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The Mycenaean Administration of Textile Production in the Palace of Knossos: Observations on the Lc(1) Textile Targets

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Abstract

The Linear B tablets from Knossos known as the Lc series record textile production targets for central and western Crete for a specific range of textiles called *te-pa*, *pa-we-a*, and *tu-na-no*. The production targets for wool textiles differed according to the groups assigned to fulfill the targets; these groups were designated according to ethnicity and occupation. A comparison of the total target for noncollector workers in central Crete with the individual targets suggests that the annual planned *ta-ra-si-ja* production did not equal the mere sum of individual targets but constituted a predefined amount of cloth. This provides an answer to why only some places in Crete were submitted to the *ta-ra-si-ja* obligation; it also suggests that the target was only part of the textile-production obligations for work groups in Crete.*

TEXTILE ADMINISTRATION IN THE PALACE OF KNOSSOS

Archaeological textiles rarely survive from the Mycenaean period.¹ Yet the Linear B tablets provide an extraordinary insight into Mycenaean textiles and the management of textile production. This article focuses on how textile production was organized on a palace-administration level. The palace-monitored textile industries had already started in the Minoan period and had by the end of the Late Bronze Age evolved into strictly controlled systems with sophisticated administrative procedures for counting sheep, allocating wool, setting production targets, and sanctioning shortfalls and deficits.² Some textiles were produced in palace workshops, as is evidenced in the Linear B documentation from the palace of Pylos,³ while Knossos primarily set up systems of assigned textile work to villages in which the palace flocks were also monitored by local

herdsmen.⁴ Textile production in preindustrial societies was one of the most important means of converting domestic labor into transportable values, and the palace of Knossos is one of the best examples of this phenomenon in ancient economy and society.

THE LC(1) TEXTILE PRODUCTION TARGETS

In 1966, Killen demonstrated that the Knossian Lc series represents targets for the textile production in central Crete.⁵ The two Lc(1) tablets beginning with the terms *to-sa* (total) and *ta-ra-si-ja* express the total of such individual targets. Since it is a recurrent phenomenon that approximately 30% of the activities in major Mycenaean economic sectors are totaled separately and associated with “collectors,” Olivier suggests that KN Lc(1) 536 totals such individual targets for “non-collector” groups, and KN Lc(1) 535, consequently, totals the collector targets, as can be seen below.⁶

KN Lc(1) 535 + 538	(103/F10)
.A ta-ra-si-ja pa-we-a [
.B ke-ri-mi-ja tu-na-no [
.C to-sa / pe-ko-to [
KN Lc(1) 536 [+] 7383 + 7731	(103/F10)
.A] ‘ta-ra-si [ja’]pa-we-a []TELA ^x 200	
.B] ‘vest.[’] tu-na-no []TELA ¹ 48	
	a-ro-zo ‘ki-to’ TELA ¹ 1
.C to-]sa / pe[-ko-to TELA ¹ +TE]18	
	TELA ² +TE 267

The “Collectors”

The term “collector” is a modern designation for a specific group of men’s names recurring in the Lin-

* My thanks to John Killen, José Melena, John Bennet, Pierre Carlier, Sigrid Deger-Jalkotzy, Richard Firth, and Françoise Rougemont for helpful comments and discussions on many aspects of this paper. My ideas were introduced in the presentation “Two Observations on the Knossos Lc(1) Targets” at the 11th International Mycenaean Colloquium in Austin, Texas, in 2000, and I thank Tom Palaima and Cynthia Shelmerdine for their kind invitation.

¹ Barber 1991. See also the survey of Greek archaeological textile remains in Spantidaki and Moulherat (forthcoming).

² Barber 1991; Militello 2007; Del Freo et al. 2010.

³ Chadwick 1988.

⁴ Olivier 1967; Nosch 1997–2000, 2000b.

⁵ Killen 1966; 1974; 1976, 121.

⁶ Olivier 1967, 91; 1972, 28 n. 6.

ear B texts.⁷ One of these, *a-ke-o*, is in a text from Pylos (Cc 660), followed by the verb *a-ke-re/ageirei*, meaning “collects,” hence the appellation “collectors.” These collectors appear in approximately 30% of the texts pertaining to the major sectors of the Mycenaean palace economy, such as sheepherding, textile production, management of textile workers, and landholdings. In some cases, specific scribes record matters concerning the collectors; for example, Scribe 108 records their textile work groups in Crete (KN Ak[2] set). As already noted, one characteristic feature is that their activities are totaled separately from the rest of the activities of the sector, the noncollector activities. Their identity and function remain much debated.

The Individual Lc(1) Targets

The Lc(1) set contains three groups of tablets:

1. Individual targets for groups of workers under a collector.⁸
2. Individual targets for groups of workers with an ethnic designation, for example, *ri-jo-ni-ja* (women at the place called *ri-jo-no*) or *pa-i-ti-ja* (women from Phaistos).
3. Individual targets for groups of workers with an occupational designation, for example, *te-pe-ja* (makers of *te-pa*) or *ko-u-re-ja* (makers of [*pa-we-a*] *ko-u-ra* cloth). These groups of workers were primarily located at Amnisos, at *da-*22-to*, or at Knossos.

