JOHN T. KILLEN

MINOAN WOOLGATHERING: A REPLY

I

In Kadmos 4, 1965, 111ff. Dr. Douglas Young offers a number of criticisms of my article, The Wool Industry of Crete in the Late Bronze Age, which appeared in BSA 59, 1964, 1—15. The first part of this paper is concerned with a detailed examination of these criticisms, taken in the order in which they may be found in Dr. Young's paper.

Little comment is needed on Dr. Young's opening paragraphs, which are largely devoted to a statement of the problems posed by the Knossos D tablets and of the solution of them suggested in my article. But a word or two is necessary on his remarks (pp. 111—112) on the classification of Knossos tablets. "Killen's paper", he writes, "was based on KT ed. 2 (1959), by Emmett L. Bennett, John Chadwick, and Michael Ventris, revised by Chadwick and Fred W. Householder. The third edition differs importantly in the classification of tablets relating supposedly to sheep in the D series. The original classification was made by Bennett before Ventris advanced his theory for the decipherment of Linear B texts, and was based on ideograms, recurrent groups of signs, format, and scribal hands. In the preface to KT ed. 3 Chadwick and Killen remark that 'a future edition will have to make some drastic changes in classification'. They think it desirable 'that letter-classes should, as far as possible, coincide with sets of documents written at one time and filed together'. This ideal [Dr. Young continues] is far from being realised, and we must keep in mind that we are not dealing, in the Dk or Dl groups of tablets with which Killen is mainly concerned, with the actual files of a group of administrators dealing with flocks. From KT ed. 2 to ed. 3 one notes that 14 tablets have been shifted out of the Dl group, and 28 others have been added to it."

In fact the Dk and Dl groups of tablets as they stand in KT[3] are much closer to being the "actual files of a group of administrators

dealing with flocks" than Dr. Young would suggest. Dr. Young quotes our remark in the preface of KT[3] that "a future edition will have to make some drastic changes" in classification; but our next sentence but one specifically excludes the D tablets from this general statement. "In this edition", we write, "only relatively minor changes have been made, and extensive reclassification has only been attempted in the D series . . .." This reclassification of the D tablets partly involved bringing the original scheme up-to-date, taking account of improved readings and incorporating tablets newly found, and partly the creation of a few new classes: Dp, for example, for records of wool totals. Its aim (like Bennett's earlier scheme) was to group together tablets which appear to have the same function. But Mycenaean scribes tended to be specialists, one writing one kind of records, another another; so much so, in fact, that the scribal hand is itself often a reliable guide to a tablet's proper classification. So the effect of grouping tablets according to function is often that one assembles together all the tablets that a particular scribe has written. Thus with the Dk tablets, for example: as Dr. Olivier has recently confirmed[1], all the texts now classified as Dk whose hand can be positively identified are the work of two scribes only, nos. 119 and 120. As far as we can see, scribe no. 120 wrote nothing but Dk (and Dh, Dp) tablets, and scribe no. 119 only Dk tablets and the small group of tablets (Pp) bearing the ADZE ideogram. The Dl texts are an even more coherent group: all but five of the tablets now assigned to this series whose hand can be positively identified are the work of a single scribe only, no. 118, who is elsewhere attested only on the totalling tablet Dp 997. Furthermore, we can deduce from what we now know of the find-spots of the tablets that all the sheep records in a given scribal hand were originally filed together. All but two of the Dk tablets written by scribe no. 119 whose find-spots are known were found in the East-West corridor (his Pp tablets were all found in Magazine 8); all except one of the tablets in hand 120 whose find-spots are known were found in the Area of the Bull Relief; and, without exception, all the tablets in hand 118 whose find-spots are known were found either in the Area of the Bull Relief or in the adjoining Room of the Spiral Cornice. It will certainly be possible in a future edition, now that we have Dr. Olivier's analysis of hands, to add to the present Dk and

[1] In Les scribes de Cnossos, Rome 1967

Dl series a number of fragments hitherto classified merely as X, Dv, Dx or Od; but Olivier's findings (and what we know of the find-spots) also make it clear how close the Dk and Dl series as they now stand in KT[3] are to being "the actual files of a group of administrators dealing with flocks", and, as far as these tablets are concerned, how much progress has been made between the second and third editions of KT towards achieving our ideal of letter classes corresponding to "sets of documents written at one time and filed together". As Dr. Olivier confirms, only one of the 14 tablets which Dr. Young asks us to note have been shifted out of the Dl group since KT[2] is in hand 118 (the totalling record Dp 997); and of the 26 (not 28) tablets which have been added to the series in KT[3], 17 are in hand 118, and none of the rest is in a hand characteristic of any other group of tablets.

