



STATISTICAL ANALYSIS OF DIMENSIONS  
OF THE BALLANEAN BURIAL CHAMBERS  
AT MISSIMINIA (SUDANESE NUBIA)

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Introduction

Modern archaeology takes more and more often into account the advantages of numerical and statistical methods which can be applied to monumental objects such as Meroitic pyramids (HINTZE 1981) or to smaller finds as Meroitic offering tables and stelae (HINTZE 1982). Statistical evaluation of the dimensions of stone implements became an inseparable part of their typological study. This trend was manifested in a special symposium dealing with application of various numerical and statistical methods to different archaeological problems, which took place at Steinförde (GDR) in 1983.

Most archaeologists know from their field experience that dimensions of tombs, especially of their burial chambers, show within the same culture with a definite burial rite a close relation to the stature of the deceased, to the number of buried individuals, to the amount and size of the offerings and to the social rank of the deceased. Small graves are generally recognized as belonging to children (NEUSTUPNÝ 1983: 13). Yet there were not many efforts to study this relationship by quantitative methods.

If the relationship between the dimensions of the tomb, especially its burial chamber, and the individual age of its occupant were numerically established, it could yield an additional evidence for demographic studies whose importance is recently substantially growing. There are robbed tombs with damaged and decayed human skeletal remains which cannot be demographically determined. In any cemetery a few or several tombs are even found empty. Age category, in which these missing individuals belonged, could be established with a certain probability according to the dimensions of their "eternal homes". According to a model for a given cemetery, other cemeteries of the same culture, burial rite and ecological situation lacking anthropological evaluation of the deceased can be evaluated by such a "demographic reconstruction".

The regular age dependent growth of both the tumulus superstructures (232 cases) as well as of the burial chambers (235 cases) was ascertained statistically in the 3rd — 5th centuries A. D. tumuli cemetery at Wadi Qitna in Egyptian Nubia, representing a peripheric variant of the Ballanean (X-Group) culture (STROUHAL 1984 : 87—88, 90—92, 1986 a). Dimensions of burial chambers devoid of human remains by robbers' activity enabled to reconstruct the probable number and age category of 51 originally buried individuals (STROUHAL 1986 b). Moreover in a special analysis of multiple burials, in which stratigraphic observations were made impossible due to robbers' activity, we succeeded in about half of the cases (if the age of the deceased was sufficiently different) to determine according to dimensions of their burial chambers for whom of the two or more individuals the burial chamber was originally built and who was buried in it additionally (STROUHAL 1986 c).

#### Material and Methods

In order to find out if the same general rules were valid in cemeteries of the same culture, but geographically distant (about 500 km) and situated in different ecological surroundings, the vast cemetery at Missiminia in Sudanese Nubia (about 1 km to the south of Abri at the right bank of the Nile) was chosen. It yielded an unbroken sequence of Napatean, Meroitic, Ballanean and Christian burials, perfectly and promptly published by VILA

(1980, 1982, 1984). For comparison with the mentioned results from the Wadi Qitna cemetery, the Ballanean section of the Missiminia cemetery, dated 4th — 6th centuries A. D., was used. It was not possible to compare tumulus superstructures, which survived excellently at Wadi Qitna, but in Missiminia only 35 graves yielded mere remnants of circular superstructures, partly eroded by high Nile, partly dismantled by people (VILA 1984 : 6, 8).

Of the infrastructures we concentrated on burial chambers which are in closest connection with the body length of the deceased. Their different types and subtypes were taken into account (VILA 1984 : 8—10).

**Type B I** — a rectangular pit oriented north-south: A) a simple pit, A 1) with a brick construction in the pit, A 2) with one or two benches.

**Type B II** — a rectangular shaft oriented north-south, provided with a lateral burial chamber A) to the west of the shaft, B) to the east of the shaft, C) to the west with an axial extension.

**Type B III** — a rectangular shaft oriented east-west provided with a lateral burial chamber A) to the north of the shaft, B) to the south of the shaft.

**Type B IV** — a rectangular shaft oriented north-south provided with an axial burial chamber A) to the north of the shaft, A 1) preceded by a brick vault, B) to the south of the shaft.

Of the total number of 253 Ballanean graves, the mostly occurring subtype was B II-A, represented by 191 graves (75.5 %), not 189 as indicated in their list (VILA 1984 : 9) which contains actually 190 of them, to which tomb no. 326 has to be added according to its description (VILA 1984 : 108). Of these B II-A graves 173 contained a single burial determined demographically. These became the basis of our analysis. Length, breadth and height dimensions (in cm) of their burial chambers were firstly arranged into age and sex groups (table 1).

