THE USE OF SEALS ON THE MINOAN ROUNDEL

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In the ordinary sense of the word a roundel is a small circular clay disc which on the edge has one or more impressions from one seal[1] and which is more often than not inscribed with one or more Linear A signs on the one or both sides *(Fig. 1)*.

Up to now 171 such roundels, complete or fragmentary, have been found at nine places in Crete and one has been discovered at Kea. Chronologically they cover the period MM II to LM IB with the oldest coming from Phaistos and the youngest from several sites destroyed at the end of LM IB. The majority of the roundels have been discovered at Khania with a total of 114[2]. Next come Hagia Triada with 24[3], Knossos with 12 and Phaistos with 10, while sites like Mallia, Zakros, Pyrgos, Tylissos and Kea have each produced five roundels or less *(Table 1)*.

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* In the summer and autumn of 1985 I had the opportunity to study all roundels in the Heraklion and Khania Museums respectively. For the facilities and help I received in those two museums I wish to express my gratitude to Dr. Yannis Sakellarakis, Mrs. Eva Grammatikakis and Mrs. Maria Vlasakis. I would like to thank Dr. Gerald Cadogan for permitting me to study and include his roundel from Pyrgos in this study and Mrs. V. Hankey for the information about the context of *PYR Wc 3*. It should be mentioned that to my knowledge there exist only four roundels (*KN Wc 26, MA Wc 5, PH Wc 47* and *MA Wc 5*) out of the total number which are not kept in these two museums.

One abbreviation used in the footnotes other than those found in the Archäologische Bibliographie is:

GORILA 1–5 Godart, L. & J.-P. Olivier, Recueil des inscriptions en Linéaire A. vols. 1–5 (Études Crétoises, XXI, 1–5) Paris 1976–1985.

All references to numeration of Linear A signs are to the new numbers given in GORILA 5.

Hitherto unpublished and/or uninscribed roundels have, in accordance with the numeration system in Khania, been given forthrunning Wc numbers. Thus are the new numbers compared to GORILA:

HT Wc 23: uninscribed roundel, *KH 2119–2121:* three unnumbered fragments from the Katré excavations (*2121* is inscribed), *KN Wc 23* roundel inscribed with "symbol", *25* and *41* two uninscribed roundels, *42* and *43* two clay discs inscribed on two sides, *44, 45* and *46* three uninscribed roundels, *MA Wc 12, 13* and *14* three uninscribed roundels, *PH Wc 45* has been excluded as a roundel since it does not have the characteristic of this document, *PYR Wc 3* uninscribed roundel and *TY Wc 5* roundel with incisions (Hazzidakis, I., Tylissos Minoiki, AEphem 1912, 216, Pl. 16e and *6* uninscribed roundel.

I am grateful to Dr. Geoffrey Bibby for correcting the English text.

Drawings and photographs by the author.

[1] There exist six exceptions to this general rule in that at Knossos there exist four roundels (*KN Wc 3, 30, 41* and *46*) which are multi-seal-impressed and at Mallia two (*MA Wc 13* and *14*). I have argued elsewhere that the multi-seal impressed specimens do in fact express the same basic functions as the ordinary roundels. The multi-seal-impressed roundels from Knossos show impressions from three- or four-sided prisms and ordinary seals and it has been argued that those from the prisms represent the administration and are in fact a substitute for an inscription. When more than one pictorial seal-design is represented on one roundel (*KN Wc 30* and *41* and *MA 13 and 14*) it is argued that it is one individual who has impressed the seals. In the statistics used below I shall therefore only count those impressions as one, i.e. representing one individual.

[2] There are 121 roundels inventoried in the Khania Museum but I have succeded in joining some fragments and ventured to reconstruct others of the fragments in drawing, whereby the number of probably different roundels has been reduced to 114.

[3] There are 22 published, but there exists one more unpublished, uninscribed (*HT Wc 2023*), and since *HT Wa 1029* is exactly the same type of document as *HT Wc 3020* it shall here be considered a roundel.

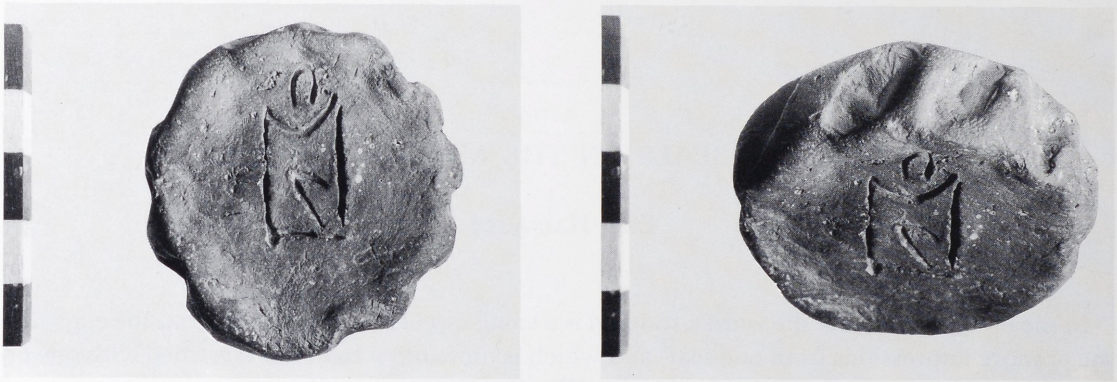

Fig. 1 Roundel from Khania, *KH Wc 2104*. One side inscribed with a single Linear A sign (AB 61) and with 10 impressions of seal 13 along the edge.

If we consider briefly the find context of those roundels we will see that they all, with the exception of Gournia, have been found associated with Linear A tablets and, with the exception of Kea, also with sealings and/or nodules. At Archanes, Palaikastro, Papoura, in the village of Hagia Triada, in some of the houses at Khania, perhaps in the palace at Zakros and at Phylakopi, Linear A tablets have been found without any kind of sealed material associated. This, in my opinion, means that we must recognize at least two different kinds of Linear A archives: those with tablets alone and those with other written documents *(Table 2)*. Written documents, because there can be little doubt that the sealings, as shown by Pini and Weingarten, sealed documents written on parchment[4], while the nodules may have sealed larger rolls of written documents. To the present day only one archive with both tablets and different kinds of sealed material has been identified at each site, and I would suggest that it may be termed the "central archive". That the roundels turn up in such contexts clearly indicates that they were documents with a specific function within the administrative system – an indication which will be further emphasized below.

In *Table 1* it will further be seen that out of the 171 roundels 111 (60%) are completely preserved[5]. 23 of the roundels are inscribed with signs on both sides, whereas 115 are inscribed with signs on one side only. 13 are uninscribed, while 19 are too fragmentary for us to decide whether or not they were inscribed.

The roundels have always been carefully made and they practically always have a very fine polished surface. A few roundels at Khania have a 0.5–1.9 cms deep hole somewhere at the edge *(Fig. 2)*[6], but no roundel has a hole going all the way through or any kind of impressions which

[4] Pini, I., Neue Beobachtungen zu den tönernen Siegelabdrücken von Zakros. AA 1983, 560–562 and Weingarten, J., The Zakro Master and his Place in Prehistory. (SIMA, Pocket-book, 26) Göteborg 1983, 38–42.

[5] My definition of "completely preserved" is a): that both sides must be sufficiantly preserved to determine with certainty whether or not they were inscribed, and b): that enough of the edge is preserved to know with certainty the diameter of the roundel and the exact number of times the seal was impressed along the edge. It should be observed, however, that many fragmentary roundels (especially in Khania) are sufficiantly preserved to decide either criterium a) or criterium b), whereby many numbers used in the statistics are higher than the number of "completely preserved roundels".

[6] Hallager, E., & M. Vlasakis, New Evidence for Linear A Archives from Khania. Kadmos XXV:2 (1986), 114 n. 16.

