

# **ROUNDELS AMONG SEALINGS IN MINOAN ADMINISTRATION : A COMPREHENSIVE ANALYSIS OF FUNCTION \***

A roundel is a clay disk with one or more seal impressions along the edge and without traces of being pressed up against anything. This means that to be a roundel the piece of clay must be roughly circular before it is worked on, and it must be big enough and thick enough to permit seals or signets to be pressed on the edge.

Documents which, according to this definition, need to be excluded from the corpus of roundels are **HT Wc 3020** and **PH Wc 45**<sup>1</sup>. **HT Wc 3020** is one of Weingarten's noduli<sup>2</sup>. It is exactly the same type of document as, for example, **HT Wa 1021**. Both are triangular clay pieces and thus do not have the canonical shape of a roundel. **PH Wc 45** is surely a sealing, and on its reverse can be seen an imprint from the object up against which the clay piece had been pressed<sup>3</sup>.

Doubtful, but nevertheless still included in the discussion which follows, are another four "roundels". **HT Wc 3021**<sup>4</sup> is a fragment which I have not seen personally; **PH Wc 42**<sup>5</sup>, although complete, has no seal impression and is so small and thin<sup>6</sup> that it would hardly permit a seal to be pressed along the edge. Among the doubtful pieces, I also include **KN Wc 42** and **43** as being slightly enigmatic, the first because of its supposed seal impression and palaeography, and the second because of its inscription/incision<sup>7</sup>.

Furthermore a few corrections must be made about several published roundels coming, with one exception, from the Khania excavations. Some are inscribed : **TY Wc 5**<sup>8</sup>, **KH Wc**

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\* Parts of this paper were originally presented at the 3rd International *Marburger Siegel-Symposium, Fragen und Probleme der bronzezeitlichen ägäischen Glyptik* held at Marburg, September 5-7, 1985 and published in the proceedings : E. HALLAGER, "The Use of Seals on the Minoan Roundels", in *CMS Beiheft 3* (1989) 55-78. For some of the more detailed arguments I shall in this paper refer to the *CMS Beiheft* article. I want to thank the Danish Research Council for the Humanities for their support which has enabled me to carry out this research on the Minoan roundels.

1 *GORILA* 2, 78 (**KH Wc 3020**) and *GORILA* 2, 96 (**PH Wc 45**).

2 J. WEINGARTEN, "Some Unusual Minoan Clay Nodules", *Kadmos* 25 (1986) 1-21.

3 I should like to suggest that those two documents should be renumbered to their proper categories : **HT Wa** and **PH Wb** respectively.

4 *GORILA* 2, 78.

5 *GORILA* 2, 95.

6 It is the only "roundel" in the entire corpus with a max. th. of less than .5 cm., and the smallest diameter of all (1.7 cm.).

7 E. HALLAGER, "The Knossos Roundels", *BSA* 82 (1987) 61 and 62.

8 **TY Wc 5** is incised : I. CHAZIDAKIS, *ArchEph* 1912 216, Pl. 16e. A secure reading is doubtful, but I tentatively suggest the reading \*81 (KU), even though the stroke binding the "wings" is missing.

2079<sup>9</sup>, 2095<sup>10</sup>, 2074<sup>11</sup> and 2121<sup>12</sup>. KH Wc 2070 has an inscription on one side only<sup>13</sup>. Two roundels could be more fully restored in drawings<sup>14</sup>; and on another two roundels, the seals could be more fully or correctly restored (Pl. XXI)<sup>15</sup>. Finally it should be added that the inscriptions on KH Wc 2043 and 2044<sup>16</sup> were possibly done by the same hand, which I would tentatively designate no. 61<sup>17</sup>.

Keeping in mind these reservations and corrections to the published roundels, the entire corpus may now be considered<sup>18</sup> (Table 1). There exist all together 171 roundels found at nine localities in Crete and one on the island of Kea. Chronologically the roundels cover the period MM II to LM I B—the oldest being those from the MM II palace at Phaistos. There is an "intermediate group" from Knossos, Mallia, Kea, and Gournia while the remaining appear to be of LM I B date<sup>19</sup>.

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- 9 KH Wc 2079 is inscribed, as also noted by J. RAISON and X. POPE, *Corpus transnuméré du linéaire A* (1980) 211. With the traces actually seen on the roundel there can be little doubt that it is the sign \*411 (the "tripod sign").
  - 10 KH Wc 2095 (seal 16) is incised with two light strokes in a right angle. Considered in the light of the other inscriptions associated with seal 16 and the very fine incision, it would be reasonable to suggest the reading \*164.
  - 11 KH Wc 2074 is also inscribed since a lightly incised stroke can be seen where the roundel is fractured. It is not placed in the center of the roundel (as is most usual) and thus somewhat resembles the position of the inscriptions on KH Wc 2028 and 2067-2068.
  - 12 KH Wc 2121, a fragment which was originally not numbered from the Katré excavations, is clearly inscribed. The sign, however, is not immediately recognizable and no reading shall be suggested here.
  - 13 KH Wc 2070 has been published as having inscriptions on both sides (*GORILA* 3, 140). This, however, is not so. In gluing the three fragments one had been turned upside down. Turned correctly it is seen to have only one inscription \*516, and furthermore it could be calculated to have had originally 6 seal impressions along the edge (seal 22).
  - 14 KH Wc 2032+2088+2089. These three fragments all have the same seal and fabric, and they all come from roundels with an identical diameter for which reason they are thought to belong to the same roundel. Furthermore there is a rough, lightly incised stroke on the fragment 2088 which in all probability constitutes the lower part of the sign \*568. Correctly interpreted the roundel would have at least 15 seal impressions (seal 21, horizontal reading).  
KH Wc 2059+2091+2092. According to seal impressions, composition of clay, surface treatment, color and calculated diameter of fragments, etc., these three fragments appear to be from the same roundel. As restored in the drawing the roundel would have carried at least 11 impressions (seal 28, vertical reading).
  - 15 KH Wc 2113 does not have three, but four seal impressions, two of which have been stamped partly one above the other. Those two may have been stamped after the roundel was inscribed and after the first two impressions had been made (E. HALLAGER, "On the Track of Minoan Bureaucrats and their 'Clients' ", in *Εἰλαπίνη. Τόμος Τιμητικός γιὰ τὸν Καθηγητὴ Νικόλαο Πλάτωνα* (1987) 350-351). KH Wc 2016 was one of the flaked roundels with only one surface preserved. It was, however, possible to glue an unnumbered fragment to this part whereby 1/4 of the reverse of the roundel became complete and two seal impressions were likewise completed.
  - 16 Note the new drawing in *GORILA* 5, 46.
  - 17 Cf. *GORILA* 5, 107-108.
  - 18 The numbers given in the tables below differ slightly from those published in HALLAGER (*supra* n. \*) because of the reservations made above and the discovery of a new roundel from Knossos (cf. J. WEINGARTEN, "A Roundel from Knossos (?) in the Ashmolean Museum", *BSA* 82 [1987] 331-334) and a new roundel from Hagia Triada (V. LA ROSA and G.P. CARRATELLI, "Nuove iscrizioni in lineare A dalla 'Villa Reale' di Haghia Triada", *PdP* 42 [1987] 463-468 and republished by E. HALLAGER, L. GODART and J.-P. OLIVIER, "La rondelle en linéaire A d'Haghia Triada Wc 3024 (HM 1110)", *BCH* 113 [1989]).
  - 19 The dates, except for the Gournia roundel (cf. Weingarten's comment to this paper) are those suggested by F. VANDENABEELE, "La chronologie des documents en linéaire A", *BCH* 109 (1985) 3-20.

Of these 171 roundels, 104 are complete, by which is meant that they are well enough preserved to be certain of : 1. the exact number of seal impressions along the edge; 2. the diameter (and size-group); and 3. the possible inscriptions <sup>20</sup>.

Of the entire corpus, 165 roundels are impressed with one seal only, i.e., the same seal is repeatedly used, while in six instances (2 at Mallia and 4 at Knossos) there are imprints from different seals along the edge <sup>21</sup>.

The roundels may or may not be inscribed with Linear A signs. There are 22 roundels known that are inscribed on both sides <sup>22</sup>, 116 roundels that are inscribed on one side, 14 roundels are definitely not inscribed, while 19 are too fragmentary to determine whether or not they were inscribed.

There are 159 roundels where seal impressions have been preserved, and 62 different seals were used in stamping those (Table 2). As will be seen from the two largest collections at Khania and Hagia Triada, a single seal is often used on more than one roundel (the average number being 5.1 and 3.1 respectively) <sup>23</sup>. At Knossos more seals were used than there are roundels. The reason is that four of the roundels were multi-seal-impressed <sup>24</sup>. It will be seen further in Table 2 that roundels, with the exception of that from Gournia, have always been found together with other administrative documents such as tablets and nodules. It thus seems safe to say that the roundels were in most cases documents intended to be kept in main archives of the different economic units into which Crete was apparently divided during the New Palace Period. That the roundels turn up in such contexts clearly indicates that they were documents with a specific function within the administrative system.