Let us now pass to more detailed points raised by Dr. Young. First, on p. 112, is the suggestion that "detailed study" of the Dk and Dl tablets shows that "a variety of ratios" exists there between sheep totals and wool totals, and does not bear out my (and others') contention that there is normally a ratio of ten sheep: one wool unit on the Dl tablets, and four sheep: one wool unit on the Dk tablets. Table A (p. 114) sets out the evidence which Dr. Young adduces in support of the assertion that the Dk tablets show "a variety of ratios", and is worth quoting in full:

TABLE A

Wool Yields of Rams where no deficit of Wool is noted

Dk Tablet Number	Total of Rams	Total of Wool Units	Average Wool Yield per Ram in lbs.
931 + 7293	100	28	1.792 lbs.
936	25	1 (or 2 or 3)	0.256 (or 0.512 or 0.768)
951	130	26	1.28
1613 + 5597	123	30.3 (?+)	1.579 (?+)
7295	100	16 (or 17 or 18)	1.024 (or 1.088 or 1.152)
7314	100	10 (?)	0.64 (?)

The only complete tablet here is 931 + 7293, which is discussed on p. 9 (n. 49) of my article, and to which we shall return in a moment. None of the other five tablets is complete, as is clearly

shown in KT[3] by the use of square brackets. The reading of 936, for example, is given in KT[3] as:

qi-ta-ro,/da-ra-ko OVIS[m] 25 LANA 1[

As the square bracket shows, the tablet is broken off immediately after the unit sign which follows the wool ideogram. We have no way of telling what the complete wool figure was (though the position of the unit we do have suggests that it was either 2 or 3), nor whether or not a deficit was recorded after the amount shown as 'present'. But on every complete Dk tablet (including 931 + 7293), a deficit in wool (*o*) is noted if the number of units recorded as 'present' falls below one-quarter of the total number of sheep on the tablet, which in the case of 936, where there are 25 sheep, would work out at $6^1/_4$ units, or $6^1/_3$ units if one rounds off to the nearest third of a unit (see below). Thus Dk 920, which is another text in the hand of 936 and is similar in arrangement to it, records 60 sheep, 8 wool units and a deficit of 7 wool units ($7 + 8 = 15$; $15 \times 4 = 60$); and 945 (which is also in the same hand) records 110 sheep, 8 wool units and a deficit of 19 units ($19 + 8 = 27$; $27 \times 4 = 108$). So there must be a very strong presumption that if the number of wool units given as 'present' on 936 was, say, 3, there was also a record on the tablet of a deficit of $3^1/_3$ wool units.

Precisely similar objections apply to the other items in Dr. Young's list. Given that none of the tablets quoted is complete, they cannot be used as evidence for the existence of sheep: wool ratios different from that which applies on complete Dk texts. There is no proof that these tablets did show the same ratio as is found on the complete tablets in the series; but there is equally no proof that they did not, and a strong presumption that they did. How strong this presumption is will be seen from the table below, which sets out the amounts of wool recorded on all Dk tablets on which sheep figures have survived either complete or in part.

Tablet No.	RAMS	WOOL	*o*. WOOL	WOOL TOTAL	$^1/_4$ SHEEP TOTAL
671	120	28	1[	29[+ ?]	30
727	100	?	?	?	25
920	60	8	7	15	15
931	100	28	—	28	25
936	25	1[	?	1[+ ?]	$6^1/_4$

Tablet No.	RAMS	WOOL	*o.* WOOL	WOOL TOTAL	1/4 SHEEP TOTAL
945	110	8	19	27	27 1/2
951	130	26	?	26 [+ ?]	32 1/2
1064	100	7 1/3	17 2/3	25	25
1065	100	11 1/3	13 2/3	25	25
1066	200	19	?	19 [+ ?]	50
1067	100	6 2/3	?	6 2/3 [+ ?]	25
1068	114	26	2	28	28 1/2
1070	100	7	18	25	25
1071	50	6	6 1/3	12 1/3	12 1/2
1072	100	13 1/3	11 2/3	25	25
1073	50	6 2/3	5 2/3	12 1/3	12 1/2
1074	100	19	6	25	25
1075	100	10 [	12 [	22 [+ ?]	25
1076	200	31 [	16 [	47 [+ ?]	50
1077	100	5 [	10 [	15 [+ ?]	25
1320	100	?	?	?	25
1613	123	30 1/3 [	?	30 1/3 [+ ?]	30 3/4
5201	100 [	?	?	?	?
5403	100	19 2/3	4 [	23 2/3 [+ ?]	25
5464	]5 ?	?	?	?	?
5566	100	9	16	25	25
5733	]8	21	?	21 [+ ?]	?
5768	]70	14 [	?	14 [+ ?]	?
7295	100	16 [	?	16 [+ ?]	25
7299	45 ?	4	?	4 [+ ?]	11 1/4 (?)
7304	50	?	?	?	12 1/2
7306	56	9 [	?	9 [	14
7308	]50	10	?	?	?
7311	200	?	?	?	50
7313	]4	2 [	?	2 [+ ?]	?
7314	100	10 [	?	10 [+ ?]	25
7316	]70	]2 [	?	2 [+ ?]	?
7322	]45	?	?	?	?
7323	]6	?	?	?	?
7329	20 [	?	?	?	?
8209	30 [	?	?	?	?