Table 1

Site	Date[1]	Inscriptions						
		Number	Complete	2 sides	1 side	None	?	M-s-I*
GO	LM IB	1	1	1	0	0	0	0
HT	LM IB	24	23	13	10	1	0	0
KE	MM III	1	1	1	0	0	0	0
KH	LM IB	114	66	1	91	4	17	0
KN	MM III	12	5	3	4	4	1	4
MA	MM III	5	4	1	1	2	1	2
PH	MM II	10	7	3	7	0	0	0
PYR	LM IB	1	1	0	0	1	0	0
TY	LM IB	2	2	0	1	1	0	0
ZA	LM IB	1	1	0	1	0	0	0
Total		171	111	23	115	13	19	6

* M-s-I: Multi-seal-impressed (see n. 1)
[1] According to Vandenabeele (infra n. 39)

HT = Hagia Triada; KN = Knossos; MA = Mallia; PH = Phaistos; KH = Khania; GO = Gournia; KE = Kea; TY = Tylissos; PYR = Pyrgos; ZA = Zakros

Table 2

Site	RwS	Nos	Tablets	Sealings	Nodules
GO	1	1	–	×	×
HT	23	9	×	×	×
KE	1	1	×	–	–
KH	107	21	×	×	×
KN	11	9	×	×	×
MA	5	5	×	×	×
PH	10	7	×	×	×
PYR	1	1	×	×	–
TY	2	2	×	×	?
ZA	1	1	×	×	–
ARKH			×		
PAL			×		
PYL			×		
PAP			×		
HT, village			×		
KH, town			×		
ZA, Palace			×	×	×
Total	162	57			

RwS: Roundels with seal impressions preserved
NoS: Number of seals used on roundels
* Nine fragments of roundels are without impressions

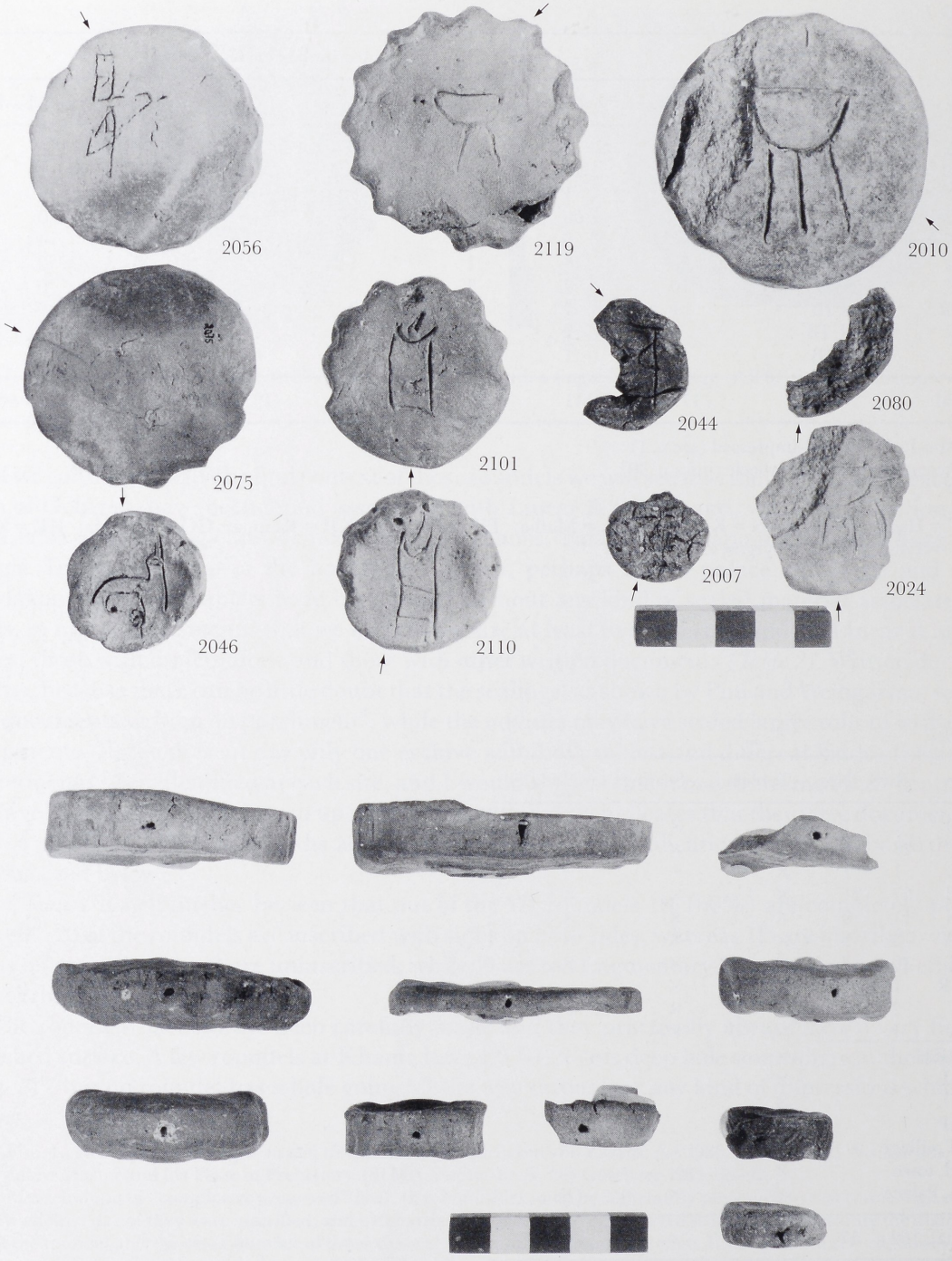

Fig. 2 The 11 roundels from Khania with a 0.5–1.9 cms deep hole in the edge. The arrows indicate the position and inclination of holes.

Table 3

	Size	Group	KH	GO	HT	KE	KN	MA	PH	PYR	TY	ZA	Total	%	%
A	1.5–1.9	I	0		2				2		2		6	4	
	2.0–2.4	II	7		10		2	2	2				23	13	
	2.5–2.9	III	17		9	1	3	1	1	1		1	34	20	
	3.0–3.4	IV	16		1		3		2				22	13	50
B	3.5–3.9	V	10	1					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	34
C	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	11
Not measurable			6		2								8	5	5
Total			114	1	24	1	12	5	10	1	2	1	171		
% of total			67	1	14	1	7	3	6	1	1	1			

might indicate that they could have been attached to another material, as have, for example, the sealings or nodules[7]. All this, together with the find contexts, implies that the roundels were independent documents in themselves, and that they may thus bear witness to a certain type of transaction.

The size of the known roundels varies from a diameter of 1.8 cms on *HT Wc 3002* to 7.0–7.4 cms on *KH Wc 2059 (Fig. 3)*. In *Table 3* the roundels have been divided by size in $^{1}/_{2}$ cm inter-

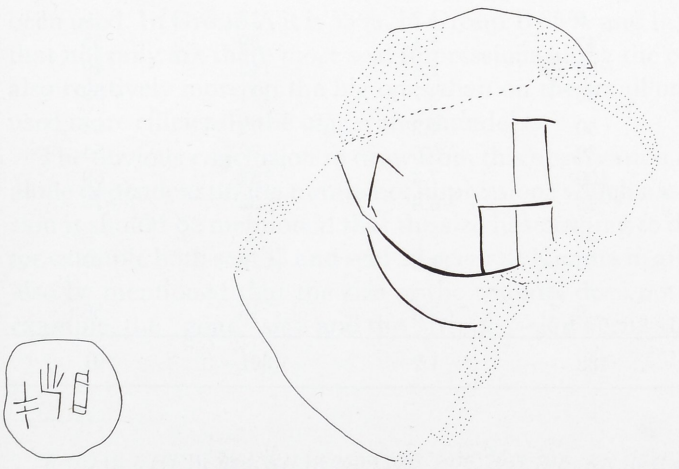

Fig. 3 The smallest (*HT Wc 3002*) and the largest (*KH Wc 2059*) roundel.

