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The pots and potters of Assyria : technology and organization of production, ceramics sequence and vessel function at Late Bronze Age Tell Sabi Abyad, Syria

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CHAPTER V: THE TECHNIQUES AND ORGANIZATION OF POTTERY PRODUCTION.

*"No man ever wetted clay and then left it,
as if there would be bricks by chance and fortune."*
Plutarch

V.1. Introduction

Although many Middle Assyrian texts deal with the organization and administration of agricultural produce, information on the organization of craft production within the state is scarce (but see Jakob 2003). Information from archaeology is even less abundant, as almost no workshops, tools and other direct evidence of craft production from this period have been excavated or published before. The discovery of pottery workshops and kilns at Sabi Abyad therefore offers a unique possibility for a better insight into the techniques and organization of Middle Assyrian pottery production. This chapter deals with both topics in detail.

Various sources of information are available for the reconstruction of techniques and organization of pottery production at Sabi Abyad. In this chapter we look at the natural environment of production to see which resources were available and how the climate may be related to production organization. I summarize the little evidence we have on the social position of the potters in Middle Assyrian times. Next, this chapter presents a detailed discussion of the architecture and artefacts found in the different locations where pottery production took place at the site. Workshops, tools, kilns and other related finds are presented and their implications for the techniques and organization of pottery production discussed. The section on technology (paragraph V.6) focusses on raw materials, shaping techniques, firing procedures, repair of damaged vessels and the use of potters' marks. The next two paragraphs (V.7 and V.8) deal with more interpretative aspects of pottery production: the quality of the vessels, the scale of production, output and demand, variability and standardization, and the distribution of the products. Appendices C, D and E contain many of the raw data pertaining to this chapter. Drawing on various studies in ethno-archaeology, a reconstruction is presented of the techniques and organization of pottery production at the site. We shall see that the potters at the site were skilful artisans working in an individual workshop related to the Middle Assyrian *dunnu* organization, and producing large amounts of utilitarian, multi-functional ceramics.

The organization of pottery production in the Middle Assyrian period: previous work.

One of the aims of P. Pfälzner's (1995) elaborate and informative study of the Middle Assyrian ceramics of Tell Sheikh Hamad and Tell Bderi was to draw conclusions on the organization of pottery production in Late Bronze Age northern Syria. He suggested that in the Middle Assyrian period at Sheikh Hamad both a state-organized (official) and a domestic production of pottery existed. He based this conclusion on formal differences between two collections of pottery, one found inside and one outside the governor's palace at Sheikh Hamad. The database used by Pfälzner for distinguishing a domestic production from the official tradition is in my opinion not sufficient, and the existence of a domestic production at Sheikh Hamad is not convincingly proved (for a discussion, see Duistermaat 1999). Pfälzner (1995, 1997) also concluded that the pottery from Sheikh Hamad was made in a "manufactory". He based this on his conclusions that the pottery from Sheikh Hamad consisted of a limited range of standardized,⁵² "mass-produced" vessel types made in one

⁵² "Standardized" in his study meant that there was a limited range of shapes, and that there is evidence for the existence of size groups. The actual standardization of each of these shapes (like the amount of variation around the mean size) was not investigated.

workshop (Pfälzner 1997: 339). The uniformity of used clays and inclusions, the limited range of shapes produced, and the existence of size classes within the group of carinated bowls were at the core of his conclusions. His classification of the Middle Assyrian production organization as a “manufactory” was mainly based on the list of “modes of production” in D. Peacock’s work on Roman pottery (Peacock 1982: 6-11, see also below). However, Peacock stated that the difference between a workshop and a manufactory lies mainly in the scale of the two organizations and the injection of capital in the case of the manufactory. The manufactory would then be archaeologically recognizable by the size of the premises (comprising more than twelve workers at least), the degree of *specialization* (not: standardization) of the products, the scale of the output and the evidence for worker specialization. Besides, the term manufactory in his work refers to conditions just preceding the Industrial Revolution (Peacock 1982: 9-10, 43-46). At Sheikh Hamad the size of the workshops is unknown since no workshops have been found.⁵³ If most of the pottery was made in one workshop, as is claimed by Pfälzner based on the homogeneity in the pastes used, this workshop did obviously not specialize in one product but produced a wider range of vessels (even if the bulk of the output consisted of a limited number of shapes only, these shapes were of different nature, function and size and required different production techniques). The standardization of each of these shapes (i.e. to what extent the potter was striving to make exact copies of a “standard” shape or size) was not really investigated by Pfälzner. The scale of the output and evidence for worker specialization was not investigated in Sheikh Hamad, and the injection of capital by the authorities in a pottery manufactory is unlikely in the light of what we know of the organization of the Middle Assyrian crafts (cf. Jakob 2003). It is therefore unlikely that pottery production was organized in a manufactory in Sheikh Hamad or elsewhere in the Middle Assyrian empire. On the other hand the *standardization* of the products, an aspect of Middle Assyrian pottery that is often seen as typical, is mentioned by Peacock not in his description of manufactories but in his discussion of individual or nucleated workshop organizations (Peacock 1982: 6-11). So, how was pottery production organized in the Middle Assyrian empire?

Since Pfälzner’s work is the only extensive study so far that explicitly deals with production organization of Late Bronze Age pottery in Syria, it is often quoted in other publications on Middle Assyrian pottery, and the verdict that Middle Assyrian pottery was mass-produced in manufactories has started to lead a life of its own (most recently Schneider 2006:392). However, as is clear from the above, many aspects of the organization of pottery production still need to be studied in detail. The material from Sabi Abyad offers the opportunity to do so.

V.2 Studying the organization of pottery production

The organization of pottery production can only partly be studied by looking at the ceramics themselves, including the study of raw materials, manufacturing techniques, vessel form and decoration. Ideally, information is also needed on the natural environment, climate and available raw materials; the number, title, status and sex of the potters; the number, size and spatial arrangement of production facilities within a site and/or a region; the technology, scale, seasonality and intensity of production; the existence of labour divisions; the consumers or market and the distribution of the products; craft specialization; standardization, function and quality of the products, as well as the organization of society in general and the position of the potter in it, and the degree of administrative control over production (Annis 1996;

⁵³ However, unfired pottery fragments have been found at Sheikh Hamad (Schneider 2006: 394, sample nos. 1834, 1863, 1864, Tabelle 2). It is likely that these come from the “Governor’s Palace” building P (but from the table it is not clear from which room or stratum). If so, this would suggest that pottery production could have taken place in the building or nearby.

Peacock 1982, Rice 1987: 168-206, 1989; P. Arnold 1991; Costin and Hagstrum 1995, Costin 2000). This approach, originally part of a direction in ceramic studies named “ceramic ecology” (Matson 1965, Rice 1987: 314-17, P. Arnold 1991), wants to study ceramics not so much from the culture-historical or chronological point of view. Instead, it tries to place the production and consumption of ceramics in a larger environmental and social context.⁵⁴ Next to the study of the ceramics on various analytical levels, the study of other archaeological, contextual and historical data must therefore be included.

The study of the organization of pottery production involves the study of the relations between the potters, the production location and the users of the pottery (Annis 1996: 143). Some aspects may be studied in the archaeological record, for example when a workshop or kiln has been found. Other questions may be answered by studying the products themselves, for example to establish what kinds of techniques were used. To establish the links between the information on tools, workshops, techniques, etc. on the one hand and inferences on how the production might have been organized on the other hand models can be used to guide interpretation.

Such models have been developed mainly on the basis of ethno-archaeological observations (Costin 2000). Different ways of organizing production are classified in a number of types or *modes* of production. They are summaries of the aspects of organization encountered in contemporary pottery workshops. Often the models list increasingly “complex” modes of production, while we recognize that the actual situation may not completely fit any of the types, that it may show an overlap of different types or that several different production systems were in use in the same area at the same time (for an example of the latter, cf. Annis 1996). It is therefore important to retain a certain flexibility in using a model. The models make use of different variables (e.g. location of production, part of the total family income generated by pottery production, etc.). For each production type it is listed what the state of each variable usually is. It is tried to include especially those variables that can be recognized in the archaeological record. Then, by looking at the archaeological record and by trying to assess what the state of these variables is, the model is used to formulate hypotheses about the organization of ancient pottery production. Ideally, several different cases of production are compared with each other. This is because terms like “degree of specialization”, “intensity” and “scale” are basically relative terms and not absolute ones. So, a production system could be “large-scale”, but this term is meaningful only when compared to other systems of a different scale (Costin 1991).

Several fairly similar models have been developed in the past years, based on ethnological, archaeological and textual data. Each model has its own particular focus (e.g. Peacock 1982, Rice 1987, Costin 1991, Costin and Hagstrum 1995, Pfälzner 1995: 27-30; for a critical discussion of the use of these models see P. Arnold 1991). It is useful here to familiarize the reader with some frequently used terms in archaeological and ethno-archaeological literature on (pottery) production organization. The model that is perhaps quoted most in Near Eastern archaeology is the one presented by D. Peacock (1982: 8-11), based on his study on pottery production in the Roman world. He distinguishes eight modes of production, described below. Table V.1 summarizes his model, with adaptations by Rice (1987) and Pfälzner (1995).

Household or domestic production

In this mode of production each household makes its own pottery. Vessels are only produced when the need arises, so the frequency of production is low (once a year?) and the output per

⁵⁴ I want to stress here that this study is not envisaged as a “ceramic ecological” study in the traditional sense of the word, limiting the analysis to environmental or functional restraints that determine the outcome of the potter’s efforts (cf. Gosselain 1998). Rather, I advocate a multi-dimensional approach incorporating as many sources of information as possible, to arrive at a deeper understanding of the work of the potter and the functioning of Middle Assyrian society.

potter small. The producers are mostly women. The technology is simple; pots are often handmade and fired in open fires.

Household industry

In this mode of production the first evidence for craft specialization becomes visible. Potting is a part-time or seasonal activity next to other subsistence activities, and involves skilled potters. Products are sold for profit to consumers outside the private household, and potting is often a substantial but secondary source of household income. A household industry is often seen to emerge *in situations* where the normal family income does not suffice, for example when agricultural yields are meagre. Production is mostly the task of women, and the technology is still simple although a turntable may be used. Vessels are fired in an open fire or a simple kiln or oven.

Individual workshop

The main difference with the household industry is that in the individual workshop potting is the main source of income. This is often difficult to establish archaeologically. Pottery production can still be a part-time or seasonal activity, next to, for example, agriculture. Since it has become economically important, the craft is practised mainly by men. There is more investment in technology and the fast wheel and professional kilns are expected to have been used. Usually the workshops are isolated, and the production is oriented towards a market. The potter may work alone or employ a small number of assistants, most likely members of his own family.

Nucleated workshops

In this type several individual workshops are located together. This may be for reasons of availability of materials, labour, and markets or for the economical use of kilns. Potting is now a major source of income, mostly practised by men and year-round if possible. Other sources of income may be present, but are all of a secondary nature. All available technological aids are used. The products are often fairly standardized and of a high quality. There is both cooperation and competition between workshops. The scale of production is large and this can attract middlemen who distribute the pottery over wide areas.

In both individual and nucleated workshops there is often a division of labour: there is a master potter, there are people for preparing the clay and finishing the vessels, and boys or untrained workers for treading the clay, turning the wheel and performing other tasks. The workshop layout shows a clear division into different activity areas for shaping, drying and storage, as well as living areas (Rice 1987: 184, Annis 1988).

Manufactory

Manufactories are large production facilities in which a number of professionals produce a single often highly specialized product. The production process is divided into many different steps, and workers specialize in one of them. The distinction between the manufactory and the large workshop is for the rest mainly to be found in the scale of the enterprise: D. Peacock suggests that we speak of a manufactory if the workshop contains more than 12 workers. Archaeological evidence for a manufactory will include the size of the production facilities, the degree of specialization in the products, the scale of the output and evidence for individual worker specialization.

Factory

The factory typically is a large-scale enterprise that groups specialized workers in a special building. Above all, a factory makes use of machinery driven by something other than human or animal force. Therefore this mode of production falls outside the scope of this study of Middle Assyrian pottery production.

Estate production

The distinguishing factor in this mode of production is the organization by, dependence on, and orientation towards the estate. To avoid unnecessary expenses, all possible products are produced by the estate itself. The organization of production on an estate was meant to fulfil internal needs, but could partly be oriented towards an external market as well.

The organizational shape of this mode of production can vary. Sometimes it is comparable to the household mode of production, sometimes to a more complex workshop organization. Although Peacock (1982) suggests that ceramic production of this kind would mainly have involved brick production, the production of pottery or any other commodity could have been organized along similar lines just as well.

Military and official production

Military production seems to have taken place especially when local production in a newly conquered area could not meet the demands of the garrison. It is expected that military production would be organized very efficiently, using the available manpower as economically as possible. In that way, the same people could be employed for other, more specifically military, tasks as well when necessary. Production would show signs of efficient planning. Technologically it would use the best available methods.

Municipal and state organized productions are also grouped under this mode of production. The organization of state production may vary. Sometimes it may have been organized under very strict control, while the produce was destined for official use only. In other cases, the work could have been left to an independent producer while the produce was delivered or sold to the state as well as perhaps to private persons.

Most important in distinguishing estate production as well as military/state production from other modes is that the production organization as well as the destination of the produce is controlled by the estate, army or state administration. The potters are then “associated” specialists or “administered” specialists. The word “attached specialists” (Rice 1987: 186, Costin 1991: 6, 7) cannot be used here, because it has been reserved for a specific type of association with the authorities in which luxury, status or elite items are produced, and not the day-to-day pottery vessels (cf. Stein and Blackman 1993: 50).

An example of a model with a different focus is the one developed by C.L. Costin (1991, and Costin and Hagstrum 1995), using eight types of production organization based on four parameters. The four aspects that describe how production is organized are:

1. the context of production (the nature of elite or government control over production)
2. the concentration of production (the degree of nucleation of the production facilities within a region)
3. the scale of the production units (from small kin-based production to factories)
4. the intensity of the production (from part-time to full-time production)

The eight types of production, taking into account these four parameters, are (Costin 1991:8):

Individual specialization

Autonomous individuals or households producing for unrestricted local consumption.

Dispersed workshop organization

Larger workshops producing for unrestricted local consumption.

Community specialization

Autonomous individual or household-based production units, aggregated within a single community, producing for unrestricted regional consumption.

Nucleated workshops

Larger workshops aggregated within a single community, producing for unrestricted regional consumption.

Dispersed corvée

Part-time labour producing for elite or government institutions within a household or local community setting.

Individual retainers

Individual artisans, usually working full time, producing for elite patrons or government institutions within an elite (for example a palace) or administrative setting.

As we shall see in this chapter, the organization of pottery production at Tell Sabi Abyad does not completely and neatly fit any of these types. Any reconstruction of production organization needs to use models in a flexible way. However, these two models are still useful because they clarify what is meant by terms like “individual workshop” or “individual specialization”. These and other models help in thinking about the relations between artefacts and workshop layouts on the one hand, and patterns of social organization on the other. Also, they indicate what kind of evidence may be useful for the reconstruction of production organization. Basically, all information on the different aspects that determine how ceramic production was organized can be gathered by trying to answer five basic questions (Annis 1996:143):

1. Who produced pottery?
2. Where was pottery produced?
3. How was pottery produced?
4. What was produced?
5. Whom was it made for?

In this chapter these questions are addressed for the material from Tell Sabi Abyad.

<i>Mode of production</i>	<i>Location</i>	<i>Frequency and income</i>	<i>The potters</i>	<i>Labour division</i>	<i>Technology</i>	<i>Variability</i>	<i>Scale</i>	<i>Distribution</i>
Household production	Private household	Occasional or seasonal, no extra income	Mostly women	No	Simple, no wheel or kiln	High	Small quantities	Private household
Household industry	Private household	More regular or seasonal, small income through sale	Mostly women	No	Simple	High	Small surplus	Private household and others within the community
Individual workshop industry	Workshop with inner spatial divisions, isolated	Part time or full time, major family income	Mostly men	Yes	Wheels, kilns	Standardized or serial production, and special shapes	Medium to large	Markets and peddling, local and regional
Nucleated workshop industry	Several workshops in one location, workshops with inner spatial divisions	Full time, major income	Mostly men	Yes	Wheels, kilns, high technological investment	Standardized or serial production, and special shapes	Medium to large	Markets and middlemen, local and regional
Manufactory	Specialized manufactory, large scale	Full time, profit oriented	Large number of workers under a supervisor	Yes	Complex, often specialized in one product	Standardized production, high worker specialization	Mass production	Very wide distribution , supra-regional
Estate production	On the estate premises	Full time or part time, not for profit	Mostly men	Most probably yes	Wheels, kilns	Standardized and functional?	Medium to large	Estate
Military or official production	On military or state premises	When possible part time, not for profit	Mostly men	Yes	Efficient use of technology	Standardized and functional?	Medium to large	Military organization or state institution

Table V.1: Overview of the different modes of production after Peacock (1982: 8-11), Rice (1987: 183-186), Pfälzner (1995: 27-30).

V.3 The natural environment of pottery production

To understand the environmental possibilities and limitations of pottery production at Sabi Abyad, it is necessary to look into the environment and climate at the site in more detail than was done in the introduction in Chapter I. The environment and climate strongly influence the availability of raw materials and fuel and the possibilities for year-round production (Rice 1987: 314-17). The available raw materials in their turn influence the possible techniques of shaping and firing, as well as the properties of the end products (Van As 1984, Rice 1987: 226).

Geology, and sources and properties of raw materials

Sabi Abyad is located in the Balikh Valley, which runs north-south from 'Ain el-Arus on the Turkish border in the north to the Euphrates River in the south. The river valley is bordered by "low rolling hills of Tertiary limestone and gypsum, with occasional expanses of Pliocene marls and related deposits" (fig. V.1; Wilkinson 1998a: 152). These are locally covered by Pleistocene gravel and sandy silt deposits (Boerma 1988: 1-2). The river valley itself is covered with Holocene fluvial deposits of calcareous silts and some gravel, that have developed into calcareous, clayey soils covered with sandy loam (Boerma 1988: 2, 6; also Schneider 2006: 391; Van Daele 2005: 25).

The Balikh flood plain is between 4 and 6 km wide. The river itself is only about 6 m wide and meanders heavily. In rainy seasons a number of swampy areas occasionally form alongside the river due to flooding (Akkermans 1993: 15-20). Several perennial side streams contribute to the Balikh, as well as many wadis that only flow after heavy rains. The long wadi al-Kheder drains most of the eastern plateau and joins the Balikh just south of Sabi Abyad, carrying its own alluvial deposits (Wilkinson 1998a: 152-4). Although the Balikh River frequently changed its flow channel, it does not seem to have been very close to Sabi Abyad in Middle Assyrian times. Certainly from the Bronze Age on it flowed west of Tell Hammam, about 5 km west of Sabi Abyad (Wilkinson 1998a: 154). Clay sources therefore seem to have been present throughout the river valley, although it will probably never be known where the clay for the Middle Assyrian pottery was mined exactly. Sandy deposits can be found along the river or in the river valley, while gypsum and calcite would have been present on the higher terraces. Water could be fetched from the river or from wadis in the rainy season, or could be taken from wells dug to the groundwater (between 4 and 9 m deep, sometimes less; Boerma 1988: 6).

Local clays in the Balikh region, as elsewhere in the Jezira, are marly or calcareous, containing a percentage of CaO between 10% and 30% (Duistermaat and Schneider 1998:93, Schneider 1994, 2006). This is due to the geological formation of clay beds in the Jezira: the rivers Balikh and Khabur cut through limestone terraces and deposit marly clay as a sediment. The composition of local clays used for pottery production at Sabi Abyad, as determined by X-ray Fluorescence analysis, is illustrated by the composition of unfired pottery fragments from the Middle Assyrian workshops in square M11 at Sabi Abyad (level 5 East, see Table D.1 in Appendix D, samples V404-V407). These are very well comparable to that of a modern clay sample collected south of Tell Hammam near the place where a small bridge used to cross the Balikh River (sample 1744) and to unbaked-clay jar stoppers and sealings from prehistoric levels at Sabi Abyad (published in Duistermaat and Schneider 1998), proving that local clays were used to make pottery at Sabi Abyad. Clay samples from the Khabur and Tell Sheikh Hamad (in Schneider 1994, 2006) show that, although the Sabi Abyad clays are not exactly the same, the differences are small and clays all over the Jezira are very similar.

The properties of these clays influence the production and firing processes and the qualities of the fired product.⁵⁵ In order to evaluate the properties of local clays in pottery production, the Department of Pottery Technology at Leiden University collected several samples of clay from the modern Balikh River bed⁵⁶ in 1996 and tested them for workability.⁵⁷ In 2006 the Department studied two samples of unfired Middle Assyrian pottery from the workshops at Sabi Abyad. The clays proved to be not very plastic (they are “short”), but with good firing properties. They showed a drying shrinkage more or less equal to their total shrinkage after firing at 700°C, between 6 and 10%. A shrinkage of more than 5 to 7% will lead to cracks during drying and firing, which can be prevented by adding additional temper. The leanness of the clay also leads to tearing during forming, especially when throwing vessels from one piece of clay or from the cone. To reinforce the structure of the clay body, up to 15% of organic material can be added (cf. the report in Appendix D. See also Nieuwenhuyse 2006, Franken and Van As 1994: 508). Organic inclusions can also be added to make a more porous fabric, yielding lighter vessels that, for example, cool water more effectively (Schneider 2006: 393). The organic material could be chaff or chopped straw, or dung from cattle or sheep. In the latter case the dung also increases the plasticity of the clay, making it easier to shape vessels on a fast wheel (Van As and Jacobs 1992: 535-536; Franken and Van As 1994: 508).⁵⁸ Other temper was not needed to produce a workable clay, and the analyses presented in Appendix D indeed confirm that normally the potter added no other inclusions.

The available clay resources put limits on the maximum firing temperatures that can be reached. Kiln temperatures higher than about 1100-1150 °C will cause the clay to vitrify and fuse, yielding kiln wasters (Schneider 1994: 103; 2006: 399-400). In firing calcareous clays care has to be taken to reach the right temperatures for a long enough period, to prevent the risk of *lime spalling*. When pottery is fired at about 750-850°C or above, the calcium carbonate in the clay decomposes to form calcium oxide. When the vessel has cooled off, the calcium oxide starts to absorb moisture from the air, forming calcium hydroxide which has a larger volume than calcium oxide. Especially when the calcium particles are large, this causes serious damages or complete crumbling of the wall. At the surface of the vessel, this feature is recognizable by a conical hole created by the expanding particle, with a white grain in the middle. The problem can be solved by firing below about 750°C or above about 1000°C or by firing in a reducing atmosphere (Rice 1987: 98, Rye 1981: 114). Apart from controlling firing temperatures and circumstances, this problem can also be solved by adding salt or salty water to the clay, which lowers the temperature at which the clay starts to sinter. This was apparently done by the modern potters in Buseira near the Euphrates river, Syria (Schneider 1994: 103; 2006: 395; Rice 1987: 119), as well as by modern potters in North Africa (Hudson 1997: 136), but not by potters in Qamishly, northern Syria, where the clay already contained enough salt of its own (Taniguchi 2003: 146). The thin-section analyses of sherds from Sabi Abyad suggest that a certain amount of salt may occasionally have been present in the clay, creating a “salt effect” (see Appendix D; none of the sherds analysed in thin section showed lime spalling). However, neither petrographical nor chemical analysis can prove whether any

⁵⁵ A description of the properties of the Balikh region clays, or of the chemical composition of the pottery found at Sabi Abyad, does not tell us anything about what the potter knew about the clay composition or clay properties, how the potter chose his clay and what characteristics he was looking for in choosing a clay bed (Van As 1984: 143-144). It can only give us some information on the technical possibilities and limitations of local clays, to further our understanding of the choices the potter had to make in shaping and firing.

⁵⁶ Villagers in the nearby village of Hammam et-Turkman claim that their mothers and grandmothers used to fetch clay from the Balikh to make pottery at home.

⁵⁷ These tests were organized within the framework of O. Nieuwenhuyse's PhD thesis on the prehistoric ceramics of Tell Sabi Abyad (Nieuwenhuyse 2006).

⁵⁸ Cuneiform sources from Sumerian and Old Babylonian periods seem to mention only the addition of straw or chopped straw, and do not mention dung (Sallaberger 1996: 14).

salt was added on purpose, or whether salt was naturally present in the clay or water used by the potter at Sabi Abyad. Texts tell us hardly anything about the price of salt in Mesopotamia in general (cf. Potts 1984: note 94) and we have no information relating specifically to Middle Assyrian times. Salt is not mentioned in the cuneiform texts from Sabi Abyad.⁵⁹ If salt was expensive or hard to come by, it is unlikely that the potter would have added substantial amounts of it to his clays. However, salt seems to have been rather commonly available in salines all over the northern Mesopotamian region (Potts 1984), and perhaps the Balikh river itself or nearby wadis contained slightly brackish water. Perhaps the potter was aware of the salt effects and selected clays with a naturally high salt content from particular locations. Or it is also possible that brackish water was preferred for pottery production because sweet drinking water would be more difficult to obtain in these arid regions.

The gypsum or lime used for repairing small cracks in the pottery after firing and the coarse crushed calcite used for the surface of rough platters (see below) was most probably also obtained in the immediate surroundings of Sabi Abyad, although perhaps a bit further away on the terraces. Bitumen, used to give vessels a watertight coating and also used to repair cracks after firing, must have been imported from further away. The closest sources of bitumen are located in Jebel Bishri in the steppe west of the southern Euphrates valley in Syria.⁶⁰ The bitumen used as decoration on the prehistoric pottery from Sabi Abyad came from Zakho or Kirkuk, both in North Iraq and at a distance of approximately 500 km (Nieuwenhuys et al. 2003). Although the bitumen found on the Middle Assyrian pottery was not analysed, several samples of bitumen used in Middle Assyrian architecture (where it was used to create watertight seams between floor tiles) indicate that in this period, too, the bitumen was imported from Northern Iraq.⁶¹ It is most likely that the potters at Sabi Abyad did not go to fetch the bitumen themselves, but that it was sent to the site through the Assyrian administrative networks.

Climate and vegetation

The area around Sabi Abyad has a dry, steppe-like climate that has not varied much over the last 6000 years (Boerma 1988: 9). Rainfall per year is low (around 250 mm annually). In the summer, between June and November, no rain falls at all, while in the rest of the year the mean rainfall per month and per year varies greatly. Most rain falls in heavy cloudbursts (Boerma 1988: 2). Consequently, even the winter is characterized by periods of dry weather. Summers are hot, with mean summer temperatures around 30°C (average maximum 39°C), while the mean winter temperature is about 8°C. The prevailing winds from March to October are westerly, while the winter months show predominantly easterly winds (Boerma 1988: 2 and table 1), possibly influencing the location of workshops in a settlement. Rainfall and temperature influence the possibilities to make ceramics. From late spring to autumn potting would have been very well possible at Sabi Abyad. The only concern would be to keep the pots in the shade while drying, because drying too quickly in the sun can cause cracks. In the winter potting would probably still have been possible, with the exception of drying on rainy days (cf. Rice 1987: table 10.1). It would have been less comfortable to work outside in the cold and damp weather, and vessels would have taken much longer to dry. Therefore a large indoor-area would have been needed for working, drying and storing fuel and clay. Firing would also have been less easy in cold, damp weather. Ethnographic studies of traditional potters in Syria and the Eastern Mediterranean show that potters in this part of the world

⁵⁹ Personal communication by F.A.M. Wiggermann, 9-10-2005.

⁶⁰ These bitumen mines are still exploited in modern times for road-building (Van Daele 2005: 125).

⁶¹ Personal communication by e-mail of J. Connan, 21-3-2006.

usually only work between April and October (e.g. Taniguchi 2003, Ionas 2000, London 1989a, b, Bresenham 1985, Hankey 1968).

Another consideration concerning the climate would be the interference of craft production with the agricultural season. This is especially important when potters were not working full time, but spent some of their time in agriculture as well. Sabi Abyad is situated just at the margin of the area where rain-fed agriculture is possible. Crops that depend on rainfall would have to be winter crops, to be harvested around May (Akkermans 1993: 24-25). Rain-fed agriculture was supplemented by the cultivation of irrigated crops. Irrigation took place with the help of channels diverted from the river or from wadis (Wilkinson 1998a, b). The existence of irrigation at Sabi Abyad is not only clear from the cuneiform texts, but also from botanical material. The presence of high-quality wheat which (unlike barley) demands well-watered conditions is a strong indication for irrigation practices. Next to winter crops and irrigated crops, there were also gardens around Sabi Abyad where summer crops like sesame and cress were grown in large quantities, as well as some herbs (Wiggermann 2000:177-178). Gardens need regular attendance most of the year. The bulk of agricultural production, however, was grain. Craft producers other than potters working at Sabi Abyad probably received rations, and possibly also had their own sustenance fields and some animals to supplement their income (Wiggermann 2000: 190). It is not expected that craftsmen were very much involved in the state's grain production, but perhaps they assisted in the harvest. The main labour demand from agriculture therefore seems to be in late spring. However, since potters would not be alone but have their families to assist with any field of their own and any agricultural service, it is expected that they could spend most of their time on the production of pottery as well as have the income of their own field as a supplement (see also below).⁶² In any case, it is expected that potting activities were coordinated with and adjusted to other requirements the potter had to fulfil, to the agricultural (and cultic?) calendar and to the seasons (Underhill 2003: 205-206; Ionas 2000: 211; Rice 1989: 110; Kramer 1985a: 117). Pottery-making would probably have stopped in the coldest rainy months of December-February.⁶³

Generally the landscape would have been more humid than it is now, drained as it is now by extreme irrigation and pumping of groundwater. At the time of the Assyrian occupation of Sabi Abyad, the surrounding lands would have been intensively used for agricultural activities, while parts of the land would temporarily have lain fallow (Wiggermann 2000). Land that was not cultivated would have been characterized by steppe vegetation. Not many trees were present in this landscape. The Balikh flow channel, however, must have been bordered by a dense vegetation of reeds and marsh plants as well as a thin riverine "forest" of some poplar and willow along the river banks (Akkermans 1993: 21). The steppe showed characteristic steppe-shrubs, dominated by *Artemisia herba-alba*, but this plant has now disappeared largely due to grazing, ploughing and fuel gathering. This vegetation was also present in wadi beds (Akkermans 1993: 23-24). The fallow land after harvest and the surrounding steppe must have been perfect grazing grounds for the herds of sheep and goats.

Organic raw materials therefore seem to have been plentiful in the surroundings of Sabi Abyad. Straw and other agricultural by-products like (wind-blown) chaff as well as animal dung would have been readily available to serve as temper material. Straw, animal

⁶² Texts from Ugarit suggest that potters working in royal service there could also be employed in other activities when necessary, such as in agricultural or military work (Heltzer 1996: 279). Perhaps this was also the case at Sabi Abyad.

⁶³ In fact, the seasonality of many aspects of life in agricultural communities results in an idea of "seasonality" or "part-time" work quite different from our western concepts. In describing how pottery making fits the agricultural and religious calendar of activities in Cyprus, Ionas comments: "This temporal distribution of activities did not take into account solely the rhythm of nature and that of the rural buyer, but as well that of the peasant-craftsman who had also to farm his own fields. In that context, it is clear that the term "seasonal craft" did not mean anything for a rural craftsman; it would be as strange to refer to "seasonal harvest" (Ionas 2000:211).

dung, steppe shrubs and agricultural refuse could have been used as fuel. It is less likely that scarce materials like high-quality wood or strong reed would have been used as fuel.⁶⁴

All raw materials needed to produce pottery were readily available at Sabi Abyad, within a distance of some 5 km. Ethnographic studies show that the distance between a production site and the source of the clay is not likely to be very large (generally shorter than 7 km), except when a special clay is needed for some particular reason (cf. Rice 1987: 116). The Balikh River and its tributary wadis in the immediate surroundings of the site are therefore the most likely source for raw materials. Other river valleys (Euphrates, Khabur) are at least 80 km away from the site, and also show a similar geology not providing clays with very different properties.

V.4 The potters at Tell Sabi Abyad and the social environment of pottery production

Access to resources

Nothing is known about any social, religious or cultural limitations to the access to clay and other resources (cf. Rice 1981: 46, 47), although it can be expected that the potter would not just dig for clay at random or in someone's field. He probably had specific opinions as to the place where the clay could best be taken from and the particular properties of that clay. As there are no textual sources from the Middle Assyrian administration dealing with the delivery of raw materials to the potter, his materials would seem to have been freely available. In other periods texts mention the withdrawal by potters of reeds from the "sheep house", probably as fuel for the kilns (Steinkeller 1996: 241-242). Whether the potters in Sabi Abyad also received fuel from officials, farmers or shepherds, or whether they were free to take whatever they could find, is not known. Most probably, the administration (if involved) only dealt with the delivery of the finished products, and left the procurement of raw materials and other necessities (work force or tools, for example) to the potter himself to take care of.

The identity and sex of the potters

Only one of the cuneiform texts found at Sabi Abyad mentions a potter (T93-3, a letter, see Appendix F). In the text Mudammeq-Aššur asks Mannu-ki Adad (who at the time was chief steward at Sabi Abyad) why he didn't send a potter to the brewer in Dunnu-Aššur. Mannu-ki Adad has to send a message to the brewer of Sahlala,⁶⁵ so that he will send beer and vessels to Mudammeq-Aššur for the reception of a group of Suteans (see Appendix F).⁶⁶

⁶⁴ Two samples from the fill of the fire chamber in kilns found at Sabi Abyad contained some charcoal and burnt grains and have been sent to laboratories for analyses to determine the type of fuel. No results have been obtained yet. For detailed information, see the description of the kilns (Appendix C).

⁶⁵ Dunnu-Aššur and Sahlala are the Assyrian names of *dunnu* settlements in the Balikh Valley. Dunnu-Aššur can probably be identified with Tell Abyad on the Turkish border. Sahlala is almost certainly Tell Sahlan north of Sabi Abyad.

⁶⁶ The occurrence of brewers and potters working together to provide for the basic needs of a reception meal can be compared to the co-operation of brewers and potters in Ancient Egypt. On two wall paintings from Saqqara and Thebes pottery production is taking place in association with baking and brewing scenes, indicating that activities involved in supplying basic foods and food containers were located close to each other (Arnold and Bourriau 1993: 75). In wooden models found in Egyptian tombs potters often appear together with carpenters, metal-workers and stone-vessel makers, working together in courtyards or outside (idem: pp. 69-75, fig. 84). In Mesopotamia, too, potters sometimes seem to be associated with food producers, and especially with brewers (Sallaberger 1996: 28,

In this single and very brief mentioning of a potter in the Sabi Abyad texts the personal determinative preceding the word “potter” designates this person as a man. We have seen above (V.2) that in ethnographic cases the craft is usually carried out by men whenever potting becomes economically interesting.⁶⁷ The Sabi Abyad potter is not mentioned by name, so his identity or ethnicity is unknown.

There are few other Middle Assyrian texts from elsewhere mentioning potters. A potter is mentioned in a text from Billa. Two men, one called Sîn-bēla-ušur and one with an only partly legible name, are mentioned in the personnel lists from Aššur, and are part of a group of *šilublu* people. A text from Tell Chuera mentions a potter who receives a ration of 2 *qû* of barley, normally a ration for two days of work (all in Jakob 2003: 475). These potters are all men. From the earliest cuneiform evidence relating to potters, dating to the Ur III period, evidence for women potters seems to be absent as all potters since mentioned in texts are men (Sallaberger 1996: 27; Waetzoldt 1970-71: 10; see also Renger 1996). It therefore seems likely that at least those persons responsible to the administration for the production of pottery (and therefore likely to be mentioned in administrative documents) were men. This does not exclude the involvement of women and children in the daily work in the workshop.

The number of potters

This single mention of a potter in one text is too meagre to draw conclusions from on the number of people that were involved in pottery production at Sabi Abyad. It is also possible that the administration only dealt with the “master” potter, while he himself employed assistants or was assisted by family members. We shall return below (see paragraph V.6) to the question of labour division in the production process, suggesting that more than one person was involved in the different stages of production. The workshops of level 6 (see below) also show evidence for the use of two potters’ wheels, suggesting that more than one potter was working in the workshops. Ethnographic research suggests that in cases of specialized pottery production “it takes a whole family to produce vessels, not simply the individual who shapes the vessels” (Underhill 2003: 206).

It has been suggested that there were at most about 60 people living inside the *dunnu* precinct as administrative and domestic staff, including families. The staff was headed by the chief steward who was assisted by “ten-men”. The staff included specialists in at least 17 professions including brewers, bakers, singers and hairdressers (Wiggermann 2000: 190). The presence of one or two potters and their families would therefore be in reasonable proportion with the number of other professions compared to the available space inside the *dunnu*.

It is of course possible that more than one workshop contributed to the locally *used and discarded* pottery repertoire that forms the excavated corpus of material. The architectural evidence and the finds so far point to the existence of workshops inside the *dunnu* (see below), but others might have been located outside the *dunnu* or at other nearby sites. If there were different workshops in the area around the site, *and* if their products (or the products from workshops further away) reached the excavated settlement at Sabi Abyad in a sufficient number, this might be visible in a high degree of variability within the corpus, whether in raw materials, techniques or in shapes (Pfälzner 1995: 28, Rice 1987: 203). See below for the discussion of this question (paragraph V.6).

31, Steinkeller 1996: 236 and note 26), but in personnel and ration lists they generally occur amongst other craftsmen (Renger 1996).

⁶⁷ Both Kramer 1985: 117 and Johnston 1977: 179 state that in ethnographic cases where fast-turning kick wheels or stick wheels are used, the potters are always men. The use of a fast wheel at Sabi Abyad is discussed in more detail below.

The social and economic position of the potters

Middle Assyrian texts give the impression that craft production was organized in various ways. Either craftsmen (like the brewer and baker) worked in the service of the temple or the palace or craftsmen would receive raw materials to produce a certain fixed amount of objects, while they probably could spend the rest of their time for private work. Among the latter craftsmen are leather workers, chariot makers, textile workers, etc., but no potters (Jakob 2003: 25-28). Middle Assyrian texts do not mention the distribution of raw material to potters. The texts from Sabi Abyad do not inform us explicitly about the position of potters in the *dunnu*. They are not mentioned in the lists of workers and rations found until now, and the texts are silent about the legal status of professionals in general. However, it might be suggested that the position of the potter would be similar to that of the other craftsmen at the *dunnu*. In that case, the potter(s) could be dependants receiving rations and/or working sustenance fields in exchange for their *ilku* service (cf. potters receiving rations at nearby Tell Chuera, Jakob 2003: 475). It is possible that some of the craftsmen belonged to the *šilublu* (Wiggermann 2000: 174, 190), as is suggested by the two *šilublu* potters from Aššur mentioned above (Jakob 2003: 475).

Ethnographic as well as textual evidence shows that in Mesopotamia the craft of potter was usually a family business, at least before large factories or manufactories were present. The craft was passed on from father to son (Renger 1996: 228, Sallaberger 1996: 26-27, Steinkeller 1996: 249), and assistants would often be family members. In third millennium BC Mesopotamia, even baby boys born into potters' families are called "potter" in ration lists (Steinkeller 1996: 240). This does not necessarily mean that the actual potting was done at home or in a workshop that was spatially part of a household (cf. Annis 1988).