Other types showed far lesser frequencies and their subtypes had to be accordingly omitted (except subtypes B II-B, C). Type B I was represented by 32 graves (12.6 %), of which 28 were demographically characterized. Subtypes B II-B and B II-C consisted of 6 and 1 graves respectively and were joined together

(2.8 %), type B III of 9 graves (3.6 %) and type B IV of 14 graves (5.5 %); all were provided with demographic data. Dimensions of their burial chambers were also arranged into age and sex groups (table 2).

Demographic data were used mostly as published by VILA (1984). In 45 cases his sexing could be checked by data sent by courtesy of Mme G. BILLY (written communication). Only three disagreements appeared, viz. in tomb no. 112 a female by Vila, a male by Billy, in tomb no. 121 a male by Vila, a female by Billy, in tomb no. 556 a female by Vila, a male by Billy. Regarding age, there were only two major differences: in tomb no. 151 a 18 to 20 year-old female by Vila, a 14–16 year-old female (?) by Billy, in tomb no. 526 a juvenile by Vila, a 20–30 year-old female by Billy. In these disputable cases data by Billy were preferred. In tomb no. 130 a single adult male was indicated by Vila, but two individuals (a skull of 40–50 year-old male and a mandible of 20–30 year-old male) by Billy; here the information by Vila was preferred.

All individuals could be arranged into age groups which correspond to categories used in construction of the life tables (their means in brackets): 0–1 (1), 2–4 (3.5), 5–9 (7.5), 10–14 (12.5), 15–19 (17.5) and 20–x (30) years. The upper limit of each category (except the last one) is the very end of the indicated year, (e. g. 1.99 years). An additional category 2–10 (6) years was included for individuals labelled by Vila simply as “enfants” without nearer specification of age. Because the same author discerns on the one hand “nouveau-né” and “bébé” aged less than 2 years, on the other hand “jeune adolescent” (11 to 14 years), the years between both categories are to be accepted for “enfants” (VILA 1984 : 180).

In the adults, the data were divided in males, females and unsexed adults without a detailed age distinction. Owing to the nearly constant stature in this age period this was felt irrelevant.

The most frequent subtype B II-A was taken as the basis of the statistical investigation. Other types (and subtype B II-B, C), numerically unsuitable for profound statistical treatment, were used for comparisons. For each age and sex group, mean ( $\bar{x}$ ) and standart deviation ( $s$ ) were calculated for the three dimensions of the burial chambers in which the individuals were buried.

Differences between means of the adjoining groups were checked by t-tests with regard to the significance of F-tests.

### Dimensions of Burial Chambers of Subtype B II-A

Dimensions of burial chambers of the Ballanean burials of subtype B II-A are summarized in table 3 and on figures 1—3. In all three dimensions a clear age dependent increase can be observed. This increase is greatest in the length of the burial chamber (being in the "all adults" group 207.6 % of the initial value of age group 0—1 years), smaller in the breadth of the burial chamber (199.4 %) and least in its height (180.8 %).

Comparing means of the adjoining age groups (table 3), growth in length proved to be highly significant (on probability level  $p = 0.01$ ) or significant ( $p = 0.05$ ), except between age groups 5—9 and 10—14 years as well as between 10—14 and 15—19 years. In the same time, growth in breadth was found significant between age groups 0—1 and 2—9 years as well as between 2—4 and 5—9 years and highly significant between age groups 15—19 years and adult males, significant between age groups 15—19 years and either adult females or all adults. At variance with it, growth in height showed significant difference between age groups 0—1 and 2—10 years as well as between 2—10 and 10—14 years, highly significant between age group 15—19 years and adult males and significant between age groups 15—19 years and either adult females or all adults. Of the 27 tests performed between adjoining groups to demonstrate age differences, 17 (63 %) were found significant or highly significant. According to these results we may consider the age dependent growth of the dimensions of burial chambers statistically proved.

Growth curves of the three dimensions (figures 1—3) are not linear but inversely S-shaped. They all begin with greatest increase between 0—1 and 2—4 years, gradually diminishing until the period between 5—9 and 10—14 years (except in height with acceleration in the same period), followed by a slightly greater increase between 10—14 and 15—19 years (except in height, where the previous acceleration is balanced by a paradoxical decrease — both are chance phenomena, caused by small

numbers of cases in both age groups). The curves end with a speeded up increase between 15—19 years and adult age period. It is conspicuously large especially in the length of the burial chamber — in average 28 cm — which cannot be related only to increase in stature, but also to enlargement in number and dimensions of burial offerings and to the rise of the social position of the deceased. A part of this increase (8.5 cm) was caused by seven cases with extremely long burial chambers (see further).

The values of the additional group of 2—10 year-old children were not used in drawing the curves (figures 1—3). In length they are located under the expected level, while in breadth and height they fit well between the values of the 2—4 and 5—9 year-old age groups.

Also the separate data of adult males and females, not included in the curves, fit well to the “all adult” values. The male means of the three dimensions are bigger than the female ones, the differences being, however, statistically insignificant.

