The dni-Measure in Ancient Egyptian Tomb Construction Projects

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Abstract

When constructing the rock-cut tombs in the Theban necropolis, the ancient Egyptian builders kept track of the progress by recording the amount of rock that was excavated. This is evident from hieratic ostraca dating to the early part of the Eighteenth Dynasty, in particular from the tomb chapel of Senenmut, TT 71. Found within and below the courtyard of this tomb and published in 1942 by William C. Hayes, these ostraca (hereafter referred to as the Senenmut ostraca) primarily record and describe the excavation, cutting and shaping of rock prior to any stages of painted decoration. Several of the different tomb building tasks referred to in the texts are linked by having their daily results recorded by the same unit of measurement, namely the dni, which has been firmly established by J. Černý as a measure for capacity equal to one cubic cubit. At the same time, Černý suggested that the dni was simply a basket, dnyt, which became a standard measure for stone chips.

The current article reconfirms Černý’s observations as to the size of the dni and its usage as a measure exclusively for capacity, particularly in building projects involving excavation. It will also be suggested that the dni-measure was already in practical use during the Middle Kingdom at Thebes, and that it possibly has been found archaeologically as baskets filled with stone flakes at Deir el-Bahri. In addition, the article will outline the significance of the reconfirmation of the dni being a measure of capacity in regard to the understanding of the tomb construction terminology used in the Senenmut ostraca, in particular the šd and the dqr.

Keywords

Tomb construction, ostraca, Theban private tombs, construction terminology, New Kingdom, dni-baskets, Senenmut, measurements

1 W. C. Hayes, Ostraka and Name Stones. From the tomb of Sen-Mut (No. 71) at Thebes (PMMA 15; New York, 1942).
2 The article is based on part of my PhD dissertation, R. Olsen, Socioeconomic aspects of ancient Egyptian private tomb construction. A study on New Kingdom tomb volumetrics as economic markers (PhD thesis, University of Copenhagen; Copenhagen, 2018), that analysed the terminology and measurements used by the ancient Egyptian builders during the construction phase of TT 71.
3 J. Černý, The Valley of the Kings (BdE 61; Cairo, 1973), 20–1.
and the dkr. The consequence is first and foremost to acknowledge that the builders of the tomb of Senenmut only recorded the progress of excavation and not decoration. Furthermore, because the same focus on excavation progress is found in and supported by other textual sources from the Theban necropolis, this approach seems to have been the normal way in which a rock-cut tomb at a practical level was managed during its construction.

Transliterations of dni

There are several translations for and interpretations of the word dni, which additionally occurs in numerous texts that have nothing to do with the excavation of tombs. Traditionally, dni has been associated with ‘dam’ or ‘dike’. For example, when analysing an ostracon from the Osireion of Seti I in Abydos, B. Gunn translates two instances of dni occurring in the same line as both ‘dike-making’ and as ‘dike’ (the latter instance specified as pt dni). The same passage is translated by K. Kitchen as ‘dyke (-making)’ and ‘canal’.

In the Hymns to King Senusret III (P. UC 32157, 2,12) dni is used as a verb with the meaning of ‘stop’, ‘restrain’, or ‘dam up’: ‘Truly, he is the dam (or bulwark) that stops (or restrains) the river (sw ? pw dni itrw). In a tomb construction setting, such a meaning could, perhaps, be used in relation to the building of retaining walls above the façade of the private Theban tombs or on either side of the characteristic open courtyards. However, neither dam nor canal or other related words seem to be applicable for the Senenmut ostraca. Here the term dni is mentioned a total of ten times in six different documents, and in every instance relates to work that has been done inside the tomb. The term is mentioned in the text alongside a numerical value that signifies a daily production result and it has in this context previously been translated as ‘section’ or ‘area’. Certainly for Hayes it signified a measure of a two-dimensional area of a surface. However, this interpretation is never substantiated or specified in any of the Senenmut ostraca. It seems that Hayes translated dni as ‘sections’ or ‘area’ because of his understanding and translation of the three construction terms sdr, sdr and dkr, which he interpreted as having to do with working, plastering and decorating wall space.