The size of the known roundels varies from a diameter of 1.8 cm. on **HT Wc 3002** to 7.0-7.4 cm. on **KH Wc 2059**. In Table 3 the roundels have been divided by size according to .5 cm intervals of the diameter. This procedure yields 12 groups. All together there exist 163 roundels where the diameter is preserved or can be securely estimated. These 12 groups fall more or less naturally into three main categories : A (1.5-3.4 cm.), B (3.5-5.4 cm.) and C (5.5-7.4 cm.). Half of the roundels fall in category A, a little more than one third into category B, while only 11% fall into the largest size-group.

There exist 115 roundels where all the seal impressions are preserved or where their number can be estimated with certainty (Table 4). On these 115 roundels, 498 impressions are found : an average of 4.3 impressions per roundel. It will further be seen in the column for Average (Av), as would also be expected, that the number of impressions along the edge increases constantly with the size of the roundel from 1.7 in group I to 11.6 in group X—or if we take the large categories, A has an average of 2.8, B and average of 6.3, and C and average of 11.2.

A close investigation of the roundels, however, reveals still more information. Except for nine instances where the edge of the roundel has been used fully for impressions <sup>25</sup>, there is

20 In certain cases criteria 1 and 2 are fulfilled while 3 is not, which means different exact numbers of "completeness" seen in relation to the problem under investigation. Thus we have 163 complete in criterion 2 and 115 in criterion 1, while there are 152 where we can be sure whether or not the roundel was inscribed.

21 HALLAGER (*supra* n. 7) 64-68 and n. 74.

22 In two cases (HT Wc 3001 and 3019) a sign has been incised above a seal impression on the edge. They are here included with the "two-sided inscriptions."

23 At Khania three seals were used much more frequently than the rest : Seal 22 on 31 roundels, Seal 13 on 20, and Seal 11 on 12. At Hagia Triada Seal 31 has been used on 13 roundels.

24 If we exclude the tools of the administration—the prisms with simple symbols (4 all together)—we would get equal numbers of roundels and seals used upon them.

25 These are : KH Wc 2046 (Seal 11), 2019 (Seal 13), 2076 (Seal 22), 2055 (Seal 28), 2005 (Seal 34); GO Wc 1 (Seal GO-Ra), HT Wc 3004 (Seal 31), KN Wc 41 (Seals KN-Rh, -Ri, -Rj, -Rk), and 44 (Seal KN-Rd). It should be noted that these are found in all 3 main categories :

A : HT Wc 3004; KN Wc 41 and 44; and KH Wc 2046



always some space left unused. It may therefore be worth while to investigate how well the space was used within each category. This can be done by calculating how many impressions could have been made along the rim on each roundel and comparing this to the number of impressions actually made. Thereby we can find out what percentage of the rim was used within each category (Table 4) <sup>26</sup>. For the total number of roundels we see that 61% of the available space is used. In Group A it is 53%, in group B 65% and in Group C 76%. The tendency is undeniable : the larger the roundel, the better use of the edge for seal impressions. In other words, the bigger the roundel is, the more efficiently the space on its edge is used .

The obvious conclusion to draw from this observation is that the size of the roundel is dependent exclusively on the number of impressions to be made. In support of this conclusion, it should be noted that the size of the roundel has nothing to do with other factors : such as the seal being used or the type inscription or the peculiarities of the scribe. Thus, for example, we find both seal 13 and seal 22 from Khania and the "tripod sign" (\*411) in all three main categories, while, for example, both Scribes 53 and 54 in Khania are found in size-groups from III to VII <sup>27</sup>.

By considering the reading of the roundel (Table 5), there is a strong indication that each seal was constantly used by one individual. By 'the reading of a roundel' what is meant here is whether one has to hold the roundel vertically or horizontally to see the motif of the sealing in an upright position. There is a slight tendency for the roundels to be read horizontally (53% against 39% while 8% are indeterminable). But when one takes into consideration the shape and motif of the seals and whether the impression was made along or across the edge of the roundel, the picture gets so confused that one must draw the conclusion that there existed no rule as to how the seals were to be read on roundels.

For example amygdaloids with horizontal motif are read both vertically and horizontally as they also are when they have a vertical motif <sup>28</sup>.

Two characteristics, however, are consistent :

1. seal impressions on one and the same roundel are always impressed in the same direction, which means that a roundel is always read either horizontally or vertically— independently of the number of seals on the individual roundel <sup>29</sup>;

2. with four exceptions a roundel is always read the same way when a specific seal is used. Thus for example, all roundels with seal 11 from Khania are read vertically, all with seal 20 horizontally, etc.

The two exceptions connected with seals 13 and 22 from Khania are in all probability due to chance <sup>30</sup>, while the exceptions where the rings are concerned (seals 10 and 28) may perhaps have a rational explanation <sup>31</sup>.

To summarize concerning the reading of the roundels, it can be stated that 16 seals have been used on more than one roundel. On these roundels, the seal is always impressed in the same orientation. Since there is otherwise no consistency in how a seal is used, it must be regarded as a reasonable hypothesis that the way the roundel is impressed is an individual mark of the seal-user.

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B : KH Wc 2076, 2055 and 2005; GO Wc 1

C : KH Wc 2019.

26 Table 4 has been presented in two graphs in E. HALLAGER, "The Roundel in the Minoan Administrative System" in E.B. FRENCH and K.A. WARDLE (eds.), *Problems in Greek Prehistory* (1988) 103, Fig. 2.

27 I have here used the scribes as identified by L. GODART in *GORILA* 5, 107-108. For scribes see further below.

28 Illustrated in HALLAGER (*supra* n. \*) 66, Fig. 7.

29 KH Wc 2113 is the sole exception. But it can be explained (*supra* n. 15).

30 HALLAGER (*supra* n. 1) 63, n. 14.

31 See further below.

This hypothesis can only be proved by identifying finger prints on each single roundel <sup>32</sup>, but there exist a few bits of evidence which seem strongly to support the general idea that there is a single individual behind each seal. The most spectacular concerns the user of seal 31 from Hagia Triada who has a very individual and characteristic way of impressing a roundel <sup>33</sup>.

Having established that we must in most cases recognize an individual, i.e., the same person, behind each seal, it would be interesting to see what relation there may be to the inscriptions and still more to the scribes. A quick look at the distribution of seals and inscriptions at Khania (Table 8) shows that there is no consequent correlation between seal and sign. Thus for example we find the "ship"-sign (\*566) in connection with the seals 5, 10, 26, 28, 30 and 36 and the "tripod"-sign (\*411) in connection with seals 13, 21, 22 and 24. Other inscriptions occur with two or three seals.

It is more interesting, however, to investigate the connection to the scribes. In *GORILA* 5, Godart has identified signs or sign-groups which were written by either the same or different hands <sup>34</sup>. There are two very interesting points to be noted in this connection. The one is that the same scribe occurs with different seals, i.e., seal-users. For example, we find Scribe 54 (sign \*411) with seals 21 and 22; Scribe 56 (sign \*605) with seals 24 and 28 while Scribe 59 (sign \*61) appears with seals 13 and 24 (Table 6). The second interesting point is that we can positively demonstrate that in one case four different scribes were working with or somehow associated with the same seal-user. The seal is number 13 from Khania which Godart has associated with Scribe 59 and Scribe 60, to whom we can safely add the scribes working on the roundels 2110 and 2035 (Pl. XXIIa) <sup>35</sup>.

The conclusion from these observations is that there must have been two individuals (or parties) involved in making a roundel : the scribe and the seal-user. There exists further supporting evidence for this conclusion, partly in the original shape of the roundels, partly in the investigation of whether the roundel was inscribed before or after it was impressed with seals.

When the edge on a roundel is not fully used for seal impressions it is quite often possible to see the original shape of a roundel <sup>36</sup>. There existed three main shapes of roundels before they were impressed : the lentoid, the flaked lentoid and the disk <sup>37</sup>. Since I have not studied the Khania roundels from this point of view, the only significant material is from Hagia Triada where all three shapes have been identified and where we can note that seal 31 is represented on 4 lentoids and 5 disks (Table 7). Since forming a roundel is probably routine work, it does not seem likely that it was the seal-user (31) who formed the roundel. If, however, we consider the scribes in connection with the shapes which have been identified in connection with seal 31, we find that Scribe 109 on **3010** and **3008** is connected with disks while Scribe 107 is found on lentoids on **3001** and **3002**. Concerning Scribe 110, I had noted one (**3012**) to be connected to a disk while on **3011** I had noted "lentoid ?" <sup>38</sup>. However meager this evidence is, I find it

32 This is a project which I hope to be able to carry through in 1990.

33 HALLAGER (*supra* n. \*) 62-63, Fig. 5, n. 11.

34 The paper promised in *GORILA* 5 (p. 83, n. 1) for the identification of the scribes has not yet appeared, but my own observations on the roundels are in agreement with those of Godart. One exception being KH Wc 2022 where I think that sign \*411 is not inscribed by Scribe 54.