The targets for the first group are presumed to have been totaled on KN Lc(1) 535, while the targets for the second and third groups, that is, for the groups with either ethnic or occupational designations, are totaled on KN Lc(1) 536.

THE SETTING OF THE TOTAL *TA-RA-SI-JA* TARGET ON KN Lc(1) 536

In the total noncollector target on KN Lc(1) 536, noncollector work groups are to produce a total of 534 pieces of cloth composed the following way:

$$267 \left\{ \begin{array}{l} 200 \text{ } pa\text{-}we\text{-}a \\ 48 \text{ } tu\text{-}na\text{-}no \\ 1 \text{ } a\text{-}ro\text{-}zo \text{ } ki\text{-}to \\ 18 \text{ } pe\text{-}ko\text{-}to \text{ } TELA+TE \\ 267 \text{ } TELA+TE \end{array} \right.$$

Total: 534 pieces of cloth

At first sight, one might assume that the 267 pieces of *TELA+TE* constitute the overall total of cloth on tablet KN Lc(1) 536, but this is not possible because, as Killen demonstrates, the various cloth types demand very different amounts of wool (table 1). One *tu-na-no* requires, for example, three units of wool, or 9 kg, while one *TELA+TE* requires seven units of wool, or 21 kg.

It is therefore not possible that *TELA+TE* is the common name of all types of cloth or that the 267 pieces of *TELA+TE* constitute the overall total target on KN Lc(1) 536. This leads one to ask if it is a coincidence that 267 is the sum of 200 + 48 + 18 + 1. The number 534 for the total of *pa-we-a*, *tu-na-no*, *a-ro-zo ki-to*, *pe-ko-to TELA+TE*, and standard *TELA+TE* is not recorded.

I argue that it is not merely coincidental that 267 is the sum of 200 + 48 + 18 + 1. Half of the noncollector target is composed of different cloth, and the other half is composed of standard *TELA+TE*. The total target for noncollector groups (KN Lc[1] 536) is expressed in figure 1.

MECHANISMS FOR APPORTIONING AND SETTING PRODUCTION TARGETS

Figure 1 suggests answers to a number of questions concerning the organization and the mechanisms for apportioning and setting production targets of the whole *ta-ra-si-ja* textile industry: Did the scribe first set the total targets (KN Lc[1] 535 and 536) and then apportion the individual targets on the Lc tablets? Or were individual targets set and later totaled on KN Lc(1) 535 and 536? It seems that the process for setting targets is the following: quantities of *pa-we-a*, *tu-na-no*, *a-ro-zo ki-to*, and *pe-ko-to TELA+TE* are added together. The result, 267 pieces of varied cloth types, then defines the size of the target of standard *TELA+TE*. The total target for noncollector groups thus consists of 50% various cloth (*pa-we-a*, *tu-na-no*, *a-ro-zo ki-to*, and *pe-ko-to TELA+TE*) and 50% standard *TELA+TE*.

This 1:1 ratio is, however, based on the number of pieces of cloth and not on their weight or size: *pa-we-a* and *tu-na-no* are relatively light textile types, while *te-pa/TELA+TE* is much larger and heavier. The 267 pieces of standard *TELA+TE* require 1,869 units of wool, 74% of the 2,527 units of wool needed for the entire KN Lc(1) 536 target (fig. 2).⁹

Thus, the method for setting the total textile production *ta-ra-si-ja* target on KN Lc(1) 536 seems to be

⁷Killen 1976, 1983, 1995; Bennet 1992; Carlier 1992; Driessen 1992; Godart 1992; Olivier 2001; Rougemont 2001, 2009.

⁸KN Lc(1) 532 (*ḫu-wo*), KN Lc(1) 551 (*e-me-si-jo*), KN Lc(1) 7392 (*we-we-si-jo*), and KN Lc(1) 540 (*da-te-we-ja*).

⁹In most works, previous works of mine included, the total

amount of wool for the production of cloth in KN Lc(1) 536 is set to 2,529 units. This, however, is based on a calculation error in Olivier 1967, 91–2. Olivier also mistakes the 200 *pa-we-a* for 300 *pa-we-a*. The correct total wool amount for *tu-na-no*, *pa-we-a*, *te-pa*, and *pe-ko-to TELA+TE* is 2,527 units of wool. One

Table 1. Relationships Between Mycenaean Cloth Types and Wool for Their Manufacture.

Cloth Type	Units of Wool	Kg of Wool	Sheep
<i>tu-na-no</i>	3	9	12
<i>pa-we-a</i>	1.67	5	ca. 7
<i>pe-ko-to</i> TELA+TE	10	30	40
TELA+TE / <i>te-pa</i>	7	21	28

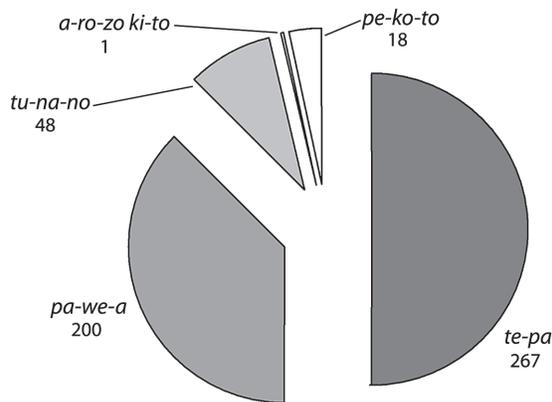


Fig. 1. The number of pieces of cloth recorded on KN Lc(1) 536.