The whole intramural space of the *dunnu* and part of the extramural areas have been excavated by now. Among the well-preserved finds several groups of cuneiform tablets have been found, belonging to the administration of different officials and employees at the *dunnu*. There are texts from the baker, the brewer and the administrative staff, but not from or about the potter. Throughout Mesopotamian history, potters seem to be underrepresented in texts when compared to other craftsmen (Steinkeller 1996: 233-34, Sallaberger 1996: 38).⁶⁸ Although we may not reason from the unknown, the absence at Sabi Abyad of any (indication of) administration about or belonging to the potter does suggest that he did not keep such an administration. This might be due to the fact that the potter had to provide his own raw materials, which were easily available and mostly free of charge. He therefore did not have to account for the receipt of raw materials and the return of finished products like, for example, the baker or the metalworkers (Sallaberger 1996: 23, 38). The *dunnu* administration would only be interested in obtaining the end product, most probably in return for food rations or a piece of land to cultivate.

The situation is perhaps comparable to that of potters in the Ur III-period public households. There the potters were obliged to deliver a certain amount of vessels, and in return they received rations and plots of land. The potters seem to have worked rather independently but affiliated with a state institution. They would provide for their own raw materials and organize their own work. The institution would only acquire the needed pots, and at the end of the year calculate how many man-days the potter had spent working for the institution. There does not seem to have been a direct control over the organization of pottery production (Steinkeller 1996, Sallaberger 1996).

When the rations the potter received from the *dunnu* administration were sufficient to sustain his family and perhaps some assistants, this would mean that potting was his only source of income. However, in comparison with other craftsmen at the site, it is likely that he and his family also worked a small piece of land, which means that there was at least one secondary source of income, while potting would still be the main source (Wiggermann

⁶⁸ For the administration of the work of potters in ancient Egypt, see e.g. Froid 2003.

2000). It is not known whether the potter could produce only for the *dunnu* or was able to sell or exchange his produce privately as well.

V.5 The location of pottery production and the potters' workshops

Ethno-archaeological studies aimed at finding material correlations for production organizations have shown that the location and layout of the workshop as well as the (regional or local) distribution of the products are among the most important indications for production organization (Annis 1988: 47, Underhill 2003). The distribution of the products will be dealt with below (paragraph V.8). Here we shall look into the evidence for the location of pottery production at the site of Sabi Abyad and the use of space by the potters.

Cuneiform text T93-3 (see above and Appendix F) suggests that a potter was resident or at least present at Sabi Abyad in the days of *abarakku* Mannu-ki-Adad (level 6). This is not explicitly mentioned, but from the other texts it becomes clear that the intendant Mannu-ki-Adad had authority solely over the site of Sabi Abyad. A potter that fell under his authority was therefore most probably located at Sabi Abyad.

The local production of pottery at Sabi Abyad can also be deduced from more direct evidence: the finds of unfired pottery, raw clay, wasters, tools and pottery kilns and their relation to the architectural context. Consequently, it is clear that pottery was produced locally, but where at the site? Before we look into this question in more detail, ethnographic and archaeological descriptions of pottery workshops can provide a general idea on how to recognize production areas and what remains we may expect or should be looking for.

Pottery workshops in ethnography and archaeology: what can we expect?

A quick survey of selected literature⁶⁹ dealing with contemporary traditional pottery workshops in the Mediterranean world reveals that there is no uniform layout of the workshop architecture and use of space inside a workshop. Even in highly organized workshops with spaces especially designated for each activity, the potters use space for different purposes when needed. However, there are some aspects of layout and use of space common to pottery workshops in general. Also, M.B. Annis (1988) has shown that there are significant relationships between different modes of production and the use of space, while A.P. Underhill (2003) proved the existence of a relation between the use of space and the intensity, output and scale of production.

Space is needed for the variety of different activities in a workshop, depending on production levels and techniques used: space for the storage of raw clay, temper materials and fuel; for the preparation and ageing of clay and the storage of the prepared clay; for the shaping of vessels, for the drying of half-fabricates and drying of completed vessels (preferably away from traffic and playing children), a firing location (kiln), a general storage area for tools and equipment and for the storage of fired vessels until they are distributed (cf. Anderson 1989). Of course, single rooms and areas can be used for different functions simultaneously, and even in modern workshops the use of a room is not always immediately clear from its layout or features. Depending on the organization of production, workshop activities will be carried out in specially designated areas, or they will be carried out within the general spaces of the household that are used for a variety of other functions as well (Annis 1988). It has been suggested that intensification of production is accompanied by

⁶⁹ Taniguchi 2003, Al-Bahloul and Kassouha 2002, Van As and Wijnen 2001, Ionas 2000, Annis 1996, 1988, D. Arnold 1991, London 1989a, b, Bresenham 1985, Golvin et al. 1982, Peacock 1982, 1981, Hankey 1968. See also the summary presented in Senior 1998: 147-160. For a study of potters in China, see Underhill 2003.

efforts to place more steps of the production process in one space devoted specially to pottery production (Underhill 2003: 206). There is no typical, universally recognizable layout for pottery workshops, but we can expect one or several indoor areas and a courtyard area next to it, as well as a kiln in the immediate neighborhood (but not necessarily attached to the workshop itself).

Raw materials and garbage are seldom left in the production areas. Working areas are regularly cleaned, raw materials are used until finished. Broken or misfired vessels and sherds are not left but used for a variety of purposes, including usage as building material, as part of the kiln construction, as flowerpots or as a pavement. Fired vessels are distributed to their future users (London 1989b: 75-76, Scham 1998/99, Sullivan 1989). Consequently, we will not necessarily find heaps of these materials in our excavations.

Workshops excavated at other archaeological sites may also help to interpret the Sabi Abyad findings. In the pottery workshops of the Late Bronze Age / Iron Age site of Sarepta the spaces where clay was prepared and stored were well recognizable by the layers of clean potters' clay on floors and walls and in the room fill. Ash and sand, also found in the room fill, was interpreted as a parting material used to prevent clay from sticking to the surface while working it. In general, the rooms were rectangular and contained features whose function was not always clear, like shallow circular pits, ceramic basins, rectangular bins made of clay or mud-bricks, lined post-holes, mortars and "single-wheel" emplacements. The basins where clay was stored or prepared were mostly up to 2 m long. Other indications that the excavated buildings were indeed pottery workshops consisted of amounts of raw and levigated clay, piles of ash and sand, fragments of unfired vessels, kiln slag, tools, and waster fragments (Anderson 1987). In the workmen's village of Amarna, Egypt, a long room and courtyard with associated pits could only be interpreted as a pottery workshop area due to the finds of a wheel bearing and unfired vessel fragments (Rose 1989). The Middle Bronze Age remains in Operation J (10-11 and 13-14) at Tell Mishrifeh have been interpreted as a pottery production location, and contained trodden mud surfaces, pottery kilns of a circular (subterranean?) type, pottery slag, kiln wasters and potters' tools, but no associated architecture (Morandi Bonacossi 2002, 2003, in press). The remains of an Iron Age pottery workshop at Khirbet Qasrij in Northern Iraq included rather unspecified rectangular rooms and courtyard spaces (Simpson 1991). The Late Bronze Age pottery workshop in Lachish, however complete, does not give us a lot of clues as to what kind of architecture and spatial layout we could expect to find, as it was located in a system of caves (Magrill and Middleton 1997). The pottery workshop found in Mari consisted of two rectangular rooms, one with a plastered platform against a wall and both with a hearth in the middle. One of the rooms opened upon a courtyard with a pottery kiln and a pit. The pit was interpreted as a wheel pit, with the potter sitting at the edge and the flywheel located at the bottom of the pit (Weygand 1997), but other than the shape of the pit there are no other arguments for identification as a wheel pit. A basalt wheel bearing was found nearby, but not in the pit. In Kassite Tell Zubeidi the rectangular rooms could only be identified as pottery workshops because of the find of several large updraft kilns (Dämmer 1985: 28-31). In Abu Salabikh a building was identified as a "potter's house" because of the find of clay layers, clinker or slag deposits and ash, together with the find of a clay disc identified as a potter's wheel (Postgate 1990: 104).

The correct identification of tool function and use is often problematic in the case of objects used in ceramic production. Potters' tools are often of a very unspecific and *ad hoc* nature and hardly ever show any usage traces or characteristics specific for pottery production tools. Identification then inevitably remains on a very general level. Also we must take into account that many tools made of thread, rope, textile, wood, leather or other organic materials are not preserved in the archaeological record (P. Arnold 1991: 88 and others, see footnote 69). At Sarepta tools found in the workshops are mainly reworked ceramic sherds, used as ribs in the shaping process (Anderson 1987: fig. 19). Other tools may include polishing stones (but note that the pottery from Sabi Abyad was hardly ever polished or burnished), ropes,

knives or blades, bone or metal pins, tubes or other sharp objects for decoration, perforation, and so on, pieces of cloth and water vessels.

The locations of pottery production at Tell Sabi Abyad

The discussion of the location of pottery production and the workshops will proceed for each level as follows: the location of production areas at the site; the location of kilns at the site and in the workshops; the description of the architecture, areas and architectural features in the workshops; and a discussion of tools and other finds possibly used in pottery production. A detailed discussion of the unfired pottery fragments will follow in paragraph V.6 of this chapter, while the kilns are presented in detail in Appendix C.⁷⁰ In this volume only the finds related to pottery production will be highlighted. No evidence for pottery production was found in levels 7 and 3.

The main reasons for interpreting the discussed areas as pottery production locations are the finds of unfired pottery fragments, occurrences of damaged or repaired pottery vessels, several two-chamber updraft kilns and, in level 6, the find of two half basalt potters' wheels. Nowhere at the site, whether in houses or in open areas near kilns, have we found the almost proverbial "piles of wasters" usually thought to be connected to a pottery production location, although single wasters or waster fragments and small fragments of "ceramic slag" have occasionally been found in various spots at the site. At the surface of the site there was no indication whatsoever for the location of kilns or the existence of a production site. This may have some implications for research into production locations using surface survey data.

The level 6 pottery workshops

The earliest evidence for Late Bronze Age local pottery production at Sabi Abyad comes from level 6. As discussed in chapter III, this is the first occupation level built by the Middle Assyrian provincial administration. So, from the start, pottery was produced locally at the site for the community living at the *dunnu*. Moreover, the level 6 workshops are the largest installations for pottery production found at the site so far. Apparently the production of large amounts of pottery was one of the priorities of the first settlers.

The location of pottery production at the site in level 6

Evidence for pottery production was found in squares N10-N13 to O10-O13, the eastern area of the *dunnu* along the moat (cf. fig. III.3 and fig. V.2). Elsewhere at the site in level 6 no indications of pottery production have been found. The workshops in level 6 were located within the *dunnu* settlement (within the confines of the moat), but outside the wall of the fortress.

⁷⁰ The information on the stratigraphy, architecture and features as well as the small finds presented here is based mainly on the internal stratigraphy reports prepared by the Sabi Abyad team (updated to September 2005, Sabi Abyad files), and partly on my analysis of the daily reports of the excavation and the small finds administration. In this and other chapters original square-locus-lot information is added in footnotes for the benefit of those working with the original field notes in the future. Since the analysis of the stratigraphy and the architecture as well as the small finds is still in progress, the results presented here are not final and may have to be adjusted once final reports and spatial analyses become available. For this reason also, sketch plans of the architecture are used instead of detailed plans. In the same manner, I will assume that the findspot of an object is related to the use of a space at least in a general manner, in the absence of detailed reports on deposition and formation processes and contextual analyses.

Level 6 workshop architecture

The level 6 architecture in this area formed a densely built quarter along the moat that surrounded the settlement. Buildings were simple, made with rather thin walls. The quarter consisted of a series of rectangular longdrawn rooms with doors towards the west. To the west of this line of rooms architecture included more rooms, open spaces and small streets or courtyards, including the kilns (fig. V.2). West of this complex was the thick wall that surrounded the inner living and working spaces of the Middle Assyrian fortress. The kilns were located between the workshops and the fortress. Their location to the east of the fortress kept the fumes and smoke from the firing away from the settlement during the summer months when westerly winds predominate. The many and varied finds suggest that the area between fortress and moat was used for a variety of functions, including craft production as well as domestic activities, as is indicated by a multitude of features and small finds not directly related to pottery production (Akkermans in prep.).

Kilns

Two large updraft pottery kilns were constructed on the first level 6 surfaces: kiln Q in N11 and kiln L in N12 (see Appendix C for a detailed description). The two kilns were probably constructed at more or less the same time directly on or in the Neolithic tell surface, but this is not completely certain. At a later stage a third kiln (H) was probably constructed to the south in square N13 (most probably early in level 5). It is possible that with the construction of each new kiln the earlier kiln was no longer used, but this cannot be stated with certainty at the moment.

The first kilns built at the site were also among the largest. The outer structure of kiln Q (figs. C.1-7) was at least 2.95 x 2.10 m, the pottery floor is estimated at approximately 4 m², while the fire chamber had an estimated volume of around 5 m³. From the descriptions of kiln Q it is clear that it was replastered at least four times: four two-centimetre thick layers of plaster have been applied to the inside of the fire chamber, and fired in alternating green and bluish green colours (figs. C.6, 7). The area immediately surrounding the kiln (between the kiln and wall G) was not excavated further and probably did not reach depositions related to the use of the kiln, but the open area south and west of the kiln was. Here, in N11, the deposition was brown-grey in colour, with lime spots. Sometimes the colour was grey-light-brown or greyish black, there were some ash pockets and charchoal parts and traces of burned reeds (remains of kiln fuel?). Several times “slag” and pieces of baked bricks or “oven wall” were found, possibly from renovating the kiln. Unfired ceramics were found in these deposits,⁷¹ as well as in the upper kiln fill (deposited after the kiln had gone out of use). Other finds are some grinding tools, pottery vessels, lots of sherds and two damaged small stone axes (possibly reused prehistoric artefacts), but none of them point specifically to pottery production. A baked clay wedge (fig. V.7: O03-105) was found in the open area south of kiln Q, and two similar objects were found elsewhere in the level 6 workshop area and one in a level 5 kiln. These wedges may have been used in the kiln to stabilize the kiln load (as for example in Beit Shehab, Lebanon: Hankey 1968: 30; cf. also Zoroğlu 2000: fig. 3). After kiln Q had gone out of use, the upper structure was taken apart and levelled. Now the area was used for several smaller bins and ovens, protected by a curved courtyard wall (wall G, fig. V.6).

Kiln L was most probably constructed only after the northern door to the small courtyard in square N12 had been blocked (fig. V.5, and figs. C.8-10). It could then be argued that kiln L was not built directly at the start of the occupation in level 6 and the building of the courtyard wall, but a little later. It is as yet unclear whether kiln Q was still in use at this time. The courtyard had a *tannur* oven built in the southern corner, next to a door with a doorsocket. The courtyard was part of the workshop complex to the east. Kiln L was therefore built in a more confined and protected space within the workshop areas, whereas kiln Q seems

⁷¹ Loci 37, 40, 41, 42, approximately between elevations 324.90 m and 324.48 m.

to have been built standing alone in the open area between the workshops and the main settlement. Although about 1.5 times smaller than Q, kiln L was another very large kiln (see table C.1), but the remains are less well preserved. The fill in the courtyard around the kiln on floor F consisted of ashy grey deposits with charcoal parts, some mud-brick debris, and some carbonized reeds (remains of kiln fuel?).⁷² In these deposits a lot of objects were found, some of which are possibly related to pottery production. Apart from many ceramic vessels, fragments and sherds, there were four grinding implements, four smooth flat stones perhaps used as palettes of some kind, a longitudinal stone tool, and two bone or horn tools. Other finds include two baked-clay model wheels, a faience bead, a stone axe and a fragmented bronze bracelet. The surface of the outer area and street west of the courtyard seems to be quite a bit higher in elevation than the surface of the courtyard itself. Deposits here⁷³ were ashy soft grey and brown soil. Unfired ceramics were found in the fill of the kiln, and in the fill just south of the courtyard walls. They include a variety of vessel rims (including rim types 315, 212, 113 and 111), many body sherds and a goblet neck with incision, and more than one kilogramme of kneaded lumps of unbaked clay. After kiln L had gone out of use, the structure was used as a tomb for a (Middle Assyrian) burial. Finally kiln H was built in square N13, dug from a surface that is probably no longer preserved, most probably from level 5.

In conclusion we may say that the kiln evidence perhaps points to two main phases of production in level 6, one connected to the use of kiln Q and one to the use of kiln L, but they may have been used simultaneously or alternatingly over a longer period of time as well, without any clear-cut phase divisions. The find of unbaked pottery in the upper fill of kiln Q suggests that the workshop was still producing after this kiln had been abandoned. Kiln H seems to be later. All three kilns are among the largest found at Sabi Abyad so far, while kiln Q is the largest of all. Contrary to level 5, where smaller kilns were used next to large ones, no small kilns have been found in the level 6 production area. It therefore seems that throughout level 6 there was a steady need for large firing facilities. Around the kilns the deposits were sometimes ashy, but no large heaps of kiln refuse, ash, or wasters have been found either near the kilns or elsewhere in the production area. This could point to the deposit of garbage elsewhere at the site (perhaps in the moat?) and a regular cleaning of work-spaces. Perhaps the ashes in the fire chamber were not removed at all (or not completely). It could also indicate a generally low rate of firing losses and waste production.

Workshop architecture and associated finds

The rooms and spaces east of the kilns contain more evidence for pottery production, the most interesting finds concentrating in room 1 in square O12, room 2 in squares N12, O12, N11 and O11, and room 3 in O11 (cf. fig. V.2). Here the level 6 workshops were located.⁷⁴

Room 1

Room 1 was situated directly along the moat (fig. V.4). Wall E was the original eastern wall, but soon after wall S was built, making the room a bit smaller, now measuring 5.4 x 3.25 m (17.55 m²). Against the southern wall a mud-brick bench (AD, at the top of fig. V.4) was placed, and at a certain point during the accumulation of fill and objects in the room a square plaster bin (Q) was built against the southern wall.⁷⁵ Most finds connected to the pottery workshop were found in the medium-hard light-brown fill and on the floor, between the

⁷² Loci 24, 25, 26, approximately between elevations 325.02 and 324.60.

⁷³ Loci 17, 18, approximately between elevations 325.25 and 325.02 (floor F).

⁷⁴ From the field day-notes and stratigraphy it becomes clear that the architecture in level 6 was of an “organic” nature: small alterations and additions took place constantly, hampering the division of material into sublevels at the time of writing.

⁷⁵ The stratigraphy of this room suggests that there may have been two, or perhaps three, phases in the level 6 use of the room.

elevations of 324.33 and 324.64. Finds indicating that the room was part of a pottery workshop included unbaked pottery fragments, fragments of wasters and a complete but partly vitrified jar, and several tools including two basalt wheel bearings.

Four shallow plastered hollows were dug out into the floor (Y, Z, AA, AB). They were between 0.27 and 0.35 m in diameter and 0.10-0.15 m deep. Three of them were plastered with white lime plaster. They were filled with soft ashy brownish soil, containing small sherds and pieces of unbaked clay. They may have been used in pottery production, for example to hold the bases of large jars or large storage pots while the potter was building the upper wall. It is also possible that (some of) the shallow pits served as bases for the lower part of the pottery wheel (see below). In front of the brick bench AD and in front of J there were concentrations of small white pebbles. Bench AD is only two mud-brick courses high.

An unfired base of a large storage pot was left against the southern wall in the corner of the room (J, visible in the top of fig. V.4).⁷⁶ A large pottery jar of which the rim had broken off (fig. IV.32.a, P03-384) was placed against wall S. It contained many small coloured stones. Another, similar, jar without a rim (obj. 212) was placed against bench AD. Next to AD a pot (obj. 172) was standing in the little niche. In the middle of the room a large, heavily overfired and collapsed jar (P03-285, fig. V.53, V.4) was lying on the floor. More than a hundred smaller and larger bowls lay scattered on the floor and in the fill, most of them upside down. It seems as if they were part of the potter's production stored in this room, mostly in the south-eastern corner of the room and away from a route leading from the door to the back of the room in the north (fig. V.4).

The fragments of unfired pottery found in room 1 were concentrated in the eastern part of the room, against wall S. They were mainly fragments (disc shapes) left over from the production of bowls and goblets (see below, paragraph V.6), pieces of kneaded clay and wall fragments of a large, hand-built basin. Apart from unfired ceramic fragments, a small unfired-clay model wheel (O03-222) was found as well. Apparently, the potters did not only make vessels, but other objects as well.

Apart from the large waster jar P03-285, no overfired ceramics were collected from room 1. However, in the day-notes it was observed several times that large fragments of grey/green overfired ceramics have been found, especially near the unfired pot J.

In room 1 two basalt upper halves of a potter's wheel have been found. The lower parts were not found. Perhaps these lower parts were taken elsewhere to be reused, as door-pivot stones for example. One of the wheel bearings (fig. V.8, S03-608) was found north of the doorway to room 2 in the roomfill, at an elevation of 324.58. It is 15.7 cm in diameter and 8 cm thick and made of a dark-grey fine basalt. The side with the pivot is very smoothly polished by the rotational movement. The other side is flat and rough, with rests of bitumen⁷⁷ sticking to it. It has an irregular depression slightly out of the centre. The bitumen was most probably used to fix a larger wheel head to the wheel bearing. The second wheel bearing (S03-764) was found in the niche next to bench AD, near the doorway to room 2, at an elevation of 324.43 near floorlevel. It is 15 cm in diameter and 8.4 cm thick, and made of grey basalt. The side with the pivot is very smoothly polished by the rotational movement, the pivot itself, however, is less polished. This side also shows some damages. The other side is irregularly convex and smooth.

⁷⁶ J was first thought to be an oven or bin, then later it was suggested that it could be a pit lined with a thick layer of clay. Both in the field and during the stratigraphy work, uncertainties about the nature of J persisted. On the field photographs, however, it seems clearly to be the (unbaked) base of a large storage pot. Another large fragment of an unbaked storage pot may be represented by locus 35 lots 83, 84, 94. In the field it was thought to be a pit, but there was a lot of uncertainty. It was noted that the "pit" had a border of hard clayey material, as if it was lined, and it got smaller lower down. However, the descriptions in the day-notes are too unspecific to conclude that this "pit" may have been a fragment of unbaked pottery like J.

⁷⁷ A sample (O12 sample no. 3) was taken of the bitumen, but has not yet been sent for analysis.

Other tools found in room 1 are much more difficult to recognize as possible potters' tools. There were twelve ground-stone tools (grinders, grinding slabs, pestles and hammers) of the kind found in large numbers everywhere at the site. There were two flat smooth stones tentatively identified as palettes, of a kind common at the site as well. Three stone objects were identified as "tools" or "polishers", but have an unclear function. One (possibly prehistoric, reused) stone axe with a sharp cutting edge was found, and two clay jar stoppers. There was also an animal horn, unworked, but perhaps used as a tool. Two small rectangular baked bricks were found (fig. V.9, perhaps used in the kiln to stabilize the kiln load or to separate vessels during drying, cf. Swan 1984: 40; Zoroğlu 2000: fig. 3), as well as a longitudinal piece of ironoxide / ochre. Finally, a piece of a faience bead and a bronze ring were among the finds in room 1.

Excursion: basalt "potters' wheel" bearings, reconstruction of the potters' wheel and implications for vessel shaping techniques

Stone potters' wheel bearings have been found at a number of sites in Syria and the Near East, dating from the Early Bronze Age up to the Byzantine and Islamic periods (Trokay 1989, Amiran and Shenhav 1984, see the distribution map in Bombardieri 2004: fig. 3). They seem to occur mostly in second millennium BC levels (Trokay 1989: 169), a time when most of the pottery repertoire was thrown on a fast rotating potters' wheel. A complete set of these objects consists of a lower half with a depression and an upper half with a protruding pivot, that fits snugly into the depression of the lower half. Constant and intensive rotational movement results in shiny polished surfaces where the two stones are in contact. Normally, they are made of basalt or granite, but occasionally limestone is used (Bombardieri 2004: 96). Although the interpretation of these objects as small hand mills is occasionally considered (e.g. Trokay 1989, Pruß 1994), their findspot in pottery workshops at several sites such as Lachish (Magrill and Middleton 1997), Mari (Weygand 1997), El Amarna (Rose 1989, 1993, Powell 1995) and now also Tell Sabi Abyad have convinced most scholars to identify them as potters' tools (Trokay 1989, Bombardieri 2004). Mostly, they are called "tournette" or slow wheel, thought to be used only for slowly turning a handmade vessel while building the walls, and not for throwing pottery.

Most pottery from the Early Bronze Age onwards, however, was thrown on what is termed the "fast wheel" or "true potters' wheel", with the exception of some hand-made or partially hand-made shapes like large storage vessels or unique special purpose shapes. As will be clear further down in this chapter (paragraph V.6), the pottery from Sabi Abyad is no exception: the majority was thrown on the fast wheel. To throw vessels on a wheel, a rotary motion of 50-150 rpm is required to provide for the necessary centrifugal force used in lifting the walls (Rye 1981: 74, Edwards and Jacobs 1986: 50). Since the two basalt wheel bearings are the only evidence for potters' wheels at Sabi Abyad so far,⁷⁸ the question emerges whether, and how, they could have been used in the production of the Sabi Abyad ceramics. The type of potters' wheel used has implications for the shaping techniques that are available to the potter, depending on the velocity, centrifugal force, continuity of rotation and operability (alone or with an assistant) of the wheel (Rice 1987: 133-134).

⁷⁸ Half of a clay disc identified by the excavators in the field as a potter's wheel was found in square N7. This disc (P01-126) originally would have measured 32 cm in diameter, and is 2.5 cm thick. It is made of baked clay. The sides are flat, while the rim is a bit thicker than the disc itself. In the middle, a hole with a diameter of 6.5 cm is made through the whole disc. On both sides, remains of gypsum plaster are still sticking to the surface. One side is smooth, while the other side is rougher and shows traces of burning. The context of this object does not provide any further indications of its use as yet. Although it is possible that it was in some way part of a potter's wheel construction, it is at the moment unclear exactly how. For now it will not be considered a potter's wheel.

To test the properties of this type of basalt wheel bearings, two experiments have been carried out in the 1980s and one in the 1990s. In the first two cases an archaeologist and a professional potter worked together on the experiments, one in Leiden at the Department of Pottery Technology of Leiden University (Edwards and Jacobs 1986), the other in Israel (Amiran and Shenhav 1984). The most recent experiments were carried out by a professional potter at an excavation site (Powell 1995 at El Amarna). All experiments showed that these wheel bearings cannot be used alone, but that a larger wheel head must be fixed to the upper half of them to provide enough momentum. In Leiden this was done by putting a cake of clay between the wheel head and the upper wheel bearing. In Leiden a wheel head of 30 cm and one of 40 cm in diameter was used, the one used by Amiran and Shenhav was 60 cm in diameter. In both cases the wheel was rotated by an assistant using his hands to move the wheel head while the potter was working. At Amarna a wheel head of 53 cm in diameter made of fired or unfired clay was fixed immediately to the upper pivot stone, while the wheel was turned by the potter herself. In Leiden an average speed of 15-20 rpm was reached by the assistant turning the wheel. A small cup could be thrown from the cone, although with difficulty, and the forming and smoothing of separate parts of vessels (like necks) was possible. It was noted that vessels formed this way showed heavy finger rilling on the interior, and a “tell-tale spiral torsion twist” in the wall of the vessel. Amiran and Shenhav, with their larger wheel, managed to attain a speed of 60 rpm. This speed proved good enough for throwing small vessels, but shaping and opening the large lump of clay on the wheel proved difficult. It may seem that the large quantities of professionally wheel-thrown pottery found at Sabi Abyad could hardly have been made on such a wheel. However, the experiments at Amarna showed that, after some experimenting with different wheel bearings, different lubricants and different types, sizes and weights of wheel heads, a comfortable operating wheel was obtained. This wheel was turned by the potter herself and reached a speed between 60 and 120 rpm that lasted for some time. The addition of a heavy lump of clay on the wheel head (throwing from the cone) helped in maintaining the speed (Powell 1995: 330-332).

Basalt wheel bearings of the type found at Sabi Abyad allow the construction of a “simple wheel” with one bearing (fig. V.11 top), as opposed to the kick wheel or double wheel that has two bearings: a wheel head on top of a longer axle with a bearing at the top, and a pivoted flywheel at the base used for kicking the wheel into motion (fig. V.11 middle left). Basalt wheel bearings, apart from providing a pivot, also provide horizontal stability because of the width of the stone (generally around 15 cm in diameter). Since this also creates a lot of friction between the stone surfaces, the stability of the stones was probably important to the potter: otherwise he could have used a thinner pivot without a horizontal surface.

A kick wheel can be constructed in a bench with the potter sitting or standing at the wheel, or in a pit with the potter sitting at the edge of the pit (cf. fig. V.11 bottom; Weygand 1997 for a possible example of this in Mari). At Sabi Abyad neither benches nor pits, nor any other obvious places for the construction of a kick wheel have been found in the workshops so far (although a bench could have been completely constructed of wood, and therefore not preserved). When basalt wheel bearings are found at sites where wheel-thrown pottery was clearly made, attempts are usually made to interpret these bearings as part of a double kick wheel operated by foot, since it is thought that wheel-thrown pottery can only be made on a kick wheel (e.g. Magrill and Middleton 1997: fig. 6b; Rose 1989: 85-86). A proper kick wheel (spindle wheel), however, does not need a wide and frictional bearing as provided by the basalt examples: since the axle of a double wheel is fixed both at the pivot in the ground and just under the wheel head to the edge of the pit or bench, it is stable enough by itself and will not topple over. The small pivot or spindle turning at the base would only leave a small pivot hole in the floor or base stone. A kick wheel would only benefit from the width of the basalt bearings when the axle was not fixed at the top, and therefore the wheel would be “free-standing”. This reconstruction (fig. V.11 middle right) seems to be rather far-fetched,

and much more complicated than either a double kick wheel with a small pivot (spindle wheel) or a low single wheel.⁷⁹ Moreover, Löbert (1984: 209) suggests that the foot-driven wheel did not appear until Hellenistic times in the third century BC, and that the spindle wheel was invented in Islamic times, while Hope remarks that there are no depictions of kick wheels in Egypt until the Persian period (1981: 130).

However, a low-pivoted wheel with one bearing is not necessarily just a “tournette” or slow wheel. A “true” potters’ wheel, combining rotary motion and pivoting with enough centrifugal force, may also have the shape of a “stick wheel” (fig. V.12). Rice (1987: 134-135) describes the stick wheel as follows: “[it] has a large wheel head and a short axle. There is no flywheel; the head itself has sufficient weight to maintain the momentum. [...] The wheel] is rotated by inserting a stick in a hole at the edge on the top, and rotating it thirty or forty times. This is enough to cause the apparatus to spin on its own for as much as five minutes without stopping. The stick-turning may be done by the potter or by an assistant while the potter sits at the wheel [...]”. The wheel may of course also be turned by hand at times, or possibly even by foot.⁸⁰ The suitability of a stick wheel for throwing pottery using centrifugal force is clearly demonstrated in the work of V. Roux describing potters using stick wheels in Northern India (Roux 1990; see also Powell 1995). The use of the basalt wheel bearings would provide extra horizontal stability to the pivot. At the Late Bronze / Iron Age site of Sarepta in Lebanon, wheel emplacements for single wheels have been found in the pottery workshops. These suggest that the wheel was about 80 cm in diameter (Anderson 1987: 48-49 and fig. 10). Stick wheels described in Afghanistan measure about 95 cm in diameter (Johnston 1977: 196). In India stick wheels measure between 76 and 101 cm in diameter and are between 7.6 and 10 cm thick. They are made of unbaked and heavily tempered clay (or, recently, cement), with a stone socket in the centre (Roux 1990: 99). The tests with the stone wheel bearings in a simple or “stick” wheel at Amarna (Powell 1995) have proved that these bearings are very well suited for this purpose.

The pottery wheel used at Sabi Abyad can therefore be reconstructed as a “simple” (stick) wheel with one bearing (fig. V.11 top, fig. V.12). It would have consisted of two basalt pivoted halves. To the upper half, a large wheel head possibly made of (un)baked clay⁸¹ was

⁷⁹ The representation of a person working with an apparently free-standing kick wheel with a thick conical axle in a Roman statue from the museum of Suweida (Dentzer and Dentzer-Feydy 1991: Pl. 20 no. 68, cat. 3,12) may be a matter of iconography rather than of proper technical representation of a mechanical device. However, Childe (1954: 201) claims that basalt wheel bearings were used in foot-driven kick wheels in early twentieth century Palestine. The lower bearing was set into the floor of a pit. A large wooden disc was apparently fixed to the upper bearing. A wooden axle was attached to the disc, supporting the wheel head on the top. The axle is steadied at the top by a looped iron rod. There are no illustrations and no references to further descriptions, and it is unclear whether Childe himself actually saw a kick-wheel constructed like this. I did not find any other ethnographic examples of the use of basalt wheel bearings for the construction of a kick wheel by contemporary potters.

⁸⁰ The simple slow-turning wheel heads still used today in Cyprus are turned by foot by the potter herself (Ionas 2000, Johnston 1977: fig. 8-13). Also a recently discovered seal impression dating from the third millennium BC from Tell Mozan, Syria, depicts two potters at work in their workshop, seated on a bench and using one of their feet to turn the low and narrow wheel (Heike Dohmann-Pfälzner, pers. comm.). They may be coiling pots on a slow-turning wheel.

⁸¹ Potters’ wheel heads of baked clay have been found in large numbers on Crete, dating from the Minoan period. There, the wheels are 30-40 cm in diameter with a maximum of 75 cm, and between 5 and 10 kg in weight. Many have thickened rims to increase momentum, and one or two holes in the rim (Evely 1988: 100). Perhaps the holes were used to attach a rope or a stick for the assistant to spin the wheel. The rims of the Cretan wheels often show ridges and notches, perhaps to increase the grip of the assistant on the wheel rim. In Mesopotamia, clay wheels have mainly been found in early contexts, as for example the clay wheels identified as potters’ wheels found in Ur and Uruk (Childe 1954: 199; Evely 1988: 112, Heinrich 1935: 25 and Taf. 15a) and Abu Salabikh (Postgate 1990: 103-104 and plate XVIIc, including references to other discs from other Early Dynastic sites), and they may have

fixed with bitumen as an adhesive. The basalt bearings provide horizontal stability to the wheel head. The bearings were probably lubricated with fat or oil, as they were in the experiments described above. The wheel was probably simply placed on the floor of the workspace or possibly fixed in a shallow pit as at Sarepta and El Amarna (cf. the pits Y, Z, and possibly AA and AB found in room 1 in square O12, in fig. V.2), with the potter and his assistants sitting or squatting next to it.⁸² Of course we cannot completely exclude the possibility that a completely wooden kick wheel (spindle wheel) including its wooden workbench has not been preserved, and that the basalt wheel bearings were used only as a slow wheel. However, with a professionally constructed simple (stick) wheel and potters who are able to use it well, there seems to be no need to suppose a spindle wheel that is not otherwise attested (nor at any other contemporary or earlier site). The find of two half wheel bearings at Sabi Abyad suggests that more than one wheel was in use in the workshops.

The suggestion that a stick wheel was used for producing the Sabi Abyad pottery has some implications for the shaping techniques (see below for further elaboration on shaping techniques employed at Sabi Abyad). First, whether the potter or his assistant turns the wheel with a stick, a continuous rotation is possible only for some minutes at a time. This is enough to form small shapes from the cone, but the shaping of larger vessels has to be interrupted several times. Turning the wheel can only be completely continuous when the potter or an assistant is turning the wheel by hand, but then the speed is lower. Perhaps, a slower speed was enough for lifting the walls once the clay had been opened to a wider shape, or for finishing a vessel (smoothing, forming the rim, scraping, turning, decoration). Rotation can be fast with a stick wheel, but it might be too slow to form the larger vessels from one piece of clay in one go. The sometimes very deep throwing ridges on the inside of jar bases from Sabi Abyad may be an indication that the wheel slowed down a lot while opening the large ball of clay on the wheel. Shaping in stages, in which parts of the vessel dry a little before they are finished on the wheel a second time, may be a solution to the problem. Scraping and turning, the forming of bases, the shaping of rims, decoration, etcetera may all have been done at a lower speed, with the wheel being turned by hand. The stick wheel is also suitable for use as a slow wheel when forming large hand-built shapes (large storage jars, for example). In that case the stability of the wheel would have been important. The presence of a wheel assistant next to the potter is very likely, but not imperative.

Room 2

Room 2 in squares N11, O11, O12 and N12 was located to the west of rooms 1 and 3 (fig. V.2). It was accessible from room 1 and from the open area to the west through doors. Towards the southeast, near oven M, it seems to have had a wider open passage towards the small courtyard south of room 1. Room 3 had no direct access to room 2, unless a door to the north is hidden in the N11-O11 section baulk. Room 2 measured 10.2 x 3.25 m (33.15 m²). In the north of the room the floor was reached at an elevation of 324.09-15 (in N11 and O11). In the south the floor was apparently found at an elevation of 324.30-45. Either the floor of room

been used as a wheel head on a simple wheel just like the Cretan examples. The wheel head from Old Babylonian Uruk is 90 cm in diameter and 8 cm thick, and was found in a double grave. It has a flat side with incised concentric circles and a patch of bitumen in the middle, and the other side has a circular pivot hole. The wheel from Abu Salabikh is 70 cm in diameter and 4.2 cm thick. The base side shows impressions at regular distances but in an irregular pattern.

⁸² A question that deserves further research deals with the body positions in which people worked and lived. I think it is most likely that most people in the Late Bronze Age were used to sitting on carpets, cushions and mats and working in sitting or squatting positions on the floor, rather than working while sitting on chairs. In Middle Assyrian iconography, sitting on chairs seems to be a priority of high-ranked officials and royalty. Cf. also the comments of Roux (1990: 24) on the squatting working position practised since childhood by people in Northern India. A kick wheel with a sitting bench would then be alien to the normal working position.

2 sloped down strongly, or a dividing wall is hidden in the section baulk, creating two separate rooms. For this reason the room halves will be discussed separately, as room 2a (south) and 2b (north). The two rooms 2a and 2b could either be connected by an internal doorway and both belong to the building of which also room 1 is a part, or they could be separate rooms, one oriented towards room 3 and the other serving room 1. In the latter case, a doorway has to be postulated in the northern wall AH under the section baulk. The fill of the northern half of the room (2b) consisted mainly of mud-brick debris and ashy deposits probably connected to oven X.⁸³ In N11 the notes mentioned that the western wall J carried traces of burning, as if something had been burning against it. In the south (room 2a) the roomfill around oven M was soft and ashy. In the rest of the room the fill consisted mainly of light brown mud-brick debris and some pieces of baked mud-brick, similar to the northern part.⁸⁴ Carbonized reeds were found near floorlevel (parts of the roof or fuel for a kiln?).