[7] This point is also stressed by Olivier, J.-P., Une rondelle d'argile d'Haghia Triada (?) avec un signe en Linéaire A. BCH CVII (1983), 80–81.

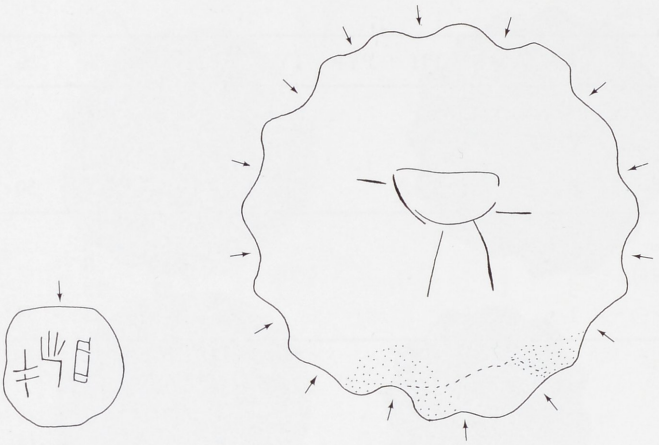

Fig. 4 Roundel with only one impression (*HT Wc 3002*) and 15 impressions (*KH Wc 2019*).

Table 4

Group	NoR	NoS	NoI	Av	NoPI	%oUS
A	72	36	188	2.6	355	53
B	38	14	233	6.1	358	65
C	6	4	67	11.2	88	76
I	5	4	6	1.2	13	46
II	20	12	47	2.4	89	53
III	29	18	69	2.4	142	49
IV	18	12	66	3.7	111	59
V	12	10	50	4.2	79	63
VI	7	4	39	5.6	72	54
VII	15	7	109	7.3	157	69
VIII	4	2	35	8.8	50	70
IX	–	–	–	–	–	–
X	5	3	58	11.6	72	81
XI	–	–	–	–	–	–
XII	1	1	9	9.0	16	56
Total	116	[46]*	488	4.2	801	61

NoR: Number of Roundels
NoS: Number of Seals
NoI: Number of Impressions
Av: Average impressions pr. roundel
NoPI: Number of possible impressions
%oUS: Percentage of Used Space
* Many seals were used in several groups, and 46 is the number of different seals

vals of the diameter, which gives 12 groups. Altogether 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 cms), B (3.5–5.4 cms) and C (5.5–7.4 cms). Half of the roundels fall into category A (50%). A little more than one third (34%) fall into category B and 11% into category C. 83% have a diameter below 5 cms.

Having recognized this difference of size the next step is to investigate the number of seals on the roundels and their possible relation to the size of the roundels. The number of impressions on the preserved roundels vary from one, for example on *HT Wc 3002*, to 15 on *KH Wc 2019 (Fig. 4)*.

In *Table 4* it will be seen that there exist 116 roundels where the complete number of impressions is preserved or can be estimated with certainty. On these 116 roundels 488 impressions are found, which gives an average of 4.2 impression pr. roundel. It will further be seen in the column "Av", as would also be expected, that the number of impressions along the edge increases constantly with the size of the roundel, from 1.2 in Group I to 11.6 impressions pr. roundel in Group X – or if we take the large groups: A has an average of 2.6, B an average of 6.1 and C an average of 11.2.

A close investigation of the roundels, however, reveals still more information. Because – except for nine instances where the edge of the roundel has been used fully for impressions[8] – there is always some space left unused, and it may therefore be worth while to investigate how well the space was used within each category. The procedure to find this out was to count on each roundel the actual number of impressions and to calculate how many more impressions there could have been to use the edge fully. The result of these investigations is given in *Table 4*. For example, if we take Group IV, there are 18 roundels which can be used in the statistics. The next column shows that 12 different seals were used on the 18 roundels. The next shows that there exist 66 impressions on the 18 roundels, while the column "NoIP" shows that there was actually space for 111 impressions. This means that only 59% of the available space was used and this is what is shown in the last column. For the total number of roundels we see that 61% of the possible space has been used. In Group A it is 53%, in Group B 65% and in Group C 76%. The amazing result is, that not only are there more seal impressions along the edge the bigger they are, but there are also relatively more on the big ones than on the small ones. In other words the given space is used more efficiently the bigger the roundel is.

The obvious conclusion to draw from this observation must be, that the size of the roundel is alone dependent on the number of impressions which has to be made. In support of this conclusion it should be mentioned that the size has nothing to do with which seal is being used, since for example both seal 13 and seal 22 occur at Khania in all three main categories[9]. And it should also be mentioned that the size of the roundel does not depend on the inscription, since, for example, the "goat"-sign and the "tripod"-sign occur at Khania in all three categories[10].

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[8] *GO Wc 1, HT Wc 3004, KH Wc 2046, 2005, 2076, 2055, 2019, KN Wc 41* and *44*.

[9] Seal 13: *KH Wc 2035* (III), *2110* (VI), *2019* (X)
Seal 22: *KH Wc 2066* (III), *2030* (VI), *2010* (XII).

[10] Goat-sign on *KH Wc 2102* (III), *2019* (VIII), *2063* (XI)
Tripod-sign on *KH Wc 2015* (III), *2009* (VI), *2010* (XII).

Table 5

	HT, Seal 31				KH, Seal 11				KH, Seal 13				KH, Seal 22			
Group	NoR	NoI	NoPI	%oUS	NoR	NoI	NoPI	%oUS	NoR	NoI	NoPI	%oUS	NoR	NoI	NoPI	%oUS
I	1	1	4	25												
II	7	22	34	65	1	3	5	60					1	1	4	25
III	4	12	20	60	3	7	13	54	2	6	13	46	3	8	19	42
IV	1	3	6	50	4	20	27	74					4	15	28	54
V					3	14	25	56	1	5	9	56				
VI									1	8	12	67	4	17	38	45
VII					1	7	9	78	3	27	38	71	7	49	78	63
VIII									3	28	38	74	1	7	12	58
IX																
X									2	27	30	90				
XI																
XII													1	9	16	56
Total	13	38	64	59	12	51	79	65	12	101	140	72	21	106	195	54
%AfGI				53				59				63				59

%AfGI: Average for Groups Involved in percentage
Remaining abbreviations: see Table 4

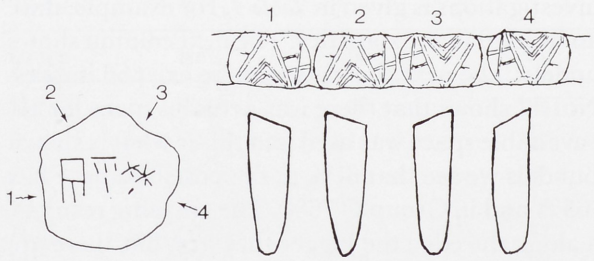

Fig. 5 Seal 31 from Hagia Triada revealing the individuality of this seal-user. The profile drawings are schematic – not measured.

The general trend expressed by all roundels may be tested on the individual seals (or seal-owners?). Four seals have been used on 12 or more measurable roundels *(Table 5)*. When we disregard those groups where only one roundel is involved we recognize in seals 13 and 22 from Khania the general rule that the larger the roundel, the better the use of the rim, whereas seal 31 from Hagia Triada and seal 11 from Khania diverge slightly from the "rule". This may be taken as an indication of an individual use of the seal. The same may perhaps be inferred when one compares the individual seals with the average of the groups involved. Seal 31 at Hagia Triada and seals 11 and especially seal 13 at Khania economize more with the space than the average (seal 13 has a 9% better use of rim), while seal 22 from Khania uses the space less well than the average.