There are in all twelve tablets here on which both sheep and wool figures have survived complete. Seven of them (920, 1064, 1065, 1070, 1072, 1074, 5566) show a ratio of exactly 4:1 between sheep and wool. On a further four (945, 1068, 1071, 1073) the basis of calculation is again clearly this 4:1 ratio, except that, in order to avoid descent into awkward fractions, the wool figures have been rounded off: where the sheep figure is over 100, to the nearest

whole number; where the sheep figure is below 100, to the nearest third of a wool unit (M) : 3M = 1 WOOL unit. There is nothing on the twenty-nine tablets which have incomplete (or possibly incomplete) numerals to suggest that any of them is likely to have shown any different ratio between sheep and wool: on not one of them is the surviving wool total more than one-quarter of the surviving sheep figure. And as for the only complete tablet we have where the wool total does exceed one quarter of the sheep figure (931), this is also the only tablet where we can be certain no deficit was recorded. This is, of course, perfectly in keeping with the suggestion I offered that these total wool figures represent 'targets' based on the number of sheep held, with the 'positive' wool figures showing actual yields and the deficits showing shortfalls. If a target was reached or exceeded, no deficit would presumably be recorded.

Having examined Dr. Young's case for "a variety" of sheep: wool ratios on the Dk series as a whole, we may pass to consider two individual Dk texts which Dr. Young suggests require "special discussion" (p. 114). The first is Dk 1064, where Dr. Young finds it curious "that there is no deficit mark, *o*." on the lower register:

.A X OVIS^{m} 100 LANA 7 M 1
.B *a-te-i-ja-ta / ku-ta-to* LANA 17 M 2

In fact, omissions of this sort are not uncommon on Linear B records. Apart from the identical omission of the deficit sign on Dk 727 (and also on Dl 1060, 2021), one finds a number of comparable omissions on the Da-Dg tablets: the omission of the adjunct on Dg 1226, for instance: the omission of the RAM ideogram on Dd 659. The scribes evidently found it unnecessary to be punctiliously accurate in such details, doubtless because they were writing for a very small public. For anyone who knew what kind of transaction was being recorded, such minor slips would hardly have caused confusion. And it is surely best to assume that the absence of the deficit sign on the present text is also the result of a careless slip, rather than to suppose that among the Dk tablets in hand 119 we have two different kinds of record, each written by the same scribe, each showing the same sheep: wool ratio, but each with a different function.

The other text in question is Dk 5403 + 5562:

.A] OVIS^{m} 98 LANA 19 M 2
.B]OVIS^{m} 2 [ ]LANA 4[

Here, Dr. Young suggests, "one could assume two entries [instead of the normal single entry, with the lower register showing the deficit]: 98 rams yielding an average of 1.29 lbs., and 2 rams yielding an average of 12.8 lbs." One could assume this; but how plausibly? 98 plus 2, as Dr. Young sees, equals 100, which is by far the most common figure for sheep on the Dk tablets; and the epigraphic evidence makes it clear that the total wool figure must have been not less than $23^{2}/_{3}$ and not greater than $28^{1}/_{3}$ units, i. e. a figure in the region of 25 units, which happens to be the amount of wool expected from 100 sheep on ordinary Dk texts. All this is unlikely to be an accident; and we may therefore feel confident that this tablet has in fact the same function as every other Dk tablet, and that what appears on the lower line is not a fresh record of wool production, but the usual record of what is 'missing'.

Dr. Young turns next to a comparison of his Table A (see above) with a Table B, in which he places, besides one Dl text (see below), thirteen Dk tablets which show wool deficits. Table A, it will be remembered, contained tablets supposedly lacking wool deficits; though, as we have seen, it is probable that most of them only lack deficits because they are incomplete. At this point it is again worth quoting Dr. Young's own words: "On Table B [he writes] we have, from 14 flocks, a total of 1304 RAMS, which were set a target (including deficits) of 313.7 (?+) wool units, making an average target per RAM of 1.539 lbs. If the 'deficits' be excluded, the actual yield from these 1304 rams is 166.7 wool units, giving an average actual yield per ram of 0.818 lbs. The spread is from a low average of 0.32 (?+) lbs. to a high of 2.03 lbs. How plausible [he asks] is this result in terms of a real situation dealt with by the bureaucrats of the Knossos Labyrinth? Note [he continues] that on Table A, where no deficit for rams was noted, the average realised target was 1.229 lbs. of wool, a target only four fifths of that set for the rams in Table B. Though set a target a quarter higher than the rams in Table A, the rams in Table B produced an average wool yield only two thirds of that produced by the norm-achieving quadrupeds of Table A. It may be noted that the highest target, that for the rams on tablet Dl 7249 + 7282, is 3.2 lbs., which is double the average target for Table B rams".

The first point to make here is one made earlier: that, apart from Dk 931, there is no evidence that any of the Dk tablets in either Table A or Table B had a sheep: wool ratio other than 4:1. As we have seen, everything points to the reason why there is no

deficit recorded on the tablets listed in Dr. Young's Table A being either that the tablet concerned is incomplete, or (as with 931) that the animals in question have achieved their required target of one quarter of a wool unit per head. 1.229 lbs. may be approximately the correct figure for the average actual yield of the animals recorded on texts in Table A; but there is certainly no evidence that on any of these tablets in their original state the average target set was any less than this norm of one quarter of a wool unit (= c. 1.6 lbs.) per animal. There are, in other words, no grounds whatever for the suggestion that the average target set for the rams in Table B was a quarter higher than that set for the rams in Table A; and to say that the average yield of the rams in Table B is lower than that of the animals in Table A is only to say that the yield of sheep which reach or exceed their targets tends to be higher than that of sheep which do not; for the inclusion in Table A of the only tablet we know where the target does appear to have been reached (931), and of one other where it may have been (1613), naturally raises the average yield of the animals in this small group above that of the animals listed on the texts in Table B, on all of which there are deficits in wool.