W. Helck refers to a special kind of dni-basket which was explicitly said to have been woven from reed grass and other similar materials. Similarly, but focusing mainly on the price of various objects, J. Janssen described the dni(t) on the one hand as a basket, but on the other hand accepts Hayes’ definition of dni being a measure, in particular for work done on a ‘section’ or ‘area’ of a wall. In analysing O. Ashmolean Museum 183 (O. Gardiner 183), Janssen cautiously attempts to set a price on labour cost for work done in decorating an unspecified tomb based on a number of dni mentioned. The ostracon does mention deben prices for work on a coffin and has an incomplete mention of a tomb (l’dft) on the recto, but the two mentions of dni on the verso do not appear to have a conclusive connection to the work on the coffin or the possible work in the tomb.

Textual Sources

Černý refuted the translation of the dni as ‘area’ by drawing attention to O. Gardiner 51 (O. Ashmolean Museum 57) and O. Gardiner 26 (O. Ashmolean Museum 26). The latter

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4 dni is translated similarly by the following: A. H. Gardiner, Egyptian Grammar (3rd rev. edn; Oxford, 1957), 602; ‘to dam off, restrain – dnt = dam (n.)’; R. Faulkner, A Concise Dictionary of Middle Egyptian (Oxford, 1962), 314; ‘to dam, construct, restrain, hold back, retvet’; A. Erman and H. Grapow, Wörterbuch der Aegyptischen Sprache, V (Berlin, 1971), 464: ‘ab dümmen, befestigen, zurückhalten’; L. Lesko, A Dictionary of Late Egyptian (Berkeley, 1989), 135: ‘to dam, to dyke, to block up, to be checked, stopped’.

5 O. BM EA66302, l. 7: ıty ın m dni ın pt dni.

6 B. Gunn, ‘The graffiti and ostraka’, in H. A. Frankfort (ed.), The Canopeum of Seti I at Abydos (London, 1933), 92–3. There are similar examples of pt dni in P. Wilbour which suggest that it refers to a specific part of the villages described or their immediate surroundings; cf. A. H. Gardiner and R. Faulkner, The Wilbour Papyrus, 4 (Oxford, 1952), 92. This in turn suggests that the temple of Seti I at Abydos had a similar feature in close proximity; this is specifically described as a feature ‘which is upon the southern (side) of the temple Memmaatre, LPH., is beneficial to Osiris (nty hr rsy sh mn-mt-t-r-… ndy weš snb n wsrn’).

7 K. A. Kitchen, Ramesside Inscriptions, Translated and Annotated: Translations I (Oxford, 1993), 107.

8 M. Collier and S. Quirke, The UCL Lahum Papyri: Religious, Literary, Legal, Mathematical and Medical (BAR IS 1209; London, 2004), 16–19.

9 The word occurs in the following Senenmut ostraca, each with its own small variation in orthography: O. 63 recto l. 4 (C) and l. 5 (C), O. 64 recto l. 3 (now lost), O. 65 l. 2–3 (C) and l. 5 (C), O. 66 l. 18 (C) and l. 9 (C), O. 67 l. 4 (C), and O. 69 l. 3 (C) and l. 3–4 (C).

10 Hayes, Ostraka and Name Stones, 40–1.

11 Hayes’ suggested interpretation of the dni does come with some caution. First, that there was ‘some uncertainty to the meaning of this key word’, and second, that the dni was distinct from the linear measures of the ndt-rod and the cubit (Ostraka and Name Stones, 40). Unfortunately, these caveats have at times been overlooked, leading to interpretations and translations that cannot be substantiated in the surviving textual material. See, for example, B. Bryan, ‘The ABCs of Painting in Mid-Eighteenth Dynasty Terminology and Social Meaning’, in R. K. Ritner (ed.), Essays for the Library of Seshat: Studies Presented to Janet H. Johnson on the Occasion of Her 70th Birthday (SAOC 70; Chicago, 2017), 9 n. 23.

