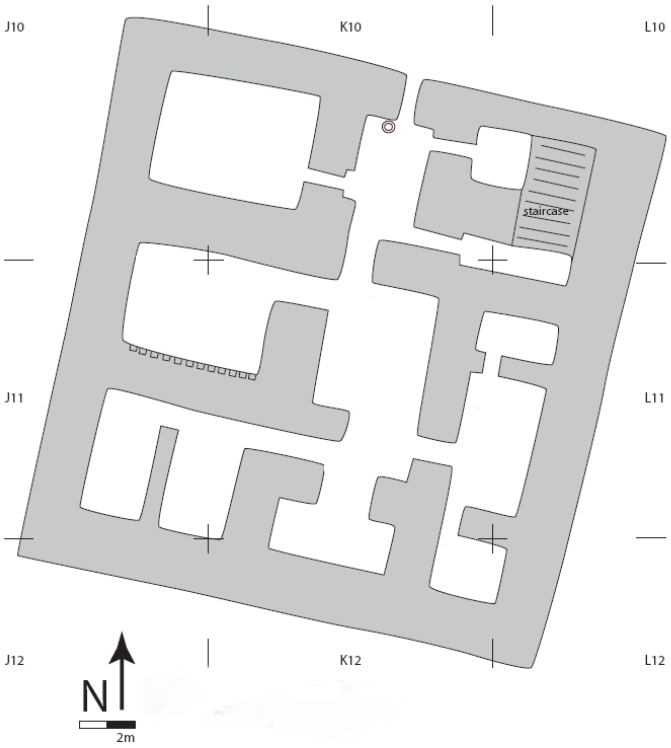

Figure 3. The level 7 *dimtu* (after Duistermaat 2007, 450)

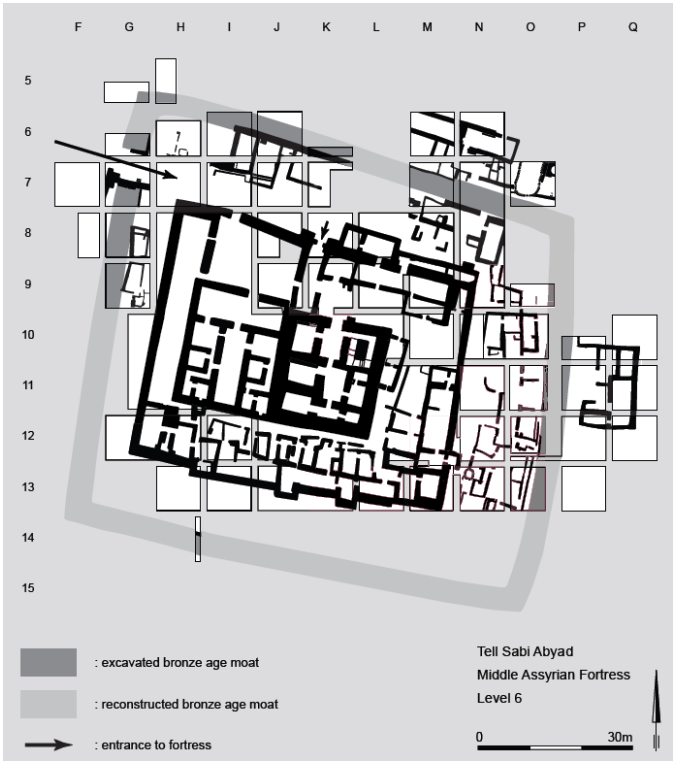

Figure 4. The level 6 fortress (after Duistermaat 2007, 451)

In level 6 (fig. 4) the remainder of the tower was levelled and consequently restored. Level 6 seems to represent a period of large restorations and new building programs. This seems to have been influenced by the arrival of the new Middle-Assyrian inhabitants. The prehistoric mound was further levelled and terraces were created. A square dry moat of 80 by 80 meters was dug around the settlement. However this dry moat is already filling up with garbage in level 6. Inside the area cordoned off by the dry moat, a fortress of 60 by 60 meters was built. At the end of level 6 the buildings on Tell Sabi Abyad were neglected and gradually decayed.

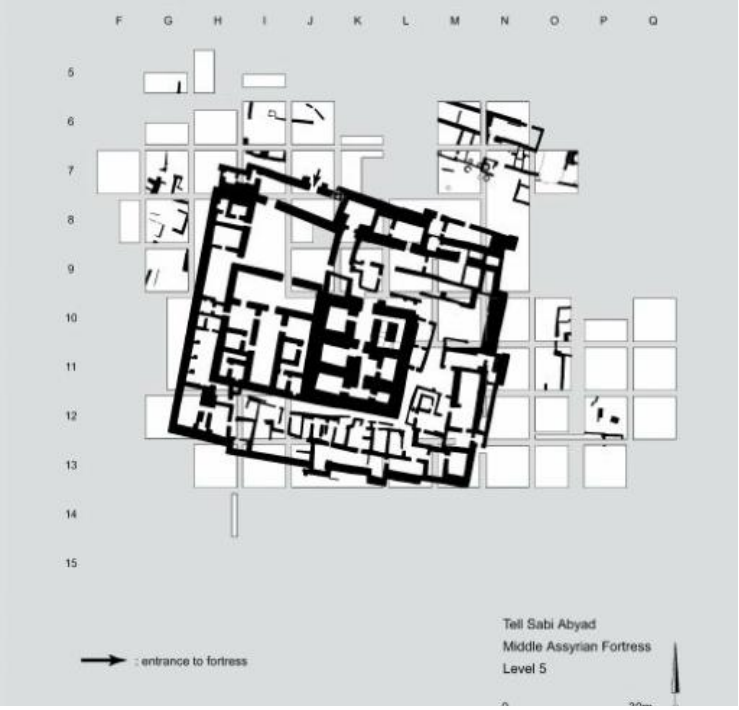

Figure 5. Level 5 (after Duistermaat 2007, 542)

In level 5 there, again, were extensive renovations and reconstruction efforts made in the settlement. The layout stayed largely the same, however some alterations were made. The settlement was more focused inside of the fortress in level 5. The previously densely populated area between the fortress outer wall and the dry moat was now cleared. During level 5 this area was mainly used for ovens, kilns and pits on the north and east sides of the wall. Just like level 7, level 5 ended due to the destructive power of fire. A violent fire caused the tower to collapse and large portions of the settlement were destroyed (Akkermans and Wiggermann in press, 6).

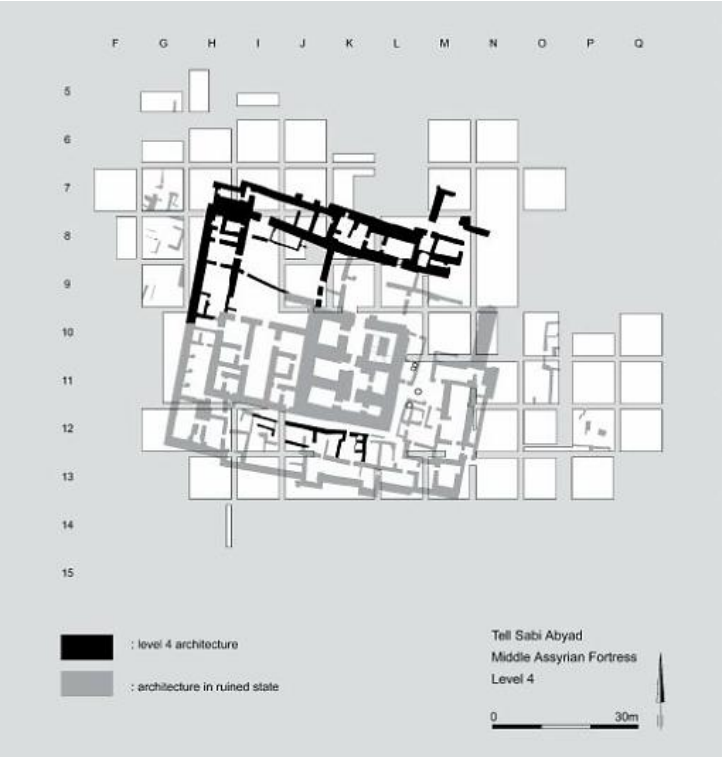

Figure 6. Level 4 (after Duistermaat 2007, 453)

After level 5 the tower and accompanying structures were filled with a large amount of rubble and were left abandoned during level 4. The parts of these structures that had been left standing were used as location for building ovens, burying the dead and garbage disposal. In the northern and north-western part of the *dunnu* some of the older buildings were reconstructed and/or renovated (Duistermaat 2007, 53).

In level 3 the same trend as in level 4 continued; no major reconstruction work was done and the ruins were not cleared away. The open areas created by them were used for a variety of activities. This resulted in an accumulation of trash. Small ovens and bins were built in these open areas within the settlement. And in the northern and north-western parts of the settlement new floors were laid in houses as the older ruins further collapsed and filled up (Duistermaat 2007, 54).

1.4 Ground stone

Ground stone artefacts appear in many shapes and sizes and were vital in the everyday life of the people inhabiting the tell. They are often associated with the production of food. However, ground stone artefacts are less often associated with their other uses such

as: the production of stone tools and craft items. These applications are discussed significantly less in literature (Wright 2008, 130). When archaeologists do focus on ground stone artefacts they tend to view it is a very static artefact category. This results in a focus on specific objects and object combinations such as: grinding slab/grinder and mortar/pestle. The overall assemblage of ground stone artefacts on a site is often neglected as a study object. In this rather restricted view of ground stone the focus remains on the role these artefacts had in food production. The association ground stones have with the production of other artefacts remains obscure.

Ground stone artefacts as an artefact category is often neglected. It does not nearly get as much attention as, for example, chipped stone (Wright 2008, 140). In fact, in some cases a type of chipped stone artefact is even used to define an entire culture concept, like the Geometric Kebaran. It is well known that chipped stone technology is seen as an indicator of a relative chronological position whereas ground stone technology has no such properties ascribed to it at all.

In essence, ground stone artefacts have had a smaller role in archaeology than their chipped stone counterparts. As mentioned before ground stone artefacts are not diagnostically useful. Without going into a debate what can and cannot be deduced from chipped and ground stone artefacts it must still be clear that ground stone artefacts do hold a wealth of knowledge. Even though this wealth of knowledge might not be as extensive as with chipped stone. There are still many things that can be learned from this artefact category. Analysis of ground stone might never create any insight into chronology or stylistic preferences. Ground stone artefacts can however be instrumental in the reconstruction of the local subsistence economy, crafts and ritualistic behaviours of a past society. Ground stone artefacts preserved *in situ* can prove to be instrumental in piecing back together different types of (food) productions on site. By analysing the locations of the type of ground stone artefacts in combination with the site layout, specialised production centres such as a bakery or brewery could be revealed/confirmed. Other possibilities; such as residue analysis can give a direct insight into what grinders were used for and in turn reveal an insight into the local diet. The role of ground stone in different artisan productions could also be better defined. Grinding pigments and making grog are just two of many possible ways in which typical ground stone objects could have been used in the production of other artefacts and products on site besides food. One other way ground stone tools were used on Tell Sabi

Abyad for example is in the production of jewellery. Grinding slabs and other abrasive tools were used in the on-site production process of beads (Kremer 2013, 38).

1.5 Research questions

There are numerous research possibilities with ground stone assemblages. However, in this particular research, the actual material is not physically available and the research possibilities are limited to a data study. On the other hand I want to illustrate more than just the composition of the Late Bronze Age ground stone assemblage. The aim is to reveal the possibilities the ground stone assemblage offers as a research subject. By delving into the spatial and chronological distribution of ground stone the correlation between this material category and activities on site are illustrated. The research questions on which this thesis is based are the following:

1. What kind of ground stone objects from the Late Bronze Age can be found at Tell Sabi Abyad?

    1.1 What types of ground stone tools are present on the site?

    1.2 Are ground stone tools produced on or off site?

2. In what way can a significant connection between type and use be made in ground stone artefacts and is there such a thing as a single use per tool type?

    2.1 Is there a noticeable difference in how different types of tools are treated or valued in use, re-use and/or production?

3. Is there a difference in how different types of ground stone artefacts are distributed along the site?

    3.1 Are various types of the same tool distributed differently on the site?

    3.2 Is there a correlation between ground stone source materials and the spatial distribution patterns?

    3.3 Is there any correlation between spatial and chronological distribution patterns and known functions of areas of the site such as a brewery or bakery?

1.6 Methodology

I started my research into the Late Bronze Age ground stone assemblage of Tell Sabi Abyad by delving into the literature, as my knowledge of this object category was fairly limited at the time. The ground stone material category is a large assemblage of all types of artefacts. Which are often not the focus of archaeological publications. Not only is ground stone often neglected in site reports it is also scarcely mentioned in the typical archaeological text books used at the first year of university[2]. Often objects found in a certain context are mentioned but the implications of assemblages and the possibilities of this material category offers are left unmentioned. Thus creating the necessity, for me, to start with getting a grasp on this group of objects.

After getting a good grasp on what ground stone archaeological research is about I delved into the Tell Sabi Abyad archives. I started by cordoning off my dataset. The amount of ground stone artefacts found on the site is immense. They are however not sectioned off within the database. It was therefore needed to search for the Late Bronze Age ground stone objects within the database of all the artefacts found on the Tell Sabi Abyad site. Through this process I was forced to define what the area of my research would cover. Handling the entire ground stone assemblage according to the definition of ground stone as will be given in chapter 2.2 would not only have been too much for a master thesis research. I personally also feel it would not result in a congruent research subject. As ground stone objects are technically all stone artefacts which are made by abrasion. Which would mean that objects such as beads would be placed in the same category as, for example, grinding slabs. Comparing these very different sorts of objects would most likely result in yet another global and rather shallow view at the objects of this material category. I therefore chose to only focus on, what was my initial idea of typical ground stone objects, the tools. So the next task I had was picking out all these ground stone tools from the 27.792 objects listed in the Tell Sabi Abyad database.

During this process it became clear that many of the objects had not been given a clear description as to their function in the database. Often objects were listed as a pestle/ grinder or mortar/ hammer and so on. This inconsistency in function definitions made me

[2] Such as: Renfrew, C. and P. Bahn, 2004. *Archaeology Theories, Methods and Practice.* New York: Thames & Hudson ; Greene 2006 and Hodges 1989.

take a closer look to the used typology. After some considerations, which will be further explained in chapter 4.2, I made a choice to revise the original typology and create a more research friendly alternative (chapter 4.3). This revised typology was entered into the database for every one of the 3200 ground stone objects of this study. As a result researching different types and shapes of ground stone artefacts became as easy as a simple query. I also re-examined the function of all the objects which had no clear function and indicated either their exclusive or primary and secondary function (chapter 5.1).

With the Late Bronze Age ground stone database clearly structured by a new typology and well-defined functions per object the research has arrived at the point where I started to look at the amounts of objects found per type, shapes per type, stone types, complete specimens and so on (chapter 5) to create a clear image of the Late Bronze Age ground stone assemblage found at Tell Sabi Abyad.

And finally I took a look at how different tool types and ground stone artefacts in general where distributed over the site and through time in ArcGIS. The spatial and chronological patterns that were found were analysed to ascertain if there was a recognisable link between either to habitation patterns over different levels. Or certain areas of the site being used for the production of particular product such as bread, beer, pottery and so on.

1.7 Limitations

Here some of the hindering factors that were encountered during this research will be discussed.

1.7.1 The actual artefacts are not present

Unfortunately it was not possible to study the actual objects found on the site. All the objects are stored in Syria. Therefore, all the information used is from the Tell Sabi Abyad archive and the Tell Sabi Abyad database. And thus fully dependent on the level of detail in which the initial documentation at the excavation was performed. Understandably the details in which objects were documented are not always consistent. Sometimes objects are only drawn from a single perspective or the scale of a drawing is not mentioned making it near to impossible to get a good grasp on what the object looks like. In addition, research such as residue analysis or petrographic analysis was sadly not possible.

1.7.2 The amount of artefacts

Another hurdle was the large amount of ground stone objects found in the Late Bronze Age layers of Tell Sabi Abyad. A total of 3200 ground stone artefacts have come from the Late Bronze Age layers of the site. Ranging from small hardly recognisable fragments and tiny polishing stones to large complete grinding slabs there is a vast amount of data. But not all of the data is as easily interpreted. Analysing shape, size, material and other interesting information of every single artefact requires a large amount of time. With the use of the database it should be simple enough, however data was not always entered in a consequent manner. Moreover it was entered with the original typology and research parameters in mind (appendix I). As a result information that is relevant to the research questions of this particular subject are not always available in the database. Manually searching through all the binders of object files of the ground stone objects takes a lot of time. Luckily the entire archive of Tell Sabi Abyad was digitalized during my research. However, it was still a very time intensive process to manually search through all the files. Therefore, this was only done in special cases.

1.7.3 The definition of ground stone

Ground stone is an extremely broad material category (as will be explained further in chapter 2.2[3]). This combined with the amount of data from the Late Bronze Age alone creates the need for a redefinition of what can and will be considered ground stone artefacts in this particular thesis. The focus of research will be on grinders, grinding slabs, grinding stones, hammers, mortars and pestles. Other small ground stone artefacts like polishers and whetstones will also be discussed briefly. Stoneware and other non-utilitarian objects of the ground stone material category will not be touched upon. The reasoning behind this choice will become apparent in chapter 2.2: Archaeology and ground stone artefacts.

[3] For an overview of the entirety of what could be considered ground stone versus what has been chosen as the research area for this particular research, take a look at chapter 2.2.

Chapter 2

Ground stone artefacts in Near Eastern archaeology

2.1 Introduction

If a clear understanding of the Bronze Age ground stone assemblage at Tell Sabi Abyad is to be acquired, a comparison to other contemporaneous assemblages in the region would be ideal. In theory, this is simple enough. However, as mentioned before ground stone artefacts are hardly ever put in the spotlight. And thus are seldom intricately discussed in excavation reports or other forms of academic literature. Moreover, an in-depth comparison is therefore not as easy as it would seem.

2.2 Archaeology and ground stone artefacts

As mentioned before ground stone artefacts are seldom the focus of an archaeologists attention. Moreover, ground stone studies are frequently put under the "other" category in site reports (Rowan and Ebeling 2008, 2). The results from research into the ground stone assemblage of a site, if done at all, rarely end up contributing to the understanding of a site. Summaries of the found ground stone artefacts may end up in a site report, however proper analyses as to what these artefacts could represent are rarely included. Whereas chipped stone and pottery often have several pages dedicated to them. There are a few very understandable reasons why this has come to be. Not the least of which are the problematic boundaries given to the category.

Often people think of utilitarian objects such as grinding slabs, grinders, mortars and pestles where ground stone is concerned (Rowan and Ebeling 2008, 2). However, in reality, this is just a fraction of what actually belongs to this constructed group of materials. Whetstones, polishers and other little tool type implements also belong to our group of artefacts. These tools however are not used in any grinding-type action whatsoever. However, this still might not be that odd; they are still tools used in everyday life and are therefore perhaps suited to be in the same category. Up until now all the types of objects in the ground stone category are simple everyday tools in which generally no stylistic effort or value is embedded. But the definition of ground stone is currently wide enough to include

stoneware as well (Rowan and Ebeling 2008, 3). And these are objects of an entirely different sort. First of all there are certainly no tools and secondly there is often a large effort made to make these vessels aesthetically pleasing. The labour investment in stoneware is not to be compared to the typical ground stone objects, as stoneware cannot be considered a staple item for survival, it is a luxury item. Other objects that also belong to the ground stone category include beads, figurines, incised objects and other “miscellaneous" artefacts (Wright 2008, 130). To illustrate the entirety of the ground stone assemblage along the lines of the First Aid for Objects forms, Tell Sabi Abyad (Appendix I) the following table was created. Here we can see which artefacts would officially be considered "ground stone" according to the above-mentioned definition.

Table 2. Ground stone artefacts (after First Aid for Objectforms Tell Sabi Abyad, 1-7)

Object	Description
Animal figurine	Three dimensional animal representation
Bead	Small pierced object, mostly disk-shaped, round, cylindrical or spherical but other shapes also possible.
Bowl	Vessel with unrestricted shape, rim diameter larger than height of vessel.
Disk	Disk shaped object, flat. Usually made of clay or stone. No piercings present (see pierced disk), and larger than 'token. Used as lid?
Door socket	Large stone object with a round, semi spherical concave and smoothed depression in at least one of the sides. In the depression the pivot of the door turned.
Figurine	Three dimensional human representation.
Goblet	Small vessel, in the shape of a cup or beaker.
Grinder	Conical, cylindrical or spherical object of stone with traces of grinding and other use at the sides, not at the short ends (see pestle).
Grinding slab	Flattened stone object with oval or rounded shape. Base is usually convex. The working surface is concave or flat and shows traces of grinding.
Grinding stone	Flattened stone with oval or rounded shape. Working surface is flat or slightly convex and shows traces of use. Used as top stone in combination with a grinding slab.
Hammer	Cylindrical, rounded or more or less square object with one or more battered areas at its surface. These surfaces are usually

	damaged and rough, not very smooth (see pestle or grinder)
Labret	Nail-shaped object, mostly of stone but clay is possible too. Probably used for personal decoration.
Mace head	Spherical stone object with smoothed surface and a hole through the centre.
Mortar	Bowl-shaped vessel of stone, used for grinding or pounding in combination with a pestle. Inside shows traces of grinding or is polished ad shiny.
Palette	Very smooth, flat, often irregular shaped stone with a slight depression. Sometimes, traces of pigment are present on the working surface.
Pendant	Small object, in various shapes and materials. One or more holes for suspension are present at one end.
Pestle	Conical, cylindrical or spherical stone tool. Traces of grinding are present on the ends and not on the sides (cf. hammer and grinder).
Pestle/grinder	Stone tool used both as a pestle and as a grinder: traces of grinding at the ends as well as at the sides.
Pierced disk	Small disk with perforation in or near the centre. Often made out of a sherd but occasionally stone disks are found as well.
Polishing/rubbing stone	Small (naturally shaped) stone with scratches or polished sides. Probably sued for polishing or burnishing.
Pot	Vessel with vertical or incurving wall (restricted/closed shape), without a neck.
Spindle whorl	Spherical, bi-conical or conical object of clay or sometimes stone, pierced in or near the centre.
Token	Small object of clay or stone in geometrical shape: sphere, disk, cone, cylinder etc. Used as counting of accounting tools (incisions, notches, fingernail impressions).
Vessel	Any container that does not fit into the categories of bowl, pot, jar, bottle, strainer, tray.
Wheel	Disk of clay or stone with a whole in or near the centre. Often, the wheel is thickened around the hole. Used as a wheel in a model, often larger than pierced disk.

The blue coloured objects are the ones that are seen as ground stone objects in this study. The remaining objects should ideally be ascribed to other and new categories. The choices that have resulted in the selection of the ground stone parameters of this study are

largely based on the already existing ground stone typology of Tell Sabi Abyad, and therefore their own vision on what is and is not to be considered ground stone.

The reality of research however is that there are also objects that belong to multiple categories. Many of these objects with dual functions have uses that are both in the defined research area such as being both a pestle and a grinder. There are however objects which second or primary function is not within the parameters of this study. These objects are nonetheless studied and reviewed mainly on their attributes as ground stone artefacts. A good example of an object with such a dual function is S03-810. This object, which is both a pestle and a figurine, has already been discussed to great detail by Noah Wiener (2011).

At the moment the ground stone artefact category is rather extensive. Making ground stone a more functional category and less of a home for miscellaneous stone artefacts should prove useful in analyses. The current reality is that, when it comes to stone artefacts there are only two options: chipped stone and ground stone. This is likely to be too broad a division between so many types of objects. This also has to do with the fact that a focus within research on the typical ground stone artefacts is likely to be for entirely different reasons as research into stoneware and jewellery. Grinders and mortars are likely looked at as a means of creating a better understanding of the more mundane parts of daily life. Whereas prestige items such as stoneware and jewellery are often seen as a marker of social differentiation and a difference in social cohesion within a society. It is therefore that, concerning this particular research, the choice was made to include only the tool-type objects that belong to the broad spectrum that is the material category of ground stone.

Another reason why ground stone artefacts are often overlooked, or quite literally abandoned, during research is their average size and weight. Even though it is just a practicality, transporting and storing these hefty objects can prove to be very labour intensive and expensive. Storing these large and heavy grounding slabs takes up space that the researchers and sponsors would rather see filled with more appealing types of artefacts. And researching artefacts that will be discarded later on is (understandably) not seen as a viable option. Therefore large stone artefacts are sometimes still abandoned in the field (Rowan and Ebeling 2008, 3).

Another reason why ground stone artefacts receive relatively little attention is the slow change in the basics of ground stone. This results in them being chronologically uninteresting artefacts. Grinders, mortars and pestles are hardly ever (seen as) diagnostic.

Add to that their durability and therefore low quantity compared to pottery and chipped stone. And the neglect becomes more understandable.

However, even though there may be considerable motivation to leave the ground stone material category for what it is. There are also clear indicators of its potential significance in archaeological research to be found within archaeology itself. Even without repeating myself and embarking on yet another plea on what could be learned from studying these artefacts. The use of ground stone tools is in fact quite common in Assyrian reliefs. Reliefs scenes on the palace gate of Salamnezer III (858-824 BC, son of Ashurnipal II) nearly always include images of soldiers grinding grain on saddle querns. There is even an infamous relief on which prisoners are, as a form of punishment, grinding the bones of their ancestors to “clay” (Curtis 2001, 203). So there are clear markers that ground stone was an important part of everyday life during the Assyrian period. It therefore deserves more attention than it is currently receiving.

2.3 Types of ground stone artefacts found in the region

The existing preconceptions about ground stone do exist for a reason and it would be debatable to what extent any comparison on a stylistic level would prove to be fruitful. Nonetheless, seeing as most of this thesis thus far has been a reminder that the preconceptions surrounding ground stone are limiting and destructive to proper archaeological research I do not plan on discarding the need for any comparison so easily.

Comparisons between different ground stone assemblages need not be made on the basis of style. Differences in the attitude towards these tools in general can also provide an important insight. Such as: Are they produced on site or somewhere else? Are the raw materials local or have they been "imported"? How are the objects treated with regards to use intensity, reparation, re-use and so forth?

Ideally, a comparison would be made between the Tell Sabi Abyad ground stone assemblage and that of a neighbouring site from the same period and other comparable sites in the region. However the problem is, as previously mentioned, that a site’s ground stone assemblage is hardly ever documented in a proper manner. A few sentences mentioning that ground stone artefacts, such as grinders, were found on (certain areas of) the site is usually the best available information. Ground stone material analyses are very difficult to find. It is perhaps interesting to mention that the lack of interest in ground stone

archaeology seems to be more profound within the Near Eastern archaeology. Whilst searching for relevant literary sources it became apparent that the archaeologies of other areas; such as the Aegean and Meso-America are clearly more focussed on ground stone assemblages.

One of the few literary references that can be found to ground stone form the "region" in Katherine Wright's article: A classification system for Ground Stone Tools from the Prehistoric Levant (1992). Even though the discussed assemblage is not from the same period nor from the Balikh region the finds are clearly similar.

The Late Neolithic assemblage of the ground stone industry (Collet and Spoor 1996) should also provide an interesting insight. However there is no juxtaposition between the Late Neolithic and Late Bronze Age assemblages. They are in fact very similar. Comparing distribution patterns and shape and stone type ratios as done in this research was problematic. No comparable studies were found.

2.4 Purposes for ground stone tools

Ground stone tools can be used for a variety of reasons. If there is any correlation between use, tool type and spatial distribution on site it is important to know a thing or two about the different demands for ground stone tools on Tell Sabi Abyad.

2.4.1 Food production

The most self-evident use for ground stone objects is food processing. Making flour out of grain, from which bread can be made, is a very important function fulfilled by the ground stone assemblage. Obviously every single person on the site needed to eat. With bread being a staple dietary item, it is something that everybody must have consumed. It is very well possible that every household organized their own bread production from flour milling up to baking (Curtis 2001, 200). However out of the about 900 inhabitants of Sabi Abyad 400 were *šiluhlu,* these were agricultural workers and craftsmen. The craftsmen were generally given rations as compensation for their work as they did not own agricultural fields. And could probably not always provide for their own sustenance (Wiggermann 2000, 183). There are also various artisans living and working on the site according to cuneiform tablets. Many professions are mentioned in text amongst which: potters, brewers, oil-pressers, builders, leather-workers, bakers, perfume makers, hairdressers, singers,

dressmakers, a smith, merchants, gardeners, sheppards, scribes and servants to the temple of Aššur (Wiggermann 2000, 190). Judging from all of this it seems logical that the production of bread was not just limited to the individual household. It would be logical for there to be a centralized production of bread organized by either the palace and/or the temple (Curtis 2001, 202). We know from the cuneiform records at the tell that there was a baker within the settlement (Akkermans and Wiggermann in press, 6). Another indication of centralized production is the mention of centrally distributed bread and beer, prepared by the baker and brewer, to the staff and visitors (Wiggermann in Duistermaat 2007, 250). So such a centralized production of flour and bread is something that needs to be kept in mind whilst analysing the ground stone record of the Late Bronze Age. As it would be interesting to see if such centralized production is visible in the material record.

At Tell Sabi Abyad there is also evidence for a brewery. A brewer and beer are mentioned in cuneiform tablets found on the site on a regular basis (Duistermaat 2007, Appendix F).

2.4.2 Other possible applications for ground stone tools

Grinding pottery to create grog for the production of new pots and such was also a way in which ground stone tools were used. There are known level 5 and 6 pottery workshops known on the site from the research of Duistermaat (2007). These pottery workshops were located in the south-eastern corner of the site in both levels (fig. 6 and 7). First outside the walls of the *dunnu* and later on, in level 5, the pottery workshop was moved to the inside of the fortress. Whether there are different concentrations of ground stone found at this location will be interesting to see.

Ground stone tools must also have been used for other purposes on the site such as grinding pigments. Ochre traces have been found on 13 objects from the Late Bronze Age ground stone assemblage. The production of beads must also have been partially done with the use of ground stone objects (Kremer 2013, 38).