35 E. HALLAGER and M. VLAKAKIS, "Two Roundels with Linear A from Khania", *Kadmos* 23 (1984) 9 and n. 30.

36 Unfortunately I only realized this at a late stage in my investigation which, therefore, is not yet complete on this point.

37 The shape in all probability depends on how the scribe (see further below) fashioned the roundel : the lentoid and the disk being formed in the hand while the flaked lentoid was formed on a flat surface.

38 While the flaked lentoid was always easy to identify, it was often difficult to distinguish between the lentoids and the disks; those I noted with a question mark might be considered a borderline between the two.

worthwhile to go back and give it a full investigation since it seems 1. to confirm the observation by both Weingarten<sup>39</sup> and Godart<sup>40</sup> that different scribes were at work on the roundels connected to seal 31; and 2. to indicate that it was the scribe who formed the roundel.

There exist clear impressions from fingerprints on practically all roundels and those fingerprints are most helpful when we want to decide whether the roundel was first inscribed and then sealed or the opposite. When studied in relation to the inscriptions, it is often possible to determine the procedure, which is demonstrated in Pl. XXIIb-c. To the left is **KH Wc 2035**. The finger prints are very clear and it is obvious that the incision of the sign has been made across the papillary lines—in other words the roundel was first stamped and later inscribed. To the right we have an example of the opposite sequence on **KH Wc 2019**. The finger-prints are clear, but they are not marred by the incisions. On the contrary it can be observed how the pressure from the fingers has at places almost closed the incisions and smoothed their original sharp edges. Here in other words we have an example of a roundel which was first inscribed and then stamped.

By going through the entire corpus from this point of view, I could, in most cases, identify with certainty which procedure was followed. In several cases, this could be determined with a high degree of certainty. These are marked with "?" in Table 5. By and large the procedure outside Khania appears to be fairly consistent in that the scribes normally found it necessary to ask the seals-users to make the seal impressions before they made the inscriptions<sup>41</sup>. At Khania the situation is much more complex in that both procedures are used frequently. Furthermore there is no consistency among the individual seal-users. This seems to indicate that the procedure was not a habit or characteristic of the seal-user. If, however, we consider the problem from the point of view of the *scribes*, we get quite a different picture. In Table 6 we can see, with one exception, a consistent pattern<sup>42</sup>! In other words it seems clear that it was the scribe who decided, according to his personal habits, whether or not it was necessary to ask for the seal impressions before the roundel was inscribed.

Discussing the reading of the roundel, we were left with two inconsistencies—both rings—from Khania nos. 10 and 28 respectively. The vertically read impression of no. 10 (**2075**) was found on an uninscribed roundel and therefore not helpful to our present discussion. Three of the four roundels where seal 28 was impressed were, however, inscribed. In this connection it may be worthwhile to note that there were also inconsistencies on the same roundels seen in relation to whether the roundel was inscribed before or after it was impressed (Table 5). But the differences are consistent, i.e., both the horizontal ones (**KH Wc 2027** and **2055**) were first inscribed, then sealed, while the vertical one (**2059**) was first sealed and then inscribed. This indicates that the scribes were different, and it raises the possibility that the seal-users might also have been different.

Three roundels are extremely limited data, but if an investigation of fingerprints confirms that this possibility—that rings may have been used by more than one person—is real, it may have interesting consequences for our understanding of the use of different seal types in the administrative system.

A roundel may have from 1 to 15 impressions along its edge, implying that the number of impressions on a roundel must be significant. This is an observation which seems to have been confirmed by the investigation of the roundel **PH Wc 39**, where obviously one seal impression had been erased and on **KH Wc 2113** where, as far as one can possibly judge,

39 J. WEINGARTEN, "Seal-use at LM IB Ayia Triada : A Minoan Elite in Action I. Administrative Considerations", *Kadmos* 26 (1987) 7-9.

40 *GORILA* 5, 104.

41 Exceptional examples are noted at Knossos, Phaistos and Zakros.

42 **KH Wc 2017** and perhaps **2021**.



two more impressions were added after the first two had been made and on **HT Wc 3024** which originally had seven impressions, but where one had been deliberately covered by smoothing a small lump of clay on top of it <sup>43</sup>.

Another general observation concerning the roundels is that, with very few exceptions, there are never any indications of numbers in connection with the inscriptions <sup>44</sup>. The exceptions, however, are interesting. **GO Wc 1** has the number 5 inscribed behind the ideogram for oxen and the number of seal impressions is 5. **HT Wc 3024** has the number 6 inscribed behind the ideogram for OVIS<sup>f</sup> and it has 6 seal impressions along the edge. In this latter case it even seems as if the number six may have been intentionally written in order to avoid any confusion about the number of seal impressions (cf. above). These two exceptions clearly seem to indicate that the number of seal impressions is intended to indicate the number of units of the commodities which are sometimes inscribed on the roundel.

On **PH Wc 41** there is one impression and we find the number 1 with a fractional sign behind it. If this is to be interpreted as signifying the quantity *one* fractional unit, we are then dealing with a case parallel to **GO Wc 1** and **HT Wc 3024**. If, however, it should be interpreted as *one whole unit plus the fraction*, it is in connection to this specific quantity that we must somehow interpret the single seal impression.

The last exception, **MA Wc 5**, seems now to be misplaced in the Heraklion Museum, meaning that we have no way of checking the published information <sup>45</sup>. According to the publication we find on the .b side the ideogram for WHEAT with the fractional sign A\*707 ('J') followed by the number 4; but the roundel, according to the publication, has only one seal impression. If this is indeed the case, I am not sure that it has to be taken as evidence against the pattern discussed above. Because, as also noted in *GORILA* 5, the combination ideogram + fractional sign is almost exclusively confined to the two crops measured in dry measure WHEAT and CYPERUS <sup>46</sup>. Since the number of fractional signs is limited, one may well imagine that it

43 For the first two, see HALLAGER (*supra* n. 15) 350-351; and for the last, HALLAGER, GODART and OLIVIER (*supra* n. 18).

44 Three roundels need to be commented upon in this discussion : KH Wc 2117 (HALLAGER and VLASAKIS, [*supra* n. 35] 1-3) where on the reverse are found two parallel strokes close to the edge. These, however, are not considered intentional incisions by the scribe, but merely scratches. On KH Wc 2069 the "ideogram" is followed by a stroke with a "hook" and in the published version (I. PAPAPOSTOLOU, L. GODART and J.-P. OLIVIER, *Γραμμική Α τῶν Χανίων* [1976] 150) by still another stroke. The last stroke is a natural "crack" in the clay and the shape of the first makes it impossible to read it as the number 1. Finally the two strokes found on the reverse of PH Wc 40 are probably accidental, cf. also *GORILA* 2, 95.

45 F. CHAPOUTHIER, "Inscriptions minoennes sur une pastille d'argile", *Revue Archéologique* 29-30 (1948) 166-169.

46 The combination WHEAT + fractional sign occurs on ([ = tablet broken, number not known) :

Combination	Number	Tablet
*120'B'	20	HT 86
	60	HT 120
*120'E'	[	HT 44
	7<	HT 125
	70[	KH 1
	[	KH 28
*120'H'	70	HT 108
*120'L <sup>2</sup> '	230	HT 22
*120'KL <sup>2</sup> '	20	HT 86
	74	HT 120
*120'L <sup>3</sup> L <sup>3</sup> '	579	HT 15

\*120'A' must, as also suggested in *GORILA* 5, rather be read as a qualification sign since on HT 102 it is seemingly added with the pure unit \*120 and on HT 128 it occurs parallel to \*120+\*81 (\*120\*81').

may have been necessary to use a combination of fractional sign(s) + numbers to express an exact amount and that it is in relation to this amount that we must interpret the one seal impression on **MA Wc 5**, as was perhaps also the case with **PH Wc 41**.

It is an easy, but dangerous procedure to build too much on an artifact which can no longer be checked. But in my opinion, there is no strong evidence against the theory that the number of seal impressions indicates the quantity of the commodities being treated <sup>47</sup>.