12 Hayes, Ostraka and Name Stones, 31, 39–41.

13 W. Helck, Materialen zur Wirtschaftsgeschichte des Neuen Reiches, Teil V (Mainz, 1964), 918–19.

14 J. Janssen, Commodity Prices from the Ramessid Period. An Economic Study of the Village of Necropolis Workmen at Thebes (Leiden, 1975), 140–3.

15 Unpublished, Černý Notebook 45.85 and 107.16.

16 Janssen, Commodity Prices from the Ramessid Period, 143.

17 See also K. M. Cooney, The Value of Private Funerary Art in Ramessid Period Egypt (PhD thesis, Johns Hopkins University; Baltimore, 2002), 125–7, who argues along the same lines as Janssen.

18 Černý, The Valley of the Kings, 20–1.
text contains a line (l. 5), which reads: ‘6 cubits by 2 cubits
(by) 4 cubits (in) depth, making 48 dni (mh 6 r mh 2 ngwt
mh 4 iri n dni 48)’, clearly demonstrating the three-
dimensional aspect of the dni-measure. From the two texts, Černý concluded that the dni must be equal to a measure of
capacity of 1 cubic cubit, most probably a basket, and stated that
‘it is natural that the cubit should be not only a unit of
length but also the basis of capacity’. Thus following
Černý and the reading of O. Ashmolean Museum 26, R.
Hannig defines the dni as a ‘Kubikelle’. 21 In his PhD thesis
on the ancient Egyptian cubit, A. Hirsch came to the same
conclusion as Černý and defined the dni as a cubic cubit
and, as a major part of his argument, linking it to the royal
system of measurements, i.e. to the cubit. 22 In preparing a
publication of a number of ostraca from Deir el-Bahri, M.
Römer also interprets the dni as a measurement, possibly
a container and very likely a basket for determining a volume
of stone. 23

In addition to O. Ashmolean Museum 26, the following
papyri from the Twentieth Dynasty demonstrate that when
referring to the dni, the Egyptians were in fact using a
measure for capacity. This capacity or volume consisted of three
different measurements of cubit-lengths that when multi-
plied together resulted in a number that was preceded by the
dni as a unit. The verso of P. Turin 1923 is a survey of the
already constructed hallways in the tomb of Ramesses V
and VI (KV 9), as well as calculations for future productiv-
ity in excavation that was needed in order to complete the
remaining elements of the tomb. 24 Line 8 reads: ‘(a hallway)
which is after it: (length) of 15 cubits, width of 6 cubits,
height of 7 cubits, making 630 (dni)25 (nty hr ss-f n mh
15 wsh n mh 6 lvt n mh 7 iri n 630)’. A similar phrasing
is found on P. Turin CGT 55002, 26 which on both
sides depict a plan of KV 2 (Ramesses IV) annotated with
hieratic writing and dimensions. The recto, which por-
trays an initial plan of the tomb, 27 contains the following
phrase: ‘The noble treasury: (length of) 6 (cubits), width of
6 cubits, height of 5 cubits, (making) 216 dni (r-hd špsy n
mh (?)) 6 wsh n mh 6 lvt n mh 5 dni 216’. 28 The scribe of
the latter phrase’s inability to correctly calculate the result
notwithstanding, the sequence of the cubit measurements in
the two examples illustrate the fact that the Egyptians
thought of the dni as having three dimensions. The same

sequence of dimensions in cubits can be found several times
in P. Turin Cat. 1885 29 and a single occurrence in P. Cairo JE
52002, 30 although without any mentions of the dni-unit in
either document. Nevertheless, based on the context of the
texts and on the examples given here, we may with some
confidence assume that the dni was implicit.