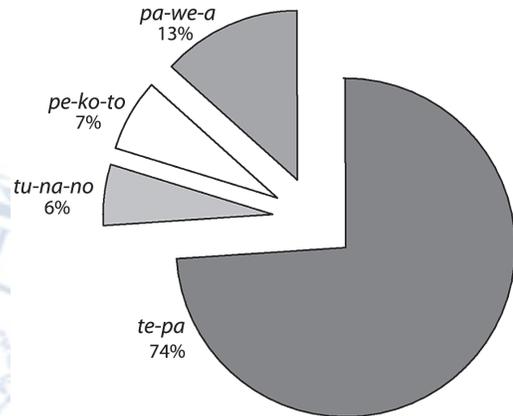


Fig. 2. The amount of wool required to meet the target recorded on KN Lc(1) 536.

as follows: initially a total *ta-ra-si-ja* target is established for *pa-we-a*, *tu-na-no*, *a-ro-zo ki-to*, and *pe-ko-to* TELA+TE, and their total number is “doubled-up” by the number of standard TELA+TE. This is recorded on Lc(1) 536 and subsequently divided into individual Lc(1) targets for the groups of workers. This administrative procedure is similar to the “top-down” theory of the Mycenaean taxation system.¹⁰

THE RELATIONSHIP BETWEEN TYPES OF TEXTILE PRODUCTION AND TYPES OF WORKERS

In general, certain groups of workers have certain types of cloth on their targets, and other groups of workers have other types of cloth on their targets (table 2). *Pa-we-a ko-u-ra* were mainly produced by

the occupational group *ko-u-re-ja* and by the collector groups,¹¹ but they were also produced infrequently by groups with an ethnic designation. *Te-pa*/TELA+TE were produced primarily by the occupational group *te-pe-ja* (see KN Lc 641) and also by groups of women with an ethnic designation. The alternative *pe-ko-to* TELA+TE textiles were produced by groups under a collector and by groups of workers with an ethnic designation.¹² This contrasts with *pa-we-a ko-u-ra* *161, which seem to have been exclusively produced by workers with an occupational designation, such as *a-ra-ka-te-ja* and *e-ro-pa-ke-ja*.¹³ Only *tu-na-no* seem to have been produced by all groups.

This differentiation of producers provides criteria for interpreting some of the highly fragmented entries;]*ja*

could argue that more wool should be added for the manufacture of one *a-ro-zo ki-to*, but we do not know the exact wool requirement for this type of garment.

¹⁰Wyatt 1962; Shelmerdine 1973. Against this, see Lejeune 1956, 1979; Olivier 1974.

¹¹KN Lc(1) 532: 16 pieces of *pa-we-a* (collector]*ku-wo*); KN Lc(1) 551: 110 pieces of *pa-we-a* (collector *e-me-si-jo*); KN Lc(1) 7392: 240 pieces of *pa-we-a* (collector *we-we-si-jo*).

¹²*Eko-so* (KN Lc[1] 527); *da-wo* (KN Lc[1] 526, KN Le 641, KN Ln 1568); *Phaistos* (KN Le 641); **i-ja-pu₂* (KN Lc 646?). The collector *e-me-si-jo* is recorded for *pe-ko-to* TELA+TE on KN Lc(1) 551. *Pe-ko-to* TELA+TE can also be restored on KN Lc(1) 5746, but it is impossible to ascertain the type of entry; see Killen 1987, 325 n. 9.

¹³The ideogram *161 is analyzed in Melena 1975, 94–117.

Table 2. The Preserved Lc (1) Targets and the Amount of Wool Needed to Fulfill the Targets for Groups with Ethnic or Occupational Designations.

		Lc (1) Targets							Amount of Wool		
Noncollector Groups	Designation	Lc (1) Tablet No.	TELA+TE (no.)	pe-ko-to (no.)	tu-na-no (no.)	pa-we-a*161 (no.)	pa-we-a (no.)	Units	Kg	No. Sheep	
<i>da-wi-ja</i>	ethnic	526	14	10	3	-	-	207	621	828	
eadem	ethnic	7549	-	-	*	-	-	-	-	-	
<i>e-ki-si-ja</i>	ethnic	527	19	2	2	-	-	159	477	636	
<i>ri-ja-ni-ja</i>	ethnic	529	30	-	x	-	-	>210	>630	>840	
<i>lja</i>	ethnic?	530	7	-	3 ^a	-	40	127.6	383	511	
<i>ilja-pu₂-wi-ja</i>	ethnic	541	22	-	-	-	-	154	462	616	
<i>se-to-i-ja, wa-na-ka-te-ra</i>	ethnic	525	40	-	3	-	-	289	867	1156	
<i>e-ra-ja</i>	ethnic	528	-	-	1	-	*	-	-	-	
eadem, <i>e-pi-qe re-si</i>	ethnic	561	1	-	-	-	-	7	21	28	
<i>tu-ri-si-ja</i>	ethnic	533	*	-	-	-	-	-	-	-	
<i>qa-mi-ja</i>	ethnic	543	11	-	*	-	-	>77	>231	>308	
<i>a-ra-ka-te-ja</i>	occupation	531	-	-	1	15	-	28	84	112	
<i>e-ro-pa-ke-ja</i>	occupation	534	-	-	1	10[-	19.6	59	78.6	
<i>da-te-we-ja</i>	collector group?	540	-	-	-	-	9 ^b	15	45	60	
<i>lja</i>	occupation?	7376	-	-	-	10[-	16.6	50	67	
<i>ne-we-wi-ja</i>	occupation	560	-	-	-	-	*	-	-	-	
<i>a-mi-ni-so/ko-u-re-ja</i>	occupation	550	-	-	-	-	*	-	-	-	
Individual Lc Noncollector Targets		all tablets above	144+	12+	14+	35+	49+	calculations speculative			
Total Target Noncollector Workers ^c		536	267	18	48	200		2,527 ^d	7,587	10,116	