In the northern part (2b) the large oven X was placed in the corner of the room. The floor of X was reached at 324.09. It was built of mud bricks and had a thick layer of burnt plaster at the inside. The field notes of square N11 mention the presence of a door angle-stone near the western wall. In the south in room 2a a large circular *tannur* (M) with a mud-brick supporting wall was built near the opening towards the courtyard south of room 1. Next to it an oval clay bin (L) was built on the floor. The 4 cm thick walls of the bin were plastered with white lime plaster on the inside. Against the southern wall of room 2a a huge mortar was placed. Next to it was a door angle-stone, but again there was apparently no door in this location. A small square mud-brick construction was standing in the southern half of the room, perhaps as a support for a workbench or roof? At a later stage of use in the room, a one-mud-brick-wide wall or construction (W) was built, preserved up to 7 courses; perhaps a support similar to the support in the western part of the room.

Against the northern section of square O12 feature AC was found: perhaps a pit or, more likely, a piece of a large unfired vessel left on the floor.⁸⁵ Next to the western wall of the room, a huge storage pot was still standing in its original location (fig. V.5, to the left side). In room 2a, 9 more or less complete pottery bowls were found in the fill and on the floor. In room 2b, 9 more or less fragmented bowls and a small jar were found.

Apart from the possibly unfired pot of feature AC, many unfired pottery fragments and waste from pottery production were found only in room 2b.⁸⁶ Most fragments were found on the floor in the south-eastern corner and in the fill of oven X. Other fragments were found in the room fill. They included a goblet rim (type 421), a ring base fragment, many body sherds from bowls, goblets and a strainer (type 511), and many fragments left over from the production of bowls and goblets. Wasters, overfired ceramics or slag fragments were not reported from room 2a, nor were they from room 2b.

In room 2a four grinding tools were found (grinding slabs and grinders). Other stone objects include a stone disc, a fractured stone palette, a longitudinal stone object and two stone objects with unclear function. These objects could have been used as tools. Two rounded, abraded pottery sherds were most probably used by the potter as a scraper (fig. V.10, O03-120). Other finds in room 2a, probably unrelated to pottery production, were a clay cylinder seal depicting a hunter and prey, a fragment of a cuneiform tablet (both found in the room fill), a spherical clay token, and a fragment of a ceramic plaque depicting a reclining

⁸³ Square N11 locus 29, lot 81 and up; square O11 loci 30, 52 and 55; between elevations 324.91 and 324.10.

⁸⁴ Square N12 loci 27 and 28, lot 60 and up; square O12 loci 37, 48, 49, lot 113 and up; between elevations 324.81 and 324.35.

⁸⁵ Again the field notes and stratigraphy information are unspecific. AC (locus 56) was described as a pit with a very hard reddish-brown plaster layer at the side. In the first field drawing it has an oval squarish shape. The fill was hard and clayey with a lot of clay pieces, lime spots, and it was covered by some large sherds. In the northern section it was visible as well, curving downwards against wall K and widening gradually.

⁸⁶ The only unbaked clay fragment found in room 2a was found at an elevation below the floor and possibly belongs to Neolithic contexts.

feline's paws. In room 2b, apart from the large amount of unfired vessel fragments, a grinder, a hammer stone and a stone palette were found. A semispherical clay token, three bone game pieces and a bronze folded pin were found as well.

Room 3

The find of unfired vessel fragments in room 3 and other spaces in squares O11 and O10 suggests that the activities of the potters were not confined to room 1 and 2 and the surrounding courtyards.

Room 3 was located in square O11 directly along the moat, like room 1 (fig. V.2). Here, as in room 1, the original east wall (CG-CI) was located right next to the moat. In a later phase of the use of room 3 wall BE-AK-AQ was built, making room 3 smaller. A door in the west wall led to the open area where kiln Q was built. Room 3 measured 5.7 x 3.2 m (18.24 m²). The fill of room 3 in level 6 may be divided into different phases. Important to us here is the lower roomfill, consisting of mud-brick debris on the floor.⁸⁷ Below the mud-brick debris, fragments of carbonized reeds and roof material were found. The mud-brick debris was higher along the walls than in the middle of the room, and was covered by ashy layers of a period when room 3 was no longer in use.⁸⁸

Against the south wall a half mud-brick wide dividing wall was built (AS). Bin AR, built of loam and mud-brick, was situated to the north of it. CM was a low mud-brick block built against the western wall, maybe a workbench or a support for shelves. On top of CM a baked brick was found with an unbaked clay disc on it. CM also seems to divide room 3 into two halves. In the northwestern corner of the room feature BI was dug into the floor. It is a cylindrical hole in the ground. The walls were lined with sherds, and a large basalt grinder formed the floor. These features are found more often at Sabi Abyad in various areas, and their function is still not completely clear. They might be mortars, or a kind of post-holes.⁸⁹

As to complete pottery shapes, two bowls were registered from this room. In the fill, large fragments of big jars were noted, but not collected as objects. Unfired vessel fragments (including a rim fragment) and a lump of unfired clay were found near the door in the northern part of the room and south of CM in the southern part of the room. Also in the south of the room, among the unfired fragments, was a large flat piece of bitumen. Bitumen was often used in pottery production at Sabi Abyad, mainly for repairing cracks or for keeping vessels watertight. No wasters or slag fragments were reported from room 3. Other finds in room 3 were three fragments of basalt grinding tools, a complete stone polisher and a complete hammer stone. Furthermore, a river shell, some pieces of eggshell and a pierced disc made from an old sherd (possibly prehistoric) were found.

Room 5

The area west of rooms 3 and 4 in O11 was most likely oriented towards the open area in square N11 around kiln Q. At an elevation of approximately 324.30, floors BV and BW were found. Floor BV is reported to have had a layer of white plaster on top, which is not common for an outer area surface. Perhaps it was a roofed room space.⁹⁰ The deposition in this area⁹¹

⁸⁷ Loci 26, 27, 50, 57, 79, 83, between lots 116 and 201 and lot 209, between elevations 324.50 and 324.27.

⁸⁸ Loci 26, 27 between lots 108 and 63. This is mixed material consisting of both the mud-brick debris of the first phase and the ashy layers of the second phase, between elevations 324.90 and 324.50. Above 324.90, locus 21 consists only of the ashy layers. The ashy layers probably belong to the phase when kiln Q was no longer used.

⁸⁹ These plastered pits never show traces of rotation on the base stone, so they cannot have been a base for the pivot of a kick wheel. They are too narrow to form the emplacement pit of a single wheel.

⁹⁰ Perhaps a north-west running wall closing the space to the west is still hidden in the section baulk or under the depositions covering kiln Q? The corresponding area in N11 was never dug to this level, since excavation was stopped there at the level of the bins and ovens of the second use phase (K, L, M) and the upper elevation of kiln Q at 324.74. However, in the field notes a brown band (mud brick?) was recognized running north-south, east of Q.

consisted mainly of mud-brick debris, with some ashy deposits and carbonized reeds (roof material or kiln fuel for kiln Q?) included.

A circular *tannur* oven AZ was built in the northern part of the room. Apart from pottery sherds, only one complete bowl was found. Several fragments of unfired vessels were found on the floor and in the room fill. They include a rim fragment of a type 322 jar and many body fragments of jars (including fragments with incisions on the shoulder). In the room fill and on the floor in the north of the room fragments of pottery slag were reported. Two grinding slabs and two hammer stones were found. Other stone tools included one palette and two polishing stones (one with traces of ochre), and two tools with unclear function. A corroded piece of bronze was found, but its function is unclear.

Room 6

Room 6 in square O10 is included in the discussion here because fragments of unfired vessels have been found there (but see below). The room was located to the north of room 5. Since the floor level in room 6 (W) was reached at an elevation of 324.57, some 25 cms higher than the floor in room 5, there might be a wall dividing room 6 from room 5 hidden in the section baulk, and/or the floor and fill in room 6 might represent a phase later than the floor in room 5. The Neolithic tell surface was not reached in this room. Room 6 now measured 4.5 x 3 m but was probably longer. The deposition consisted of brown fill including a lot of mud-brick debris and lime spots.⁹²

A rectangular bin X was built of half mud-bricks in the north of the room. Next to it against wall Q a pot was set between two bricks (AN). In front of the pot there was a pit lined with sherds (Y), about 20 cms deep. The function of this kind of pit or post-hole is not yet clear. Against the western wall a bin (AD) was placed, next to a small closed oven (AB). A drainage system was constructed in the western wall, with the water running through a partly covered gutter towards the moat in the east, thereby cutting the eastern wall of the room.

Apart from sherds, one complete bowl was found. A large cracked pot (P04-91) was standing in feature AN. Several fragments of unfired vessels (including carinated bowls type 111, body sherds of bowls, a ring base, thicker body sherds) and unbaked clay were found, among a group of around 35 cuneiform-tablet and envelope fragments. Since these tablets were not found directly on the floor, they are thought to have fallen from elsewhere, and not to belong to the original floor context of room 6. That would mean that the unfired vessel fragments, as indications for pottery production, originally did not belong to the room either. Other finds in the room were some grinding-stone fragments, a stone polisher and a flat limestone platform, a stone axe (possibly a reused prehistoric axe), some small fragments of bronze and a faience bead.

Definite conclusions about the context of the unfired vessel fragments and tablets, as well as about the function of room 6 and its relation to the pottery workshops to the south, can only be established after the final reports on the excavation have become available.⁹³

The open spaces, small courtyards and rooms south of the workshops in squares N13 and O13 may have been used by the potters as well, but no evidence pointing in that direction was found.

Perhaps these are the upper traces of a wall closing room 5 to the west. There generally seems to be quite some difference in elevation between floors in different rooms, with those in the west being higher than those in the east.

⁹¹ Loci 32, 33, 41, 42, 56, between lots 67 and 173, between elevations 324.78 and 324.27.

⁹² Loci 20, 21, 41, 34, between elevations 324.78 and 324.57.

⁹³ The area west and north of room 6 was excavated in 2005, but the results could not be included in this study anymore. However, they did not yield any indications for the use of room 6 by a potter.

Conclusion: the level 6 workshops

In conclusion, the total area apparently in use by the potters in level 6, according to the finds of unfired vessel fragments, kilns and other production related objects, was approximately 17 x 19 m (323 m²) large, comprising the whole eastern area between the moat and the fortress and including open areas. In anticipation of the final stratigraphy and architecture reports we may suggest that the level 6 workshops show at least two main phases of use. In general, however, the use of space seems to be continuous with minor alterations and additions of features happening throughout the life of the buildings. From the beginning of level 6 the potters seem to have used rooms 1, 2a, 2b, 3 and 5. Kiln Q and perhaps also kiln L were built and used. In a later phase of level 6, it might be suggested that rooms 3 and 5 were no longer used by the potters. Perhaps this is related to the abandonment of kiln Q. Activities seem to continue uninterruptedly in rooms 1 and 2a (and 2b?) and in the courtyard where kiln L is located. Perhaps the smaller kiln L was built in this time, possibly indicating a reduction in production levels related to the reduction in workshop surface. However, until the final stratigraphy reports are published no conclusions can be drawn with certainty.

Room 1 seems to be the core of the workshop, at least in the later phase. Unfired vessels and waste from shaping vessels were found here, as well as the two wheel bearings. Perhaps the shaping of vessels took place in room 1 (cf. fig. V.3). The room may also have been used as a drying space for semi-finished and finished vessels, a room to stock fired vessels that had not yet been distributed, and as a general storage. In addition drying of vessels may further have taken place in the workshop area as a whole, including floors and shelves in the other rooms, the open area in front of the workshops, the area around kiln Q and the small courtyard where kiln L is located.⁹⁴ In summer drying is preferably done in a shaded area or indoors. If unfired clay vessel fragments can be used as an indication of drying locations, room 2b in particular may have been used for drying. The unfired fragments here indicate that especially unfired bowls and goblets were dried or stored in room 2b, while the fragments in room 5 are all from larger jars. Whether this might be connected to a differential use of kiln L and Q respectively (or a specialization of two neighbouring workshops), or whether these finds are related to different production events, must remain unclear. A piece of bitumen, often used to repair slightly damaged vessels after firing, was found in room 3. The large mortar in room 2a might have been used to crush dried clay or other additions to the paste (salt?, chaff, etc.). No basins or pits for levigation or areas for mixing or storing wet clay have been found in the immediate surroundings of the workshops. Perhaps clay was prepared elsewhere and brought in only in the needed quantities (the amount necessary for a day's work for example; cf. Ionas 2000: 154). Clay could have been mixed with temper materials and kneaded outside or inside one of the rooms, but no traces were found. No particular space could be identified for the storage and processing of temper materials (dung, straw) and fuel either. Perhaps fuel was simply piled up in the kiln area at the time of firing.

Firing took place in one or both of the two kilns in front of the workshops. Kiln Q was the largest, and located in an open area. Kiln L was smaller but still quite large, and located in a more confined courtyard area of the workshops.

Pottery production in level 6 is located in a specific, functional area of the site. Space was most probably used in a flexible and organic way, without strict functional divisions between rooms. Although other (domestic) activities seem to have been carried out in these rooms and spaces,⁹⁵ as is indicated by the finds of bread ovens, grinding tools, etc., the rooms and courtyards seem to have been mainly used for pottery production. It is likely that the potters and their family were also living in these same spaces,⁹⁶ although it may also be suggested that they were living inside the main fortress located a bit further to the west. In

⁹⁴ The fragments of unfired ceramics may be the only remains left of the drying process.

⁹⁵ Activities carried out simultaneously with the pottery production, but possibly also activities (including other types of craft production?) carried out in the low season for pottery production (winter; cf. Simpson 1991: 126).

⁹⁶ Perhaps the presence of bread ovens (*tannurs*) may point in this direction?

that case the pottery workshops were located in their backyards. The find of a clay cylinder seal and a cuneiform tablet fragment, as well as the find of unfired vessel fragments among cuneiform tablet fragments in room 6 in square O10, suggests that the potters were in some way closely connected to the *dunnu* administration (although the tablets did not deal with their craft).⁹⁷

The level 5 pottery workshop and other production locations

Pottery continued to be produced locally at Sabi Abyad in level 5, as is shown by the many finds related to pottery production coming from this level. As was shown in chapter III (and fig. III.4), the start of the level 5 settlement is characterized by major renovations and changes in the existing architecture, the building of new structures and the reuse of old structures, often with a changed function. The moat that had been dug at the start of the level 6 occupation had gradually filled up with garbage and debris. If its location was still visible, it was at least not functioning as a moat anymore. The area between the former moat and the main fortress seems to be deserted in level 5. Now the area was only occasionally used to dig a pit or build a small bread oven. The main activities of the settlement had all retreated within the main fortress walls.

The location of pottery production at the site in level 5

During the occupation of Sabi Abyad in level 5 times pottery production locations can be identified in several different areas of the site (fig. III.4). As far as the current state of the stratigraphy and architecture reports allow at the moment of writing, we can establish that the kilns and the other finds associated with pottery production were built or deposited at at least two, possibly at least three, different moments within the level 5 period.

At the beginning of the level 5 occupation the production of pottery was located in a building in the south-east of the main fortress, covering squares M11, L12, M12 and part of M13. The open area in square M10 and the open area outside the main fortress may have been used for pottery production, too, as some small finds indicate (unfired vessel fragments and unfired pottery production waste), and a larger kiln was probably built in square N13 at this time. This workshop was located due west of the level 6 workshops discussed above and may represent a continuation of the activities of the level 6 workshop, but now relocated inside the main fortress. The level 6 building in squares M11-M12-L12 was renovated at the end of level 6, but retained its general plan. If the level 6 potters were not already living in the house located in squares M11-M12, the move of the workshop into this building in level 5 also indicates a major change in the use of this building. Stratigraphical evidence suggests that the potters were carrying out their activities in an area where considerable debris had been deposited already, suggesting that the space was not in use at the time the potter moved in (see below). In the following discussion, we shall call this workshop “level 5 East” (figs. V.13, 14).

Another production location can be identified at the western side of the main fortress, in square H8 (cf. fig. III.4). Here the potters also seem to have made rather opportunistic use of the available space to build two smaller updraft kilns. The kilns built in H8 seem to date from a later phase in the level 5 occupation, when the architecture in this area was no longer used for its original functions. Many fragments of unfired vessels were found in the same area, but should most probably be dated earlier than the kilns. In square H9 several indications for firing activities were found, but at the moment these are difficult to interpret. In the following discussion we shall call this production location “level 5 West” (fig. V.20).

⁹⁷ The use of cuneiform signs and seal rollings on pottery vessels (see below) might also point to literacy among potters. However, we know little about the literacy of craftsmen in this period (F.A.M. Wiggermann, personal communication 9-10-2005).

In squares K8 and L8, finally, two updraft kilns (figs. C.21-25) were built within the existing walls of level 5 buildings, each dated to a different moment in level 5, and again completely changing the function of the former rooms these walls enclose. Hardly any other finds indicate that pottery was actually produced in these areas (apart from the firing stage), and it is as yet difficult to connect these kilns to a workshop location. In the following discussion we shall call this location “level 5 North”.

The level 5 East workshop

During the excavations the finds in squares M11 and M12 were first recognized as belonging to a pottery production location because of the unusually large amounts of damaged and repaired vessels, most of them of similar shapes and sizes, and amounts of unfired vessel fragments and production waste (see below, paragraph V.6). Only later, when other better preserved updraft kilns were excavated elsewhere at the site, were the badly preserved remains of kiln T/U and kiln AC/AI recognized as small updraft pottery kilns.

The level 5 East workshop was located in the area between the tower and the eastern fortress wall (fig. V.13). In the second phase of level 6 this building was levelled and rebuilt in more or less the same location. Then it does not seem to have been a workshop but rather a house, and part of the building was still used as a house at the time of the level 5 workshop (and identified through texts as the house of scribe Belu-erish). Access to the building was provided through the small courtyard or patio in the middle of the area. There was also an exit towards the open area in the east, leading out of the fortress. In the north of the building a corridor led to a staircase leading to the roof or second floor. As in level 6, the level 5 East workshop was part of a larger chain of workshops and utilitarian buildings now located in the south and east of the fortress.

Kilns

It is likely that kiln H in square N13 was built in level 5. Kiln H was located outside the fortress walls, and was built in an open area south-east of the fortress and west of the former moat (fig. V.14). Possibly the ruins of the level 6 buildings were partly still visible. Kiln H was built in general alignment with the level 6 architecture, but the kiln does not make use of a corner between walls, as is often done elsewhere at the site. If kiln H was indeed built in level 5, its location near the former level 6 pottery workshops suggests that there existed some continuity in the use of space here. If kiln H belonged to the level 5 East workshop, it could be reached through the door in room 4. Kiln H was a large kiln, comparable in size and construction to kiln L in level 6. The outer structure of the kiln measures 2.54 m by more than 2.65 m, while the fire chamber measures 1.10 m by more than 1.85 m. The fire chamber is not preserved to its complete height, and possibly slightly more than half is preserved (see fig. C.11 and Appendix C for a detailed description). The deposits around kiln H in square N13 were light-brown soils containing mud-brick debris, but these most probably belonged to layers into which H was dug. The level from which H was dug is no longer preserved in square N13. No unfired ceramics or wasters were found in square N13. In the kiln fill four bowls, a goblet and a spindle whorl were found.

In the squares N11, O11, N12 and O12 east of the main fortress wall, where the pottery workshops were located before in level 6, several fragments of ceramic slag and pieces of overfired pottery have been found in level 5 deposits. This area seems to have been used just for the construction of bread ovens and for digging pits. At least two large, more or less rectangular pits with a clay lining have been found in this area (in N12 and O12-O11, see fig. V.14). Perhaps these pits were used for the storage or preparation of the potters' clay. In O12 some fragments of unfired vessels were found in a pit fill, but they were probably dug up from the level 6 context when pit R was dug. Several fragments of unfired clay vessels and pottery production waste were found in square M10, in the open area north of the workshop.

Two smaller updraft kilns were built inside the workshop building, in an area that was most probably an unroofed interior courtyard or patio (courtyard 2, fig. V.13). Both kiln T/U and kiln AC/AI were most probably dug from floor AN at an elevation of 326.15 to 326.04, a rather uneven surface in this courtyard on which the remains of pottery making were found. It is not clear whether the two kilns were built or used simultaneously or not. Floor AN does not seem to be the original floor of the courtyard but rather the top surface of a layer of debris in this area, perhaps after the original courtyard had gone out of use.

Kiln T/U was a small kiln built in the northeastern corner of the yard after a doorway had been closed during the renovations of the building at the end of level 6. Only the fire chamber is partly preserved. A mud-brick wall made of half bricks surrounded the top part of the fire chamber and measured 1.53 x 0.89 m. The plaster that was on the inside of one of the arches supporting the pottery floor is still preserved as well (fig. C.12). This kiln was substantially smaller than the large kilns that had been used until now. The fire chamber of T/U was only dug into the floor about 35 cm, while its total height under the preserved arch was around 60 cm.⁹⁸ The resulting volume of the fire chamber was therefore about 7 times smaller than that of the largest kiln Q (level 6), while the surface of the pottery chamber was perhaps approximately four to five times smaller than kiln Q (see Appendix C). The fill in the kiln consisted of brown and black ashy soil, with some big stones, large sherds, burnt sherds and a burnt bowl.

Kiln AC/AI was built in the middle of the courtyard and was a middle-sized kiln (cf. fig. V.13). Since initially only the northernmost and southernmost sections were found sticking out of the section baulk, heavily disturbed by later pits, there were many unclarities and difficulties during the fieldwork. Kiln AC/AI was most probably also dug from floor AN, from an elevation of approximately 326.12 to 326.05. Like kiln T/U, it was originally surrounded by a mud-brick structure. In the north this structure was no longer preserved because the kiln was damaged by a later burial pit. In the south bin W possibly belonged to the kiln and formed part of the pottery floor and upper structure, but it was not recognized as such.⁹⁹ The floor of the fire chamber was reached at an elevation of 325.07 m. In the middle of the kiln one of the mud-brick arches supporting the pottery floor was still preserved. The fire chamber was approximately 1.28 m deep, while it measured 1.50 x 0.90 m. The estimated volume of the fire chamber is therefore almost 1.8 times smaller than kiln Q. Depositions inside kiln AC/AI consisted of soft brown/grey soil with ash pockets and a lot of unfired vessel fragments. Three goblets and a clay sealing with a seal impression were also found, as well as some sherds and a fragment of bone. The presence of unfired vessel fragments in the kiln fill (see below) suggests that the fire chamber of kiln AC/AI was no longer used but had started to fill up with garbage when pottery making was still going on in the area. Perhaps we can take this as an indication that kiln T/U was used later or longer than kiln AC/AI.

Workshop architecture and associated finds

The level 5 East workshop (fig. V.13) consisted of a central courtyard or patio (courtyard 2) located along the main fortress eastern wall. To the north a rectangular room (1) was situated, accessible only from the small courtyard (3) to the west. From here a door led to a narrow corridor-like space or staircase. To the south a smaller room (4) gave access to the open area to the east. To the west a door led into a square building consisting of a main room or courtyard, several smaller rooms and a corridor with a drainage leading to a cesspit. The cuneiform texts found on the floor of this room identify the house as the place where scribe Belu-Erish lived or worked.¹⁰⁰ Stratigraphical evidence seems to suggest that the use of room

⁹⁸ In the field documentation of 1996 it is noted that the kiln was not completely excavated down to floorlevel.

⁹⁹ In the field documentation bin W is described as follows: "Bin W has baked bricks in the fill. Against the eastern side there are several ash layers. The fill of W is soft brown soil, dark grey-brown ashy material with charcoal, and patches of burnt loam. Perhaps it was used as an oven".

¹⁰⁰ Personal communication by F.A.M. Wiggermann, 9-10-2005.

1 and courtyard 2 as a pottery workshop dates from a later moment than the original level 5 floors of these areas. The surface of the whole complex measured 21 x 14 m (294 m²), about the same size as the level 6 workshops. But if the open area east of the workshop is included, the potters would have been using an area of about 580 m². The finds related to pottery production came mainly from courtyard 2 and room 1.

Courtyard 2

This area measured about 11.4 x 4 m, or about 46 m² and was accessible from the central courtyard (3) and from the house. Floor AN was an unplastered, slightly irregular outdoor surface sloping towards the south between elevations 326.10 and 325.95. The presence of the updraft kilns in courtyard 2 suggests that this area was not, or only partly, roofed. A small *tannur* AN was built next to kiln AC/AI, perhaps shielded by low mud-brick walls (feature X). A pit (AF) was situated in the centre of the southern half of the yard. Its edge was lined with big sherds and pieces of grinding slabs. The diameter of the pit was approximately 0.35 m and it was about 25 cm deep. A little more to the south, pit V (0.37 x 0.42 m, about 15 cm deep) was dug into the floor as well. V was a pit lined with stones and plastered with an 8 cm thick mud plaster. On the bottom of the pit was a grinding slab. The function of these pits is as yet unclear, but similar lined pits have been found elsewhere at the site as well. Perhaps they were post-holes used to support a light roof over this part of the yard, or perhaps they were mortars of some sort. In the north of the yard, near kiln T, the base of a large jar was set in the floor. Some sherds from the wall of the jar were spread around its edge in a circle measuring approximately 60 cm in diameter (fig. V.17). Next to this jar base, a shallow pit AE approximately 50 cm in diameter was dug into the floor. Possibly this pit was used as an emplacement for a potters wheel (cf. possible wheel emplacements in level 6, above, and the wheel emplacements at Sarepta described in Anderson 1987). The depositions¹⁰¹ in courtyard 2 consisted of soft grey-brown soil with some ashy layers and charcoal fragments in the southern half. In the northern half the soil was brown and grey with lots of sherds and some bones. Especially in the middle of the room but also in the north and west amongst the many pottery objects found here, the soil was brown with lime spots and often very dense, clayish in texture. In the middle a larger spot of very dense clayish material was found, which contained hardly any sherds. Most probably this indicates that amounts of prepared clay were processed or discarded here. Possibly the preparation of the clay body and/or the shaping of the vessels was carried out in this part of the courtyard.

The southern half of the courtyard was relatively empty of finds.¹⁰² Two bowls, a small jar and a goblet were found in the corner next to the door into room 5, at the same spot where also a large amount of unfired vessel fragments were found. Two jar stoppers were found in the area enclosed by feature X. The northern part of the courtyard, however, was full of finds (figs. V.16 and V.18). In this area one cylindrical pot, 85 small and middle-sized bowls and 33 goblets have been found, lying in concentrations on the floor and in the fill in the northern and western part (see fig. IV.36 - 40, 42, 43, 90, 91, vessels from the lots mentioned in footnote 101). In the middle of the room a passage to and from the doorway to courtyard 3 and around kiln AC/AI was kept more or less clear of objects, indicating that the doorway and surface were still in use when these objects were discarded here and that we are not just dealing with a garbage heap. A very large number of these bowls and goblets were misshapen, deformed, cracked, repaired or filled with gypsum, suggesting they are the refuse of a pottery workshop (figs. V.16, 18, 55). This deposit included kiln wasters, of which some

¹⁰¹ In square M12, locus 4 lots 4, 12, 26, locus 7 lot 7, locus 10 lot 17, locus 13 lot 27, locus 16 lot 29, locus 33 lots 50, 55, 67, between elevations 326.68 and 325.70 (surface in the south). In square M11, locus 7 lots 69, 88, 90, locus 9 lot 126, locus 33 lots 96 until 173, locus 38 lots 13, 138, 157, locus 45 lot 172, between elevations 326.60 and 326.05 (surface in the north).

¹⁰² Possibly the level 5 deposits including contexts belonging to the potter's activities in the northern half of the courtyard have eroded away in this area. Cf. Room 4.

were repaired after firing. The repairs were mostly unsuccessful (fig. V.56). Most probably the vessels deposited here were fired in kiln T/U or in kiln AC/AI.

In the southern half of the courtyard unfired vessel fragments and waste from the shaping process were found in the corner next to the door into room 5 and just north of the lined pit AF. These were mainly goblet and bowl fragments and waste from pottery shaping (figs. V.43, 44, 46). In the northern half of the room large concentrations of unfired vessel fragments were found just north of kiln AC/AI, between kiln AC/AI and the western wall of the room among the bowls and goblets on the floor, and in the fill of the kiln itself (fig. V.16). A few fragments were found south of kiln T/U. The fragments at this side of the room were mainly from goblets, type 131 bowls and larger shapes (figs. V.43, 44, 47). The find of unfired fragments indicates that the drying or shaping of pottery may have taken place in this area, or that unfired broken vessels and waste of the shaping process were discarded together with the kiln wasters here. Just north of kiln AC/AI and in bin X there were some small fragments of completely overfired pottery.

Some of the other finds in the northern half of the courtyard may have been tools used in pottery production. A rounded Halaf sherd with abraded edges was found amongst the bowls and goblets near kiln T/U. It was perhaps used for scraping/turning the vessel wall during the shaping process. Two stone objects were identified as possible polishing or rubbing stones. Next to wall R was an irregular boulder with a pierced hole, of a type of which many more examples were found in room 1 (see below). A piece of animal horn found along wall H was perhaps used as a tool as well. Amongst the bowls and goblets along the northern wall H, a terracotta miniature wheel was found. Perhaps the potter occasionally made these kinds of special shapes as well. Furthermore, four basalt grinding tools of different shapes were found, as well as a fragment of a thick, baked clay tray or platter with large, sharp stone inclusions in the top surface.¹⁰³

Room 1

Room 1 measured about 7.7 x 3.1 m (approximately 24 m²) and was accessible from the central courtyard (3) (fig. V.15). This room could be closed with a door, as indicated by a door angle-stone located on the inside of the western door-jamb. In the northeastern corner of the room a door led into a narrow corridor to the east, perhaps a staircase. Originally a door in the southern wall connected this room directly with the courtyard to the south (2) as well, but the door was later blocked in the renovations of the building and the building of kiln T/U. Floor AM, a simple earthen floor, was found at elevation 326.27-16. Just east of the door, a shallow pit was dug (AR, about 15 cm deep and 65 cm in diameter). Large sherds were used to line the southern edge of the pit, while the inside was lined with soft limestone cobbles and was plastered. Its position next to the door and its width make it unlikely that this pit served as a post-hole. Similar pits have been found in the Late Bronze Age potters' workshops at Sarepta, and are there interpreted as wheel pits for the construction of a potters' wheel (Anderson 1987: 48). Perhaps a similar interpretation could be valid at Sabi Abyad.¹⁰⁴ In the eastern part of the room another shallow pit was dug (BJ), around 0.70 m in diameter and some 15 cm deep. To the east of pit AR a small oven or kiln was built (X/Y/Z/BI). This structure was unfortunately heavily disturbed by a later burial pit, so it is unclear whether this very fragmentarily preserved oven is a very small example of an updraft structure or not. It may also be comparable to single-chamber oven X in square O11 in level 6 (see fig. V.2). In the west a rectangular mud-brick wall surrounded the oven, but the whole eastern part was cut away by the later burial. The inside was rounded and made of red burnt brick and plaster. The mud-brick wall was only flimsily preserved, while the burnt curved inside wall of the oven went down some 20 cm more. In the west two large stones seem to partly cover the oven. The

¹⁰³ So-called polishing stones, grinding tools, an animal horn and a terracotta wheel were also found in room 1 of the level 6 pottery workshop.

¹⁰⁴ Cf. the plastered pits Y, Z, AA and AB in the level 6 workshop, fig. V.2.

oven seems to have been rebuilt several times, as indicated by the remnants of two other oven walls in the same spot. On both sides of the oven a thick layer of burnt soil and carbonized material was visible. Oven X/Y/Z/BI is too fragmentarily preserved and too badly understood to interpret it as a pottery kiln at this moment. Along the southern wall of the room some baked bricks were lying on the floor, next to pit AR and behind the oven, forming a kind of platform or working surface. A niche was set into the centre of the western wall of room 1. The blocked door in the south wall served as a niche as well. Next to the niche in the western wall a large base of a jar was set into the floor.

The fill¹⁰⁵ in room 1 consisted of dark-brown mud-brick debris and grey or black ashy soil, perhaps related to the use of oven X/Y/Z/BI. The field documentation mentioned that the soil was often very dense and clayey, and contained baked clay fragments and pieces of gypsum, next to large amounts of sherds. In several spots in the room along the western, northern and eastern wall large concentrations of big sherds, stones and grinding tools were found. The soil under the stones was noted to be very clayey as well, and contained pieces of baked clay and gypsum. The relatively clayey character of the fill might indicate that clay was prepared, stored or used in this room.

Among the many sherds found in the fill and on the floor of room 1 there were eight more or less complete vessels. Against wall J near the niche a base of a jar was set into the floor. The jar had been broken before, but the fractured edge was carefully smoothed so that the jar could be used as a pot (fig. IV.96.a). The jar base was painted, which is rare at Sabi Abyad. Two pot stands and five bowls make out the rest of the pottery objects. Two of the bowls were perhaps used as an oil lamp.

In contrast to the clayey nature of the room fill, there were almost no finds of unfired vessels in this room. One fragment was collected just south of oven X/Y/Z/BI. Two fragments of overfired and molten pottery were collected. Baked and burnt clay pieces were found in the concentrations of sherds and stones along the eastern wall. Against wall J burnt clay and burnt bricks were found.

Other tools and objects in room 1 included a wide range of ground-stone tools and fragments of ground-stone tools, like hammers (n= 6), grinders (n=8), grinding slabs (n=2), a mortar and a pestle, two “whetstones” and a “polisher”, and an axe or hammer. Another pierced cobble, with a perforation smoothed by use, was found. A similar object was found in courtyard 2, and five more stones with various piercings were found higher up in the later fill of room 1 and three in the corridor to the east. The function of these pierced cobbles is as yet unclear. A stone pendant and two clay jar stoppers were found, as well as a scraping tool made of a reworked ring base of a sand-tempered bowl (fig. V.19). Metal finds included a bronze nail fragment and a fragment of an iron knife or blade. The ring base and the metal finds could have been used in the shaping process, for example to turn or trim clay from the wall of the vessel (see below). Finds from a bit higher up in the fill of the room,¹⁰⁶ perhaps dating to a later phase of level 5, also included (apart from more pottery and groundstone tools) a tool made of a curved goat horn, a bronze pin and a stone cylinder seal, as well as a goblet with a cylinder-seal impression.

Room 4

Room 4 measured 3.2 x 5 m (16 m²) and was accessible from courtyard 2. A door also led to the east, providing access from here to the open area in the east and a way to reach kiln H. The opening from courtyard 2 could be closed with a door as is indicated by a door angle-stone on the inside of the door-jamb. The fill and the floor preserved in room 4 most probably belong to level 6, and therefore cannot be used as indication for the use of this room in level 5. Level 5 is not preserved in this part of the building, but it may be suggested that the general layout of the room was similar to level 6, as is the case in the rest of the building.

¹⁰⁵ M11 Locus 13 lots 137 until 171, locus 513 lot 511, between elevations 326.37 and 326.16.

¹⁰⁶ M11 Locus 13 lots 113 until 127.

Courtyard 3

Courtyard 3 was the open space west of the building and it gave access to the different spaces of the complex. A level 5 floor level was not found in this area. Possibly pits V and W were dug in the yard in level 5, or in a slightly later level 5 phase. Both pits were about 1 m in diameter and between 20 and 35 cm deep. One was filled with greyish ashy soil and lots of bones, the other contained dark-brown soil with lots of sherds. From courtyard 3 a narrow street ran to the north and to the west around the building towards the other workshops of level 5. The deposits in the courtyard¹⁰⁷ consisted of greyish and brown soil with lots of sherds, bones, flint fragments and pieces of gypsum plaster. Next to the northern wall was a concentration of large cobbles amongst very dense compact and clayey soil. Next to the door into room 1 a small wedge-shaped piece of unbaked clay was found (O96-209). Other than a pottery bowl and a goblet, no objects were found in the courtyard.

The house

The main house attached to the workshop area could be entered via two doors, one coming from courtyard 3 and one coming from the internal courtyard 2 (fig. V.13). Both doors had mud-bricks on the threshold, but no door angle-stones. Room 5¹⁰⁸ seems to be a small vestibule before entering the actual house. In room 5 a shallow depression (P) filled with sherds was set in the corner of the walls, protected by a low and narrow mud-brick wall. Perhaps there used to be a large ceramic (water) vessel here. Bin M, built against the eastern wall of room 5, was a partly collapsed structure perhaps used for storage. Five pottery bowls and a hammer stone were found in the vestibule. From room 5 the main room or internal courtyard of the house (6) could be reached. The opening to room 6 could be closed with a door, as indicated by the door angle-stone found on the inside of the door-jamb. In the northwestern corner of room 6 a plastered pit (AH) with a grinding slab at the bottom was built. As with the other plastered pits found at the site, its function is not completely clear but it may have been a post-hole or a mortar. Around AH a lot of burnt seeds were found. In the middle of the room a shallow pit (O) was found, containing pebbles and sherds. The deposits in room or courtyard 6¹⁰⁹ consisted of mud-brick debris, lots of sherds and grinding-stone fragments. On the solid orange-brown earthen floor at elevation 326.05-15 large amounts of ground-stone tools and more than 30 complete pottery vessels were found (ranging from small bowls to large jars), and a lot of burnt grain and charcoal. One of the pottery objects was a completely warped and overfired pot stand (P93-311), obviously a kiln waster. Perhaps room 6 in the house was used as a storage room by the potter. In the south-western corner and in the door opening towards room 7 ten fragmented and complete cuneiform tablets were found, identifying the house as the location of scribe Belu-Erish, and mainly including letters concerning the delivery of different kinds of food stuffs.¹¹⁰ Also there were many fragments of bronze objects among the vessels on the floor. From this room a door opening led to room 7.¹¹¹ Here, too, many sherds and five complete pottery objects were found, as well as a stone grinder. From room 6 to the north a narrow corridor led towards room 8, and then around it to the back of the house. On the floor in room 8,¹¹² lying a bit higher than the other floors in the house at approximately 326.30, seven ceramic objects (bowls, jars) were found, as well as four ground-stone tools. In addition a fossilized stone, a bronze ring and a stone bead were found. Near the southern wall of the room a complete cuneiform tablet was found on the floor. In room 8 another floor was found belonging to a later phase of use (but most probably

¹⁰⁷ M11 Locus 34 lots 103 until 177, locus 28 lots 147, 152.

¹⁰⁸ M12 locus 5 lots 5 until 13, locus 8 lots 14 until 23, L12 locus 48.

¹⁰⁹ M12 locus 9, L12 loci 18, 23, 24, 29, 38 and 47 (door to room 7).

¹¹⁰ Personal communication by F.A.M. Wiggermann, 9-10-2005.

¹¹¹ L12 loci 19 and 39.

¹¹² L12 locus 26.

still level 5). On this mud-brick floor, at an elevation of 326.80, several fragments of an unfired bowl and left-overs from pottery production have been found.¹¹³ Also in this phase, two plastered pits with grinding slabs at the bottom (S and V) were found in this room, comparable to feature AH in room 6 and other similar features elsewhere at the site. The narrow corridor leading to the back of the house was fairly empty of finds in the eastern part.¹¹⁴ On the sloping earth floor (326.31-21) two complete and two fragments of cuneiform tablets have been found. In the western part¹¹⁵ at the back of the house the floor of the corridor was made of baked bricks (elevation 326.37). Here a drainage pipe leads into space 10. Most probably this part of the corridor was the bathroom or toilet of the house. On the baked-brick floor a pot stand, a goblet, several bowls, a grinding slab and a complete bronze arrowhead were found. Space 10 was most probably used as an outlet for the drainage in the bathroom and perhaps as a garbage pit as well. The southern half of the little room seems to have been separated from the northern part by a thin wall. The inside of the walls of the whole area, as well as the separation wall, were heavily burnt. The depositions in room 10,¹¹⁶ possibly separable into two phases, consist of very soft black and grey ashy burnt soil. In the southern half there were many fragments of burnt mud-brick, burnt pottery, and many other objects. Apparently the garbage in the drainage outlet was regularly burnt, not surprising in view of the door opening towards the main room of the house.¹¹⁷ Many objects were found in room 10, including a complete cuneiform tablet very close to the door into room 6, a bronze needle fragment, three possible clay sealings, two jar stoppers, several ground-stone tools and many pottery bowls.