In a similar way, the results of two pieces of work are
recorded on O. Senenmut 76 without mentioning the dni,
but very clearly referring to volumes: ‘The work of Kay:
the [...] width 2 cubits, depth 2 cubits [...] by 7 cubits.
The other activity (…) 5 cubits, depth 4 cubits, by 7 cubits
(ps bskw n kly t […] wsh mh 2 ngwt mh 2 […] r mh 7 ps
ky r-r[… wsh] mh 5 ngwt mh 4 r mh 7)’. 31 This way of
recording is, however, uncommon for the Senenmut corpus
and the results of work are usually denoted by the dni-unit
followed by a number. A close parallel to this way of
recording is found in a similar, albeit smaller, unpublished
ostraca corpus from TT 29. 32 These texts document the
construction of TT 95, which is situated just above and to
the west of TT 29 on the Sheikh Abd el-Qurna hill. TT 95,
which is currently being excavated and studied by the
University of Basel (directed by A. Loprieno-Gnirs),
belonged to the High Priest of Amun, Mery, from the time of
Amenhotep II. Where the term dni occurs in the TT 29
ostraca, 33 it records the work of either stonemasons (ḥnty or
men carrying rubble (ḥmr), most often compiling the num-
bers into monthly results. Noticeably, all the dni amounts
recorded in the TT 29 corpus are ‘neat’ numbers (e.g. 15,
20, 30, and 45) and it is therefore possible that the records
show not the achieved work but instead the intended work,
i.e. budgeted work quotas. This tenuous interpretation
would, however, depend greatly on the actual moment of
writing, which is difficult to ascertain. What this corpus
clearly demonstrates, however, is the fact that the work
output was recorded in the dni-measure, which, due to the
lack of any other terminology, suggests that the records
concern the measuring of stone work and indeed the
removal of stone (ḥmr). 34

21 R. Hannig, *Großes Handwörterbuch Ägyptisch - Deutsch* (4th
rev. edn; Mainz am Rhein, 2006), 1054.
22 A. P. Hirsch, *Ancient Egyptian Cubits – Origin and Evolution,*
(PhD thesis, University of Toronto; Toronto, 2013), 119.
23 M. Römer, personal communication, 19.10.2016.
24 R. Ventura, ‘The Largest Project for a Royal Tomb in the Valley
of the Kings’, *JE A* 74 (1988), 137–56.
25 The unit is omitted in this line, but it is used in line 6 in summing
up the volumes, and it is clear from the context that this is what
is meant in line 8. The unit occurs a total of nine times on the papyrus.
26 S. Demichelis, ‘Le projet initial de la tombe de Ramses IV?’,
*ZÄS* 131 (2004), 114–33.
27 Demichelis, *ZÄS* 131, 132–3.
28 Demichelis, *ZÄS* 131, 118–19, table XIII.

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29 A. H. Gardiner and H. Carter, ‘The Tomb of Ramesses IV and
the Turin Plan of a Royal Tomb’ , *JEA* 4 (1917), 130–58. See also
W. Pleyte and F. Rossi, *Papyrus di Turin* (Leiden, 1869–76), pls
LXXI–LXXII.
30 Verso l. 3. Cf. P. Posener-Kriéger, ‘Construire une tombe à
l’ouest de mn-nfr (P Caire 52002)’, *RdE* 33 (1981), 47–58.
31 Hayes, *Ostraka and Name Stones*, pl. XVI.
32 These ostraca, found by the joint project of the University of
Brussels and the University of Liège working on TT 29 (Mission
archéologique dans la Nécropole thébaine), are currently planned
for publication of a number of ostraca from Deir el-Bahri, M.
Römer also interprets the dni as a measurement, possibly
a container and very likely a basket for determining a volume
of stone. 23

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33 O. Senenmut 76, verso l. 3. Cf. P. Posener-Kriéger, ‘Construire une tombe à
l’ouest de mn-nfr (P Caire 52002)’, *RdE* 33 (1981), 47–58.
34 Hayes, *Ostraka and Name Stones*, pl. XVI.
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36 O. Senenmut 76, verso l. 3. Cf. P. Posener-Kriéger, ‘Construire une tombe à
l’ouest de mn-nfr (P Caire 52002)’, *RdE* 33 (1981), 47–58.
The *dni*-Measurement from a Practical Point of View