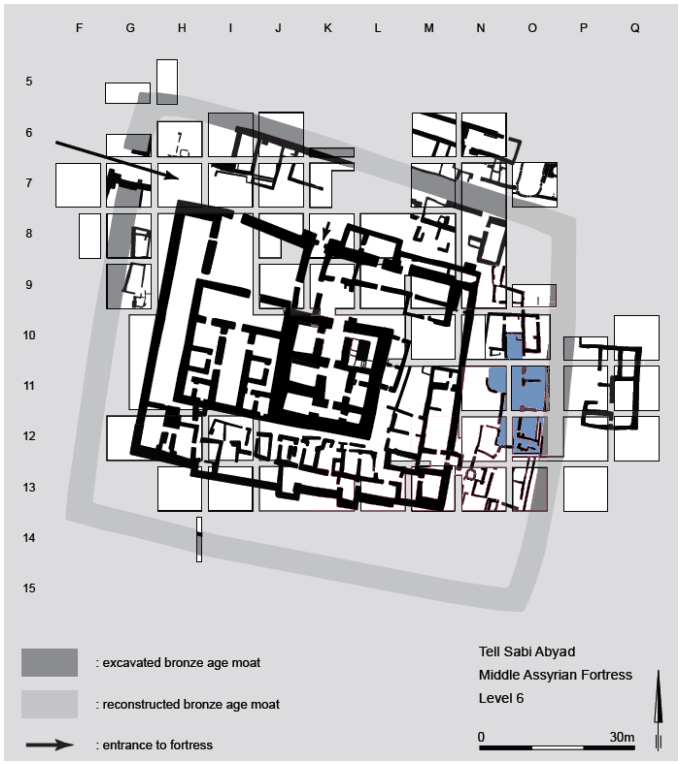

Figure 8. Level 6 pottery workshop in blue (after Duistermaat 2007, 697-698)

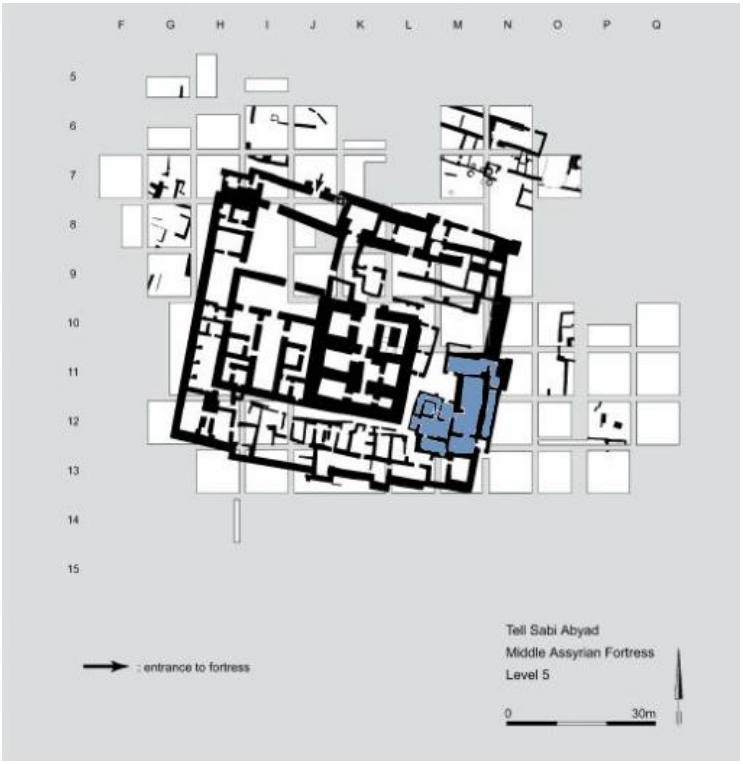

Figure 7. Level 5 pottery workshop in blue (after Duistermaat 2007, 705)

Chapter 3

Raw material and production

3.1 Introduction

Ground stone objects can be produced from a variety of stone types. As stands to reason certain types are preferable for particular tools. By looking at all the possible source materials in the region and possible imported materials, an insight might be provided in the choices made for any particular type of stone.

It can also prove to be interesting to investigate if the ideal stone types were actually available in the region. In addition, if not, did people opt to import a more preferable source material or did they manage with what was at hand?

3.2 Stone types used for ground stone

During the Late Bronze Age, a total of 51 types of stone have been used to produce the studied ground stone assemblage. As the preferred attributes of a stone type differ per tool, the idea is to look at the stone types per tool category. This is done to highlight the difference in preferred stone type attributes for certain objects. It will also be interesting to see if there is a clear division in used materials per tool type. Is the idea of a preferential stone type as important as we have made it out to be? For example are whetstones and polishers preferably made from a very fine-grained stone whereas the typical grinders from coarser stone types, or is this exaggerated? Perhaps these perceived preferences are just our own modern preconceptions about ground stone and in that way very similar to the grinder and grinding slab versus mortar and pestle debate discussed in chapter 1.1. The stone types that were used per tool type in the Late Bronze Age assemblage will be investigated in chapter 5.

Preconceptions set aside it is clear that the different ground stone tools that exist all have divers tasks to perform. Ground stone tools are not only used for the preparation of food. They are also utilized in all types of artisan productions. If ground stone objects were used and produced with a specific purpose in mind it would not be unrealistic to assume that different stone types were preferred for certain uses. By this, however, I do not mean to

imply that all mortars served the same purpose. The point I am trying convey is that the ideal material for a mortar to de-husk grain might not be ideal for grinding pigments.

The stone types entered into the database at the Tell Sabi Abyad project are determined on the basis of an internal source of the Tell Sabi Abyad archive. The Tell Sabi Abyad reference list for stone types is comprised of an in-depth analysis of all the 81 "stone types" found on the site[4]. All the characteristics of a stone types such as texture, colour, density and so on are indicated in the reference list making it possible to use it as a guide for everyone entering objects in to the database. Below the stone types found in the Late Bronze Age ground stone assemblage at Tell Sabi Abyad are displayed. The stone types are accompanied by the amount of objects found of this type and the percentage of the assemblage comprised of this stone type.

Table 3. Stone types entire Late Bronze Age ground stone assemblage after the stone types reference list of Tell Sabi Abyad

Stone type	Amount	Percentage
1. Basalt, fine grained	1207	37.72%
2. Basalt, vesicular	1256	39.25%
3. Limestone (pebble)	66	2.06%
4. Granodorite	33	1.03%
5. Gabbro	21	0.66%
6. Flint	36	1.13%
7. Compact gypsum	30	0.94%
8. Limestone	22	0.69%
9. Porfirite	7	0.22%
10. Granite porfiry	11	0.34%
11. Quartzite sandstone (pebble)	27	0.84%
12. Dolorite	43	1.34%
13. Gypsum/limestone/marble	5	0.16%
14. Gypsum	3	0.09%
15. Gypsum/alabaster	4	0.13%
16. Limestone	2	0.06%
18. Alabaster	3	0.09%

[4] Materials such as obsidian, faience and glass are also included in the list. The entire reference list, in all its details, can be found in appendix II.

20. Iron hydroxide concretion	3	0.09%
21. Compact marl	1	0.03%
22. Sedimentary stone	10	0.31%
23. Quartzite	50	1.56%
24. Serpentinite	2	0.06%
26. Serpentinite	1	0.03%
28. Compact gypsum	2	0.06%
29. Sandstone	62	1.94%
30. Porous limestone	5	0.16%
31. Limestone/travertine	26	0.81%
32. Chlorite	2	0.06%
34. Porous limestone	8	0.25%
35. Very porous basalt	87	2.72%
36. Volcanic stone with feldspar	4	0.13%
37. Quartzite	4	0.13%
38. Limestone	5	0.16%
39. Granite/porfiry	2	0.06%
40. Quartzite/sandstone	2	0.06%
41. Limestone	1	0.03%
43. Limestone/marble	4	0.13%
44. Coarse sandstone	9	0.28%
46. Serpentinite	1	0.03%
49. Brecci	2	0.06%
50. Limestone	7	0.22%
51. Chlorite/chloritite	2	0.06%
52. Soft limestone	1	0.03%
55. Soft limestone	1	0.03%
56.	7	0.22%
57. Green quartzite	1	0.03%
58. Sandstone with quartzite	16	0.50%
61. Steatite	1	0.03%
64. Serpentinised ultramafic stone	2	0.06%
66. Black serpentinite	1	0.03%
67. Greenish-black serpentinite	5	0.16%
68. Grey agate chalcedony	1	0.03%
71. Quartzite sandstone	4	0.13%

72. Quartz-rich sandstone	2	0.06%
76. Alabaster/gypsum ?	2	0.06%
Unknown	69	2.16%

3.3 Local stone sources

There are 51 types of stone used in the manufacturing of the ground stone artefacts at Tell Sabi Abyad. In the database as many as 81 different types of stone are indicated as being used for all the artefacts on the site (appendix II). It is however not entirely clear where these different types of stone have come from. Moreover, as non-local versus local resources could indicate preferences. Preferred stone types are an insight into the way the locals saw their ground stone objects in their daily life. Were these ground stone objects something serving a sole and simple purpose? Or was there a difference in appreciation and did people prefer the imported pestle en mortar over the one made from local resources?

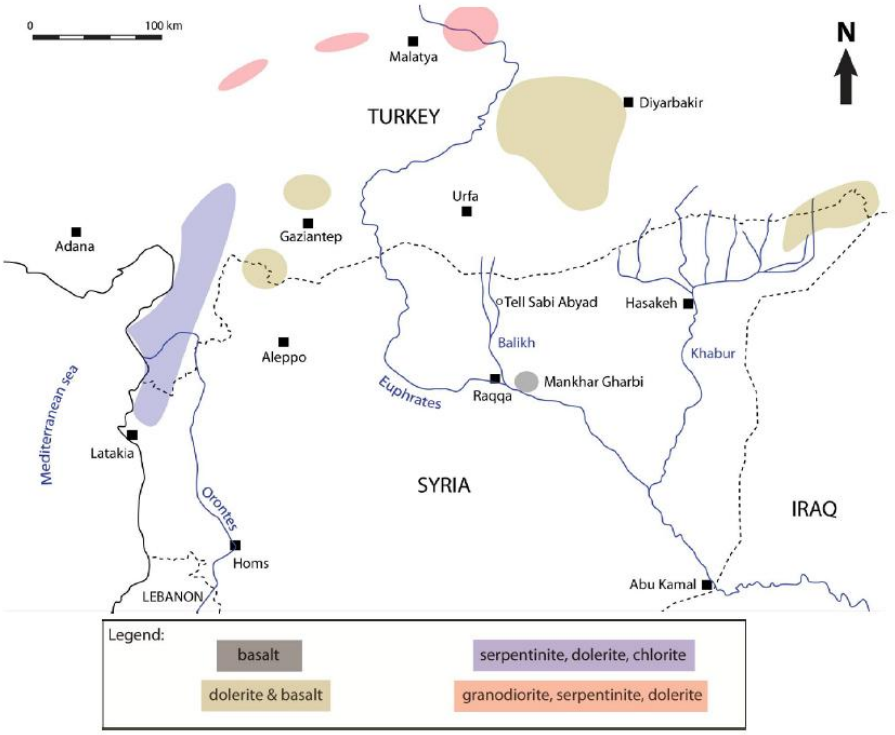

Figure 9. Stone types found around the Balikh valley (from Huigens 2012, 26)

At the moment it sadly is near to impossible to do research in the field in Syria. Therefore, the information is restricted to what has been documented in the past and what

can be deducted from relevant literature[5]. As a part of research into the origins of stone types used in the productions of Late Neolithic axes, adzes en chisels at Tell Sabi Abyad Huigens (2010) has done some research into the available stone types in the vicinity of the site. Many of the stone types used to produce these Neolithic tools have also been used in the Late Bronze Age to produce ground stone artefacts. In his thesis Huigens illustrates that even though the Balikh basin is covered largely in fluvial and aeolian sediments from the Holocene (Huigens 2010, 24), outcrops of the original bedrock are still present on river terraces and the valleys fringes. As a result, many types of sedimentary rocks are available around the site. This means that rocks such as sandstone, gypsum, quartzite and limestone can be found locally. However, in tab. 3 we can see that the most used stone type is basalt, which is not a sedimentary stone. Basalt and a variety of other non local stone types had to have been brought in from elsewhere. The only available sources within a reasonable distance are illustrated in fig. 9. It is safe to that there was a significantly lower interest in the local stone sources when it came to source materials for ground stone objects from the Late Bronze Age at Tel Sabi Abyad (tab. 3). The choice for basalt in producing ground stone is however not surprising. Vesicular basalt (stone type 2) is a very durable and rough stone type limiting the need for re-pecking the work surface to ensure a workable grinding surface (Wright 1992, 54).

3.4 Production of ground stone tools

Apart from limestone building material (Akkermans 1993, 273) and smaller stone items such as beads and seals (Kremer 2013, 35) all stone objects seem to have appeared on site as a finished product.

None of the ground stone objects that were found seem to have been unfinished. Nor is there any mention of ground stone tool production during the already documented Neolithic periods (Spoor and Collet 1996, 415). There is also no mention of ground stone production, trade or anything related to the ground stone tool industry to be found in the published translations of the cuneiform tablets found at Tell Sabi Abyad (Wiggermann 2000).

[5] Such as: Akkermans 1989; Akkermans 1993; Akkermans 2006; Akkermans and Wiggermann in press; Collet and Spoor 1996; Duistermaat 2007; Huigens 2010; Huigens *et al.* In press; Kremer 2013 and Wiggermann 2000.

The lack of manufacturing waste on site is actually a very common phenomenon where ground stone assemblages are concerned (Abadi and Rosen 2008, 99). As a result the current theory is that ground stone objects are nearly always manufactured off-site. This theory is supported by the often exogenous source materials used in producing ground stone objects, such as basalt and sandstone (Abadi and Rosen 2008, 99). As a result it is unclear whether the objects where brought on site as complete artefacts. And how these objects were brought to the site.

Recovering the sources of the specific types of basalt used in the Late Bronze Age ground stone assemblage is not possible for this particular research as the objects are not physically available. Samples from all the possible basalt sources in the region should also be sampled for comparison. However recovering the original stone source for a basalt artefact is not as simple as comparing samples. There are many basalt provenance studies done in the region (Rutter and Philip 2008; Abadi and Rosen 2008; Williams-Thorpe and Philip 1993). And it is clear that similarities in compositions of basalt outcrops (Williams-Thorpe and Philip 1993, 54) cause difficulties in precisely determining the source of an artefact by petrographic analysis alone.

Chapter 4

Typology

4.1 Introduction

Before any real assessment of typology can be made, it is important to quickly ascertain the difference in the actual types of ground stone artefacts and their definitions. At this point the type is not meant as being part of any sort of typology. It is simply an overview of what is seen as a grinder, grinding stone, mortar and so on. The following terminology is directly copied from the "Tell Sabi Abyad, First Aid For Object forms" hand-out which is used in the field (appendix I). It is by these standards that all the forms were filled in at the excavation by the excavators. And later on entered into the database.

There is no project specific definition in the Tell Sabi Abyad, First Aid Objectforms of whetstones nor are they included in the following original typology (chapter 4.2). There are however 81 artefacts from the Late Bronze Age assemblage classified as being a whetstone.

Often, a typology is a means of creating a relative chronology. However, where ground stone is concerned this is hardly possible and therefore not a very useful starting point for creating a typology. Strictly speaking the tell Sabi Abyad Grinding Tools Shape Typology is not a typology at all. If we go back to the basics of archaeological practice and theory, we see that *typology seeks to identify and analyse changes that will allow artefacts to be placed into sequences* (Greene 2006, 141). The typology is, in fact, a classification as it is created to divide the artefacts upon their description.

There are types of artefacts that could officially be included within the ground stone class that would be viable candidates for chronological typology, such as stoneware. Nevertheless, the decision has been made earlier on not to include these types of artefacts in this thesis. In addition, these types of objects were not included in the original ground stone typology of the site as they are rarely seen as ground stone artefacts yet still officially part of the material category. So even a new version of the ground stone typology of Tell Sabi Abyad cannot have any significant chronological value. It is however possible to compare research done into the ground stone assemblages of the different periods on the site. By doing this different trends and preferences might come to light. However I do not necessarily expect to find any of these changes clearly defined within the Late Bronze Age

assemblage. As all literature suggests that, where ground stone is concerned, (style) changes proceed very slowly.

Preferably, a typology should have a logical and oversee-able structure where it is clear on what criteria a subdivision is made. If not research can be hampered by the inconsistent typology (Wright 1992, 53). A clearly structured descriptive classification system is even called a prerequisite by Wright (1992, 53) for discovering and discussing any significant varieties within a ground stone assemblage. The original ground stone shape typologie is however not a logically and clearly structured typology. Therefore, it seems suitable to restructure the old typology into a tool that can provide a valuable insight in to this particular material category.

4.2 Existing typologies and problems

First the current Tell Sabi Abyad ground stone typology will be shown and discussed. This typology is used for the entire project and all periods. After this, some issues with the original typology will have been revealed. Following will be a revised version of the Tell Sabi Abyad typology with an explanation as to how and why. The existing typology at Tell Sabi Abyad, called the grinding tools shape typology, is as follows:

4.2.1 Tell Sabi Abyad grinding tools shape typology

Type 1 Rather large, cylindrical grinders or pestles

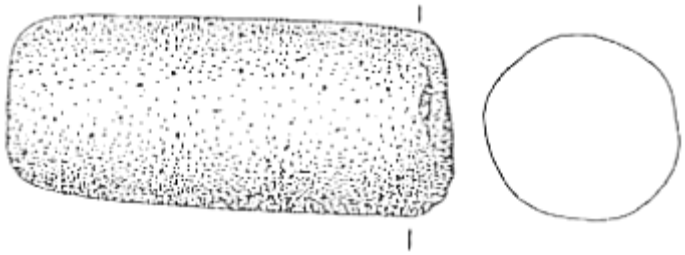

Figure 10. Type 1, Original typology (from First Aid for Objectforms, 8)

Type 2 Rather large, conical grinders or pestles

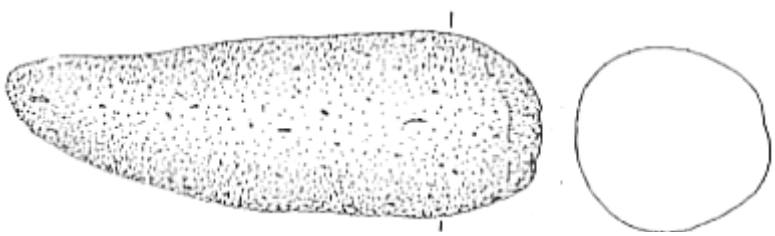

Figure 11. Type 2, Original typology (from First Aid for Objectforms, 8)

Type 3 Cylindrical or conical grinders or pestles with more irregular shape

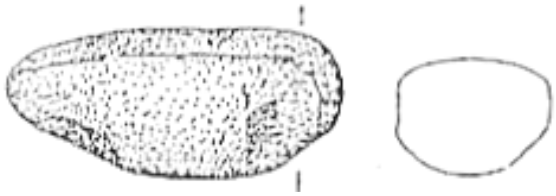

Figure 12. Type 3, Original typology (from First Aid for Objectforms, 8)

Type 4 Small spherical (**4a**) or cubical (**4b**) tools used as hammers, grinders or pestles

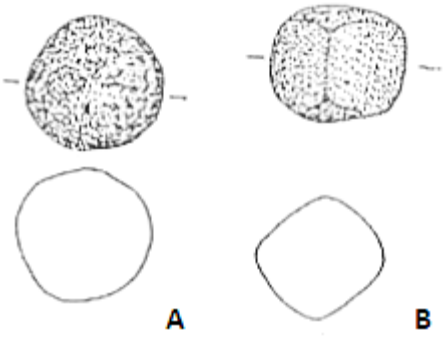

Figure 13. Type 4 a and b, Original typology (after First Aid for Objectsforms, 8)

Type 5 Mortars

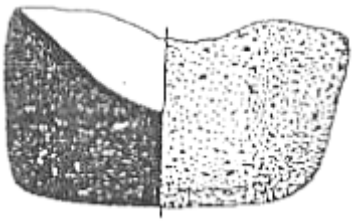

Figure 14. Type 5, Original typology (from First Aid for Objectforms, 8)

Type 6 Flattened grinding slabs (**6a**) or flattened grinders (**6b**)

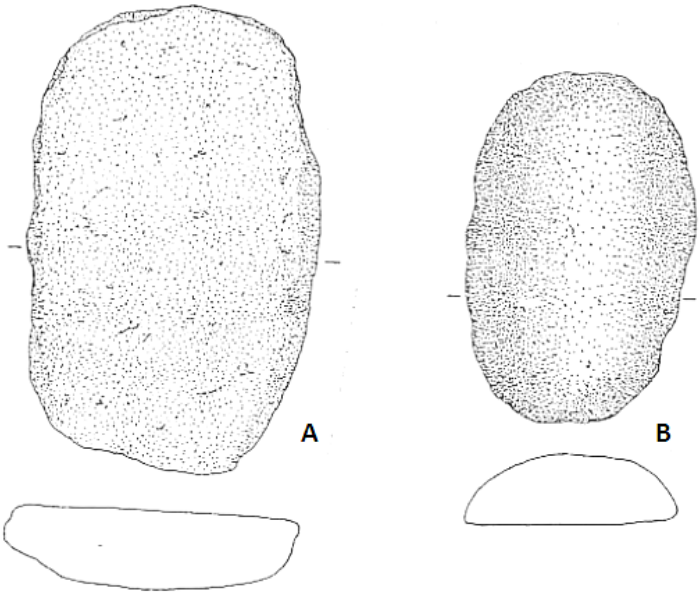

Figure 15. Type 6 a and b, Original typology (after First Aid for Objectforms, 8)

Type 7 Small cylindrical grinders or pestles

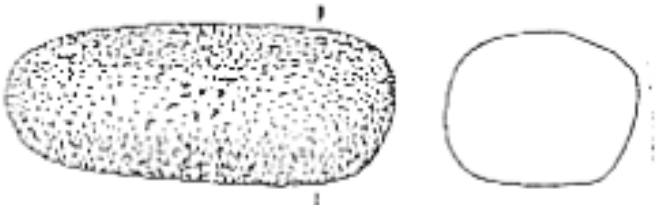

Figure 16. Type 7, Original typology (from First Aid for Objectforms, 8)

Type 8 Small conical pestles

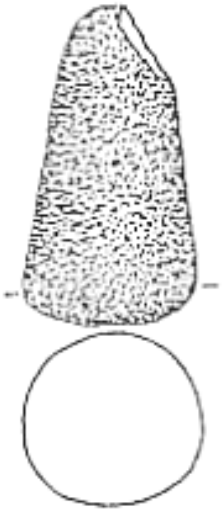

Figure 17. Type 8, Original typology (from First Aid for Objectforms, 9)

Type 9 Unidentifiable pieces

Type 10 Rectangular grinders

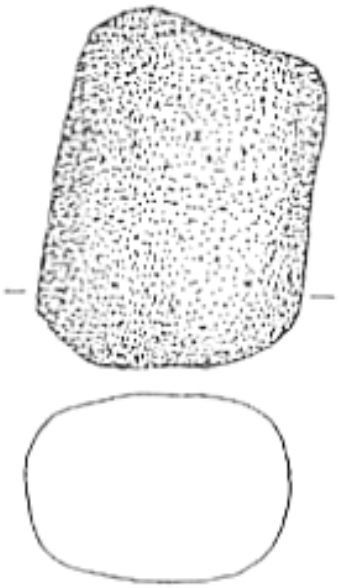

Figure 18. Type 10, Original typology (from First Aid for Objectforms, 9)

Type 11 Flat tools made of extremely light and porous basalt

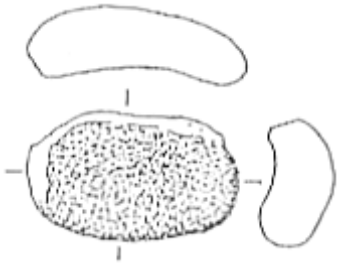

Figure 19. Type 11, Original typology (from First Aid for Objectforms, 9)

Type 12 Large spheres, smoothed on one or more sides

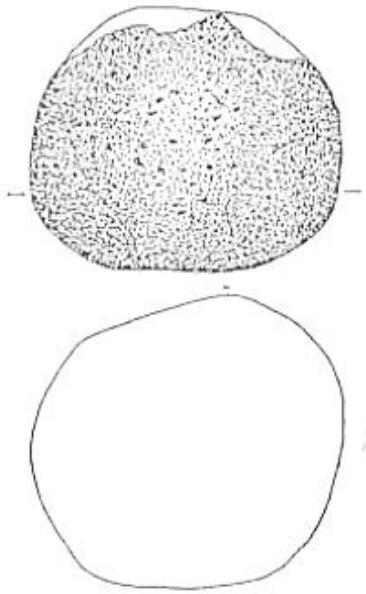

Figure 20. Type 12, Original typology (from First Aid for Objectforms, 9)

Type 13 Large pear-shaped pestles

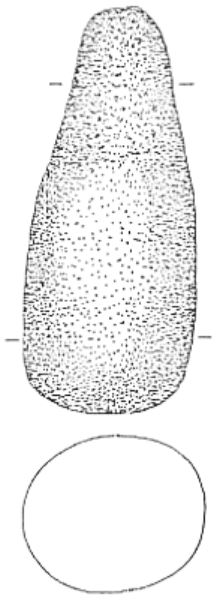

Figure 21. Type 13, Original typology (from First Aid for Objectforms, 9)

Some issues that have become apparent on closer examination are that there is no clear structure in the currently used typology. Types are not based on a clear list of criteria. Sometimes it is shape, other times it is the sort of tool. Like with type 5, mortars. However polishers and whetstones are completely neglected in the current typology and do not appear anywhere. They are, however, tools types that frequently return in the database. Grinding stone is another example of such an irregularity. According to the *first aid in object forms* we have discussed earlier on in this chapter there is a clear difference in shape between a grinder and a grinding stone yet there are nine possible types of grinders (original types 1, 2, 3, 4a, 4b, 6b, 7, 10 and 11) and none for grinding stones. There is also a category that is solely based on the type of material the artefacts are made of (type 11, are all stone type 35). Type 12, the large spheres, is also an elusive entity as it fails to specify what sort of objects these spheres thought to be. Nonetheless, the creators of the typology obviously saw fit to dedicate a type to these objects. However, only five of these spheres have been found in the Late Bronze Age layers at Tell Sabi Abyad. Whereas they could have also have opted to assign these spheres to the unidentifiable pieces of type 9. Finally, type 9 "unidentifiable pieces" is a problem in and out of itself. As technically all grinding stones, polishers and whetstones should be considered unidentifiable, as no types for these objects are included in this typology. Therefore, when it comes to typology criteria there seems to have been no coherent idea of what the main structure of this typology should be.

Asides from an unclear main structure of the original typology there is another problem. As can be seen in fig. 10-21 a differentiation is made between different objects of the same shape based on size. Type 1 are rather large cylindrical pestles and grinders whereas type 7 are small cylindrical grinders or pestles. The same differentiation is made between type 2 and type 8. However, nowhere are any parameters given pertaining to the measurements of these types.

This current typology is certainly not wrong; it is however clearly created out of necessity and in the field. Categories were added on when they appeared to be needed. This has resulted in a non-cohesive typology. This original typology is well suited to the diversity of artefacts found on the site. It is, however, not very practical or useful for research or an analysis of any kind.

4.2.2 Neolithic ground stone typology by Collet and Spoor

This typology (Collet and Spoor 1996, 416-417) is based on research done on the ground stone assemblage of Tel Sabi Abyad found up to 1993. Collet and Spoor have effectively adopted the original shape ground stone typology. They have built upon the original types and further specified the categories and distinguish between several possibilities or tendencies within the type seen in the assemblage up to 1993. These differentiations are however not given any distinctive subtype. An example of this is type 5. In the original typology all mortars, regardless of shape, belong to this type. Collet and Spoor have recognised a clear difference in two types of mortars. Smaller portable bowl like mortars and large irregularly shapes mortars that were sunk into the floor. Even though it was significant enough to mention such a clear difference within the typology itself the choice was made not to alter or add on to the typology that was already in place.

4.2.3 Neolithic ground stone typology Huigens *et al.*

This typology is based on research done on the ground stone assemblage of Tel Sabi Abyad found from 1994 up to 1999. The typology used in this research is clearly different from the two previously mentioned typologies. The typology in this research was based more on other ground stone typologies[6] of Neolithic assemblages and less on the original shape typology.

[6] Huigens *et al.* have partly based their typology on: Davis 1982, Gopher and Orelle 1995 and Wright 1992.

Tool type	Level																	
	8		7		6		5		4		3		Topsoil		Mixed		Total	
Grinding slabs	14	18%	39	16%	23	17%	4	16%	1	50%	1	100%	12	26%	26	14%	120	17%
Mortars	6	8%	10	4%	9	7%	1	4%	-	-	-	-	1	2%	10	5%	37	5%
Circular dishes	3	50%	5	50%	5	56%	-	-	-	-	-	-	-	-	5	50%	18	49%
Rectilinear dishes	-	-	1	10%	1	11%	1	100%	-	-	-	-	-	-	-	-	3	8%
Cups	1	17%	2	20%	-	-	-	-	-	-	-	-	-	-	3	30%	6	16%
indet.	2	33%	2	20%	3	33%	-	-	-	-	-	-	1	100%	2	20%	10	27%
Handstones	18	23%	65	26%	27	20%	6	24%	1	50%	-	-	12	26%	28	15%	157	22%
Large flattened	7	39%	18	28%	8	30%	3	50%	1	100%	-	-	2	17%	8	29%	47	30%
Small discoidal	1	6%	4	6%	2	7%	-	-	-	-	-	-	2	17%	1	4%	10	6%
Small ovate	1	6%	3	5%	1	4%	1	17%	-	-	-	-	-	-	-	-	6	4%
Small rectilinear	1	6%	3	5%	2	7%	1	17%	-	-	-	-	1	8%	-	-	8	5%
Small loaf-shaped	-	-	5	8%	4	15%	-	-	-	-	-	-	2	17%	3	11%	14	9%
indet.	8	44%	32	49%	10	37%	1	17%	-	-	-	-	5	42%	16	57%	72	46%
Pestles	9	12%	42	17%	19	14%	4	16%	-	-	-	-	5	11%	14	7%	93	13%
Small	5	56%	16	38%	6	32%	1	25%	-	-	-	-	2	40%	2	14%	32	34%
Medium-sized	-	-	7	17%	3	16%	1	25%	-	-	-	-	1	20%	6	43%	18	19%
Large	1	11%	11	26%	3	16%	2	50%	-	-	-	-	-	-	3	21%	20	22%
indet.	3	33%	8	19%	7	37%	-	-	-	-	-	-	2	40%	3	21%	23	25%
Stone vessels	9	12%	23	9%	16	12%	5	20%	-	-	-	-	-	-	29	16%	82	11%
Type 1	2	22%	7	30%	7	44%	-	-	-	-	-	-	-	-	10	34%	26	32%
Type 2	1	11%	3	13%	1	6%	1	20%	-	-	-	-	-	-	2	7%	8	10%
Type 3	1	11%	3	13%	3	19%	-	-	-	-	-	-	-	-	5	17%	12	15%
Type 4	-	-	1	4%	-	-	-	-	-	-	-	-	-	-	1	3%	2	2%
indet.	5	56%	9	39%	5	31%	4	80%	-	-	-	-	-	-	11	38%	34	41%
Celts	1	1%	1	0,4%	8	6%	1	4%	-	-	-	-	-	-	1	1%	12	1,7%
Maceheads	-	-	1	0,4%	-	-	-	-	-	-	-	-	-	-	-	-	1	0,1%
Pounders	-	-	10	4%	8	6%	-	-	-	-	-	-	3	6%	6	3%	27	4%
Spherical	-	-	5	50%	7	88%	-	-	-	-	-	-	2	67%	4	67%	18	67%
Cubical	-	-	5	50%	1	13%	-	-	-	-	-	-	1	33%	2	33%	9	33%
indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worked pebbles	6	8%	9	4%	3	2%	-	-	-	-	-	-	-	-	12	6%	30	4%
Pounders	1	17%	6	67%	2	67%	-	-	-	-	-	-	-	-	3	25%	12	40%
Polished	2	33%	3	33%	1	33%	-	-	-	-	-	-	-	-	6	50%	12	40%
Elongated	3	50%	-	-	-	-	-	-	-	-	-	-	-	-	3	25%	6	20%
indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Very porous abraders	-	-	13	5%	3	2%	-	-	-	-	-	-	6	13%	10	5%	32	4%
Small abraders	-	-	1	0,4%	2	1%	-	-	-	-	-	-	1	2%	2	1%	6	0,8%
Flaked discs	1	1%	-	-	2	1%	-	-	-	-	-	-	-	-	4	2%	7	1%
Spheres	-	-	2	1%	2	1%	-	-	-	-	-	-	-	-	-	-	4	0,6%
Palettes	2	3%	-	-	-	-	1	4%	-	-	-	-	-	-	5	3%	8	1,1%
Platforms	2	3%	1	0,4%	1	1%	-	-	-	-	-	-	1	2%	3	2%	8	1,1%
Cupholes	-	-	1	0,4%	1	-	-	-	-	-	-	-	1	2%	-	-	3	0,4%
Weights	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1%	1	0,1%
Miscellaneous	-	-	1	0,4%	-	-	-	-	-	-	-	-	-	-	-	-	1	0,1%
indet.	10	13%	32	13%	12	9%	3	12%	-	-	-	-	5	11%	36	19%	98	13%
Total	**78**	**11%**	**251**	**35%**	**138**	**19%**	**25**	**3%**	**2**	**0,3%**	**1**	**0,1%**	**47**	**6,5%**	**187**	**26%**	**727**	**100%**

Figure 22. Ground stone typology Huigens *et al.* (from Huigens *et al.* in press, 140)

4.3 A revised typology

A revised typology should not only be structured more clearly internally. It should also become visually structured and clear for any user and/or reader. Therefore, it would be ideal if the names given to types illustrate the hierarchy present in the typology system.