But what of Dr. Young's "highest target" of 3.2 lbs. per head, supposedly set "for the rams on tablet Dl 7249 + 7282"? The text in question reads as follows:

.A]OVIS^{m}20 LANA 6 M 1
.B] *o* LANA 3 M 2

This tablet, it will be observed at once, is the only Dl tablet included in Table B, which otherwise contains only Dk tablets. Its classification as Dl, and not Dk, is not merely fortuitous. As Dr. Olivier again confirms, it was written by the scribe of the great majority of Dl texts (no. 118), who is clearly distinguishable from any of the scribes of the Dk tablets. There can be no doubt, in fact, that what we have here is the right-hand end of a Dl tablet of the normal pattern. We may compare, for example, Dl 938, which is also in hand 118, and is similarly broken off at the left:

.A]*jo* OVIS^{f} 50 *ki* OVIS^{m} 40 LANA 7
.B] *o ki* OVIS^{m} 10 *o* LANA 3

Here the standard Dl pattern can be seen more clearly: the 1:1 ratio between female and *ki* animals (OVIS^{f} 50 : *ki* OVIS^{m} 50); and the 10:1 ratio between sheep total (100) and wool total (10).

Once given the analogy of 938, it immediately becomes clear, first, that one must restore *ki* before OVIS^{m} on 7249.A (the line of the break runs through the middle of the OVIS^{m} sign) and, second, that the wool figures given at the end of the tablet must relate, as they do on 938, to the production of the whole 100 sheep which the tablet must originally have listed, and not merely, as Dr. Young assumes, to the production of the 20 *ki* animals who happen to be recorded on the piece of the tablet that has actually survived. In other words, all the indications are that the 'target' set on this particular text was not 3.2 lbs. per head, but precisely the same target as was set on nearly every other Dl tablet — that is to say, one wool unit for every ten animals listed, which works out at .64 lbs. per animal, or 1.2 lbs. per ewe if the *ki* animals were non-productive.

With this "highest target" of 3.2 lbs. per head there also disappears Dr. Young's highest average yield for animals in Table B of 2.03 lbs. per head; for this figure is also derived from Dl 7249 + 7282, and is again based on the assumption that the wool figures on that text only refer to the 20 *ki* animals on the part of the tablet that happens to have survived. Dr. Young's lowest average yield of 0.32 lbs. (?+) per head is derived from Dk 1077 + 5292, where the wool figure is again broken off. Five is the minimum wool figure here: it could have been as high as eight (giving an average yield of .512 lbs.). If therefore we ignore the illusory 'high' average of 2.03 lbs., and substitute for the 'low' figure the lowest complete figure we have, we find that the spread in average wool yield for animals in Table B is actually from .448 lbs. (1070) to 1.79 lbs. (931). On the Dk tablets as a whole (or rather on all those with complete or restorable numerals) the spread is from a low of .43 lbs (1067) to a high of, again, 1.79 lbs. (931), with the average working out at about .96 lbs. Six tablets out of eighteen show an average yield of between .43 and .7 lbs. (.43, .45, .47 (2), .58, .61); six have an average of between .7 and 1.25 lbs. (.72, .77, .84, .85 (2), 1.2); and six an average of between 1.25 and 1.79 lbs. (1.28 (2), 1.46, 1.49, 1.6, 1.79). Two further tablets with less complete wool figures must have shown average yields of between .64 and .83 lbs. and between .93 and 1.09 lbs. respectively. How plausible all this is "in terms of a real situation dealt with by the bureaucrats of the Knossos Labyrinth" we shall be considering in the second part of this paper.

Dr. Young turns next to consider EWES; and, assuming that I am correct in supposing that the Dl tablets are records of breeding

ewes and their progeny (*ki* OVIS^{m}), he compares the lambing targets set on these texts with the actual production recorded on such tablets as show *ki* animals as 'present'. On such tablets, he observes, the average lamb crop is 43.3%, as against a target (in most cases) of 100%; and he notes that the range of yields is 9%, 12.5%, two flocks at 20%, 35.3, 40, 41.7, 50, 75, 80, 88%. The average size of flock, he finds, is somewhat over 55 ewes. Dr. Young notes that in modern Crete the average size of flocks of breeding ewes is 60 animals (though "it is probably coincidence that modern Cretans usually have 60 ewes to a breeding flock": p. 120), and that shepherds regard a 60% lamb crop as satisfactory. He thinks it anomalous (p. 117) "that, in the eleven flocks for which there are actual numbers of lambs (Table C), the actual lamb crop averages 43.3 per cent of the ewes, whereas, on the seventeen flocks for which 'deficits' are noted and the picture is otherwise complete enough for a computation (Table D), the Labyrinth administrators set an average target of 94.63"[2]. "Moreover", he continues, "what are we to make of the thirteen flocks where there is a total failure of the ewes to bear any lambs?".