Concerning seal 31 from Hagia Triada one more feature exists which emphasize that this seal was used by one person only. On eight of the roundels where more than one seal was impressed

it could be observed that the motif from the seal was in several cases turned upside down[11]. By studying the profiles of these roundels it becomes clear that the user of seal 31 after one or two impressions twisted the hand holding the roundel 180° for a second or third impression whereby the impression would appear upside down compared to the previous one, although the seal was kept in the same position during the impression procedure *(Fig. 5)*. The user of seal 31 is the only one among all those involved with roundels who has this characteristic[12].

In general terms there exists another feature which may point to an individual use of the different seals, and that is when we consider the "reading" of the roundel. By reading is meant: whether one has to keep the roundel vertical or horizontal to see the motif of the sealing in an upright position. In *Table 6* it can be seen that there was a tendency for the roundels to be read horizontally (53% against 39% vertically and 8% indeterminable); but when one takes into consideration shape and motif 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 absolutely no rule as to how the seals were to be read on roundels.

In *Fig. 6* it will be noted that lentoids are read both horizontally and vertically, while eliptical impressions with horizontal motif are read horizontally and elliptical impressions with vertical motif are read vertically. *Fig. 7* demonstrates how amygdaloids with horizontal motif are read both vertically and horizontally – as they also are when they have a vertical motif. Also the rings, which are found only with horizontal motifs[13] are read horizontally as well as vertically *(Fig. 8)*.

Two things, however, are consistent:

1. The seals are always impressed in the same direction on the roundels, i.e. a roundel is always read either horizontally or vertically – independently of the numbers of seals on the individual roundel.

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 exceptions to the last rule are in all probability only due to chance[14].

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[11]

No	Group	Reading	No	Group	Reading
2023	I	↑	*3011*	II	↓ ↑
3002	II	↑ ↑ ↑	*3004*	II	↑ ↓ ↓ ↑ ↑
3001	II	↓ ↑ ↑	*3006*	III	↑ ↑
3003	II	↑ ↑ ↑	*3009*	III	↑ ↑ ↑ ↑
3005	II	↓ ↑	*3010*	III	↑ ↓ ↓ ↓
3007	II	↑ ↑ ↓ ↓	*3012*	III	↑ ↑ ↑
			3008	IV	↓ ↑ ↑

[12] Only in two other instances on *KH Wc 2102* and *2113*, can we observe something similar, where seal 13 and seal 11 respectively are impressed upside-down. In those cases, however, it was a different procedure which caused the upside-down impressions. For *KH Wc 2113* see Hallager, E., On the Track of Minoan Bureaucrats and their "Clients" in Εἰλαπίνη. Τόμος Τιμητικὸς γιὰ τὸν Καθηγητὴ Ν. Πλάτωνα. Heraklion 1987, 347–353.

[13] One possible exception may be the impression on *HT Wa 1021* which is difficult to read, but displays Levi's type 107. Levi, D., Le cretule di Haghia Triada, ASAtene VIII–IX (1925–26), 119–120, Fig. 123.

[14] When in the summer 1985 I made 10 roundels (unaware of the problem under discussion) eight had to be read horizontally and two vertically. The first was made vertically, thereafter horizontally with the exception of one very small (Group III). The exceptions on seals 13 and 22 are also small compared to the majority of their roundels.

Table 6

Shape	Reading	HT									KN								MA				PH							
		15	31	40	79	84	107	112	125	132	a	b	c	d	e	f	j–k	l–m	a	b	c	d–e	272	274	279	271	340	64	Th
Lent.		1											1							1										
								1										1				2								
	U															2											1	1		
Ellip.			13								1					2										1				
																			1	1			1	1	1					
Amygd.				1																										
Ring					1	1			1	1			1																	
							1																							
Fl. cyl.											1																			
Cyl.															1															
Thumb.																													1	
		1	13	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1	

U: uncertain (reading)
H: horizontal
V: vertical

It should be noted that the way of reading the roundel has nothing to do either with the scribes or with the inscriptions. This is clearly seen, for example, in connection with seal 13 from Khania where at least three different scribes have been making the sign AB 61 *(Fig. 9)*[15]. Further it will be noted that where apparently the same scribe has been involved, different seals have been variously impressed – as for example seen in connection with AB 61[16].

To sum up concerning the reading of the roundels, it can be stated that 16 seals have been used on more than one roundel. On these there is a consistency in the seal always being impressed the same way. Since there is otherwise no consistency in how the 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-

[15] Hallager, E. & M. Vlasakis, Two New Roundels with Linear A from Khania. Kadmos XXIII (1984), 9.

[16] According to Godart in GORILA 5, 107, "Scribe 59" is responsible for both *KH Wc 2033* with seal 24 read horizontally and for example *KH Wc 2001* with seal 13 read vertically.

KH																							GO	KE	TY		PYR	ZA				
5	6	7	10	11	13	15	16	17	20	21	22	24	26	27	28	30	33	34	35	36	a	a	a	b	a	a	Total	H	V	U
4		1				2			8	3	30																9	9		
				12				1			1										1						7		7	
																							1				4			4
																		1									5	5		
	1												1				1						1				9		9	
					1		4																				3	3		
					19																				1		2		2	
												3															1	1		
																				1							1		1	
			4											2	2				1				1				11	11		
			1												2	1											3		3	
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																											1	1		
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																											1			1
4	1	1	5	12	20	2	4	1	8	3	31	3	1	2	4	1	1	1	1	1	1	1	1	1	1	1	59	31	23	5

owner/user. In other words, the reading of the seals on a roundel is dependent on the seal-owner/user and not on the scribe, and it may be concluded that it was the seal-owner himself who stamped the roundel independently of whatever scribe was responsible.

We have so far seen that there appears to be an individuality behind each seal, and we have seen that the numbers of impressions on a roundel increase relatively the larger the roundel is, implying that the size of the roundel is dependent on the number of impressions. This clearly indicates that the person who made the roundels must have known in advance how many times the actual seal was going to be impressed. It also clearly implies that the number of impressions is important for the "transaction" expressed by the roundel. And it further implies that there must have been an agreement as to the kind of transaction before the actual roundel was made and that the transaction was then confirmed by impressing the seal a specific number of times along the edge.

A further implication of all this – taken together with the fact that different scribes are involved with the same seal – is that there must have been two parties involved in the transaction expressed by the roundel: the seal-owner who confirmed the transaction, and the one who expressed the transaction – call him the scribe and let him be a representative of the central administration.

Fig. 6 Lentoids and elliptical impressions from Khania. Seals are from left: 6, 10, 22 (top) and 34.

Fig. 7 Amygdaloids from Khania. Seals from left: 16 (top), 24, 36 and 13.

Fig. 8 Rings from Khania. Seals from left: 28 and 30.

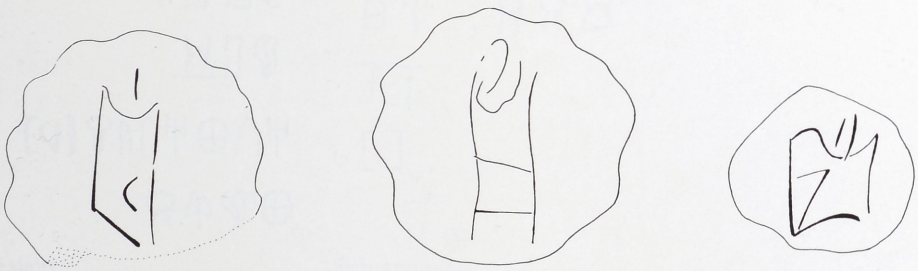


Fig. 9 Three different handwritings of sign AB 61. All on roundels of seal 13. (*KH Wc 2033, 2110* and *2035*).

And this leads to a few words about the inscriptions. Because, since the roundels were made to carry a specific number of seals, it would be reasonable to suppose that the inscriptions or at least a part of them would indicate what was measured by the number of seals on the edge.