Seeing as all the classifications have already been made in the field and the physical objects are not available for further analysis. Creating an entirely new, properly functioning, classification system would be problematic. Mainly because this thesis only looks in to the ground stone assemblage of the Late Bronze Age. While the typology is targeted to all the ground stone found on the site in general.

So revising the current typology seems like a smarter plan. Rearranging the structure and splitting some of the categories up will create a more accessible and approachable typology. For these reasons, the original typology serves as a guideline in the proposed revised typology (tab. 6).

To create a more intuitive nomenclature the types start with a letter combination that indicates a tool-type such as grinder (G) or pestle (P).

Table 4 Letters indicating tool type in revised typology

Letter	Tool type
F	Flat tool
G	Grinder
Gsl	Grinding slab
H	Hammer
M	Mortar
P	Pestle
Pol	Polisher
S	Sphere
U	Unidentifiable
W	Whetstone

Then a numeral differentiates between types based on the shape of the artefact. Here an attempt has been made to create a uniform meaning with regards to the numeral. For example: 1 stands for a cubical shape, 2 for spherical and so on. To make this possible

tool types that do not have multiple types within the typology have been ascribed the numeral 0. This is also to indicate that there is no real distinction between different types or shapes where this type of object is concerned. And to not create a false notion of multiple types. In the table presented below all the encountered shapes are listed with their corresponding numeral.

Some examples to illustrate how the structure of the revised typology actually works:

G.3.	(G) Grinder	(3) conical shape
G.4.	(G) Grinder	(4) cylindrical shape
P.4.	(P) Pestle	(4) cylindrical shape

Another choice made while revising the typology that needs attention concerns the original types 9 (unidentifiable), 11 (Flat tools out of extremely porous basalt) and 12 (Large spheres smoothed on one or more sides). Unlike all the other types in the newly revised typology these are not primarily based on function. The capital letter in at the beginning of their type-name indicates, in these cases, a shape. I have debated leaving these three types from the original typology out of the revised version. However, these types were created with a reason and therefore serve a purpose within the structure of the assemblage (especially type 11 and 12). Types 11 and 12 indicate that a there was a clear visible trend seen by the excavators at the time and they therefore felt the need to create these two types. Type 9 on the other hand has more practical roots in that every ground stone object can be assigned to the existing typology with the creation of it.

Table 5. Numerals indicating shape in revised typology

Numeral	Shape
0	Non-specific
1	Cubical
2	Spherical
3	Conical
4	Cylindrical
5	Flat or flattened
6	Rectangular
7	Pear shaped

8	Irregular
9	Oval or oblong
10	Triangular or trapezoid
11	Disk/circular
12	Natural

Keeping these three types in the revised typology also had two practical reasons. Not only are these types assigned to a large number of artefacts in the database, 202 objects (tab. 8). Leaving a gap in the revised version would also create confusion. The reason for revision was to create a more workable and analytically viable typology and to leave out a relatively large chunk of the assemblage for the sole reason of not fitting into the designed structure is problematic. As this would mean that when research needs to be done to the entire assemblage two overlapping typologies would need to be utilized. Therefore, types F.0, S.0 and U.0 deviate from the typical structure of the typology.

Following are both the newly revised typology (tab. 6) and the original typology (tab. 7) with their, where possible, counterparts displayed in the outer right column.

Table 6. Revised typology Late Bronze Age ground stone Tell Sabi Abyad

Use	Type	Shape	Originally
Flat tools	F.0		11
Grinder	G.0	fragment	
	G.1	cubical	4b
	G.2	spherical	4a
	G.3	conical	2
	G.4	cylindrical	1
	G.5	flat or flattened	6b
	G.6	rectangular	10
	G.7	pear shaped	
	G.8	irregular	3
	G.9	oval or oblong	
	G.10	triangular or trapezoid	
	G.11	disk/ circular	
	G.12	natural	
Grinding slab	Gsl.0	fragment	

	Gsl.5	flattened	6a[7]
	Gsl.6	rectangular	
	Gsl.7	pear/egg shaped	
	Gsl.8	irregular	
	Gsl.9	oval/oblong	
	Gsl.10	triangle/trapezoid	
	Gsl.11	disk/circular	
Hammer	H.0	fragment	
	H.1	cubical	4b
	H.2	spherical	4a
	H.3	conical	
	H.4	cylindrical	
	H.6	rectangular	
	H.7	pear/egg shaped	
	H.8	irregular	
	H.9	oval/oblong	
	H.10	triangle/trapezoid	
	H.11	disk/circular	
	H.12	natural	
Mortar	M.0		5
Pestle	P.0	fragment	
	P.1	cubical	4b
	P.2	spherical	4a
	P.3	conical	2
	P.4	cylindrical	1
	P.6	rectangular	
	P.7	pear shaped	13
	P.8	Irregular	3
	P.9	Oval or oblong	
	P.10	triangular or trapezoid	
	P.11	disk/circular	
	P.12	natural	
Polisher	Pol.0	fragment	
	Pol.1	cubical	
	Pol.2	spherical	
	Pol.3	conical	
	Pol.4	cylindrical	
	Pol.6	rectangular	

[7] There are some issues concerning original type 6a and how it relates to the revised typology (chapter 5.2.2).

	Pol.7	pear shaped	
	Pol.8	Irregular	
	Pol.9	Oval or oblong	
	Pol.10	triangular or trapezoid	
	Pol.11	disk/circular	
	Pol.12	natural	
Spheres	S.0		12
Unidentifiable	U.0		9
Whetstone	W.0	fragment	
	W.3	conical	
	W.4	cylindrical	
	W.5	flattened	
	W.6	rectangular	
	W.8	irregular	
	W.9	oval/oblong	
	W.10	triangle/trapezoid	
	W.12	natural	

As can be seen in tab. 6 and 7 the choice has been made to step away from the criteria of rather large and small (as were used in types 1,2,7 and 8). This was deemed necessary because the differentiation between small and rather large is never actually specified in measurements in the original typology, nor is there a clear trend detectable in the data entered into the database.

Instead of splitting up tools with a similar shape into small and large, the choice has been made to simply portray the size range. And look at whether there is actually an uneven distribution of size ranges, suggesting a smaller and larger type. If a significant difference in distribution of size is to be discovered the choice could be made later on to split up any of the revised typology types when necessary. However, what should be a significant difference in size? And even more importantly what is a large enough amount of artefacts to base a new type on? The amount of objects per type within the Late Bronze Age ground stone assemblage at Tell Sabi Abyad is not always very high. Making it difficult to divide types in proper sections, shape wise. Moreover, dividing types on the basis of size could lead to the assemblage being arbitrarily divided. Was size as important to the inhabitants of the site as we make it out to be? Of course, the same argument could be made for a shape based typology. However, with little known about ground stone tools shape is a good basis to start

a more intensive research. Perhaps inhabitants did not care is a hammer stone was cubical or spherical but like the issue of size this will become apparent in chapter 5.

Table 7. Original typology linked to revised version after First Aid for Objectforms, 8-9

Type	Tool Type	Shape	Extra	Revised
1	Grinder Pestle	cylindrical	Rather large	G.4 P.4
2	Grinder Pestle	conical	Rather large	G.3 P.3
3	Grinder Pestle Grinder Pestle	conical cylindrical	Irregular	G.8 P.8 G.8 P.8
4a	Grinder Hammer Pestle	spherical	Small	G.2 H.2 P.2
4b	Grinder Hammer Pestle	cubical	Small	G.1 H.1 P.1
5	Mortar			M.0
6a	Grinding slab	flattened		Gsl.5
6b	Grinder	flattened		G.5
7	Grinder Pestle	cylindrical	Small	G.4 P.4
8	Pestle	conical	Small	P.3
9	Unidentifiable pieces			U.0
10	Grinder	rectangular		G.6
11	Flat tools		Made of extremely light and porous basalt	F.0
12	Spheres		Large, smoothed on one or more sides	S.0
13	Pestle	pear shaped	Large	P.7

Chapter 5

Bronze Age ground stone artefacts on Tell Sabi Abyad

5.1 Introduction

In this chapter, we take a look at the actual ground stone artefacts of Tell Sabi Abyad from the Late Bronze Age. Per tool type information such as the amounts, shape, size and source material will be discussed. At the end of the chapter, results of all the categories will be combined to create an overview of the entire ground stone assemblage of the Late Bronze Age. When looking at the following data it is important to keep in mind that some of the objects have been used in multiple ways and are, for example, both pestle and grinder. The choice has been made to ascribe both functions to these objects. In the following tables (tab. 8-15) a distinction is made between the primary and secondary function of an object. The differentiation between primary and secondary function is based on an assessment of shape, material and ware patterns. Objects with a single type of use are labelled under the category exclusively.

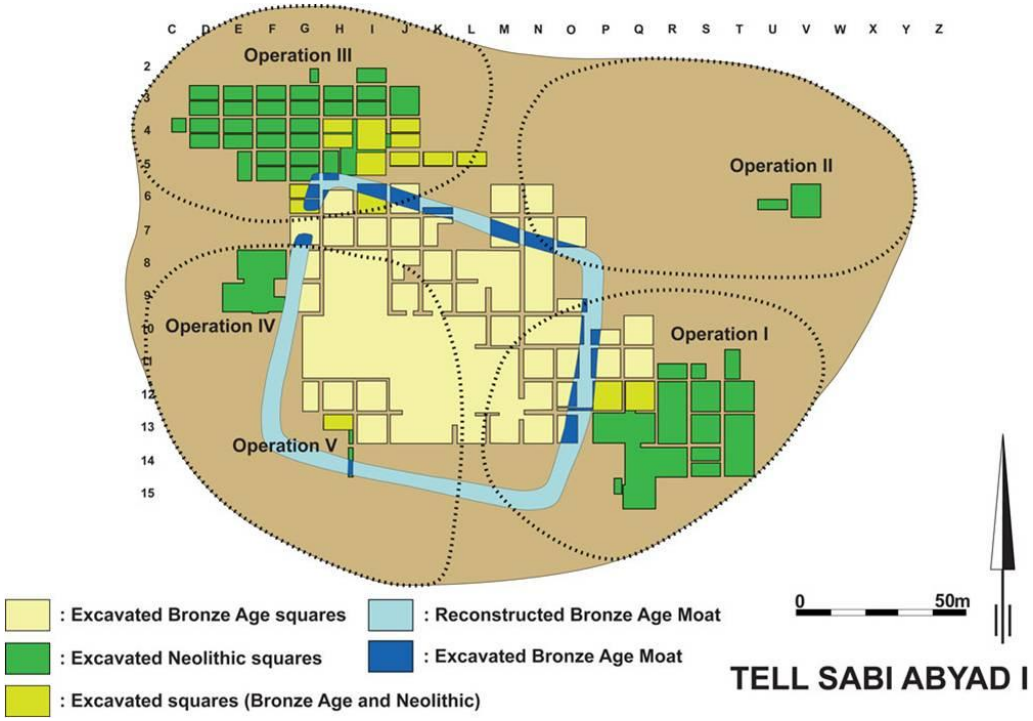

Figure 23. Bronze Age operations on Tell Sabi Abyad from the Tell Sabi Abyad archive

This subdivision may create more data entries than the actual amount of objects and cause confusion. However, it does give a more complete account of the ground stone assemblage and its use. The excavated Bronze Age areas are located in the centre of the tell (fig. 23). They are located mainly on the inside of the Bronze Age Moat as discussed in chapter 1.

As a start, an overview of all the found ground stone material will be visible in tab. 8. Here the amount of artefacts per tool category is displayed. A distinction has been made between the total amounts of objects attributed to a tool category, the amount of objects that exclusively belong to the particular category and items that had a dual function.

Table 8. Ground stone overview[8]

	Total	Exclusively	Dual Function	
			Primary	Secondary
Flat	41	0	0	41
Grinder	1078	916	106	56
Grinding slab	1227	1210	17	0
Hammer	108	24	23	61
Mortar	154	152	2	0
Pestle	326	240	41	45
Polisher	233	213	14	6
Sphere	5	0	0	5
Unidentified	156	156	0	0
Whetstone	86	85	1	0

The incredibly high amount of grinders and grinding slabs create a misrepresentation. All objects that are found on the site are entered separately into the database. This results in all kinds of small unrecognisable fragments. In most cases the only ways to ascertain the tool type these fragments belonged to are the traces of use. All the different tool types show different signs of usage. The work surface of a grinder is on the broad side and is directed in a linear pattern, resulting in an either flat or convex work surface. Pestles on the other hand are used on their ends and show a rotary grinding or pounding traces (Huigens *et al.* in press,

[8] Polishers represented in the database as polishers or rubbing stones are presented in this study as one category: Polisher (Pol.). There are 48 rubbing stones of which 41 are solely a rubbing Stone, five have a dual function and about two of the artefacts researchers were uncertain.

141). Where the objects were too small to identify what type of tool they belonged to they were ascribed to U. If tool type could be discerned but original shape was impossible to ascertain 0 was given as a shape indicator (for example a small fragment of a grinding slab which could not indicate original shape would be Gsl.0).

When looking at the flat tools and spheres it is important to keep the following in mind: Flat tools and spheres are not organized by function but shape. And can therefore never have a dual function as being a flat tool or sphere is not a function (chapter 4.3). There are however objects considered flat tools that do have a dual function.

5.2 Grinders and grinding slabs

Grinders and grinding slabs are used as a duo. The grinding slab stays stationary and the grinder is moved along its surface. The combination of these tools can be used to grind a wide variety of materials. Grinding slabs and grinders are shown to have been used in food production (Wright 1994, 242), pottery production (Duistermaat 2007, 151) and the production of smaller artefacts such as beads (Kremer 2013, 37).

5.2.1 Grinders

Grinders, also called hand stones (Huigens *et al.* in press, 141) or manos (Wright 1994, 240) in some publications are used in combination with a stationary grinding slab. The working surface of a grinder is located on the broader side of the object and convex in shape. Grinders are smaller than their grinding slab counterparts.

Many of the grinders have a flattened shape. These flattened grinders are the type 6b grinders from the original typology. Even though there is little distinction between the shape, apart from it being flattened, the type does illustrate a significant difference. As can be seen in the original typology and the figure below (fig. 24) there are also non-flattened grinders. These objects with, for example, a conical shape are not flat but still have a longitudinal shape. Whereas there are also some cubical and spherical grinders.

Another note worthy number is the percentage of artefacts in shape category 0. Only 1,76% of the grinders are comprised of unrecognisable grinder fragments. This is the lowest percentage of fragments per tool type, as will become apparent further on in this chapter. But perhaps more importantly it is significantly less than the 35,13% of unrecognisable

fragments found at their counterparts, the grinding slabs (chapter 5.2.2). Out of the 1078 grinders 76 are complete artefacts:7,05%.

Table 9. Grinder types

	Exclusively	Primarily	Secondary	Total	Percentage
G.0 fragment	31	2	10	19	1,76%
G.1 cubical	27	5	7	39	3,62%
G.2 spherical	38	13	2	53	4,92%
G.3 conical	45	17	12	127	11,78%
G.4 cylindrical	43	12	6	61	5,67%
G.5 flattened	543	26	0	569	52,78%
G.6 rectangular	85	9	4	98	9,09%
G.7 pear/egg shaped	5	2	4	11	1,02%
G.8 irregular	44	4	4	52	4,82%
G.9 oval/oblong	34	5	4	43	3,99%
G.10 triangle/trapezoid	19	7	1	27	2,50%
G.11 disk/circular	10	0	1	11	1,02%
G.12 natural	16	0	1	27	2,50%
Total per function	916	106	56	1078	

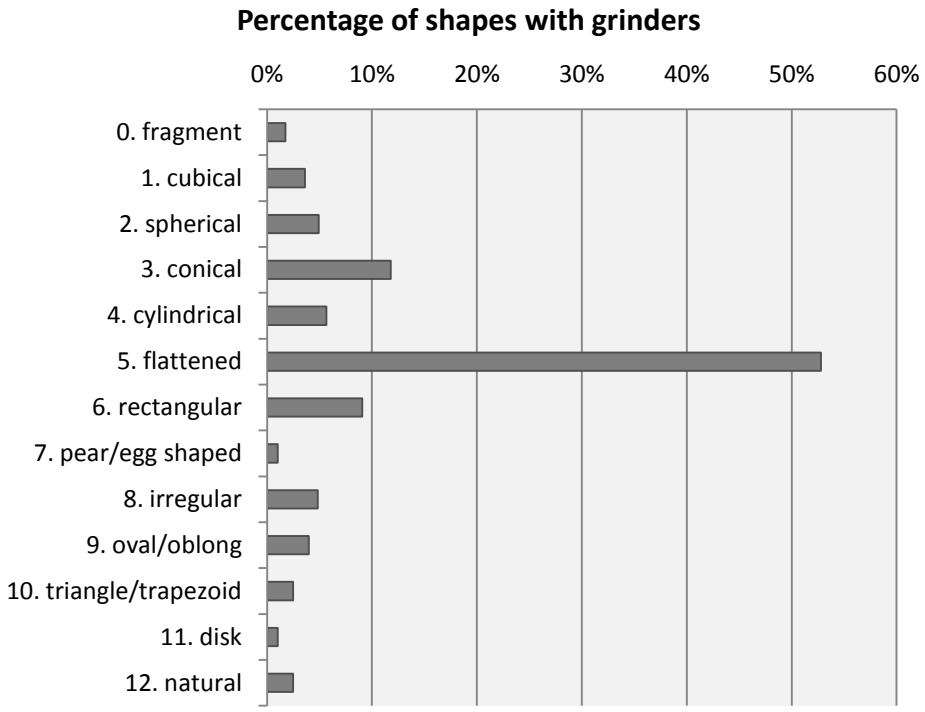

Figure 24. Percentage of shapes with grinders

Eight of the grinders have traces of ochre on them, one grinders had traces of bitumen and another was probably re-used as a weight (it was perforated). There is no connection or preference between the ochre traces location on site and grinder or stone type. Some of the grinders were very intensively used. These objects are for example polished by use, have multiple work surfaces or were used even after fragmentation. There is no clear connection between grinder and/or stone type for extensive use. There are however areas on the site where grinders were kept longer in use. Out of the 27 extensively used grinders, seven are from square J9 (25,93%). As it turns out there is a large dump layer at this location on the site[9].

In the original typology a differentiation is made between small and large cylindrical grinders (G.4, original type 1 and 7). And small and large, conical and cylindrical, pestles (P.3 and P.4, original typology type 1, 2, 7 and 8). But as discussed in the previous chapter there were no parameters given to the measurements for the small and large types. Because the pestles and grinders are grouped together in the original typology in types 1, 2 and 7 the choice was made to also include a look into the size distribution of G.3. Type G.3 will function, more or less, as a control group. By taking a look at the size distribution of type G.3, G.4, P.3 and P.4 it should become visible what the parameters (in cm) of a small or large pestle/grinder are. And, more importantly, if the differentiation between small and large is such a contrast that any subdivision based on size should be continued in the revised typology.

Calculating anything of statistical importance based on such small groups of data is problematic. Another limiting factor is that only a portion of the artefacts used on a site will have been found by archaeologists. And the objects that are found are often not complete. So naturally the sizes portrayed in the following figures are those of the damaged artefacts. If one size was preferred per type the graphs should result in an normal distribution and show a bell curve type shape.

Below the distribution of the found sizes per grinder type are portrayed. Classes are at a 0,5cm interval. All the sizes displayed in the graphs are the lengths of the objects in cm, not the width, height or diameter.

[9] This dump layer is mentioned in the context section of the object forms.

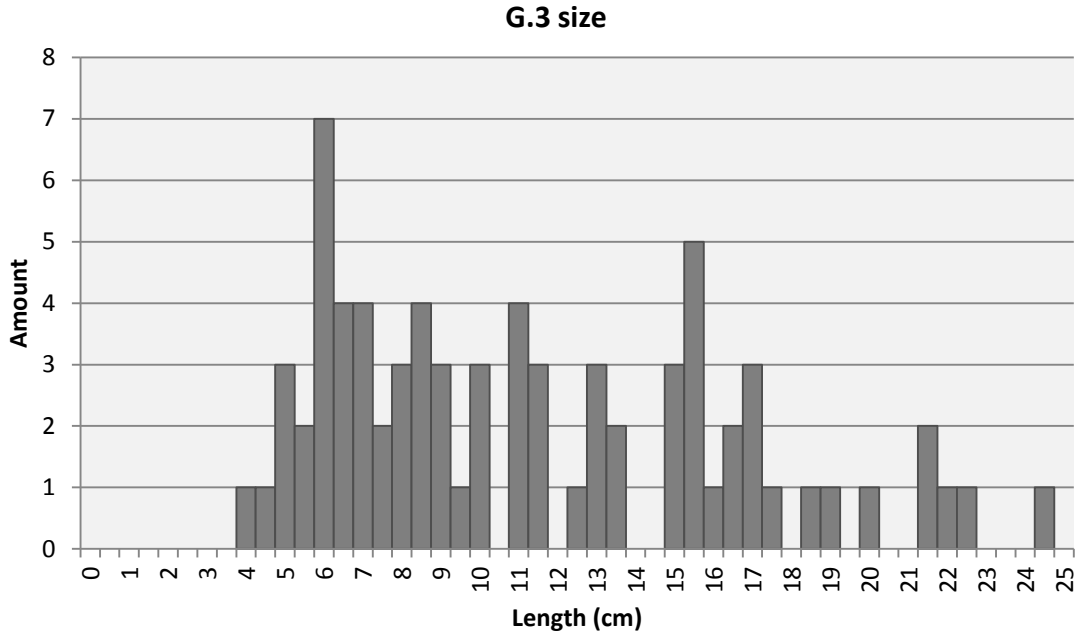

Figure 25. G.3 size distribution

Starting the control group type G.3, which was originally not split up on the basis of size in the original typology. We now take a look at the distribution of size in grinders. The average size of G.3 is 11,36cm and the standard deviation is 5,33. As is visible in fig.25 there is no bell curve type shape detectable in the distribution of size where G.3 is concerned. However there are also not two bell curves indicating two clear preferences in size.

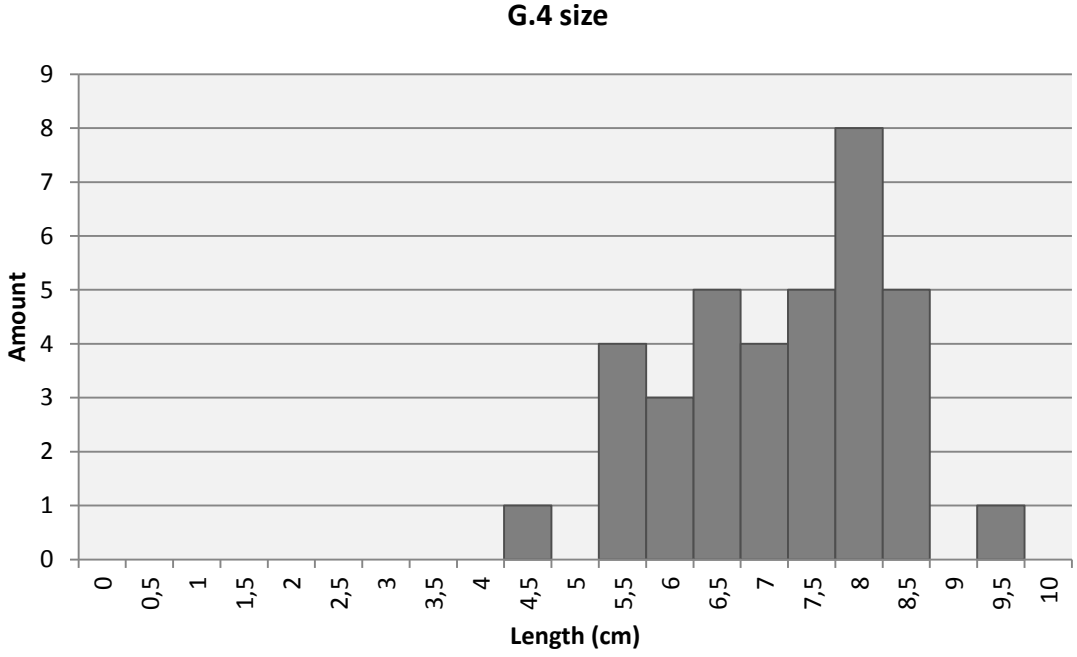

Figure 26. G.4 size distribution

The average size of type G.4 is 10,03 with a standard deviation of 4,62. Unlike fig. 25 the distribution of size for type G.4 are shapes much more like a bell curve (fig. 26). And it is therefore unclear why a division was made between a large and small version of cylindrical grinders (original type 1 and 7).

There are two stone types that are clearly preferred. Stone type 1 fine grained basalt and stone type 2 vesicular basalt. Where fine grained basalt (stone type 1) is also often used for objects with a dual function (both primary and secondary grinders). Vesicular basalt (stone type 2) is only used in eleven objects with a secondary grinder function.

Stone type 35 is a very porous basalt. All the objects made from this material are either solely a grinder of have a primary function as a grinder. Amongst these objects are type F.0 (type 11 in the original typology). Out of the 1078 grinders 62 are made from this extremely porous basalt type.

Figure 27. Stone types grinders

5.2.2 Grinding slabs

In the original shape typology and the Collet and Spoor (1996) typology grinding slabs were limited to type 6a (chapter 4.2). In this type the only clear definition “flattened grinding slab” and the image (fig. 15) given as an example for 6a grinding slab shows a rectangular grinding slab with next to it type 6b an oval grinder. As a result, not much thought has been given to the actual shape, aside from it being flat which is a logical characteristic for a grinding slab. With a total of 1227 grinding slabs from the Late Bronze Age. Out of the 1227 only 29 of the grinding slabs were complete.

It is clear that grinding slabs seem to have broken quite easily, especially after extended use and it is therefore not unthinkable that some of the fragments represented in the database belonged to the same tool. The percentage of grinding slab fragments is with 35,13% however the highest of all the ground stone tool types.

Table 10. Grinding slab types

	Exclusively	Primary	Total	Percentage
Gsl.0 fragment	426	5	431	35,13%
Gsl.2 spherical	1	1	2	0,16%
Gsl.5 flattened	675	0	675	55,01%
Gsl.6 rectangular	25	5	30	2,44%
Gsl.7 pear/egg shaped	1	0	1	0,08%
Gsl.8 irregular	16	2	18	1,47%
Gsl.9 oval/oblong	30	3	33	2,69%
Gsl.10 triangle/trapezoid	23	0	23	1,87%
Gsl.11 disk/circular	13	1	14	1,14%
Total per function	1210	17	1227	

The image displayed below (fig. 28) gives a very distorted view of the actual situation. It however does illustrate how many of the grinding slab finds are recognisable. With shape category 0 it is clear that the original object shape could not be ascertained. However in this case the same could be said for shape category 5, being flat is after all grinding slab specific and not a characteristic that could differentiate between types. A flat grinding slab can still have all kinds of shapes when looking from above. The fragments that make up type 5 in fig. 28 are all artefacts that were a part of type 6a, which criteria was flattened grinding slab, in

the original shape typology. Judging by the image attached to this type in the first aid for objectforms[10] these flat grinding slabs should have a rectangular shape. Whereas the grinder counterpart, type 6b is an oval. No mention of shape, besides flattened, is found in the original typology where type 6 a or b is concerned. And when examining some of the different fragments it is clear that no distinction was made between for example rectangular, oval or triangular flat grinders and grinding slabs. In reality there was only one type of grinding slab in the original typology so all objects and fragments were ascribed to type 6a.

In this research, the choice was made to only re-determine the shape of the complete Gsl.5 artefacts. To reassess the original shape the object form of every object needs to be re-examined. Doing this for the remaining 675 objects in shape category 5 would have taken up to much valuable time. Some of the Gsl.5 incomplete objects were looked at as a control group but nearly all were grinding slab fragments of which the original shape was not clearly distinguishable. Thus, in the case of grinding slabs, shape category 5 is not dissimilar to shape category 0.

The problem with grinding slabs seems to be that they break into relatively small pieces. The original objects on the other hand are quite large and figuring out the original shape form such small fragments is problematic.

Aside from the clear spikes in shape category 0 and 5 there is no real shape preference visible for grinding slabs. If anything, the oval shape (category 9), with 2,69%, is the preferential choice. Whether this is a significant difference though, is a completely different matter. Perhaps the shapes of the complete grinding slabs can give some insight in to if this perceived preference.

Out of the 1227, 29 of the grinding slabs are complete(2,36%). Eight of the complete objects are rectangular (Gsl.6), one is pear/egg shaped (Gsl.7), five have an irregular shape (Gsl.8), fourteen of the complete artefacts are oval/ oblong (Gsl.9) and one object is circular in shape (Gsl.11). Just like with the entire grinding slab assemblage Gsl.9 seems to be the preferred type.