The problem of the tablets which show 100% deficits in *ki* RAMS is discussed in an appendix to my paper, and Dr. Young quotes me as saying there that "It might perhaps be tempting to think of these huge deficits as reflecting an emergency situation; and the tablets which we possess are certainly those which record the transactions of the palace in the months preceding its destruction". He then proceeds to demonstrate how unlikely such deficits are to have occurred as a result of some "untoward event", and quotes such authorities as a leading Scottish expert and the Greek Ministry of Agriculture on the likely effect upon breeding ewes of scaring by dogs or some similar disturbance. Dr. Young then concludes with the comment that "the thirteen flocks of ewes with totally negative results in achieving their lambing targets may incline some to believe that Killen's whole picture is baseless".

One point should perhaps be made here before we come to the problem of the missing lambs itself. Anyone reading this section of Dr. Young's paper might reasonably be forgiven for supposing that I had actually stated a belief that the enormous deficits in *ki* animals on certain Dl tablets were the result of some emergency, and that Dr. Young, with the help of his expert advisers, was

[2] For discussion of the target of only 50% on Dl 1060, see p. 117 below.

showing me the error of my ways. Now I certainly say in my appendix that "It might perhaps be tempting to think of these huge deficits as reflecting an emergency situation; and the tablets which we possess are certainly those which record the transactions of the palace in the months preceding its destruction". But I immediately follow this sentence with another which gives the passage as a whole a rather different complexion than might be inferred from the extracts given by Dr. Young: "But since deficits of wool on Dl tablets are not abnormally large (compare the deficits of similar proportions found on Dk records), it is unlikely that the solution of the problem lies in this direction". It is unfortunate that the effect of quoting the first of these two sentences without the second is to credit me with views which I actually argue against.

But the question still remains: is the presence of 100% deficits of *ki* RAMS on a large number of Dl texts (and very small 'positive' figures on others) completely incompatible with the explanation of these tablets that I suggested in my article? Certainly, if the deficits imply, as Dr. Young puts it, "a total failure of the ewes to bear any lambs", then my hypothesis — that these are records of breeding flocks — is unlikely to be correct. But is this the only inference which it is possible to draw from these deficiencies? One alternative possibility is surely this: not that the ewes have failed to bear any lambs, but that at the time the records were written the lambing returns were still incomplete. The Dl tablets record three different kinds of information: numbers of ewes 'present' and missing; numbers of *ki* RAMS 'present' and missing; and amounts of wool 'present' and missing. It seems perfectly conceivable that all this information might not have become available simultaneously; that at the time of year when the wool crop was being despatched to the palace, for instance, the current year's lambs were still not mature enough to be separated from their mothers. Indeed it is difficult to think that the Dl tablets, whatever their correct explanation, could really represent complete returns for the year, given these enormous deficits of *ki* animals. Total failure to meet the palace's requirements in certain kinds of tribute, for example, would be just as puzzling as total barrenness among flocks of breeding ewes[3].

[3] There are a numbers of instances on the tablets of the palace administrators dealing with the same subject at what appear to be different stages in the same year. See for example the two sets of Pylos records of women and children (Series Aa, Ab). And there is an almost certain instance on the KN sheep tablets themselves of

Dr. Young next turns to consider the wool yields of the Dl ewes. He begins by setting out the targets set (Table E), and goes on to examine the actual production (Table F). As far as targets are concerned, Dr. Young calculates that there is an average target set of 1.263 lbs., with a range "from a low of 1.024 (?+) lbs. to a high of 1.28 lbs., at which average we find 8 out of the 11 flocks concerned" (my emphasis). On eight of the eleven tablets, in other words, Dr. Young finds that the sheep : wool ratio of 10:1 which I have argued is normal on Dl tablets does in fact hold good; just as his Table D, which sets out the Dl lambing targets, shows that fifteen (out of seventeen) tablets have the 1:1 ratio of EWES: *ki* RAMS which I have also argued is the norm. But what of the exceptions? Do they provide evidence for Dr. Young's "variety of ratios"?

In Table D, the two texts which show a EWE : *ki* RAM ratio other than 1:1 are 463 and 1060; the aberrant texts in Table E are again 463 and 1060, together with 935 + 942. Let us take the last text first. 935 is broken off at the end. What survives of the wool figure is a ten stroke and a trace of a unit sign on the broken edge. The minimum figure is therefore eleven; the maximum is

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a deficit being cleared off in the interval between the writing of two documents on the same subject. On the flock record De 1112 there is a record of a deficiency of 20 sheep (out of 100):

.A OVIS^{m} 57 OVIS^{f} 23
.B *a-ko-mo-ni-jo / ku-ta-to* *o* OVIS^{m} 20

On the shearing record Dk 1067 + 5189, however, what appears to be this same flock is recorded as all 'present':

.A *ki ne* X OVIS^{m} 100 LANA 6 M 2
.B *a-ko-mo-ni-jo / ku-ta-to* [vestigia]