There exist 137 roundels with inscriptions and they may preliminary be divided into six main categories *(Fig. 10)*: 1. One-side inscriptions with one sign only, 2. with ligatures, 3. with one or more sign-groups. 4. Two-side inscriptions with a single sign on one side and a sign group on the other side, 5. with two single signs on one side and one or more sign groups on the other side, and 6. with sign-groups on both sides. Altogether there are 67 different inscriptions on the roundels. 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 recognized as true ideograms from Linear A

ONE-SIDED INSCRIPTIONS

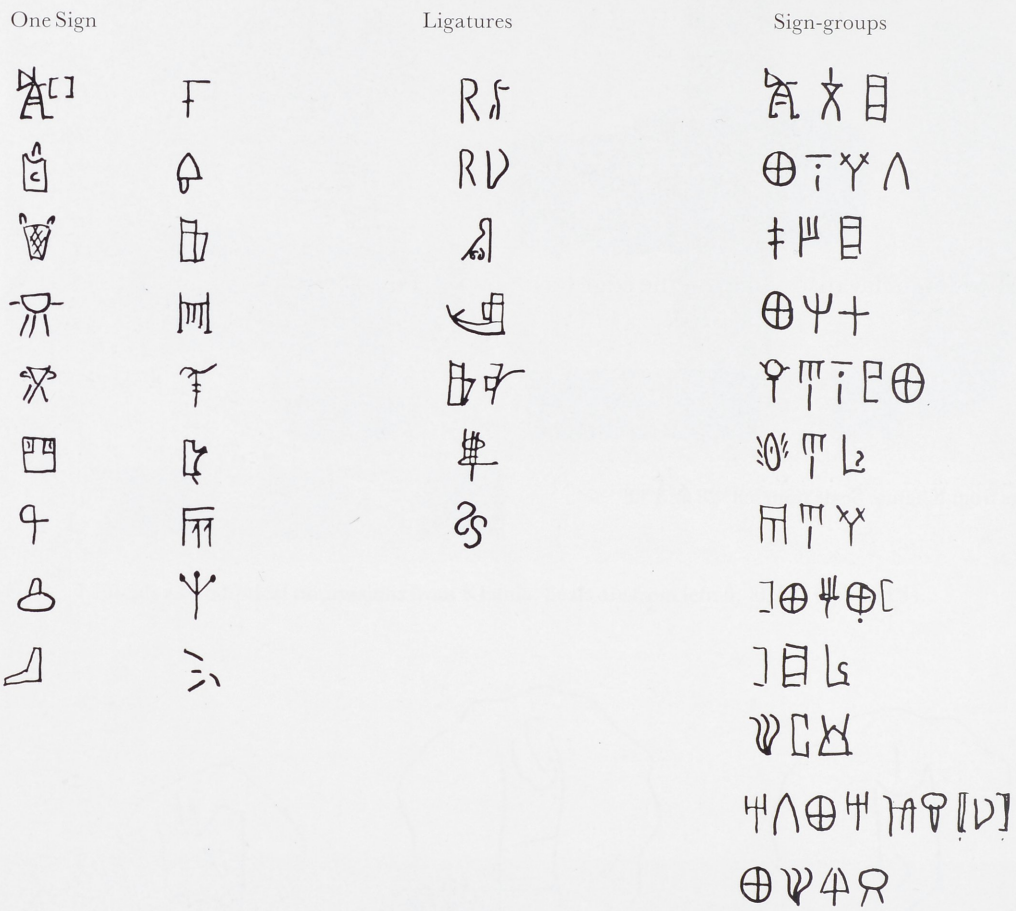
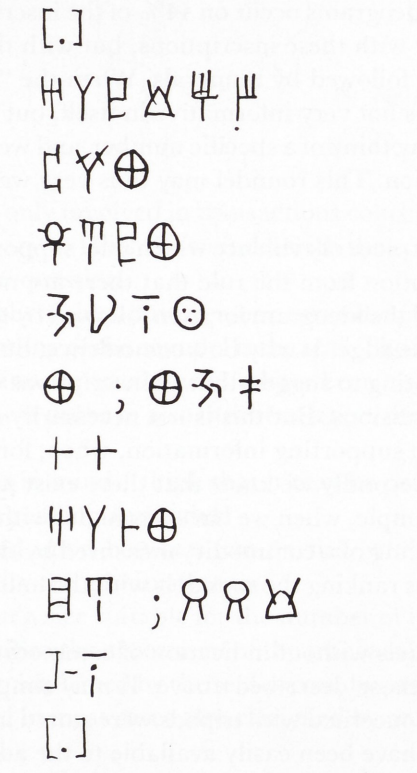


Fig. 10 List of existing signs and sign groups on roundels.

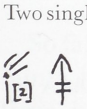
TWO-SIDED INSCRIPTIONS

A-Side
Single signs

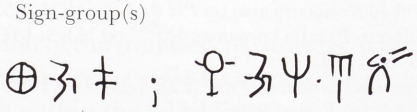
B-Side
Sign-group(s)



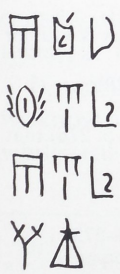
Two single signs



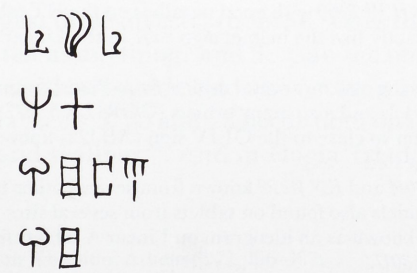
Sign-group(s)



Sign group



Sign group



and Linear B: The "basket"-sign[17], the "tripod"-sign[18], another vase-sign[19], a "cloth"-sign[20], the sheep-sign[21], the bundle-sign[22], the ox-sign[23], the helmet-sign[24], an unidentified sign known from the Mallia and Phaistos tablets[25], the wine-sign[26], probably the olive-sign[27], the goat-sign[28], the cyperus-sign[29] and finally the wheat-sign[30].

The above identified ideograms occur on 44% of the inscribed roundels, and one thing which is remarkable – not only with these inscriptions, but with them all – is that they are, with one certain exception, never followed by numerals. When the "tripod"-ideogram is found on, for example, *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 to a specific person. This roundel may thus very well refer to a transaction where four tripods are involved.

There exists one slight piece of evidence which may support the above consideration, and that is the only certain exception from the rule that there are never numbers on the roundels. On *GO Wc 1 (Fig. 11)* we find the ideogram for oxen followed by the numeral 5 – and the roundel has five impressions along the edge. It may be a coincidence, but is it likely to be so?

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, when, for example, one finds both ideogram and two sign-groups[31]. Secondly we know that there exist many 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 impressions, or whether it is supporting information, thus ranking the roundels with the uninscribed ones as far as the commodity is concerned.

That there exist roundels without indication of commodities does not mean that they have a meaning different from those described above. It may simply be a matter of storage. Suppose that all "transactions" concerned with tripods were stored in the same basket or tray – all necessary information would have been easily available to the administration. Another explanation

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[17] A 417^{VAS} on *KH Wc 2006* and *2007;* occurs also on *PH 8a.1* (GORILA 5, 315).

[18] 409^{VAS}–411^{VAS} is with a different handle known as 410^{VAS} on HT 31.1 (GORILA 5, 313).

[19] 408^{VAS} on *KN Wc 2084, 2063* and *2114*.

[20] AB 164 a–c which are much like Linear B *164 (Papapostolou, I.A., L. Godart & J.-P. Olivier, Grammiki A ton Khanion. (Incunabula Graeca, LXII) Rome 1976, LXI.

[21] AB 21 on three KH and one PH roundel, also known on *HT 38.2* and specified either as males or females on several other tablets (GORILA 5, 176–177).

[22] A 322 on *KH Wc 2026, 2027* and *2098* which closely resembles the Linear B *158 (Papapostolou, Godart & Olivier (supra n. 20), LXI).

[23] AB 23^{m} on *GO Wc 1* and *KH Wc 2069* with good parallels on the HT tablets (GORILA 5, 179).