* Entry illegible

^a Unusual ratio of one *tu-na-no* to four units of wool (possible calculation error)^b Only three strokes evident; arrangement suggests nine^c Based on textiles recorded on Lc(1) 536^d Plus 1 *a-ro-zo ki-to* of unknown wool weight

on KN Lc(1) 7376 can thus plausibly be interpreted as the last syllable of an occupational designation because the target is set for producing *pa-we-a* *161.

There is only one exception to this pattern. We would expect the women with the ethnic designation *e-ra-ja* to primarily produce *te-pa*, but they are mainly recorded for *pa-we-a ko-u-ra* (Lc[1] 528 and 561).

THE TWO SIZES OF LC TEXTILE TARGETS

There seems to be a distinct pattern for the sizes of individual targets. Table 2 lists the well-preserved targets for groups of workers with ethnic designations¹⁴ and for groups of workers with occupational designations.¹⁵

Large targets

Two sizes of targets appear: large targets and small targets. Large targets requiring roughly 100–300 units of wool are set for groups with an ethnic designation: *da-wo* (207 units of wool); *e-ko-so* (159 units of wool); *ri-jo-no* (210 units of wool, or more); *i-ja-pu₂* (154 units of wool); *qa-mo* (>77 units of wool, with a maximum of 100 units); and *se-to-i-ja* (289 units of wool).

Each group of workers in a village would need wool from 400–800 sheep to fulfill such a large *ta-ra-si-ja* target. We would expect a relationship between the size of the textile target and the number of sheep recorded in the village, but this does not always seem to be the case.

The women at *se-to-i-ja* would need a relatively large amount of wool, 289 units, to fulfill their target, which constitutes wool from at least 1,150 sheep and may represent a special case because *se-to-i-ja* textiles—or textile workers—are called “royal” (*wa-na-ka-te-ra*).¹⁶

No sheep are recorded in the Da–Dg or Dv series at *i-ja-pu₂-we*, but a *ta-ra-si-ja* target is nevertheless set for that place. The women at *qa-mo* have a small target, and quite a small number of sheep are recorded for the village of *qa-mo* (there is preserved documentation of 556 sheep in the Da–Dg and Dn series); this might suggest that, at least in this case, there was a relationship between the size of the target and the number of sheep in a village. The relatively small target could

also be explained as an indication of both collector and noncollector textile production at *qa-mo*: KN Ak(2) 613 records women and children at *qa-mo*, but the tablet is written by Scribe 108, who normally records work groups under collectors. However, on KN Ak(2) 613, no collector occurs. Thus, is the KN Lc(1) 543 target lower than those of other ethnic groups because there were fewer sheep, or did another group of workers in *qa-mo* under a collector (KN Ak[2] 613) fulfill a second target?

The place *da-*22-to* is associated with only a few flocks of sheep (a total of 1,370 sheep on KN Dn 1093) and also hosts workers of the collector *a-no-zo-jo* (KN Ak[2] 627), *da-*22-to* women with a textile target (KN Lc[1] 7901), and an occupational group *da-*22-ti-ja/a-ze-ti-ri-ja* (KN Xe 544).¹⁷ It can be concluded that there is no close relationship between the number of sheep associated with a village and the number of textiles woven in that particular village.

Small Targets

This contrasts with the small targets recording the *a-ra-ka-te-ja* with a target of 28 units of wool (KN Lc[1] 531), the *e-ro-pa-ke-ja* with a target of 19.6 units of wool (KN Lc[1] 534), the *da-te-we-ja* with a target of 15 units of wool (KN Lc[1] 540), and the unidentified *]ja* with a target of 16.6 units of wool (KN Lc[1] 7376). These targets are complete, and each group needs roughly 15 to 28 units of wool (i.e., an average of 20 units). This corresponds to approximately 10% of the large targets for the ethnic groups.

The workers with the small targets and the designations *a-ra-ka-te-ja*, *e-ro-pa-ke-ja*,¹⁸ and the *]ja* have two other points in common: they produce *pa-we-a ko-u-ra* *161, which seems to be a subcategory of the standard cloth type *pa-we-a*. The *a-ra-ka-te-ja*¹⁹ and *e-ro-pa-ke-ja* are both occupational designations, and the *]ja* probably is also (see above).