Conclusion: the level 5 East workshops

According to the finds related to pottery production and the architectural structure of the building, we may conclude that the total area in use by the potters was 294 m² or 580 m² including the open area to the east (fig. V.14). While awaiting the final stratigraphy reports, it seems that the workshops show one, or more likely two phases of use, but it is not clear how long the workshop was in use. One large kiln was in use in level 5 East, but located outside the workshops in the open area to the east. Two smaller kilns were built within the workshop, possibly at different times. Probably these smaller kilns were built and used for smaller kiln loads (when production levels or demands were lower) or for special types of pottery (like smaller bowls or goblets). So, there seems to be a larger variety in production (either in output levels or in the kinds of vessels produced, see also below paragraph V.7) than in level 6, when only large kilns were used. The outer area east of the workshop was possibly also used to store or prepare clay in pits. Room 1 and courtyard 2 seem to form the core of the workshop. At several places in the workshop, most notably in the north of courtyard 2 and in room 1, dense and clayey deposits suggest that clay may have been prepared, stored or used in these spaces. Both in courtyard 2 and in room 1 a shallow pit (AE and AR) has been found that might be interpreted as a wheel emplacement. However, no other indications were found for

¹¹³ As long as the detailed stratigraphy reports are not available, we can only assume that the pottery workshop in M11 was continuously used during the accumulation of floors in this room, and that the unfired fragments belong to the contexts in M11.

¹¹⁴ L12 loci 36, 37.

¹¹⁵ L12 loci 40, 50.

¹¹⁶ L12 loci 17, 31, 34 (northern part, between elevations 326.94 and 325.80), locus 27 (southern part, between elevations 326.70 and 325.79). At 326.22 in locus 31 and at 326.17 in locus 27 there seems to have been a floor or separation of deposits. The upper part above these elevations (locus 31-68 and locus 17; locus 27-48, 75, 76) might be connected with the mud-brick floor in the "bathroom", at elevation 326.48. In locus 34 the burnt fill seems to continue; the bottom of it was not reached.

¹¹⁷ The possibility that the little room 10 actually represents the dug-in part of an oven or kiln (perhaps even an updraft kiln?) from a later phase, making good use of the already existing walls of this small space, is interesting but cannot be tested or proved at the moment.

the existence or type of potters' wheel used. If AE and AR were wheel emplacements, the shaping of pottery took place in these areas as well. The drying of finished shapes could have taken place in the courtyards (2 and 3), or in room 1. Firing the vessels took place in kiln H in the outer area, accessible through room 4, and in the two smaller kilns in courtyard 2. It is not certain where the fuel was stored, perhaps on the roof of the house. After firing many cracked vessels were repaired, but then finally discarded next to the kilns.

Pottery production in level 5 East took place in an area of the site that bordered on the workshop areas to the south of the tower. However, the architecture and the integration of the activities in the spaces of the house in the western part seem to suggest that the use of space was less specific than in level 6. It seems that the workshop activities have moved closer to the living spaces, making use of whatever empty space was available, and perhaps sometimes workshop activities (like storage) entered the living areas. This seems to be a marked difference with the layout of the level 6 workshops. The location of the workshop, now inside the fortress walls and close to the location of the scribe, as well as the find of a sealing with cylinder-seal impression in the kiln fill, suggest that the potters were still firmly connected to the Assyrian administration.

The level 5 West location

In the west of the settlement in square H8, and probably a bit later than the pottery manufacturing activities in the East, a room just inside the fortress walls was used for pottery production (fig. III.4 and fig. V.20). Two small updraft kilns were dug into the fill of the room, in the corner of the walls. Other finds pointing to pottery production, although stratigraphically probably not contemporaneous with the kilns as will be shown below, include amounts of unfired vessel fragments and pottery wasters. The finds in H8 have the character of a waste dump rather than a proper pottery workshop with finds *in situ*, and I therefore call this area a production location instead of a workshop. The potters seem to have used an empty, unused room to build their kilns. Most likely the workshop proper was located elsewhere. In square H9 the heavily fired western wall may indicate that this area was used for open firing, perhaps of large storage jars.

Kilns

Two small updraft kilns were built in room 14 of the small building located in square H8 just east of the fortress outer wall. At the end of level 5 (level 5B) this room had a floor (J) made of grey ashy soil at an elevation of 326.37-25, while the southern half of the room was covered with baked bricks (floor G). Several very large storage jars were set into floor J, indicating that the room was used as a storage space (fig. V.21). At some point several doors to room 14 were closed and the storage space filled up with enormous amounts of large broken pots, sherds and other waste (fig. V.21, the lower brown part of the eastern and southern section baulks). The two kilns were dug into this layer of waste and debris.¹¹⁸ Both kilns, as well as the waste dump in room 14, were later levelled with the construction of floor F (level 4D) at an elevation of 326.95-83 (fig. V.21, the grey ashy layers in the eastern and southern section baulks).¹¹⁹ The kilns and the pottery production activities could therefore belong to the final stages of level 5 or to the earliest times of level 4 (between 5B and 4D). It is unclear whether the two kilns were built or used simultaneously or at different moments.

¹¹⁸ This is not only clear from the stratigraphy and section drawings but also from the general construction of this type of kilns, with the fire chamber below ground level and a fire chamber architecture that could not have been a free-standing structure but was always dug in. Also, the absence of any waste related to pottery production in the fill above floor J and under floor F, while the kiln is filled with this kind of waste, suggests that the original surface from where the kilns were used was levelled away.

¹¹⁹ This also means that any deposits in room 14 associated with the use of the kilns have most probably been levelled away.

Kiln H/AE was dug into the room fill in the northeastern corner of room 14, using the northern and eastern wall for support (see Appendix C and figs. C.13-17). Only the lower part of the fire chamber was preserved, the upper structure was cut away during the construction of floor F. The preserved part of the fire chamber measured 1.44 x 0.68 m, and is 1.10 m deep. Consequently, the size of the kiln is comparable to kiln AC/AI in M11/M12 and to kiln CJ/V in K8 (see below and table C.1). In the pit of the fire chamber whole bricks were upended against the northern wall B of the room and against the western side of the pit, while at the southern side of the pit half bricks were laid in normal masonry. This was probably done to create a stronger fire-chamber wall since the southern pit side was not supported by a wall. At the eastern side the surface of wall AB was used, without a brick covering. All bricks and the surface of wall AB were heavily fired and molten to grey/green, due to the high temperatures reached in the fire chamber. The fill in the oven¹²⁰ consisted of soft brown-red, grey and black fill with ash, burnt loam, mud-brick fragments and clay lumps. The bottom of the fire chamber was made of dark-brown soil at an elevation of 325.85. On top of the fire-chamber floor mainly soft ashy fill was found. Higher up in the fill a lot of sherds and many fragments of unbaked vessels were found (mainly belonging to goblets, small bowls and jars, see below paragraph V.6), as well as three kiln wasters (a jar (fig. IV.74.k) and two bowls). Other fired bowls, a jar stopper, a grinder fragment, and two fragments of sealings were also found in the kiln fill.

Kiln I was dug in the northwestern corner of room 14, again making use of the walls for support (see Appendix C and figs. C.18-20). Again only the lower part of the fire chamber is preserved, but the eastern wall seems to curve inwards already. Perhaps the kiln floor was not very much higher. The preserved part of the fire chamber measures 1.12 x 0.65 and is 0.90 m deep, and so kiln I is comparable to kiln H/AE in size. The construction of kiln I was less solid than that of H/AE. The southern, narrow side of the fire-chamber pit as well as the eastern side of the pit were covered with complete mud-bricks set on their sides. At the northern and western sides the faces of the walls B and C were used as fire-chamber walls without any further strengthening. It is unclear what the arch supporting the pottery floor rested upon at the western side. Perhaps the western wall C was cut at a higher level for construction of the pottery floor arches. The bricks inside the fire chamber as well as the western and northern walls of the room were heavily burnt by the fire in the kiln. The walls showed traces of burning up to an elevation of approximately 327.46, indicating that the fire chamber may have been about 1.58 m deep (estimated volume 1.15 m³). The bottom of the fire chamber, at an elevation of 325.88, consisted of brown soil. The fill of the kiln¹²¹ consisted of two deposits: the lower part was filled with blue-grey ash associated with the use of the kiln. The upper part contained blue-grey, grey-brown fill with ash, loam, burnt loam and mud-brick fragments. The ruins of the fire chamber were later used for a burial, similar to the use of kiln L in square N12 (level 6). The burial partly cut the fire-chamber wall. One fragment of unfired pottery was found in the kiln fill, and several body sherds of unfired pottery were found in the fill of burial 1.

In the open area south of room 14, in square H9, there were indications of firing activities as well, possibly related to pottery production. The eastern side of the bricks of the outer wall of the fortress, called F in this square, were reportedly fired and the whole northern part of the wall was covered in burnt plaster, sintered clay and slags. Clearly, a fierce fire creating very high temperatures had been burning against the wall. The level 5B deposits in the area seem to be dump layers on top of a floor (at elevation 326.26), containing loads of highly eroded and broken pottery sherds, a lot of burnt material, ashes, burnt straw, grain and wood charcoal. In the southeast against wall I feature Y was reported to have been made of a row of

¹²⁰ H8 locus 16 and 42.

¹²¹ H8 locus 17.

baked and burnt bricks and burnt mud-bricks (measuring 2.18 x 0.65 m with lower elevation at 326.63). The available data at the moment are not clear enough, but perhaps Y represents the lower remains of a fire chamber? Similarly, in level 4C, a rectangular band of burnt mud-brick filled with grey soil was reported against the western wall F (feature V/AB, measuring 2.15 x 0.85 m and lower elevation at around 326.86). Possibly the firing and sintering of wall F is connected with the use of V/AB. If indeed Y and V/AB are the remains of kiln fire chambers, they were both probably dug from a level much higher than the level 5B burnt dump fill of the open area. The high firing and sintering of the surface of wall F could also have been caused by an open fire against the wall. Perhaps the firing of large storage jars in a bonfire took place here, in the absence of an updraft kiln large enough to hold them, although there are no further indications for this. A fragment of unfired pottery was found in square H9 along the eastern wall of the open area, in level 4B. In level 5B large amounts of slag and molten clay were found on the floor of the area near the burnt wall under a thick layer of burnt straw and charcoal, and in the thick dump layer also containing burnt material.

Other finds associated with pottery production

In the level 5 West location so far no particular area or associated architecture could be clearly identified as a workshop location. Again the finds of unfired vessel fragments and kiln wasters could point to a production location, but the evidence is much less clear than in level 5 East or in level 6.

Earlier (in level 5C) an office or archive space of the *abarakku* of the *dunnu*, Tammitte, was located in the small rooms to the north. Here many cuneiform tablets were found. Later this room filled up with roof debris and dump layers. Large amounts of unfired vessel fragments were found in the fill of a former bathroom north of room 14 (fig. V.20). The deposits that contain unfired pottery can be divided into two phases. Originally, the room seems to have housed some kind of toilet installation. Baked bricks were placed on their sides against the walls. In the south of the corridor on top of baked brick floor W (elevation 325.80) a layer of debris of some 10 cm thick was deposited with hardly any finds. On top of this soil layer a concentration of cuneiform tablets and envelope fragments, clay sealings and some fragments of unfired pottery vessels (including a ring base) were lying amongst sherds of a large vessel.¹²² Other finds included more or less complete pottery bowls, a bone awl, a bronze arrowhead, and a basalt hammer stone. These finds are dated to level 5C. Later, at elevation 326.24, an uneven surface called floor Q was present in the room. On top of this floor and concentrated against the northern wall, in the niche in western wall C, and in the southern part of the room,¹²³ there was a concentration of large amounts of pottery sherds and many unfired vessel fragments, amongst some ground-stone tools, more or less complete pottery objects, and three jar stoppers. This deposit is dated to level 5B. The unfired fragments comprise hundreds of pieces and show a large variety in rim types and vessel shapes (see below, paragraph V.6). A single unbaked clay fragment related to pottery production was found in the small room (17) in the northeast of the square at an elevation of around 326.54, belonging to level 5B or 4C. And so, if the stratigraphical placement of kilns H/AE and I in room 14 after level 5B (between 5B and 4D) is correct (see above), the finds in corridor 16 cannot be related to the use of the kilns.¹²⁴ In that case the area was used more than once by the potters.

Other isolated finds of unfired vessel fragments in surrounding areas come from square G7 (most probably from the fill of the moat that was dug around the settlement in level

¹²² Square H8 locus 30.

¹²³ Square H8 loci 26, 34 and 27 respectively.

¹²⁴ Another possibility is that the floors in the “bathroom” and adjacent rooms were kept clean and were in use during level 5B, the time when room 14 filled up with waste. Only in that case could the use of the kilns in room 14 be contemporary with the deposit of unfired vessel fragments in room 16, but then the stratigraphical placement of the deposits in corridor 16 is not correct.

6), from the open area in square H9 (see above, level 4B), and from the floor context in the large courtyard to the east in square I9 (elevation 327.03, level 5B/5C).

Kiln wasters are reported in square H8 from room 15 in level 5C, room 17 in level 5B/5C, from floor J in room 14 (level 5B) and from room 16 in level 4C/5B. Another kiln waster was found in square I8, but very high up in the fill dating from level 1C/3A.

Many slag fragments possibly related to pottery firing were found in square H9 (see above, level 5B), square I8 (level 4B/4C and mixed context), square J9 (courtyard, level 5B/5C), square J8 (courtyard, levels 4B, 3, 1) and squares G8 and G9 (no stratigraphical information available yet). However, these finds come from different levels and do not seem to be strongly associated with other finds related to pottery production. Moreover, “slag” can be related to other fire-related productions as well.

Conclusion: pottery production in the level 5 West location

The deposits of unfired vessel fragments in corridor 16 suggest that pottery production waste was put here on at least two occasions (level 5C and 5B), both most probably unrelated to the building of the kilns in room 14 (after level 5B). Therefore the area was used by a potter at at least three moments in time. The finds in the open area of square H9 are possibly related to pottery production as well. It seems that there was not a specifically designed building in use as a pottery workshop in this area. Rather, the potters made use of empty unused buildings and spaces for their activities. Possibly they used room 14 itself, the outside area west of the fortress wall, the large courtyard to the east or the smaller open area to the south of room 14 (square H9) for shaping and drying their vessels. Or the actual workshop was perhaps located further away from the kilns and room 14 was just thought to be a suitable place for building the kilns. We even cannot completely exclude the possibility that the kilns in level 5 West were actually used by the potters working in the level 5 East workshop. Compared to level 5 East and especially level 6, the activities in level 5 West seem to have been more of an *ad hoc* nature. As in level 5 East, the evidence from this location suggests that the use of space was very flexible, and that any space not used for other functions at the time could be put at the disposal of the potter if needed.

The location of kilns in the west of the settlement, as opposed to the formerly preferred eastern location, might be related to the time of production. Westerly winds predominate in the summer season, creating a lot of nuisance for the settlement if pottery kilns are located in the west. In the winter, however, the predominant direction of the winds is easterly. Perhaps, the kilns in the level 5 West production location were used only in the autumn or winter season?

The level 5 North location

A third location of pottery production identified by the presence of two updraft kilns is found in the north of the fortress settlement (fig. III.4 and fig. V.22). Two kilns were located in squares K8 and L8.

Kilns

The earliest kiln in the northern area is kiln AR located in square L8. It is a rather large updraft kiln built in the corner of the western and northern walls of room 2 in what later would be the so-called “office” building. Although the stratigraphy here is not yet available in detail, it seems clear that level 5B floor AI in room 2 (at an elevation of 326.28-34) covered or even levelled kiln AR. Only the fire chamber has been preserved. The top elevation of the preserved kiln construction is 326.10, and because the air flues of the pottery floor are already visible, the pottery floor and the level from which the kiln was constructed would not have been much higher than that. Perhaps kiln AR was dug at a time when the level 5C room was no longer used for its original functions, or perhaps a pottery workshop was located here

originally in level 5C.¹²⁵ Kiln AR ranks amongst the largest kilns found at Sabi Abyad (see table C.1 in Appendix C), with a fire-chamber volume similar to kiln H in N13 (level 5), kiln L in N13 (level 6) and kiln K in J7 (level 4). The kiln was replastered or repaired at least three times. The fill of the fire chamber consisted of pure black and white soft ashes on the earthen floor, then a layer of soft ashy soil¹²⁶ covered with debris including stones and large chunks of burnt and unburnt mud-bricks originally belonging to the upper structure. Green/blue sintered plaster pieces, some pottery slag and some fragments of heavily burnt bone were included in this fill as well. In the lower kiln fill near the floor a bowl, a bronze ring and a wedge-shaped object (fig. V.7, O03-198) of baked clay were found, of a type similar to objects found in the level 6 pottery workshops. Perhaps this object was used to stabilize the kiln load during firing. A clay sealing with a cylinder-seal impression¹²⁷ was found in the kiln fill near the floor.

After the *dunnu* gate in square K8 went out of use as a gate, but before the recesses in the wall and the gate were closed and bricked up, kiln CJ/V was built against the eastern wall (see figs. C.21-25 and Appendix C for a detailed description). This is the only updraft kiln found at Tell Sabi Abyad of which not only the pottery floor but also part of the pottery chamber construction have been preserved. The kiln was built from a surface at an elevation of 326.80, using the western wall of the room as a support. At this elevation no real floor was recognized in the room,¹²⁸ and it seems that the kiln was built in an otherwise unused space. The fire chamber was dug into the fill covering floor CM (level 5B, elevation 326.19), and cut floor CM. The lower elevation of the fire chamber was 326.16. The sides of the pit were covered with upended mud bricks, two bricks on top of each other. On the surface at 326.80, a rectangular bin was built using half mud bricks on all sides of the fire-chamber pit. The bin seems to extend towards the south more than the fire-chamber pit, and perhaps formed a fuel hole or entrance to the fire chamber.¹²⁹ Also at this level two mud bricks were placed obliquely leaning against each other over the fire-chamber pit, forming an arch to support the pottery chamber floor. The pottery chamber floor, with at least six preserved flue holes, had an elevation of 327.11 and was well plastered. The floor is not preserved over the whole length of the structure. The walls of the bin continued and now formed the side walls of the pottery chamber. The pottery-chamber walls have been preserved up to the elevation of 327.62, two courses above the pottery-chamber floor. A firing hole to the fire chamber was present on the northern side just next to the buttress of the former gate. Because kiln CJ/V cut level 5B floor CM and the fill on top of it, it should be dated later than level 5B. In level 4 the door opening of the gate was blocked, making the use of the firing hole impossible. A level 4B surface at 327.60 covered the remains of the kiln. Consequently, kiln CJ/V was built and used between level 5B and 4B. The fill of the pottery chamber¹³⁰ consisted of brown soil with plaster fragments and charcoal, and included a pottery bowl and a stone sphere. The fill of the fire chamber¹³¹ was loose brown and grey, sandy and ashy soil, while a thin layer of soft, pure fine black-to-grey ash with charred grains¹³² was lying on top of the fire-chamber floor. Small finds from the fire-chamber fill included a small piece of faience, a clay jar stopper, and a

¹²⁵ However, at the moment there are no other indications for the presence of a workshop in this location.

¹²⁶ Sample SN03-182 was taken from the ashy kiln fill, containing charcoal and burnt plant material. The sample was sent to the botanical laboratories in Groningen but results of the analysis have not yet been received.

¹²⁷ See Duistermaat and Wiggermann in prep.

¹²⁸ A surface was noted in the southern section drawing, at elevation 326.72. This surface was also noted in the northern section drawing of square K9, at elevation 326.60-70.

¹²⁹ Cf. kiln AC/AI in square M11/M12. If bin W in square M12 originally belonged to this kiln as part of the superstructure, it also extended more to the south than the fire chamber itself.

¹³⁰ Square K8 loci 29, 47.

¹³¹ Square K8 loci 161, 164.

¹³² Sample SN99-5 contains ash with seeds from this layer just above the fire chamber floor. The sample was not yet sent for analysis.

grinder fragment. The deposits around the kiln possibly associated with the use of the kiln¹³³ consisted of grey ashy soil and mud-brick debris with grey spots.

Other finds associated with pottery production

Finds of unfired vessels or kiln wasters that might be associated with the use of kiln AR in square L8 and kiln CJ/V in square K8 are few. No unfired vessel fragments are reported from square L8. One unfired bodysherd of a jar was found in square K8 (O99-2, level 5B) and two fragments in square M7, possibly in the fill of the Assyrian moat. Kiln wasters have been found in square K8 (two objects, both level 5B), square M9 (two objects, both level 5B) and square L9 (level 5B). Several pieces of “slag” have been reported from different levels in surrounding squares, but without a clear association with the kilns. As with the level 5 West location, no specific architectural space seems to have been designated for pottery production. The potters seem to have used the space whenever they needed to build a kiln in this general area, making use of spaces not used otherwise at that moment.

Conclusions: The location of pottery production in level 5

We have seen that the location of pottery production in level 5 presents us with a picture of flexibility and of opportunistic use of space at the site. At the start of level 5 a large updraft kiln was in use in square L8 in the north of the settlement, in a room built against the outer fortress walls. This room would later become a kind of office. Apparently no pottery workshops were located in the immediate vicinity of the kiln. A bit later in level 5 a pottery workshop including two smaller updraft kilns (T/U and AC/AI) was located on the eastern side of the settlement, making use of the courtyard and a room belonging to a house. This house belonged to a scribe, and perhaps he still lived or worked there. Although this location (level 5 East) was identified as a proper pottery workshop, it seems that the allocation of space to the potters proceeded in a less fixed way than in level 6. The potters mainly used areas that had been left empty for some time. The workshop in level 5 East probably also used the large kiln H in square N13. At more or less the same time large amounts of unfired vessel fragments were dumped in corridor 16 in square H8, a space formerly belonging to a kind of archive or office. Later still, two smaller updraft kilns (H/AE and I) were built in the waste dump of room 14 in square H8, while possibly the open area in square H9 was used for firing activities as well. Around the same time or again a bit later, possibly already in level 4, a smaller updraft kiln CJ/V was built in the recess behind the former city gate in square K8. It is unclear whether the workshop in level 5 East was still in use at this time, or whether pottery was shaped in a location closer to the western and northern kilns.

During level 5, a period of about 15 years as indicated by the dates in the cuneiform texts (see Chapter IV), two larger and five smaller pottery kilns were used. Compared to the use of the two large kilns in level 6, estimated at a duration of ca. 30 years, this could suggest an increase in production output when the ovens were used with the same intensity. The settlement itself, however, seems to have contracted within the fortress walls.

It is as yet unclear why, in level 5, pottery production seems to be shifting to different locations in the settlement. Perhaps there is a relation between the season and prevailing winds and the location of the kilns needed at that moment. Perhaps depositional circumstances only preserved the remains of one workshop for us to excavate, while other workshops were located but not preserved, found, or identified close to the western and northern kilns. It might also be suggested that the potters did not have or need a permanent workshop during (part of) the level 5 occupation of the settlement, but that they used available spaces for producing pottery and building kilns as soon as vessels were needed, and that they were perhaps not producing continuously. Whether they participated in other work when they

¹³³ Square K8 locus 162 lot 371, square K9 locus 61 lots 146, 148.

were not producing, or whether they were absent from the site to produce pottery elsewhere,¹³⁴ must remain unanswered.

Evidence for pottery production in level 4

As was shown in chapter III, the occupation of the settlement in level 4 changed drastically. The settlement contracted to the northwestern part of the site, while the rest of the *dunnu* was partly a landscape of ruins and derelict buildings occasionally used for *tannurs* and other small-scale activities. Although it is most probable that there was no longer an *abarakku* during this time, it seems that the settlement was still part of the Assyrian administration, albeit on a different scale and perhaps with a different function. Despite this radical change of function and scale, local pottery production now also continued, although evidence is restricted to the earliest phases of level 4.¹³⁵

The small kiln CJ/V in square K8 is as yet tentatively dated to a period between level 5B and level 4B. Although for the moment the kiln is discussed together with the level 5 evidence, it may have belonged to the early level 4 occupation. See above for a full description of this kiln and other related finds.

In the area north of the former (level 5) *dunnu* gate, which was blocked in level 4, a large updraft kiln K was built in square J7 (fig. III.5 and fig. V.23; see figs. C.26-31 and Appendix C for details). This kiln was published earlier in Akkermans and Duistermaat 2001. The kiln is free-standing and very well preserved, including the complete pottery floor with flue holes. The kiln is preserved up to an elevation of 327.24-35. The fire chamber was dug from a surface S at elevation 327.10. The long sides of the fire chamber were covered with walls made of half mud-bricks in normal masonry. The short sides were covered with whole mud-bricks on their sides. Three real V-shaped arches, made of whole mud-bricks slightly leaning inwards one after the other, cover the fire chamber and support the pottery floor. The pottery floor has nine circular flue holes, made with mud-bricks fixed between the arches. The whole inside of the fire chamber and flue holes was plastered, and everything was fiercely burnt and baked to a greenish colour. The kiln has two fuel holes on the northern and southern side. The fire chamber measures 2.16 x 0.64 m and is 1.70 m deep, putting this kiln in the size-range of kiln AR in L8, about 1.3 times smaller than the volume of kiln Q in N11 (see table C.1 in Appendix C). The deposits inside the kiln¹³⁶ consisted of soft fine dark-brown soil with some sherds and bone in the flue holes. The fill of the fire chamber was soft brown and ashy grey soil, sherds and charcoal. Below that was a layer of very powdery soft grey, grey-yellow and pink ashy soils, with big parts of burnt mud-bricks. On the bottom of the fire chamber, fill was dark-brown to black ashy soil. Some large jar bases and other large sherds, bone, stones and burnt mud-brick were found in the south of the fire chamber, under one of the fuel holes. Lots of objects were found in the oven fill, including jar stoppers, stone grinding tools, a bronze pin fragment, two figurines of baked clay, and more or less complete pottery shapes. The deposits surrounding the kiln¹³⁷ form a thick pack of sloping ashy soil layers, looking like

¹³⁴ Cf cuneiform text T93-3 discussed above and in Appendix F.

¹³⁵ The excavations in 2005 yielded the badly preserved remains of an updraft pottery kiln in square M6, dug from a high but undatable level (P.M.M.G. Akkermans, personal communication 2-11-2005), and possibly connected to the evidence for pottery production in level 4. This kiln could not be included in the current study anymore.

¹³⁶ Square J7 locus 38 lots 74, 112, 142, and loci 76, 78, 81. Sample SN98-531, sintered plaster, was taken from the inside of the pottery chamber, but has not yet been analysed.

¹³⁷ Square J7 locus 31 lot 62, locus 33 lots 65-66, locus 34 lots 67, 75, locus 36 lots 69, 70, locus 41 lot 79, locus 45 lots 83, 87, locus 58 lot 111, locus 60 lot 114, locus 62 lots 120, 124, locus 63 lots 121, 122, 127, 130, locus 64 lot 125, locus 65 lot 12, locus 66 lot 128, 129, locus 69 lot 132, locus 74 lots 140, 146, to the west, south and east of kiln K, between elevations 327.37 and 326.85 (surface S is sloping). Sample SN98-10 was taken from slags near the kiln in an ashy layer, but was not sent in for analysis.

a waste deposit of ashes and garbage and containing many sherds, pieces of slags, bones, stones, and burnt mud-brick pieces. The small finds contain a remarkable amount of bronze fragments (n=10), two grinding tools and two pottery vessels.

No fragments of unfired vessels were found in square J7. However, many fragments were found in the adjoining square J6 to the north approximately at an elevation of 326.40, in an area south of a wall running east-west north of the kiln (see fig.) Although the stratigraphy of this square was not available at the time of writing, the daily field notes indicate that these fragments could be from the same level as kiln K. Among the fragments was also a fragment of a cuneiform tablet.

No kiln wasters have been registered from square J7 or surrounding squares. Fragments of “slag” have been found in the fill of square J7, and in squares H6, H7, I6, K6, K7.

It is therefore clear that at the beginning of the level 4 occupation, despite the major changes in the organization of the Middle Assyrian provinces and the *dunnu*, the staff at Sabi Abyad kept producing pottery on a reasonable scale, even making use of a large kiln. The potters’ activities seem to have shifted to the north of the settlement, just like the rest of the occupation. No workshop was found or identified, but it was probably located not far from the kilns, possibly in squares J6 and K6.

V.6 Technical aspects of pottery production at Tell Sabi Abyad

Identifying the local output of pottery production

The variability, standardization and size of the output of production, as well as the locally used techniques for shaping and firing are important factors in determining the kind of production organization. These aspects should ideally be studied *within* the corpus of locally produced pottery: otherwise, the aspects of products originating from different sources and perhaps different production organizations are mixed and the conclusions will be less clear. It is therefore important to know what range of vessels was actually produced locally and which vessels came from other sources.

Shapes that can easily and securely be identified as local produce are those shapes that are present among the unfired pottery and the kiln wasters. Other shapes likely to have been produced at the site are the huge storage vessels, which are very heavy and are not likely to have been moved over large distances.¹³⁸ It is clear that a large variety of shapes was produced locally at Sabi Abyad. From fragments of unfired vessels and from kiln wasters it appears that at least the following vessel types were definitely produced locally (fig. V.25; cf. also figs. V.43, 44, 45 for unfired fragments and page 190 for figure numbers of kiln wasters):

Bowls: 111, 113, 131, 132, 135, 141, 142, 143, 145

Pots: 212, 221

Jars: 311, 315, 322, 323

Pot stands: 611

Goblets: 411, 421

Strainers: 511

Bases: 711, 712, 721, 731, 741

¹³⁸ For an example of potters travelling in a region to produce large storage vessels on the location of use, see London 1989b and Voyatzoglou 1974.

To this list we can add the large handmade storage pots type 213, 215 and 226, and the large bowls type 1410, because they were probably too large to be transported anywhere far and are most likely to have been produced locally. We may also possibly add jars type 321 and bowl types 112, since they occur in large numbers at the site and are amongst the “top ten” of shapes (see table V.21 and below), and because they are minor shape variations only. The wares recognized among the unfired vessels and wasters were B, C, H and I (although the inclusions are often difficult to compare with normally fired sherds). All taken together, local shapes made from supposedly local wares¹³⁹ (ware groups X and Y) comprise 84.3% of the total database of described diagnostic sherds. For the majority of shapes found at the site we may therefore assume that they were locally produced, although this is of course not absolutely certain for every single sherd. Not all locally produced shapes are necessarily also represented amongst unfired fragments or kiln wasters. So the list of local shapes is probably even longer, including for example those shapes that are made in similar traditions as the ones in the list above (see below, table V.5). The technological analysis of shaping and firing techniques is discussed below. Although technological similarities do not prove local production, conclusions can be drawn on whether the pots were produced in the same technological tradition.

For the other shapes and wares present among the corpus of Sabi Abyad, the only certain way to establish whether they, too, have been produced at the site or not, is archaeometric research. A first step is to study thin sections of a sufficient sample of sherds from both groups with a polarizing microscope. In this way the minerals included in the clay and their number, shape, size and distribution can be identified. This is important to compare different clay mixtures. Something may be said about firing circumstances and temperature as well. Thin-section analysis therefore gives information on whether vessels are produced using the same materials and in the same technological “tradition”, or not. Chemical analysis of the clay of a selected sample of sherds from both groups and of local raw materials can indicate whether the sherds in each group are actually made of the same chemical components. This may show whether groups of vessels are produced in the same geographical area or made from the same clay source, or not. On the basis of the archaeometric results, five groups of raw materials could be formed, three of which are probably not local to Sabi Abyad or the Balikh region. The detailed data is presented in Appendix D; here, table V.2 presents these groups including information on shape and wares described in the field. Based on the thin-section analyses, I suggest to consider all type 911 “pilgrim” flasks as foreign to the site, as well as red-slipped pottery, glazed pottery, and most (but not all!) cooking-ware vessels. Interestingly, these types were already recognizable from their different shaping or decoration techniques. Type 315 jars could partly have come from elsewhere in the region as well, as could the burnished deep bowls with spout and handle type 151.

For some unique shapes it was suggested that they could have been imported to the site. For some of them comparisons with shapes from other (non-Middle Assyrian) sites were found (Chapter IV). Shapes that were certainly or possibly imported to the site are shown in fig. V.26.

Based on these considerations, and knowing that the recognition of “imported” vessels on the basis of macroscopic identification of the fabric has proved to be largely impossible, the following shape types will be considered as belonging to the local production at Tell Sabi Abyad (types between brackets are only included based on the similarity of shaping techniques used, cf. Table. V.5. Cf. also fig. V.25):

Bowls: 111, 112, 113, 117, (121), 122, (125), 131, 132, (134), 135, 141, 142, 143, 145, 1410

¹³⁹ As with the shapes, the local origin of a ware group can only be proved by thin-section and chemical analysis. See Appendix D for results of these analyses.

Chapter V: Techniques and Organization of Production

Pots:	(211, but excluding cooking pots), 212 (but excluding cooking pots), 213, 215, 221, (222), (225), 226
Jars:	311, (312), 313, 314, 321, 322, 323
Pot stands:	611
Goblets:	411, 421
Strainers:	511
Bases:	711, 712, 721, 731, 741

group	Description	Field wares	Shape types	Possible origin	Sample nos.
A1a	Calcareous clay with organic incl.	Ware I	132, 117, 315 (mostly level 7!)	Balikh Valley, Sabi Abyad?	02, 05, 32, 42
A1b	Calcareous clay, no org. incl.	Ware C, B	122, goblet	Balikh Valley, Sabi Abyad?	<u>44</u> , 45 (Nuzi)
A1c	Calcareous clay, fine-sand incl.	Ware A	911 pilgrim flask	Balikh Valley??	12
A2a	Calcareous clay with org. incl.	Ware H, I, J	111, 112, 113, 221, 212, 311, 313, 315, 322, 611 waster	Sabi Abyad	01, 03, 04, 11, 13, 14, 16, 17, 18, 21, 22, 26, 29, 31, <u>47</u>
A2b	Calcareous clay, no org. incl.	Ware A, B	314, 421, 711, 712, 721	Sabi Abyad	09, 10, 15, 24, 25, Nuzi: <u>40</u> , <u>43</u>
A2c	Calcareous clay, fine-sand and org. incl.	Ware I	151 bowl with spout	Sabi Abyad??	08
D1a	Cooking ware, calcareous clay with coarse calcite incl.	Ware E	212 cooking pot	Balikh Valley	<u>35</u>
D1b	Cooking ware, calcareous clay with coarse calcite incl. and org. incl.	Ware D	212 cooking pot	Balikh Valley	<u>46</u>
D2	Cooking ware, calcareous clay and crushed-shell incl.	Ware F	2211 cooking pot	Balikh Valley	<u>34</u>
B1	Calcareous clay with basalt and fine quartz/chert	Ware I	Base from a glazed bowl	Jezira	23
B2	Like A1a but with basalt	Ware I	123, 111	Jezira	39, 41
B3a	Calcareous clay with basalt and fine-sand and org. incl.	Ware I	Body of red-slipped jar	Jezira??	<u>38</u>
B3b	Calcareous clay with basalt and fine sand.	Ware B	111	Jezira	<u>48</u>
C1a	Cooking ware, calcareous clay with fine basalt and coarse calcite	Ware E	211 cooking pot	Jezira	<u>33</u>
C1b	Cooking ware, calcareous clay with coarse basalt and coarse calcite	Ware E	212 cooking pot	Jezira	<u>36</u>
C2a	Calcareous clay with coarse basalt and chert	Ware C	911 pilgrim flask	Jezira	07
C2b	Cooking ware, calcareous clay with coarse sand and coarse calcite	Ware D	212 cooking pot	Jezira	J730
C3	Calcareous clay with medium-coarse sand and basalt	Ware B	315 jar	Jezira, Euphrates?	<u>37</u>
E1	Non-calcareous clay with basalt and coarse sand	Ware B	911 pilgrim flask	Upper Euphrates?	06
E2	Cooking ware, non-calcareous clay with steatite	Ware D	211 cooking pot	Ugarit area	J728

Table V.2: Archaeometric groups and comparison with field ware groups and shape types, suggesting the possible origin of the clay and including sample numbers used in Appendix D. Samples from level 7 are underlined.

Clay and inclusions, preparation of the clay body

As was clear from the discussion of the natural environment (paragraph V.4), pottery clay is abundant close to the site. After the clay had been carried to the site, it had to be cleaned of larger particles and plant roots. The end product (the pottery) at Sabi Abyad seems to be made of rather clean clay, with few impurities (cf. Appendix D). Very rarely a small piece of shell, a small pebble or a larger calcite particle was left in the clay. It is not likely that it was necessary to crush or grind the clay with pestles and grinding stones, as is sometimes the case in other geographical areas (cf. Rice 1987: 120-123). After cleaning, the clay would then be mixed with water and soaked until it reached the right plasticity and temper material could be added.

All inclusions that were distinguished for the Bronze Age pottery from Sabi Abyad (see chapter II) were present locally, at the site or in its immediate surroundings. Fine-sand and fine-calcite inclusions were most probably already present in the clay, and were not added (cf. Appendix D; Franken and Van As 1994: 508). Chaff was probably best available just after the harvest in early summer, as it is now in the Balikh valley (personal observation), but could also be stored for later use. Dung would have been available year-round, and could also have been used as fuel for the kilns. Calcite was available on the terraces on either side of the river valley, sand most probably in the riverbed itself. Coarse calcite was crushed or ground to reach the right particle size. After cleaning the raw clay, it was mixed with water. Tanks or pits for this purpose have not been recognized at Sabi Abyad so far, although perhaps large vessels or the squarish pits east of the level 5 workshop may have been used for mixing or soaking (see fig. V.14). For 8.7% of all vessels no additional temper material was added. But most pottery (90.6%) was made of clays with organic inclusions. Pots with added mineral inclusions or with both mineral and organic added inclusions were rarer, and most of them were not locally made (cf. Appendix D). Perhaps salt was added (see above). Organic temper was possibly added while the clay was in a thick liquid condition, after which it was left to allow the organic particles time to absorb water and become more plastic (Appendix D). After adding the temper material, the clay would be kneaded thoroughly, perhaps by trampling on it with bare feet, to make it ready for shaping. Rarely (n=5) the presence of air bubbles in the vessel wall indicates that kneading was not sufficiently thorough (fig. V.35). The majority of the pottery therefore required the preparation of the clay in several stages: digging the clay, cleaning, adding inclusions, resting, kneading. In rural workshops in modern-day Cyprus the amount of clay prepared is just sufficient for one day of work. Prepared clay is stored only in urban workshops (Ionas 2000: 154).