[24] AB 191 on *KH Wc 2028* exactly like the helmet sign *191 in the Linear B tablets (Papapostolou, Godart & Olivier (supra n. 20), LXI–LXII).

[25] AB 180 on *MA Wc 7* occurring also on several tablets from Phaistos and Hagia Triada (GORILA 5, 280).

[26] AB 131 on some PH roundels and also many tablets (GORILA 5, 277).

[27] A 328 comes in my opinion so close to the OLIV sign (AB 122) known from many tablets (GORILA 5, 276) that an equivalation should be suggested.

[28] AB 22, CAP^{m} on *HT Wc 3014* and *KN Wc 29* known from several other tablets (GORILA 5, 178).

[29] A 303 on several HT roundels also found on tablets from several sites (GORILA 5, 286).

[30] AB 120 GRA on *MA Wc 5* known as an ideogram on Linear A tablets from most sites (GORILA 5, 274–275).

[31] As for example on *HT Wc 3017*.

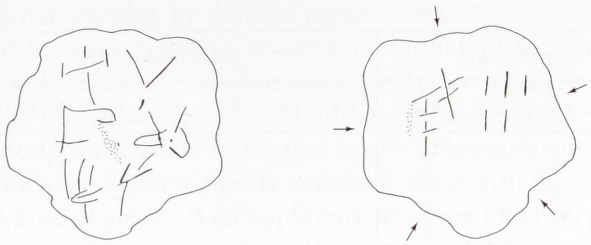

Fig. 11 Go Wc 1.

may be that one person was usually only involved in transactions concerning one commodity. In such a case it would only be necessary to label the roundel with the commodity, if it was out of the ordinary routine of the person in question.

Other explanations may be thought of, but, however, one turns the problem, the point always recurs, that crucial to the understanding of the roundel is the seal. The inscription is a help to us in understanding it, while in the Minoan period it would have been a safeguard against mixing and confusion in the archives, and was perhaps also meant as a security to the party who sealed the roundel.

With all the above considerations in mind I think that it may be permissible to advance the following hypothetical procedure in making a roundel:

1. A transaction would be agreed upon between two parties, where the one was the seal-owner, and the other in all probability the administration.

2. A clay disc would be formed in a size suitable for the number of impressions agreed to be impressed on the edge (i.e. according to the agreement of the transaction).

3. The transaction would then be confirmed by the seal-owner, by pressing the seal the agreed number of times along the edge, and in most cases also clariyfied by an inscription, in someway related to the transaction.

4. The roundel would then be stored in the central archive where the necessary informations would thus be available to the administration.

So far, I think, the close examination of the roundels permits us to go with a high degree of certainty, but the most interesting problems remain. Who owned the seals, what were the transactions, how did the roundels function within the administrative system? No firm answers can be provided to those questions, but I would like to suggest a few lines of investigations which may help to clarify the problems.

As to the first question, who owned the seals, i.e. who were involved in transactions with the central administration, I would suggest three investigations: 1. Does the seal occur in other contexts?; 2. Can the shape of the seal tell us anything? and 3. Can the motifs tell us anything?

It may be useful to note that seals used on roundels do also occur in other contexts. In Khania we know of four such instances in that seals 5, 20 and 28 occur both on roundels and on nodules, while seal 26 is found on roundels and sealings[32]. And in Hagia Triada there are at least three

[32] Papapostolou, I.A., Ta sphragismata ton Khanion. Athens 1977, 166–167.

Table 7

Shape	Middle Minoan					Late Minoan IB							Total
	PH	KE	MA	KN	Total	TY	HT	PY	ZA	GO	KH	Total	
Lentoid			3	5	8	1	2			1	11	15	23
Disc	2				2							–	2
Ellip. stone		1	1		2		1				1	2	4
Ellip. stamp	3				3							–	3
Amygdaloid				1	1	1	2				4	7	8
Rings				1	1		4	1	1		5	11	12
Fl. cylinder				1	1							–	1
Cylinder				1	1							–	1
3-side prism?				1	1							–	1
Thumb	1				1							–	1
Uncertain	1		1	2	4							–	4
Total	7	1	5	12	25	2	9	1	1	1	21	35	60
NoDS	4	1	2	6	10	2	4	1	1	1	4	4	10

NoDS: Number of different shapes

Table 8

Decoration	Middle Minoan					Late Minoan							Total
	PH	KE	MA	KN	Total	TY	HT	PY	ZA	GO	KH	Total	
Pictorial	1		4	4	9	1	9	1	1	1	20	33	42
Decorative	5	1	1	7	14		1				1	2	16
% Pictorial	17		80	36	39	100	90	100	100	100	95	94	72
% Decorative	83	100	20	64	61		10				5	6	28

HT = Hagia Triada; KN = Knossos; MA = Mallia; PH = Phaistos; KH = Khania; GO = Gournia; KE = Kea; TY = Tylissos; PYR = Pyrgos; ZA = Zakros

instances with seals 79, 112 and 125 where they occur on both roundels and sealings[33]. This means that being involved in a transaction based on roundels does not preclude the seal-owner being involved in other transactions with the central administration.

From *Table 7* it will immediately be seen that there is no specific shape of seal connected with the roundels since we find practically all types represented – even a thumb print[34]. There is, however, a tendency to use fewer seal types and more rings at the close of the period.

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[33] Type 79: Olivier (supra n. 7), 78–79 (on *HT Wc 3022*).
Type 125: Levi 1925–26 (supra n. 13), 132 (on *HT Wc 3015*).
Type 112: Levi 1925–26 (supra n. 13), 122 (on *HT Wc 3016* and *3017*).

[34] On *PH Wc 44* a thumbprint has quite obviously been substituted for a seal impression. Hallager 1987 (supra n. 12).

The motifs can roughly be divided into two main categories *(Table 8)*: decorative and pictorial, and there is a clear tendency towards pictorial motifs in the LM IB period. And all the different kinds of these appear: human beings in different positions and actions, different kinds of animals in different actions, bucrania, insects, birds, monsters and talismanic stones. Superficially these motifs do not have much in common. However, with the exception of the talismanic, they are all with naturalistic motifs and most often with figural scenes showing people or animals in some kind of action. And apparently they are all of very good workmanship[35].

Also important in this connection is the relatively high percentage of rings used (for the LM I period, 31%). Such rings, I believe, were only in the possession of people high up in the Minoan hierarchy. Interesting in this connection may also be the griffin on seal 15 from Khania. If the interpretation that this monster is a symbol of royal power is correct, there would have been a very limited number of people, who could have had the possibility of using this seal. Could something be established more firmly about the symbolic meaning of the different motifs on the roundels it would be a great help towards a better understanding of the "seal-owners". I would not, however, be in the least surprised, if future research or discoveries were able to show that the seals used on roundels belonged to people high up in the Minoan society, and, if the considerations with the griffin holds true, that they might even had been employed within the administration.

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[35] Most of the seals on roundels outside Khania, Hagia Triada and Phaistos have never been published. A very short description of the motifs is given here. The numbers of the seal motifs have been given by me and the designate for example: KN (Knossos)–R (roundel) a (forthrunning letters). See also *Table 6* and *Table 7* for types.