The term *da-te-we-ja* is most likely derived from the man’s name *da-te-wa* and could thus be interpreted as a collector group; Killen therefore interprets *da-te-we-ja* as referring to women under the collector *da-te-wa*.²⁰ However, unlike the other collectors who are attested

¹⁴ All possible targets for women workers with an ethnic designation: KN Lc(1) 525–529, 533, 541, 543, 546, 547, 561, 7549, 7901; probably Lc(1) 530, 552, 553, 555, 557, 558, 582, 1580, 5746, 7285, 7321.

¹⁵ All possible targets for women workers with an occupational designation: KN Lc(1) 531, 534, 548–550, 560, 5053, 7376, 8572; probably KN Lc(1) 7289.

¹⁶ A single scribe, Scribe 106, records all the *se-to-i-ja* sheep, and this emphasizes the special status of *se-to-i-ja*.

¹⁷ On this tablet, see Killen (1998), who suggests that KN Xe 544 should be reclassified as KN Lc(1); see also Firth 1998,

37. Firth and Melena (2002–2003, 114) and Firth and Nosch (2002–2003, 132) suggest that 544 [+] 5511 should be reclassified as KN Od(1).

¹⁸ The designation *e-ro-pa-ke-ja* is the feminine version of *e-ro-pa-ke-u* (KN As <4493> and perhaps KN As[1] 5609). On MY Fo 101, the *e-ro-pa-ke-ja* women occur together with another occupational designation from the textile industry, the *a-ke-ti-ri-ja* (Melena 1975, 37–40).

¹⁹ Spinning women; cf. ἡλακάτι (spindle) (Del Freo et al. 2010).

²⁰ Killen 1983, 78–9.

in several contexts, *da-te-wa* occurs only on tablets from the Room of the Chariot Tablets, KN V(2) 147 and Vd 138, which are probably dated earlier than the main part of the Knossos archives.²¹ Furthermore, collector groups are primarily recorded by Scribe 108 in the KN Ak(2) set from findplace F7, but the *da-te-we-ja* are recorded by Scribe 103 in the KN Ak(1) set from findplace F14.²² Finally, as noted above, *da-te-we-ja* is a derived form taken from a man's name, and Scribe 103 records this group three times under this derived form, on tablets KN Ak(1) 612, KN Lc(1) 540, and KN Xe 5891. The work groups under collectors, however, are normally not recorded by a derived form but rather by the collector's name in the nominative or genitive form. Scribe 103 writes *we-we-si-jo-jo*, *e-me-si-jo-jo*, and *]ku-wo* in the KN Lc(1) set, and Scribe 108 writes *a-no-qa-ta*, *we-we-si-jo-jo*, *a-no-zo-jo*, and *]ki* in the KN Ak(2) collector set. The *da-te-we-ja* are thus in some regards quite different from the other collector groups recorded by Scribes 103 and 108.

It can be concluded that there are small *ta-ra-si-ja* targets set for the women with an occupational designation and for the *da-te-we-ja*; these women may belong to a collector or may previously have belonged to a collector but now perform activities like the groups with an occupational designation.

It can furthermore be concluded that targets are set within two orders of magnitude: ethnic groups are to produce textiles from 100 to 300 units of wool (300–900 kg), and occupational groups and the *da-te-we-ja* are to produce textiles from 15 to 28 units of wool (45–84 kg). The targets for the latter are about a tenth the size of those for ethnic groups.

The size of an Lc(1) target can thus become a criterion for interpreting a designation. For example, tablet KN Lc(1) 530, on which only the ending *]ja* is left of the entry, can plausibly be interpreted as the final syllable of an ethnic designation because the target requires 127.6 units of wool, and this amount corresponds to the ethnic groups' targets (100–300 units of wool).²³

Targets for collectors vary greatly and cannot be integrated in the two categories above: the collector *]ku-wo* needs only about 58 units of wool for his target, collector *e-me-si-jo* needs 282 units of wool, and collector *we-we-si-jo* at least 430 units of wool.

The reason for the lower targets set for occupational groups and the *da-te-we-ja* may be that there were fewer

workers in these groups. Other possibilities are that the production of *pa-we-a ko-u-ra* *161 demands more time and/or that this *ta-ra-si-ja* target is only one of their duties. These hypotheses are examined below.

THE SIZE OF WORK GROUPS WITH SMALLER TARGETS

The working strength is generally difficult to estimate because of the state of preservation of the Knossos lists of personnel, the Ak series. In the Ak lists, there are three or perhaps four tablets with preserved figures for the size of occupational groups: 10 *to-te-ja* women (KN Ak[1] 611), 1 *a-ke-ti-ri-ja* (KN Ak[3] 7001),²⁴ 2 *ne-ki-ri-de* (KN Ak[3] 780),²⁵ and 14 *?e-ro-pa-]ke-ja* women (KN Ak[1] 620). The number of the *da-te-we-ja* is also preserved, indicating 9 *da-te-we-ja* women (KN Ak[1] 612).