[10] Appendix I

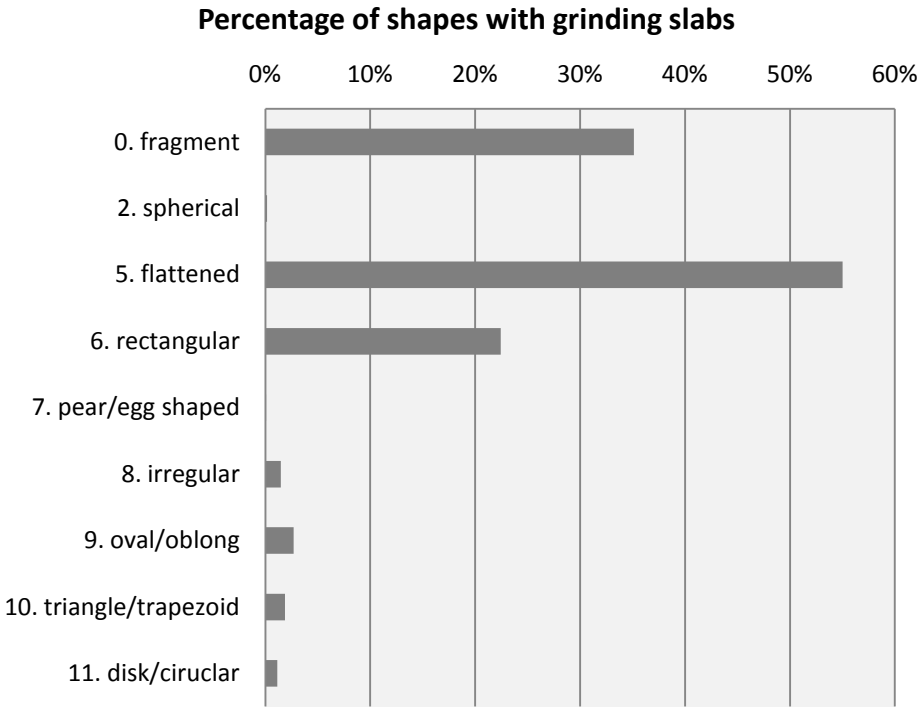

Figure 28. Percentage of shapes with grinding slabs

A total of 37 (3,02%) grinding slab pieces have been extensively used. And as was the case with the extensively used grinder there was no connection between extensive use and stone type or shape. There was however again a connection with a location on the site. Out of the 37 extensively used grinding slab pieces 21 have been found in square J9 (56,76%). The same spot as a large portion of the extensively used grinders were discovered. Even though these extensively used grinding slab pieces are also from the before mentioned dump layer in J9. There is no proof that this concentration of extensively used ground stone tools are from one particular period in time. Only one grinding slab fragment form the Late Bronze Age with traces of ochre on it has been found.

As for the stone types used for manufacturing the grinding slabs; there is a clear preference visible (fig. 29) for stone type 1 and 2. Stone type 2, vesicular basalt is also clearly more popular than stone type 1 with grinding slabs.

Only 17 (0,57%) of the 1227 grinding slabs have a dual function (all of which have a primary grinding slab function). Portraying them as separate statistics within the same figure would not prove useful therefore all objects are shown together.

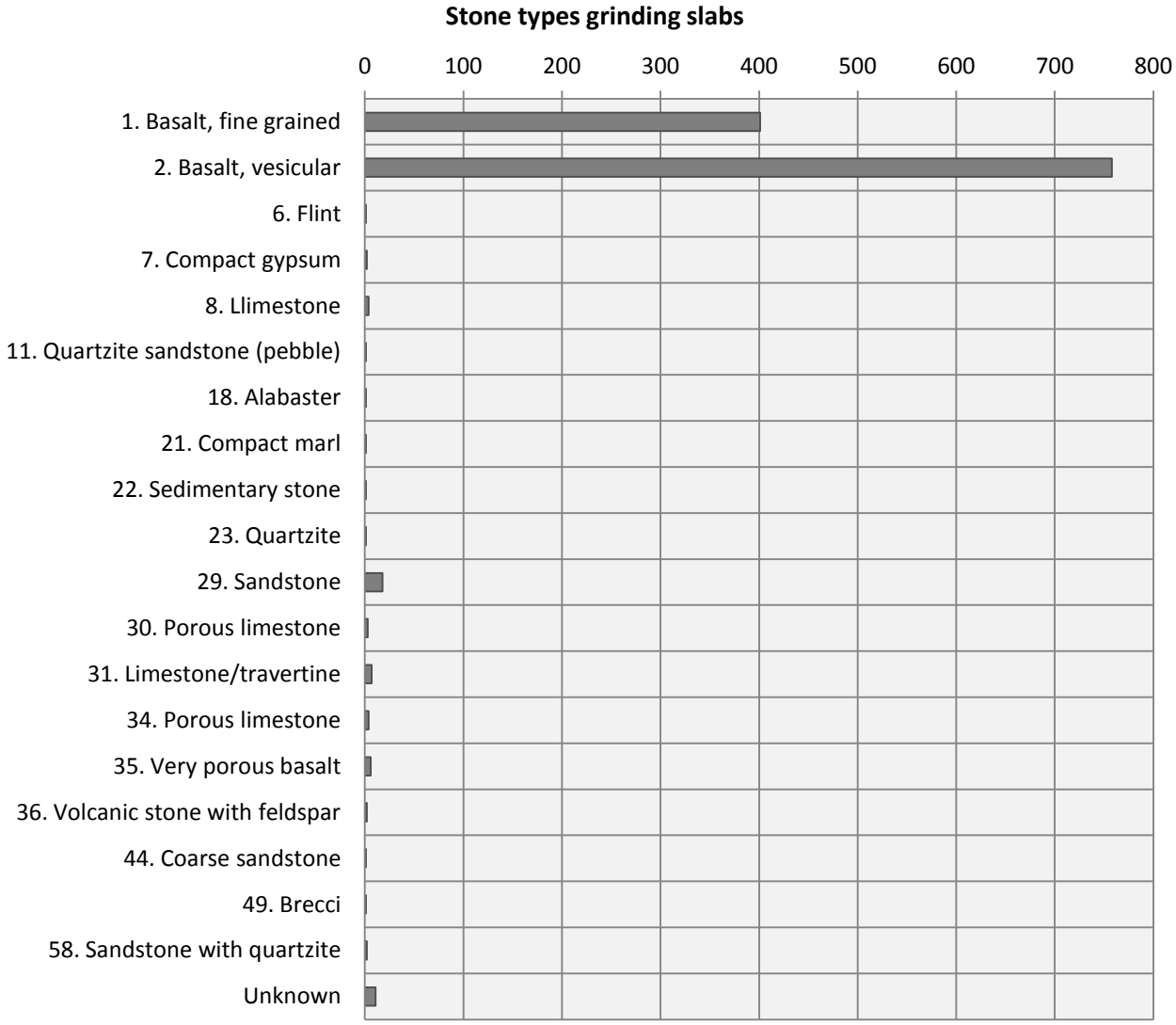

Figure 29. Stone types grinding slabs

5.3 Hammers

Hammers or pounders (Huigens *et al.* in press, 141) are used, as the name suggests, to hammer or pound. They can be recognized by various peck marks and battering traces. Many of the hammers found on the site are re-used objects or objects with a dual function. Broken pestles, grinders or any other kind of sturdy stone tool get a second life. The other hammers have a clear dual function, with one of which being a hammer. In fact, if you take a look at tab. 11 it becomes clear that only 22,22% of the hammers are or were solely a hammer. Most of them were either used as a different tool early on or were both hammer and, for example, pestle simultaneously.

Table 11. Hammer types

	Exclusively	Primary	Secondary	Total	Percentage
H.0 fragment	2	0	3	5	4,62 %
H.1 cubical	6	9	6	21	19,44 %
H.2 spherical	1	2	10	13	12,03 %
H.3 conical	1	0	9	10	9,26 %
H.4 cylindrical	1	1	8	10	9,26 %
H.6 rectangular	2	1	6	9	8,33 %
H.7 pear/egg shaped	2	0	4	6	5,55 %
H.8 irregular	4	4	3	11	10,18 %
H.9 oval/oblong	5	4	6	15	13,89 %
H.10 triangle/trapezoid	1	0	2	3	2,78 %
H.11 disk/circular	0	0	1	1	0,92 %
H.12 natural	0	1	3	4	3,70 %
Total per function	24	23	61	108	

Where shape is concerned there is a preference for the more compact shapes (H.1 cubical, H.2 spherical and H.9 oval/oblong). Another shape that is quite common is irregular (H.8). However, in the case of the hammers the irregular shape is most likely because there is no real shape requirement for a hammer. When looking at the hammer assemblage the only requirement for a hammers seems to have been a surface to batter with and an easy enough shape to hold in your hand. Another reason for the high amount of irregular shaped objects might be a result of the actual use of the hammers. Battering scars can reshape the artefact significantly.

Hammers are certainly not the largest objects of the ground stone assemblage. As an example: H.1 hammers are, on average 5,86 cm. The standard deviation for H.1 is 1,21; illustrating that there is not much difference in size where this type is concerned. The H.2 hammers average a size of 4,96cm, with a standard deviation of 0,89 (even less size difference[11]).

When looking at fig. 31 fine grained basalt (stone type 1) seems like a clearly preferred stone type. But when looking at the numbers for type 1 with ground stone objects that are exclusively a hammer or primarily a hammer this preference does not appear to

[11] The higher the standard deviation, the more spread out values are.

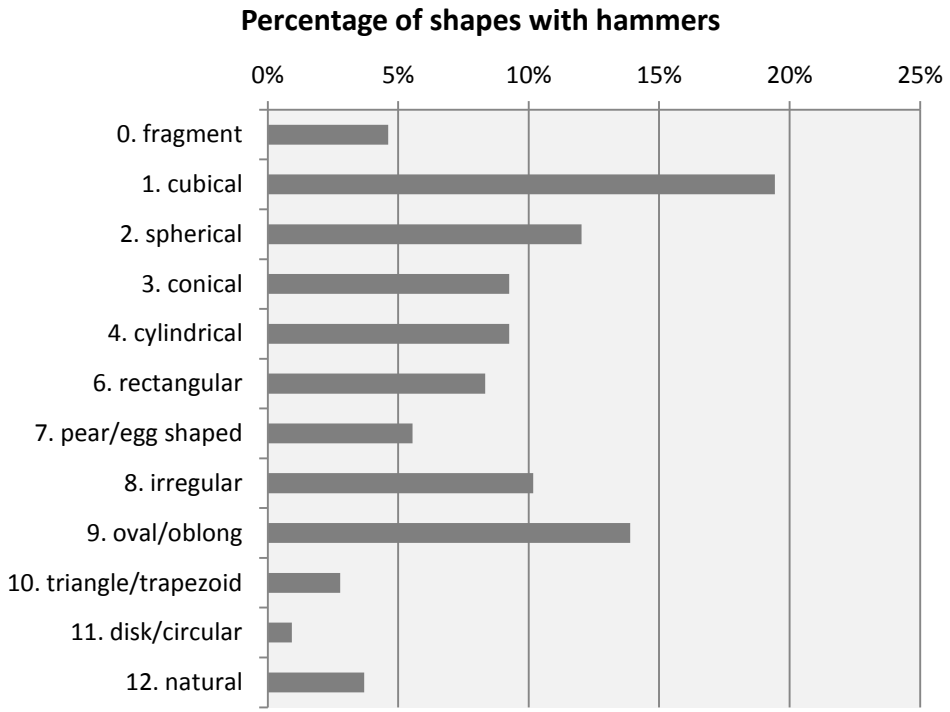

Figure 30. Percentage of shapes with hammers

exist. All the secondary hammers of stone type 1 have a primary function of either a grinder or a pestle. And stone type 1 is a clear preference for grinders and pretty much a staple for pestles. It seems that the preference for stone type 1 in, in this case, has nothing to do with the preferential attributes of fine grained basalt for hammers. The material choice was obviously based on the needs of the tools primary function. More than half (36) of the secondary hammers have a primary function as a grinder (chapter 5.2.1). And almost a quarter (15) has the primary of a pestle (chapter 5.4.2). The tendency to reuse these tools as hammers is the reason for the high amount of objects of stone type 1 in objects with a secondary function as hammer. All the secondary hammers of stone type 1 (27 objects) are either grinders (19 objects) or pestles (eight objects) as their primary function.

Seven of the Late Bronze Age hammers are considered to be complete by the excavators (6,48%). Four hammers had traces of ochre on them. There was however no connection between location on site, type or stone type.

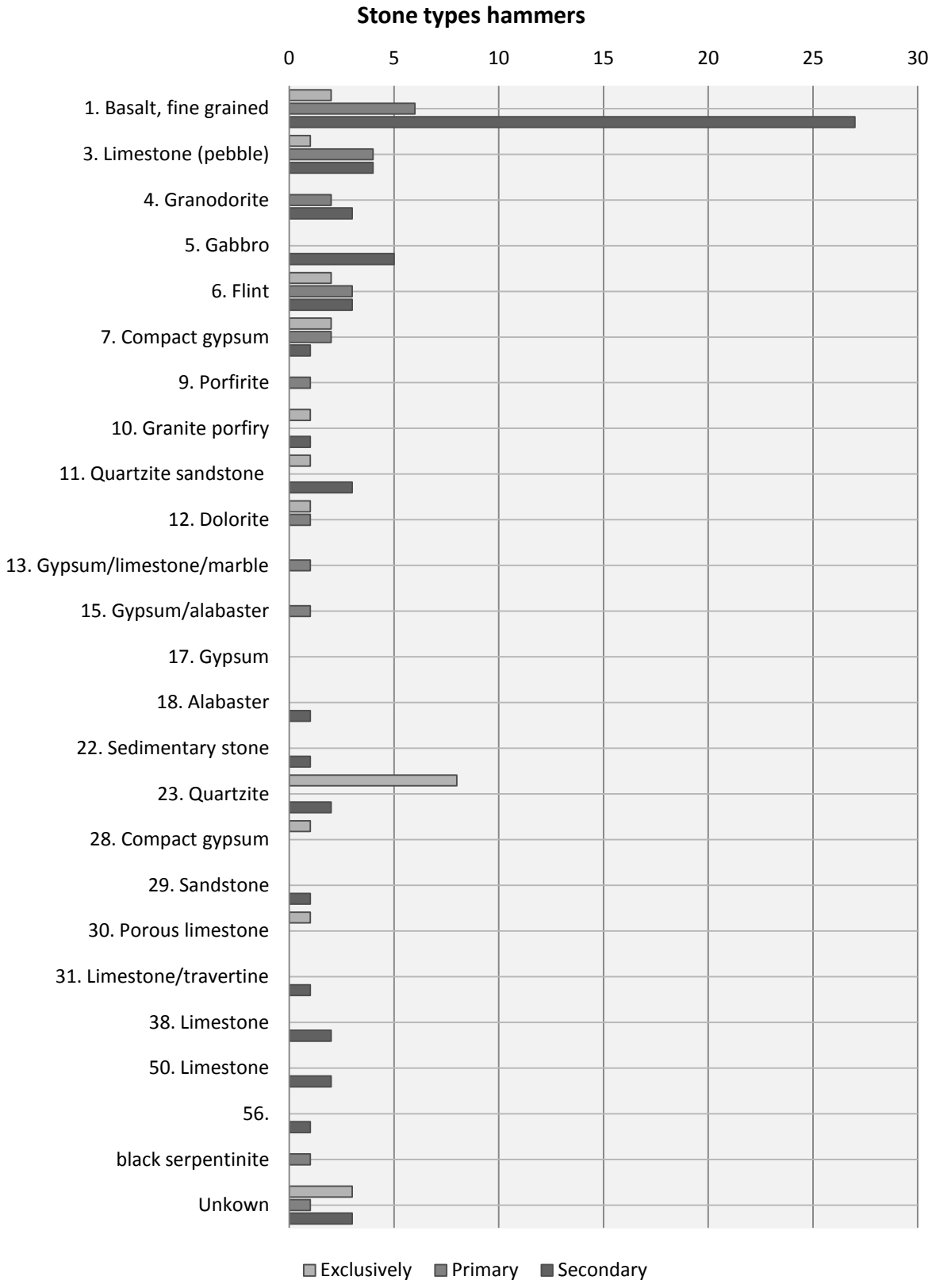

Figure 31. Stone types hammers

5.4 Mortars and pestles

Just like grinders and grinding slabs; mortars and pestles are used as a set. The mortar stays stationary and the pestle is used for grinding and pounding within the mortar. For a long time it was thought that mortars and pestles were mainly used to process foods like nuts and acorns. Ethnographic data has, however, showed that this assumption is incorrect as many different hunter-gatherer groups studies used their grinding slabs and mortars for different purposes (Wright 1994, 241).

In ancient Mesopotamia mortars and pestles were utilized in processing cereals, chicory, *ḫašânu*-plants[12], onions grapes, dates, spices and sesame (Wright 1994, 241).

5.4.1 Mortars

Out of the 154 mortars none have clearly definable different shape according to the revised typology made in this research. Therefore, they are all seen as type M.0. There are however some differences in between the mortars found on the site. When looking from above most have a circular shape but there is one object that has rectangular shape. Some of the mortars also have legs instead of a flat base. However no complete items with these legs have been found, only a few fragments. A total of fourteen out of 154 mortars was found more or less complete, which is 9,09%. Most of the of the mortars are round with a flat base as mentioned before. There are however two oval mortars found from the Late Bronze Age. Object S07-816 is a circular flat based mortar that is intensively used form both sides. Resulting in a hole where the work surfaces have met. Object S01-520 is a rectangular grinder with a triangular cross-section. But the most remarkable mortar from the Late Bronze Age is perhaps S93-213. This mortar has noticeably higher sides than all the others and is shaped more like a stone vessel, with a foot at the base.

Not unlike other ground stone object types studied in this study fine grained basalt (stone type 1) is the popular choice for producing mortars during the Late Bronze Age. Stone type 2, vesicular basalt is a the runner up where stone type preferences for mortars are concerned for the Late Bronze Age.

[12] Brinkman, J.A., M. Civil, I.J., Gelb, A.L. Oppenheim and E. Reiner (eds), 1956. *The Assyrian Dictionary of the Oriental Institute of the University of Chicago: volume 6.* Oriental Institute: Chicago, 138.

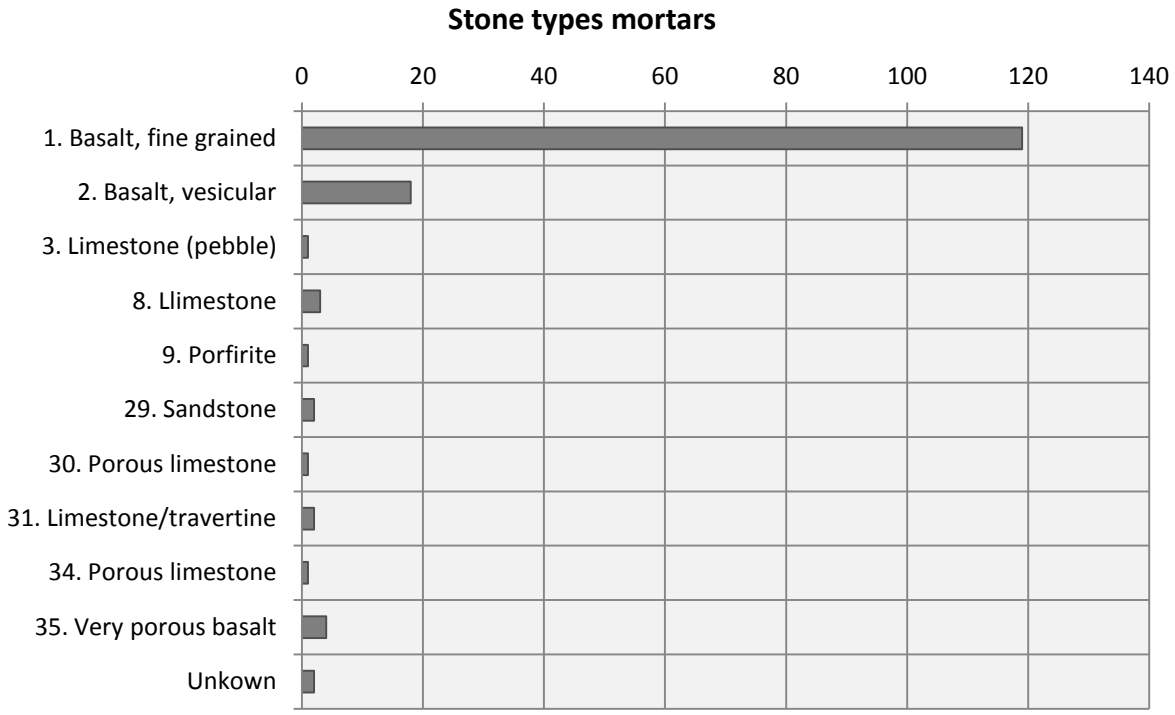

Figure 32. Stone types mortars

Three mortars were re-used as pivot stones in the Late Bronze Age at Tell Sabi Abyad. And one mortar was found with ochre stains inside

5.4.2 Pestles

There are 34 complete pestles found within the Late Bronze Age assemblage, this means that only 10,22% of the pestles are complete objects. Pestles are used in a grinding, often more or less rotary (Huigens *et al.* in press, 141), and pounding motion. The latter results in peck marks on the working surface.

Shape wise the conical and cylindrical shapes are predominant. This is unsurprising as the way a pestle is used requires a more longitudinal shape of which the ends can be used in either a rotary grinding or pounding manner. Other shapes can still function as a pestle but would most likely be less easily handled. The conical and cylindrical shape is more easy to hold in your hand while making rotary grinding or pounding motions within a mortar. Other shapes are on the other hand easier to use as grinders and as many of pestles had a dual function as grinder it is possible that a sacrifice in ideal shape was made. If there is such a thing as shape sacrifice it has been made on both sides as there are also grinders which have been used as pestles (or other objects) with a less than ideal shape for a grinder.

Table 12. Pestle types

	Exclusively	Primary	Secondary	Total	Percentage
P.0 fragment	5	0	8	13	3,99 %
P.1 cubical	16	1	1	18	5,52 %
P.2 spherical	8	2		12	3,68 %
P.3 conical	97	18	16	131	40,18 %
P.4 cylindrical	60	8	6	74	22,70 %
P.6 rectangular	8	2	5	15	4,60 %
P.7 pear/egg shaped	17	7	2	26	7,97 %
P.8 irregular	17	0	3	20	6,13 %
P.9 oval/oblong	5	2	2	9	2,76 %
P.10 triangle/trapezoid	2	1	0	3	0,92 %
P.11 disk/circular	3	0	0	3	0,92 %
P.12 natural	2	0	0	2	0,61 %
Total per function	240	41	45	326	

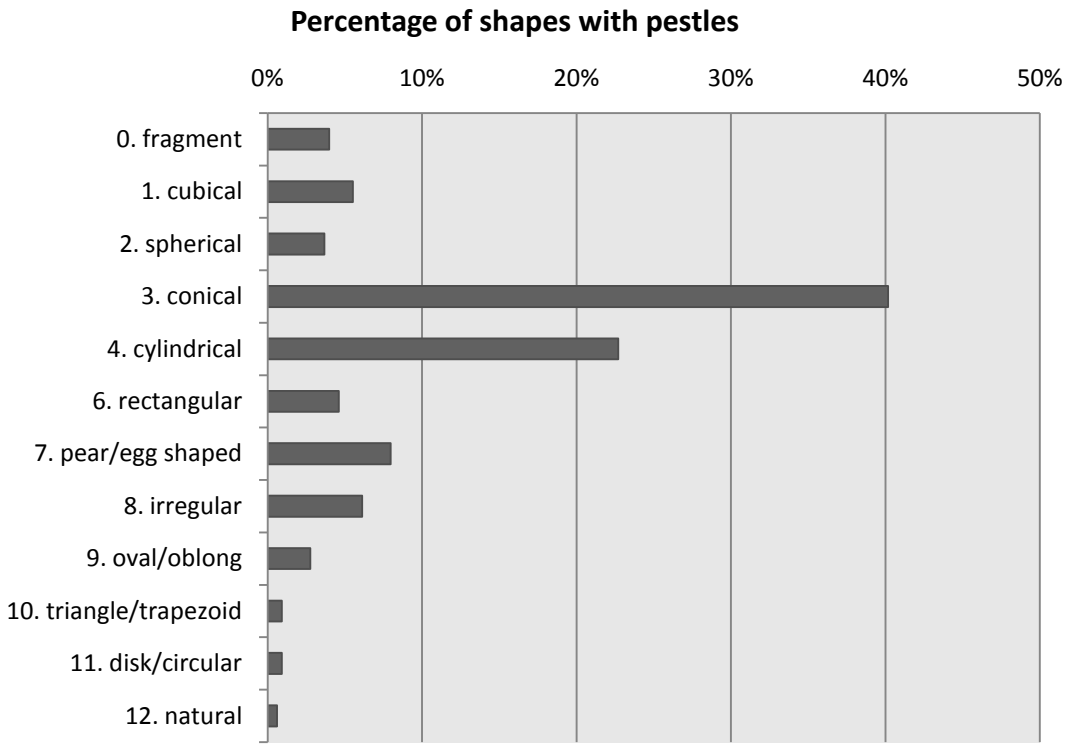

Figure 33. Percentage of shapes with pestles

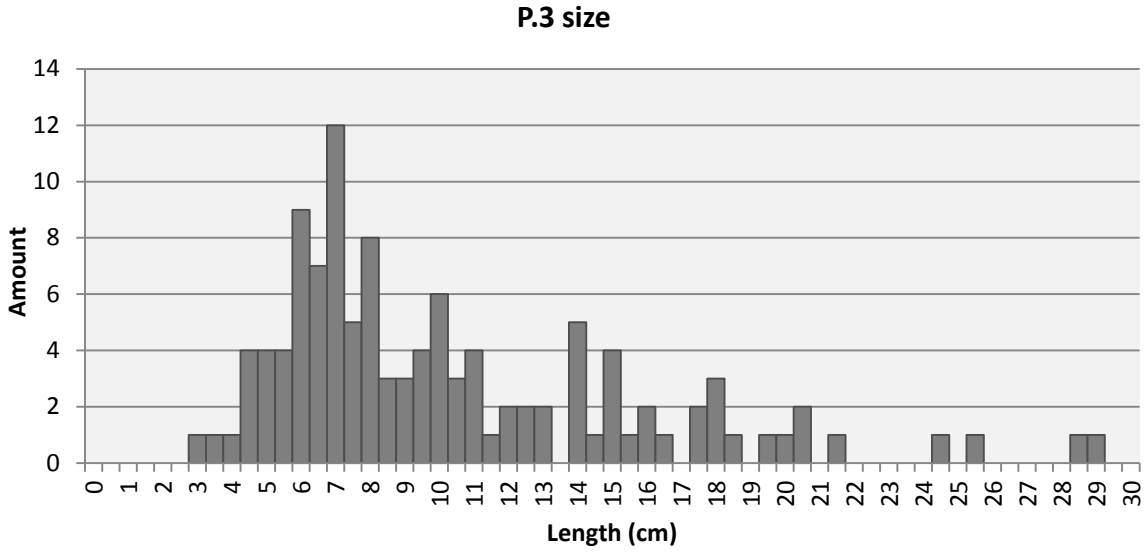

Figure 34. P.3 size distribution

The average size of P.3 is 10,16cm and the standard deviation is 5,34. The distribution of sizes are shaped more or less as a bell curve.

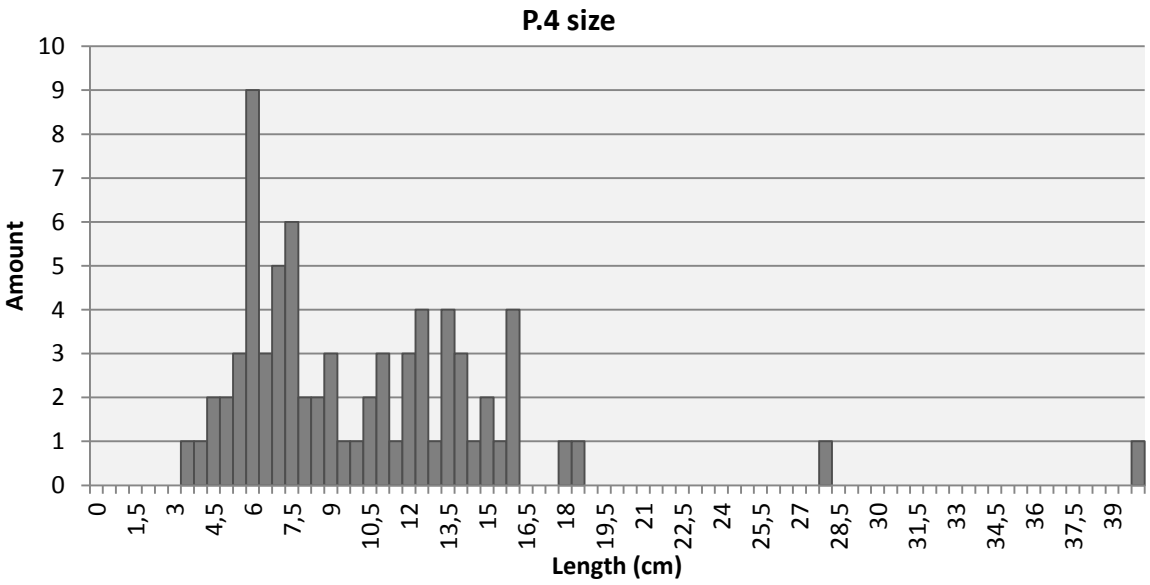

Figure 35. P.4 size distribution

The average size of P.4 is 10,17cm and the standard deviation is 5,60. As with type P.3 the distribution of size graph resembles, more or less, a bell curve shape.

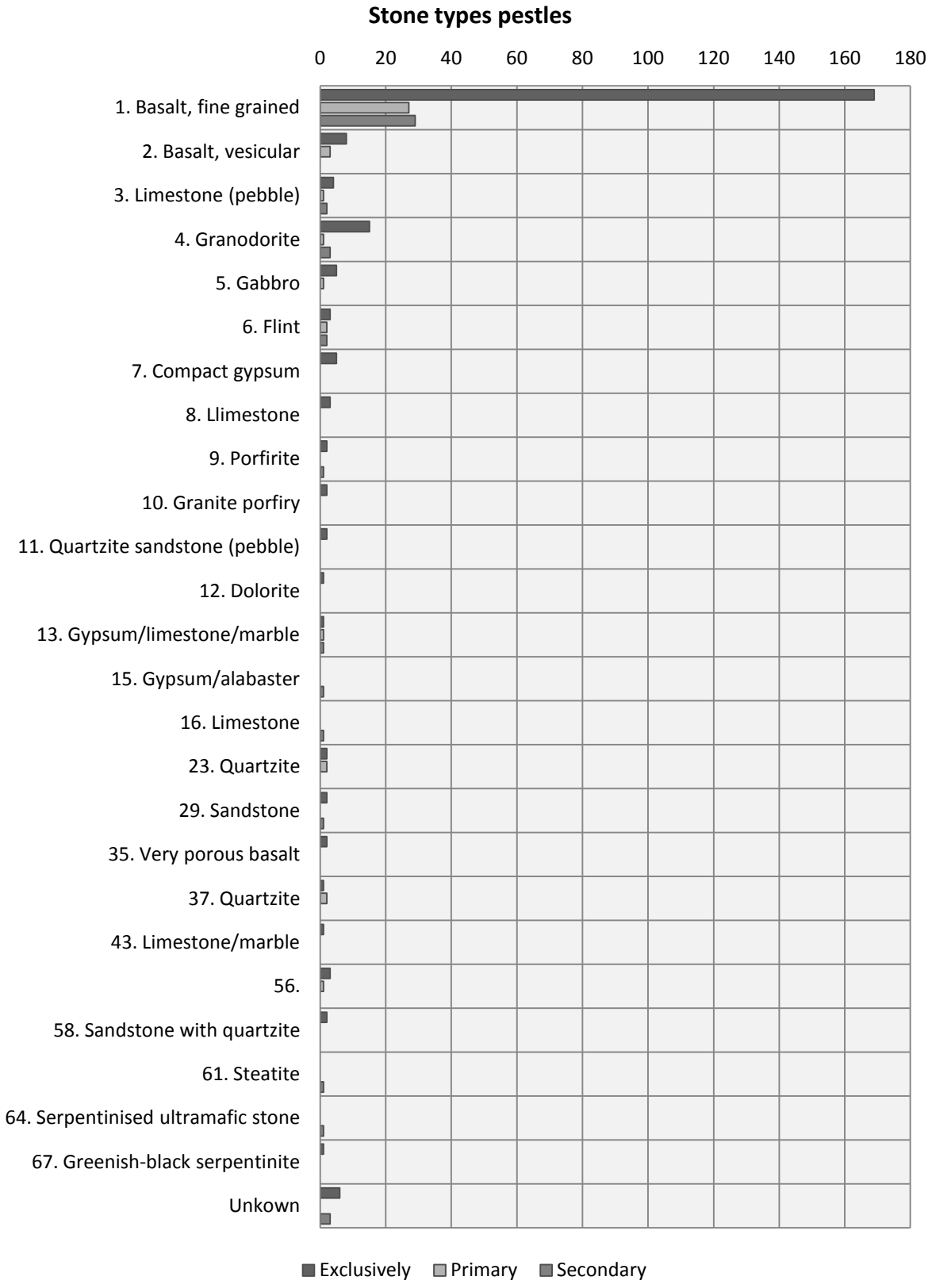

Figure 36. Stone types pestles

There is an overwhelming preference for stone type 1 when it comes to pestles. Compared to other tool types the preference of stone type 1 fine grained basalt is extremely outspoken where pestles are concerned. This preference is clearly visible in objects which are exclusively pestles and as either a primary or secondary function a pestle.