MA Wc 5, Ra: Flying bird, Chapouthier, F. Inscriptions Minoennes sur une pastille d'argile (Mélanges Charles Picard, RA 29–30 [1948]), p. 166–169
7, Rb: Monster? holding egg-shaped object in hand
12, Rc: Flying bird, Chapouthier, F., Les Écritures Minoennes au palais de Mallia. (Études Crétoises, II) Paris 1930, 5 Fig. 4a
13 and *14*, Rd: Rosette between lines
Re: Scence with daemon or running animal
GO Wc 1, Ra: Running or wounded bull with sunk head
KN Wc 25, Ra: Warrior? with lioness, Evans, A.J., Knossos Excavations, 1903. BSA 9 (1902–03), 59, Fig. 38
Rb: Papyrus stalks, CMS X, 120
29, Rc: Lying agrimi
44, Rd: Lion attacking bull, Gill, M., Knossos Sealings: Provenance and Identification. BSA 60 (1965), 73, O.3, Pl. 12
45, Re: Intertwined rope-design
3 and *23*, Rf: 3 rosettes with lotus as filling ornament
3, Rg: Plain cross
41, Rh: Plain cross
Ri: Lying S
Rj: Indeterminable decorative design
Rk: Canopy resting on three forks
30, Rl: Lying bull showing neck
Rm: Architectural design
Rn: Plain cross
46, Ro: Running spiral
Rp: Arrow head formula
42, Rq: Indeterminable
TY Wc 5, Ra: Indeterminable
6, Rb: Flying bird
PYR Wc 3, Ra: Bull attacked by two lions
ZA Wc 2, Ra: Dancing lady in long trousered dress.

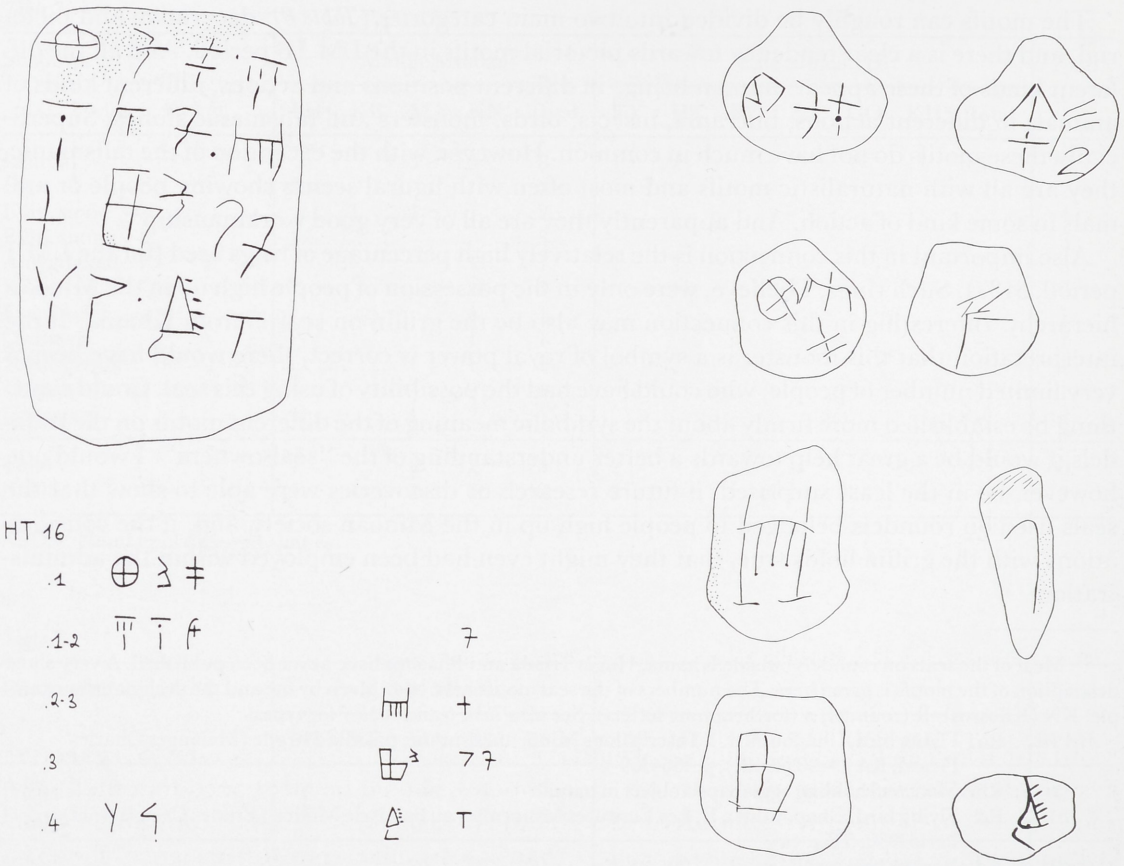

Fig. 12 HT 16 and roundels (*HT Wc 3016, 3015, 3019* and *3013*) and one nodule (*HT Wa 1299*) displaying sign-groups and signs also occuring on the tablet.

Also concerning the kind of transactions expressed by the roundels we do not know very much. The ideograms, of course, give us an idea of what kind of items were involved. There are different kinds of agricultural products (olives, wine, grain, cyperus etc.), livestock (oxen, goat, sheep), different kinds of containers (tripods, baskets) different kinds of textiles and other items connected with the textile industry, and probably military equipment (the helmet and perhaps a chariot)[36]. Apparently there is no end to what can be dealt with on roundels – but again, what kind of transactions between the central administration and some individuals do they express?

It would not be surprising if the information expressed by the roundels, being part of the central archives, were also to be found in a better arranged and systematized form in other documents. In this respect my research among the Linear A tablets has been largely in vain. Only in two uncertain instances might there have been connections between tablets and roundels. One *(Fig. 12)*, from the villa in Hagia Triada, is the tablet *HT 16*[37] which is headed by an introductory

[36] A 337 on *KH Wc 2056* and *2057*.

[37] The exact findspot unknown, i.e. we do not know whether or not it was found together with the roundel.

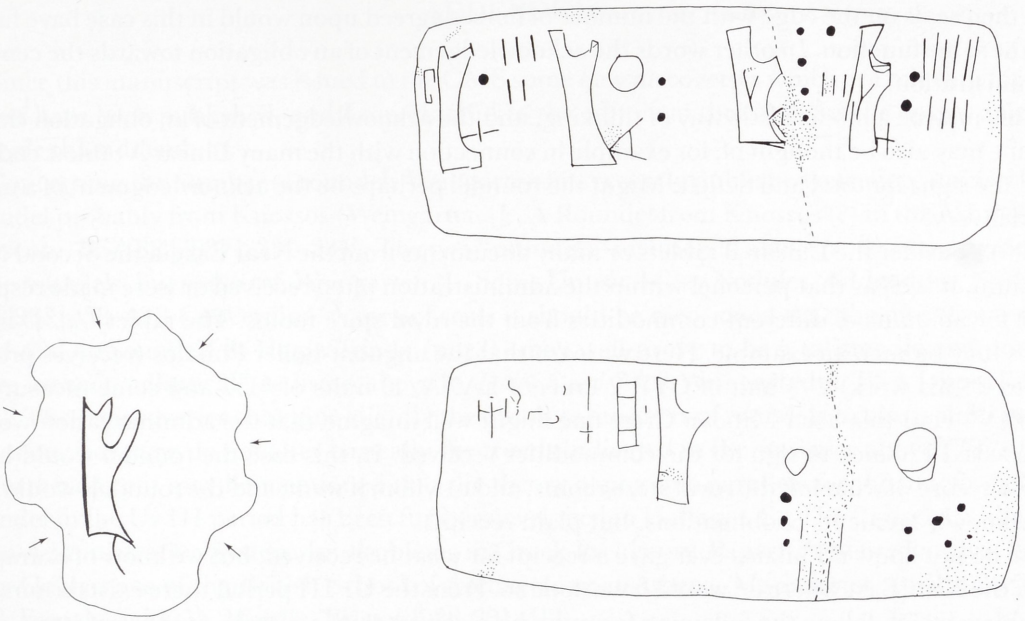

Fig. 13 Roundel (*MA Wc 7*) and tablet (MA 4. a, b) displaying same ideogram.

word also found on two of the roundels, while two of the ideograms listed are attested in another two roundels likewise from Hagia Triada. In addition it should be mentioned that the "saw" ideogram occurs frequently on the inscribed nodules in the same villa[38]. It is tempting to see a connection here, but at present it cannot be more than a possibility. The other instance *(Fig. 13)* is the tablet *MA 4* enumerating an ideogram which also occurs on a roundel from the same archive[39]. Also in this case it is tempting to see a connection, with the roundel forming part of the information collected on a tablet. Too many uncertainties; and it is my feeling that the existing Linear A archives are not sufficient to provide us with a positive answer to the more precise function of the roundel.