The size of the above groups cannot easily be compared with the working strength of the groups with an ethnic designation because of the state of preservation of the tablets. However, the tablets concerning *se-to-i-ja* (KN Lc[1] 525 and KN Ak[1] 634) suggest the same proportions of 10:1 between the number of women in ethnic groups and the number of women in occupational groups; there are nearly 80 women working at *se-to-i-ja*, and this is nearly 10 times the number of women in average occupational groups.

The number of women in occupational groups, as far as may be surmised, is generally lower than the number of women in groups of collectors. There are 30 women under *a-no-qa-ta* (KN Ak[2] 615), 34 women under *]jq* (KN Ak[2] 621), and 40 women under a collector whose name cannot be deciphered (KN Ak[2] 9407).²⁶ Only one collector group is comparable with the occupational groups: the nine women under *a-no-zo-jo* (KN Ak[2] 627).

THE RELATIONSHIP BETWEEN THE NUMBER OF WOMEN AND THE TARGETED NUMBER OF FABRICS

In the groups with small targets, there may be a relationship between the number of women and the number of *pa-we-a ko-u-ra* and *pa-we-a ko-u-ra* *161 in the KN Lc(1) targets. Indeed, Killen has suggested that there would be a correspondence of 1:1 between the number of women registered in the Ak series and the number of *pa-we-a* on the Lc targets;²⁷ thus, there

²¹ Driessen 2000.

²² Killen 1972, 425–33.

²³ It is, however, also possible that the ending *]ja* is a designation derived from a collector's name, but the scribes normally record these groups by the collector's proper name and not by a derived form.

²⁴ Killen 1979, 165 n. 23. This occupation occurs on tablets from Knossos, Pylos, Thebes, and Mycenae and has been interpreted as "finishers" from ἄσκέω.

²⁵ On this occupational title, see Killen 1986, 279–80.

²⁶ See Melena's join in Godart et al. 1990–1991, 393.

²⁷ Killen 1968, 638 n. 11; 1984, 52 n. 10, 54 n. 12.

are nine *da-te-we-ja* women who were supposed to produce nine *pa-we-a*:

KN Ak(1) 612 (103/F14)
 .A TA 1 'DA 1' MUL 9
 .B ko-wa , / me-zo 1 ko-wa / me-u-jo 1
 .C da-te-we-ja / ko-wo / me-zo 1 [[kə-wo / mə-]]

KN Lc(1) 540 + 8075 (103/F10)
 .A 'pa-we-a' ko-u-ra TELA¹ 3[
 .B da-te-we-ja / []
 .A 3[: arrangement suggests 9.

I believe that the 1:1 correspondence may also be attested in the records of another group with a small target, the *e-ro-pa-ke-ja*. There are 14 or more *e-ro-pa-ke-ja*, and their targets consist of 10[*pa-we-a*. The tablet is broken immediately after the figure, and this means that it records at least 10 *pa-we-a*, but it could also be more.

KN Ak(1) 620 + 6028 + fr. (103/F14)
 .A] TA 2 'DA[1]' MUL 14
 .B] ko-wa di 1 ko-wa []
 .C ?e-ro-pa-ke-ja / ko-wo , de 1 []

KN Lc(1) 534 + 7647 + 7818 (103/F10)
 .A pa-we-a , ko-u-ra '*161' TELA¹ 10[
 .B e-ro-pa-ke-ja / tu-na-no TELA¹ !

Finally, it is tempting, but admittedly speculative, to suggest the same relationship of 1:1 between the number of pieces of *pa-we-a* and the occupational group *to-te-ja*.

KN Ak(1) 611 (103/F14)
 .1 to-te-ja , TA 2 'DA 1' MUL 10[] dē-di-ku-ja
 MUL 1[]
 .2 ko-wa , / me-zo-e 4 [] ko-wo , /
 me-wi-jo ! []
 .3 vacat []

KN Lc(1) 7376 (103)
 .A] 'pa-we-a' ko-u-ra '*161' TELA¹ 10[
 .B]ja / []

Tablet KN Lc(1) 7376 records 10 or more pieces of *pa-we-a ko-u-ra* *161, and if it also records *to-te-ja* women, then it could correspond to the 10 or more *to-te-ja* women on KN Ak(1) 611. The numbers on both tablets are incomplete, but both tablets record 10 or more women and *pa-we-a ko-u-ra* *161. This hypothesis is supported by Melena's observation that tablet KN X

7846 may record the occupational designation *to-te-ja* and the textile type *161.²⁸

At present, evidence of the relationship of 1:1 can only be advanced for the groups with textile targets of *pa-we-a ko-u-ra* *161, but Killen suggests a similar relationship between the number of *te-pa* and the number of women in groups with an ethnic designation: "[A] normal target for an Ak worker, for whatever period the Lc(1) records cover, was one unit of cloth; and since the Lc(1) tablets as a whole are likely to have recorded something on the order of 1,000 cloths, it follows that the labor force was probably at least 1,000 strong."²⁹

However, the tablets concerning *se-to-i-ja* (KN Lc[1] 525 and KN Ak[1] 634) suggest a relation of 2:1 between the number of women and the number of *te-pa* because at *se-to-i-ja*, there are nearly 80 women who are to produce 40 pieces of *te-pa*.