5.5 Polishers and whetstones

Unlike other ground stone objects, polishers and whetstones are quite often stones used in their natural form (65 out of 233 polishers and eight out of 86 whetstones). Polishers and whetstones are small abrasive stone used to smooth or sharpen other objects.

5.5.1 Polishers

Polishers are used to, as the name suggest, polish surfaces. Stones used to burnish pottery also belong to this category. However, burnished pottery is not very common on Tell Sabi Abyad (Duistermaat 2007, 39). Polishers were also used to polish pottery, however, polished pottery is also scarce on Tell Sabi Abyad (Duistermaat 2007, 142). Another way in which polishers were used was in the production of jewellery.

The below displayed tab. 13 and fig. 37 clearly show that there is a tendency to use pebbles and stones in their natural shape as a polisher. Aside from the natural shapes of pebbles and stones there are other shape that are well loved. Polishers in the shapes of a disk and oval make up for 41,63% of all Late Bronze Age polishers found on Tell Sabi Abyad.

The other clear trend visible when analysing the shapes of the Late Bronze Age polishers is that the outline of the polisher, shape wise, is not of much importance. More important is that they have a flat surface. Shape category 6 up to 11 are all two-dimensional shapes and indicate a flattened shape on at least two sides of the object. Many of the natural shaped objects (Pol.12) are also flattened in shape. Perhaps the oval and disk shapes are more a reflection of the more easily produced and natural shapes of the material at hand. As many of the frequently used stone types in producing polishers can be found locally. Finally, 13,73% of the polishers from the Late Bronze Age belong to Pol.0; where only function and not the original shape could be determined.

Eight of the Late Bronze Age polishers are complete. And three polisher pieces had traces of ochre on them.

Table 13. Polisher types

	Exclusively	Primary	Secondary	Total	Percentage
Pol.0 fragment	29	1	2	32	13,73%
Pol.1 cubical	3	0	1	4	1,72%
Pol.2 spherical	8	0	0	8	3,43%
Pol.3 conical	2	1	0	3	1,29%
Pol.4 cylindrical	5	0	1	6	2,58%
Pol.6 rectangular	16	0	0	16	6,87%
Pol.7 pear/egg shaped	10	1	0	11	4,72%
Pol.8 irregular	10	1	0	11	4,72%
Pol.9 oval/oblong	52	3	1	55	24,03%
Pol.10 triangle/trapezoid	11	0	0	11	4,72%
Pol.11 disk/circular	36	4	1	41	17,60%
Pol.12 natural	31	34	0	65	27,90%
Total per function	213	14	6	233	

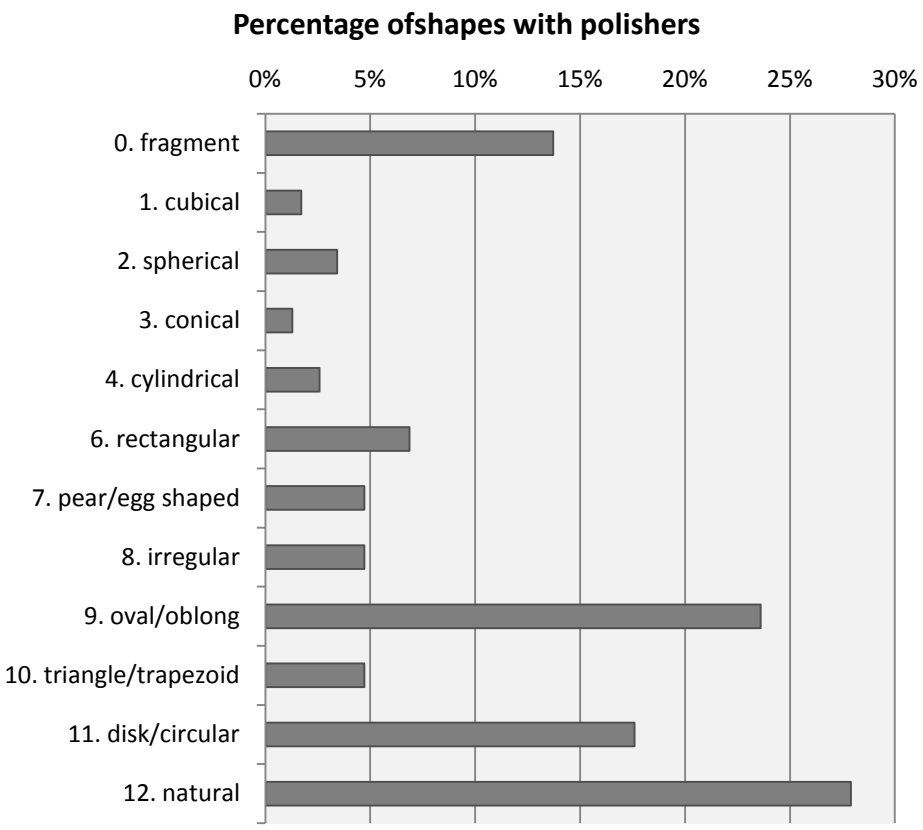

Figure 37. Percentage of shapes with polishers

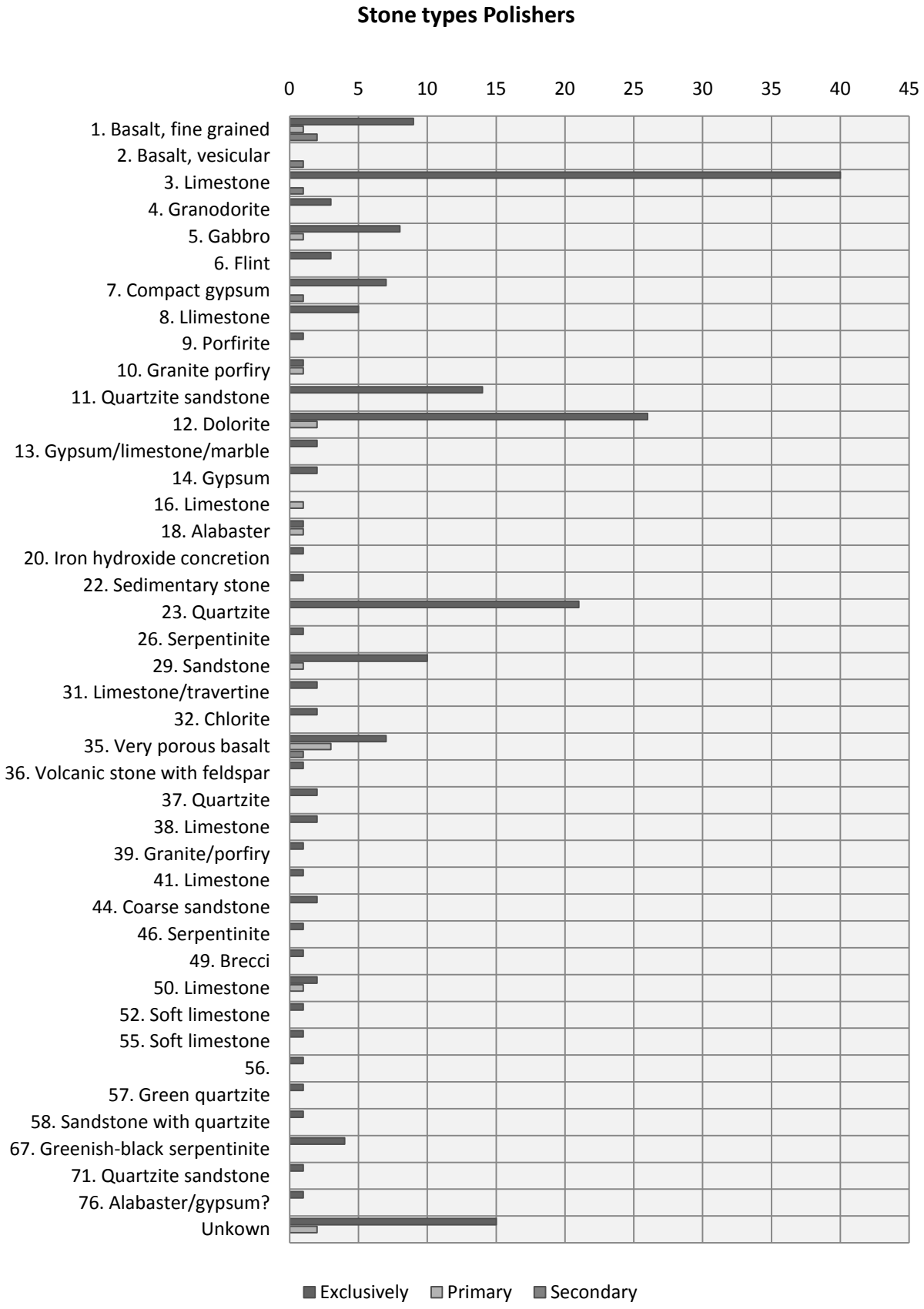

Figure 38. Stone types polishers

A wide variety of stone types was used in the manufacturing polishers during the Late Bronze Age. Polishers are the ground stone object in which the most stone type diversity was found during the Late Bronze Age. The most used stone type is stone type 3 limestone described as smooth and fine. Some other more preferred types of stone are stone type 12 dolerite, which is a very hard and fine stone that is almost polished and glassy. Stone type 23 quartzite a fine grained and hard stone has also been a popular choice. These three stone types are all hard and fine stones.

5.5.2 Whetstones

A whetstone is used to sharpen other objects such as knives and blades. Whetstones are used in the production of stone axes (Hodges 1989, 105).

Table 14. Whetstones shape

	Exclusively	Primarily	Total	Percentage
W.0 fragment	17	0	17	19,77%
W.3 conical	1	0	1	1,16%
W.4 cylindrical	7	1	8	9,30%
W.5 flattened	1	0	1	1,16%
W.6 rectangular	27	0	27	31,40%
W.8 irregular	7	0	7	8,14%
W.9 oval/oblong	10	0	10	11,63%
W.10 triangle/trapezoid	6	1	7	8,14%
W.12 natural	8	0	8	9,30%
Total per function	84	2	86	

The small amount of whetstones found during the Late Bronze Age seems to be a continuation from the Neolithic trend. During this period only a few whetstones were found per level (Spoor and Collet 1996, 426). There is a strong preference for the rectangular (shape category 6) shape with 31,40% of the retrieved whetstones belonging to this type. Another popular shape is oval/oblong (shape category 9) 11,63% of the whetstones have this shape. The rectangular and oblong shape are in fact quite similar as the biggest difference between them is rounded off corners. So perhaps it was more important to have a longitudinal working surface than any aesthetically pleasing shape. Noteworthy is that four

Late Bronze Age whetstones were perforated at the top. One of the options is that they were re-used as pendants. However they seem quite large for this purpose. The sizes of these perforated whetstones are: 10,34cm² (S01-199), 19,95 cm² (S96-087), 24,66cm² (S93-

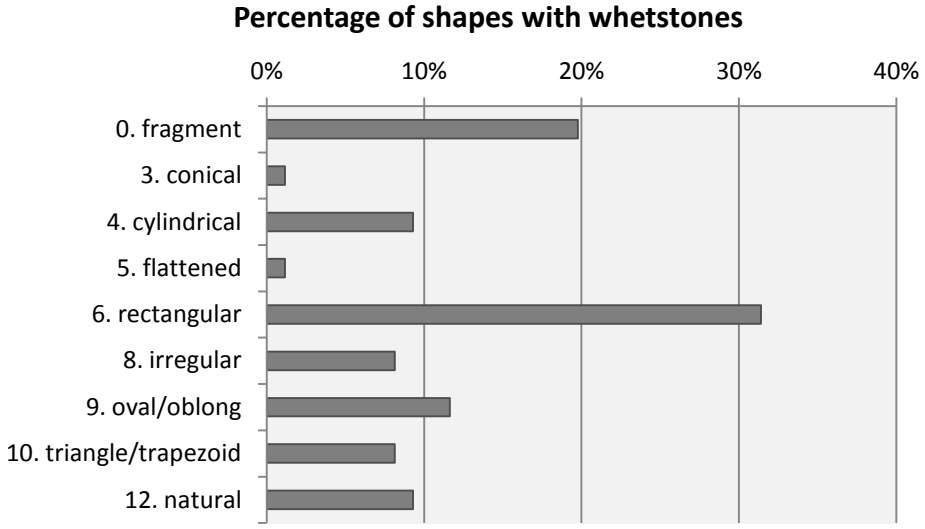

Figure 39. Percentage of shapes with whetstones

466) and 31,75cm² (S93-402). The smaller one could perhaps have been worn as a pendant. However, considering the size and weight it seems more likely that the holes were to facilitate carrying these items with you. So blades and other implements could be sharpened on the go.

Many fragments of whetstones have been found of which the original shape could not be ascertained (19,77%). Only grinding slabs seems to have been more fragmented (35,13%).

Type 29 sandstone is clearly the preferred stone type for whetstones. The description given with this stone type is as follows: light brown- yellow to dark purple, sandy, fine to rough with glitters. Other types that are preferred are type 22 sedimentary stone with a fine to rough surface. Type 23 quartzite which is fine grained and hard and type 58 sandstone with quartzite which is hard, granular and sandy. The preference in material for whetstones is the same during the Late Bronze Age as it was in the Neolithic period. Collet and Spoor mention that the whetstones found in the Neolithic levels of Tell Sabi Abyad are made of tabular sandstone or limestone (Collet and Spoor 1996, 426). Clearly local stone types were the preference in producing whetstones.

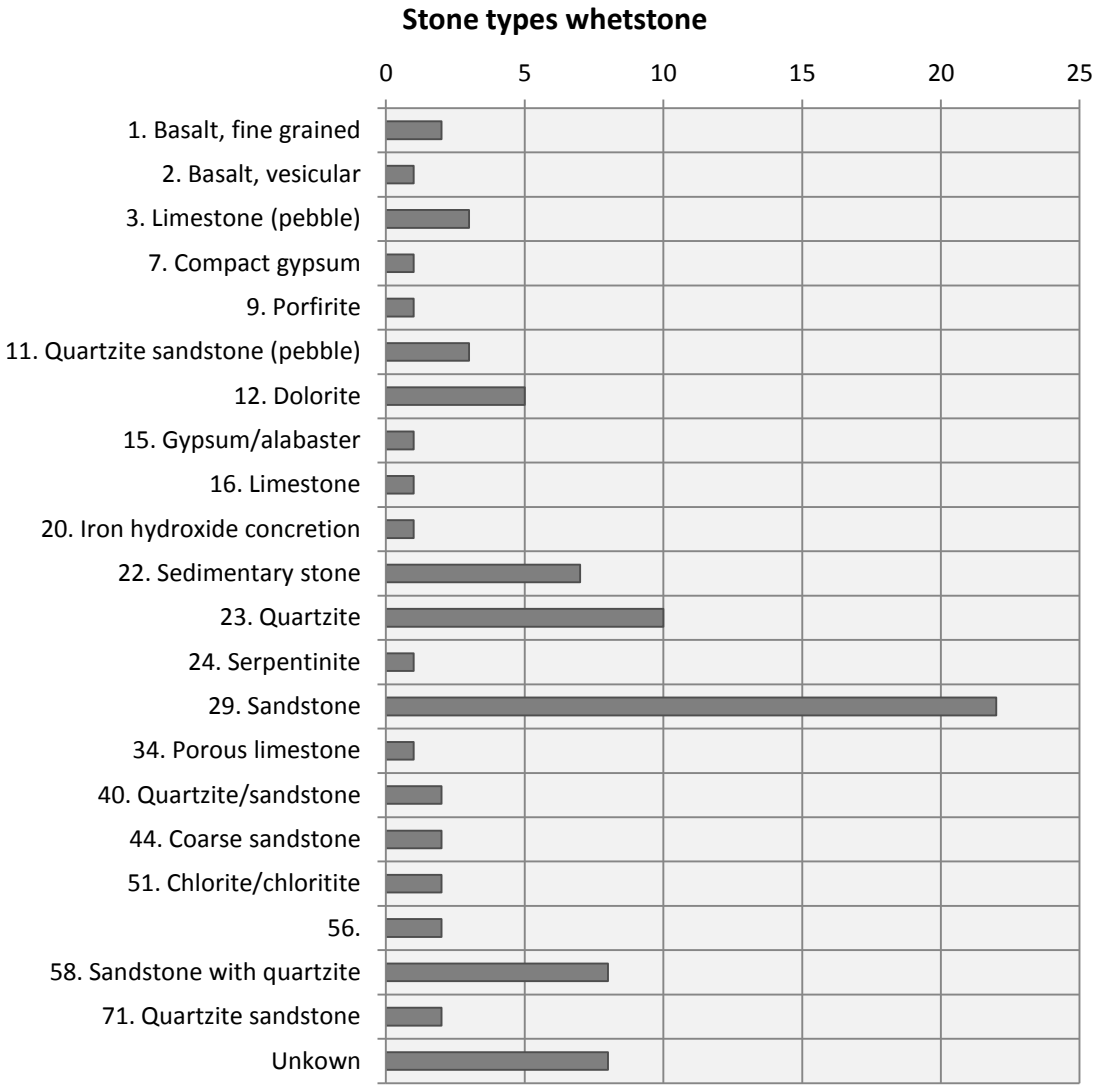

Figure 40. Stone types whetstones

5.6 Other types of ground stone

Following are the left over categories as it were. Flat tools and spheres are presented here. Where the five objects that make up the category of spheres. The flat tools and spheres are both always a secondary “function” of an artefact.

5.6.1 Flat tools

Creating a graph in which the stone types used for flat tools would be useless as all objects are made of stone type 35. Out of the 41 objects 39 are grinders and two are considered to be polishers.

Table 15. Flat tools shape

	Secondary	Percentage
F.0 fragment	2	4,88%
F.5 flattened	33	80,49%
F.6 rectangular	1	2,44%
F.8 irregular	1	2,44%
F.9 oval/oblong	4	9,76%
Total per function	41	

5.6.2 Spheres

Out of a total of five; two objects are stone type 1 (fine grained basalt), two are type 2 (vesicular basalt) and the last is type 43 (limestone/marble). Only one of the spheres is a complete one. Logically all the objects are shape 2, spherical. They were all about 10cm in diameter.

5.6.3 Unidentified ground stone objects

Unidentified objects have no real discernible shape, because if they would, they would no longer be unidentifiable. All unidentifiable ground stone objects are fragments. There is no difference in the distribution of stone types amongst the unidentifiable objects. The majority is stone type 1 or 2. This is however not surprising as 76,97% of all the Late Bronze Age ground stone objects are made from one of these two stone types.

5.7 All ground stone tools together

There seems to be a clear preference for basalt (stone type 1, fine grained basalt and stone type 2 vesicular basalt) with nearly all the ground stone objects (chapter 3.2, tab. 3). But basalt was not the favourite material for all the ground stone tools. For hammers, a wider range of source materials was used. It seems that material properties were not as important, the stone type only needed to be able to withstand battering. As a result more local stone types were used, the focus however remained on the non-local basalt. This is due to the fact that many basalt tool were re-used as a hammer. Polishers and whetstones are often made from more local materials. As basalt is not the ideal material for polishing or

sharpening. Basalt is however not a stone type found in the Balikh valley. There is a clearly noticeable preference for non-local stone types in the Late Bronze Age. This was however already the case during the Neolithic period. Only 18% of the Neolithic axes, adzes and chisels found on Tel Sabi Abyad were produced from stones that could have been obtained locally (Huigens 2012, 25). A clear answer as to where these stones have come from is however not easily given.

While studying the sizes of type G.3, G.4, P.3 and P4. no clear motivations become visible for the subdivisions made in the original Tell Sabi Abyad shape typology based on size. The only type that perhaps could be divided into a smaller and larger category is G.3, the control group. However, even for this type there is no overwhelming indication that there were two clear size preferences of conical grinders. The only thing is that the graph of sizes clearly does not resemble a normal distribution.

There are clear preference in shape per tool type. However, shapes are generally dictated by the use of the object. Hammers need to be compact, pestles elongated so they can be held easily upright in the mortar and so on. There is a difference in shape, and most likely use, where grinders are concerned. A clear difference was visible between G.5 (flattened) grinders and shapes with less surface area. However I personally wonder whether shape mattered to the Late Bronze Age inhabitants when they were producing certain ground stone tools. And shapes are more a result of the practical shape of a tool.

Little complete ground stone artefacts have been retrieved from the Late Bronze Age at Tell Sabi Abyad. No patterning in the dispersal of complete objects has been discovered. A pattern was discovered, on the other hand, in extensively used and re-used grinders and grinding slabs. A high concentration of these intensively used ground stone tools is located in square J9. This concentration is the result of a layer at this location of the site.

Chapter 6

Ground stone tools in context

6.1 Introduction

As mentioned before the ground stones artefacts encompassed in this research are not particularly viable for chronological research. This however of course does not mean that they cannot attribute in any way to a further understanding of the site. Distribution patterns of ground stone artefacts on the site could provide previously unknown insights into the everyday life of the Tell Sabi Abyad inhabitants.

There is of course more than just one type of ground stone artefact from the Late Bronze Age. To further enhance the informational value dispersal patterns will be looked at on several different levels: the entire ground stone assemblage, tool type and typology.

6.2 Spatial dispersion

First of all it is important to mention that not all the 3200 objects of this research have locational data. Some of the objects discussed in previous chapters have been found after they were removed from their original context. These objects were found in the fill and assigning them to any particular location other than the square they have come from is impossible. It can also happen that not all finds were documented as meticulously as would ideally have been done. As a result only 2228 objects out of the 3200 can be represented in to following images as actual dots[13].

As a compensation for the 972 missing object points the underlying grid in all the spatial and chronological distribution figures indicates the amount of ground stone objects that were found from the Late Bronze Age per square in total (fig. 43). This figure illustrates the overall Late Bronze Age ground stone object density per square. As nearly all objects entered in to the database have been designated to a square on the excavation. Only if an object was found in a context in which the square it came from could not be ascertained is

[13] All the dots that are seen in the following figures represent items of the object category with either a sole or primary function.

this data missing (11 objects miss square information for the Late Bronze Age ground stone assemblage).

Another important bit of information to point out is that the map of the *dunnu* seen in the background of the following spatial dispersion pattern images is an indication. The walls of the *dunnu* have not been as static over the ages as the image would imply. However if all the different walls and features would serve as the background the images would be extremely difficult to interpret. Therefore the choice has been made to use a more simplified version of the *dunnu* floor plan as a backdrop for the dispersal patterns. To indicate this problem take a look at fig. 41.

Figure 41. Walls and features Tell Sabi Abyad ArcGIS

6.2.1 Entire assemblage

Figure 42. Spatial dispersion entire ground stone assemblage Tell Sabi Abyad ArcGIS

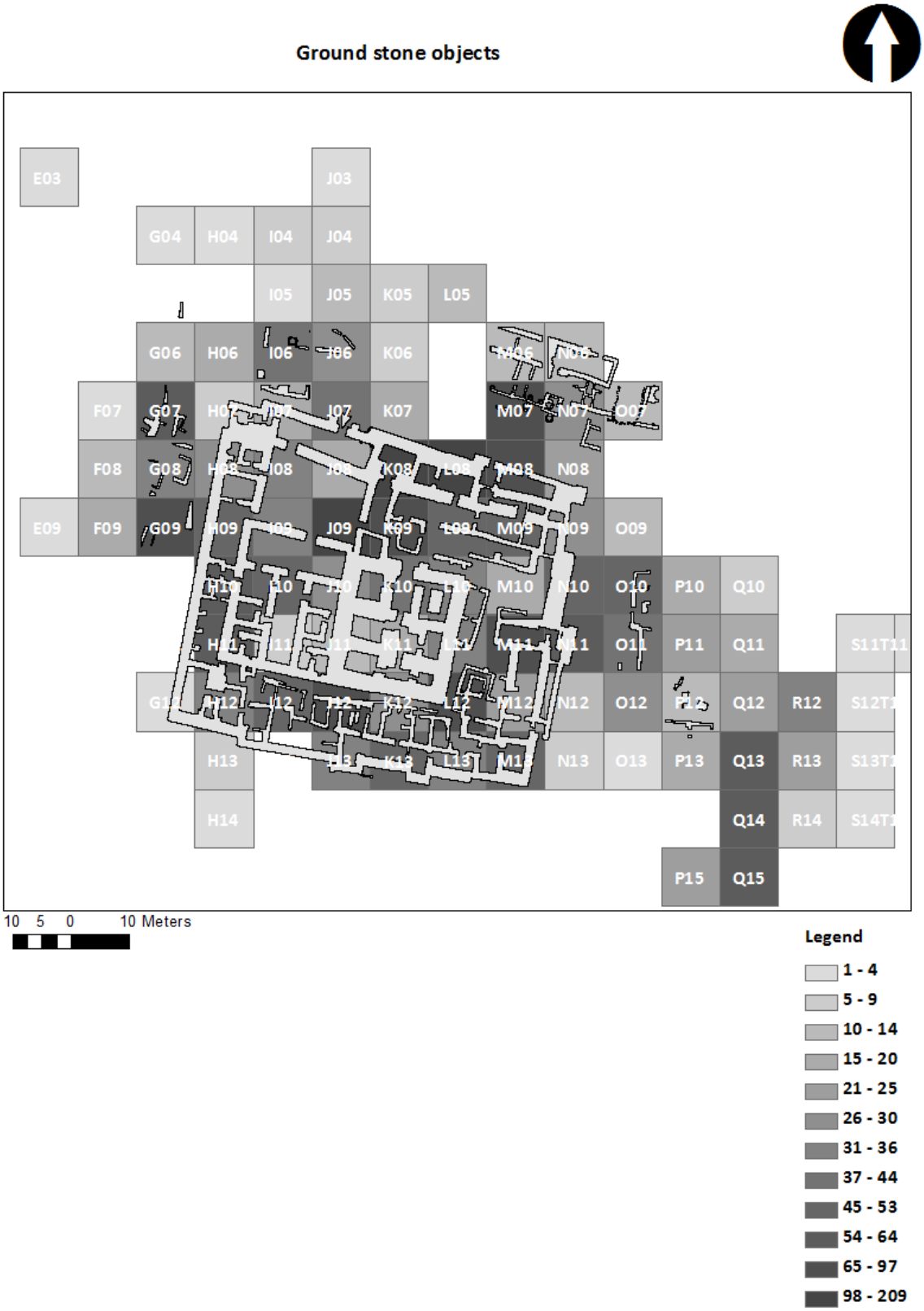

Figure 43. Late Bronze Age ground stone count per square by Victor Klinkenberg

The previous two images and actually all the data in this research are undoubtedly "manipulated" by where, how and when areas were excavated on the site. Some areas with more promising features have been more intensively examined. The excavated area per year and location on site differs; naturally this has a distorting effect on spatial dispersal. An example of this effect is given in Huigens *et al.* (in press). In this publication the excavation results from 1994 up to and including 1999 are revisited. Out of all the ground stone objects found during these six field season only 11% was from level 8. The main reason given for such a overall low amount of ground stone artefacts from this particular level is that only 405m² was excavated (Huigens *et al.* in press, 139).

6.2.2 Grinders and grinding slabs

As in chapter 5.2 grinders and grinding slabs will be discussed in unison as they are used as a duo. By doing this it has become apparent that the distribution of grinders is not identical to that of grinding slabs on the site (fig. 44).

When looking at the distribution of grinders during the Late Bronze Age no clustering or any other form of patterning is visible. There are some areas on the site where higher concentrations of grinders were found these, however, coincide with the areas with a higher ground stone artefact density (fig. 43). With 33,69% of the entire Late Bronze Age ground stone assemblage comprised of grinders this correlation is to be expected. There is however something that was remarkable about the distribution of grinder types along the site. In fig. 45 all the thirteen different types of grinders are displayed by another colour. To be honest, this creates a rather confusing image. However, at a closer look it clearly displays a differentiation in shape preferences. As was discussed in chapter 5.2.1 the G.5 is the most encountered grinding type on the site during the Late Bronze Age. But it seems that these flattened grinders were truly unpopular in certain areas of the settlement. It appears that in some of the rooms of the *dunnu* almost every shape of grinder was found except G.5. Yet in other rooms the grinders found are almost exclusively type G.5. It would seem that this differentiation between grinders types per room/area of the *dunnu* is the first indication of different uses per type in ground stone found at Tell Sabi Abyad. There is no different preference in stone types for G.5 than that of the entire grinder Late Bronze Age assemblage.