A few roundels—all from Khania—have some physical peculiarities for which I can see no consistency nor any immediate rational explanation. On 11 roundels there can be observed a thin hole in the edge <sup>48</sup>. The diameter of the hole would apparently fit very well the diameter of a stylus. Such holes are not confined to roundels alone. They are found on tablets as well <sup>49</sup>. The depth of the hole varies from 0.5 to 1.9 cm.—apparently unrelated to the size of the roundel. The tendency is the bigger the deeper, but one of the smallest holes of 0.6 cm. is found on size group X (on **2075**). The hole is not connected to any special seal, size, thickness, inscription, or scribe <sup>50</sup>. Nor is there any consistency in the placement of the hole in relation to the inscription. The hole is found below, to the side of, or above the inscription. In most cases, it is placed on the part of the roundel where there are no seal impressions, but on **2044**, for example, this is not so. Only in one characteristic is there complete consistency. The hole never touches the seal impression and it is therefore likely to have been made after the roundel was impressed and also inscribed. One more thing which is (with the possible exception of **2044**) consistent is that the hole always goes in at a right angle to the edge.

Another peculiarity is found on three roundels at Khania <sup>51</sup>: a depression made on the edge rather than in the center of the unused space of the rim. If the physical forming of the roundel, as indicated above, was done by the scribe this may have been a characteristic of a particular scribe. We also see that two of the roundels (**2054** and **2055**) have an identical scribe (56) and I tentatively suggest that sign \*411 on the third roundel (**2021**) may have been done by the same hand. Anyway this peculiarity is not dependent on either seal-user (24 and 28), inscription, or size. Clay analyses have not been made of the roundels, but to the eye and with the help of a magnifying glass it is possible to see clear differences in the tempering of the clay within each archive <sup>52</sup>. At Khania where it was possible to divide the clay of the roundels

47 I am most grateful to Dr. Jean-Pierre Olivier who has pointed out to me that, to judge from the published photographs of **MA Wc 5**, there seems to be not one, but *two* seal impressions and that, if the fractional sign A\*704 ('E')—as generally accepted—means  $1/2$  we have  $1/2 \times 4 = 2$  (= number of impressions).

48 All illustrated in HALLAGER (*supra* n. \*) fig. 2.

49 In fact they occur sporadically on tablets in most archives (cf. descriptions in *GORILA* 1 and 3).

No.	On	Bel	Size	Th	Inc	Seal	Scr	Reading	Depth
2056	x	—	X	e	med	5	57	horiz	0.9
2075	—	—	X	c	—	10	—	vert	0.6
2046	—	?	IV	e	med	11	—	vert	1.7
2110	x	—	VI	d	light	13	—	vert	0.8
2101	x	—	VII	f	deep	13	60	vert	0.3+
2019	x	—	X	f	light	13	—	vert	0.6
2044	x	—	IV	d	med	16	—	horiz	0.6
2007	—	—	III	d	light	22	53	horiz	0.5
2080	—	—	IX	d	—	22	—	horiz	1.2
2010	—	?	XII	f	deep	22	—	horiz	1.9
2024	x	—	VII	—	light	—	54	—	1.5

Abbreviations : On = Fingerprints upon inscription, i.e. the roundel was inscribed before it was stamped with the seal; Bel = Fingerprints below the inscription, i.e. the roundel was inscribed after it was stamped with the seal; Th = Thickness; Inc = Depth of incision; Scr = Scribe; Reading = Reading of roundel.

51 KH Wc 2055 (seal 28), 2054, and 2021 (both seal 24).

52 This investigation of tempering of clay needs a word or two of warning. First of all, the division into clay groups is ultimately based on an arbitrary valuation and may therefore be subject to different opinions.



into three main categories, there is a definite tendency for seals and inscriptions/commodities to be associated with one clay group. This relationship is a little less consistent for the scribes.

At Hagia Triada at least two roundels (**3006** and **3008**) clearly departed from the rest in regard to the tempering of the clay in that they are filled with larger sand corns not discernible in any of the others. **3008** is especially interesting. It has on the .a side the same inscription as found on **3007** and they are both done by Scribe 109. While **3007** is inscribed on one side only, **3008** has added one more inscription on the .b side, emphasizing the difference between the two.

At Knossos one (**30**) was seen to be tempered with small white inclusions not found otherwise.

If the divisions into clay types can, by and large, be accepted, they may perhaps mean one of two things : that clay was differently tempered at the same spot, say, for example, when a new supply of clay was needed; *or* if the clay was usually tempered similarly at one place, it may indicate that the roundels of different clay types were produced at different spots. There exist two different types of multi-seal-impressed roundels : 1. the first type (only represented at Knossos) combines impressions from "ordinary" seals together with impressions from prisms displaying simple symbols or hieroglyphs; 2. the other type found both at Knossos and at Mallia bears impressions from more than one "ordinary" seal (i.e., non-prisms with symbols). These roundels need not have performed any different function from the ones impressed only with one seal <sup>53</sup>.

If we consider the shape and type of seals used on roundels, it will immediately be seen that there is no particular type—nor choice of motif for that matter—connected to those used on roundels. Almost all known types of seals are used on the roundels. Two things, however, are worthy of note : there is a clear tendency 1) to use fewer seal-types and 2) to use more rings towards the close/end of the period <sup>54</sup>.

There exist 138 roundels with 67 different inscriptions. Of these, 34 are sign groups (mainly from Hagia Triada) and 33 are single signs and ligatures. Of these, 14 can, with reasonable certainty, be identified as true ideograms from either Linear A or Linear B <sup>55</sup>. These "ideograms" (where details are naturally open to question) occur on 44% of the inscribed roundels, and it is remarkable that they—with the few exceptions mentioned above—are never followed by numerals! When the "tripod"-ideogram is found, for example, on **KH Wc 2014**, it is not very informative in itself; but when the four seal impressions are related to the sign, we may think of a specific number, and we may perhaps even relate those four "tripods" in some way to a specific person (seal-user 22).

It would thus be tempting to suggest that all inscriptions would be something measurable by the number of seal impressions. But this is not necessarily so. First of all, we see that many inscribed roundels contain supporting information, such as when one finds both ideogram and two sign groups. Secondly we know that there exist at least 14 roundels without inscriptions. This means that, for example, when we have a roundel with one sign group, we cannot be sure whether it is the full spelling of a commodity measured by the seal impressions or whether it is supporting secondary information, thus ranking the roundel with the uninscribed ones as far as the commodity is concerned.

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Secondly and more importantly, the criteria for the division need not necessarily be significant. I am most grateful to Dr. B.P. Hallager who has informed me that at least in LM III pottery, examples are known where the clay of the same pot is tempered differently at various parts of the pot.

53 HALLAGER (*supra* n. 7) 64-68.

54 HALLAGER (*supra* n. \*) 72-73.

55 For details HALLAGER (*supra* n. \*) 67-70.

As indicated above there need not—when viewed from the point of view of a countable unit—be any difference between roundels inscribed with sign group(s) and those without inscriptions. Consequently, the uninscribed roundels need not have had any different administrative purpose than the inscribed ones. Several explanations may be thought of, but the most likely, in my opinion, is that the seal-user was normally concerned with one commodity only within the administration (a type of specialized interest which is well documented in the contemporary Near East <sup>56</sup>). The roundels, therefore, were only inscribed when the commodity in the transaction required some specific qualification or if it was something out of the ordinary <sup>57</sup>.

### The roundel in time and space

The above considerations and conclusions are based on the roundel as an artifact and no attempt has been made to interpret the function of the document. What is worthwhile considering in this connection is that no assemblage of roundels differs in any fundamental ways from the average of the total material. The isolated conclusions reached about each problem we have discussed seem, by and large (i.e., when the collection of data is sufficient), to fit any group of roundels.

Details may change over time (for example, a more limited use of seal-types at the end of the period) or from site to site (for example, to give much more written information at Hagia Triada than at Khania), or we may find odd physical characteristics among the roundels (for example, the multi-seal-impressed); but the roundel seems to be the same in all essential aspects during the entire period from MM II till the end of LM I B. Considering roundels as artifacts, we may be reasonably certain that throughout their existence in Minoan Crete they retained the same basic function.

Before we continue to the interpretation of function, I would like to summarize what the investigation of the roundel as an artifact has strongly indicated :

1. It is a unique document within the Minoan administration which does not seem to change either through time or from site to site.
2. Generally there are two parties involved in making a roundel : the seal-user and the scribe.
3. The size of the roundel is dependent solely on the number of seal impressions it is intended to support.
4. The number of impressions of seals is essential to the understanding of the roundel, and each impression is most likely intended to count a unit of what is sometimes explicitly inscribed.
5. With the possible exception of rings, a single person uses a particular seal.
6. The scribes have individual habits of requiring seal impressions before or after the inscription and probably they had an individual way of forming the roundel initially.
7. Roundels found in the same archive may have been produced at different times or at different places.