[For the relationship between the Da-Dg and Dk series, see Part II (to follow)]. We can hardly suppose that the 'shorthand' figure on the second tablet includes the animals in deficit on the first: a deficit is recorded on one Dk tablet (5403), and one presumes therefore that one would also have been recorded here if it had still existed. Two caveats must, however, be entered. First, a small element of doubt must remain as to whether De 1112 is the corresponding flock record to Dk 1067. Given all the correspondences between the two tablets (shepherd's name, place-name, total number of animals), it is virtually certain that they do form a genuine 'pair'; but it is a little curious that there is no reference to *ki* sheep on 1112, given that the animals on 1067 are described as *ki ne*; and there is another tablet (X 1472) in the same hand as 1112 which begins with *a-ko-mo-ni*[(though there is no evidence as to where this individual was located). Second, there is the fact that Dk 5403 is in a different hand from most of the other Dk tablets; and it is just possible, though highly unlikely, that this particular scribe had different habits from the rest of his Dk colleagues, and did distinguish animals missing, while they did not.

probably thirteen. Since twelve would give the normal ratio of 10:1 between sheep and wool, there must be a reasonably strong presumption that this is what the original figure was. On 1060, as I pointed out in my article (p. 12, n. 59), the difference in EWE : *ki* RAM ratio (here 2:1, not 1:1) seems clearly connected with the fact that here, instead of the normal *ki* OVIS^{m} signs, we find *ki* OVIS, the form of the SHEEP ideogram without the two crossbars on the upright stem. What this variation implies is quite unclear (for a guess, see my article, loc. cit.); but that it is deliberate is beyond doubt. The same form of the ideogram recurs on 463; but here the problem is complicated by the difficulty of determining what the numerals are: as we note in KT^{3}, "most numerals on this text [are] indistinct, some probably erased".

With the "commonest average" target for ewes of 1.28 lbs. Dr. Young now proceeds to compare (p. 119) what he calculated was the average target for RAMS on those Dk tablets "where no deficit was noted for wool". As we saw earlier, he reckoned this to be 1.229 lbs., "which is below the commonest figure for ewes of 1.28 lbs." But, as we also saw earlier, this figure of 1.229 is derived from a group of texts of which the great majority have every appearance of being incomplete. In fact, as we saw, there is no evidence whatsoever that the wool target on Dk tablets ever fell below c. 1.6 lbs. per animal, and much to suggest that this target is invariable. We shall later be returning to the point which I made in my paper, that these regular targets of c. 1.6 lbs. for RAMS and c. 1.28 lbs. for EWES (plus lambs) correspond very closely to the targets for wool production most usually set for rams and ewes on medieval English estates.

"Further", Dr. Young continues, "on tablet Dl 7132 + 7279, a parcel of 50 ewes and 50 rams are set a wool target totalling 10 wool units, making an average target for each animal of 0.64 lbs., which is half that of the average target most commonly found on the Dl tablets about ewes. The actual average yield from the 100 mixed ewes and rams comes to 0.384 lbs., which is oddly low, though not so low as the average yield of 25 rams on Dk 936, which was 0.256 (?+) lbs."

There is, however, no doubt that 7132 + 7279, like 7249 discussed earlier, is the end of a Dl tablet of the normal pattern:

.A	]OVIS^{f}	50		LANA	6
.B	]OVIS^{m}	50	*o*	LANA	4

The hand is that of the great majority of Dl texts (Dr. Olivier's No. 118); and the ratios both of sheep to wool and of EWES to RAMS are the standard Dl ratios of 10:1 and 1:1 respectively. Thus we can hardly doubt that in the tablet's original state the RAMS on line .B were not unqualified animals, but *ki* RAMS, like all the other RAMS on Dl tablets. There is no epigraphic evidence to suggest that *ki* (or, more likely, *o ki*) did not originally stand before OVIS^{m}: the line of the break runs immediately in front of the OVIS^{m} sign. Thus we can feel certain that the wool target for ewes on this tablet was not "half the target most commonly found on Dl tablets about ewes", but precisely the same — that is to say, 1.28 lbs. per head, assuming that the *ki* RAMS were non-productive.

As far as 936 is concerned, it is quite misleading to suggest that the yield on this tablet is lower than the supposed yield on 7132. It needs to be emphasised that 0.256 is a minimum figure: as we have noted earlier, and as Dr. Young himself observes (p. 114), the broken wool figure on the right hand edge of the tablet could have been 2 or even 3, which would imply a yield of .768 lbs.

As we have already mentioned, the actual wool yields from Dl flocks are set out in Table F. Dr. Young calculates that the average yield is .664 lbs. per animal, and notes that the range is from a low of .32 lbs. to a high of .896 lbs.[4]. How plausible this is "in terms of a real situation dealt with by the bureaucrats of the Knossos Labyrinth" we shall again be considering later.