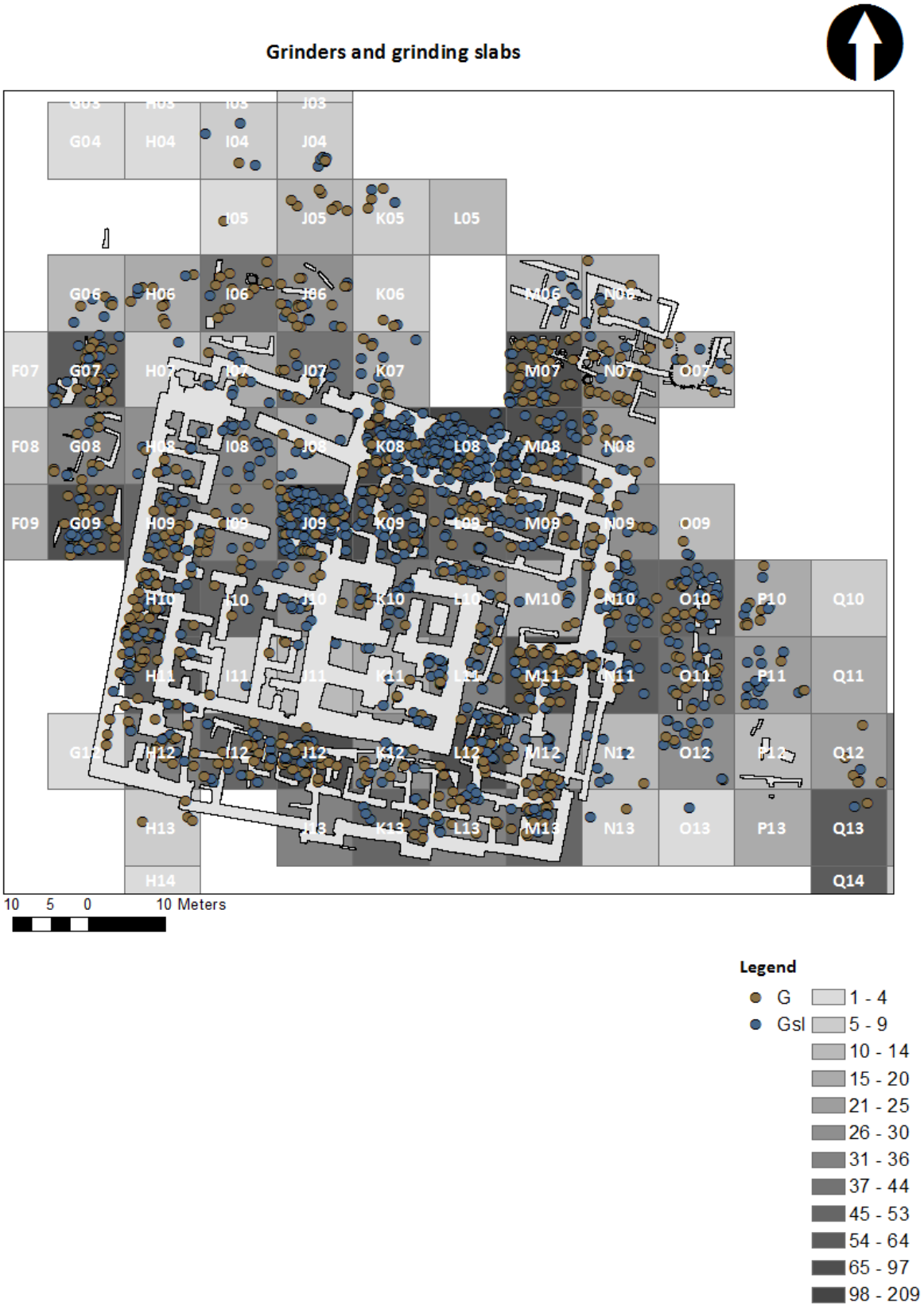

Figure 44. Spatial dispersion grinders and grinding slabs Tell Sabi Abyad ArcGIS

Figure 45. All grinder types Tell Sabi Abyad ArcGIS

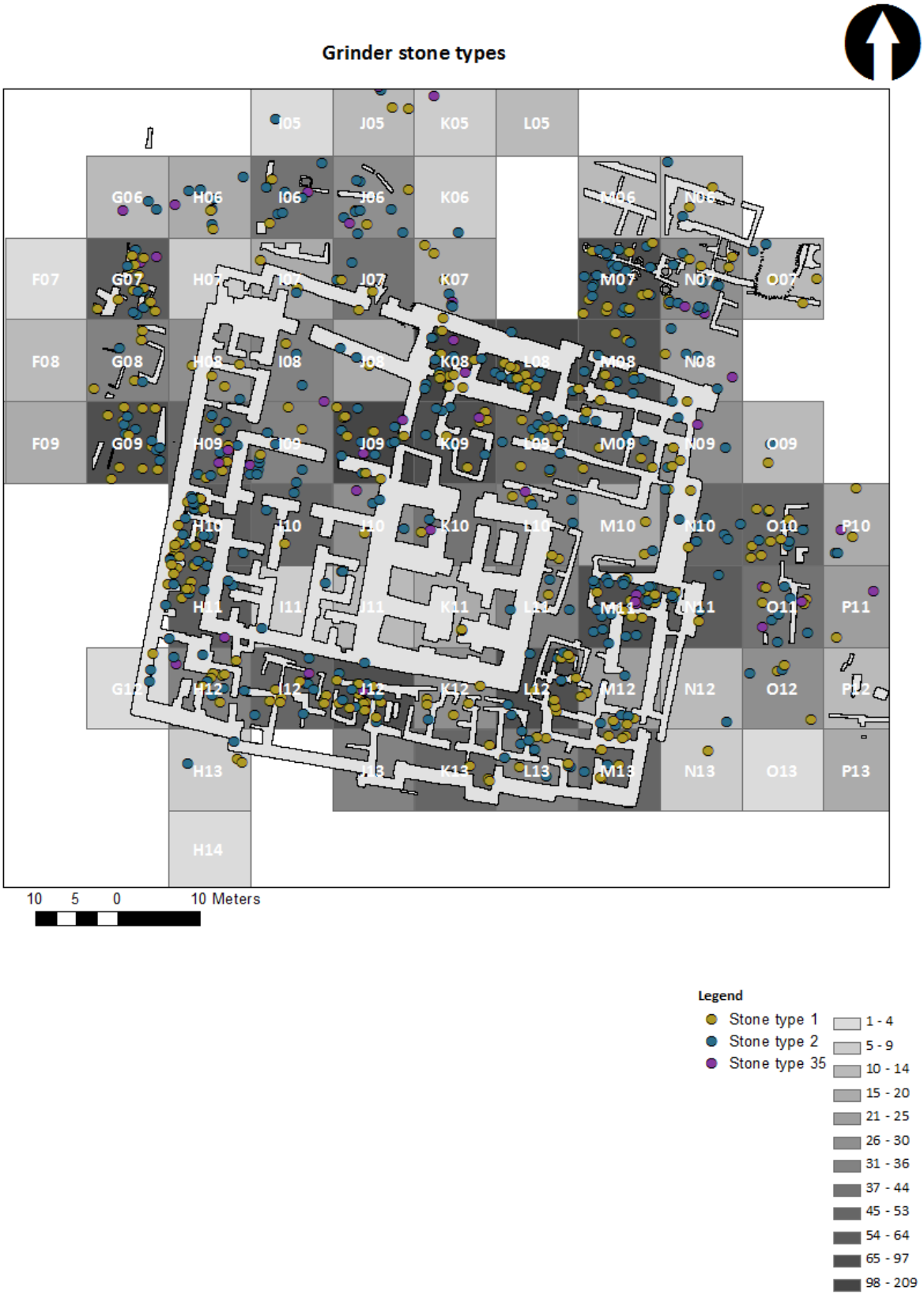

Figure 46. Most occurring grinder stone types Tell Sabi Abyad ArcGIS

If there was an actual difference in function for G.5 opposed to all the other grinder types the distribution patterns sadly show no insight into this function. The wide spread nature of the G.5 might suggest a role in bread production. However, there is no higher concentration of them in the bakery- area (southern side of the *dunnu*). Connection to other functions such as the brewer or pottery workshop are also not present. They are, on the other hand, clearly absent from the dump layer in J9.

There might be clear patterning in the preference for G.5 but no such differentiations are visible when looking at the stone types. In fig. 46 only the three most common stone types are represented (stone type 1, 2 and 35). The grinders made out of these three stone types combined make up 85,81 % of the Late Bronze Age grinder assemblage at Tell Sabi Abyad. And unlike with the discovered differentiation in grinder type preferences mentioned above no such patterns were found in stone types where grinders are concerned. The only recognisable pattern is the preference for stone type 2, vesicular basalt in squares M7, M11 and within the tripartite structure within the *dunnu.* It is unclear what was located in square M7 and making a connection between the use of this area and a high concentration of grinders of stone type 2 is therefore, sadly, not possible. The preference for this coarser variety of basalt in square M11 might be linked to its function as a pottery workshop in level 5 (Duistermaat 2007, 705). It might be conceivable that the production of grog and other tempering materials required more coarse grinders. The relatively few objects found within the tripartite are clearly made of more coarser stone sources (stone type 2 and 35) instead of fine grained basalt.

While taking a look at fig. 44 it is clear that there is a difference in grinder and grinding slab distribution. This is probably facilitated by the high amount of grinding slab fragments distorting the image. However it also could very well be the result of the sheer amount of weight these grinding slabs had. Weight was sadly not included in the database. To remedy this the estimated weight of the complete grinding slabs was calculated. This was done by calculating the cm^3 per object and multiply it by the specific gravity of basalt[14]. By taking a look at the approximate weight of the complete Late Bronze Age grinding slabs it

[14] Specific gravity was found on: http://www.edumine.com/xtoolkit/tables/sgtables.htm : last accessed on 15-12-2013. The specific gravity of basalt is between 2,8 and 3,0. Calculations were made with a specific gravity of 2,9.

becomes clear that quite a few could have been picked up and moved around the site easily (fig. 47). However some are very heavy and it seems unlikely that these were moved often.

Looking at fig. 44 it is clear that there are significant clusters of grinding slabs in square K8, L8 and J9. The clusters in K8 and L8 seem to occupy entire rooms whereas the cluster in J9 is limited to the south-east corner of a much larger area. The rooms located in squares K8 and L8 most likely belonged to the brewer of the *dunnu* (Akkermans and Wiggermann in press, 6)[15]. The production of beer could explain the relatively high amount of grinding slabs found at this location of the site. If we take a more detailed look at the three clusters of grinding slabs in K8, L8 and J9 (Figure 489) we can see that these clusters are situated in squares with a high object count. In the room located on the west of square L8 a pottery kiln was found in level 5 (Duistermaat 2007, 452). Another pottery kiln from level 5 was found at the entrance of the room in square K8. Even though two pottery kilns were closely situated together here during this period, these rooms are not considered to be a pottery workshop during this period. The workshop in level 5 is located at the east/ south-eastern side of the *dunnu* (Duistermaat 2007, 704-705). If we are to reason from the research by Duistermaat (2007) the two pottery kilns found in square K8 and L8 are not necessarily connected to a professional workshop.

As seen in chapter 5.2.2 there is a very clear preference for stone types 1 and 2 where grinding slabs are concerned (95,95% of the Late Bronze Age grinding slab assemblage consists of these stone types), there were however no such preferences for shape. In fig. 49 grinding slabs of stone type 1 and 2 are displayed. There are clearly more representations of stone type 2 grinding slabs but considering that 62,64% of the grinding slabs is type two and only 33,14% is stone type 1 this is to be expected[16]. A slightly higher concentration of stone type 1 grinding slabs is found in squares N10 and O10. It is however unclear what these areas were used for.

With all grinding slab data it is important to keep in mind that this tool category contains an abnormally high amount of fragments in comparison to the other tools (90,14%). This accounts for the dense clusters found in fig. 44, 48 and 49.

[15] A cluster of brewer-related cuneiform texts has been found in this area of the site (personal comment F. Wiggermann).

[16] The percentages mentioned here are based on the entire grinding slab assemblage not just the objects with location data that are presented in the figures of chapter 6.2.2.

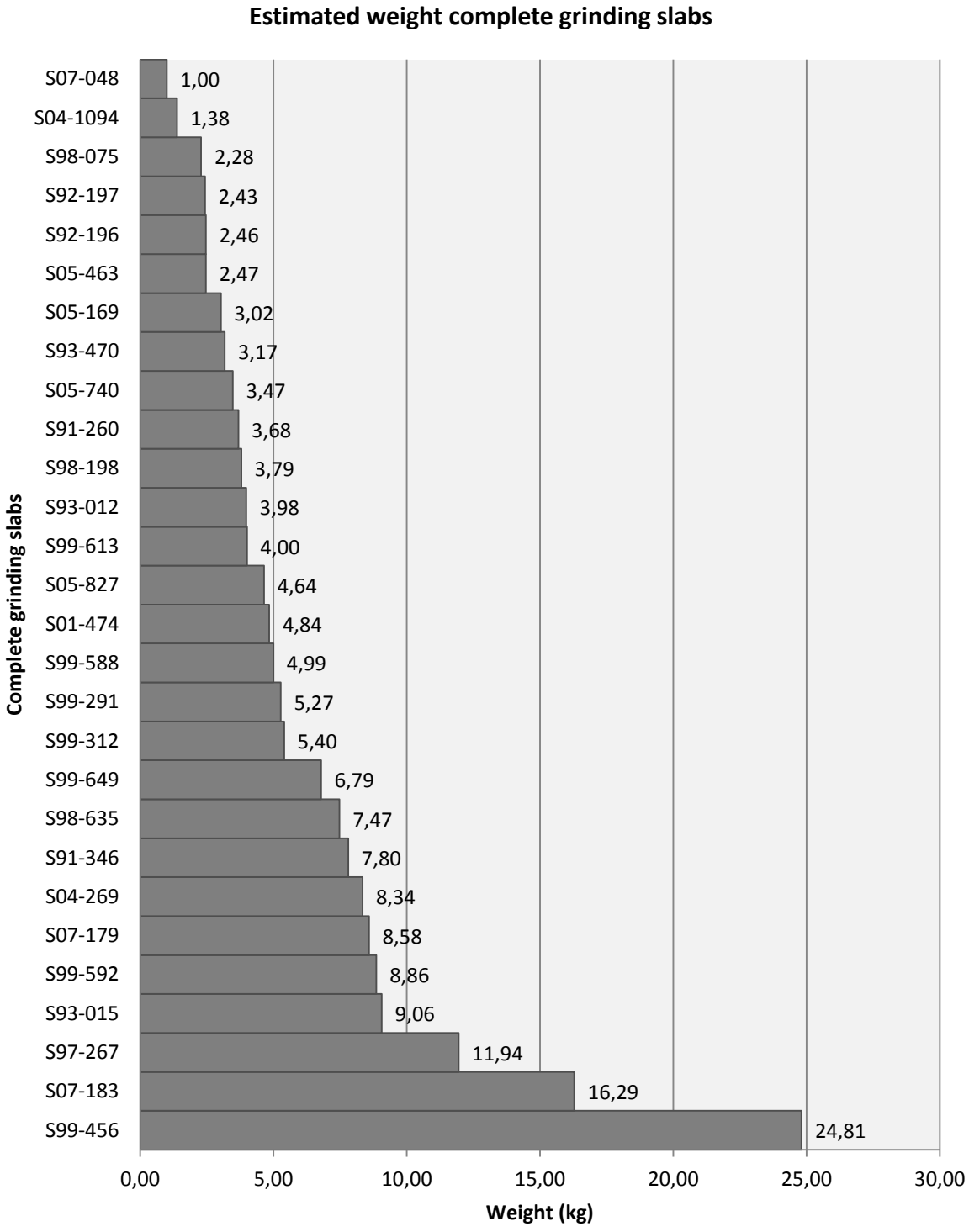

Figure 47. Estimated weight of the complete Late Bronze Age grinding slabs

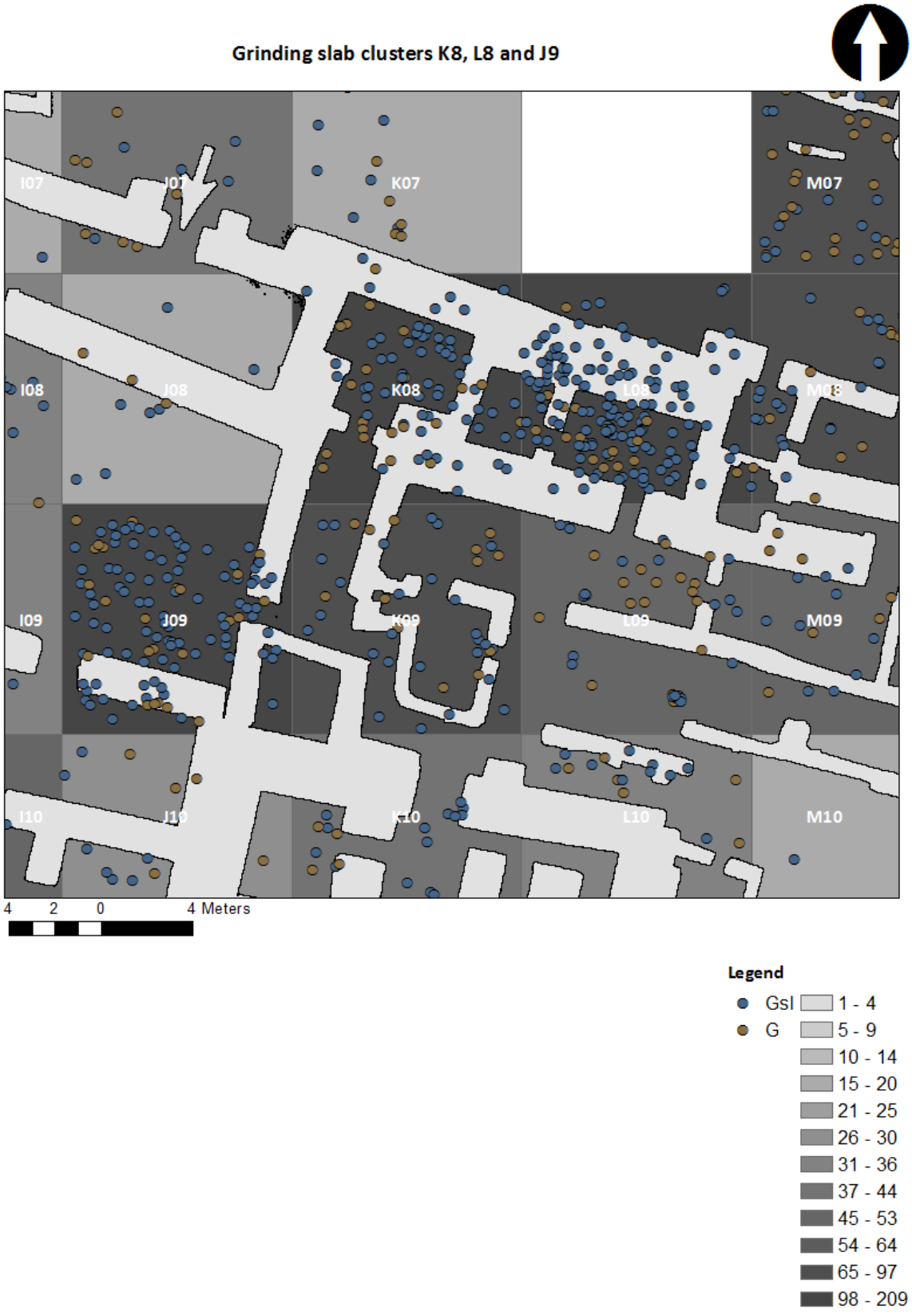

Figure 48. Grinding slab clusters K8, L8 and J9 Tell Sabi Abyad ArcGIS

Figure 49. Most occurring stone types grinding slabs Tell Sabi Abyad ArcGIS

6.2.3 Hammers

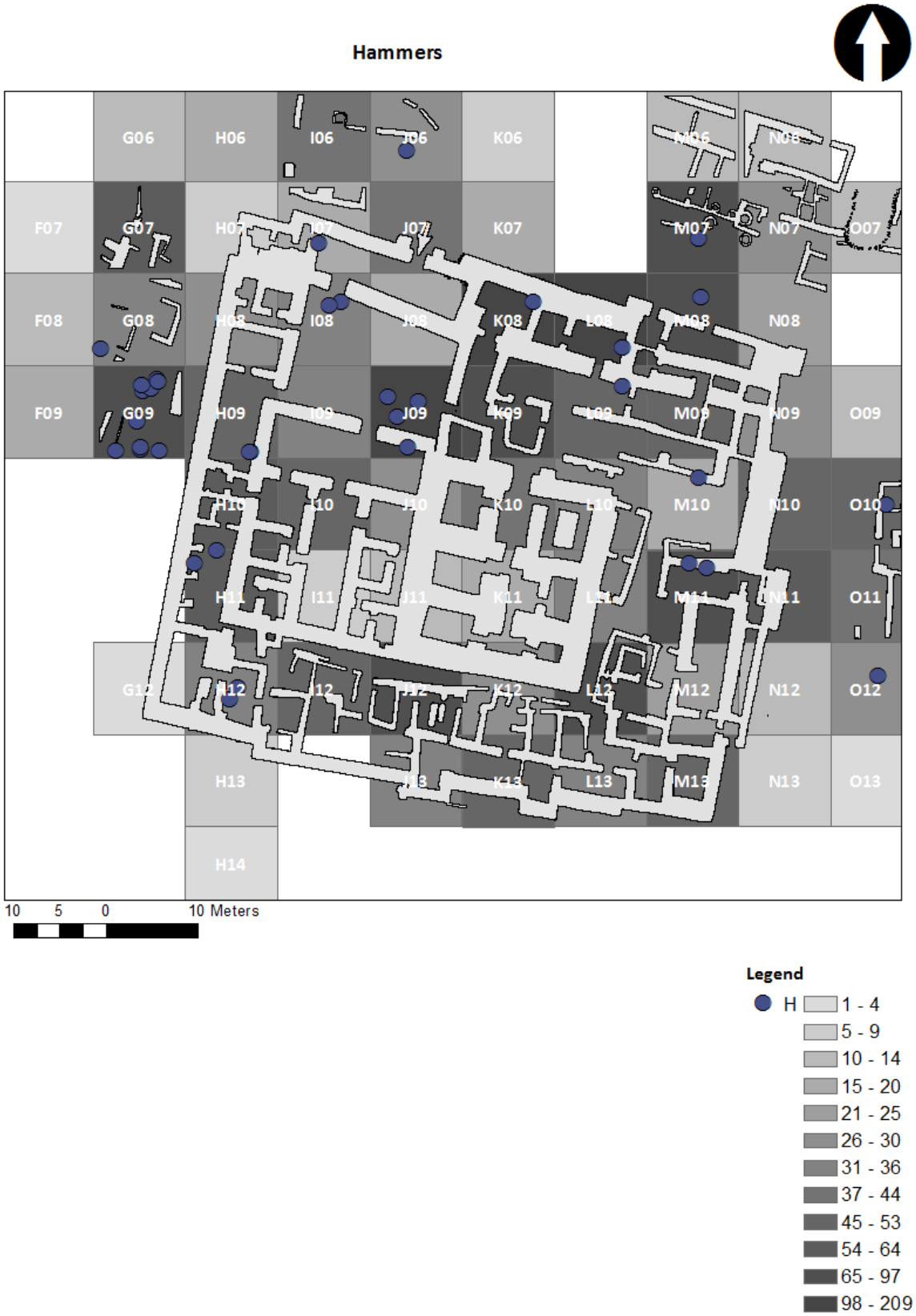

Figure 50. Spatial dispersion hammers Tell Sabi Abyad ArcGIS

With a total of 108 object the hammers are not represented by a great number of objects within the ground stone assemblage. Add to that the diminishing effects of not all objects having locational data and thus being invisible in ArchGIS. This results in a meagre image (fig. 50) of the hammer assemblage. The only thing close to a cluster is in square G9 on the western side the *dunnu*, in square G9.

It is however interesting to see that four objects are located in square J9, where also a cluster of grinding slabs was found. And the high concentrations of extensively used grinders and grinding slabs were discovered. This dump spot has resulted in a concentration of various types of ground stone during the Late Bronze Age. The south-east corner of this large area within the *dunnu* will prove to be one of the focal points of ground stone concentration during the Late Bronze Age of the Tell Sabi Abyad site. As will become visible through the rest of chapter 6.

The distribution of stone types in hammers and hammer types showed no interesting patterns or rendered any additional information that was noteworthy to add onto this research. The same choice has been made, where necessary, for other tool types.

6.2.4 Mortars and pestles

As with grinders and grinding slabs one would expect to find mortars and pestles relatively close together. However in squares I4, J5, M13, N6, N7, N12, N13, O12 and O13 pestles are found but no mortars accompany these 33 pestles in their respective squares[17]. An explanation that comes to mind is that these pestles were re-used as other objects. However, only two of these 33 objects has a secondary function (as a grinder). These isolated pestles are however also not from a particular type (fig. 51). it just seems that pestles were more mobile or portable than their mortar counterparts. Some of the pestles have remarks about them in the database and on the object forms along the lines of lying very comfortably in your hands. So perhaps these pestles were more personally tailored than the mortars. This is, however, speculation.

No diverging distribution patterns in preferences for stone types were found where mortars and pestles are concerned.

[17] Not in ArcGIS nor the database.

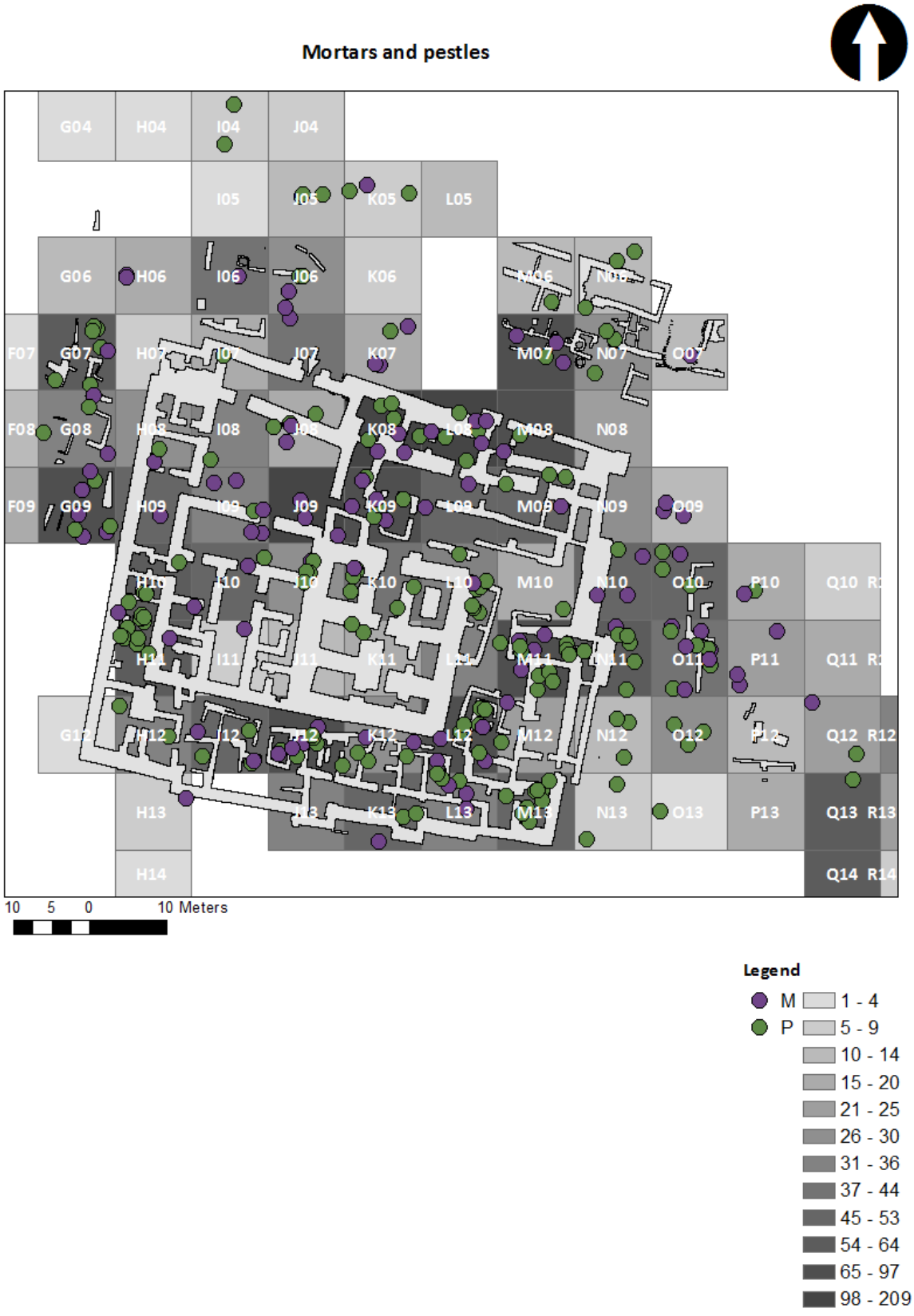

Figure 51. Spatial dispersion mortars and pestles Tell Sabi Abyad ArcGIS

Figure 52. Pestle types Tell Sabi Abyad ArcGIS

6.2.5 Polishers

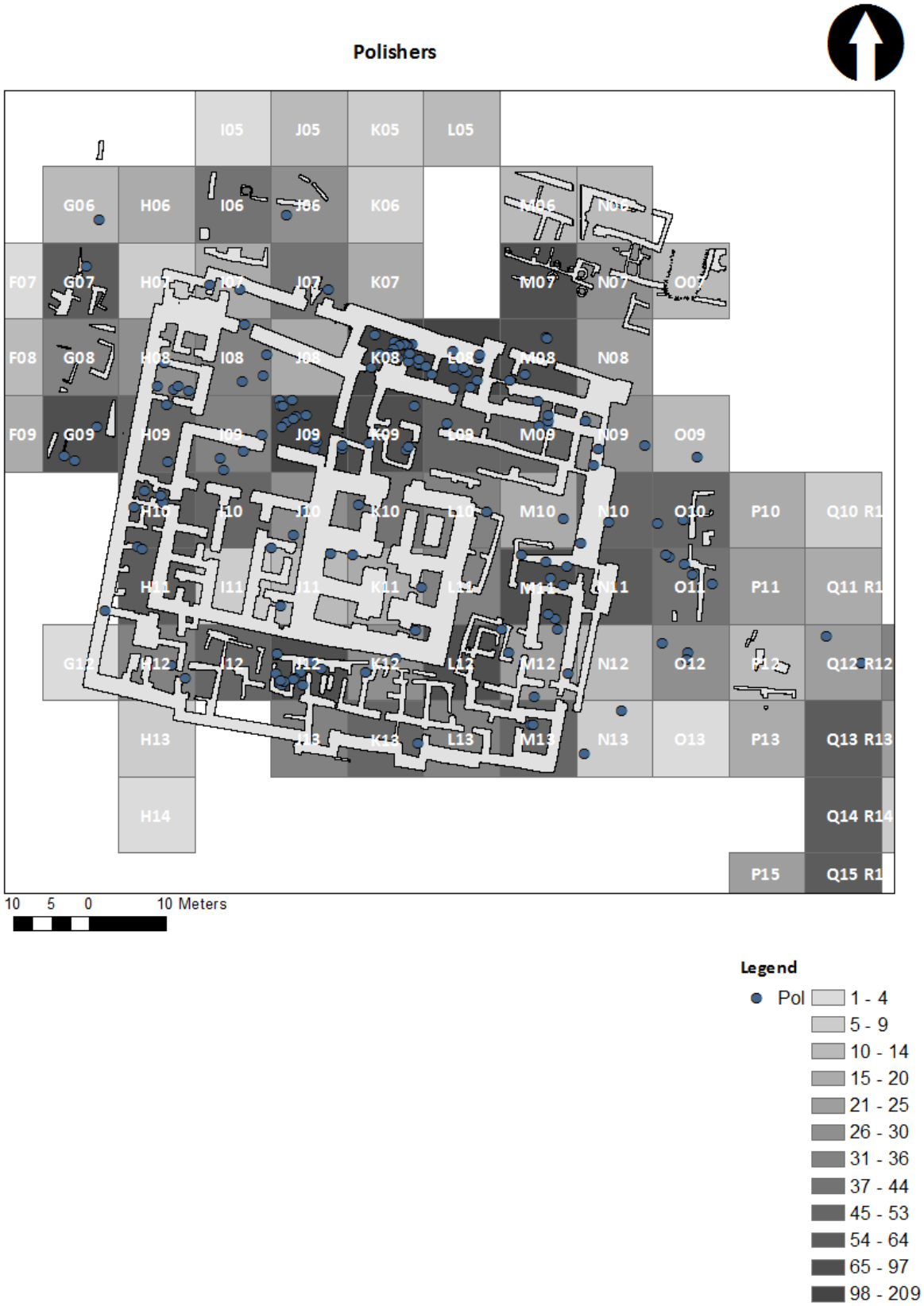

Figure 53. Spatial dispersion polishers Tell Sabi Abyad ArcGIS

Figure 54. Polisher types Tell Sabi Abyad ArcGIS

Interestingly enough a higher concentration of polishers can be found in precisely the same locations as the clusters of grinding slabs and grinders were found. Namely; K8, L8, J9 and also in J12 was a high concentration of polishers found. And even more interesting is that in these locations there is a clearly higher concentration of type Pol.9. For some reason the oval/ oblong polishers were clearly preferred on these areas of the site. Pol.9 makes up 23,61% of the polisher assemblage and is the second most popular polisher type in the Late Bronze Age on Tell Sabi Abyad. Interestingly enough there is not a different stone type preference for Pol.9 than was already established for the entire polisher assemblage in chapter 5.5.1. The designations of K8 and L8 (brewery) and J9 (refuse area) have already been discussed. The designation of square is not specifically known. The southern side of the *dunnu* is however seen as a baker related area (Akkermans and Wiggermann in press, 6). Bakeries with the remains of baker Paja's administration have been found in squares H12 and L13[18]. And Akkermans and Wiggermann (in press, 6) refer to the series of buildings between these locations as being part of the bakery. The distribution of type Pol.11 also shows some clustering. Especially in the room found in square H10 were quite a few of these polishers found. The designation of the room in square H10 is unknown.