If the above results of our investigation so far can be accepted, we are faced with a transaction within the administration where the seal-user acknowledges a certain quantity of a

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<sup>56</sup> As for example also presented by B. Magness-Gardiner in her presentation of the material from Mari in this volume.

<sup>57</sup> See discussion below and HALLAGER (*supra* n. \*) 70-71 and HALLAGER (*supra* n. 26) 109.

commodity to the scribe. Before we proceed to answer the question when such a transaction occurs, it may be worth while to consider three points :

1. What commodities are treated on roundels ?
2. What do we know about the scribe ?
3. What do we know about the seal-user ?

### The commodity

In discussing the commodities we must restrict ourselves mainly to the identifiable ideograms on the roundels. We find different kinds of agricultural products (olives, grain, cyperus, wine, etc.), livestock (oxen, goat, sheep), different kinds of containers (tripods, baskets), different kinds of textiles and probably other items connected to the textile industry (bundles, loom [?]) and perhaps even military equipment (helmet [?] and chariot [?]). The other isolated signs might indicate a still wider range of items and perhaps even services. Apparently there is very little which cannot be treated on a roundel. From what we can recognize, however, agricultural products (including livestock) <sup>58</sup> and textiles seem to be the most prominent : i.e., products which can be grown, bred, sacrificed, stored, worked, given as disbursements, be collected as taxes, traded, transferred, etc. In which of these capacities do we find them on the roundels ?

### The scribes

From the roundels themselves, it would seem that it was the scribes who physically formed the roundels and who by definition inscribed them. Apparently it was also the scribes who decided in which order to perform the procedures to complete the roundel. As seen both at Khania and Hagia Triada, the scribes of the roundels are working with different seal-users. Furthermore, we see at Hagia Triada at least one scribe who is working on different types of documents <sup>59</sup>. If the differences in clay composition at Khania and Hagia Triada imply different places where the clay was kept, we may propose that the scribes were active at different places as they also seem to have been at Hagia Triada <sup>60</sup>. But the fact that the roundels were chiefly found in "main archives" makes it likely that the scribes in most cases were working directly for the central administration.

### The seal-users

The seal-users should be divided into the categories "normal" and "uncertain", considering our reservations stated about rings. But let me start with the normal : usually we shall find only one individual behind a seal, i.e., it was always the same person who was involved with scribe/ administration when a single seal was used <sup>61</sup>. In this normal case, it is tempting to call this person the seal-owner.

The "uncertain" category concerns the rings for which there were ever so slight indications that they might have been used by more than one person. If so, the transactions

58 As also noted in Palaima's paper in this volume in his discussion of the role of the protopalatial centers controlling the basic economic commodities.

59 Scribe 111 works on both roundels (HT Wc 3016) and nodules (HT Wc 3020). Cf. *GORILA* 5, 104.

60 WEINGARTEN (*supra* n. 39) 38.

61 This, however, does not mean that an individual could not have had more than one seal; but on this issue again an investigation of the fingerprints is needed.



would basically express the same thing, but it would not be an individual, but rather an "institution" we had to seek behind the seal—an institution which could hardly be sought anywhere but within the administration itself. For the time being, it may perhaps be more appropriate to talk of "seal-representative." Thus I would, for example, rather prefer to see the seal 125 from Hagia Triada, Weingarten's "over all leader" <sup>62</sup>, as the authority behind seal 125.

But there are also cases where the individuals, i.e. non-rings, can apparently be positively identified with people connected with the administration. At Hagia Triada, seal 79 belongs to the "elite leaders" (of group I) and the same is true for seal 20 at Khania (group II) <sup>63</sup>. There exist a few more cases where we find the same seal on roundels and on nodules <sup>64</sup>, but in these cases we may perhaps not be able to state for sure that they were directly connected with the administration.

Whatever the function of the roundel, we must realize that the transaction expressed by the roundel does in some cases take place between two parties who are *both* employed in the administration, but this need not always be so.

Since I think it is permissible to connect the number of seal impressions to the item inscribed on the roundel, we shall also discover that the seal owner dealt with more than one commodity. However, where many roundels are concerned, there is a tendency for seal owners to deal more with one commodity than with others (Table 8). Thus, for example, seal 22 at Khania is on more than half the roundels connected with the "tripod sign" (\*411), while almost 2/3 of the roundels connected to seal 13 deal with \*61 <sup>65</sup>.

At Khania there are three examples, where we have more than 1 roundel preserved, in which a seal owner deals with one commodity only. Most spectacular are seals 16 and 20 which exclusively deal with some kinds of textiles (\*164) <sup>66</sup>, and less spectacular seal 15 which only occurs with "feet" (\*338). The opposite extreme is attested by seals 24 (a talismanic) and 28 (a ring) each of which occurs on three roundels inscribed with three different items.

When seal owners materialize with more than one commodity, it may be noted that some commodities reappear in pairs with two seals :

- signs \*322 and \*553 appear with seals 11 and 28;
- signs \*553 and \*61 appear with seal 24;
- signs \*61 and \*411 appear with seals 13 and 24;
- signs \*411 and \*100/\*102 [+] appear with seals 21 and 22.

Each of the above mentioned seals appears with one more commodity, except seal 22 which appears with 3 more commodities.

62 J. WEINGARTEN, "The Sealing Structures of Minoan Crete : MM II Phaistos to the Destruction of the Palace of Knossos. Part I : The Evidence until the LM IB Destructions", *OJA* 5 (1986) 285.

63 WEINGARTEN (*supra* n. 62) 283-285.

64 HT 112 (D. LEVI, "Le cretule di Hagia Triada", *AnnScAtene* 8-9 [1925-1926] 122) and KH 5, both found with inscribed nodules, and KH 26 and 28 both found with uninscribed nodules. For Khania see I. PAPAPOSTOULOU, *Τὰ Σφραγίσματα τῶν Χανίων* (1976).

65 \*61, unfortunately, is one of the Linear A ideograms which have not yet been identified. It may in this connection be worthy of note that there seems to exist an iconographic parallel to the sign in one of the Thera frescoes. Of the four signs depicted here



the last three are drawn from *GORILA* 5 while the first is a drawing of the object floating next to the drowning or swimming person found on the "battle-scene" on the west wall of Room 5 of the West House. See for example, C. DOUMAS, *Santorini. A Guide to the Island and its Archaeological Treasures* (1982) 50, fig. 34 (at the very bottom to the left of the left person). The object here is by many believed to represent a shield, but there is no general agreement on this interpretation.

66 As suggested by Godart and Olivier in PAPAPOSTOULOU, GODART and OLIVIER (*supra* n. 44) LX-LXI.

If the "commodity" and number of seal impressions are related, it may also be worthwhile to relate the total number of impressions to the individual signs and seal "owners" to get an impression of the amounts or units each individual is dealing with. We certainly have a double check in that at Gournia one person deals with 5 bulls (**GO Wc 1**), at Hagia Triada one person deals with 6 sheep (**HT Wc 3024**), and at Knossos (**KN Wc 29**) a person deals with 9 goats—all relatively small amounts.

At Khania the "tripod" sign (\*411) is the sign occurring with the greatest frequency. We can connect it to at least 92 seal impressions. If—just as a working hypothesis—this sign depicts a bronze cauldron (such a type in clay is not known at Khania in LM I)—weighing, say, 3.5 kgs.<sup>67</sup>—we are concerned with at least 92 bronze tripods representing more than 300 kgs. of bronze, with half of it connected to seal 22 and a little more than a third to seal 13. This, of course, may not mean very much as long as we do not know with absolute certainty the meaning of this representational sign, but my hypothetical reconstruction warns us against the conclusion that only small scale operations can be expressed on roundels. Evans closed his brief description of the roundels with the following words: "It seems probable that these sealed 'roundels' represented obligations of some sort undertaken by the person or persons whose signet impressions they bore"<sup>68</sup>. Essentially I believe Evans to be correct, but I think that we may venture to be a bit more specific.

The investigation of fingerprints on the multi-seal-impressed KN 41 seems to indicate that there is only one person involved in the "obligation". Even though there are different seal motifs, they have in all probability been impressed by the same person<sup>69</sup>. It would therefore be appropriate to rephrase person or persons to "person or institution whose impression they bore".

We are now, thanks to the large number of roundels and to Weingarten's investigations on nodules<sup>70</sup>, able to ask specific questions. For example: in what capacity would a person at Khania (seal 20) who is employed in the administration be obliged to acknowledge formally to a colleague (Scribe 55) the responsibility for 5 pieces of textile (**KH Wc 2036**)?