Compared to the geological composition of the western part of Sheikh Abd el-Qurna in which TT 95 is situated,53 TT 71 was built in an area where the local limestone is of relatively poor quality,54 which at some point later in time no doubt contributed to the complete collapse of the ceiling in the north end of the transverse hall. Near the top of Sheikh Abd el-Qurna the limestone is coarse, friable, perforated with intrusions of sedimentary gravel, and filled with cherty nodules of flint and other types of harder stone.55 Also, the top of the hill is generally riddled with fractures and fissures that make the stone relatively weak and therefore not particularly suited for sculpted underground structures, as evidenced by TT 71 and the surrounding tombs, e.g. TT 72 (Re),38 TT 73 (Amenhophet),39 TT 120 (Anen),40 and TT 121 (Ahmose).41 The general excavation of rock is therefore unlikely to have happened in neat blocks of stone, but rather as loose stone flakes and compressed gravel. Recording the progress of tomb production based on the removal of such materials could be achieved by simply filling and counting containers of roughly similar proportions. From a practical point of view, this would entail removing the materials not in vessels with the capacity of a cubic cubit (144.7 litres), but rather in smaller and more manageable containers,42 perhaps leather sacks or wicker-work baskets.43 Once outside the tomb, the workers could transfer the collected limestone rubble to *dni*-baskets (or bags), making sure to fill them to the brim in order to standardise the measure in which a scribe could then count and record.

Archaeological evidence from the excavation of another Theban monument, albeit from the Middle Kingdom, supports the interpretation of filled containers standing in rows for the scribe to count and record. In 1921, H. Winlock and...
Fig. 1. 50 baskets in four rows containing limestone flakes, rubble and sand. The scale in the centre of the image in front of the baskets is 1 meter (photo: from Arnold, *Temple of Mentuhotep*, pl. 36c).

Fig. 2. Close-up of baskets filled with limestone flakes, rubble and sand (photo: from Arnold, *Temple of Mentuhotep*, pl. 36d).
Amenhotep IV at Karnak, where four entries for products are defined by the use of dni-measurements. For example, incense: 2 dni, and fruit: 2 dni. Here, the unit is without a doubt a three-dimensional container, but it is unclear whether it is a basket or another form of vessel. Several other examples can be cited where a translation of dni as basket or vessel is preferable.

Tomb Construction Terminology

Where it occurs in the Senenmut ostraca, the dni-unit probably also refers to the use of a physical object, most likely a sack or a basket, with a capacity of approximately 145 litres, corresponding to one cubic cubit (52.5 cm³ or 0.1447 m³). Hence, the construction terminology recorded in the Senenmut ostraca is unlikely to refer to stages of the decoration as previously interpreted. This interpretation stems from the misconception of the term dni, having been thought of as a vague and/or flexible unit that could be used in measuring both surfaces as well as capacities. This is not only impractical but also unnecessary as the ancient builders already utilised the cubit rod (and to a lesser extent the nbi rod) to indicate measures of area. The terms s’d, s’t, and dkr are all recorded in the Senenmut ostraca alongside a numerical value, i.e. a result, which are signified as units of dni. Therefore, each of these construction tasks produced results that was measured in volume, which in turn merits a reinterpretation of each term and purpose within the tomb construction process.

s’d - cutting of stone

The meaning of the word s’d is fairly well established and usually relates to cutting by means of a tool made of metal. The use of the knife determinative (Gardiner D3) in all the examples from the Senenmut ostraca makes a similar interpretation plausible. Hayes translated s’d as ‘cut’ or ‘trim’ in the ‘work documents’ and envisioned an edged tool used in an operation of truing the wall surfaces after the initial excavation. In another ostracon (O. Senenmut 86, l. 8), Hayes translated the word as ‘sawyers (of wood)’, which seems appropriate as the document is a list of people with various professions. Thus, s’d basically means ‘to cut’ in most circumstances, but can also be translated as ‘to trim’ in the context of tomb construction. In the Senenmut ostraca dealing with construction, s’d very likely refers to the straightening of the walls and ceilings after the initial excavation. That s’d is unlikely to describe the initial excavation, or the cutting of virgin rock, is clear because it is always recorded in the Senenmut ostraca as having produced relatively low numbers of dni, between 1½ and 2, and always fewer than both dkr and s’(see below), which perhaps is because it was a slower process or required more precision.