KN Ak(1) 634 + 5767 (103/F14)
 .A [] 'DA 1' [] 74[] di 5 []
 .B se-to-i-ja / ko-wa , me-u [-jo-e] 10 ko-wo me 5[]
 lat. inf. vac. [] ru-si[]

KN Lc(1) 525 (103/F10)
 .A 'wa-na-ka-te-ra' TELA³+TE 40 LANA 100[
 .B se-to-i-ja , / tu-na-no TELA¹ 3 LANA[]

Possible solutions to this inconsistency are that two women were employed to weave each of these large fabrics, *te-pa*, or that a second target was set for *se-to-i-ja*.

Killen has suggested that tablet KN Lc(1) 557 could be a second target for *se-to-i-ja*.³⁰ In fact, this tablet is bigger than the other KN Lc(1) tablets and similar to the *se-to-i-ja* tablet KN Lc(1) 525.

KN Lc(1) 557 (103/F10)
 .A] TELA¹ 80 LANA 130[]
 .B]TELA¹ 7 LANA !1[]

The relationship between cloth and wool (see table 1) suggests the following restoration:

KN Lc(1) 557 (103/F10)
 .A pa-we-a ko-u-ra] TELA¹ 80 LANA 130[M 1
 .B tu-na-no]TELA¹ 7 LANA 21[]

The target on Lc(1) 557 is thus about 151 units of wool—that is, within the standard scale for groups with an ethnic designation. If this tablet is a second *se-to-i-ja*

²⁸Melena 1975, 116.

²⁹Killen 1984, 52 n. 10.

³⁰Killen, pers. comm. 2000.

target, then it would certainly be a strong argument for a relation of 1:1 between the number of women and the number of *pa-we-a*. It would also suggest a *pa-we-a* target that is twice the *te-pa* target (in terms of number of textiles).

Above I argued that the total target of noncollector groups was 534 pieces of cloth (KN Lc[1] 536), and if we assume an approximate relation of one woman to one textile, there should be a total of 534 women in these noncollector groups. To them we could add the women under collectors, and since the collectors were generally involved in 30% of the economy, it follows that there were about 230 women in collector groups.³¹ This does not bring us to “at least 1,000” (as suggested by Killen) but only to 764. If, however, in some places, two women would produce one *te-pa*, as the *se-to-i-ja* tablets might suggest, the total number of women could reach 1,000.

THE PRODUCTION OF *PA-WE-A* *161

Pa-we-a were delivered from work groups to finishers, and after the finishing process they were received and stored. This is recorded by Scribe 116 on the tablets classified as KN Ld(1) that were found in the west wing of the palace.³² The KN Ld(2) set, in contrast, was found in the area of the north entrance passage and records *pa-we-a*₂ *161. As demonstrated above, this type of cloth seems to have been exclusively produced by groups of workers with an occupational designation (and the *da-te-we-ja*). KN Ld(2) records, which are by Scribe 114, all seem to be storage records.³³ Scribe 114 uses detailed descriptions of cloth, and this indicates that *pa-we-a*₂ *161 had undergone a sophisticated finishing process. Scribe 114 also uses terms such as *ki-ri-ta*, *ki-to-na*, *ke-ro-ta*, and *a-*34ka*, which never occur as descriptions of *pa-we-a* in the KN Ld(1) set by Scribe 116.

Generally, the KN Ld(2) tablets contain small quantities of cloth; this corresponds perfectly with the fact that occupational groups also had quite small KN Lc(1) targets. The KN Ld tablets thus highlight the differences between *pa-we-a* and *pa-we-a*₂ *161, which are differences in administration and decoration. However, at present we cannot know whether the cloth type *pa-we-a*₂ *161 was much more sophisticated, or time-consuming, to produce.

³¹ However, collector groups had a much more important *pa-we-a* production, and this may imply more collector workers (Nosch 2000a).

³² Killen 1979.

³³ KN L 870 and KN L 871 may be related in some way to the Ld(2) set, because of Scribe 114(?) and the findplace I3, but they do not record *pa-we-a* *161 and appear to be delivery

A COMPLEMENTARY EXPLANATION OF THE SMALLER TARGETS

A further explanation for the small targets could be that the *ta-ra-si-ja* targets in the KN Lc series were only a small part of the obligations to the palace. It is significant, I believe, that two of the groups discussed above, the *e-ro-pa-ke-ja* and the *da-te-we-ja*, reappear in series recording linen textiles, which are foreign to the *ta-ra-si-ja* fabrics in the KN Lc targets:

KN L(1) 594 (103/F14?)
 .a] ri-ta , pa-we-a
 .b] da-te-we-ja TELA¹ 1 TUN+KI 1

KN Ld(1) 595 (116?/F19?)
 .1] e-ro-pa-ke-ja o TUN+KI 1[
 .2 pe TUN+KI 8 [

There are *ta-ra-si-ja* targets set for the *da-te-we-ja* and the *e-ro-pa-ke-ja* and their production of woolen cloth.³⁴ Yet on the tablets above, the groups are recorded as producing linen *pharwea*, and TUN+KI³⁵ is perhaps a kind of light tunic or chiton (KI = *ki-to*).