Could it be that he was acknowledging a debt of 5 textiles to his colleague, who took the roundel back to the archive where it was kept until the textiles were delivered and the roundel then destroyed as a kind of receipt for a missing or promised delivery? Or could it be that the user of seal 20 had gotten 5 textiles from the magazine for a specific purpose and for which he gave a plain receipt to his colleague who took the roundel back to the archive for further treatment?

Perhaps we may think of more simple or sophisticated explanations; but whatever way we consider the problem, we apparently come back to the fact that one person acknowledges under the authority of the administration a responsibility for a specific number of a commodity. In other words the roundel serves as some kind of receipt, parallels for which may be found in contemporary or slightly earlier Mesopotamia<sup>71</sup>; but parallels which do not seem to occur later in the Mycenaean administration.

67 I am most grateful to Dr. Elpida Hadjidakis for weighing and giving me information on one of the bronze cauldrons in the Khania Museum.

68 A. EVANS, *PM* I, 621.

69 HALLAGER (*supra* n. 15) 348-349, and (*supra* n. 7) 67.

70 WEINGARTEN, (*supra* nn. 39 and 62).

71 Parallels to Ur III, cf. HALLAGER (*supra* n. 26) 107-110 and HALLAGER (*supra* n. \*) 76. In all probability a similar case could be made for Mari where it is tempting to fit the roundels into the transactions concerning the "movable goods" as described by Magness-Gardiner in this volume. In my opinion the copies of receipts issued in Mari might have been avoided if roundels had been used, because one cannot tamper with the seal impressions for the delivered (or received) numbers of movable goods.

If correctly interpreted the Minoan receipt-system is ingenious and unique in that it automatically protects the individual against infringement by the administration. While a scribe may easily change a number on a still damp clay tablet, the numbers cannot be tampered with when they are indicated by seal impressions. We know that within the Mycenaean administration commodities were transferred from magazines to workshops. But receipts were, as far as we know, never issued. The "individual" Mycenaean did not seem to have the same integrity as his Minoan counterpart. Have we here detected a fundamental difference between persons dealing with or employed by a Minoan administrative system vs. a Mycenaean one ?

Erik HALLAGER

#### LIST OF ILLUSTRATIONS

- Pl. XXI : Corrections to the published roundels.  
Pl. XXIIa : Examples of four different scribes working with seal 13 at Khania.  
Pl. XXIIb-c : Examples of fingerprints below (b : **KH Wc 2035**) and on (c : **KH Wc 2019**) inscriptions.



**TABLE 1**  
Overview of Corpus of Roundels

Nature of Inscriptions								
Site	Date	Number	Complete	2-sided	1-sided	None	?	M-s-I
GO	LM I A	1	1	1	0	0	0	0
HT	LM I B	23	21	12	10	1	0	0
KE	MM III	1	1	1	0	0	0	0
KH	LM I B	114	60	1	92	4	17	0
KN	MM III	13	6	3	4	5	1	4
MA	MM III	5	4	1	1	2	1	2
PH	MM II	10	7	3	7	0	0	0
PYR	LM I B	1	1	0	0	1	0	0
TY	LM I B	2	2	0	1	1	0	0
ZA	LM I B	1	1	0	1	0	0	0
TOTAL		171	104	22	116	14	19	6

M-s-I : Multi-seal-impressed

**TABLE 2**  
Statistics on Roundels and their Seal Impressions

Site	RwS	NoS	SpR	Tablets	Nodules	Sealings
GO	1	1	1.0	-	x	
HT	22	7	3.1	x	x	
KE	1	1	1.0	x	-	-
KH	107	21	5.1	x	x	x
KN	12	16	0.8	x	x	x
MA	5	5	1.0	x	x	x
PH	7	7	1.0	x	x	x
PYR	1	1	1.0	x	x	
TY	2	2	1.0	x	x	
ZA	1	1	1.0	x	x	
ARKH				x		
PAL				x		
PYL				x		
PAP				x		
HT : village				x		
KH : town				x	(x)	
ZA : palace				x	x	
<b>TOTAL</b>	159	62	2.6			

RwS : Roundels with seals

NoS : Number of seals used on roundels

SpR : Average seal per roundel

**TABLE 3**  
Size Groups of Roundels

Size	Group	GO	HT	KE	KH	KN	MA	PH	PYR	TY	ZA	TOT	%
1.5-1.9	I		1					2		2		5	3
2.0-2.4	II		11		7	3	2	2				25	15
2.5-2.9	III		7	1	17	3	1	1	1		1	32	19
3.0-3.4	IV		2		16	3		2				23	13
<b>GROUP A</b>		0	21	1	40	9	3	7	1	2	1	85	50
3.5-3.9	V	1			10			3				14	8
4.0-4.4	VI				14							14	8
4.5-4.9	VII				18	3	1					22	13
5.0-5.4	VIII				8	1						9	5
<b>GROUP B</b>		1	0	0	50	4	1	3	0	0	0	59	35
5.5-5.9	IX				2		1					3	2
6.0-6.4	X				10							10	6
6.5-6.9	XI				4							4	2
7.0-7.4	XII				2							2	1
<b>GROUP C</b>		0	0	0	18	0	1	0	0	0	0	19	11
Not measurable			2		6							8	5
Total		1	23	1	114	13	5	10	1	2	1	171	
% of total		1	13	1	67	8	3	6	1	1	1		

**TABLE 4**  
Number of Seals per Roundel by Size Groups

group	NoR	NoS	NoI	Av	NoPI	%oUS
I	3	3	5	1.7	10	50
II	21	13	51	2.4	96	53
III	28	20	68	2.4	144	47
IV	20	13	75	3.8	125	60
<b>A</b>	72	37	199	2.8	375	53
V	11	9	49	4.5	76	64
VI	7	4	39	5.6	73	53
VII	15	7	109	7.3	157	69
VIII	4	2	35	8.8	50	70
<b>B</b>	37	13	233	6.3	358	65
IX	0	0	0		0	
X	5	3	58	11.6	72	81
XI	0	0	0		0	
XII	1	1	9	9.0	16	56
<b>C</b>	6	4	67	11.2	88	76
<b>TOTAL</b>	115	46	498	4.3	819	61

NoR : Number of roundels  
 NoS: Number of seals  
 NoI : Number of impressions  
 AV : Average Number of Impressions per Roundel  
 NoPI : Number of Possible Impressions  
 %oUS : Percentage of used space



TABLE 5

Reading of roundel															Fingerprint/sign				
SEAL	LENTOIDS			OVAL		AMYGDALOIDS				RINGS		F.C.	Cyl.	Th.	TOTAL	O n		Bel.	
	-/h	-/v	U	h/h	v/v	h/h	h/v	v/h	v/v	h/h	h/v	v/h	v/h			sure	?	sure	?
GO-Ra											1				1			1	
HT-31						13									13			11	1
-40							1								1			1	
-79										1					1				
-84										1					1			1	
-112		3													3			3	
-125										1					1			1	
-132										1					1			1	
KE-Ra					1										1				
KH-5	4														4	2			
-6		1													1			1	
-7	1														1			1	
-10										4	1				5		1	1	1
-11		12													12	1	5	3	4
-13						1	19								20	12	1	1	
-15	2														2	1			
-16						4									4	2	1		1
-17		1													1	1			
-20	8														8	4	3		
-21	3														3	1	1		1
-22	30	1													31	8	4	1	3
-24								3							3	1			1
-26		1													1				
-27										2					2				
-28										2	2				4	2		1	
-30											1				1				
-33		1													1	1			
-34	1														1				1
-35										1					1				
-36									1						1				
KN-Ra												1			1				
-Rb				1											1				
-Rc	1														1	1			
-Rd										1					1				
-Re													1		1				
-Rf			2												2			1	1

Reading of roundel														Fingerprint/sign					
SEAL	LENTOIDS			OVAL		AMYGDALOIDS				RINGS		F.C.	Cyl.	Th.	TOTAL	O n		Bel.	
	-/h	-/v	U	h/h	v/v	h/h	h/v	v/h	v/v	h/h	h/v	v/h	v/h			sure	?	sure	?
-Rj-k				2											2				1
-Rl-m		2													2				1
-Rq						1									1				
-Rx						1									1				
MA-Ra				1											1				
-Rb	1														1			1	
-Rc				1											1				
-Rd-e	2														2				
PH-272					1										1	1			
-274					1										1				1
-279					1										1			1	
-271				1											1				
-64			1												1			1	
-Th														1	1				
-275			1												1				
PYR-Ra										1					1				
TY-Ra			1												1			1	
-Rb							1								1				
ZA-Ra											1				1	1			

F.C.            Flattened cylinder  
 Cyl.           Cylinder seal  
 Th.            Thumb  
 On             Fingerprints upon the inscription, i.e. the roundel was inscribed before it was stamped with the seal  
 Bel.           Fingerprints below the inscription, i.e. the roundel was inscribed after it was stamped with the seal  
 h              horizontally  
 v              vertically  
 before slash   reading of motif of seal  
 after slash    reading of roundel, i.e. must one keep the roundel horizontally or vertically to see the motif of the seal  
                  in an upright position

Numeration of seals :

Hagia Triada : LEVI (*supra* n. 64).