<i>Raw clay</i>	<i>Added mineral inclusions</i>	<i>Added organic inclusions</i>	<i>Ware group</i>	<i>n</i>	<i>%</i>
No visible incl.	No 99.3%	No X 9.0%	N	4	0.0%
Fine calcite			A	251	1.6%
Fine sand			B	924	5.8%
Calcite and sand			C	240	1.5%
100%					
		Yes Y 90.3%	G	14	0.1%
			H	1418	8.9%
			I	12259	76.6%
			J	745	4.7%
	Coarse sand Coarse calcite Shell 0.6%	No	D	54	0.3%
		0.5%	E	33	0.2%
			F	3	0.0%
		Yes	K	11	0.1%
		0.1%	L	2	0.0%
			M	4	0.0%

Table V.3: The preparation of the clay body and frequencies of the different wares. Ware groups X and Y were found among the unfired vessel fragments and kiln wasters at the site (only diagnostics described by the author).

Shaping techniques

In 1996 pottery specialist A. van As and professional potter L. Jacobs from the Department of Pottery Technology at the Faculty of Archaeology, Leiden University, visited the site of Sabi Abyad with the objective of performing a first and small scale assessment of the ceramics found at the site. For the Middle Assyrian pottery a selection of the most common shapes was made. This included goblets (type 411), pot stands (type 611), small, medium and large bowls (like types 111, 131), deep bowls and pots (like types 141, 222), small jars (like type 311), and large jars (like types 321, 322, 323). Study of imported vessels included one “cooking-ware” vessel (type 211, P93-308), and one “pilgrim flask” (type 911). L. Jacobs commented on general shaping techniques, clays and inclusions, as well as on more particular techniques used for the different shapes. The following description of shaping techniques is based on his comments as well as on the notes made by myself during the description of the pottery in the field. The shaping techniques were grouped in the following technological groups:

- A Thrown from the cone
- B Thrown from one lump of clay
- C Thrown in two parts
- D Thrown closed (only imported “pilgrim flasks”)
- E Handmade (including some imported cooking-ware vessels)

Most of the pottery was made on the fast potters’ wheel (98.9%). Even in wheel-thrown pottery, however, parts of the shaping process took place with the help of a slow-turning support or on a stationary vessel.¹⁴⁰ Examples of the latter are the addition of spouts, handles

¹⁴⁰ In the only other extensive publication of Middle Assyrian pottery, P. Pfälzner (1995: 244-245) spends no more than a few lines on the shaping techniques of the pottery from Tell Sheikh Hamad. In consultation with a potter from Bamberg (Germany), he concludes that a large part of the pottery there may have been pre-shaped by hand in coils, and then finished on the potters’ wheel. For the large jars shaping in two stages is suggested, whereby the lower part is shaped in coils and the upper part on the fast potters’ wheel. It is unclear whether the Bamberg potter saw the pottery in the field or worked with drawings and photographs only. The described techniques are not attested at Sabi Abyad, and also seem to be at odds with Pfälzner’s idea that the pottery of Sheikh Hamad was “mass-produced” in a quick and careless way in a “manufactory” (see also below).

and decorations, or turning a leather-hard vessel. Only very large vessels and special shapes were made by hand (for the largest part), sometimes with the help of a slow-turning turntable. Therefore the distinction between wheel-made and handmade is sometimes not very sharply delineated.

Wheel-throwing techniques

Wheel-made vessels mostly show thin horizontal, parallel lines on the outside and more or less clear throwing ridges on the inside (cf. Courty and Roux 1995). The spiral traces on the inside and string-cutting traces on the outside of several objects (fig. V.27) show that the potters' wheel at Sabi Abyad turned in a counter-clockwise (CCW) direction.¹⁴¹ Wheel direction was generally not noted when describing the pottery. Table V.4 describes the direction of spiral traces on a random sample of 9 vessels available to me in 2005. Spiral traces of the wheel direction during the shaping of the vessels are often visible on the inside of the vessel. Not all vessels still show the original direction of the wheel. Spiral traces on the outside of the vessel indicate the direction of the wheel when cutting the vessel off the cone or when finishing the vessel, but it must be noted that the vessel may have been placed up-side-down on the wheel at this stage, thus creating spiral traces in the opposite direction (see below, cf. Senior 1998: 381-384, 392). See fig. V.28 for a guide to the reading of spiral traces on pottery. Often turning or scraping has obliterated the spiral traces on the outside (fig. V.29).

<i>Masterfile no.</i>	<i>Type of vessel</i>	<i>Inside or outside</i>	<i>wheel direction</i>
P03-226	Carinated bowl 111	inside	CCW
P03-202	Goblet	inside	CCW
P03-212	Goblet 421	inside	CCW
P03-235	Goblet 421	inside	CCW
P03-208	Bowl	outside	CCW
P03-196	Carinated bowl 111	outside	CCW
P03-204	Carinated bowl 111	outside	CCW
P03-191	Carinated bowl 111	outside	CCW
P03-219	Carinated bowl 112	outside	CCW

Table V.4: Potter's wheel rotational direction as reconstructed from spiral traces on vessels.

Several techniques were used to make vessels on the wheel. Rim shapes can vary widely within and between wheel-made shape groups, and are often not the most informative part of the vessel when looking at shaping techniques.

Small bowls were thrown from the cone in one stage (fig. V.30 step 1-3, technology group A). They show spiral traces at their bases, made by cutting the bowl from the cone with a thread while the bowl was still rotating fast. Flat bases were mostly not finished further. Sometimes a ring base was added in a separate stage (fig. V.30 step 4): the bowl was placed on the rim so that the base could be scraped (turned) and the spiral cutting traces were smoothed away, after which the ring was attached. Throwing from the cone is a very fast technique that allows for the production of large quantities of vessels in a short time, especially when the vessels are shaped in one stage and are not finished off any further. The speed with which vessels are produced on the other hand influences the quality of the vessels and the care that is taken in finishing them. This is reflected in the high number of base cracks and oval or slanting shapes in these vessels, as described below. Moreover, Franken and Van As (1994: 508) found that the limited plasticity of Euphrates clays influences the shape of the pottery thrown from the cone: strongly curving walls are difficult to make without causing

¹⁴¹ The same counter-clockwise direction was obtained with the experimental simple wheels at El Amarna: the potter pulled the wheel towards her with her left hand (Powell 1995).

cracks. Indeed, Sabi Abyad shapes that were thrown from the cone are mostly open shapes with flaring walls.

Goblets have been thrown from the cone as well (technology group A, fig. V.31), in two stages. The shaping technique, whereby the base of the vessel is finished after a drying period, was reconstructed with the help of unfired goblet fragments and is described in detail below.

Larger bowls, small and middle-sized jars and small and middle-sized pots were each thrown from one lump of clay (fig. V.32, technology group B). After throwing and a short drying period, the vessel would be put upside down on the rim (fig. V.32 steps 5-6), to scrape the lower body and base, to add a ring base (fig. V.36) or to finish the flat, pedestal or knob base. The fact that ring bases were added in a second stage, and were not thrown from the same clay body, is clear from numerous fractured bases in which the separate attachment of the ring is clearly visible. Large pots were possibly started with one lump of clay on the wheel. After a short drying period coils would be added to the “rim” to build up the vessel wall, after which the shape was finished further on the fast wheel. Franken and Van As (1994) suggested that the Euphrates clays are too short to allow for larger vessels to be completely thrown from one piece of clay.

Large jars were made in several steps: first two “cylindrical” parts were thrown (a base part and an upper part) which were later joined together to form the body (fig. V.33, technology group C, also described in Van As and Wijnen 2001). The rim was formed in a separate stage from the clay at the top of the upper part. The joint between the two halves was carefully closed and smoothed, and is rarely visible on the fired vessel (but see fig. V.34). The base of large jars often shows very deep throwing spirals on the inside, suggesting that the opening of a large amount of clay on the wheel was difficult (the wheel speed was barely fast enough). The vessel was sometimes stabilized with a rope during the shaping of the rim and the drying stage (cf. fig. V.34). The lower half and base of the vessel were often scraped in a separate stage some time after the shaping stage (perhaps together with the joining of the top part), perhaps on a slow-turning wheel. The scraping improved the vessel shape and made the lower vessel wall thinner and more even in thickness. Often an extra layer of clay with lots of organic inclusions was added on the inside of the base, to cover the deep throwing ridges and to prevent drying cracks (fig. V.35; cf. Van As en Jacobs 1992: 539). It is believed that this method of shaping in different pieces was not used for vessels with a diameter larger than approximately 30 cm, because then the prefabricated cylinders became unmanageable and the clay would tear (Franken and Van As 1994: 511, Jacobs and Van As in prep.). This corresponds more or less with the maximum shoulder diameter of the Sabi Abyad large jars.

Shaping in several stages, as described for the latter two groups, may leave a characteristic trace at the base. A lot of these vessels show an inside midpoint that is eccentric compared to the outside circumference. The wall thickness at the base is uneven. This could be due to initial careless centring of the clay at the first stage of throwing. This was probably the case when no traces of scraping are visible and when the differences in the wall thickness occur throughout the whole vessel up to the rim. It rarely occurred, however. An uneven wall thickness at the base was more often caused in one of the subsequent shaping stages. In the first stage the vessel was thrown on the wheel. In a following stage, it was replaced on the wheel (but not centred in exactly the same spot as the first time), and clay was removed from the lower part of the wall by scraping. Because the vessel was not exactly in the same position as in the first stage, more clay was removed from one side than from the other, creating an uneven wall thickness and an eccentric midpoint on the inside (Rye 1981: 74, 87).

Many larger bowls, pots and jars, but sometimes smaller bowls as well, show “stretching” traces in the vessel wall. This is due to the leanness of the clay (see above and Appendix D) and is characteristic of wheel-thrown pottery (Van As and Jacobs 1992: 535-536).

Apart from shaping, the wheel was also used to make simple horizontal or wavy painted or incised decorations.

Handmade shapes

Handmade shapes (technology group E) include handles, spouts, large storage vessels and shapes that cannot be made on the wheel (e.g. rectangular shapes).

Very large storage vessels are too heavy to make on a fast-turning wheel (handmade storage vessels include types 212, 213, 215, 221, 222). Instead, they were partly or completely made by hand, by joining rectangular slabs or coils. These vessels were made in several different stages. First the base was made, either on the wheel or by hand, or with the support of a mould or a shallow pit (cf. for example Bresenham 1985: fig. 4). Often the lower part of the vessel was supported by ropes wound around the wet vessel, to prevent the wall from collapsing under the weight of the wet clay. This leaves characteristic rope impressions on the surface (cf. fig. V.38 and figs. IV.58.e, IV.67.d, IV.69.h). The edge or the 'rim' of this base part was then pinched between thumb and finger, after which it was allowed to dry. When strong enough to carry the weight of the upper wall, slabs or coils were attached to the pinched rim and firmly joined, forming the upper vessel part. The pinched parts on the joints act as a 'zipper': when the new part is added to the already dry lower part, the shrinkage of the clay fixes the joint (fig. V.38). After the attachment of new slabs or coils, the vessel could be rotated on a slow-turning wheel to finish the shape. The rim was joined in the same manner in a later stage (fig. V.40, 41). Often the upper part of the vessel and the rim show traces that are similar to wheel-thrown pottery. It is possible that the rim was added on a slow-turning wheel. The line along which the rim part was attached, some 15 cm below the rim, is often masked with an appliqué band of clay, imitating a thick cable. Vessels made in this way often fracture along the line where coils or slabs were joined. In the cross-section of the sherds a void is often visible between the joined parts. Sometimes finger impressions from pinching are still visible where joints have broken (fig. V.39). Some very large shallow bowls (type 1411) seem to have been made by hand, too, with the same slab or coil building method.

Rectangular boxes, low circular or rectangular trays and platters, a lid, large pot stands and some miniatures were completely shaped by hand. Spouts, handles and appliqués were shaped on the wheel or by hand, and were attached by hand after shaping the vessel. Sometimes these parts have more organic inclusions than the vessel body. This prevents their breaking off the vessel during the drying and firing stages, because of different drying and shrinking rates of vessel and added parts, which often differ in thickness. Handles generally have an oval or circular section. Ribbed handles rarely occur. The holes in the bases of small bowls, large storage vessels and strainer walls were also made by hand. Mostly these holes were made by piercing from the outside of the vessel, when the clay was still plastic. The edges of these holes are frayed and irregular, especially on the inside of the vessel. Sometimes holes have been drilled after the vessel was fired. Most of the decorations, especially elaborate appliqués, were made by hand on a stationary vessel.

Techniques not applied at Tell Sabi Abyad

The imported lentil-shaped, so-called "pilgrim bottles" were made out of one lump of clay, thrown closed in several steps (fig. V.42, technology group D). First, one side was thrown on the wheel, as if making a shallow bowl. Then this shape was closed again by turning the walls upwards and inwards until they closed, so that a lentil-shaped "balloon" existed, and no air could escape. In this way the vessel was firm enough for further treatment. The outside traces of throwing and cutting from the wheel head were removed. After a drying stage a hole was made where the diameter of the "lentil" is largest, and a spout was attached. A handle was attached to the spout and the shoulder of the vessel, and then the surface was smoothed or burnished. The sherds of these flasks are characterized by a carefully treated, mostly burnished outer surface, while the inner surface is not smoothed at all and shows fine throwing ridges (cf. also fig. D.52 showing the burnished outer surface and fig. D.53 showing

the rough untreated inner surface in thin section). At the largest diameter the absence of a seam indicates that the vessel was made from one piece of clay and not from two bowl-shaped parts joined together. A spiral navel is present at the centre of the flat sides of the bottle, on the inside, where the shape was closed. The edges of the spout have been left rough at the inside, because the spout is too narrow for the fingers to reach this point (cf. also Magrill and Middleton 2004: 2532-2539 for a description and illustrations of this technique). These shaping techniques as well as the wares used for making these vessels put the “pilgrim bottle” in a different technological tradition or group than the rest of the wheel-made pottery at Sabi Abyad. The archaeometric analyses in Appendix D confirm the foreign origin of these shapes.

Some very large imported cooking-ware vessels (cf. fig. IV.62.a) were partly or completely made by hand. The base of the vessel was probably made in a mould, after which coils were used to build the wall. These vessels were very carefully finished by scraping and burnishing, leaving a relatively thin, very even and smooth wall without sharp carinations. Other cooking-ware vessels were not studied by Jacobs, but could have been handmade or wheel-made. The part mould, part coil-building techniques, together with the careful burnishing, place the cooking pots outside the main Sabi Abyad shaping traditions. This is confirmed by the archaeometric analysis (Appendix D), which showed that many cooking pots came to the site from other areas.

A. Thrown from the cone	Small and medium-sized bowls and goblets, rim types 111a-c, 112a-b, 122a-c, 132a, 411, 421, 511, some miniatures.
B. Thrown from one lump of clay	Larger bowls, small and medium-sized jars and pots, cooking vessels (?), pot stands, rim types 113, 121, 122d, 123, 125, 131, 132b, 134, 141, 142, 143, 211a, 212a, 221a, 222a, 225, 311, 312, 315, 611.
C. Thrown in two parts	Collared rim large jars, rim types 321, 322, 323.
D. Pilgrim bottles thrown closed (import)	Rim type 911 and bases and handles belonging to these bottles.
E. Handmade (cooking pots partly imported)	Big storage pots, cooking vessels (?), special shapes, types 1411, very large 145 (rim diameter > ca. 410 mm), 211b, cooking vessel P93-308, 212b, 213, 215, 221b, 222b, 226, loose handles and spouts, trays, special shapes, varia.
Technique unclear	Unspecified body sherds, other rim shapes and vessel types not studied technologically (114, 115, 116, 117, 124, 127, 128, 129, 1210, 1211, 1213, 133, 135, 144, smaller 145 (rim diameter < 410 mm), 146, 147, 148, 149, 1410, 1412, 1413, 151, 214, 227, 228, 229, 2210, 2211, 2212, 2213, 231, 232, 313, 314, 316, 318, 324, 331, 332), loose bases not assigned to a shape category.

Table V.5: List of the vessel types made in each technological group.¹⁴²

Surface treatment

After the initial shaping of the vessel, the surface could be treated further to improve the qualities and appearance of the vessel. This was very rarely done within the Sabi Abyad corpus. In 183 fragments (0.9%) the surface was burnished on the outside, inside or on both sides. Burnishing was done with a blunt hard tool on the leather-hard surface of the vessel. Polishing stones or bone tools could have been used for this task. The application of a slip is

¹⁴² The classification in a technological group was not done in the field but during the processing of the data. In the field only the presence or absence of “wheel marks” was coded. Vessels were classified in a group based on vessel shape, rim type and rim diameter or vessel height (in the case of complete vessels), as shown in the table. Further classification was based on remarks in the database or on drawings. In the group of handmade large storage vessels, many rims have been coded in the field as being “wheel-made” due to the presence of rotating finishing marks on the rim fragment. These vessels, however, have been finished on a slowly turning wheel while the vessel itself was made by hand. The distinction made above between “small” and “larger” vessels is based as much as possible on analyses of vessel dimensions (bimodality or size groups, see appendix B). If size groups were not apparent within a rim type, the classifications were more or less arbitrarily based on rim diameter in comparison with other shapes in the same group.

even rarer. For only 40 fragments (0.2%) a real slip was recognized. The slip could have various colours: whitish and buff, grey-buff, but mostly slips were shades of orange, reddish-brown, dark red or dark brown. The analysis of sample no. 38 (Appendix D) showed that the raw materials for a dark-red slip are not available around Sabi Abyad. Red-slipped pottery was therefore probably not locally made.

Decoration

The pottery at Sabi Abyad was rarely decorated, as only 4.8% of all described fragments showed decoration. Different techniques were used for decoration. All are reasonably simple. Decoration was mostly carried out by incising lines with a blunt or slightly sharper object (Table V.6). Many vessels were decorated with applied decoration, in which a separate piece of clay was shaped and attached to the surface of the vessel, or with a combination of incision and application. Painted decoration occurred less often (this overview excludes the painted and incised marks that were identified as “potters’ marks”; see below for a detailed discussion of them). Painted and incised decoration was often carried out on a slowly rotating vessel. Impressed and applied decoration was mostly done on a stationary or occasionally rotated vessel.

<i>Decoration</i>	<i>%</i>
Painted	10.9
Incised	48.5
Painted + Incised	0.3
Applied	21.5
Incised + Applied	12.9
Impressed	5.2
Glazed	0.5
Total	100.0

Table V.6: Decoration techniques used at Sabi Abyad.

The patterns used on the vessels illustrate that decoration was in most cases carried out in a careless and irregular way. Little time was spent on patterns and motifs (Table V.7). The greater majority of decoration consisted of one (or sometimes more than one) horizontal line. These lines occur on the shoulder of the vessels or below the rim. Wavy lines were made by moving the tool up and down while the vessel rotated slowly. Often no attention was paid to whether the beginning and the end of the line would meet up neatly or not. A combination of horizontal and wavy lines was often carried out, either with incision only or with applied and incised decoration together. The greater majority of incised-and-applied decoration consists of a horizontal band of applied clay, often impressed with fingerprints to make it look like a thick rope, with a wavy incised line above and/or below this band. The indication “circles” in table V.7 is used to indicate a special pattern. A regular pattern of circles was impressed with a tubular instrument. Often triangles were cut out of the rim of the vessel. The circles and triangles were then filled with a white paste, probably gypsum (cf. fig. IV.45.i). Motifs classified under “other” include a wide range of different patterns and shapes. With painted decoration, they include irregular lines and blobs and unrecognizable patterns, as well as very detailed and fine “Nuzi” style decoration. Incised “other” patterns include more complex combinations of wavy lines, straight lines and impressions, often with double lines. Applied “other” decorations vary from vertical “handle”-like applications on the rim of pots, to applied human and animal figures (cf. figs. IV.61.g, IV.64.a, b).

	Painted	Incised	Painted + Incised	Applied	Incised + Applied	Impressed
Horizontal	34	172	1	107	2	
Wavy	1	66		11	4	
Horizontal + wavy		38			69	
Other	30	12		10	2	1
Circles			1			30

Table V.7: Patterns of decoration.

A special kind of decoration is represented by the cut-out technique: holes cut out of the wall of pot stands. The holes are oval, triangular or rectangular in shape (cf. fig. IV.92.k, l, IV.111.k-n). The edges of the holes have been smoothed. Six stands show this kind of decoration, one combined with applied decoration. Possibly the cut-out shapes do not only have a decorative effect but a functional aspect as well, by allowing some ventilation under the base of the vessel that is set in the pot stand.

Details of surface treatment and decoration were discussed in the chapter on typology and chronology (Chapter IV), where the characteristics of the ceramics have been presented per level.

Unfired pottery fragments

Unfired pottery is one of the clearest pieces of evidence for the local production of pottery. Fired pots may have been transported from the place of production to sites at a considerable distance, especially when they were transported as containers for other goods. Unfired pottery, like kiln wasters, was certainly not transported anywhere, but discarded at the site of production. Unfired waste of pottery production may also provide new insights into the techniques of production. The shapes of the unfired fragments give some indication of the range of shapes produced by the local workshop(s). Unfired fragments have mainly been found in deposits from level 6 and level 5, while some fragments come from level 4. They are often related to the pottery workshops and kiln locations (see above, paragraph V.5).

Fragments of vessels (figs. V.43, 44, 45)

In total at least 61 rim fragments of vessels were found, of which five could be fitted to base fragments therefore forming a complete profile. At least 55 pieces were base fragments of vessels. Furthermore, several hundreds of body fragments were found, sometimes recognizable as coming from bowls, jars or goblets.

Level 6

In total 19 rims, 2 bases, and many body fragments have been found in level 6. A small number of fragments comes from the Assyrian moat in square G7, in the northwestern part of the site, and may be dated to level 6.¹⁴³ The fragments from square G7 include one type 323 jar rim (fig. V.44.g) and some body sherds of a jar, several small fragments of type 111 carinated bowls, a body sherd possibly from a pot and several other body sherds. All rims and body sherds have organic inclusions (ware I).

The majority of unfired vessel fragments (rims, bases and body fragments) from level 6 come from the workshops in the east of the site. They were found mainly in room 2b, the fill of kiln L in square N12, and amongst the fragments of cuneiform tablets in square O10. A few isolated fragments come from rooms 3, 4 and 5, the open area south of the courtyard in square N12, and the open area around kiln Q in square N11 and square N10. From room 1,

¹⁴³ G7 lot 90, 95 and 167.

the main workshop area (see above), there are several thick fragments of a hand-formed squarish bin (fig. V.44.i, j, k). Perhaps feature J in this room can be interpreted as a large unfired pot (similar to type 221) set into the corner of the room (see above with the discussion of room 1). Unfired-clay waste that is left over during the shaping process (see below) was found mainly in room 1 and room 2b, as well as in the open area north of kiln Q in square N10, while many pieces and lumps of clean kneaded clay without further shape were found in room 1, the fill of kiln L (more than 1 kg!), the fill of kiln Q (one piece) and the outer area in squares N11 and N10. It can therefore be suggested that the shaping of vessels apparently took place in rooms 1 and 2 (a and/or b), while the finished but still unfired vessels were dried or stored in rooms 1, 2b, and in the outer area around kiln Q, as well as perhaps in rooms 5 and 3 (cf. fig. V.3). Interestingly, the unfired fragments from room 2b mainly comprise fragments of goblets and bowls, while those from room 5 are all from jars.

Recognizable unfired vessel fragments from level 6 include a wide variety of shapes. Apart from eight fragments of type 111 carinated bowl rims (figs. V.43.g, h, i), single fragments were found of a type 113 bowl (fig. V.43.l), a type 132 bowl (fig. V.43.m), a type 142 deep bowl (fig. V.44.c), a burnished type 212 closed pot with incised lines on the shoulder (fig. V.44.d), a 315 jar (fig. V.44.e), a 322 and a 323 jar and a type 421 goblet (fig. V.44.n). Base fragments included two ring bases (fig. V.45.c, type 741). Among the body fragments there were thin pieces belonging to goblets, one strainer fragment (type 511), many fragments of carinated and other bowls both large and small, 9 fragments of a jar with an incised line on the shoulder, other jar body sherds, and one fragment of a neck of a small fine-ware jar or goblet with a horizontal incision (cf. fig. V.44.s). The fragments of goblets were all made of a fine clay without any organic inclusions (ware B), while the other sherds were all made of the common fabric used for most ceramics at the site, ware I with organic inclusions and small particles of calcite and sand.

Level 5 East

In total at least 16 different rim fragments, more than 12 different bases, and many body fragments of unfired clay were found in the level 5 East workshop. Isolated finds came from room 1 (one fragment), courtyard 3 near the door to room 1 (a small wedge-shaped piece), and a later level 5 floor in room 8 (a carinated bowl body fragment, three discs left over from pottery shaping and a clay cylinder (see below). In the open area to the east, the former location of the level 6 workshops, a 322 jar rim (fig. V.44.f), several body fragments from jars, and several fragments of production waste were dumped. In the open area to the north, in square M10, a group of unfired fragments was found as well, including a fragment of a large storage pot (perhaps type 221), a rim fragment of a bowl (type 111, analysed in Appendix D (SN96-130), a ring base, a thick body sherd, one disc and several lumps of pottery production waste.

The large majority of unfired vessel fragments and waste from pottery production came from different locations in courtyard 2. Here, next to the door into the house, a concentration of unfired vessel fragments was found, including four goblet rims (3 type 421 and 1 type 411 fragments, fig. V.44.l, m, o, p), one goblet base (fig. V.45.a), many goblet body-sherds, three small carinated bowl rims (fig. V.43.a, b, e) and several body fragments, a ring base (fig. V.45.i) and three unclear bases, and some thicker body-sherds perhaps belonging to bowls or jars. In the same concentration more than 25 fragments of disc-shaped waste from shaping bowls and goblets (fig. V.46.g, h) as well as three unbaked clay lumps were found as well (see below). In the north of the courtyard, between the concentration of damaged and repaired fired goblets and bowls, there were five rim fragments of straight-sided bowls (fig. V.43.n-q, t and fig. V.47), a large carinated-bowl rim fragment (fig. V.43.j), two flat bases, and a wall fragment of a thick-walled bowl or trough with cut-out holes in the wall (fig. V.44.t). Furthermore, in the fill of kiln AC/AI, many fragments¹⁴⁴ of unfired vessels were

¹⁴⁴ I did not have the opportunity to see this collection myself.

found, including four goblet bases, body-sherds, rim sherds, lumps of clay and disc-shaped left-overs from pottery shaping. The vessel fragments in this collection were all clearly deformed when the clay was still wet. The fragments of goblets were all made of a fine clay without any organic inclusions, sometimes with some fine-sand inclusions (wares B and C), while the other sherds were all made of the common fabric used for most ceramics at the site, ware I with organic inclusions and small particles of calcite and sand.

There seems to be a difference between the unfired vessel fragments found next to the door to the house (including mainly goblet and small bowl fragments) and the fragments found in the north of the courtyard (mainly belonging to larger bowls and thicker walled vessels). Perhaps they are waste from two different production occasions. Unlike the unfired fragments, the fired vessels in the north of the courtyard were mostly small bowls and goblets (see above with the discussion of production locations).

Level 5 West

In total at least 30 different rim fragments, parts of at least 37 bases, and a large amount of body fragments of unfired clay were found in the western location. Isolated finds come from the large courtyard in square I9 (a goblet-base fragment type 711), the courtyard in square H9 (a disc-shaped leftover from production), the northern small room 17 (a cylinder related to production waste), and from the lower fill of the corridor between the cuneiform tablets (a ring base type 741).

Most unfired vessel fragments were found in the fill of updraft kiln H/AE and in the upper fill of the corridor. In the fill of kiln H a strainer rim fragment (fig. V.44.r), six small carinated-bowl rim fragments (fig. V.43.c, d, f), a goblet (fig. V.44.q) and several goblet body sherds, five flat bases (fig. V.45.d), two unclear bases and a bowl that was not cut off from the cone (fig. V.46.a, see below), several body fragments of large jars, about 700 gr of body sherds belonging to a larger vessel, and five disc-shaped leftovers from pottery shaping (fig. V.46.d-f, see below) were found.

In the upper fill of the corridor a large variety of rim fragments and other pieces was found, including a goblet rim fragment (type 421), two rims of jars (type 322 and 315), a rim of a type 221 pot, two rims of deep bowls (fig. V.44.a, type 145 and 143), six rims of type 141 bowls (fig. V.44.b), a type 135 bowl rim, seven rims of straight-sided type 131 bowls (fig. V.43.r), and two rims of carinated bowls (type 111, diameter 170 mm). Furthermore, five goblet bases (type 712), a pedestal base (type 721), ten flat bases (type 731), four ring bases (fig. V.45.j, k, type 741), and six bases of which the shaping had not been finished (with the “disc” still attached, see below and fig. V.46.i-k). Body fragments include pieces of goblets (n=2), a strainer (n=1), a base fragment with a hole from a large pot (n=1), body fragments of a deep bowl (n=16), of jars (n=42) and a large pot with a cable appliqué band (n=3), as well as about 200 body fragments of unidentified vessels. A lot of waste from shaping was also found in the upper fill of the corridor, including 52 discs left over from shaping, three cone/cylinder shapes, and about 500 gr of lumps of kneaded potters’ clay. Like the other unfired vessel fragments, the fragments of goblets were all made of a fine clay without any organic inclusions, sometimes with some fine-sand inclusions (wares B and C), while the other sherds were all made of the common fabric ware I with organic inclusions and small particles of calcite and sand.

Level 5 North

Very few unfired vessel fragments were found in the northern level 5 location around kilns CJ/V and AR. A body sherd was found in square K8, three pieces of kneaded potters’ clay in square K9, and two discs left over from pottery production were found in square M7, perhaps in the Assyrian moat. Diagnostic fragments were not found in this area.

Level 4

In level 4, around kiln K in square J7, unfired fragments have only been found in square J6 in an open area north of kiln K. These fragments include seven flat bases (type 731), and 22 pieces of waste left over from pottery shaping.

The unfired vessel fragments are often damaged, folded, squeezed or otherwise deformed, and sometimes fragments stick together. Many fragments have lumps of clay stuck to their surface, as if they have been pressed together with other waste fragments. This obviously happened when the clay was still plastic. Apparently the shaping of some vessels failed, while others were damaged while standing to dry. The large diversity of the vessel types found together in dumps of unfired vessel fragments might indicate that different vessels were shaped or dried together in the same production event, or that the same workshop or potters produced a large variety of vessel shapes.

Waste from shaping vessels

An interesting group of unfired pottery fragments does not consist of vessel fragments, but of fragments that may be identified as waste from the shaping of vessels.

More than two kilogrammes and many separate pieces or lumps of kneaded pottery clay have been found in all locations where unfired vessel fragments were found. Apparently these pieces of clay were never used again for shaping vessels.

More than 150 disc-shaped pieces of unfired clay (figs. V.46.c-h, V.48) provide an interesting clue for understanding shaping techniques. These discs are between 2.8 and 4 cm in diameter. In most cases both sides show spiral string or knife cuts. One side appears to have been incised before the piece was cut, with the string cut just on the incision (cf. fig. V.48, the top two discs on the right). Some unfired bases of an unusual shape, not present among the collection of fired pottery, can be compared with these discs (fig. V.46.i-k). They are bases of goblets, but instead of a nipple or knob base the base part is disc-shaped, with a deep horizontal incision. The shaping technique may be reconstructed as follows (cf. fig. V.31). The goblet was shaped on the wheel, thrown from the cone. An incision was made at the base side to indicate the proper final thickness of the base. Then, the vessel was cut from the cone a bit below the incision, so that a 'disc' was left attached. The vessel was then put aside to wait for the next shaping stage (the finishing of the base). Perhaps the disc was left attached to prevent the base from drying too quickly before it could be finished, or to provide the goblet with a stable support so that it could dry without having to put it on its still wet and fragile thin rim. When dry enough, the vessel was then put rim-down on the wheel, perhaps on a support (as indicated by traces of sticking on the inside wall of many straight-sided goblets; perhaps the support was a clay cone like fig. V.51?). The disc was cut off with a string or knife, while the incision indicated the spot where to cut, so that the base would not become too thin. Then the base was scraped and shaped into a nipple or knob shape with a sharp knife and wet hands (fig. V.31).¹⁴⁵ The discs consist both of ware B and C (used for goblets) and ware I (of which small bowls are usually made). Some evidence for similar procedures in shaping bowls (perhaps in case a ring base was intended) is provided by a carinated bowl with an unfinished base (fig. V.43.c). A second carinated bowl still attached to a long cylindrical piece of pottery clay (fig. V.46.a, V.49) may suggest a similar technique. The cylinder is clearly wheel-thrown but not smoothed, and a finger impression shows it was pressed a little when it was lifted. The bottom shows string cuts. This cylinder most probably represents the last bit of clay left on the wheel. A few other fragments of similar bowls with unfinished bases and loose cylinders have been found among the unfired pottery fragments (fig. V.50). These cylinders, however, never show incisions like the discs. A further support

¹⁴⁵ For pottery from second millennium Iraq, Franken and Van As, too, remark that it appears to be very difficult to create bases with a correct thickness in goblets. But the Old Babylonian and Kassite potters found another technical solution to the problem (Franken and Van As 1994: 508).

for the above reconstruction can be found in the spiral direction of the string and knife cut traces on the discs. We have seen above that the rotational direction of the potters' wheel was counter-clockwise (ccw). Most discs in which spiral direction could be established show spiral traces of string cutting in the same direction on both sides. This is only possible when one side of the disc was cut off while the piece was upside down on the wheel. In some pieces the knife cut left a spiral trace in opposite, clockwise direction. This indicates that the knife cut was made when the piece was still standing upright on the wheel.

Similar base "slices" have been found in the pottery workshop at Tell el-'Amarna, Egypt. They, too, are interpreted as leftovers from the last stage of shaping the base, by cutting off the excess clay from the base with a string (Rose 1993: 128, fig. 136).

A question that may be asked with regard to these unfired fragments, is why they were not reused to make other pots? Since the clay was unfired, it would have been easy to remoisten it and make it plastic again, or to knead and store the still wet clay. This would save the time and effort of acquiring new clay and cleaning it. It is possible that the resources of pottery clay were so abundant and easy to process that recycling of unfired clay was not seen as profitable. However, another reason for throwing away unfired and even unshaped clay without reusing it in a next shaping session could be that there was no such next session and therefore no reason to recycle the clay. If true, this would mean that pottery production did not take place continually, but that there were intervals during which no pottery was produced. These intervals would have been longer periods, so that the storage of wet clay was no option. Maybe this was the case in winter, or when the potter was busy at other sites or in agricultural work.

Firing procedures

After the vessels had dried thoroughly, they were packed in the kiln for firing. It is not known what kind of fuel was used, as the ashes left in the kilns did not yield any macroscopically visible parts and their composition was not analysed. Considering the environment of Sabi Abyad, dung cakes, agricultural refuse and steppe shrubs are good candidates for fuel.

The effects of firing circumstances, such as the duration, temperature and atmosphere of firing, are visible in the end product. They influence the colour of the core and surfaces on the inside and outside of the vessel, and the hardness and porosity of the fabric. Consequently, colour, hardness and porosity may theoretically be used to estimate the firing circumstances. This will, however, yield only a very general indication of firing circumstances, as the exact circumstances can only be established in detail by archaeometric research. Re-firing experiments and thin-section analysis may be used for this purpose (cf. Appendix D and Chapter II).

For the purposes of this chapter the exact firing temperature of the pottery is of little interest. It is more important to draw conclusions about the control of the potter over the firing process, and the desired quality of the products (Rice 1987: 435). Therefore I believe that a general, rough estimation of firing temperatures, duration and atmosphere is sufficient. The methods used to describe colour, temperature and atmosphere were described in Chapter II. The data recorded in the field will be used here, although with due caution and with the comments regarding the difficulties and inaccuracies of estimating firing temperatures (discussed in Chapter II) at the back of our minds.

Firing atmosphere

The colour of pottery is influenced by the composition of the clay, mainly by the presence of iron, calcite and organic matter. Iron gives the pottery reddish colours when fired in an oxidizing atmosphere. When the clay is fired above approximately 1000 °C, calcite reacts

with iron and produces a yellowish to olive green colour. Organic matter in the clay leaves a grey to black colour (Rice 1987: 333-336). All locally made pottery was made of clays with the same basic mineral composition and would therefore fire to similar colours in similar circumstances and with similar added inclusions.

A second factor that is of great importance for the colour of the vessel are the firing circumstances (Rice 1987: 335). Three different firing circumstances have been distinguished for the Sabi Abyad pottery. They have been identified on the basis of the degree of burning out of organic matter (carbon) from the sherd. *Oxidizing* circumstances prevailed when enough oxygen (fresh air) was present in the kiln. This allowed the full combustion of any organic matter in the clay. An oxidizing atmosphere yields clear colours throughout the sherd's fracture. When organic matter was not completely burnt out (leaving a dark grey or black core), this points to an *incompletely oxidizing* atmosphere. Oxygen was not sufficiently available during the firing (or parts thereof), and/or the vessels were fired for too short a period or at too low temperatures to allow complete oxidation (see below). *Reducing* firing circumstances yield dark-grey and black sherds and fractures. In this case oxygen was scarce and organic matter did not burn out completely¹⁴⁶ (see chapter II, and Rice 1987: 343-345). As is clear from table V.10, pottery with organic inclusions more often has a dark core than pottery from clays with only mineral inclusions, as would be expected because the dark core is due to organic inclusions in the clay. The fact that vessels with only mineral inclusions sometimes show dark cores, too, indicates that the carbon was probably present in the atmosphere of the kiln due to the fuel and to a mixed kiln load consisting of both wares with organic and mineral inclusions. This very general indication¹⁴⁷ of firing atmosphere does not tell us anything about the variations in atmosphere that may have occurred during firing, adding of fuel and cooling. Occasionally sherds were found that have a "multiple" sandwich fracture, with alternating layers of brighter and darker colours. These may point to a variable kiln atmosphere. The pottery from Sabi Abyad shows little variation in firing circumstances, most vessels having been fired in oxidizing or incompletely oxidizing kiln atmospheres. The words "incompletely oxidizing" may suggest to the reader that the potter did not or not completely control the firing process. However, incompletely oxidized vessels have attained the same surface colour as the completely oxidized vessels and are of the same quality. To the potter and his customers, incompletely oxidized vessels consequently did not differ from completely oxidized ones. It is clear that the potters at Sabi Abyad had sufficient control over the firing procedures to make suitable vessels.

<i>Surface colours</i> <i>Atmosphere</i>	Brown, dark red	Grey, black	Light red, orange, buff	Buff, cream, greenish
Oxidizing	Same, other		Same, other	Same, other
Incompletely oxidizing	Dark		Dark	Dark
Reducing		Same/dark Other: reducing in last stage of firing		

Table V.8: The relation between firing atmosphere and surface and core colours. Core colours: same= same as the surface colour. Dark= grey or black. Other= other than the surface colour but not grey or black (red, orange, buff, etc.).

¹⁴⁶ Thin-section analysis of one sherd described as fired in reducing circumstances showed that it seems actually to have been fired under incompletely oxidizing circumstances and at a low temperature (Appendix D, sample 16). Possibly not all sherds described as such were really fired in reducing atmospheres.

¹⁴⁷ That the estimate of firing circumstances must stay general is also illustrated by the fact that core colours may vary with the thickness of the sherd: often the carbon has burnt out completely in the thinner upper wall of the vessel, while a dark core remains in the thick base. So it may depend on the remaining vessel part which atmosphere is coded for. Surface colours, too, may vary considerably in a single vessel.