We must next examine Dr. Young's tables G and H. Here he works out average figures for wool production on Dl tablets on the assumption that wool was expected from *ki* animals as well as from ewes (in Table E, it was assumed that *ki* animals were non-productive). As far as targets are concerned, Dr. Young concludes that the average per animal is .6456 lbs. and that "the range is from a low of 0.594 lbs. to a high of 0.886 (unless one accepts the figure of 26 wool units as the total on Dl 463, as in the second edition of KT: in which case the average target there

[4] We have no idea what the yield was on Dl 2021, which Dr. Young mentions on p. 120. As he correctly points out, "the format of the tablet makes probable the supply of the EWES ideogram at the start of the top line"; but one is not then entitled to say, as he does, that we have therefore "27 ewes yielding (?) 1 wool unit, an average per ewe of 0.236 lbs." Once again, Dr. Young ignores the square bracket which immediately follows the 1 and shows that this is merely all that can be seen before the tablet is broken off.

would be 1.188 lbs.)". We need not linger over these figures, since they are based on exactly the same texts as are included in Table E, which we discussed above. On eight of the eleven tablets the average target is in fact .64 lbs., as it doubtless also was on the ninth (935) in its original state (see above). This average figure is of course half that quoted for the same tablets in Table E, where it was assumed that *ki* animals were non-productive; on all these texts, ewes and *ki* animals appear in equal numbers. For the variation in target on the two remaining texts (again 463 and 1060), see again the discussion of Table E.

In Table H Dr. Young sets out yields found on four Dl texts which record both ewes and *ki* animals as 'present' (463, 938, 947, 1060), and works out the average yield per animal. He finds that "the total wool yield is 30.3 units, making an average per animal of 0.647 lbs."

It is worth quoting in full what Dr. Young has to say on all this. "The average of actual yield [he writes] from four mixed flocks of ewes and lambs (Table H), at 0.647 lbs., is almost exactly the average theoretical target for eleven flocks of largely notional ewes and lambs (Table G), which was 0.6456 lbs. This triumph of State planning by the Labyrinth was achieved even though all four flocks in Table H missed their targets by substantial excess or deficiency, the smallest margin of error being 11.55 per cent."

It does not, however, take long for one to realise that any conclusions based upon these average figures for targets and yields will be entirely valueless unless the target set for both ewes and *ki* RAMS was exactly the same (.64 lbs. apiece); and if of course the *ki* RAMS are lambs this is most unlikely to have been the case. Let us take as an example the tablet Dl 947, which appears in both tables:

.A] *e-se-re-e-jo* OVIS^{f} 80 *ki* OVIS^{m} 10 LANA 11
.B] *ma-ri* *o ki* OVIS^{m} 70 *o* LANA 5

This text lists a total of 160 animals: 80 ewes (all of which are 'present') and 80 *ki* RAMS (of which only 10 are 'present'). The wool target, as usual one tenth of the sheep total, is 16 units, of which 11 are 'present' and 5 are in deficit. 160 sheep as against 16 wool units of c. 6.4 lbs. gives an average target of .64 lbs.; 90 sheep 'present' as against 11 wool units 'present' gives an average yield per animal 'present' of .782 lbs. Hence, according to Dr. Young, these animals have "missed their target by substantial

excess". But in the 160 notional sheep there are equal numbers of ewes and *ki* RAMS; in the 90 actually 'present', ewes outnumber *ki* RAMS by eight to one. All that has happened therefore is that the production of 80 ewes and 10 *ki* RAMS has exceeded the target set for 45 ewes and 45 *ki* RAMS, which is precisely as one would expect if the *ki* RAMS were lambs. What one must of course compare is not these figures for average production and target, which are always likely to mislead, but total production with total target; and a total production of 11 wool units from 80 ewes and 10 lambs seems safely within the bounds of credibility, once we assume, as we certainly must, a lower yield for the younger animals. In other words, there is nothing at all to support the claim that these 90 animals "have missed their targets by substantial excess". Equally, one may suspect that the only reason why the average yield of the sheep in Table G comes as close as its does to .64 lbs. (though not as close as Dr. Young calculates[5]) is that the animals in question happen to include a high proportion of ewes, whose average yield on the tablets as a whole works out at about .66 lbs.

Dr. Young concludes with a discussion of possible wool yields from lambs and some observations on "two possible anomalies". His estimation of what the wool yield of lambs is likely to have been is based on three texts, Dl 413, Dk 1066 and Dk 1067. 413, he notes, "lists 30 *ki* RAMS (= lambs), followed by 2(?+) wool units, and a deficit noted of 2(?+) units. Thus [he continues] we have a minimum target of 4 units, making an average target per lamb of 0.853 lbs. of wool. But the actual yield is 2 units, an average per lamb of 0.427 lbs."

The text in question runs as follows:

.A] *ki* OVIS^{m} 30 LANA 2[
.B] *o* LANA 2[

As Dr. Young himself observes, the tablet is broken both at the left and at the right. We cannot therefore determine what the precise wool figures were; and, more important, we cannot tell whether or not the wool figures refer to the *ki* RAMS alone. But, as we saw earlier, on all other Dl tablets the wool figures at the end of the tablet relate to all the animals listed on the text; and

[5] The wool figure on Dl 1060.A should read 6[, and not 7[, as printed in KT^{3}. With this alteration, the average for the four tablets drops from Dr. Young's .6456 lbs. to .629 lbs.

these invariably include ewes (listed first) as well as *ki* RAMS. Thus the chances must be very high that 413 began with a ewe entry, and that the wool entries at the end relate to both these ewes and the 30 *ki* RAMS. In other words, both Dr. Young's average target of .853 lbs. and his average yield of .427 lbs., which are based on the assumption that the wool figures relate only to the *ki* RAMS, are likely to be far too high.