s’t - reconstruction and repair

Most occurrences of the term s’t are translated in a way that relates to the process of plastering or repairing. In his review of the Wörterbuch der Aegyptischen Sprache, R. Saad and L. Manniche, ‘A Unique Offering List of Amenophis IV Recently Found at Karnak’, JEA 57 (1971), pl. XXI. See, for example, O. BM 29555; O. Gardiner 151; O. Gardiner 163; O. Gardiner 238; O. Gardiner 286; O. IFAO 1261; O. Michaelides 13; and O. Turin 57378. For an example from the Valley of the Kings, see O. 694 (rto. l. 4) in A. Dorn, Arbeiterhütten im Tal der Könige. (AH 23; Basel, 2011), tables 573–5.

Černý, The Valley of the Kings, 19–21.

See, for example, B. Bryan, ‘Pharaonic Painting through the New Kingdom’, in A. B. Lloyd (ed.), A Companion to Ancient Egypt (Oxford, 2010), 1004; and Bryan, in Ritter (ed.), Essays for the Library of Seshat, 6–19.

Although the text in some of the ostraca breaks off before the number and supposed mention of the unit of measure, this still seems a highly probable suggestion in each instance.

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Gardiner refers to ‘a hieratic ostracon (Twentieth Dynasty) acquired for the Ashmolean Museum’ in which he translates Aaa as ‘to patch up’. B. Bryan describes the Aaa-procedure as a ‘plastering to fill in wall gaps, hide rock deficiencies, and create a surface for decoration’. While this interpretation seems likely, the problem is that when it occurs in the Senenmut corpus, the Aaa-task is not measured in, for example, the menet-jars, in which normal plaster (kDw) of Late Egyptian 2: ‘to coat (with plaster), to smooth, to patch’; or by Hannig, Großes Handwörterbuch, 2: as ‘bestreichen, glätten’. A. H. Gardiner, ‘The First Two Pages of the “Wörterbuch”, JEA 34 (1948), 18.

Bryan, in Lloyd (ed.), A Companion to Ancient Egypt, 1004. See also the description in Bryan, in Ritner (ed.), Essays for the Library of Seshat, 12.

O. Senenmut 63, rto l. 5; O. Senenmut 65, l. 2; O. Senenmut 66, l. 6; and O. Senenmut 69, l. 3. It arguably also occurs on O. Senenmut 64 recto l. 5, but the passage is too damaged to say for certain.

For the size and capacity of the menet-jars, there is currently no set value. Cf. Hayes, Ostraka and Name Stones, 35; Janssen, Commodity Prices, 330; B. Kemp, ‘Reviewed Work: Commodity Prices from the Ramessid Period. An Economic Study of the Village of Necropolis Workmen at Thebes by Jac. J. Janssen’, JEA 65 (1979), 183; J. D. Bourniau, P. T. Nicholson, and P. J. Rose, ‘Pottery’, in P. T. Nicholson and I. Shaw (eds), Ancient Egyptian Materials and Technology (Cambridge, 2000), 140; and M. Müller, ‘Es werde Licht? Eine kurze Geschichte von Öl und Fett in Deir el-Medina in der 20. Dynastie’, in B. Haring, O. Kaper, and R. Van Walsem (eds), The Workman’s Progress. Studies in the village of Deir el-Medina and other documents from Western Thebes in Honour of Rob Demarée (Leiden, 2014), 180.