The roundel is a unique document unknown in any other society. Thus any search for parallels can only be for documents for which we believe that the roundels might be substituted – or an explanation may be attempted when we see a situation where a roundel might have filled a function.

Ethnographic records provide a kind of document, which could well have been expressed on a roundel. A few administrators from the capital came to a remote village in the Himalaya Mountains to arrange for horses to be put at their disposal at a certain date a few weeks later. A very simple agreement was written down and signed with a thumbprint by the ones who had to make the horses available[40]. The ideogram of a horse, with the additional information of the date

[38] *HT Wa 1282–1321* GORILA 2, 28–30 and *KH Wa 1005–1010*, GORILA 3, 105–107.

[39] Chapouthier (supra n. 35), 19 and 26–27, also Vandenabeele, F., La chronologie des documents en Linéaire A. BCH CIX (1985), 11.

[40] Rasmussen, M., Gia – et landsbysamfund i Lille Tibet. Copenhagen 1981, 16–20.

and then seals on the edge with the number of horses agreed upon would in this case have fulfilled the same function. In other words the acknowledgement of an obligation towards the central administration.

This may be a modernistic way of thinking, and the acknowledgement of an obligation closer in time may also be thought of, for example in connection with the many Linear A tablets ending with the signs for total and deficit. Might the roundel perhaps be the acknowledgment of a missing delivery?

If we consider the Linear B tablets or many documents from the Near East in the Second Millennium, it is clear that personel within the administration often received or were made responsible for amounts of different commodities from the royal store rooms. The tablet *Un 249* from Pylos may be such an example. Here we learn that the unguent-boiler Philaios (receives probably to do his work) $2^{1}/_{2}$ unit of CYP, 2 units of LANA, 10 units of *157 and some measure of KAPO[41]. Had this been Minoan Crete one might well imagine that the administration would have asked Philaios to sign for the commodities received. In this case the roundel would have been a record of what left the royal store rooms, and to whom it went; and the roundels would not be acknowledgements of obligations, but plain receipts.

We do not know if Philaios ever gave a receipt for what he received, but we know of examples from the Near East where he would have done so. From the Ur III period there exists a number of tablets which follow the following formula: he receives, then a certain number of items, personal name, seal – and the tablet is sealed by the person who receives the goods[42]. In my opinion the roundels may reflect exactly the same procedure – there is only a physical difference in the two types of documents: where the Mesopotamians wrote the actual number of items on the tablets the Minoans who received goods wrote the number themselves by impressing their seal the agreed number of times along the edge. In this way they could be sure that nobody could claim that they had received more than they actually did.

How was the seal used on the Minoan roundel? Each seal was, as far as I have been able to detect, used by one individual involved in some transaction with the central administration. The extent of the transaction was measured by the number of impressions the seal-owner made. Should the parallels to the Near Eastern material hold true we may surmise that the roundel is an expression of commodities and/or services transferred from the central administration to an individual. Much work, however, remains to be done before we can reach a full understanding of the roundel and, as a wider aspect, the administrative system in which it functioned.

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[41] Bennett, E.L. jr. & J.-P. Olivier, The Pylos Tablets Transcribed. (Incunabula Graeca, LI), Rome 1973, 242 and Ventris, M. & J. Chadwick, Documents in Mycenaean Greek. 2nd rev ed, Cambridge 1973, 224–225 and 550 (for KAPO). Also Shelmerdine, C.W., The Perfumed Oil Industry at Pylos. (Pylos Comes Alive), ed. by C.W. Shelmerdine and T.G. Palaima, New York 1984, 83.

[42] Steinkeller, P., Seal Practice in the Ur III Period. (Seals and Sealings in the Ancient Near East), ed. by McG. Gibson & R.D. Biggs, Malibu 1977, 42.

ADDENDUM

Since this manuscript was issued to the CMS some new discoveries which are relevant for this paper have been published, and I am grateful to the editors of the CMS for the opportunity to include this addendum.

Concerning the number of roundels Weingarten has recently published one more uninscribed roundel probably from Knossos (Weingarten, J., A Roundel from Knossos (?) in the Ashmolean Museum, BSA 82 [1987], 331–334). The two "roundels" mentioned above (n. 4) I now agree not to be roundels, but *noduli* (cf. Weingarten, J., Some Unusual Clay Nodules. Addendum, Kadmos 26 [1987], 38–43). Concerning shapes of seals it should be mentioned that the most frequently used seal on roundels in Hagia Triada (no. 31) may well prove to be a talismanic and not the more inexact "elliptical" as listed above in *Tables 6 and 7* (cf. Weingarten in BSA [supra], 333, n. 7). These discoveries changing slightly the absolute numbers of roundels, seals, sealing procedures etc, however, do not alter basically the trends indicated in the statistics above *(Table 1–7)*.

Furthermore it may be mentioned that the theory of possible parallels for the function of the roundel in the Ur III period has been further developed in Hallager, E., The Roundel in the Minoan Administrative System, in: Problems in Greek Prehistory. Papers Presented at the Centenary Conference of the British School of Archaeology at Athens, Manchester April 1986. Eds. E. B. French and K. A. Wardle, Bristol 1988, 101–112.

Since CMS, Beiheft does not use bold script, references to Linear A documents have been given in italics.

Århus, 9th June 1988

DISKUSSION

N. Marinatos macht einen anderen Vorschlag zur Deutung der Roundels und fragt, ob nicht das Siegel die Identität des Besitzers und die Zeichen die Art der Transaktion anzeigen könnten. Es kämen dann, wie E. Hallager gezeigt hat, Getreide, landwirtschaftliche Produkte oder Gefäße und ähnliches in Frage.

E. Hallager hält die Zahl der Siegelabdrücke auf dem Rand der Roundels für wichtig. Er glaubt, daß die Transaktion mit irgendeiner Sache zu tun hat, die in ganzen oder halben Einheiten oder Flächeneinheiten zu messen ist, da bestimmte Zeichen auf Teileinheiten hinweisen. Um aber mehr über die Art der Transaktionen zu erfahren, muß man Linear A verstehen.

J.G. Younger hält E. Hallagers Vermutung, der Greif sei möglicherweise ein Zeichen der königlichen Familie, nicht für belegbar. Er nimmt an, daß das Siegel, von dem der betreffende Abdruck stammt, aus gewöhnlichem lokalem Stein wie Serpentin gefertigt wurde und stilistisch zur »Cretan Popular Group« gehörte. Wenn nun der Greif ein königliches Zeichen sein soll, würde er vorschlagen, daß der Besitzer des Siegels ein niederer Bediensteter war. Auf keinen Fall gehörte er der königlichen Familie selbst an, wenn es diese überhaupt gab. J.G. Younger kommt auch auf die talismanischen Siegel zu sprechen und warnt davor, diese Gruppe außer acht zu lassen. Er erinnert sich nämlich daran, daß auf einem Abdruck (Papapostolou, Sphragismata Taf. 35) Spuren von Goldperlen zu erkennen sind, die zu einem Armband gehört haben könnten,

an welchem das Siegel befestigt war. In diesem Fall mußte der Besitzer ziemlich vermögend gewesen sein. Das Gold konnte, wenn es eine totalitär herrschende Regierung gab, ein Geschenk oder eine Bezahlung von Seiten des Herrschers gewesen sein.

E. HALLAGER nimmt den Kommentar von J.G. Younger als Anregung für weitere Untersuchungen.

A. SAKELLARIOU fragt nach dem Beginn der Roundels.

E. HALLAGER antwortet, daß sie von Linear A-Leuten benutzt wurden, und nennt das Ende der alten Paläste von Phästos als Datum für die frühesten Roundels mit Abdrücken.