Dr. Young next examines Dk 1066, 1067, where the RAMS listed are described as *ki ne*. He suggests that if I am right in thinking that *ki* RAM represents a "young animal of either sex" and if Ventris and Chadwick are right in thinking that *ne* may stand for *newos*, 'young', "then perhaps it would be reasonable to think that a *ki ne* RAM is a lamb somewhat younger than some other class of lambs". "On Dk 1066", he goes on to note, "we find 200 *ki ne* RAMS yielding 19 wool units, with an average per lamb of 0.613 lbs. On Dk 1067 100 *ki ne* RAMS yield 6.7 units, with an average of 0.427 lbs."

As evidence for the likely wool yield of the *ki* animals on the Dl tablets these two Dk records are, however, quite unreliable. The difficulty is simply this: that we do not know what range of age the description *ki* may cover, assuming that it does represent some kind of immature animal. Sheep do not become fully mature until they are at least a year old; and *ki* might therefore have been applied to anything from a newborn lamb to a yearling[6]. Apparently, the *ki ne* animals on these two Dl texts are old enough to have been shorn at least once in their careers; but we have no way of telling whether this is also true of the *ki* animals on the Dl records. Nor does the fact that the animals on the Dk tablets are described as *ne* offer us much help, even assuming that it does represent *newos*. *newos* is frequently used on the tablets in the sense, not of 'young', but of 'this year's', as opposed to

[6] In the present article, I have sometimes used the term 'lamb' as a convenient, rough indication of what I take it that *ki* RAM means; but *ki* could well cover a wider (or even different) range of age than 'lamb' usually implies. This is why I preferred to speak in my original article of 'young animals of either sex': a phrase which encounters some criticism on p. 112 of Dr. Young's article. "In plain English", we are told, "a *ki* RAM would be called a lamb". However, the term 'lamb' is properly applied only to animals of about ten months and younger; and other terms are used to describe sheep which have passed this stage, but have not yet achieved full maturity: 'hogg', for example, or 'shearling': a hogg being an unshorn sheep about twelve to fifteen months old, a shearling a ewe between its first and second shearing, aged fifteen to eighteen months.

perusinwos, 'last year's'; and 'this year's' will not necessarily mean 'born this year' as against 'acquired this year' or 'contributed this year'.

We come finally to Dr. Young's two "possible anomalies". The second of these "is on tablet Dl 1046 + 7281, where KT ed. 3, restoring the EWE ideogram, suggests that we have to do with 20 ewes and a deficit of 50 lambs. If [he continues] this is a lambing target, on the pattern of the accompanying tablets classified with it, then it is an unusually optimistic one. But perhaps there is an error in the number 20. A larger figure before 20 may have been destroyed?"

The text as printed in KT[3] shows that 20 is indeed only a minimum figure (there is no question of an error):

.A *e-]ṣe-re-e-jo* [OVIS[f]]20 LANA [
.B]*ra-su-to o ki* OVIS[m] 50 LANA 3̣ [

A V-shaped section of the tablet is missing on the top line, and all that has survived of the assumed EWE entry is two ten strokes to the right of the break. But, given the almost invariable 1:1 ratio of ewes to *ki* animals on Dl tablets, and the fact that nowhere is the number of ewes less than the number of *ki* RAMS, restoration of]20 as OVIS[f] 50 is almost certain to be correct. 50 is normally written (as it is on the lower line) with three ten strokes in the left hand column and two in the right; and a fracture down the middle would consequently leave 20 on the right hand edge.

Dr. Young's other possible anomaly "is on tablet Dk 7306, where KT ed. 3 reads: ?OVIS[m]]4 LANA 9̣[." This, he suggests, would imply that 4 rams had produced 9 wool units, an average per ram of 14.4 lbs. of wool. If this were correct, he continues, "Minos would appear to have had at least one pen of rams as well-fleeced as a champion long-woolled Blackface ram".

But once again the square bracket immediately before the numeral implies, not that this is the total figure (though it might be), but that it is the minimum; all that survives is four strokes, before which the tablet is broken off. In fact, since the publication of KT[3], the missing piece to the left of this tablet has been recognised by Dr. Olivier as (X) 7381, and the two fragments have been re-united[7]. The text now reads:

[7] See J. T. Killen, J.-P. Olivier, 388 raccords des fragments dans les tablettes de Cnossos, in L. R. Palmer, J. Chadwick (eds.), Proceedings of the Cambridge Collo-

? OVIS^{m}] 56 LANA 9[

There is nothing here to suggest that this was not a one-line Dk text of the normal pattern, showing the usual 4:1 ratio between sheep and wool, and doubtless concluding with an entry showing the deficit in wool. Minos' champion flock is, alas, yet another mirage.

[To be continued in the next issue of KADMOS]

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quium on Mycenaean Studies 1966, 89. 9[is perhaps only 4[: the two traces beneath the certain unit strokes are possibly accidental.