Ware	Oxidizing	Inc. oxidizing	Reducing	Total
N	41 97.6%		1 2.4%	42 100.0%
A	297 96.1%	4 1.3%	8 2.6%	309 100.0%
B	645 97.9%	6 0.9%	8 1.2%	659 100.0%
C	116 84.1%	9 6.5%	13 9.4%	138 100.0%
D	27 84.4%	1 3.1%	4 12.5%	32 100.0%
E	1 12.5%	7 87.5%		8 100.0%
F	1 100.0%			1 100.0%
G	173 95.6%	6 3.3%	2 1.1%	181 100.0%
H	1856 91.8%	141 7.0%	25 1.2%	2022 100.0%
I	7494 85.9%	1126 12.9%	105 1.2%	8725 100.0%
J	387 83.2%	51 11.0%	27 5.8%	465 100.0%
K	5 50.0%	2 20.0%	3 30.0%	10 100.0%
L	1 50.0%	1 50.0%		2 100.0%
M	4 100.0%			4 100.0%
Total	11048 87.7%	1354 10.7%	196 1.6%	12598 100.0%

Table V.9: Numbers and percentages of sherds fired in different kiln atmospheres split according to ware.

Ware	Atmosphere	Oxidizing	Inc. oxidizing	Reducing	Total
Group X (mineral inclusions)	No.	1100	19	30	1149
	% of group X	95.7%	1.7%	2.6%	100.0%
	% of atmosphere	10.0%	1.4%	15.9%	9.2%
Group Y (organic inclusions)	No.	9915	1324	159	11398
	% of group Y	87.0%	11.6%	1.4%	100.0%
	% of atmosphere	90.0%	98.6%	84.1%	90.8%
Total	No.	11015	1343	189	12547
	Total row %	87.8%	10.7%	1.5%	100.0%
	Total column %	100.0%	100.0%	100.0%	100.0%

Table V.10: Comparison of ware groups and kiln atmosphere.

A Chi-Square test indicates that sherds with a “sandwich” are significantly more often made of wares with organic inclusions.

The atmosphere that prevailed during firing must also be seen in relation to the kilns used. At Sabi Abyad only updraft kilns seem to have been used. When an updraft kiln has an open top that is only temporarily covered during firing, it is impossible to fire in a reducing atmosphere (Rhodes 1968: 123, Golvin et al. 1982: 74). To create a reducing atmosphere (yielding black colours), the kiln has to be completely closed so that no oxygen can enter the kiln atmosphere. In an updraft kiln with a closed top and a door at the side, a reducing firing is possible but difficult. All openings including flues, stoke hole, door, and so on have to be completely closed (Swan 1984: 34, 35; Rye 1981: 100). A black surface colour may have been desired for esthetical reasons. Not only the design, but also the remains of the kilns may provide clues about the firing circumstances. It has been suggested that the quantity and texture of the ashes left after firing reflect the atmosphere in the kiln during firing. Swan (1984: 41) notes: “In an oxidizing firing the fuel becomes completely burnt out, leaving little ash. In a reducing firing however, wood stoked into the flue and furnace chamber to burn up excess oxygen at the pre-cooling stage, immediately before the flue-mouth is sealed, carbonizes and remains as a layer of abundant charcoal fragments and black ash”. The kilns at Sabi Abyad all have a thin layer

of very fine yellowish to light grey and black ashes at the bottom of the fire chamber. Virtually no fragments of charcoal were found, except for the kiln in K8 where small charcoal pieces were found (cf. Appendix C). So both the design of the kilns and their contents suggest that pottery was not fired in reducing circumstances at the site.

Temperature and duration of firing

The properties of a fired vessel depend for a large part on the firing temperature and the duration of the fire. These two variables are closely interrelated, and without archaeometric research it is almost impossible to separate the two. A high-temperature fire for a short while may have exactly the same result as a lower-temperature firing for a longer period. There is some evidence from ethno-archaeology to suggest that pre-industrial potters did not “soak” the fire (keeping the fire at maximum temperature for a longer period) but that after reaching the maximum temperature the kiln was almost immediately allowed to cool down (Rice 1987: 435; Golvin et al. 1982; Nicholson and Patterson 1989: 79). In the absence of archaeometric research on this specific topic for the Sabi Abyad material, the temperature of firing and the duration will not be discussed separately, and will inevitably remain very imprecise. Firing temperature is roughly estimated on the basis of sherd colours, along the lines described in chapter II.

	<i>Number</i>	<i>%</i>
“High” temperatures (ca. 950-1000 °C)	1925	15.3
“Medium” temperatures (ca. 800-950 °C)	10324	81.9
“Low” temperatures (ca. 700-800 °C)	354	2.8
Total	12603	100.0

Table V.11: Frequencies of roughly estimated firing temperatures.

It is clear that a large majority of the pottery was fired in the range of “medium” temperatures, while one out of seven vessels was fired at high temperatures. This means that the potters controlled the firing temperatures well, and aimed at well-fired vessels and perhaps at light colours. At the same time they tried to avoid creating wasters by firing at too high temperatures, to judge by the extremely small number of over-fired wasters found at the site (see below).

The firing temperatures also have to be considered in relation to the used kilns. It was no technical problem to reach temperatures up to 1000 °C (Akkermans and Duistermaat 2001; Rhodes 1968: 16). In an updraft kiln the heat is relatively unevenly distributed through the kiln load, because of the upward draft. This results in local overheating (Rye 1981: 100). Firing experiments in an updraft kiln in Egypt have shown that the temperature near the kiln floor was higher than at the top of the load. Consequently, the number of greenish coloured vessels and wasters due to over-firing was significantly higher in the lower part of the kiln load than near the top (Nicholson and Patterson 1989). Once a potter knows the characteristics of his kiln, he can try to reduce firing losses caused by over-firing by placing vessels that can stand higher temperatures in the “hot” spots and delicate, thin-walled vessels higher up in the kiln load where temperatures are lower (Swan 1984: 38). If this is true, it may be possible to draw some conclusions on the loading of the kilns, by comparing the estimated firing temperatures or colours with vessel shapes.

In table V.12, vessel shape and firing temperatures are compared. When we look at the percentages for each vessel shape, it seems that pot stands are more often fired at high temperatures than expected. Next are pots, which also seem to have been fired at higher than average temperatures. Could it be that pot stands, and perhaps pots, were fired lower in the kiln load and other shapes higher up? Indeed, the pattern of firing temperatures in pot stands is statistically significant: pot stands are generally fired at higher temperatures. There are 26 wasters resulting from over-firing (see below). Eight of them are pot stands (30.7%), and nine are bowls (mostly type 111). If vessel shapes were equally distributed within the group of

wasters (each vessel shape having the same chance to become a waster), the expected numbers of pot stands and bowls within the group of wasters would be 0.75 (2.9%) and 10.45 (40.2%), respectively. So pot stands are strongly overrepresented among wasters, again suggesting that they were packed in the lower part of the kiln load during firing.

	<i>High temperatures</i>	<i>Medium temperatures</i>	<i>Low temperatures</i>	<i>Total</i>
<i>Bowls</i>	670 13.2%	4280 84.4%	119 2.3%	5069 100.0%
<i>Pots</i>	164 23.1%	511 72.0%	35 4.9%	710 100.0%
<i>Jars</i>	341 15.8%	1762 81.7%	53 2.5%	2156 100.0%
<i>Goblets</i>	69 14.5%	396 83.0%	12 2.5%	477 100.0%
<i>Pot stands</i>	133 34.7%	248 64.8%	2 0.5%	383 100.0%

Table V.12: Vessel shape related to firing temperature.

Wasters and other production damages

Firing losses

Firing is the most risky stage of pottery production. Chances are big that part of the production will be lost due to under-firing, over-firing or cracking. For updraft kilns Rice (1987: 173 table 6.1) estimates a rate of 12-20% of firing losses per kiln load on the basis of ethnographic studies. Other reports of modern firings in updraft kilns give rates of 5% wasters (Nicholson and Patterson 1989: 80) or only 2% (London 1989b: 76). The presence of wasters is often taken as an indication for the existence of a pottery production site (Rice 1987: 179-180), but ethnographic studies show that the occurrence of large amounts of wasters near production localities is rare because sherds are immediately used for various other purposes (e.g. London 1989b).

Wasters are generally defined as vessels that have become so damaged during firing that they are unusable or unsaleable. This is a slightly problematic definition if working with archaeological material, because whether a vessel is unusable or not is a matter of judgment by the potter and the user. A vessel may have cracked during firing so that it was unsuitable for holding liquids, but it may still have been suitable for dry goods. In many cases minor damages were repaired (see below), so that the vessel was still usable. Another problem is that it is often impossible to infer from fragments (sherds) whether the original vessel was usable or not. In this study a waster is defined as a piece of pottery that has become totally and obviously unusable, because of the following reasons:

- Over-firing to such an extent that the clay became vitrified and extremely brittle, and the shape warped. This includes molten and fused pieces, but not the greenish and sometimes brittle vessels that were fired at high temperatures but retained their shape and are otherwise apparently undamaged.
- Cracking caused by firing, to such an extent that the vessel could clearly not have held any contents. Traces of repair must be absent.

Wasters from updraft kilns such as the ones used at Sabi Abyad are most likely to be over-fired (Rye 1981: 100) or cracked. Under-fired vessels, with a soft and brittle fabric resembling unfired clay, were not found at Sabi Abyad. At Sabi Abyad only 33 vessels and fragments were defined as wasters, out of a total of 19,562 coded diagnostics (or 0.2%). This seems to

be a rather small number, but many of the vessels that were damaged in the production process were not complete wasters. The rate of firing losses must have been higher than these 33 wasters suggest (since cracked vessels are unrecognizable among sherds, and complete wasters were possibly disposed of in dumps that have not all been excavated), but the rate of recycling and repairing of damaged vessels seems to have been high as well (see below). In any case, there is no evidence for very high firing losses, suggesting at least that the potters controlled the firing process well. Perhaps it is reasonable to assume a rate of 5% of firing losses at the most. Vessels and fragments described as wasters can be found in figs. IV.30.h, IV.33.y, IV.40.c, m, s, IV.41.h, IV.42.i, IV.43.d, h, IV.74.k, IV.90.ac, ah, and fig. IV.91.ac.

Most wasters (n=26) were severely over-fired, so that the clay turned bright green or green-grey. The fabric was vitrified and brittle (as in fig. V.52, see also fig. D.29), while the shape of the vessel was seriously deformed due to warping. The best example of this is perhaps the large jar with a completely warped rim found in room 1 of the level 6 pottery workshop (fig. V.53). Many over-fired wasters are pot stands (n=8, see above and fig. V.54), but carinated type 111 bowls (n=7), a type 131 straight-sided bowl and a type 141 bowl, a goblet type 421, three bases (721, 731 and 741) and some body sherds were found, as well as a number of unrecognizable molten pieces. Most are made of ware I or H (with organic inclusions and calcium, and sometimes a little sand), while the over-fired goblet was made of ware A (a fine clay with some calcium inclusions).

Only five vessels or fragments with severe cracks were identified as wasters. This is mainly due to the fact that cracked vessels are unrecognizable if not complete. Also, the potters made great efforts to use or repair even severely cracked vessels. One complete type 311 jar (from kiln H/AE, fig. IV.74.k) had a wide crack running spirally all along the circumference of the lower body, as well as some base cracks that extended into the wall. The jar did not show any signs of repair and would actually have been unusable. The other vessels that were severely damaged by cracks include a carinated type 111 bowl and three goblets (types 412 and 411) (from the level 5 East workshop, figs. IV.43.h, IV.90.ac, ah, IV.91.ac). The cracked vessels were made of ware I or of ware B (fine calcium and sand, for the goblets).

At Sabi Abyad kiln wasters occurred in very small quantities all over the settlement, with two concentrations. The first was in square H8, where seven wasters were found (in kiln H, in room 14 near the kiln, and in the corridor and two rooms north of room 14), most of them in a fill that also included unfired pottery waste. The other concentration was in square M11, in the level 5 East workshop. Here, too, amounts of unfired pottery were associated with the wasters. Moreover, the wasters here were mainly cracked vessels, while many damaged vessels had been repaired (fig. V.55, 56, and see below). Kiln wasters were also found in the squares surrounding the workshop in M11, in square K8 and L8 (in the vicinity of kilns CJ/V and AR), and in the squares where the workshop in level 6 is located (N11, N12, O12, O13, each one piece only). Although most wasters were actually found near the kilns, no large heaps of wasters were found in their immediate surroundings or anywhere else. Perhaps the rate of kiln losses was not very high, but there are other ways for damaged vessels not to end up next to the kiln. Damaged vessels may have been repaired or reused for other purposes on a large scale. Sherds may have been used as tools in pottery or other craft production, or as pavement and filling material. Wasters and other production waste may have been dumped in particular places rather than simply around the kiln, especially considering the location of the kilns close to or inside inhabited areas.

Minor damages from firing, drying and shaping

Damages that occurred during the pre-firing stages of production (shaping and drying) could never have been so severe as to make the vessel unusable: in that case the vessel would not have been fired at all. The unfired pottery fragments discussed above perhaps belong to this group. Minor cracks from drying may have been almost invisible or deemed not serious, although they could later become worse during firing. But as long as a vessel seemed to be

usable, the potters did not seem to care much about some minor damages that occurred during shaping or drying and proceeded to fire them.

Cracks

Spiral, S-shaped or star-shaped cracks have been found in 686 bases (3.4% of all sherds, 9.2% of the total amount of described bases). These cracks occurred during the drying or firing of the vessels. Tiny drying cracks may have increased during firing, when the clay shrank further. Table V.13 shows the distribution of base types with cracks. The percentage of these base types in the total database is given as well. It appears that flat bases are overrepresented in the group of bases with cracks. The presence of most base cracks in flat bases is related to the shaping technique. When vessels are thrown from the cone and the base is not finished further, the clay forming the base cannot be pressed to push out the air in the pores. A large risk then exists of the base cracking during drying (L. Jacobs, pers. comm.). Most base cracks started on the inside of the vessel, and often the crack extended through the vessel wall. Base cracks occurred far less often only on the outside. Perhaps this can be taken as an indication that the vessels were put to dry on their bases, so that the outside dried slower (and therefore cracked less) than the inside.

In jars base cracks sometimes occurred during drying because the vessel wall was much thicker at the base than at the lower body. Often the potter tried to prevent or repair this type of base crack by covering the inside of the base with a second layer of clay after the vessel had dried. This second layer contained a lot more organic inclusions than the original vessel clay. The fact that such measures were taken indicates that some care was taken to prevent firing losses (Van As and Jacobs 1992: 539). Moreover, the extra clay layer made the inside of the base smoother, by covering the often very deep throwing spirals. This may have been important to prevent people from hurting their fingers when reaching for the contents in the jar. In total 265 bases (3.6% of total amount of bases) were covered by such an extra clay layer on the inside. The majority of them were ring bases (96.2%), and most of them belonged to jars. In only 13 of them base cracks were noted.

Minor base cracks generally did not make a vessel unusable. Many vessels seem to have been used even with base cracks, perhaps for solid contents only. Only 16% (n=110) of cracked bases were repaired before or after firing (see below, and cf. Appendix G).

Base type	No.	% of bases with base cracks	% of bases of this type in the database
711	11	2.3	6.4
712	29	5.9	6.0
721	11	2.3	4.6
731	315	64.5	36.7
741	119	24.4	44.9
751	3	0.6	1.3
Total	488	100.0	100.0

Table V.13: Number and percentage of bases with base cracks, according to base type. A Chi-Square test showed that flat bases show base cracks significantly more often than other bases.

A small number of sherds (1.1% of all described sherds) shows cracks other than base cracks. Vertical cracks in the rim or cracks more or less horizontal and parallel to the throwing ridges may occur during drying and firing. During the drying stage small cracks may have been caused by the large weight of the clay in large vessels (L. Jacobs, pers. comm.). During the firing stage cracks in the rim or wall can occur when the vessel is cooled or heated too rapidly or unevenly (Rye 1981: 114). Moreover, any existing tiny cracks will become larger during firing.

Spalling

When thick-walled vessels are not dried completely before firing, the wall can be damaged when the vessel is heated too quickly. Moisture in the centre of the wall expands, and causes a large lens-shaped piece to break away, sometimes even creating a hole (Rye 1981: 114). Spalling occurred rarely in the Sabi Abyad corpus (n=3), and then only in extremely thick-walled vessels.

Lime spalling

The phenomenon of lime spalling is described in Chapter II. The damage caused by lime spalling is recognizable by a conical shaped hole with a white grain in the middle. Lime spalling was noted for 461 sherds (only 2.3% of the total). Lime spalling is of course related to the amount of calcite present in the clay. As the Balikh clays are marly clays, it is to be expected that large amounts of calcite are generally present and that spalling would occur in many vessels made from this clay, depending on the firing circumstances. Occasionally larger calcite particles (up to 8 mm) occurred, but generally the calcite particles that caused the spalling were rather small but visible (under 3 mm). Lime spalling *only* occurred in wares where visible calcite inclusions were described (wares A, B, G, H, I). In most cases spalling does not seem to have caused very serious damage to a vessel. However, when there were many damages due to lime spalling, the vessel wall was seriously weakened or even crumbled completely. In a few vessels it caused the crumbling of the inside wall surface, and once a 17 mm wide hole appeared through the whole vessel wall. Wares with coarse calcite inclusions (E, L) do not show any lime spalling, a fact which possibly supports the idea that cooking-ware was fired at low temperatures (below ca. 800 °C) that do not cause lime spalling (see chapter II and Appendix D). But also in other wares lime spalling might be related to the firing circumstances, especially the temperature.¹⁴⁸ In Chapter II we saw that lime spalling occurs especially when the clay is fired between about 750/850 °C and 900/1000 °C, in oxidizing atmospheres (Rice 1987: 98, Rye 1981: 114). With the help of table II.2, describing the relation between sherd colour and firing temperature, the estimated firing temperatures for sherds with lime spalling are summarized in table V.14. It is clear that most sherds fall in the group of “medium-fired” fabrics, as is generally true for the whole corpus. A Chi-Square test indicated that the firing temperature does not significantly influence the presence of lime spalling.

	% of sherds with lime spalling	% of all sherds
<i>High temperatures</i>	12.3	15.3
<i>Medium temperatures</i>	86.8	81.9
<i>Low temperatures</i>	0.9	2.8
<i>Total</i>	100.0	100.0

Table V.14: Firing temperatures in sherds with lime spalling and firing temperatures in the whole assemblage.

The comparatively rare occurrence of lime spalling then might be due to the addition of salt to the clay, which prevents lime spalling. Salt at the same time makes the colours of the fired product lighter at lower temperatures than without salt, perhaps resulting in slightly too high temperature estimates based on colour alone (Rice 1987: 119, see also Chapter II and Appendix D).

Crumbling

When a vessel is fired at a high temperature and the fabric has turned greenish in colour and crumbly in texture, the surface both on the inside and outside of the vessel may crumble

¹⁴⁸ A Chi-Square test indicated that in the Sabi Abyad corpus there is absolutely no relation between firing atmosphere and the occurrence of lime spalling.

away. In this case, the crumbling was clearly caused by over-firing. However, some vessels fired at lower temperatures also showed a crumbling inner or outer surface. The reasons for this crumbling are not completely clear and might be connected to several different processes. First, the surface hardness may have been influenced by the migration of salts to the surface of the wall during the drying stage, resulting in a softer surface (Rice 1987: 355; see also Appendix D). Secondly, the inside surface might have crumbled because of a chemical reaction of the vessel wall with the contents (e.g. acid fluids?), or by other use-related causes (e.g. repeated and heavy stirring with a hard object). These use-related possibilities will be further discussed in Chapter VI and Appendix G. Or the crumbling might be related to post-depositional processes. The deposition environment (soil pH) may influence the chemical composition of the fired vessel, causing leaching. This might for example remove the calcium in the surface of the vessel (Rice 1987: 421). This process may have been active in the case of one or two vessels that had preserved their shape before deposition, but completely crumbled upon excavation. One would, however, expect the environment to be of equal influence on all ceramics buried at that spot, and not on a single vessel only. Crumbling may also be due to the very high content of small calcite aggregates in the natural clay, as is illustrated in some of the sherds in Appendix D. The lime-spalling effect in many tiny particles of calcite may have destroyed the internal strength of the vessel wall completely.

Deformation

Sometimes vessels were damaged or deformed when the clay was still wet. When the vessel was pressed or bumped against something, this could result in dents in the wall or in an oval circumference. Rims and bases were sometimes struck by other objects, leaving notches or scratches in the wet clay.

A particular kind of deformation is visible most clearly in the small to medium-sized bowls. As we have seen, they were thrown from the cone. When they were cut from the cone with a thread, a lot of them were cut askew. The base is then not aligned with the rim, resulting in a bowl with a slanting rim when standing. This type of deformation is often quoted as an example of the hasty and careless shaping of these bowls (e.g., Pfälzner 1995: 244).

Repair and use of damaged vessels

Some vessels (n=232) with minor or more serious damages were repaired, so that they could still be used. Several different ways of repairing vessels were in use:

- filling the crack or damaged part with a gypsum/lime paste (e.g. figs. IV.26.a, IV.39.ap, IV.42.p, IV.49.c, IV.58.f, IV.76.a, IV.81.d, e, IV.82.b, c, IV.88.d, IV.96.g, IV.106.g).
- filling the crack or damaged part with a bitumen paste (e.g. figs. IV.58.f, IV.84.e and fig. VI.9 right)
- drilling holes along a fracture to tie it with rope (fig. V.57).
- closing cracks when the clay is still plastic (before drying and firing the vessel, cf. fig. IV.76.k)

A few vessels were repaired in several places (e.g. base and rim) or with two different methods. In the following table a distinction is made between cracks and other damages. Cracks mostly occurred during the production of the vessels, mainly during drying and firing. The group of other damages includes spalling damages (see below), but also damages that may have occurred during the use of the vessel.

	Gypsum/lime	Bitumen	Repair holes	Clay repair	Reworked fractures
Base cracks	96	2		1	
Base damage	1			1	2
Base and wall/rim cracks	10				
Wall/rim cracks	68	22	1	1	
Wall/rim damage	7	1		7	13
Total	182	25	1	10	15

Table V.15: Methods and location of repairs on damaged vessels.

From table V.15 it is clear that most repairs were done by filling up the crack or the damaged spot with a gypsum/lime paste. This paste was carefully smoothed into the crack so that the surface of the vessel would be smooth and the crack would not show too much. During deposition, however, the gypsum expanded in volume, yielding irregular blobs of white paste on the surface of the vessels in and along the fractures. Occasionally, this process has widened the crack by pushing the fracture apart. Refitting the vessel for drawing and description was then only possible by removing the complete gypsum layer. When bitumen was used for repair, it was mainly used for rim and wall cracks.

Reparations of damages before the clay had dried were only rarely carried out. This was done by pressing the clay around a crack with a blunt object, to close the crack; another method was to press the damaged part together and to smooth the spot with the fingers. Sometimes an extra piece of clay was added to a damaged spot before the vessel dried. This method did not work very well: often the vessel cracked again during firing exactly in the repaired spot, thereby further weakening the vessel.

When part of a vessel had broken, the fractures were sometimes smoothed, so that the undamaged part of the vessel could still be used (n=15). Vessels used in this way include large jars of which the rim had broken off, while the base part was subsequently used as a pot (cf. figs. IV.35.l, IV.95.g, IV.96.a); vessels of which only the broken rim was smoothed, preserving the same general vessel shape (goblets, bowls, strainer, small jars, figs. IV.73.j, V.58); and a complete type 321 jar rim that was reused as a pot stand. Another use of damaged and otherwise unusable vessels (n=4) can be illustrated by a small jar base that was used as a bitumen container after the upper body broke off (fig. VI.5). Some over-fired very brittle and severely cracked and warped bowls were used as gypsum paste containers in the level 5 pottery workshop (fig. VI.5).

Summary: techniques and the organization of production

When summarizing the different aspects of production techniques discussed here, we see the following picture of pottery production at Sabi Abyad emerge.

There is little variety in the used clay and clay bodies. Most pottery is made of clays with organic inclusions. Wares without added inclusions and wares with coarse mineral inclusions were prepared for specific purposes: finer thin-walled vessels, large vessels, cooking vessels, etc. The clay seems to have been prepared sufficiently well: particles are evenly distributed through the matrix and air bubbles hardly occur. For particular purposes, such as handles, applied decorations, and to prevent base cracks, a paste was prepared with extra organic inclusions to avoid shrinking cracks. The potters seem to have known the properties of the clay and the effect of inclusions well.

Most pottery was wheel-thrown, but handmade techniques were used for special purposes. Several different shaping techniques were distinguished:

- A throwing from the cone in one stage
 throwing from the cone with subsequent finishing stages
- B throwing from one piece of clay, in several stages
- C throwing in cylindrical parts and combining the pieces later
- D throwing closed (not part of the Sabi Abyad tradition)
- E handmade from one piece of clay
 handmade with slabs
 handmade with coils
 handmade decorations, holes, applied parts like spouts and handles

Throwing from the cone is a technique that is especially suitable to produce large quantities of pottery in a short time (Franken and Van As 1994: 508). Especially when vessels are not finished or decorated further, as is indeed the case at Sabi Abyad, this technique is extremely efficient. When vessels were shaped in several stages, the most efficient way to do this would be to work in series: first make a large amount of half-finished vessels and then finish all of them. When throwing from the cone this working in series is necessary: first the hump of clay has to be used up before anything else can be done on the wheel. But even with pieces thrown from one piece of clay it would be better to work in series. While shaping the next half-fabricates, the vessels can dry a little so that they are stronger and won't be damaged so easily when put back on the wheel to be finished. Throwing in cylindrical parts seems to be the most complex shaping technique. Pots shaped in this technique are produced in series, as each base part has to dry a while before connecting it to the top part. L. Jacobs (pers. comm.) estimated that one experienced potter could produce around 30 large jars (types 321, 322, 323) in a day's work with this technique. Among the handmade vessels, the large storage vessels seem to have been the most labour-intensive. When building the vessel in slabs or coils, the vessel had to dry before one could add the next part. It would therefore be efficient to make more vessels at the same time, or to fill the time of drying with making other shapes on the wheel. Modern itinerant storage jar makers on Crete using similar techniques can make 400 storage jars in 40 days with a team of six potters and assistants (Voyatzoglou 1974). Their colleagues on Cyprus worked at 30 jars simultaneously. In both cases the whole process of shaping took about forty days, allowing for drying time (Voyatzoglou 1974: 19; London 1989b: 70). Other hand-shaped vessels were most probably only made on occasion, in spare time or when needed for a specific purpose. They were definitely not produced serially.

Most pottery was therefore shaped using techniques that aim at a large output and quick, efficient production. The fact that the potters neglected to finish their products in more detail seems to confirm this picture. Hardly any attention was paid to further surface treatment or to decoration, suggesting that the time investment per vessel was limited. When decoration was applied it was mostly on the larger shapes on which most time was spent in shaping. Decoration was almost exclusively of a very simple, schematic nature and was often carried out in a quick, careless manner. The beauty of the vessels seems to have been a minor concern to the Sabi Abyad potters: a functional collection of pots was their main aim.

As expected, the potters did not use very sophisticated tools or equipment. However, both the type of kilns and the professional way they are built, as well as the use of the fast potters' wheel, show that the potters were professionals in their craft.

All shaping techniques used at Sabi Abyad could have been executed by one and the same potter. None of them are particularly complicated, although skill is needed. According to L. Jacobs (pers. comm.), all the pottery in the selection he studied was made within a single larger "tradition". But he thought it very well possible that several different potters worked to produce this range of shapes, each with his particular specialization and techniques. In any case, all techniques that involve serial production would benefit enormously from the presence of one or more assistants who carried and prepared raw clay, carried away the finished vessels to a drying place, handed over tools, etc. A small modern potters' workshop in Damascus employs two professional potters while a young boy assists them with these

various tasks and another adult spends his time decorating pots (pers. observation by the author, 1999). It may therefore be suggested that the Sabi Abyad potter did not work completely on his own but was assisted by others, most likely members of his family. There is, however, no evidence for “worker specialization” (each worker specializing in shaping part of the vessel in an “assembly line” fashion, as is characteristic of manufactories).

Firing the vessels took place mostly in oxidizing circumstances, a fact that is most probably largely connected to the structure of the kilns. The potters seem to have aimed for well-fired pottery and perhaps they preferred vessels with a light colour. Although vessel colours vary from dark-red to buff and bright green, and colours may even vary strongly within one vessel, the amounts of both over-fired and under-fired sherds are very low. The variable temperatures during firing in updraft kilns must have caused these colour variations. On the other hand, if the firing temperature estimates in chapter II are in the right range, temperatures varied generally between around 800 and 950 °C, a variation of 150 °C only. So it would seem that the potters controlled the temperature and atmosphere of their kilns well.

When vessels showed minor damages like base cracks or lime spalling, this does not seem to have prevented their use. Sometimes serious cracks were repaired with gypsum or bitumen. Also, it was not very important whether vessels were exactly circular or whether their bases were exactly horizontal. Especially bowls, hastily cut from the cone, are often slanting or slightly oval. Again, the most important issue seems to have been whether a vessel was usable, not its appearance or beauty. The reuse of broken or damaged vessels also points in this direction.

Signs and “potters’ marks”

All non-decorative marks and signs that occur isolated on a vessel and are intentionally applied (Lindblom 2001: 13) are described as a “potters’ mark” or as a sign. From the start, we have to make a distinction between those marks applied when the clay was still wet or before firing (potters’ marks), and those applied after the firing of the vessel (signs). The first group was certainly applied in the workshop, while the signs applied after firing may have been applied anywhere and at any point in time after the vessel left the workshop. The first group is therefore most likely related to the production of pottery, while the second group of signs may have had more varied uses. For the sake of convenience, both groups will be discussed in this paragraph. Not much is known about the use or meaning of these signs, and the use and meaning may differ from sign to sign. The only way to recover some of this meaning is to look for relations between sign, vessel and context.¹⁴⁹ Few extensive studies of potters’ marks and signs have been carried out in Near Eastern archaeology (cf. Koliński 1993-94, but see Seidl 1972 for Hittite marks, see also Lindblom 2001 for the Mediterranean). At Sabi Abyad, a total of 128 marks and signs was recognized on vessels and vessel fragments. So only a very small percentage of all ceramics was actually marked (only 0.6% of all described sherds). Fifty-nine marks were impressed (n=17) or incised (n=42) on the vessel surface before the clay had dried, i.e. before firing. Sixty-nine signs were painted on the vessel surface after firing. All signs are presented in a catalogue in Appendix E, listing the figure number in the catalogue, the excavation sherd number, the place on the vessel, the type, state of preservation and dimensions of the vessel, the estimated capacity in litres in the case of complete vessels, and the level number. All signs are complete unless stated otherwise.

¹⁴⁹ Lindblom (2001:7) rightly remarks that we have to look at the marks as “indices of a specific situation”, studying the relations between marks, vessels, chronology, distribution, etc. (and ask ourselves “what activities do the marks reflect”) rather than trying to assess the original meaning of the marks. The original meaning is a priori difficult to establish for an outsider, and may moreover have differed depending on whether the viewer was the potter, a consumer, or someone at a different site far away.

Fragmentary signs may be part of known signs or belong to other, new signs. Comparisons are only cited for contemporary ceramics.

Potters' marks applied before firing

Since potters' marks were applied before the vessel was completely dry and before firing, it is generally thought that the meaning of these signs is related to the potter or to pottery production, an idea that is reflected in the name. Other suggested functions of pre-firing marks include religious symbols, identification of ethnic groups, capacity of the vessels, quantity or quality of the contents, a numerical system, the quality of the pots themselves, the price, the distribution or destination of the pots, ownership, or a relation with a script (Lindblom 2001: 18 table 2, Koliński 1993/94, Potts 1981, Dollfus and Encrevé 1982, Quivron 1980). Because the function of the vessels produced at Sabi Abyad is mostly of a general nature (in all likelihood no vessels were produced for just one specific function or product, see also chapter VI), the potter could not have known much about the specific use of the vessel after it left his workshop. It is therefore unlikely that potters' marks have anything to do with different aspects of the use of the vessel including the kind, quality, quantity or ownership of the contents. Although it is theoretically possible that the potter would indicate a capacity measure on his products, this is not likely. Precise measurement of capacity is only possible after firing,¹⁵⁰ and anyone with some familiarity with the current shapes and sizes would be able to give a general indication of capacity without a sign or mark. The idea that potters' marks represent a basic form of writing can be excluded in the case of Sabi Abyad, since ceramics were sometimes inscribed with cuneiform script, and therefore the potter did not need another writing system. When any function of potters' marks outside the production process is suggested, a connection should be demonstrated between the use of the marks and the type, material, size, shape, findspot, context, and so on of the marked vessels. This has never been possible in archaeological cases (Lindblom 2001: 19), and at Sabi Abyad there does not seem to exist a clear relation between a mark and the vessel size or quality either (see below). Ethnoarchaeological investigations all conclude that pre-firing marks on pottery are related to the production process. Invariably marks are used to distinguish the production of "single economic units" (a family, a workshop) from the production of others (Lindblom 2001: 19-21; Donnan 1971). This is necessary when potters fire the production of more than one potter in one kiln load to save on fuel; when the products of different potters are drying or are stored in the same space; when a potter from a different economic unit (i.e. producing for himself) works in a workshop belonging to someone else and is paid for his output; or when potters are remunerated (by middlemen or authorities) on the basis of their production. It seems that none of the ethnographically attested marks were intended for the user of the ceramics (*ibid.*). Lindblom (2001:132-133) also examines the possibility that marks are used to regulate economic obligations between a ruling elite and dependent potters. In archaeological cases usually only a small amount of the total corpus is marked. This may indicate either that the potter did not mark all vessels but only a small number of them, for example the last vessel of a batch (cf. Koliński 1993-94:15), or that it was only occasionally necessary to mark the production of different potters.

With these thoughts in mind, we shall now take a closer look at the marks from Sabi Abyad. A total of 59 potters' marks was found within the corpus described in this thesis. They were impressed (17) or incised (42) on the vessel surface before the clay had dried.

There are five groups of impressed marks, one of which comprises sherds inscribed with cuneiform signs. Since cuneiform signs are most probably used in case a message was to be conveyed to the user of the vessel, this group is slightly outside the present discussion of

¹⁵⁰ A jar from Tell al-Rimah that carries a capacity measure was indeed inscribed *after* firing (Postgate 1978). A large Middle Assyrian storage jar from Tell Chuera also has a capacity measure inscribed after firing (I. Boesze, personal communication). See also Chapter VI for a more detailed discussion of capacity measures.

pottery marks. As far as the meaning of the inscription is clear, the cuneiform signs seem to have been used to indicate the intended function of the vessel or a personal name (see Appendix F for more information on the cuneiform inscriptions, see also chapter VI).¹⁵¹

Another somewhat exceptional group is composed of two instances of a seal impression on a ceramic vessel. Once a cylinder seal was used on a goblet, and once a stamp seal was used several times on a carinated bowl (fig. E.4). Whether these impressions are part of the same system as the other marks is difficult to establish. Seal impressions are often found on ceramics from the Near East (Aruz 2005); however, mainly on large storage and transport jars and not on small vessels as at Sabi Abyad.

We are then left with three types of impressed marks: impressed crescents (fig. E.1), impressed crescents upside-down (fig. E.2), and an impressed figure (fig. E.3). Of course, the crescents could all belong to one group depending on whether the orientation of the mark was of any importance or not. The impressed figure comes from level 7 and apparently has close parallels at Mitanni / Middle Assyrian Nemrik, Tell Mohammed Arab and Aššur.¹⁵² The crescents, on the other hand, all come from level 5 (n=8) and level 4 (n=2). For our discussion on pottery production, these are therefore the most important. There are 10 cases of the use of this mark, all of them on the shoulder or rim of large jars (type 321, 322, one type 312 jar). Impressed crescents were also used on vessels from Tell Sheikh Hamad (MA III, Pfälzner 1995: Taf. 151a) and Tell Brak HH1 (Oates et al. 1997: fig. 182 no. 30).

The 42 incised marks were all applied with a blunt object in wet or mostly leather-hard clay. They are more varied in shape than the impressed marks. Shapes vary from five-pointed stars, tridents and crosses to more irregular crossing lines, crescents and vertical lines, presented in Appendix E in eleven shape groups (figs. E.5-14). These incised marks are generally a bit larger than the impressed crescents. Often the incisions have a somewhat careless appearance, as if the exact shape was not of very important as long as the vessel was marked. A special type of incised marks is represented by notches incised at the top of the rim or at the edge or ring of the base (fig. E.14). They occur alone or in groups of three or five notches. Incised marks from level 7 are exclusively notches, at the edge of the base of three small bowls. Incised marks from the later levels include three notches on the rim of a large type 322 jar, from level 3. All other incised marks come from levels 6-4, with most occurrences in level 5. The majority (n=20) of incised marks appears on large jars and are always applied at the rim or at the shoulder or upper body and never near or at the base. However, unlike the impressed crescents that were used exclusively on large jars, incised marks appear on other vessel types as well. These include a cross and a “plough” shape on medium-sized type 318 jars, a cross on the body of a pilgrim flask (type 911, probably not made locally), below the rim of a type 131 bowl, near the base of a type 111 bowl, and at the underside of a bowl base; crossing lines under the rim of a type 222 pot; a trident at the lower body of a bowl; four crescents incised on the rim of a pot stand; notches incised on the bases of small bowls and unknown¹⁵³ incised signs at the rim of a pot stand and the rim of a type 131 bowl. Whereas incised marks on jars appear always at the rim or on the upper body of the vessel, incised marks on bowls (n=11) and other shapes (n=9, including undetermined body

¹⁵¹ Cuneiform inscriptions have been found on Middle Assyrian pottery from Aššur as well. The names and titles of the king were written on vessels made especially for the *tākultu* ceremony, and the inscription stated that the vessels belonged to the temple of Aššur (Weidner 1926: XX (Adad-narari) 33, 34, XXI (Shalmaneser I) 24, 25; cf. Grayson 1987: 76.28 and 27, 77.25, 26, 27, see also Frankena 1953: 51f.). Other inscriptions on pottery mention the names of kings or functionaries, and some indicate that they were meant for storing cuneiform tablets (Frahm 2002: 85; Pedersén 1985: 43, cf. Postgate 1980: 69). Another vessel was inscribed: “1 x-vessel []-ši (?) of the potter of the servant of the palace, the servant of the king” (Jakob-Rost 1991). From Tell Chuera (Orthmann 1990: Abb. 43 Fig. 3) comes a fragment possibly inscribed with a personal name, and similarly an early NA pot from Tell al-Hawa is inscribed with a personal name (George 1990: 42 no. 2).

¹⁵² Personal communication of A. Reiche.