Inside the burial chamber of Djehuty (TT 11), a jar was found with mortar residue that might be considered a menet-jar. Cf. J. Galán, ‘The Inscribed Burial Chamber of Djehuty (TT 11)’, in J. Galán, B. Bryan, and P. Dorman (eds), Creativity and Innovation in the Reign of Hatshepsut (SAOC 69; Chicago, 2014), 255.

O. Senenmut 65: 5 dni; O. Senenmut 66: 12 dni; O. Senenmut 69: 1 dni. The last document records another measure of 6 cubits immediately after the mention of dni. This could be unrelated, but in O. Senenmut 63 and O. Senenmut 64, the Aaa-task is followed by the word cubit (mH), although without a numerical value. In fact, the space immediately after the word Aaa in both documents is left blank, giving the impression that the scribe was unsure how to record the result. The cubit measure mentioned on O. Senenmut 69 refers, as I understand it, to the length of wall the ‘shorer’ Sennefer had reinforced.

Dorman, The tombs of Senenmut, 26.

On the description of ‘mud-plaster’, which is similar to the plaster used in TT 71, see E. MacKay, ‘The Cutting and Preparation of Tomb-Chapels in the Theban Necropolis’, JEA 7 (1921), 159–60.
gypsum was applied as a basis for the painted decoration (see fig. 4). Therefore I suggest that the application of the mortar with limestone flakes represents the ṣr-procedure. The remaining problem is to explain the measuring of ṣr in dni quantities.

In the textual material, it is the workman Sennefer who in each instance performs the ṣr-procedure. He is in O. Senenmut 65 called the ‘reinforcer’ (ṣkn) and in O. Senenmut 69 the ‘shorer’ (twsw), both titles suggest an aspect of building, i.e. of adding material in contrast, for example, to a stonecutter who removes material. This building aspect provides an important clue to the measuring of ṣr in dni, which may not have been removed from the tomb, but rather brought back inside and added to the walls and ceilings along with the coarse mortar. Whether the dni-baskets were simply being hauled inside again or whether the hm-cREW had to unload them into smaller containers is not clear, but we can observe a similar situation in the TT 29 ostraca. On the verso of O. 291437, the ṣr is mentioned alongside the terms dni, hm, plaster (kgwv), and menet-jars. I therefore argue that the recording of a dni-measure in connection with the ṣr-procedure points to the limestone flakes already removed by the initial excavation, having been counted outside the tomb, being brought back inside to be used with a coarse mortar in the repairing of the walls and ceilings.

**dkr - working with stone**

The term dkr refers to a rough or ‘normal’ smoothing or outlining of features depending on the stone and place. It is very likely related to the verbs ḏk, ‘to grind’, and ḏg, which relates to stonework or building in stone. dkr occurs only once in the Senenmut corpus, where the stonecutter Teti was recorded as having produced 2 dni, which is the equivalent of 289.4 litres or about 750–810 kilos depending on the density of the limestone, the size of the limestone flakes and the packing density of the dni-basket. According to Hayes, dkr is ‘apparently an old form of ḏg’, and he therefore suggests translations of the term as ‘to face’, ‘to coat’, ‘to overlay’, and ‘to cover’. He argues that the fact that on the versos of both the ostraka on which this word occurs the principal activity recorded is the fetching of plaster and water suggests that dkr describes specifically the plastering of the walls of the tomb.

The mention of plaster on the verso of O. Senenmut 63 (and O. Senenmut 64) is unlikely to be related to the technical aspect of the term dkr, which occurs in the beginning of the recto before the mention of both ṣd and ṣr. The term ḏg is most likely the same as, or at least closely related to, dkr, because both terms in some way produce results that can be measured in dni. In O. Ashmolean Museum 7 the term ḏg is used no less than ten times. In each entry, the same phrase is used: ‘Those who are ḏg-ing (nty ḏg)’, which is followed by a result measured in either dni or as a number of stone blocks. It is not entirely clear what the document is describing, but the main point for the present paper is that the ḏg is here measured in terms of volume, in dni and stone blocks. According to A. Erman and H. Grapow, ḏg is used as an ‘Ausdruck bei der Maurerarbeit’ and has to do with stone-laying, the establishment of columns, or vault building.79 L. Lesko’s suggestion for a translation of ḏg is ‘to plate, to cover, to erect’ which encompasses both the plastering aspect as well as the stone working/building aspect. Finally, the term dkr occurs once in the TT 29 corpus, involving work being done on columns by a single stonecutter and with no mention of plaster. It seems, therefore, that the dkr is more likely to be related to stonework in some sense.