Another tablet possibly indicates that the women with occupational designations performed various tasks and were temporarily engaged in another specialized textile activity:

KN Ai(2) 762 + fr. (227/I1)
] ra-ma-na , / e-ne-ra MUL[

On this tablet, one or more women from the village *ra-ma-na* are dealing with *e-ne-ra* (a decoration item for textiles). That the women are not recorded under an occupational designative such as *e-ne-re-ja* (cf. KN Ak[1] 638) may imply that they only temporarily or occasionally dealt with *e-ne-ra*. This hypothesis is strengthened by KN Xe 544. The tablet also suggests that occupational groups could have various activities.³⁶

KN Xe 544 (F10/103)
 .a pe-re-ko[
 .b da-*22-ti-ja / a-ze-ti-ri[-ja

Killen has reclassified this tablet as a KN Lc(1) target and has interpreted line “.a” as *pe-re-ko[-sa/plekon-*

records.

³⁴ KN Lc(1) 540 and KN Lc(1) 534.

³⁵ It occurs on tablets KN L(2) 593, 647, and 5961 by Scribe 103; KN L 870 from I3 by Scribe 114(?); KN L 5917 by Scribe 103; KN L 1649.

³⁶ See Firth and Nosch (2002–2003, 132) on KN Od(1) 544 [+] 5511.

sai (female weavers).³⁷ He suggests that at the place called *da-**22-*to*, the finishers/ *asketriai* were required to weave, that is, to do *ta-ra-si-ja* work.³⁸

It therefore seems plausible that, at least in some cases, the occupational groups and the *da-te-we-ja* performed various activities and produced various types of cloth within the textile industry, that they could be transferred from one activity to another, and that it was only one of their duties to fulfill the KN Lc *ta-ra-si-ja* targets. This suggests that these groups of workers were not extremely specialized but could be assigned various tasks in the textile industry according to the needs of the palace.

CONCLUSIONS

Mycenaean textile production was tied to animal husbandry, since the raw material was obtained from sheep herded in palace-controlled and collector-controlled flocks in Crete. Textile production was also connected to agriculture, since flax and plant dyes were obtained from cultivation on palace land or levied through taxation. Finally, textile production was connected to crafts, skill, and cheap labor. This article has investigated the management structures of the Knossos textile production that interlinked animal husbandry, agriculture, craft, and labor to provide substantial numbers of textiles according to the palace's predefined criteria and needs. The different Mycenaean palace systems testify to various modes of organization, but they were similar in their control mechanisms and in their administrative traditions. Thus, in the Knossos textile administration, we perceive a complex combination of the inherited Minoan decentralized system with strong centralized administrative practices.

A closer examination of the textile production targets (the Lc tablets) yields important insights into the mechanisms of bureaucracy and the organization of the *ta-ra-si-ja* textile industry. The total target for non-collector workers in central Crete was not only the sum of individual targets; rather, the total target was probably established first, and individual Lc(1) targets were subsequently apportioned according to the work strength of the groups and their technical capacities. The "top-down" method, which is also known from the Mycenaean tax assessments, was in use, but it was modified by what seems to be a "double-up" method whereby the sum of different types of cloth equaled the sum of standard *TELA+TE*.

If the total textile production target was set beforehand by the palace and subsequently individual targets were set for the work groups, this may constitute a part of the explanation as to why not all places in Crete were submitted to a *ta-ra-si-ja* obligation.³⁹ Scribe 103 did not distribute the targets equally among the central Cretan villages: only about one-third of the places with flocks of sheep were recorded to fulfill a KN Lc(1) *ta-ra-si-ja* target. Perhaps Scribe 103 simply distributed individual targets until the total amount of desired cloth was reached or, alternatively, the *ta-ra-si-ja* obligation was rotated among the villages.

Some groups had much lower targets than others. These were groups with an occupational designation or with a designation derived from a man's name, such as the *da-te-we-ja*. Groups of women from the villages had to produce 10 times as much cloth. There may have been several differences between the groups with small targets and those with large targets: labor strength, skill, and the time it took to produce the fabrics. Much smaller *ta-ra-si-ja* targets were set for occupational groups and the *da-te-we-ja* for two compatible reasons: there were fewer women in these groups compared with the other groups of workers in the textile industry, and it is plausible that the *ta-ra-si-ja* target was only a part of the obligations of the groups with an occupational designation.

Groups of women in the villages were the main producers of *te-pa*, which was the typical cloth type in central Cretan textile production. In western Crete, the cloth type *pa-we-a* played a major role, and *pa-we-a* were also the typical products of collectors. The cloth type *pa-we-a* *161 was produced by occupational groups, and it was demanded in small quantities by the palace. Thus, there seem to have been some productive traditions or specializations among the work groups, despite the quite standardized repertoire of Mycenaean cloth types.

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³⁷ Killen 1998 (following an observation by Firth 1998, 37).

³⁸ However, it is still possible that on KN Xe 544, two occupational groups, *plekonsai* and *asketriai*, are listed at *da-**22-*to*. Finally, it cannot be ruled out that *pe-re-ko* is the name of a col-

lector. It should also be mentioned that there are other male and female occupational designations for weavers, *i-te-we* and **i-te-ja* (Del Frego et al. 2010).

³⁹ Nosch 1997–2000, 2000a.

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