¹⁵³ Unknown because no drawings are available.

sherds) could be applied either on the rim or body of the vessel or at the base. The marks on pot stands indicate that they certainly were not an indication of the expected contents of the vessel. With the exception of the cross on a pilgrim-flask fragment, all marks appear on vessel types that were produced locally. In the group of incised marks there is not only more variety in the shape of the marks than in the group of impressed crescents, but also these marks are used on more different vessels and in different places on these vessels. Table V.16 shows the capacity in litres of the complete vessels with impressed or incised marks. Although the sample is small, it seems clear that the capacity of the vessel was not the intended message of the mark. Although a detailed contextual analysis cannot be performed at this moment, a quick look at the squares from which the sherds and vessels with potters' marks come, shows that there might be a pattern in the findspots. In level 5, most potters' marks seem to come from squares in the northwestern and northern part of the *dunnu* inside the walls (mainly in squares H8, K8, L8, M9), and not so much from the "palace", "tower", or areas in the east and south. Whether this means that the potters' marks are indeed related to the control over production by the *dunnu* authorities, whose offices were mostly located in those areas in level 5, or whether other factors are of influence, must remain open.

In conclusion we can say that the use of impressed and incised marks seems to be in accordance with the idea that potters' marks were used during the production process, most probably to keep apart batches of vessels in the kiln or during production stages. The fact that similar marks were used on different vessels may indicate that one potter or workshop produced a variety of shapes (as was already clear from the evidence in the workshops themselves, see above). Why impressed crescents were only used on large jars is unclear. The rare occurrences of marks on the pottery from Sabi Abyad may suggest that it was not rarely necessary to separate different batches of pottery, and that it definitely was not a daily practice in the workshops to mark vessels. The marks are therefore unlikely to indicate a particular potter (as a kind of "signature", as with the use of workshop stamps in Roman times). It is possible that marks on vessels were used to account for the number of days the potter worked or the number of vessels he produced, so that he could account for his work to receive rations, although there are easier ways of accounting for this in a society very much used to the compilation of lists. It is also possible that potters' marks at Sabi Abyad were used mainly to distinguish the production of different potters (or economic entities) in case the same facilities (kilns, drying spaces) were used, and that this did not occur very often.¹⁵⁴

¹⁵⁴ It is also possible that the marked vessels were not produced at Sabi Abyad at all, but came from other sites where a different production organization predominated (e.g. more workshops at one site, so that there was an increased need to distinguish produce from workshop to workshop). However, this would not explain the occurrence of marks on bowls and pot stands at Sabi Abyad, since vessels transported from other sites would most probably be jars (transported as packing material). A sample for thin-section analysis was taken for one marked sherd, type 122 bowl P93-110, from level 7. The thin-section analysis showed that the vessel was probably made in the Balikh Valley if not at Sabi Abyad itself (sample no. 44, Appendix D).

<i>Excavation number</i>	<i>Vessel type</i>	<i>Capacity in litres</i>	<i>Sign</i>	<i>level</i>
P93-127	Base of small bowl type 122	0.1	Incised notches	7
P93-110	Base of small bowl type 122	0.2	Incised notches	7
P93-91	Middle bowl type 111	1.2	Incised Greek cross	4
P97-320	Deep pot type 222	10.2	Incised crossing lines	5
P98-57	Middle jar type 318	12.8	Incised Greek cross	-
P97-314	Middle jar type 318	13.9	Incised “plough”	5
P93-454	Large jar type 322	23.4	Incised crescent	5
P96-527	Large jar type 322	25.0	Impressed crescent 2	5
P93-448	Large jar type 323	36.8	Incised St. Andrew’s cross	5

Table V.16: The capacity of vessels with impressed or incised marks.

Signs applied after firing

Sixty-nine signs were painted on the surface of the vessel after firing (figs. E.15-29). They could have been applied in the potter’s workshop, but they may also have been painted at other places and points in time during the use of the pot, perhaps even years after manufacturing. Consequently, there is no inherent link between the sign and pottery production, and interpretation of the signs may be even more difficult. They do seem to indicate something, but their “meaning” may vary from playful “doodles” to precise indications of owner, content, capacity, destination, etcetera. At the same time, it is clear that if a very particular message was to be conveyed, the cuneiform script could have been used to write the message, as we have seen above. Again only the careful analysis of possible relations between sign, vessel and context will perhaps yield a pattern that we can try to interpret.

The composition of the paint was not analysed, but in all cases the paint is very dark brown to black or blackish grey. It is thin, not clay or slip-like, and somewhat transparent. It is very well possible that bitumen was used. The painted signs are generally larger than the impressed or incised signs. Drippings of paint sometimes indicate that the vessel had been standing on the rim (drippings “upward”) or on the base (drippings “downward”) during painting. It is recalled here that many of the large jars without neck (types 321, 322, 323) are not stable when standing on the base without a support. Perhaps, after the paint had been applied “right side up”, the vessels were put to dry on their rims. This means those vessels were empty when the sign was applied.

In total 15 different groups of signs have been distinguished, of which some contain fragmentary signs that possibly belong to another group (see Appendix E). The signs consist of single geometric shapes like triangles, crescents, circles and squares. Circles and squares also occur filled with a cross. The most popular signs are the crossed square (fig. E.21), the crescent (fig. E.18), the crossed circle (fig. E.20) and the triangle (point up or down, figs. E.15, 16, 24). Together these signs account for 31 cases, while another 28 cases show fragmentary or unclear signs that may belong to one of these groups. The other 6 signs occur only once or twice, together in 10 cases. Painted signs, like impressed and incised signs, occur mostly on large jars (rim types 321, 322, 323, n=44). Signs were applied far less frequently on middle-sized jars (n=1, type 312) and small jars (n=2, types 311, 312), or on other shapes like large storage vessels (n=1, type 213) or pots (n=1, type 226). Painted signs were never used on open shapes like small or larger bowls, or on goblets, pot stands or other shapes that are not meant for storage. Moreover, the signs on the storage vessel, large pot and middle-size jar are either fragmentarily preserved or belong to the less popular sign groups, while only the small jars were marked with a crescent that occurs more often on other shapes as well. So we see that the most popular sign groups were used almost exclusively on large jars (rim types 321, 322, 323). A large majority of the signs appear on the shoulder or upper body of the vessel, as shown in table V.17, while they never occur on the rim, near the base or on the base

of the vessel. It appears that the signs were meant to be seen, even if the jar was closed with a piece of cloth or a jar stopper over the rim¹⁵⁵ (cf. Müller-Karpe 1988: 148).

	<i>Large jar</i>	<i>Middle jar</i>	<i>Small jar</i>	<i>Storage vessel</i>	<i>Pot</i>	<i>Body sherds</i>	<i>Total (%)</i>
<i>Shoulder</i>	24	1	1		1		27 (39.1)
<i>Upper body</i>	12		1	1			14 (20.3)
<i>Lower body</i>	1					1	2 (2.3)
<i>Body sherd</i>	8					18	26 (37.7)
<i>Total</i>	45	1	2	1	1	19	69 (100.0)

Table V.17: Position of the painted signs on different kinds of vessels.

A calculation of the capacity for each completely preserved vessel, shown in table V.18, shows that there is no apparent relation between the capacity of the vessel and the sign, although the sample is very small. As to the context of the vessels with painted signs, it seems that the painted signs in level 5, too, occur mostly in the northern part of the *dunnu* (two-thirds of the sherds have been found in the northern squares comprising the “offices”). But again we cannot draw any further conclusions on a possible relation with the *dunnu* administration.

Summarizing, we can say that a variety of geometric signs (with four popular types) was used mainly on large jars, and that they were well visible. It seems that the signs are related to the function of the vessels (all are suitable for storage), and it is possible that these signs were used to indicate the contents inside the jar, the destination or owner of the jar, the day of filling, etc. However, only a very small percentage of jars was marked with a sign, so the use of a sign seems to have been exceptional.

<i>Excavation number</i>	<i>Vessel type</i>	<i>Capacity in litres</i>	<i>Sign</i>	<i>level</i>
P96-255	Small jar type 311	1.3	Painted crescent	4
P96-569	Middle jar type 312	13.8	Painted rectangle	5
P97-181	Large jar type 322	21.7	Painted Y-shape	5
P93-334	Large jar type 323	27.4	Painted triangle point down	4
P96-555	Large jar type 323	27.5	Painted crescent	5
P97-200	Large jar type 323	38.4	Painted comb	5
P93-426	Storage pot type 213	106.0	Painted rectangle, open base	5

Table V.18: The capacity of vessels with painted signs.

Some of the signs are reminiscent of symbols used on seals and other figurative art. These include the crescent, the (Greek) cross and the circle (or disc?) with a cross (cf. Matthews 1990). These symbols most probably represent gods and goddesses, like the moon god *Sîn* (crescent), the sun god *Šamaš* (cross; disc with a star). A star is also used frequently as a symbol in art, but is mostly composed as an eight-pointed or six-pointed star and not as a five-pointed one like the mark on the pottery (Black and Green 1992). Our impressed figure (fig. E.3), topped by a crescent, might also be connected to the moon god *Sîn*. However, from superficial similarities we cannot lightly conclude that these and other signs used on the pottery have a meaning comparable to the symbols used in glyptics and art, and were used for example to indicate vessels destined for the temple. Not all signs can be compared to symbols used in art, while the signs that are alike are so simple that it could easily be a coincidental similarity. More importantly, the context of the symbols in seal designs is very different and incomparable to the use of signs on pottery, so that their meaning may not be compared just on the basis of their similar shapes.

¹⁵⁵ It also may mean that the signs were applied when the vessel was standing upright, but that this was not always the case can be inferred from the drippings of the paint as discussed above.

V.7 The products of the Tell Sabi Abyad workshops

The kind and quality of the vessels

In chapter IV we have seen what the pottery looks like in each level and what kind of shapes and sizes were produced. The kind of vessel produced at Sabi Abyad was mainly utilitarian. Any more luxurious shapes or decorations are exceptional. A general idea existed about what kind of shapes one needs in a household. When looking at the frequencies of vessel types in the corpus, it seems that there is a group of vessels that was frequently made, while others were made in smaller numbers. The efficient production techniques, the use of slightly damaged vessels and the repair and reuse of damaged vessels indicate that usability was the main issue, not the appearance. Nevertheless, the potters sometimes found reason or time to decorate vessels, with simple incisions or with appliqué decorations. Perhaps these vessels were made for specific occasions.

In chapter VI we will look at the function or use of different types of vessels in more detail. However, we can conclude that the potters produced the majority of vessels for general storage and serving purposes (bowls, pots, jars). Furthermore, they produced vessels with more specific functions, like strainers, pot stands, bowls with spouts, a bowl with a strainer in the base, large storage pots, drinking goblets. The production included vessels of different sizes, ranging from very small bowls to very big storage pots. It is clear that the workshops at Sabi Abyad did not specialize in a specific type or shape of pottery but had a varied output, and that they used different shaping techniques for different vessels. Apart from ceramic vessels, the pottery workshops most probably also produced other objects. This study will not discuss these products, but we can name drain pipes, baked tiles and other architectural and engineering elements, figurines, toys (chariot wheels), moulds and tools for metal production, cylinder seals, beads, spindles, and so on.

The quality of the vessels was actually quite good. Although they were quickly, sometimes almost hastily, produced and not much time was spent on the finishing, decorating, etcetera, they are generally well made and well fired by skilled potters who mastered the shaping techniques they used. The quality of the pottery was sufficient for its purpose. The shaping techniques, using “throwing from the cone” and the serial production of vessels in two or more stages of production, point to a focus on efficiency and on lowering the labour investment per vessel. This may be related to two partly interrelated aspects of production. On the one hand, it can be linked to independent production for a market or for “commoners” (e.g. Costin and Hagstrum 1995: 621, Rice 1991: 266). On the other hand, it may be related to increased levels of production, in which a small number of potters had to produce larger amounts of vessels and therefore strove for more efficient production methods (e.g. Stark 1995: 233, 235). It seems that the Middle Assyrian potters at Sabi Abyad were oriented more towards efficiency and quick production than the potters who produced the ceramics from level 7, who spent more time on, for example, surface treatment and decoration, as we have seen in Chapter IV.

Scale of production, output and demand

The term *scale* encompasses two related aspects of production organization: the size of the production facility or the number of individuals working in one production unit, and the principles of labour recruitment (e.g. are co-workers part of the family, or manufactory personnel recruited from different families? Costin 1991: 15). Apart from the size of the production unit, Pool (1992: 278) considers the input (in energy, capital, or material resources) and output (amount of vessels) of production also as an aspect of the scale of production. However, Costin (1991) warns for equating output levels and scale: a large

number of vessels may have been produced by many small-scale production units. Several archaeologically recognizable dimensions are related to, and influence, the aspect of scale (Costin 1991: 29-30):

- the size of production facilities (single production units).
- the context or location of production: in the family home, in specially designed buildings, etc.
- the organization of the workspace.

It is clear that these dimensions are related to the direct evidence for pottery production more than to the products themselves. We will now have a look at the Sabi Abyad evidence for scale of production based on the evidence and suggestions collected in this chapter.

In level 6 we have seen that the pottery workshops are clearly located in a separate area of the *dunnu*, but within the moat surrounding the *dunnu*. The workshops cover an area of approximately 323 m². In the workshops two wheel bearings for a potter's wheel have been found, suggesting that at least two potters were working here. The discussion of shaping techniques has made clear that the presence of several assistants for clay preparation, wheel turning, and helping with the serial production of shapes in two or more stages, is very likely. Perhaps in level 6 there were between 5 and 10 people (men, women and children) involved in pottery production. Two very large kilns were in use, indicating that output levels were relatively high. Later in level 6 there is some evidence for a reduction in scale: fewer rooms now seem to be used and perhaps one of the kilns went out of use. Firing of the products took place close to the workshop location. It is probable that the potters and their family lived in the workshop area as well, as is indicated by the find of domestic installations and tools like *tannurs* and mortars. The workshops are clearly located within the *dunnu* and at a specific site inside the settlement, but at the same time they seem to overlap with domestic space. Inside the workshop there is not a very clearly visible distinction between the use of different areas, and space seems to have been used in a rather flexible way.

In level 5 the flexibility of the potters in their use of space seems to increase. At the beginning of level 5 a large kiln was in use in the northern part of the site, inside the fortress walls, but no associated workshop was found. The remains of a workshop were found in the east of the site. Here an area of around 294 m² (or 580 m² if we include the open area to the east) was used by the potters, a size comparable to the level 6 workshops. They used a large kiln in the south-east, and two smaller kilns inside the workshop. The workshop now does not seem to be a specially designed area anymore, and the potter's work is encroaching even more on the domestic spaces of the fortress, perhaps indicating a decrease of intensity in production. It seems that the potters used a suitable and otherwise unused space within the houses and working spaces of the fortress. Other areas that were unused at specific times, such as spaces in the west and north of the site, were used for building smaller kilns. Perhaps, as was suggested above, this is related to the direction of the wind in different seasons. This could be an indication that production was continued in the winter season as well. In level 5 several smaller kilns were used for the first time. Perhaps the potter wanted to be able to fire his products more often at the same output level, or perhaps his output levels were lower at certain moments so that he did not need the large kiln (kilns are only fired efficiently if fully loaded). Or perhaps he used the smaller kilns for different products than the larger kilns. Also only one large kiln seems to have been in use at any one time.

The evidence for production in level 4 is much more difficult to interpret. However, at least one large kiln was in use at these times, indicating that although the settlement changed its character profoundly, the production of pottery was still kept up at a certain level. A workshop was not found. As to the context of production, it seems that the Middle Assyrian *dunnu* administration had changed, but Assyrians were still living at the site. We may summarize the information on scale as follows:

- Level 6: 1 or 2 workshops (total 323 m²), around 5-10 people, 2 large kilns, 2 wheels in use over a span of ca. 30 years. At the end of the period the scale probably decreased slightly. Separate area for workshops but overlapping with domestic functions, associated with the *dunnu* administration, flexible use of space.
- Level 5: 1 workshop (total 294-580 m²) and several more flexible locations, 2 large kilns used one at a time, several small kilns in use over a span of ca. 15 years. Workshops now more mixed with domestic or unused space, associated with the *dunnu* administration, very flexible use of space.
- Level 4: at least one large kiln, no information about workshops.

The output of production, or the number of vessels produced, is another important aspect of the organization of production. However, it is not easily measured in archaeological cases. Depositional and post-depositional processes, differential breakage of vessels, inability to always distinguish locally produced vessels from “imports”, differences in archaeological context and preservation, differences in archaeological processing (e.g. how much time was spent on refitting) of the pottery, all influence our ability to estimate output levels. Moreover, the amounts of sherds and vessels recovered from an archaeological context perhaps reflect the scale of consumption rather than the scale of production (Pool 1992: 280-281). In the same way we cannot be sure that the complete production of a workshop stayed at the site and can therefore be recovered, and was not partly transported to other sites. Lastly, not all pottery from the site was excavated or recorded (although the excavated sherds were all counted). I therefore feel that, especially in the absence of detailed stratigraphical control, calculations of “output” based for example on numbers and radius of rim sherds in relation to the total counts of sherds are not valid. A relative indication of output may, however, be found in the size of the kilns. Elsewhere (Akkermans and Duistermaat 2001) it was suggested that a larger kiln could hold a mixed load of at least 500-1000 vessels of different shapes and sizes (between around 4000 middle-sized bowls not stacked inside each other, or around 70 large jars; the numbers would increase if bowls were stacked). The larger kilns in squares N11 and L8 show evidence of several occasions of replastering (see Appendix C), something that was necessary after a number of firings.¹⁵⁶ Without being able to calculate the exact number of firings and size of the kiln load per firing, we can still see that the large kilns (of which at least one was in use at any one time) could have yielded many thousands of vessels per year. The used shaping techniques, as we have seen above, are aimed at an efficient and quick production of large amounts of pottery, something also reflected in the lack of labour-intensive treatments like burnishing or decoration. It therefore seems clear that the workshops at Sabi Abyad were producing a sizeable amount of vessels.

It is without doubt that these vessels were produced for the *dunnu* staff living at the site, estimated at maximum 60 people (see above and Wiggermann 2000: 191). While a future spatial analysis of the site will perhaps yield information on the number of vessels a household generally used, one may ask whether only these 60 people would have consumed the thousands of vessels produced by the potters. Both the facilities the potters used (especially the kilns) and the techniques they employed were aimed at high production levels. It therefore seems reasonable to suggest that the produce of the Sabi Abyad potters was distributed to other, surrounding sites as well. The dependents of the *dunnu*, calculated by

¹⁵⁶ Ethnoarchaeological information about the renovation of kilns is scarce. The very large kilns in Fustat, Egypt, are replastered after every firing, while the smaller Fustat kilns that are comparable to the Sabi Abyad large kilns are replastered after “repeated use”. Firing takes place every two weeks, and approximately 5000 flower pots are fired per kiln load (Golvin et al. 1982: 60-61, 73). Potters in Qamishly, using a rather small kiln, replace the pottery floor with the flue holes every two years, after about 70 firings. Firing takes place every week in summer, around 36 times per year, and the kiln load contains a mixed load of around 100 vessels (Taniguchi 2003: 148). Swan (1984: 33), expects that a well-built updraft kiln can survive “scores rather than dozens of firings.”

Wiggermann at around 900 people living in the area under authority of Sabi Abyad, are the first group that comes to mind (see also below). Whether distribution to those people took place by the potter selling his wares on a market, or whether the *dunnu* administration was in charge of distributing the vessels, is not clear.

Variability and standardization of the pottery

Standardization of vessel attributes has become an important aspect of the description of the organization of production, especially in cases where direct evidence for production is absent. Many studies of ceramic production assume that there exists a more or less direct relation between the organization of production and the standardization or diversity of the produce. Most studies focus on the economic factors behind the process of standardization, such as increase of production, efficiency, cost-reduction and economic competition, or “political” factors like the emergence of craft specialization (taken as an indicator for the emergence of complex societies) (e.g. Coursey 1997; Stark 1995; Costin and Hagstrum 1995; Costin 1991; Rice 1989, 1991). Some more recent studies also try to take into account the social and technological factors influencing standardization (e.g. Berg 2004, Underhill 2003). The study of standardization in pottery is not new. As Rice (1989: 113; 1991: 258) noted, the link between standardization and specialized production was already made by Anna Shepard in the late 1950s. The link between standardized shapes and ancient systems of measurement was already investigated in the 1960s (Rottländer 1966, 1967). Most studies date from the late 1980s and 1990s and after, and more and more data is becoming available for comparison both from archaeology and from ethnoarchaeology. However, there are many and important problems with this type of study.

First of all, it is not so clear what the nature is of the relation between diversity or standardization of ceramics and the organization of production. Several ethnographic studies, in which researchers have the possibility to study the output of a known production organization, have been carried out in an attempt to establish these links (e.g. Roux 2003a; Underhill 2003; Longacre 1999; Kvamme et al. 1996; Stark 1995; Arnold and Nieves 1992; Rice 1989), but so far without unequivocal results. Craft specialists in contemporary traditional societies sometimes do and sometimes do not produce more standardized pots than household potters, and it seems crucial to understand which other factors may have contributed to the observed standardization (Stark 1995: 231, 232).

Moreover, the definition of the terms involved is not clear: what exactly is standardization, and how can we quantify it? Similar problems exist with terms like “skill” or “efficiency”. Mostly, statistical techniques and metrical data are used to measure standardization, but problems exist in the comparability of assemblages and contexts as well as in the statistical testing of similarities. Non-numerical analyses remain of an intuitive nature and cannot easily be compared with results from other studies. The development of techniques to measure standardization and diversity in a statistically valid way, and so that assemblages can be compared, has only just started in archaeology (cf. Eerkens and Bettinger 2001; Kintigh 1989, 1984).

Besides, standardization is not an absolute measure. We can only speak about more standardized assemblages (in shapes, sizes, decoration, etc.) in comparison with other, less standardized assemblages. Standardization and diversity are relative notions, so that the best results are obtained when comparing two data groups (but groups that are somehow related, in geographical area or time, for example; see Costin 1991: 35; Arnold and Nieves 1992: 94). The relative standardization of an assemblage is not a qualitative measurement in itself, but only meaningful when compared to one or more other, comparable assemblages.

Most studies focus on standardization as an indication of (the emergence of) specialized craft production, assuming that “increased production intensity is reflected in increased product uniformity” (Kvamme et al. 1996: 116, see also Costin 1991, Rice 1991,

Kramer 1985). In the case of Sabi Abyad it is clear that the potters were specialists in their craft. The existence of craft specialization at the site does not need any further proof. The direct evidence for pottery production and the technologies used are a much stronger indication of specialized craft production than is the standardization of output. Therefore, we are interested in standardization not so much to prove the *presence* of craft specialization, but to learn more about the other factors influencing standardization. We have to ask the question whether the relative standardization of the Sabi Abyad assemblage is just a natural consequence of the fact that the potters were indeed specialists, or whether other factors were involved as well. There are, however, many such factors, as we will see below, and (especially in archaeological cases) it is difficult to establish which factors were responsible for the standardization encountered. So, even if we can measure standardization, it is not always clear what exactly we are measuring (the results of which process or factor).

Notwithstanding these difficulties, most Near Eastern archaeologists would intuitively agree that Middle Assyrian pottery is of a “very standardized” nature, that it comprises a limited set of “standard” shapes that look similar all over the Middle Assyrian empire, and that these aspects are related to the production technology and production organization. The typical Middle Assyrian shapes are easy to recognize and often used as type-fossils in surveys. A discussion of Middle Assyrian pottery production must therefore discuss the nature and extent of standardization and variability, and discuss the possible relations with production organization or other factors.

The information I have collected in this chapter about the organization of pottery production at Tell Sabi Abyad will be used as a background to interpret any conclusions on standardization (Costin 1991: 32). In this paragraph we will look closer into the different aspects of diversity and standardization in the ceramic assemblage at Sabi Abyad. The conclusions reached in this paragraph are used to colour in the picture of the organization of pottery production at Sabi Abyad further and are also meant as a group of data on standardization from an archaeological production context for comparison with other sites.

Factors influencing variability and standardization

If we can measure or describe the relative amount of diversity or standardization of different aspects in our assemblage, what can we say about the underlying causes for this pattern? What are we actually measuring? Standardization is not simply an indication of a certain type of production organization. Many different and interrelated factors (some more than others related to production organization) affect the relative degree of standardization of a product (Underhill 2003; Kvamme et al. 1996: 125; Stark 1995; Eerkens and Bettinger 2001; Blackman et al. 1993; Benco 1988; Rice 1987: 201-204), and several of them may have acted at the same time:

- The need for easily stackable shapes for firing, transport or storage.
- The availability and choice of different raw materials.
- The function of the vessels, e.g. the need for vessels holding specific volumes, the need for “unique” vessels, etc.
- Consumer demands, ideas about “normal” shapes and sizes, and consumer acceptance of variability. The presence of traditions and customs related to shapes and sizes or vessel properties.
- Calculations or accounts of costs of production, raw materials, numbers of delivered vessels, etc.
- Orders from authorities to produce standardized forms or shapes, control over resources, etc. (administrative control of production or output).
- The destination of the produce (or “market”), composition of the consumer groups. Vessels produced for one’s own household, for a commercial market, for the state or for tourists may differ in the amount of standardization striven for.

- The size of consumer groups. When fewer potters have to produce vessels for more people, they will strive for a lower labour input per vessel and more efficient production methods. These again lead to increasing standardization.
- The use of measuring systems or measuring tools in production. If a measuring system is used during production, the products will be more standardized than when sizes are estimated only visually.
- Human errors. Even if aiming at an exact copy, a potter will always create pots with a small margin of variation (unless he/she uses a mould, machinery or a measuring tool). The minimum amount of variation within a class that can be obtained by humans is 1.7% (also called “Weber fraction”, Eerkens and Bettinger 2001).
- Motor skill and experience of the potter, or expertise. The more skilful the potter and the more experience he/she has, the more he/she will be *able* to produce identical products. Routine and repetition will increase the uniformity of the output. The random variation in the actual production of one producer seems to depend strongly on whether or not a standard shape or size is aimed at, whether this does not matter or it has been decided to vary, whether or not the potter is working continuously or only part of the year or occasionally, etc.
- The ratio of the amount of producers to the total size of the assemblage. Each producer has his/her own range of variation. Vessels produced by one potter can vary even within a group of similar vessels produced in one day. When more producers have contributed to the total assemblage, the variation in the assemblage will be larger (“ratio effect”).
- The span of time the assemblage covers. This effect is similar to the ratio effect: the longer the period over which the assemblage has been built up, the larger the variation will be (“cumulative blurring”).
- The technology used (handmade, wheel-made, mould-made, etc.). Intuitively, archaeologists seem to think that handmade pottery is more variable than wheel-made pottery. However, ethnographic studies yield varying results and often conclude the opposite (wheelmade pottery being more variable), and the method of forming does not always influence the morphological standardization of the vessels as much as other factors do (Benco 1988: 68).

In the case of Sabi Abyad some of these factors are better known than others, as is clear from the data presented in this chapter. I will summarize these data and ideas here, discussing each of the above-mentioned factors influencing standardization for the Middle Assyrian levels.

The raw materials were probably rather uniform in the area of Sabi Abyad. Any minor differences in ware composition are therefore probably due to small differences in paste preparation. As to the function of the vessels, we may conclude that in general all vessels were of a utilitarian nature and that there was very little demand for “special” or “unique” shapes, and decorated vessels (see also Chapter VI). The Sabi Abyad potters produced the bulk ceramics used for daily life. There was hardly any need for vessels holding a specific volume (see Chapter VI). Some vessels were produced for specific purposes (e.g. pot stands, strainers), while others (bowls, pots, jars) served a variety of purposes. It is very well possible that there existed a “mental image” or specific names for most shapes produced in Middle Assyrian times (see Chapter VI for Assyrian pottery names). That would facilitate for example the ordering or listing of a number of specific vessels without confusion. In that case, too large a variation from this image may have made vessels unacceptable to the consumer. However, it is impossible to know exactly how much variation an Assyrian would have accepted in his/her vessels. There is no information on the question whether the potters had to present accounts to the administration on used resources, number of produced vessels, and so on, but it does not seem likely. Above it was concluded that resources were possibly available without cost. Accounting considerations do not seem to be at the basis of any standardization observed at Sabi Abyad. Reduction of labour or time spent in production may

have been a factor, though. The authorities in Sabi Abyad do not seem to have exercised strict control over the resources or the work of the potter, since they do not seem to have administrated his raw materials or labour. Perhaps they placed orders for amounts or certain kinds of vessels. The main consumer group for the Sabi Abyad potters seems to have consisted of the inhabitants and possibly the dependents of the *dunnu*, and perhaps even other *dunnus* in the area. This group consisted (in level 5) of around 900 people, including farmers, craftsmen and administrative staff, of which approximately 60 people were living inside the *dunnu*. For now it is assumed that this size stayed more or less constant over time during levels 6 and 5, and perhaps in level 4. There does not seem to have been a separate production aimed at the “elite”, although there are a few special shapes with unique types of decoration. The consumer group of *dunnu* staff most probably does not constitute a “commercial” market, if the potter produced pots in exchange for rations or a plot of land as argued above. Whether other *dunnu* dependents had to pay for their pots or received them as part of their own remuneration from the administration, and whether Sabi Abyad potters could also produce for an outside market is not known, but anyway those vessels would not constitute a big percentage of the assemblage found at the *dunnu* since they would have left the site. The potters working at Sabi Abyad are considered to be specialized craft producers, most probably making pottery full time and perhaps occasionally performing other tasks as well. They would have possessed the necessary skill and routine needed to produce vessels in the techniques used and in the quantities needed. The exact number of potters that contributed to the assemblage in each level at Sabi Abyad is not known. However, based on the production facilities and the set-up of the *dunnu* as a whole, it can be argued that the number of potters working at Sabi Abyad in level 6, 5 and 4 was in the range of 2 to 10 rather than in the range of dozens of potters. It seems that relatively few potters produced large amounts of vessels for a large group of consumers. We cannot exactly establish what percentage of pots came to Sabi Abyad from other sites and was made by (how many) other potters. The span of time the assemblage in each level covers may be estimated at 30 years (level 6), 15 years (level 5) and a very rough estimation of 50 years (level 4). The technological tradition at Sabi Abyad includes several different technologies using the potter’s wheel and hand-building. Each vessel type used in this analysis of standardization was produced with one technique only, therefore enabling us to check for this factor.

So the relative standardization or variability of the ceramics at Sabi Abyad seems to be related mainly to the following (partly interrelated) factors:

- The intended function of the vessels and the possible need for specific size classes.
- The context of production and the nature of the consumer group.
- Possible existing ideas or consumer demands about shapes and sizes, or the demand for specific vessel types by the authorities or consumers.
- The limited amount of producers producing large amounts of vessels, and possible efforts to reduce labour or time needed in production.
- Specialized and skilful full-time potters producing wheel-made vessels using several efficient techniques.
- The time span covered by the assemblage in each level.

The relative standardization of the ceramics in each level should ideally be compared to the other levels at Sabi Abyad or to contemporary or similar assemblages from other sites. Few publications, however, offer enough material for such comparisons.

Standardization of ceramic vessels can be detected in the standardization or variability of used raw materials or of the clay preparation processes, in the used techniques for shaping and firing, in the shape, size and detailed measurements of vessels and in decoration of the vessels (Roux 2003a: 768; Blackman et al. 1993: 61; Stein and Blackman 1993). We will now have a look at each of these aspects for the assemblage from Sabi Abyad.

Used raw materials and their preparation

The best way to establish standardization in the used raw materials and preparation is to compare detailed (chemical) analyses for a large enough number of sherds from each group in each level (cf. Blackman et al. 1993). However, as explained in chapter II and this chapter, description of the clay and inclusions proceeded only on a macroscopic level in the field, using 14 ware categories. Petrographical analyses were only carried out on a limited number of samples (Appendix D). Any conclusion on the standardization of raw materials is therefore severely limited by the lack of detail in the data. The conclusions in this paragraph would benefit from a more detailed study of the wares, with a large-scale programme of thin-section analyses and chemical characterization of the clays.

As was shown in table IV.42, the large majority of ceramics at Sabi Abyad was made of wares with added organic inclusions. A small part was made of fine wares without any added inclusions. Coarse mineral inclusions were rare in levels 6 to 3 and more popular in level 7. Also, the percentages were most similar between level 6 and 5, while they were slightly more variable in level 4 and 3. In levels 6 to 4 the amount of sherds with remarkably few or many mineral inclusions is relatively lower than in level 7. The thin-section analyses (Appendix D, see also Chapter II) have shown that any further distinctions between different wares have no basis in petrography, and can therefore not be used for any analysis of standardization in raw materials. Standardization of raw materials and inclusions can also take place within a shape group. As we have seen in Chapter IV, goblets were made of fine wares with no added inclusions. Other shapes, including small bowls and large jars, were made of similar pastes with similar amounts of organic inclusions, suggesting that the Middle Assyrian potters in levels 6 to 3 only prepared a different paste for goblets. Cooking pots were also made of a different paste, but Appendix D showed that many of them do not come from Sabi Abyad and were therefore not part of the local production tradition.

Shaping, decoration and firing technology

Earlier in this chapter we have seen that the potters at Sabi Abyad employed a number of specific and efficient techniques to produce their pottery, each technique suited to the size and shape of the vessels produced. The number of different shaping techniques used is therefore directly related to the kind and size of the vessels produced. We have never detected the occurrence of different shaping techniques for producing the same type of vessel.

Because throwing from the cone is a technique aimed at a quick production of large numbers of small vessels resulting in relatively more standardized shapes, the relative increase or decrease of this technique in an assemblage might give us some indication of the standardization of shaping techniques. In the graph in fig. V.59 we see the share of each technology group in each level. With caution we may conclude that in the Middle Assyrian levels a higher percentage of pottery was thrown from the cone, whereas the relative share of vessels thrown from one lump of clay is lower than in level 7, suggesting that production in levels 6 to 3 was aimed at more standardized shapes. However, we have to keep in mind that the shaping technique is related to the vessel shape: a higher percentage of vessels thrown from the cone also reflects a higher number of small bowls in the assemblage.

Other aspects of shaping techniques related to standardization are for example surface treatment and decoration. The burnishing or decoration of pottery gives the vessel a less uniform appearance and takes more time in production. At Sabi Abyad burnishing was mostly done in level 7, while the other levels each contained a burnished vessel only very rarely. In level 7 9% of all pottery was decorated, while in levels 6 to 3 only 3.6 to 5.4% was decorated. The pottery in levels 6 to 3 looks more standardized.

The control over the firing circumstances is an indication for the skill and professionalism of the potters. They were able to control the firing temperatures and possibly aimed at producing lighter colours, and kiln losses were low. If we look at differences in the firing temperatures between levels in table V.19 we see that, in general, this picture is true for

all levels. In level 7 there are slightly more vessels fired at relatively low temperatures. Levels 6 to 3 show a tendency for medium to high temperatures and a relatively small amount of vessels fired at low temperatures. Control over firing temperatures therefore seems to be stricter in levels 6 to 3.

Level	high	medium	low	Total
7	23 6.7%	289 84.0%	32 9.3%	344 100.0%
6	257 11.2%	1985 86.8%	46 2.0%	2288 100.0%
5	1260 16.6%	6112 80.4%	226 3.0%	7598 100.0%
4	360 17.9%	1595 79.1%	61 3.0%	2016 100.0%
3	48 6.8%	632 90.2%	21 3.0%	701 100.0%
Total	1948 15.0%	10613 82.0%	386 3.0%	12947 100.0%

Table V.19: Comparing firing temperatures between levels.

Diversity in vessel shapes and rim types

When looking at the shape typology (Appendix B), it seems that there is a very large variety of types present at Sabi Abyad. However, a closer look shows that many of these types are only represented once or a few times. The bulk of the pottery from Sabi Abyad consists of a limited number of shapes and types. We have seen in chapter IV how the different types change over time, with some types being more popular in level 7 and some being more characteristic of the Middle Assyrian levels 6 to 3. But what can we say about the diversity of rim types in each level?¹⁵⁷ If we take a look at the number of different rim types per level, it seems that the diversity is largest in level 5, with 65 different types. However, it is also clear that the assemblage sizes are very different, ranging from 214 rims in level 7 to 5367 rims in level 5. Consequently, it is difficult to judge the diversity of types in each level. We will explore two other less intuitive ways of measuring diversity. First, the diversity index Shannon's H and the evenness (E_H) are calculated for each level (see chapter II for an explanation how). These indices take the assemblage size into account, so that H and E_H are comparable between levels. We see that the diversity indices of rim types are fairly close together. Level 7 has the largest diversity, while level 6 has the least diversity. In other words: level 7 has relatively more rim types than level 6. When we look at evenness, it shows that the rim types in level 7 are also more evenly distributed, while the rim types in levels 6 and 5 are less evenly distributed. This means that in levels 6 and 5 a smaller number of rim types forms the majority of cases, while in level 7 each type is represented more equally.

Level	Number of rims	Number of rim types	Diversity index H	Evenness E_H
7	214	36	1.27	0.82
6	1639	52	1.07	0.63
5	5367	65	1.13	0.63
4	1380	53	1.16	0.68
3	560	38	1.12	0.71

Table V.20: The diversity index Shannon's H and equitability index E_H for the rim types within each level.

¹⁵⁷ The following calculations do not take into account any functional differences between the assemblages from each level.

We can also have a look at the “top ten” of rim types per level, listing the percentage of sherds of each rim type (see table V.21). It is clear that the “top ten” differs from level to level, with some types and shapes being more popular in one level than in the other. This is due both to chronological and perhaps also to functional differences between levels (see chapter IV). For our questions about diversity we are now interested most in the cumulative percentages. These show, for example, that in levels 6 and 5 more than 50% of all cases is represented by three rim types only: types 111, 322 and 311. In level 6 type 111 alone is already responsible for more than 40% of all cases. When we put the cumulative percentages in a graph (fig. V.60), it becomes clearer. The steeper the line, the more even the distribution of shapes is and the lower the line starts, the fewer shapes are dominant. There is a marked difference between level 7 on the one hand and levels 6 to 3 on the other.

level rank	7			6			5			4			3		
	Type	%	cum%	Type	%	cum%	Type	%	cum%	Type	%	cum%	Type	%	cum%
1	111	14.9	14.9	111	41.8	41.8	111	33.3	33.3	111	33.2	33.2	111	33.9	33.9
2	122	11.1	26.0	131	7.5	49.3	322	12.6	45.9	322	8.2	41.3	131	8.3	42.2
3	212	9.1	35.1	322	6.9	56.2	311	7.2	53.1	131	7.9	49.3	322	6.5	48.7
4	123	7.7	42.8	311	4.4	60.6	131	6.5	59.5	311	5.8	55.1	611	6.5	55.1
5	125	6.3	49.0	411	3.9	64.5	611	4.3	63.8	221	5.2	60.3	321	5.2	60.3
6	322	6.3	55.3	421	3.2	67.7	421	2.9	66.7	321	4.7	65.0	113	3.6	63.9
7	131	5.3	60.6	221	3.1	70.7	411	2.9	69.5	611	4.6	69.6	221	3.6	67.5
8	132	4.3	64.9	611	2.8	73.6	221	2.6	72.2	222	2.7	72.3	311	3.4	70.9
9	315	3.4	68.3	132	2.3	75.8	141	2.4	74.6	132	2.2	74.2	143	3.1	74.0
10	411	3.4	71.6	222	2.1	78.0	222	2.2	76.8	112	2.0	76.5	141	2.5	76.5

Table V.21: Table showing the rim types and percentages for the first ten most popular rim types per level.