**Conclusions**

Based on the findings of my PhD dissertation, which partly dealt with the archaeology of the two tombs of Senenmut and the related textual material, I understand the three terms as follows. The ṣd was the trimming of stone most likely using a copper or bronze tool following the initial excavation. The ṣr was the term used for the repairing, shoring, or patching of cavities in the poor-quality rock surface using large quantities of previously excavated limestone flakes set in a pinkish mortar. The dkr was a rough smoothing or outlining of features or details within the tomb, e.g. the outlining of pillars. Because all three tasks were connected to the removal or reuse of rock, their

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71 For similar techniques of plastering in TT 81, see E. Dziobek, Das Grab des Ini. Theben Nr. 81 (AVDAIK 68; Mainz am Rhein, 1992), 22–3; and in TT 99, see N. Strudwick, The Tomb of Pharaoh’s Chancellor Senneferi at Thebes (TT99) (Oxford, 2016), 61–2, figs 51–3.
72 Gardiner, *Egyptian Grammar*, 603: ‘to press, move, expel’; Lesko, *A Dictionary of Late Egyptian*, 143: ‘to hack up’; Hannig, *Großes Handwörterbuch* (ed.), *A Dictionary of Late Egyptian*, 143.
73 O. Senenmut 63, rto l. 3, and O. Senenmut 64, rto l. 3. The two texts are slightly different versions of each other, recording the same activities on the same day.
74 As a solid limestone weighs approximately 2.6–2.8 tons per cubic metre. Cf. O. V. Rasmussen, *Kemiiske og Fysiske Tabeller* (Chemical and Physical Charts) (9th rev. edn by P. Hartmann-Petersen; Copenhagen, 2003), 56.
75 Hayes, *Ostraka and Name Stones*, 41.
76 Hayes, *Ostraka and Name Stones*, 41. Perhaps drawing on Hayes’ statement, Hannig (Großes Handschräubbuch, 1061) translates dkr as ‘überziehen (Grabwand mit Verputz)’, and Bryan states that the term refers to ‘background painting with a blue or white frit mixture with emphasized adhesive qualities to cover any visual inconsistencies. Also means “whitewash”’ (Bryan, in Lloyd (ed.), *A Companion to Ancient Egypt*, 1004). Elsewhere, Bryan noted that the term means ‘to apply’ (Bryan, in Ritner (ed.), *Essays for the Library of Seshat*, 14).
77 Lines 1, 3, 6, 10, and 11 on the recto, and lines 4, 5, 6, 7, and 9 on the verso.
78 The same occurs in O. Berlin P. 10621, O. Leipzig 13, and possibly O. Ashmolean Museum 42, although the term used here is dkr and appears to concern the construction of a roof (recto line 3).
79 Erman and Grapow, *Wörterbuch IV*, 499 (7–9).
80 Lesko, *A Dictionary of Late Egyptian*, 143.
81 O. 291492, recto line 3.
82 Olsen, *Socioeconomic aspects of ancient Egyptian private tomb construction*, 88–103.
production rate was measured in numbers of dni, and, from a practical point of view, very likely in dni-baskets. Thus, the purpose for recording the precise numbers of dni, in the Senenmut ostraca and elsewhere, was to keep track of the progress of construction, specifically the progress of excavation and cutting of rock by measuring the extracted volumes. The dni, then, is the key to analysing the production rate of the New Kingdom rock-cut tombs and to calculating the speed with which they were built.

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