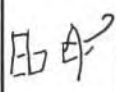




KHania : PAPAPOSTOLOU (*supra* n. 64).

PHAistos : D. LEVI, *ASAtene* 35-36 (1957-1958).

KNossos Rx : J. WEINGARTEN, *Aegaeum* 3 (1989), 51.

Remaining : HALLAGER (*supra* n. \*), 73, n. 35




**TABLE 6**  
The Scribes of Khania

Number	On	Bel	Sign	Size	Th	Inc	Seal	% of Space used
<b>SCRIBE 53</b> 2007 2006	- x	-		III VII	d f	light light	22 22	33% 73%
<b>SCRIBE 54</b> 2017 2018 2015 2011 2014 2016 2009 2012 2023 2024	 x x x x x x ? x x	x		IV IV III IV IV IV VI VII VI VII	e d c c e d e e - -	deep med deep med light light med deep med light	21 21 22 22 22 22 22 22 - -	43% 33% 57% 57% 57% 43% 45% 50% - -
<b>SCRIBE 55</b> 2038 2036 2039 2037	x x x x			II III III IV	c e c d	light light light light	20 20 20 20	40% 83% 40% 72%
<b>SCRIBE 56</b> 2054 2055 2021 (?)	? x	?	 	IV VII V	f f f	light med deep	24 28 24	42% 100% 75%
<b>SCRIBE 57</b> 2057 2056	x x			X X	e e	light med	5 5	84% 86%
<b>SCRIBE 58</b> 2067 2068	x x			IV V	e e	med med	15 15	50% 50%
<b>SCRIBE 59</b> 2034 2001 2033	x x x			V VII VI	e f f	med light deep	13 13 24	- 62% -
<b>SCRIBE 60</b> 2101 2105 2002 2104	x x x x			VIII VII VII VIII	f d e e	deep light deep deep	13 13 13 13	54% 77% 83% 83%
<b>SCRIBE 61</b> 2043 2044	x x			III IV	d d	deep med	16 16	- -

Abbreviations : see *supra* n. 50



**TABLE 7**  
Original shapes of roundels

Shape	GO	HT	KE	KH	KN	MA	PH	PYR	TY	ZA
Lentoid 		4	1	x	2		1	—		—
Flaked lentoid 		1	—			1	2	—		—
Disk 	?	5	—	x				1	1	1

— : not present

x : present, but unknown amount

blank: may or may not exist

SEALS																							
SIGN(S)	5	6	7	10	11	13	15	16	17	20	21	22	24	26	27	28	30	33	34	35	36	TOTAL	
*566	2 <sup>1</sup>			9 <sup>1</sup>										3 <sup>1</sup>		11 <sup>1</sup>	6 <sup>1</sup>				4 <sup>1</sup>	35[	
*645	23 <sup>2</sup>																					23	
*606		5 <sup>1</sup>	2 <sup>1</sup>		39 <sup>8</sup>																	46[	
*553					8 <sup>1</sup>								5 <sup>1</sup>			6 <sup>1</sup>						19	
*191				1 <sup>1</sup>																		1	
*322					4 <sup>2</sup>											2 <sup>1</sup>						6	
*61						70 <sup>10</sup>							8 <sup>1</sup>									78[	
*21						18 <sup>3</sup>																18[	
*411						35 <sup>4</sup>					5 <sup>2</sup>	46 <sup>11</sup>	6 <sup>1</sup>									92	
*338							6 <sup>2</sup>															6	
*164								14 <sup>4</sup>		19 <sup>8</sup>												33[	
*100/102[+]											15 <sup>1</sup>	19 <sup>4</sup>						6 <sup>1</sup>				40[	
*417												10 <sup>2</sup>										10	
*516												8 <sup>2</sup>										8	
*23												4 <sup>1</sup>										4	
*100-352-57									9 <sup>1</sup>													9	
*77-6-30-37																			7 <sup>1</sup>			7	
*none				2 <sup>2</sup>												12 <sup>2</sup>						14	
?	3 <sup>1</sup>			6 <sup>1</sup>		14 <sup>3</sup>						45 <sup>11</sup>				2 <sup>1</sup>				1 <sup>1</sup>		71[	
N.o.I.	2 <sup>4</sup>	1 <sup>1</sup>	1 <sup>1</sup>	2 <sup>5</sup>	3 <sup>12</sup>	3 <sup>20</sup>	1 <sup>2</sup>	1 <sup>4</sup>	1 <sup>1</sup>	1 <sup>8</sup>	2 <sup>3</sup>	5 <sup>31</sup>	3 <sup>3</sup>	1 <sup>1</sup>	1 <sup>2</sup>	3 <sup>4</sup>	1 <sup>1</sup>	1 <sup>1</sup>	1 <sup>1</sup>	1 <sup>1</sup>	1 <sup>1</sup>	520[	

N.o.I. : number of "ideograms" or sign groups which occurs with each seal user

[ : indicates that number of impressions is incomplete

superscript : indicates the number of roundels

**TABLE 8**  
Distribution of Signs on Khania Roundels

**Response by Judith WEINGARTEN**

I would like to congratulate Erik Hallager on his meticulous and convincing study of roundels, hitherto a most puzzling form of mini-document. He does not leave his respondent with a great deal to say.

Some minor points :

1) It is not safe to place the Gournia roundel in LM I B. It is very probably LM I A (which might have something to do with its unusual isolation). The roundel comes from House C 25, one of the older houses on the eastern slope of the town; quarters C and D probably went out of use after an LM I A destruction (S. HOOD, *Thera and the Aegean World I* [1978], 685-686; P.P. BETANCOURT, *Thera and the Aegean World I* [1978], 384).

2) Evidence from sealings does not support the idea that rings were used by more than one person. The most active seal at Ayia Triada, the ring AT 125, stamped 251 nodules : not a single nodule ever has the whole ring impression but, usually, either the left or the right half of the ring. Rather than signifying two different people (right- and left-handed ?), it is, of course, one individual's habit; but, sometimes, mistakenly, the ring-owner holds his ring upside down. Such innocent quirks could also account for the twists on the roundels stamped by rings.

3) Compare the number of scribes working on roundels—as many as four scribes for the seal-owner KH 13—with those working on sealings. At Ayia Triada, at least seven scribal hands inscribed the sign L 88 on nodules stamped by AT 13; in addition, *each* of these seven hands also wrote for at least one other seal-owner.

Perhaps of greater interest :

1) I hesitate to label roundels as 'archival' documents since the roundels from Ayia Triada and Zakro were not with the main tablet hoards. The Ayia Triada roundels were found with six tablets and 850-900 sealings in Room 11/13 of the villa; at Zakro one tablet and one roundel were found with 525 nodules in House A.

2) I wonder therefore if roundels are not more closely related to sealings than to tablets (their inscriptions are closest to those on *noduli*). If so, they may be equally temporary documents, meant for a brief shelf-life and not intended as archival records. Yet roundels are, strangely enough, our closest approach to the sealed written documents known from the Near East. Are there any contemporaneous Near Eastern receipts which are sealed but not normally filed in main archives ?

3) I think it unlikely that roundel inscriptions describe the 'out-of-the-ordinary' transactions. Rather, since there are 138 inscribed roundels versus 14 uninscribed, the latter must be the unusual transactions. This seems the reverse of the situation on Minoan sealings where written descriptions or specifications are rare (and even at Ayia Triada the minimalist inscriptions do not describe products or quantities).

4) The first roundels and the first flat-based document sealings appear at much the same time, the former at MM II B Phaistos and the latter at the (possibly) slightly later Hieroglyphic Deposit at Knossos. Both are Minoan innovations. Both vanish at the Mycenaean conquest and have no obvious replacements in Mycenaean administration, i.e., the Mycenaeans have no use

for either type of document. This implies that both were specialized forms, related, perhaps, to a specifically Minoan social or economic condition.

5) In 1985, Hallager first presented his idea that the number of seal impressions stamped on the roundel's rim counted the units of a commodity, and thus roundels were receipts. The chance find HT Wc 24 at Ayia Triada came in the autumn of 1988; thus, it is something in the nature of the Pylos 'tripod' tablet for Linear B studies that we read : WHEAT 6, while, on the rim, we observe six seal impressions.