At Tell Sheikh Hamad P. Pfälzner identified the “leichte Knickwandnäpfe” and “leichte Knickwandschalen” (our type 111) and the “eingezogene Flaschen” (our type 322) as being Middle Assyrian “standard” shapes, because these shapes together represented 57.5% of the total number of shapes and because they look very standardized (1995: 245). If we look at Sabi Abyad (table V.21), we can see that in levels 6 to 3 in each level only three types make up 50% of the rims (111, 131 and 322 in levels 6, 4 and 3; 111, 322 and 311 in level 5). Consequently these four types (111, 131, 311 and 322) are characteristic of the Middle Assyrian assemblages.¹⁵⁸ Whether these types were standardized will be discussed below.

These data show that, although in the Middle Assyrian levels there are more rim types present than in level 7, the majority of the corpus is composed of a few rim types only. The diversity of rim types in levels 6 to 3 is lower than in level 7. Furthermore in level 7 each rim type is more equally represented than in the Middle Assyrian levels 6 to 3, where a limited number of shapes predominates. Although differences are small, it can be concluded that in levels 6 to 3 production was oriented more towards a limited “set” of shapes than in level 7. The rim types with which we are concerned here are related primarily to vessel shape, wall shape and general shape and direction of the rim (see chapter II). The classification system of rim types used at Sabi Abyad is not geared towards distinguishing detailed variations in rim shape (cf. for example the detailed classification of “Lippenvarianten” in Pfälzner 1995: 62-70). These minor variations in rim shape are most likely a consequence of variation between potters or between different production events in the same workshop, while trying to reproduce a certain rim type. This means that the diversity measures of rim types at Sabi Abyad do not allow us to conclude much about individual potters or production events. Rather, they suggest that there existed a strong consumer demand for certain specific vessel/rim types in levels 6 to 3, while this demand was less strong in level 7. Obviously this

¹⁵⁸ For the other popular Middle Assyrian types, see table V.20. In levels 6-3 all “top ten” types except three also appear among the unfired vessel fragments and were therefore certainly produced locally. Types 321 and 112, although not found among the unfired fragments, do appear in the “top ten” for these levels and are possibly also locally made. Types 321 and 112 represent minor variations on types 322 and 111, respectively.

demand was related to the presence of the Middle Assyrian *dunnu* administration. Rare types perhaps reached the site from other, less regulated workshops, were coincidental variations, or were produced by the potters as special shapes or for other “markets”. Simultaneously these data may suggest that in level 7 pottery from more different workshops reached the site in larger numbers, perhaps because there was no resident potter at the site.¹⁵⁹

Vessel sizes and size groups

The diversity of types per assemblage does not say anything about the relative standardization of those types themselves. Did the Sabi Abyad potters shape bowls and jars that were only roughly similar to each other, or did they try to exactly reproduce a shape, size or even volume in their vessels? We will now look at the existence of size groups and the relative standardization of vessel types.

When looking at the standardization of a single shape, we have to make sure that there are no size groups hidden in our population (Roux 2003a, Stark 1995). If one type group consists of small bowls and large bowls lumped together, the variability in this group will be big. But looking at the small bowls only, the variability may be small. Size groups have to be made on the basis of the ceramic material. Size groups may already be apparent in the field, so that different vessel type numbers are used for description. Size groups can also be deducted afterwards, by comparing as many measurements as possible. In the case of the Sabi Abyad assemblage, total vessel height and rim diameter as well as the relation between these two measurements, have proved to be most informative.¹⁶⁰ For every shape and rim type in the shape typology (Appendix B) simple visual comparisons of the distribution of rim diameters, vessel height and their mutual relation were performed, making use of different graphs, scatter plots and histograms. In some cases, two similar types were compared to each other. When size groups became apparent, the type was subdivided into different size groups. These size groups were then used as a basis for further calculations on standardization and variability. So there are size groups for carinated bowls (types 111, 112), rounded bowls (type 122), perhaps for pots (type 211, 212, 221, 222) and for jars (small, middle and large jars; types 311, types 321, 322, 323), but not for all types.

¹⁵⁹ This is also reflected in the results of the thin-section analyses for sherds from level 7; see Appendix D.

¹⁶⁰ It is useless to make size groups on a random basis, dividing a shape type into three groups of equal size (as was done in Pfälzner 1995: 25). Size groups are only interesting if they have at least a basis in the material itself, if not in the mind of the potter or consumer.

Rim type	Small	Medium	Large	X-large	No groups
122a	88				
111a	91				
122b		130			
511a		135			
112a		137			
111b		143			
511b			190		
112b			206		
132a			206		
122c			209		
111c			216		
122d				307	
132b				308	
125					245
134					248
113					252
123					273
131					300
Mean	89	136	205	307.5	263

Table V.22: Bowls and strainers, mean rim diameters (mm) organized into size groups.

When looking at table V.22, it becomes clear that amongst the shallow bowls and the strainers there are clear groups around similar mean rim diameters. The size groups seem to vary around core measurements of 89, 136, 205 and 307 mm rim diameter. It is striking to see that each larger size group is exactly 1.5 times larger than the smaller group immediately below.

In the case of deep bowls and pots, size grouping is less clear. Not only was it more difficult and often impossible to distinguish size groups within the rim type groups and did rim types often display a large variety of rim diameters (see Appendix B). The size groups that did appear also showed more variety. Table V.23 summarizes mean rim diameters for deep bowls and pots. The measurements apparent in the bowls do not seem to return here, and the ratio of 1.5 is only apparent in the size difference between middle and extra-large pots. Generally, deep bowls and pots seem to be more variable in rim diameter and it seems that the potter was not aiming for specific groups in rim diameters.¹⁶¹

¹⁶¹ This effect may also be caused by divergences between the shape typology and the “emic” classes of pots used by the potter.

Rim type	Small	Middle	Large	X-large	XX-large
225a	140				
211a		213			
212b		216			
144		227			
222a		228			
141			270		
142			282		
225b			287		
221a			288		
1410			290		
143				327	
231				329	
222b				331	
211b				340	
215				340	
213				347	
212b				357	
226					381
145					405
221b					741
Mean	140	221	283	339	509

Table V.23: Deep bowls and pots, mean rim diameters organized into size groups.

As discussed in the shape typology (Appendix B), size groups in jars were most apparent when comparing vessel heights. Jars can be divided into three groups: small jars (with a vessel height < 250 mm, mean height 173 mm), middle-sized jars (with vessel height between 250 and 500 mm, mean height 376 mm), and large jars (with vessel height > 500 mm, mean height 609 mm). The large jars form the most coherent group, containing rim types 321, 322 and 323, and showing little variety in height (CV for height = 6.1%). The small jars, although consisting mainly of rim type 311, show much more variety in vessel height (CV for height = 22.6%). Below we will look at the standardization of rim diameters for several jar types separately.¹⁶²

Size groups can be made by the potter for different reasons and with different causes. For example, it is possible that the potter was aiming at a set volume. Since it is impossible to measure the volume of a wet, unbaked piece of pottery exactly, the potter has to rely on his experience with known shapes and sizes, and perhaps on his experience with the ratio between vessel height and rim diameter or maximum vessel width in the case of closed shapes. This ratio was studied for all types for which enough complete examples were present, but no apparent relationship appeared. It is unlikely that the volumes of the pottery types were aimed at capacity measures (see below and Chapter VI). Another possible cause for size grouping to appear is related to the potter's use of certain implicit or explicit measuring systems. In the absence of absolute measuring scales, a potter could, for example, use the measurements of his hands (finger width, hand width, hand span from little finger to thumb, etc.; cf. Arnold and Nieves 1992: 99, 100; Underhill 2003: 208). The use of body measurements leads to less variety in an assemblage, but not to as much standardization as when fixed measurement scales were used. If measuring systems were used, we would expect to see a relatively higher degree of standardization than if potters varied loosely around an idea of "small", "middle" and "large". Size groups can also be related to the use of the vessels. For example, the stacking of similarly sized vessels in the kiln or in the storage room

¹⁶² Not enough data is available for a useful comparison of vessel height per rim type.

at home is easier than the stacking of lots of different-sized vessels.¹⁶³ Since deep bowls, pots and jars are not stacked in similar ways, the size grouping was possibly less important here.

The relative standardization of measurements of several shape types was investigated using the rim diameter measurements made in the field. Rim diameters may not have been the main focus of the potter in creating more or less standardized shapes.¹⁶⁴ However, since not all vessels are completely preserved, it is one of the few measurements that is easy to obtain from diagnostic fragments (easier than for example maximum vessel circumference or vessel height), and therefore often used in archaeological studies of standardization (e.g. Stark 1995; Blackman et al. 1993: 71; Arnold and Nieves 1992). As an indicator of the relative standardization of rim diameters, the Coefficient of Variation (CV) has been used (see chapter II for an explanation how). This CV is by now accepted as a useful measuring tool of variation in archaeological assemblages, enabling comparisons between different assemblages irrespective of the value of the mean (Roux 2003a; Underhill 2003; Eerkens and Bettinger 2001).

The raw data (mean rim diameter and CV) for a number of different vessel types from Sabi Abyad are listed in table V.24, showing measurements per level and measurements for the unfired vessel fragments. Since unfired vessel fragments are definitely all from (a few?) production events at Sabi Abyad, they may function as a comparison group to establish how much “cumulative blurring” or “ratio effect” has affected standardization in the assemblages. There were too few rim fragments in this collection to enable comparisons with unfired fragments for each level separately. Also, between square brackets for rim type 111a, the CV values have been added for sherds that come from the pottery workshops in level 6 and 5, respectively. Although we do not know for sure that these sherds stem from one or a few production events only, it is likely that they do stem from the production of these particular workshops. This is especially the case for the bowls from square M11 in level 5, most of which were found among the heaps of damaged bowls and goblets discarded in the workshop (see above).

¹⁶³ The conclusion in Pfälzner (1995: 245-246 and 253, abb. 144 and 160a-c) that Middle Assyrian bowls are better stackable than Mitanni ones is misleading, because for his analysis of “stackability” drawings of the same vessel are duplicated and “stacked”. In reality, however, the bowls never show such an exact similarity as in these figures and stackability is much less, also due to the often careless and slanted shape of the Middle Assyrian bowls (see fig. VI.15 and also Appendix G for these bowls). Moreover, Pfälzner’s conclusion (1997: 338) that from stackability it follows that bowls were used in massive numbers and thus may have been used as ration bowls is disputable.

¹⁶⁴ Although potters in China did focus on standardization of the rim diameter within a batch, more than on other vessel measurements. Their consumers saw a clear sign of the potter’s skill in the uniformity of the batch, and preferred to buy from skilled potters (Underhill 2003: 208).

	7		6		5		4		3		unbaked	
	mrd	CV(%)	mrd	CV(%)	mrd	CV(%)	mrd	CV(%)	mrd	CV(%)	mrd	CV(%)
111a	91	11.0	90	12.0 [11.9]	91	11.0 [10.2]	90	9.2	89	7.8	90	-
111b	138	10.6	141	12.2	141	10.5	144	10.8	147	10.5	148	15.4
111c	246	18.3	218	13.3	217	11.5	210	10.7	209	10.3	212	16.8
131	261	11.9	308	18.3	303	18.6	305	19.7	278	21.5	273	7.9
311a	-	-	85	8.9	87	9.1	88	7.3	83	13.9	-	-
311b	120	-	127	13.1	125	9.1	124	5.6	119	(1.7)	-	-
322	161	10.4	144	13.9	146	10.8	139	12.8	150	12.9	145	14.6
411	87	9.4	88	13.7	89	13.0	90	8.5	90	15.7	60	-
421	78	(3.7)	80	12.8	79	14.4	81	13.6	80	10.8	81	9.9
611	-	-	198	12.8	199	14.6	193	14.2	206	14.8	-	-

Table V.24: Mean rim diameter (mrd) and CV values (in %) for selected rim types per level and for unbaked pottery fragments. Between brackets: these values are not valid because of a very small sample size. Between square brackets: values for sherds from the pottery workshops only.

If we look at these data, the CV values vary between 5.6 and 35.9%. If we look at each shape type separately, a clearer picture emerges. The smallest carinated bowls (type 111a) and the middle and larger carinated bowls (types 111b, 111c)¹⁶⁵ have CV values that are rather close together, varying between 7.8 and 13.3% with 18.3% as an outlier in level 7. In contrast, the straight-sided bowls type 131, for which we could not find any size groups before (Appendix B), show a large variety of sizes with CV values ranging from 11.9 to 21.5%. The CV values in the group of large jars, here represented by type 322¹⁶⁶, also show a very close distribution with values ranging from 10.4 to 13.9%. Small jars show CV values that are lower, indicating a smaller variety of rim diameters than with the large jars. CV values range from 5.6 to 13.9% for type 311 jars. For goblets, CV values range from 8.5 to 15.7% for type 411 goblets and from 10.8 to 14.4% for type 421 goblets. For pot stands type 611, the range is equally narrow, with values between 12.8 and 14.8%. We see that carinated bowls, jars, goblets and pot stands show a relatively high degree of standardization (below ca. 15%, mostly around 10%) as compared to straight-sided bowls (over 20%). But what do these values mean? We can either compare the CV values per type within the ceramic sequence of Sabi Abyad, or compare them to assemblages from other sites.

In the graphs in figs. V.61-63 a comparison of CV values of the different levels at Sabi Abyad is shown per rim type. In graph fig. V.61 it is clear that the CV values of the different carinated bowls (type 111) in levels 6 to 3 are very close to each other: they show a similar degree of standardization. Straight-sided bowls (type 131) however, are less standardized and show higher CV values throughout the sequence. This is remarkable, since we have seen that type 131 bowls feature prominently in the “top ten” of shapes and could be considered a typical Middle Assyrian shape. However, they are apparently not subject to the same ideas about size groups or standardization as the type 111 bowls. The CV values of the carinated bowls seem to become a little lower through levels 6 to 3, perhaps indicating more attention for a standardized size, or indicating that fewer workshops or potters have contributed to the assemblage, or perhaps indicating the shortening time spans of the different assemblages.¹⁶⁷ However, it is unclear whether this small decrease in CV values is statistically significant. Graph fig. V.62, summarizing the CV values for jars, shows a different picture. Here we see that the large jars type 322 are fairly even in relative standardization, with CV

¹⁶⁵ These three types are “standard” Middle Assyrian bowls in Pfälzner 1995.

¹⁶⁶ This type is the “standard” Middle Assyrian jar in Pfälzner 1995.

¹⁶⁷ The occupation of level 5 lasted only about 15 years as opposed to the 30 years or thereabouts of level 6; the longer the time span an assemblage represents, the more variation is to be expected. The duration of levels 4 and 3 is less wellknown.

values that are only a bit higher than those of the carinated bowls. From level 7 to 3 large jars seem to have rather fixed rim diameters, with a slightly larger variation in level 6. Small jars types 311 seem to vary more between levels, and although the variation in rim diameters first decreases sharply towards level 4, in level 3 an increase can be seen again. Graph fig. V.63 shows the relative standardization of goblets and pot stands. Throughout levels 6 to 4 the values are relatively even and slightly decreasing, again with values varying between around 10 and 15%. Levels 7 and 3 both show a more complex picture.

Comparison with data from fired vessels in the workshop contexts shows that the CV values hardly decreased in these contexts. So small bowls type 111a from the level 6 workshop in square O12 show a CV value of 11.9% as opposed to a CV value of 12.0% for the whole level 6 assemblage. Similarly, these bowls from the level 5 east workshop in square M11 have a CV value of 10.2% as opposed to a value of 11.0% in the whole of level 5. This indicates that the variation within the output of a workshop (independent of whether or not these vessels come from one production event) is comparable to the variation of the whole assemblage in a level as a whole. This strengthens the idea that a vast majority of the ceramics found in levels 6 to 4 at Sabi Abyad was produced by a limited number of local workshops.

Comparison with data from the unfired vessel fragments is less straightforward. Calculation of the CV value for type 111a bowls was impossible since all four fragments have the same rim diameter. For type 111b and 111c bowls, however, the CV values (15.4 and 16.8%) are higher than those of the fired ceramics, even if the unfired fragments of type 111b are from square H8 only and may represent a single production event. Possibly the deformation of still plastic unfired bowls has corrupted the measurements. On the other hand, unfired type 131 fragments (mainly from square M11) show a much lower (7.9%) CV value than the fired assemblage, possibly because only bowls of a certain size were produced in the production event from which the waste came. Although unfired vessel fragments seemed to form an ideal baseline for variation in local production, the interpretation of the data appeared to be rather difficult. The small sample sizes complicated the matter as well.

Summarizing, we can see that levels 6 to 4 show a rather homogeneous picture as compared to levels 7 and perhaps 3. Of course, the Middle Assyrian *dunnu* administration would probably put similar demands on pottery production and output in these levels. It is probably also related to the fact that the majority of the pottery found in these levels was produced locally by the *dunnu*'s own workshops, whereas in level 7 (and 3?) pottery was most probably obtained from other sites and therefore from different workshops, as was suggested by the results of the thin-section analyses (Appendix D). Besides, some shapes in levels 6 to 3 show more relative standardization than other shapes, indicating that similarity in size was more important for some shapes than for others. This may be related to (consumer) ideas about size classes (small, medium, large bowls) or to intended vessel function, since these size classes do not seem to be apparent for all bowl types. Also, the lower standardization in type 131 bowls might be related to the differences in production technique (thrown from one lump of clay as opposed to throwing from the cone). For jars, we can question the reliability of rim diameters as a measure of standardization or size. In the case of large jars, the rim may have been produced just so that the opening was large enough to put in a hand, while small enough to close the opening with a jar stopper or piece of cloth, but without fixed ideas about a standard rim diameter. Vessel height and maximum circumference may have been better indicators of size. In this respect, the low CV value for vessel height (6.1%) for large jars is recalled. In the case of small and medium jars, size grouping and standardization seems to be lowest.

But how standardized is a vessel type with a CV value of 11%? Does this value indicate that standardization of size or replication of exact sizes or shapes was the intent of the potter? Or is it the "natural" variation occurring within the production output of an experienced potter not aiming for a specific measurement? J. Eerkens and R. Bettinger (2001) have tried to design a scale that can be used for standardization of artefacts of all times and cultures, by relating the scale to the limits and properties of human psychology and psychophysics. They

concluded that, when skilled people attempt to reproduce an exact copy of an artefact without moulds or measurement scales, and they are allowed to discard those attempts that were perceived as being not exact enough, there is a minimum variation of 1.7% (CV) irrespective of the artefact's size. This is because of limitations in the interpretation and comparison of visual information in the human brain. On the other hand, completely random production would in theory (mathematically) show a CV of 57.7%. In the real world, however, artisans never produce objects with a variation this large, and the actual variation of "random" sizes would be much smaller. These values can be used as baselines.

Data from ethnoarchaeological studies show that CV values are generally lower than CV values obtained from archaeological assemblages (tables V.25 and 26). This may be due mainly to the "cumulative blurring" effect, pooling data from different potters or from a long time period together, thus increasing the variation in the data set (Blackman et al. 1993). Ethnoarchaeological data often use measurements from one production event or from one potter only, and from complete vessels only, a situation hardly encountered in archaeology where we have to deal with an unknown amount of production events and potters, and where we have to rely on diameter chart measurements. Besides, archaeologists have to devise a classification themselves, while ethnoarchaeologists can ask the potter which vessels belong to one group.

When it is known that potters aim for a standardized shape or exact replicas of shapes and sizes, the CV value in ethno-archaeological cases is generally low, up to around 5% (table V.25, e.g. Spanish and San Nicolas data, Chinese data). Pots that are not explicitly standardized but are meant to form a size class, show CV values between ca. 5 and 10%. Of course, these data come from varying production contexts, and vessel sizes and standardization will have been influenced by as many different factors. However, some general idea may be obtained, without taking these numbers as absolute limits. Moreover, these data are in general alignment with the findings of Eerkens and Bettinger discussed above.

<i>Ceramic group</i>	CV (%)
Andhra Pradesh (India) cooking vessels produced by low-rate producing specialists made in one production event by 6 potters, not aimed at strictly standardized vessels, demand for volume depending on family size.	6.24
Uttam Nagar (India) small water jars produced by high-rate producing specialists in urban pottery workshops, made in one production event by 6 potters. Small jars form a size class, but it is unclear whether standardized size is aimed at.	4.85
Spanish pitchers produced by a full-time urban high-rate producing specialist aiming at standardized products, made over the course of two days by one potter.	2.5
Kalinga (Philippines, Dangtalan) pots made in household production and for household use, from ca. 7 years, all pots from one volume class.	7.47
Kalinga (Philippines, Dalupa) pots made by part-time specialists made for distribution, from one year, all pots from one volume class.	4.99
Paradijon (Philippines) pots made by full-time specialists for shops, from two years, all pots from one volume class..	4.53
Ticul (Mexico) bowls produced for the internal market by one specialist producer household over 6 months, vessels are not measured during production.	10.8
Ticul (Mexico) pots produced for external markets through middlemen by one specialist producer household over 6 months, vessels are measured with hand spans and fingers but rims are ruffled making diameters more variable.	12.3
San Nicolas (Philippines) water jars from one production event by four potters, aiming at standardized sizes and volumes due to customer demand, but relying on skill and not using measuring tools.	4.6 (2.4-7.5)
Guizhou (China), rim diameters of <i>wan</i> bowls produced by 6 specialized household potters in two areas for commercial distribution, over a period of three years. Potters aiming at standardized rim diameters because of consumer demand and because of easier stacking in the kiln, using their hands for a quick measurement.	3.3

Table V.25: Comparing some CV scores for rim diameter measurements on vessels from different ethno-archaeological contexts. Most measurements stem from single (or a few) production events or from single (or a few) potters (based on Roux 2003a: tables 4, 6 and 7; Kvamme et al. 1996: table 4; Arnold and Nieves 1992, based on table 4.2; Longacre 1999: table 4.5; Underhill 2003: table VI).

Data from archaeological studies are informative as well. At the site of Ayia Irini in the Aegean, potters explicitly seemed to aim at exact copies of Minoan conical cups. The CV value is correspondingly low at around 3% (table V.26). At Tell Leilan the unique find of a stack of kiln wasters offered the opportunity to study the output of one production event for one type of vessel. The CV of the rim diameters in the stack is around 9%, leading Blackman et al. to conclude that this indicates specialized mass production of standardized shapes (1993: 72-73). However, similar bowls from the whole assemblage show a much higher CV of around 16% due to the cumulative effect of ca. 200 years of production. Roux (2003a: 780), on the contrary, thinks that the CV value of 9% for the Leilan waster stack indicates a rather low degree of standardization compared to ethnoarchaeological data. In fourth millennium BC Abu Salabikh, data on perhaps the best known “mass-produced, highly standardized” shapes (bevelled-rim bowls, BRB) yields a comparatively high CV of almost 15%, although it is the lowest CV value within the Abu Salabikh corpus. Although the BRBs seem to be more standardized than the rest of the corpus, Coursey (1997: 110-118, 174) concludes that it is unlikely that standard volume sizes were aimed for, and she concludes that the apparent relative standardization is “probably more a factor of coherence to an accepted size and shape defined by the local [...] tradition than [related] to mass-production [...]”.

Comparison of the relative standardization of the Sabi Abyad vessels with other archaeological and ethno-archaeological assemblages does not, and cannot, lead to definite conclusions concerning standardization. There are simply too many factors influencing standardization involved in each case. However, we could tentatively suggest that although size classes and generally accepted ideas about vessel shape and size seem to be present in

several Middle Assyrian shapes, the potters did not seem to aim for completely standardized vessel measurements and/or did not make use of an external measuring system.

<i>Ceramic group</i>	CV (%)
Late Cycladic II (Late Bronze Age) conical cups from Ayia Irini, intentionally copying Minoan shapes.	2.97
Al Basra islamic pottery produced in independent urban workshops.	3-10
Roman cooking vessels from Libya made in large, state-run workshops.	6-7
Tell Leilan 3 rd millenium fine-ware bowls rim diameter in waster stack, single workshop output.	9.19
Tell Leilan 3 rd millenium fine-ware bowls rim diameter, output of multiple independent workshops (over 200 years).	15.68
Middle Uruk bevelled-rim bowls (rims) from Abu Salabikh.	14.56
Inka pottery produced by part-time corvée labourers in Inka state service.	29.46

Table V.26: Comparing some CV scores for measurements on vessels from different archaeological contexts (based on Berg 2004: table 1; Benco 1988; Stein and Blackman 1993: table 3; Coursey 1997: table 4.6; Costin and Hagstrum 1995: table 4).

Capacity

The capacities of vessels were calculated for a large number of completely preserved shapes. The calculations took place on the basis of the drawings, as described in Chapter II. The capacity of each calculated vessel is mentioned in the descriptions with fig. IV.1-120. In Chapter VI and Appendix G the capacities of different shape and size groups are discussed. There it becomes clear that the variation in capacity is much larger than the variation in rim diameter or vessel height. This suggests that there was no standardization of capacity for any of these shape groups (except, perhaps, for the so-called “grain measures” type 225). See Chapter VI for a more detailed discussion of capacity and of Assyrian capacity measures.

Variability and standardization: conclusions

Summarizing, we can draw the following conclusions on variability and standardization within the corpus of Sabi Abyad and from a comparison between the different levels. In levels 6 to 3 the diversity of used raw materials seems to be slightly lower than in level 7, but the database is not suited for further analysis. The potters were in good control of their paste preparation, but prepared different wares only for some functionally and technologically different vessel groups. The homogeneity of used wares in the Middle Assyrian pottery is therefore also related to the small amount of functionally very different pottery vessels, like cooking pots and “luxury wares”, and to the general “daily, utilitarian” nature of the majority of the vessels (see also chapter VI). With due caution we might conclude that in the Middle Assyrian levels more vessels are made by “throwing from the cone” than in level 7, suggesting that efficient and quick production was favoured in these times. Moreover, the pottery from levels 6 to 3 shows less decoration and less elaboration of the vessels during production, giving the pottery a plainer and more homogeneous look. In levels 6 to 3 there seems to have been a stricter control over firing temperatures, which may again be related to the lower number of (very skilled) producers in relation to the size of the assemblage. When looking at vessel shapes, it appeared that the assemblages in levels 6 to 3 consisted of a lower diversity in rim types, and also that a smaller amount of rim types dominated the assemblage when compared to level 7. This may be related to the Middle Assyrian consumer demand (for only a particular “set” of vessels consisting of a few characteristic shapes) as well as, again, to a more limited number of workshops contributing to the assemblage in these levels. For some bowls and for small and large jars, ideas about size groups seem to have existed, but for other bowl types, pots and other jar types, size groups were apparently not really an issue. Shapes that were made in size groups show a higher standardization in measurements than other shapes. Size groups seem to be focussed on a set of measurements of 89, 136, 205 and 307

mm for bowls, but it is unlikely that a measuring system was used during production or that explicit standardization of size was aimed at. Rather, the size groups seem to be related to more general ideas about “small”, “middle” and “large” bowls. The “cumulative-blurring” effect of the time duration of an assemblage seems to have had some effect on the standardization at Sabi Abyad.

So the data about standardization and variability seem to corroborate the picture that was already emerging. Compared to level 7, levels 6 to 3 show an assemblage of which the variability was most probably mainly related to aspects of the consumer demand and character of the consumer group on the one hand, and the small number of producers as opposed to consumers on the other hand. However, although the pottery generally *looks* “standardized” or shows little variety, potters probably did not aim at producing exactly standardized sizes or shapes.

V.8 The distribution of the products

Questions on the distribution of the products deal with the consumption and demand side of the production organization. Although it is an important aspect of studies of production organization (cf. Pool 1992: 275), I will only be able to give some general comments on the topic in this study. On the one hand, this is because solid conclusions about the consumption of pottery at the site of Sabi Abyad can only be drawn after a detailed stratigraphical and spatial analysis of the site has been carried out, taking all the contextual and depositional aspects into account. On the other hand, little is known about the distribution of pottery made in Sabi Abyad to other sites in and outside the region. This paragraph will try to summarize what can be suggested about consumption on the basis of the information collected in this thesis, and to propose further lines of study.

First of all, it must be remarked that almost all the ceramics presented in this study come from consumer contexts, not from production contexts. Some of the ceramic vessels found in the workshops in level 6 and level 5 East (especially the kiln waster goblets and bowls in square M11), kiln wasters, unfired pottery and perhaps sherds found in and around kilns are part of the production context. However, other vessels in the workshops,¹⁶⁸ and most if not all ceramics elsewhere at the site, are part of the consumption context. In this chapter, I have therefore tried to reach conclusions on production organization by studying material that was mostly derived from a consumption context (cf. Pool 1992: 280-282).

We will look at the distribution of the vessels produced in the Sabi Abyad workshops to “circles” of increasing size, starting with the *dunnu* itself. It goes without saying that pottery was produced in the first place for the people living at the *dunnu*. It is expected that the potters would have produced vessels with special functions for example for the baker or the brewer, next to the normal domestic vessels everyone needed. Some occasional special shapes would be produced as well. In chapter VI, we will look in more detail at the function and use of the vessels. At the moment there is little information available about the use of different vessels in different areas or buildings at the site. A detailed spatial analyses could shed light on whether the administrative staff used or needed different vessels than the craftspeople living and working at the site, and on how many vessels each household used. In this study it was not possible to discern between two or more different “traditions” of ceramics, for example a luxury kind and a common kind. It seems that staff and workers at the *dunnu* all used the same kind of vessels, perhaps apart from those they needed for their craft (e.g. brewing, cooking). Although the demand of this group of consumers would have largely determined the kind and quality of the vessels the potters produced, we have seen above that it is unlikely that the administration exercised a lot of control over exact shapes,

¹⁶⁸ Unless spatial analyses would identify these as the storage or stock of the workshop.

used techniques or resources. But although the products of the workshops, the used techniques and materials and the variability of the products mostly resemble “independent” production organizations (cf. Costin 1991), it is reasonable to assume that the potters were completely dependent on the administration at least for their rations.

As was argued above it is very likely that the output of the workshops was larger than the demand of the *dunnu* inhabitants only. Most probably, pottery was produced for the hundreds of dependents of the *dunnu* as well. In his informative article discussing agriculture in the Balikh and at Sabi Abyad in Middle Assyrian times, F. Wiggermann used textual evidence to estimate a catchment area of the *dunnu*. In this area, measuring about 36 km² around the site (within a radius of approximately 3.5 km from the site), the *dunnu* had its fields and dependents were living in small villages and farms. The sites of Khirbet esh-Shenef and Tell Hammam et-Turkman fall within this catchment area and could have been (small) subcentres, while the existence of four more subcentres is suggested but not proven by survey material (Wiggermann 2000; in the whole Balikh Valley only six sites and six small possible sites dating to the Middle Assyrian period have been identified in surveys; see Lyon 2000: 100). We know very little about the extent to which the local, non-Assyrian (Šubarean) villages around Sabi Abyad also had their own pottery workshops producing vessels in their own, different tradition (Wiggermann 2000: 192; Lyon 2000: 94). This would archaeologically be very difficult to recognize from survey material. First, since potting is a very conservative trade, a local tradition of people resident in the area before the Assyrians came would possibly build on past practices regarding shape, decoration, and so on. Thus their pottery would perhaps be similar to the ceramics of the time when the region was under Mitanni rule, and in a survey it would be dated to the Mitanni period. Secondly, whereas the Middle Assyrian products are easily recognizable in survey material, it could be possible that a local produce different from the Assyrian one is not so easily recognized and therefore not dated to the same period. A detailed re-evaluation of ceramic material both from the Balikh survey (carried out by P.M.M.G. Akkermans in 1983 and by T.J. Wilkinson in 1993, 1994 and 1995, see also Curvers 1991) and from the excavations at Khirbet esh-Shenef (Bartl 1990) and Tell Hammam et-Turkman (Van Loon 1988, Smit 1988) would shed more light on the Middle Assyrian pottery corpus at the sites in Sabi Abyad’s catchment area. One of the most interesting questions would be if there is a distinction between the assemblages found at these sites and the assemblage at the *dunnu*; in other words, whether there is evidence for an “official” tradition of pottery and a “common” one (cf. Pfälzner 1995, 1997), or an “Assyrian” and a “local” tradition.¹⁶⁹ If dependents of the *dunnu* indeed obtained most of their pottery from the workshops at Sabi Abyad, one would expect the pottery at the smaller subcentres to be similar to that found at the *dunnu*. Such a re-evaluation was partly undertaken in the work of J.D. Lyon (2000) but needs more detailed study. It is as yet unclear whether distribution to the dependents followed “market” principles, or whether pottery vessels were part of the remuneration of the administration.

It is hardly likely that Sabi Abyad was the only Middle Assyrian site in the province of Hanigalbat where pottery was produced. More likely, most *dunnus* and certainly every town had its own resident potters, like Sabi Abyad. In any case, especially near the rivers and wadis, the resources for pottery production were available everywhere. There were several other *dunnus* and numerous other Middle Assyrian sites in the Balikh Valley, identified both from surveys and from texts (see Chapter I). The surveys carried out in the Balikh Valley (see Chapter I) did not yield any direct evidence for pottery production in Middle Assyrian times at any of the other identified sites. However, such evidence is very rarely found in surveys in general and the evidence at Sabi Abyad has shown that the absence of wasters, kiln fragments

¹⁶⁹ Since the sites in the catchment area of Sabi Abyad are so close to each other, the areas from which raw materials would have been taken overlap, and archaeometric analyses of the clay composition can therefore not be used to differentiate the products from the settlements around Sabi Abyad from those made at the site (Rands 1988: 167).

or the like in survey material is not surprising. A Middle Assyrian text (TCh 95.G.185:5) from Tell Chuera, to the east of Sabi Abyad, mentions a ration of two days for a potter, suggesting that pottery was produced locally at the site, but it is possible that this potter was working at Chuera on a special order and did not reside there (Jakob 2003: 475). Cuneiform text T93-3 (see above and Appendix F) shows that the potter of Sabi Abyad could be sent to other places when the need arose. This is reminiscent of the “redistributive” use of specialized craftsmen by the state as described by Zaccagnini (1983: 247-249) for the Mari archives, and continuing until the end of the first millennium BC (*idem*, 259). However, the texts from Sabi Abyad and other sites show that Dunnu-Aššur and Sabi Abyad stood under the authority of different families. Both are private agricultural estates, with their own responsibilities and their own employees. Still, on occasion the Sabi Abyad potter seems to have provided Dunnu-Aššur with the ceramics needed, therefore taking care of the production for another Assyrian state settlement in the region. Apparently Mudammeq-Aššur was not able or not willing to acquire pottery from other sources such as a local (non-Assyrian?) potter or market, but rather asked for the potter under Sabi Abyad’s authority. Whether Dunnu-Aššur itself never had a resident potter (as suggested by Jakob 2003: 475) or whether this situation was exceptional is not clear. The analyses of the Middle Assyrian pottery from Sheikh Hamad in the Khabur and Tell Umm Aqrebe in the eastern steppe on the route to Aššur showed that the pottery at these sites was produced locally and therefore that each had its own pottery production (Pfälzner 1995: 248). Chemical and thin-section analyses of Middle Assyrian ceramics from Tell Chuera, ancient Kharbe, located between the Khabur and Balikh valleys, will demonstrate whether this is true for Chuera as well (Boesze in prep., personal communication). However, chemical and thin-section analyses will not show whether the potter himself travelled to other sites and then produced pottery at that site with local resources. If Middle Assyrian potters who fell under the authority of an official administration did actually travel to other sites to produce pottery locally, this may partly explain the typological homogeneity of Middle Assyrian pottery in the area from Sabi Abyad in the west to Kar-Tukulti-Ninurta in the east (described in Pfälzner 1995: 227). Not only would pottery at many sites be produced by a limited number of potters only, therefore increasing formal similarities between sites, potters would also be in closer contact with each other, exchanging information and experiences with techniques and local materials.

It is unlikely that the pottery produced at Sabi Abyad reached sites further away in any significant numbers. Transport of vessels over long distances usually occurs only if they are used as packaging material in the transport or trade of other commodities, or if the pottery produced had special qualities. Specific characteristics of only locally occurring resources (as in the case of, for example, Neolithic Dark Faced Burnished Ware, certain types of cooking pots, Chinese porcelain, etc.) may create a demand for vessels produced in other regions, as well as particular shaping or finishing techniques not mastered elsewhere. However, in the case of Sabi Abyad, we see that the resources used by the potters are very similar all over northern Mesopotamia, and that they did not produce technically or functionally exceptional wares or shapes.

V.9 Conclusions: the organization of pottery production at Tell Sabi Abyad

In this chapter, I have tried to study all aspects of production organization and combine all available data on the pottery and its production, in order to draw a picture of the organization of pottery production at Tell Sabi Abyad. Of course, as is often the case in archaeology, definite conclusions on any of these aspects are difficult to draw, and in many instances our reconstruction of pottery production organization is built on suggestions and possibilities at best. However, by combining all aspects and trying to take into account all different variables as much as possible, we can at least choose the most likely story, the one that fits the material and the larger picture of society in Middle Assyrian times best. As always, this story will be

subject to changes, adaptations and further detailing when more work is done on the other finds from Sabi Abyad, from other contemporary sites, on Middle Assyrian texts, and on pottery production in archaeology and ethnoarchaeology.

A short summary of the conclusions in this chapter yields the following picture. The organization of pottery production at Middle Assyrian Sabi Abyad seems to have been of a professional but unassuming and practical nature. The picture that emerges from the data presented in this chapter is one of one or two professional, skilful and efficient potters and several assistants (women, boys, members of his family?) producing the daily utilitarian pottery at the *dunnu* for the *dunnu* staff and their dependents, and occasionally at other *dunnus* as well. They had a good knowledge of their resources, how they needed to prepare them and what the problems in shaping and firing would be, but they balanced the time and effort needed to overcome these problems against the small advantages of a perfect product. Since the resources at other *dunnus* were similar to the ones at Sabi Abyad, it was easy for them to travel elsewhere and produce pots locally. They used efficient shaping techniques and professional tools and kilns, and were most probably involved full time in pottery production. It is likely that the local administration paid them for their work in rations or perhaps also with a sustenance field. Although they were in this way part of the Middle Assyrian state organization, they do not seem to have had a very large role in it, and probably did not have a very high status. The administration was apparently not deeply involved in how the potter acquired his resources or his assistants, and they apparently did not exercise much control over the work of the potter. The products the potters made are rather uniform and comprise a rather limited set of shapes. For some shapes they made pots in different size groups, but the exact size or capacity was not important. The production of a limited range of shapes may have facilitated the coordination between the administration and the potter: everyone knew what to expect if for example a quantity of “drinking cups” was ordered. It is not known whether the potter received rations based on the number of pots he produced or based on the amount of days he was working. Although the potter was therefore part of the Middle Assyrian administrative system, he does not seem to have been an “attached” specialist. Rather, the picture that emerges is that of a relatively independent potter working in an individual workshop organization, but commissioned by and under the protection and authority of the Middle Assyrian *dunnu* administration. This would compare most closely to an “estate” or “state” individual workshop organization, or to individuals performing their corvée (*ilku*) obligations. Although the potters in Middle Assyrian times seem to continue their work technically largely in the old traditions pre-eminent in Mitanni days, the difference with earlier production seems to lie mainly in the decrease of variability in the products and the decrease of time spent on decoration and special shapes. This is most probably related to the changed consumer demands and production organization under the Middle Assyrian management of the provinces. Perhaps fewer potters now had to produce more vessels, while there was less need to produce special or especially nice vessels since there was no competition on a free market.