6.2.6 Whetstones

When looking at the distribution of whetstones on the site there is little patterning to be seen. A contributing factor to this is the low amount of whetstones found. Out of all the tool types[19] researched, whetstones were found the least. The diminishing effects the digitalization requirements for ArcGIS had on the amount of whetstone records visible in fig. 55 also makes it less likely that any patterning becomes visible. Even though there might not be any significant patterning in fig. 50 there is something remarkable where the distribution of whetstones is considered. All types of whetstones are evenly distributed along the site except for W.12. Inside the *dimtu* only W.12 whetstones are found. With type W.12 no effort is made to alter the shape of the source material and the stone is directly used as whetstone.

[18] Personal comment F. Wiggermann.

[19] Flat tools, spheres and unidentified ground stone objects are excluded from this calculation. As these do not represent tools with a specific function. For an all encompassing view of the occurrence of types of ground stone objects see tab. 8.

Figure 55. Spatial dispersion whetstones Tell Sabi Abyad ArcGIS

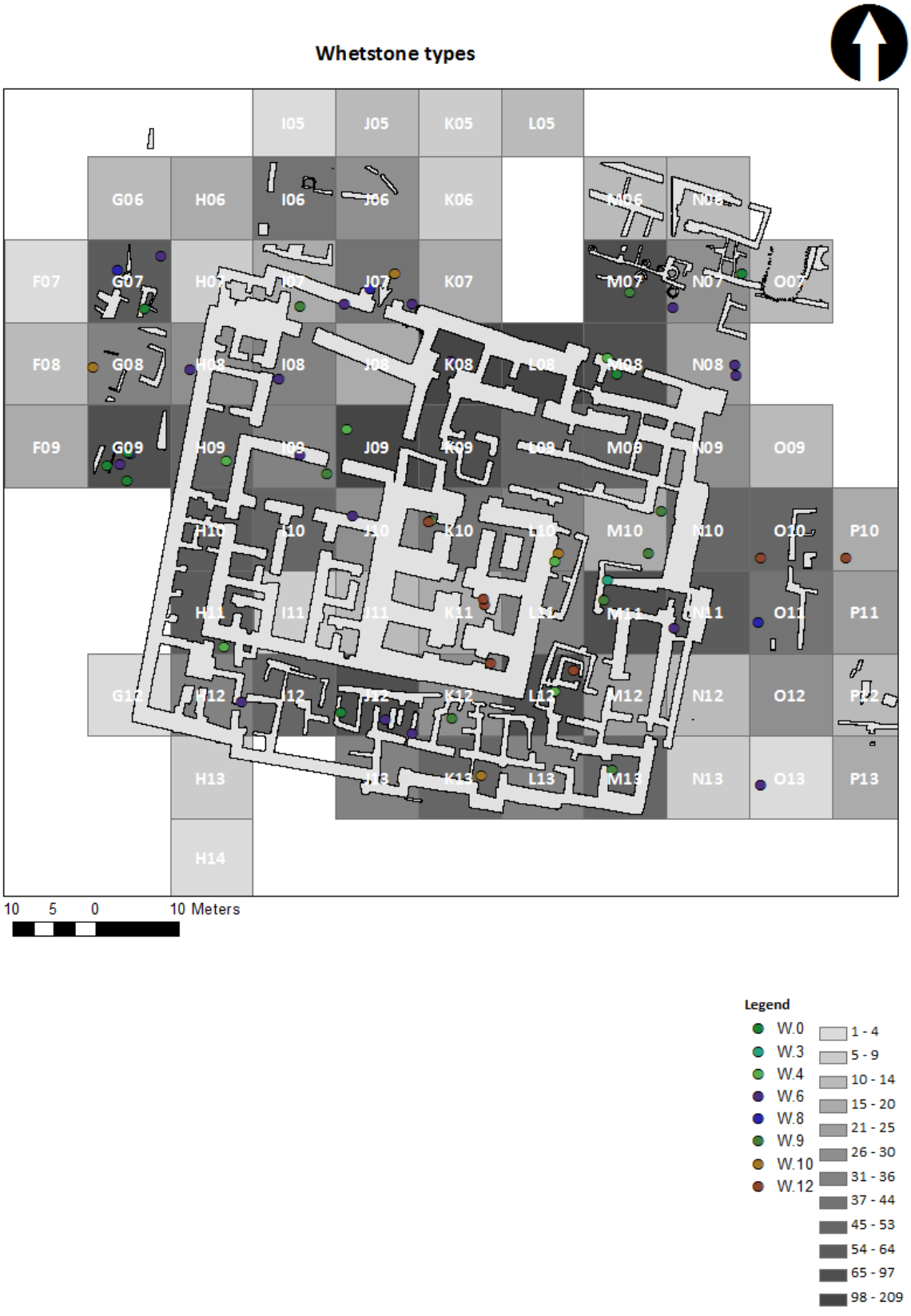

Figure 56. Types of whetstones Tell Sabi Abyad ArcGIS

6.3 Chronological dispersion

Looking at how the ground stone objects are dispersed on site through time can reveal interesting details on preferences and use patterns. However the same problem, of incomplete data, arises here (chapter 6.2). Where out of 3200 objects the location of only 2228 was known and almost a third of the dataset went unrepresented. Regrettably the same data diminishing effect is at play here. The discussed levels in chapter 1.3 are interesting and useful in hindsight. However, such determinations are extremely difficult to make pertaining to singular a object (especially during the excavation). This results in that of the entire stone assemblage only 1128 objects could be definitively ascribed to a level. Not all of these 1128 objects are from the Late Bronze Age; some are from earlier periods such as the Late Neolithic where others are more modern. The images shown in this thesis are however of course only of relevant objects within the dataset. It is also important to keep in mind that the time elapsed between levels is relatively short (tab. 1).

6.3.1 Level 7

There is only one ground stone object from level 7. This objects can be found on the northern side of square N10 and is represented by the single red dot. Object S99-538 is a fragment of a flat grinder found on the floor of an open area[20].

[20] Even though in fig. 52 it looks like it is situated in a wall. This is due to the single map overlay that is used explained in chapter 6.2 by fig. 37. On the object form it was noted under the context remarks where and how this grinder fragment was found.

Figure 57. Chronological dispersion of ground stone objects Tell Sabi Abyad ArcGIS

6.3.2 Level 6

Figure 58. Chronological dispersion, level 6 Tell Sabi Abyad ArcGIS

There are some clear clusters along the inside of the outer walls of the eastern and southern side of the *dunnu* walls, at the location of the bakery (Akkermans and Wiggermann in press, 6). There are also some clusters on the eastern side of the *dunnu* in squares N10 and O12.

6.3.3 Level 5

High concentrations of ground stone artefacts are located in the rooms situated in square K8 and L8. It is clear that the entire site was in use at level 5. But more mention worthy is the manner in which all the ground stone artefacts are spread out over the site. Instead of being located only on the eastern and southern side of the *dunnu* like in level 6. Indicating that the entire site was intensively used.

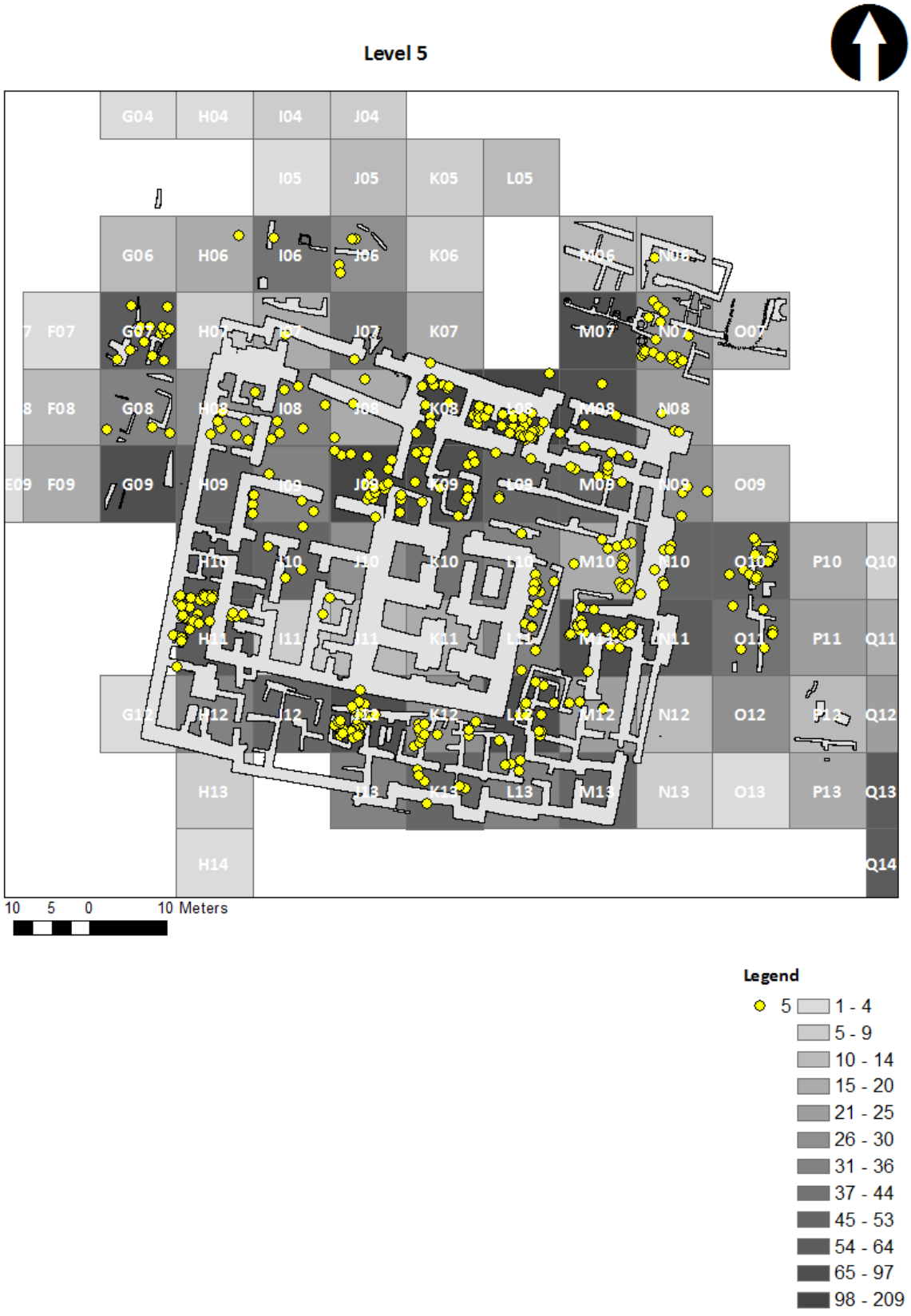

Figure 59. Chronological dispersion, level 5 Tell Sabi Abyad ArcGIS

6.3.4 Level 4

Figure 60. Chronological dispersion, level 4 Tell Sabi Abyad ArcGIS

The concentration of artefacts found in this period in the north and north-western side of the *dunnu* corresponds with the neglected areas of the site in level 4 mentioned in chapter 1.3 (fig. 6). Some objects have been found in areas that were not used/ inhabited in level 4. Which is congruent with the use of the remains of the *dunnu* as a area for building ovens, waste disposal and burying the dead.

The highest concentration of ground stone found in level 4 is located in the room found in and around square H9. No clear use for this room is

6.3.5 Level 3

Just as at level 4 a large portion of the site was left in ruins and not in use during level 3 (chapter 1.3). The ground stone items represented in fig. 61 seem to indicate the areas which were actively used in level 3. In contrary to level 4 little objects have been ascribed to waste disposal at level 3. A lot of the finds are, again, concentrated in square J9. This seems to have been a focal point of the site in levels 5, 4 and 3.

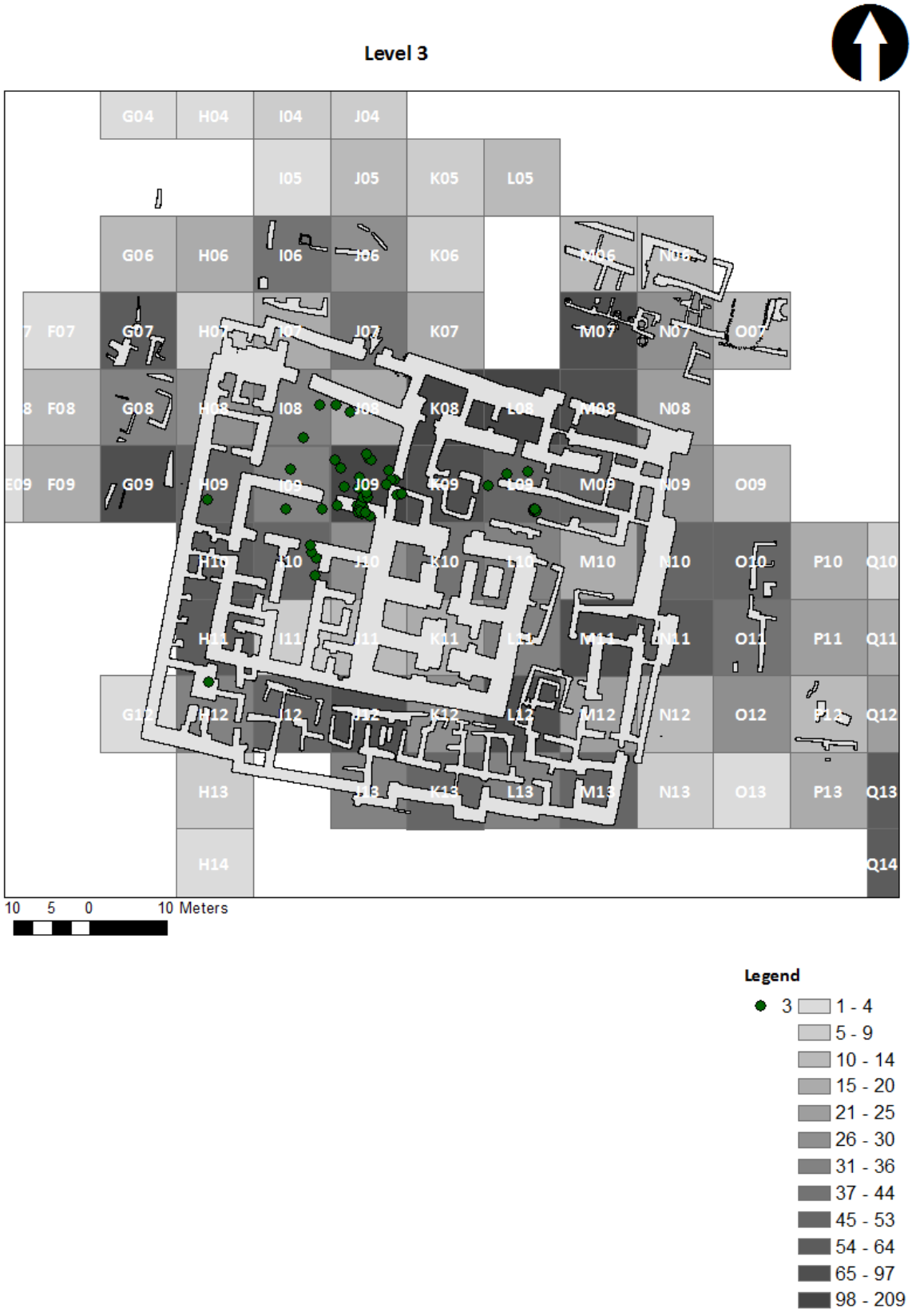

Figure 61. Chronological dispersion, level 3 Tell Sabi Abyad ArcGIS

6.4 Chronological distribution of tool types

Asides from looking at the distribution of ground stone artefacts per level I also took a look at the chronological distribution per tool type. By doing this the age certain spatial clusters discovered in chapter 6.2 could perhaps be ascertained. Only the chronological distribution of tool types where interesting correlations were discovered between chronology and spatial clustering will be discussed.

6.4.1 Chronological distribution of grinders

Even though there were no clearly recognisable spatial clusters of grinders (chapter 6.2.2). There are appears to be some spatial clustering within the grinder assemblage. It is clear that different rooms of the *dunnu* were used for grinding purposes in various levels. At level 4 H9 seems to have been a popular spot. Whereas in level 5 H11 was clearly more preferred.

The before mentioned cluster rich area of square J12, the bakery, is limited to level 5 and 6 where grinders are concerned. Grinders in the pottery workshop mentioned by Duistermaat (2007, 705) are mainly from level 6 and 5. This corresponds with the levels in which this area of the site functioned as a pottery workshop.

Figure 62. Chronological distribution grinders

6.4.2 Chronological distribution of grinding slabs

Figure 63. Chronological distribution grinding slabs

The chronological clustering of grinding slabs show that the popular J12 in level 5 and 6 is also a popular location for grinding slabs. The clusters of grinding slabs mentioned in squares K8, are filled with grinding slabs from level 4 and 5. Whereas the cluster mentioned in J9 is comprised of objects from level 4, 5 and 6. As was the case with the chronological grinder distribution; the room in square H11 is a popular spot for grinding slabs in level 5. All but one of the pestles found in H11 are from level 5. However, the image of chronological distribution of pestles was not very interesting beyond this and was therefore not included. The chronological data from grinding slabs confirms the assessment made in chapter 6.3.5. This corner was a focal point of ground stone activity on the site during level 5, 4 and 3.

6.4.3 Chronological distribution of polishers

Through the chronological distribution of polishers many of the important ground stone clusters found in this research become visible yet again. The brewery contains polishers from level 4 and 5.

Figure 64. Chronological distribution polishers

6.5 Analysis

Up until this point all the tools and levels were discussed separately. Here a more all encompassing view will be given of the overall trends in distribution of ground stone materials during the Late Bronze Age on Tell Sabi Abyad.

6.5.1 Spatial dispersion analysis

When looking at the dispersal patterns of many of the tool types a higher concentration of artefacts was found in square K8, L8 and J9. Apart from the mention of two pottery kilns in the research of Duistermaat (2007, 452) situated in K8 and L8 the only other reason for this higher concentration of finds is that this is the location of the brewer Silli-Ištar-Nabula (Akkermans and Wiggermann in press, 6)[21]. The high concentration of ground stone appears to confirm the presence of the brewer/a brewery at this location on site. As a matter of fact, 10,60% of all Late Bronze Age ground stone originates from these two squares. It would thus seem that the assumed location of the brewer is confirmed by the ground stone assemblage.

Clear clustering of particular ground stone tools also confirm the level 5 pottery workshop from a ground stone perspective. Highlighting that ground stone is not just used in food production.

Finally it is perhaps important that it stands out that little ground stone objects have been found in the tripartite structure and *dimtu* at the centre of the Tell Sabi Abyad settlement. Indicating that these areas were not used for the production of any kind of product.

6.5.2 Chronological dispersion analysis

Any clustering seen in the chronological dispersion patterns should be looked at from a somewhat sceptical viewpoint. With almost two thirds of the objects missing from these chronological representations it is likely that most of these perceived clusters actually represent the rare areas of the site where the distinction between levels was clear. And thus items could be ascribed to a level. It is also important to keep in mind that ascribing these finds to levels is something that is done in a much later stage of the Tell Sabi Abyad research.

[21] The exact location of the brewer is not confirmed. However, in a personal comment from F. Wiggermann the location of the brewer cuneiform texts are confirmed to be from the same location as the ground stone cluster.

Assigning objects to levels is done from looking at the documentation object, stratigraphy and other contributing factors and is not definitively done in the field.

Determining whether objects are *in situ* is not an easy process. The fire that ended level 5 has made it easier to ascribe level 5 finds to this particular level. As these objects were abandoned in their positions at the time of the devastating fire that signalled the end of level 5 and was followed by abandonment.

The location of the level 5 pottery workshop was already a an area with relatively high amounts of ground stone in level 6. Suggesting there was perhaps already a shift during level 6 from the pottery workshop outside of the dry moat to inside the *dunnu*. Based on the ground stone record the brewery at the northern side of the *dunnu* was only used in level 5 and 4. The Bakery at the southern side of the fortress was in use during level 6 and 5. The refuse layer in J9 was in used during levels 6, 5 and 4.

There are three chronological grinder clusters on the site. In level 6 at M13 near the pottery workshop of level 5 at the south-east corner of the *dunnu* perimeter. In level 5 a grinder cluster is located in H11. And in level 4 a cluster is found in H9. The meaning of these clusters and the corresponding rooms is unclear.

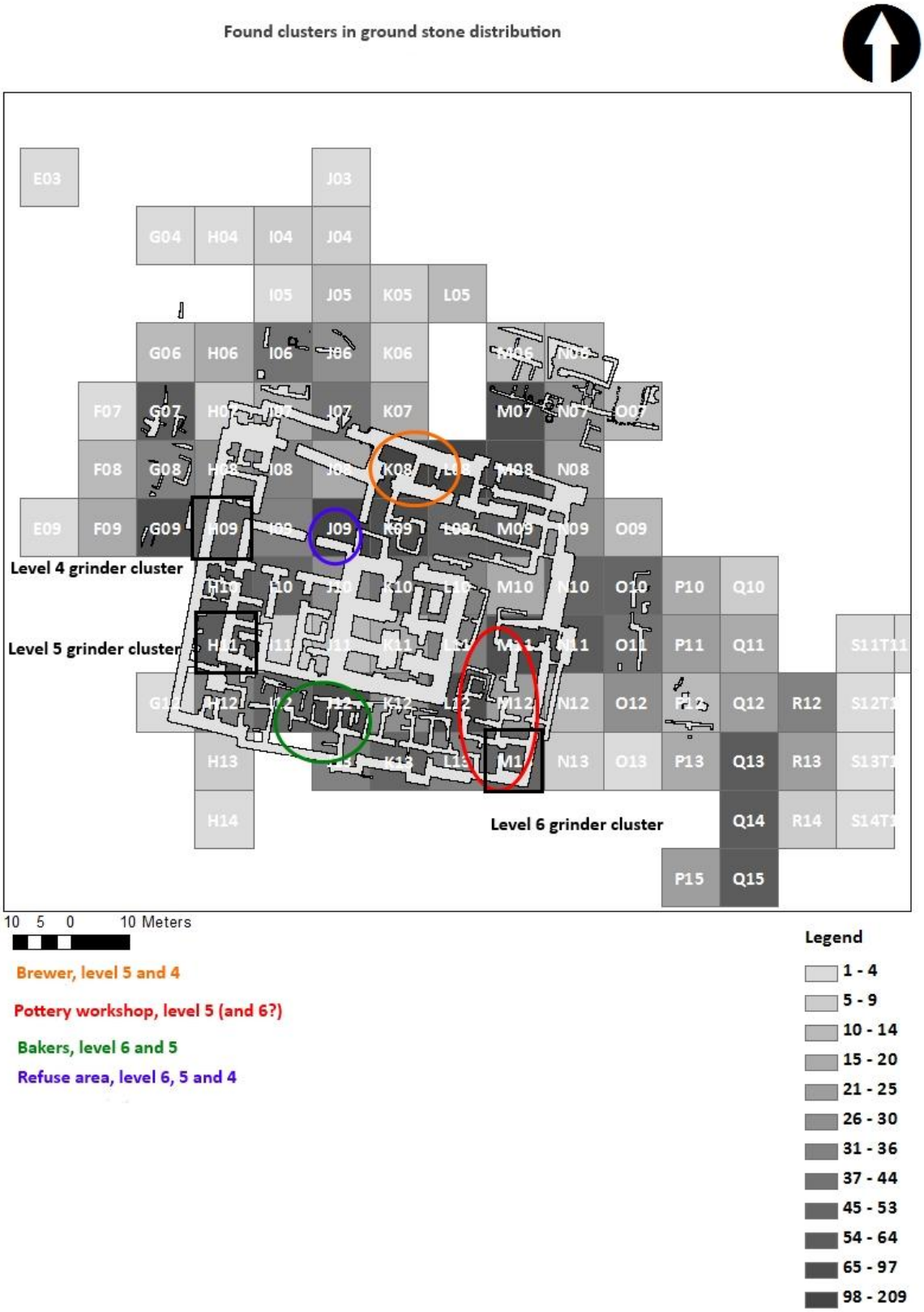

Figure 65. Found clusters in ground stone distribution

Chapter 7

Conclusion

Various types of ground stone objects are found on Tell Sabi Abyad. However only the ground stone tools are the subject of this particular research. Grinders, grinding slabs, hammers, mortars, pestles, polishers and whetstones from the Late Bronze Age have been found on the site. These objects are found in all sorts of shapes and sizes. Preferences in shape were, logically, directly influenced by the use of an object. Pestles are preferably of an elongated shape and grinding slabs, of course, flat.

There is no sign of any ground stone artefact production on the site. No unfinished ground stone objects have been found. And no type of waste product that could have come from producing these tools has been located on the site. It is however common, not to find any sign of manufacturing waste of ground stone production (Abadi and Rosen 2008, 99).

Retrieving any connection between type and use has proved to be a difficult task. As a result it has become clear that ground stone tool types were used for a multitude of purposes. As was already suggested by Wright (1994, 242). The only case where a clear differentiation could be discerned in use was with type G.5. This flattened grinder was distributed quite differently over the site compared to all the other grinders. However the reasoning behind this differentiation in distribution has not been found(52,78% of the Late Bronze Age grinders is type G.5).

When looking at any patterning in intensively used ground stone tools. The grinders and grinding slabs retrieved from square J9 stood out. No other concentration of intensively used ground stone objects was found here or at any other location on the site. Why a concentration of only extensively used grinders and grinding slabs was located in a large dump layer at the corner of this area at the entrance of the *dunnu* is unclear.

There is a clear difference in how different types of tools are distributed over the tell. But in most cases, except G.5, different types of the same tool are not distributed differently through space. Chronological clustering of objects does occur. However, it should be mentioned that these clusters are likely to be influenced greatly by the stratigraphy of the site. The levels used to structure the chronology of the site, have been ascribed to artefacts on a much later stage. This could only be done with finds that were retrieved from a square

with a clear stratigraphy. As a result only 1128 out if the 3200 studied object are linked to one of the five Late Bronze Age levels. The visible chronological clustering is thus partially a visualisation of the squares with a clear stratigraphy per level. No correlation between stone type and spatial distribution has been found during the Late Bronze Age.

Judging on the ground stone assemblage thelocation of the brewery in squares K8 and L8 seems to have been confirmed and was in use during level 5 and 4. Whereas the area of the pottery workshop from level 5 in the south-eastern corner of the *dunnu* mentioned by Duistermaat (2007, 705) already shows an elevated amount of ground stone in level 6. The bakery at in southern side of fortress was used in level 6 and 5.

The results of this study show that not only was there an extensive ground stone assemblage present during the Late Bronze Age on Tell Sabi Abyad. It also illustrates that the possibilities in ground stone research can, in fact, contribute significantly to the understanding of an archaeological site. And thus underlining the fact that ground stone archaeological studies are unjustly neglected.

Abstract

Ground stone tools have clearly been neglected in archaeological research. The misconception that nothing interesting is to be learned from this particular material category has had a devastating effect on the amount of attention these objects have received in archaeological projects. They are often neglected in literature and discarded in the field. The presumption that these objects have nothing to tell is however wrong. Ground stone assemblages can tell us many things about the daily life on a site.

This is why a new look into the ground stone artefacts of Tell Sabi Abyad was warranted. Research started with a look into the occurring types on the site. To facilitate this the original ground stone shape typology was revised. Via a look into ground stone types and the used stone types to produce these artefacts an overview of the Late Bronze Age ground stone assemblage of Tell Sabi Abyad was constructed.

Tell Sabi Abyad also has the great advantage of having a clear stratigraphy and lots of *in situ* ground stone artefacts. However, perhaps even more interesting, there is also clear evidence of different crafts being practiced on site. Known crafts location include a baker, brewer and potter. By comparing their known locations on the site to concentrations of different types of ground stone a correlation between use, type and tool was researhed. A close look was taken at preferences in shape and stone type per ground stone tool category.

Furthermore, both the spatial and chronological dispersal of the artefacts were examined to ascertain if any of the patterns could lend an insight into any of the preferences the inhabitants of the site had, where ground stone was concerned. Clusters of ground stone objects were found in areas of the site where certain crafts were performed. There were, for example, clusters of ground stone found inside a pottery workshop (Duistermaat 2007, 705) and the office of the brewer[22]. Other than some cuneiform the location of the brewer was confirmed by any other material evidence. Illustrating that ground stone archaeological research is not as insignificant as it is being generally portrayed.

[22] A cluster of brewer cuneiform texts were found in this room and it is thus considered to be the office of the brewer (personal comment F. Wiggermann).

Bibliography

Abadi, Y. and S. A. Rosen, 2008. A Chip Off the Old Millstone: Grinding Stone Production and Distribution in the Early Bronze Age of the Negev. In: Y. Rowan and J. Ebeling (eds), *New Approaches to Old Stones: Recent Studies of Ground Stone Artefacts,* London: Equinox Press, 99-115.