## Discussion

### Hallager :

I thank Weingarten for her valuable comments. Here I would like to respond to three of her points of "greater interest". Let me begin with point two. I am quite prepared to agree that the roundels (like noduli and nodules) may be only temporary documents. We may well think that they were intended to be kept only for a limited period of time and that the information recorded on the roundels had to be transferred to other types of documents. Such was the case with similar receipts in the Ur III dynasty, and there may be some evidence for such a procedure in Minoan Crete. This brings me to Weingarten's first point : since the roundels were permanent or more likely temporary documents intended for further registration, it is logical to conclude that they were taken to an archives. The work of Pini and Weingarten has established that the flatbased nodules most likely sealed written documents, and I personally believe that hanging nodules may have done the same. In an "archives" of some kind, therefore, is where the nodules are found, but not necessarily an "archives" where there are many tablets (which may also have been only temporary documents). Since the roundels are found with nodules as well as tablets (cf. table 2 in my paper), I think it is fair to maintain that the roundels were in most cases "intended to be kept in main archives".

Concerning Weingarten's third point, I realize that the expression "out-of-the-ordinary-transaction" is misleading and insufficient. But if we disregard, for a moment at least, the Khania roundels, we shall see that 23 roundels (of which 12 are from Hagia Triada) carry "isolated signs"/ideograms. Of the remaining 33, 10 are uninscribed, while 23 are with sign-groups which, as I argued in my paper, should rank with the uninscribed ones as far as the commodity is concerned. This seems to indicate that there is not always an absolute or urgent necessity to specify the commodity involved. Concerning the Khania roundels (where a seal-user is represented with more than one roundel), there is only one case (Seal 15) where precisely the same ideogram is repeated twice. And I have a *feeling* that in many of the remaining cases—as is certainly the case with seal 16 [\*164 d and e]—the ideograms describe subdivisions of the same general commodity : hence the necessity for an ideogram or a supplementary inscription. I should have expressed myself more precisely. The roundels may be inscribed when the commodity involved in a transaction required further specification or if it was something out of the ordinary. For example, a person exclusively responsible for wool would not need to have his/her roundels inscribed, but a colleague responsible for different kinds of textiles would need an inscription to specify which type of textile is being treated.

### Palaima :

I find Hallager's explanation of the seal impressions on the perimeter convincing. Previously I had argued with him that they were similar to the striated marks placed around the edge of coins in order to guard against tampering. Of course, the larger the perimeter, the more seal impressions are needed. But his explanation must prevail.



**Magness-Gardiner :**

I think, as Hallager has pointed out, that this is very similar to the system at Mari that deals with the internal circulation of goods within workshops. Within the administration of the Mari palace itself, receipts are made for a certain number of goods given out for further processing for which an individual is held accountable. Also in the Near East, the visual appearance of the tablet itself had a meaning. The scribes knew that a small square tablet was probably a receipt, and various other sizes and shapes were used for different procedures. Therefore, if the roundels were used for receipts, could the nodules have been used for some other kind of order? In other words, the very shape of the document might have indicated the nature of the activity involved.

**Pini :**

In the first part of Hallager's paper, he referred to the "seal-user"; and later on he seemed to prefer "seal-owner". For example, he suggested that only the "seal-users" would have metal rings. I would prefer the term "seal-user" in general. We do not know anything about the owner of the seal. In the complex at House A at Zakro, we now can identify 240 seals plus 24 variations of seals. It strikes me as improbable that we have 250-260 seal-owners at work at Kato Zakro. In later tomb contexts like the cemetery at Armenoi, we have up to three seals in one larnax. We have in a tomb excavated recently at Khania nine seals together with one burial. So we do not know how many seals a person could have owned or how many seals could have been used by one person.

**Shelmerdine :**

I do not want to divert the discussion from Hallager's main points, but in LH II/III A :1 we can observe a tremendous proliferation of seal stones found in tombs, several to an individual. It is my own belief that if we had excavations of the right kinds of sites and buildings, we might well find that some of these seals were used for administrative purposes.

**Hallager :**

We certainly cannot be sure that the seal-users did not use more than one seal. I think that the planned investigation of fingerprints on the roundels might give us some insights into this question. On Pini's second point, I only used the term "seal-owner" at the end of the paper in regard to those cases where the same person definitely inscribed and sealed the roundels. But it is impossible to make a clear-cut and definite distinction.

**Marcus :**

I have some questions about the fingerprints that Hallager was just discussing, because I have been interested in fingerprints on the sealings from Hasanlu in Iran. I had the prints analyzed by a unit of the New York City police department. Did he have a similar analysis done or is this planned for the future?

**Hallager :**

In one case I had the fingerprints analyzed, when they were exceptionally clear. I took them to the police department to sort out whether the impressions had been done by the same person. It turned out that this was the case. In one case it was definitely the same person who impressed all three sides of a prism seal.

**Marcus :**

Hallager has had more luck than I had. There were about fifteen sealings at Hasanlu with good fingerprints on them. The sealings were first pressed on a jar or a door or on some container. Then the seal would be rolled, and often the lump of clay would be pressed again to secure it even further. This second pressing would often overlap the seal impression, as Hallager showed, as if there was no concern for the integrity of the seal impression. Of the fifteen sealings, the police experts were able to analyze only those five which had what they call diagnostic ridge characteristics sufficient for comparative study. I was interested in seeing whether they could identify the same individual or tell if the same individual was pressing the

seal or if different individuals were pressing sealings impressed by the same seals. However, they were not able to come up with any good results because of my meager sample. They could not tell me if two separate individuals were involved.

**Hallager :**

In the case of the roundels, the procedure for holding and impressing the clay disk can differ very much from person to person, as it actually did in the case which I had analyzed. This provides further clues for identifying particular individuals.

**Wiener :**

Do you know whether the roundel was inscribed before or after the seal impressions ? If it was inscribed afterward, you could put your fingers on the faces of it, whereas if it was inscribed before you would have to hold it rather gingerly by the edges to avoid obliterating the inscription.

**Pini :**

Some five or six years ago I started to collect fingerprints from many sites on Crete and the mainland. I have hundreds of fingerprints. I went to specialists and the results were again rather disappointing. But I believe that Hallager's work with the roundels will yield better results because of his clear samples. Some roundels preserve complete impressions of the upper part of a finger with the central area of the papillary lines where they come together. If we can match these on other roundels, we can definitely say that the same persons held these roundels.

**Weingarten :**

Did you have better results with the nodules ? One would expect them to have clear fingerprints because they were pinched regularly as part of their manufacture ?

**Pini :**

Not really. There are some papillary lines, but they are not sufficiently diagnostic to yield results along the lines of Åström-Sjöquist. The results would be so tentative as to be almost useless.

**Palaima :**

For those who are interested in this, the reference is to P. ÅSTRÖM and K.-E. SJÖQUIST (appendix by T.G. PALAIMA), *Pylos : Palmprints and Palmleaves* (SIMA Pocket-book 31 : Göteborg 1985) which analyzed the Pylos Linear B tablets in this way. The interesting thing is that the criteria of analysis used to identify tablet-manufacturers by means of palmprints would not convict anyone in a court of law. They lowered their standards a bit in order to suggest identifications from the rather poor data. The criminal courts require more whorl patterns just to make sure that the wrong person is not sent to prison.

**Aruz :**

Because the roundels have inscriptions as well as seal impressions, is it possible that the fingerprints are those of the scribes instead of the seal-users ?

**Hallager :**

I do not think so for two reasons. First of all—and this may not be significant—when I tried to make a roundel myself, I placed the disk on a flat surface to inscribe it. Secondly, in all cases the fingerprints are where one has to press his thumb against the seal in order to make a clear impression. So there is very little to indicate that these are the fingerprints of the scribes.

**Palaima :**

The same applies to the Pylos tablets. The papillary line prints all come from the formation of the tablet rather than the actual handling of the tablet. The number of instances where thumb prints or palm prints seem to be from the scribes are very minimal or undiagnostic.

**Shelmerdine :**

It is interesting that the roundels are in almost every case except Gournia found with tablets. If these are receipts and they are readily transportable, perhaps more so than tablets,

how were they eventually used ? Would they have been made and inscribed in another place along with something verified and sealed, and then brought to their eventual locations so that the information they contained could be transferred to tablets ? Do they imply that writing is going on in other locations ?

**Hallager :**

To answer this I think we would have to indulge in speculation. I think that there would have been two main ways of using the roundels. For example, one can imagine material being transferred within the palace administration from a magazine to a workshop. The roundel would then have been kept in the archives of the person who gave out the material. We may also imagine that things could have been brought from outside a center, and that the roundels would then have served as receipts of delivery. The Gournia roundel may be proof that a person from Gournia at one time gave five oxen to a herdsman and required a receipt.