Akkermans, P.M.M.G., 1989. *Excavations at Tell Sabi Abyad; Prehistoric Investigations in the Balikh Valley, Northern Syria.* Oxford: B.A.R. International Series.

Akkermans, P.M.M.G., 1993. *Villages in the Steppe: Later Neolithic Settlement and Subsistence in the Balikh Valley, Northern Syria,* Ann Arbour: International Monographs in Prehistory.

Akkermans, P.M.M.G., 2006. The fortress of Ili-pada. Middle Assyrian architecture at Tell Sabi Abyad, Syria. In: P. Buterlin, M. Lebeau, J-Y Monchambert, J.L Montero Fenollós and B. Muller (eds), *Les Espaces Syro-Mésopotamiens, dimension de l'experience humaine au proche-orient ancient*. Turnhout: Brepols, 201-211.

Akkermans, P.M.M.G. and G.M. Schwartz, 2003. *The Archaeology of Syria; From Complex Hunter-Gatherers to Early Urban Societies (ca. 16,00-300 BC).* Cambridge: Cambridge University Press.

Akkermans, P.M.M.G. and F. Wiggermann, in press. West of Aššur: the Life and Times of the Middle Assyrian *Dunnu* at Tell Sabi Abyad, Syria. In O. Rouault and M.-G, Massetti-Rouault, *eds., After the Empire: Crisis of the State and of the Monarchy in Northern Mesopotamia and in Anatolia (XIIIth -Xth centuries BC). centuries BC).* Lyon.

Collet, P. and R.H. Spoor, 1996. The Ground-Stone Industry. In: P.M.M.G. Akkermans, *Tell Sabi Abyad - The Late Neolithic Settlement II, Report on the Excavations of the University of*

Amsterdam (1988) and the National Museum of Antiquities Leiden (1991-1993) in Syria. Nederlands Historisch-Archeologisch Instituut te Istanbul: Herent, 415-438.

Curtis, R.I., 2001. *Ancient Food Technology.* Leiden, Boston, Köln: Brill.

Duistermaat, K., 2007. *The Pots and Potters of Assyria: Technology and Organization of Production, Ceramics Sequence and vessel Function at Late Bronze Age Tell Sabi Abyad, Syria.* Turnhout: Brepols.

Greene, K., 2006. *Archaeology an Introduction.* London and New York: Routledge.

Hodges, H., 1989. *Artifacts, An Introduction to Early Materials and Technology.* London: Duckworth.

Huigens, H.O., 2010. Axes*, Adzes and Chisels: Stone Tools from Late Neolithic Tell Sabi Abyad, Syria*. Leiden University BA thesis: Faculty of Archaeology.

Huigens, H.O, V. van Exel, P. Flohr, J.M. Kelder, E. Koek and T. Rooijakkers, in press. The Ground-Stone industry, in P.M.M.G. Akkermans, M.L. Brüning. H.O. Huigens and O.P. Nieuwenhuyse (eds), *Excavations At Late Neolithic Tell Sabi Abyad, Syria; The 1994-1999 Field Seasons*, Leiden Museum of Antiquities: Leiden, 137-165.

Kremer, R., 2013. *Middle Assyrian Jewellery from Tell Sabi Abyad*. Leiden University BA thesis: Faculty of Archaeology.

Rowan, Y.M. and J.R. Ebeling, 2008. Introduction: The Potential of Ground Stone Studies. In: Y.M. Rowan and J.R. Ebeling, (eds), *New Approaches to Old Stones: Recent Studies of Ground Stone Artefacts,* London: Equinox Press, 1-15.

Rutter, G. And G. Philip, 2008. Beyond Provenance Analysis: The Movement of Basaltic Artifacts through a Social Landscape. In: Y.M. Rowan and J.R. Ebeling, (eds), *New Approaches to Old Stones: Recent Studies of Ground Stone Artefacts,* London: Equinox Press, 343-358.

Tsoraki, C., 2011. Disentangling Neolithic Networks Ground Stone Technology, Material Engagements and Networks of Action. In: A. Brysbaert (eds), *Tracing Prehistoric Social Networks through Technology, A Diachronic Perspective on the Aegean,* London: Routledge, 12-29.

Wiener, N., 2011. Damaged Representation, the Figurines from Bronze Age Tell Sabi Abyad, Syria and the Archaeology of Disregard. University of Leiden, Faculty of Archaeology: Master thesis.

Wiggermann, F.A.M., 2000. Agriculture in the Northern Balikh Valley, the Case of Middle Assyrian Tell Sabi Abyad. In: R. M. Jas (ed.), *Rainfall and Agriculture in Northern Mesopotamia*. Istanbul: Nederlans Historisch-Archeologisch Instituut, 171-232.

Williams-Thorpe, O. and G. Philip, 1993. A provenance study of Jordanian basalt vessels of the Chalcolithic and Early Bronze Age I Periods. *Paléorient* Vol. 19, 51-63.

Wright, K.I., 1992, A Classification System for Ground Stone Tools from the Prehistoric Levant. *Paléorient* Vol. 18 No. 2, 53-81.

Wright, K.I., 1994. Ground-Stone Tools and Hunter-Gatherer Subsistence in Southwest Asia; Implications for the Transition to Farming. *American Antiquity* Vol. 59 No. 2, 238-263.

Wright, K.I., 2008. Craft Production and the Organization of Ground Stone Technologies. In: Y. Rowan and J. Ebeling (eds), *New Approaches to Old Stones: Recent Studies of Ground Stone Artefacts,* London: Equinox Press, 130-143.

Figures and tables

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Appendix

Appendix I. First aid in object forms Tell Sabi Abyad

TELL SABI ABYAD

FIRST AID FOR OBJECTFORMS

Objects are all artefacts made or used by humans. Excluded are flint artefacts. Pottery vessels are objects when the vessel shape can be reconstructed from base to rim.

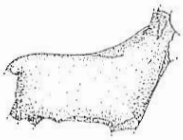
Try to describe the object as extensively as possible: note dimensions, shape, forming/manufacturing technique, directions of drillings, traces of use/marks/damages etc. and their position on the object, colour, burnt or not, fragment/damaged/complete, surface appearance (rough, smooth, polished), etc.etc. Make a 1:1 sketch (or smaller if that is too large for the form, indicate the scale) showing the shape and the characteristics you described. A section drawing is useful! For future work on the objects, your object form has to be understandable without having to see the object itself!

First describe the object, then, at the end of the description, you may add comments on interpretation and your own thougths about use, manufacture etc.

SOME OBJECT DESIGNATIONS

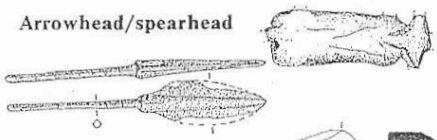
Other objects not in this list can be added, of course.

Animal figurine



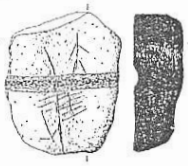
Three dimensional animal representation. Indicate the kind of animal depicted if possible.

Arrowhead/spearhead



Point of an arrow or spear, made of metal (flint arrowheads are kept with the other flint and are not treated as an object).

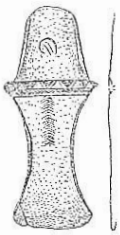
Arrowshaft straightener



Flat stone with groove in the middle.

Awl

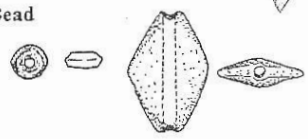
Pointed tool usually made of bone (metapodia), smoothed surface at the point due to use. Piercing tool.



Axe

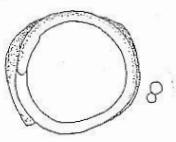
Wedge shaped cutting implement of metal or stone. Cutting edge is sharp, the other end blunt. Originally the object was hafted. Indicate traces of use.

Bead



Small pierced object, mostly disk-shaped, round, cylindrical or spherical but other shapes also possible. Indicate how the piercing was made, from what direction, and where the object is pierced (center, edge etc.)

Bracelet



Chain of various beads, or ring of metal or bone large enough to ware around a (child's) wrist or ankle. Smaller than necklace. Indicate how many beads are present and describe them in detail.

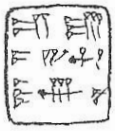
Burin

Hollow chisel, of bone or metal.

Bowl

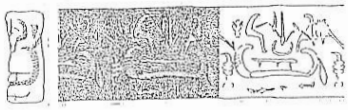
Vessel with unrestricted shape, rim diameter larger than height of vessel.

Cuneiform text



Any piece of clay or a clay tablet with cuneiform signs on it. Describe size and whether damages are recent or old. Notice seal impressions. Describe the context very carefully, and hand the text over to a specialist. Be very careful in handling the object as many are unbaked!

Cylinder seal



Cylindrical object pierced lengthwise. On the surface, a decoration is cut out in relief. Description as with beads. Note details in the seal motif and make a detailed drawing. Make plasticine rollings, ask Peter or Pieter.

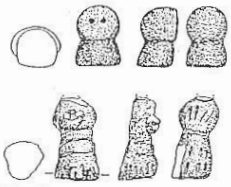
Disk

Diskshaped object, flat. Usually made of clay or stone. No piercings present (see pierced disk), and larger than 'token'. Used as a lid?.

Doorsocket

Large stone object with a round, semipherical concave and smoothed depression in at least one of the sides. In the depression the pivot of the door turned. Notice traces of turning!

Figurine

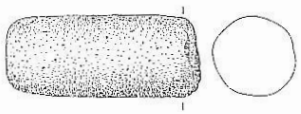


Three dimensional human representation. Indicate presence and appearance of limbs and other body parts, dress, hairdo etc. and describe decoration: incision, paint, where on the body?

Goblet

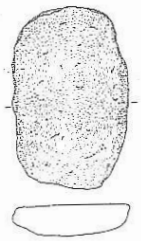
Small vessel, in the shape of a cup or beaker.

Grinder



Conical, cylindrical or spherical object of stone with traces of grinding and other use at the sides, not at the short ends (see pestle). Indicate the position and appearance of traces of use and describe the kind of stone (finegrained, coarse etc.). For type number, see typology.

Grinding slab



Flattened stone object with oval or rounded shape. Base is usually convex. The working surface is concave or flat and shows traces of grinding. Description as with grinder. For type number, see typology.

Grinding stone

Flattened stone with oval or rounded shape. Working surface is flat or slightly convex and shows traces of use. Used as top stone in combination with a grinding slab. Description as with grinder. For type number, see typology.

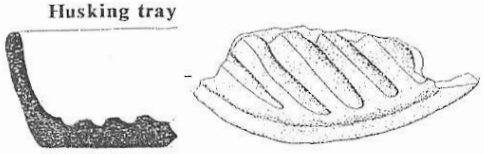
Hammer

Cylindrical, rounded or more or less square object with one or more battered areas at its surface. These surfaces are usually damaged and rough, not very smooth (see pestle or grinder). For type number, see typology.

Handle

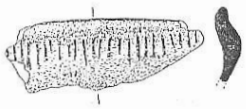
Handle from a vessel, sometimes pierced. Pottery handles are no objects: please hand them over to the pottery people.

Husking tray



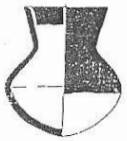
Low vessel made of pottery. Interior shows deep grooves and ridges or deep finger impressions.

Incised bone



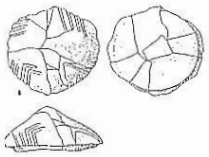
Piece of bone with parallel cutmarks. Indicate number and length of incisions, position on bone and direction, intervals between incisions.

Jar



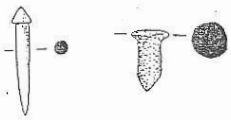
Vessel with a restricted/closed shape and a neck. For description of pottery jars, see under 'pottery'.

Jarstopper



Lump of clay, flat or conical, used to close the mouth of a vessel. Often, impressions of the rim of the vessel are visible. Besides the general description of the stopper, describe the kind and size of vessel/rim that was closed. Pay attention to any seal impressions (see sealing).

Labret

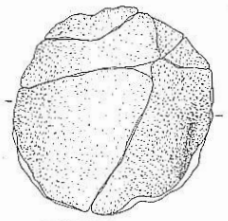


Nail-shaped object, mostly of stone but clay is possible too. Probably used for personal decoration.

Leg

Cylindrical or conical object, broken off a figurine or a vessel. When the latter is the case, please give the leg to pottery people. In case of a figurine leg, description is as with figurines.

Lid

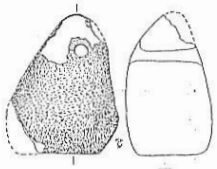


Flat disk, mostly made of clay. These disks were probably used to close a vessel. They are larger than 'disks'. Pay attention to traces of manufacture, use, wear, impressions of rims etc.

Loamer

More or less flat and rounded tool made out of a sherd. The surface often shows traces of use.

Loomweight



Relatively large ball or conical shape of unbaked clay with a perforation.

Macehead

Spherical stone object with smoothed surface and a hole through the center.

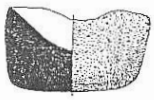
Metal fragment / ore

Any fragment of metal or metal ore that has no recognizable shape. Try to identify the kind of metal, if not possible try to describe it as detailed as possible.

Miniature (bowl, jar, etc.)

Miniature variety of any vessel. A miniature is considerably smaller than normal vessels. Very often a miniature is a model, not really useable as a vessel.

Mortar

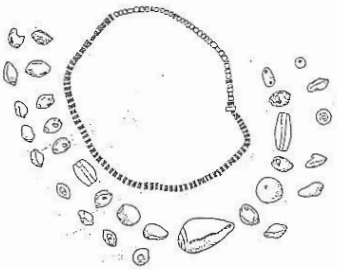


Bowl-shaped vessel of stone, used for grinding or pounding in combination with a pestle. Inside shows traces of grinding or is polished and shiny. For type number, see typology.

Nail

Long pointed object with sharp end and blunt head.

Necklace

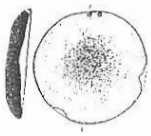


Chain of various beads, long enough to wear around the neck. Describe the material and shape of the individual beads, their sequence in the necklace, and the number of beads.

Needle

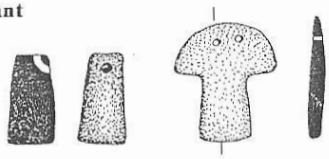
Long, thin, sharply pointed object with a hole in the top.

Palette



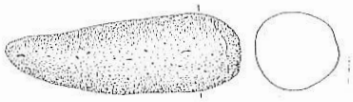
Very smooth, flat, often irregular shaped stone with a slight depression. Sometimes, traces of pigment are present on the working surface.

Pendant



Small object, in various shapes and materials. One or more holes for suspension are present at one end.

Pestle



Conical, cilindrical or spherical stone tool. Traces of grinding are present on the ends and not on the sides (cf. hammer and grinder). For type number, see typology.

Pestle/grinder

Stone tool used both as a pestle and as a grinder: traces of grinding at the ends as well as at the sides. For type number, see typology.

Pierced disk

Small disk with perforation in or near the center. Often made out of a sherd but occasionaly stone disks are found as well. Notice the way the hole was made and its dimensions.

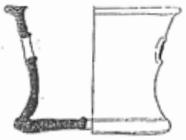
Platform

Large piece of stone with at least one worked surface. Probably used as a working surface.

Stamp (seal)

Small object of stone, baked clay or bone, with at least one flat surface. The surface has an incised motif. Indicate precise dimensions and make an accurate drawing: comparison with possible impressions found earlier is important! Make plasticine impressions or ask Peter or Pieter.

Stand, potstand



Collar-shaped pottery object, used as a stand for a larger pot or jar. Sometimes made out of a re-used jar neck. Description as with 'pottery'.

Strainer

Bowl-shaped pottery vessel with many holes in the wall. Indicate number and dimensions of the holes. Were they made before or after firing? For description, see 'pottery'.

Token

Small object of clay or stone in geometrical shape: sphere, disk, cone, cilinder etc. Used as counting or accounting tools. Notice marks (incisions, notches, fingernail impressions).

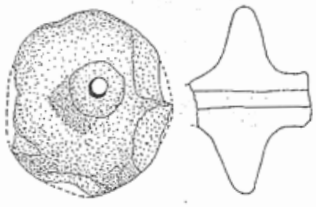
Tray

Low dish, like a plate. If made from pottery, see 'pottery' for description.

Vessel

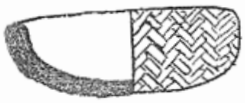
Any container that does not fit into the categories of bowl, pot, jar, bottle, strainer, tray. If made from pottery, see 'pottery' for description.

Wheel



Disk of clay or stone with a hole in or near the center. Often, the wheel is thickened around the hole. Used as a wheel in a model, often larger than pierced disk.

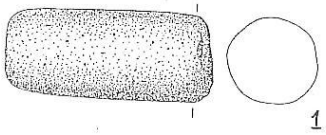
White ware



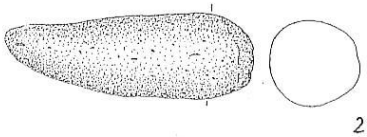
A very coarse vessel or vessel fragment made out of gypsum. At the base, impressions of basketry are often visible.

GRINDING TOOLS
Shape Typology

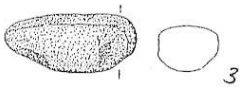
TYPE 1
rather large, cylindrical grinders or pestles.



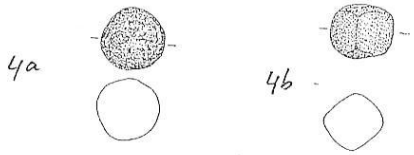
TYPE 2
rather large, conical grinders or pestles.



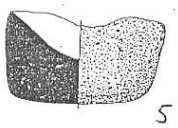
TYPE 3
cylindrical or conical grinders or pestles with more irregular shape.



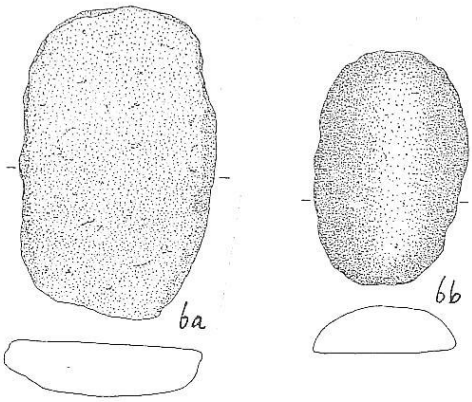
TYPE 4
small spherical or cubical tools used as hammers, grinders or pestles.



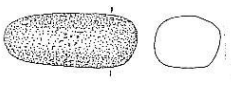
TYPE 5
mortars



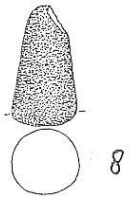
TYPE 6
flattened grinding slabs (6a)
flattened grinders (6b)



TYPE 7
small cylindrical grinders or pestles



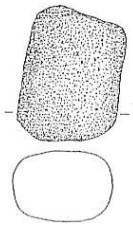
TYPE 8
small conical pestles



8

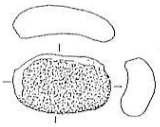
TYPE 9
unidentifiable pieces

TYPE 10
rectangular grinders



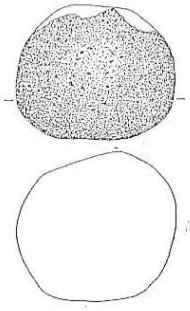
10

TYPE 11
flat tools made of extremely light and porous basalt



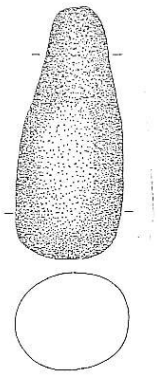
11

TYPE 12
large spheres, smoothed on one or more sides



12

TYPE 13
large pear-shaped pestles.

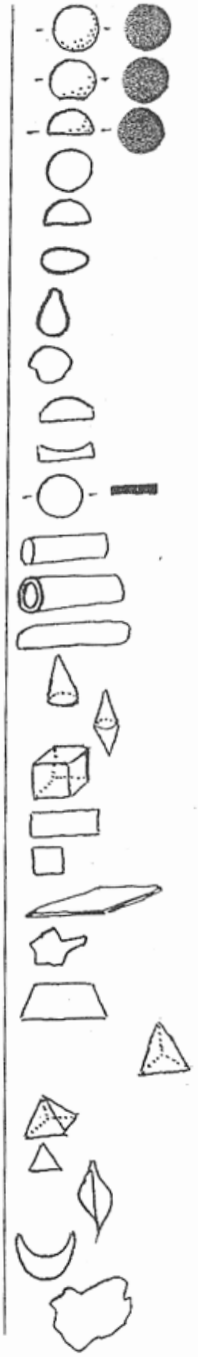


13

GEOMETRICAL SHAPES

Some words used for describing shapes and sections of objects.

Sphere
Three-quarter sphere
Semisphere
Circle
Semicircle
Oval
Egg-shape, pear-shape
Rounded
Convex
Concave
Disk
Cylinder
Tube
Longitudinal
Cone
Bicone
Cube
Rectangle
Square
Flat
Angular
Trapezium
Tetrahedron
Pyramid
Triangle
Leaf-shaped
Crescent
Irregular



DESCRIPTION
Some words for describing objects

Shape
horizontal (horizontaal)
oblique (schuin)
straight (recht)
tapering (smal toelopend)
vertical (verticaal)
carinated (geknikt)
blunt (bot)
sharp (scherp)
pointed (puntig)
nipple-base (van een goblet: tepelvormige bodem)

top (bovenzijde)
front (voorkant)
working surface (werkvlak, kant die gebruikt is)
back (achterkant)
side (zijkant)
obverse side (voorkant)
reverse side (achterkant)
base (onderzijde, bodem)
core (kern)
fracture (breukvlak)
edge (rand)
cutting edge (snede, snijrand)
centre (centrum, midden)
central (centraal, in het midden)
out of centre, near the centre (iets uit het midden)

Dimensions
wide (breed)
width (breedte)
long (lang)
length (lengte)
diameter (diameter, doorsnede)
height (hoogte)
circumference (omtrek)
section (sectie, doorsnede)
wall (wand (van een pot ofzo))
wall thickness (wanddikte)

Surface, piercing etc.
bitumen (bitumen, asfalt)
burnished (gepolijst, glad gemaakt)
dull (dof, mat)
coating (dunne laag, overtrek)
corrosion (corrosie)
crust (korst, aanslag)
frayed (rafelig)
gypsum/lime (witte gips of kalk)
polished (gepolijst)
residu (residu, resten van de oorspronkelijke inhoud)
rough (ruw)
rust (roest)
scraped (van aardewerk: geschraapt oppervlak)

scratch (kras)
shiny (glanzend)
slip (dekkende laag, bij aardewerk)
smooth (glad)
traces of pigment (sporen van kleurstof)

depression / indent (deuk)
impression (indruk, afdruk (stempel))
incision (incisie, met scherp voorwerp)
finger impression (vingerafdruk)
fingernail impression (nagelindruk)
groove (groef)
mark (teken)
notch (kleine, puntige incisie)
ridge (richel)

plait (vlecht, vlechten (van touw, manden en matten))
weave (weven (van textiel)
fabric, tissue (weefsel)
ply (van touw of draad: gedraaid)
spin (spinnen (van draad))

piercing (doorboring)
pierced (doorboord)
symmetrical (symmetrisch)
asymmetrical (a-symmetrisch)
drillhole (boorgat)
drilling (boren)

Damages etc.
battered (geslagen, sporen van hard slaan)
broken (gebroken)
cleave (splijten)
complete (heel, compleet)
crack (barst)
cut (snijden)
damaged (beschadigd)
fragment (fragment)
fragmentarily preserved (gedeeltelijk bewaard)

Texture
translucent (doorschijnend (als matglas))
porous (poreus)
vesicular (van basalt: met veel grote gaten)
brittle (bros, breekbaar)
coarse (grof)
grains (korrels)
granular (korrelig)
inclusions (vegetal or mineral) (inclusies, magering)
fine (fijn)
soft (zacht)
hard (hard)
veined (van steen: geaderd)

Appendix II. Stone types at Tell Sabi Abyad

N	Stone	Colour	Surface	Interior
1	basalt, fine grained	dark grey	fine grain, finely perforated	as surface
2	basalt, vesicular	dark grey	large holes, coarsely perforated	as surface
3	limestone (pebble)	light brown with brown + yellow spots	smooth, splotched col., fine	light brown, crystallized
4	granodorite	white - green splotched, veined	rough - crystallized (feldspar) – glittery	as surface, irregular fractured
5	gabbro	dark green with light green + black specules	rough - crystallized, glittery, finer than 4	rough, irregular fractured, feldspar
6	flint	light to dark brown	rough cortex	glassy fractures, light brown
7	compact gypsum	white to light brown	hard crystallized parts in softer fine limestone	crystallized, hard glassy to fine
8	limestone	white yellow	rough bubbly surface, soft, porous	as surface, bubbly fractures
9	porfirite	dark green with light white chunks	fine, hard	as surface, crystallized fractures
10	granite porfiry	purple-ish brown with white crystals	coarse, hard	as surface, crystallized fractures + feldspar
11	quartzite sandstone(pebble)	light brown to red brown	fine, hard	crystallized fractures, light brown, glassy
12	dolorite	black/blue-ish black, finely specked	very fine + hard, polished →glassy	fine crystallized fractures, light green
13	gypsum/limestone/marble	white to beige, few dark brown veins	very fine + hard	crystallized fractures, glittery
14	gypsum	whitish beige, bands lighter/dark	fine, hard	long crystals in fractures, glittery
15	gypsum/alabaster	white to brown	rough with feldspar/crystals, hard to soft	fine crystals in fractures
16	limestone	white to beige	fine + soft, porous	fine fractures, crystallized
17	gypsum	pink with white veins	hard, finely porous	rough, irregular crystallized fractures
18	alabaster	light grey with dark grey/white veins	hard, smooth	rough, layered crystals in fractures
19	calcite crystals	transparent	hard, glassy	smooth, long fractures, layered
20	iron hydroxide concretion	purple-black, red to black	hard, compact, fine to very fine	smooth, darker fractures
21	compact marl	yellow to (light) brown	soft fine surface	

22	sedimentary stone	light grey exterior, dark grey interior	fine rough surface	crystallized fractures, rough, irregular
23	quartzite	dark grey splotched	fine grained, hard	roundish crystallized fractures, glittery
24	serpentinite	(dark)green, white, black, dark grey veins	fine grained, hard	
25	obsidian ?	black - translucent to green	fine - glassy	rounded glassy fractures
26	serpentinite	light grey - veined black(spidery)	fine, sometimes flakey	
27	serpentinite	dark brown-black, splotchy	fine, hard	
28	compact gypsum	dirty brown - beige	finely porous, sandy	in layers, long fractures
29	sandstone	light brown-yellow to dark purple	sandy, fine to rough with glitters	as surface, rougher, more glitters
30	porous limestone	dirty grey - beige to brown	rough, porous softish, large inclusions	as surface, ridgey fractures
31	limestone/travertine	beige to grey	fine bubbly to coarse bubbly, hard, porous	fine crystallized fractures, light green
32	chlorite	dark brown greenish splotched dark brown/black	fine, hard, glassy	very fine crystallized fractures, some glitters
33	soft stone + iron hydroxide	red stone splotched red brown/purple	rough, edgy, compact, polished-->smooth	as surface
34	porous limestone	light grey to beige	fine, finely porous, soft	as surface
35	very porous basalt	dark grey	very porous, coarsely perforated	as surface
36	volcanic stone with feldspar	dark grey	fine grained	fine crystallized structure, lots of feldspar
37	quartzite	light grey-whitish splotched	rough hard surface	dark grey, crystallized fractures
38	limestone	light brown to brown	fine grainy surface, middle hard	light brown crystallized fractures, few glitters
39	granite/porfiry	buff/light grey with white/grey speckles	hard granular surface, white speckles	beige crystals, white large cold glitters
40	quartzite/sandstone	beige - buff, with dark brown glitters	sandy with large glitters and ?	as surface
41	limestone	brown grey - splotched	fine, hard	crystallized fractures
42	glass			
43	limestone/marble	light grey	fine, compact, granular	very crystalline fractures, glittery

44	coarse sandstone	dark greyish brown	coarse sandy - glitters	as surface - more glitters
45	amazonite	pastel, sea green, veined whitish	fine, almost flakey	fine crystalline fractures
46	serpentinite	translucent green-brown splotched	fine, glassy	
47	obsidian - scratched	dull black	scratched glassy	
48	serpentinite	white with large/small spidery black veins	fine, hard, looks flakey	
49	brecci	white, brown, green	flakey, crumbly, coarse surface	flakey fractures
50	limestone	beige	hard crystallized, almost glass-like, fine	glass-like, large crystals
51	chlorite/chloritite	dark brown with glitters	fine grainy surface - glittery	fine crystalline fractures, glitters
52	soft limestone	brown with grey splotches	fine, smooth	fine crystalline fractures, glitters
53	? Faïence	greenish white with brown patina	finely porous, light	
54	compact red schali	reddish purple	fine, hard	ridged fractures, lamered
55	soft limestone	beige	hard, smooth	fine crystalline fractures
56	-	brown, splotched dark brown/light brown	hard fine surface, slightly sandy	
57	green quartzite	dark green brown (olive) splotched green	hard fine glassy surface	finely layered, crystalline fractures
58	sandstone with quartzite	dark greyish brown + glitters	granular, sandy, hard	fine crystalline fractures
59	limestone	light grey - white, splotched(darker)	fine, lightly porous, softish	fine crystals
60	limestone + fossils	brown splotchy light brown	fine, slightly porous, softish	
61	steatite	dove grey speckled black, glitters	hard, fine granular	crystalline fractures, glitters
62	jasper-like	red with black, grey specules	hard, fine, glassy	
63	soft sandy limestone	pink, finely speckled white	fine granular, sandy	as surface - glittery
64	serpentinised ultramafic stone	green with light green veins/specules	fine granular, lumpy, hard	fine crystalline fractures
65	carnelian	translucent reddish-orange	glassy	

66	black serpentinite	black with grey veins	hard, fine, almost flakey	coarse crystalline fractures, glittery
67	greenish-black serpentinite	black with green/grey splotches	soapy hard surface, irregular	
68	grey agate chalcedony	light brown lumpy - grey "eyes"	lumpy glass-like	
69		dark brown - specules lighter	fine, irregular glass like surface	
70	chalcedony	translucent pale red - white splotches	glass-like	
71	quartzite sandstone	yellow brown - layered	layered - fine sandy surface	fine granular fractures
72	quartz-rich sandstone	white grey - speculed brown/white	granular coarse surface	layered, medium coarse crystals
73	pale white serpentinite	white - dark grey/blue veins	fine, glass-like	layered crystalline fractures
74	lapis lazuli	blue, gold, white, splotched	fine, flakey	
75		translucent dark red	scratched glass like	
76	alabaster/gypsum ?	white, yellow brown veined	crystalline, glittery, hard	
77		white pinkish, veined translucent-, blue	crystalline, glass-like	hard crystalline fractures
78	amazonite	light blue-green - splotched	fine, hard	
79		almost translucent green, glitters	grainy, crystalline surface lots of glitters	some crystalline fractures
80		dark grey/black - splotched	dull, fine hard surface	
81		pink beige - dark specules, glitters	grainy, hard	grey crystallized fractures, glitters