Variability of the dimensions (expressed by their standard deviations) shows (table 3) an age dependent increase except a few anomalies (15—19 year group in length, 10—14 and 15 to 19 year groups in breadth and 15—19 year group in height). On figures 1—3 this is manifested by the gradual divergence of the  $x+s$  and  $x-s$  curves. Differences of variability between pairs of adjoining age categories were found to be insignificant by F-tests except between 15—19 year group and adult males in breadth and height. The additional group of 2—10 year-old children has the same variability as the 2—4 and 5—9 year-old groups except in breadth, in which it is slightly (not significantly) larger. In the same time, variability of the three dimensions was in adult males only slightly greater than in the “all adults” group, but expressively greater than in adult females, whose extraordinary low variability in height was proved statistically significant by the F-test. This finding may be explained by the supposition of greater differentiation of adult males in wealth and social position than of females.

## Dimensions of Burial Chambers of other Types

Dimensions of burial chambers of the Ballanean graves of other types or subtypes are summarized on table 4. They are too poorly represented for the infant, child and juvenile age groups. This fact causes anomalies in the gradual age dependent increase of the mean values and makes unreliable the standard deviations.

For the adult period, only type B I, whose burial chamber is represented by a simple rectangular pit, occurs in several cases, enabling a sexual division. Male burial chambers of this type were somewhat longer and clearly higher but narrower than the female ones, but the significances could not be statistically proved. Compared with our basic subtype B II-A (last row in table 4), adults of type I had insignificantly shorter, slightly and insignificantly broader but highly significantly higher burial chambers. Their variability was found insignificantly lower in length, exactly the same in breadth, but statistically significantly greater in height, by F test. The great height can be explained as basically different from the height of other types. In type B I it was actually the depth of the burial pit from the adjoining surface to the bottom, while in other types it was the height of the lateral or axial niche used as the burial chamber.

The somewhat bigger length and breadth and slightly smaller height of burial chambers of subtype B II-B, C and type B III cannot be considered distinct from our basic subtype B II-A in view of the paucity of cases. We may consider all types and subtypes with lateral niches, in spite of their different orientation, practically of the same dimensions (see the further part of the paper).

Type IV, provided in contrast with previous types by an axial chamber, occurs in somewhat more cases in adults. The burial chamber was found shorter than in other types (in spite of the insignificance of the t-tests) and definitely broader, highly significantly compared with type B I as well as with subtype B II-A. Its breadth showed in the same time an enlarged variability (significant result of the F-test in both mentioned comparisons). The burial chamber of type IV was also higher than

of other types (except type B I), highly significantly compared with subtype B II-A.

According to these results we may conclude that there was a definite difference between lateral burial chambers of types II and III and burial pits of type I on the one hand, as well as axial chambers of type IV on the other hand.

#### Ranges of Individual Dimensions of Burial Chambers in Adults

More light can be shed on the variability of the three dimensions by plotting the whole ranges of their individual values, separately for males, females and unsexed adults, in the form of frequency polygons (figures 4 — 6). Their basic outline derives from the most frequent subtype B II-A, individual values of other type or subtypes are graphically distinguished. The slight shift of both sexes is apparent in all three dimensions.

In length (figure 4) the variability is enlarged assymetrically to the side of high values (above 200 cm) of eight cases, all belonging to type B II (mostly subtype B II-A, no. 83 subtype B II-C). Three occur in males (tombs nos. 441, 97 and 131), two in females (nos. 83 and 165) and three in unsexed adults (nos. 183, 100 and 60). The reason for this anomalous increase is not clear in four cases where the tomb was completely robbed, bones dispersed and a few objects remained but were not in situ (nos. 60, 100, 183, 441). In one of these cases (no. 60) the extreme length of the chamber (320 cm) surpassed substantially the length of the shaft (210 cm).

Of the remaining cases in three (nos. 97, 165 and 83) a group of 4, 6 or 8 vessels were found between the north end of the chamber and the feet of the flexed skeleton (in a special extension in grave no. 83, whose burial was also dispersed). In tomb no. 131 the space containing two big jars occupied the northern third of the chamber (100 cm long) and was detached from the proper burial, occupying the southern two thirds (180 cm long), by a wall of mud bricks. There were, however, plenty of other graves with similar deposits of vessels in the same location without causing an unusual increase in length of their burial chambers. We have, therefore, to suppose that the exaggeration of the length of burial chamber of the mentioned



burials could have been connected more probably with higher social rank of the deceased.

As regards the individual values of length of the burial chamber in other types, the tendency towards lower range can be observed in type B I and especially in type B IV in males and unsexed adults (not in females). The few cases of subtype B II-B, C and of type III fit well into the range of the basic subtype B II-A.

In breadth (figure 5) the individual values of basic subtype B II-A form homogenous blocks without any extension. Type IV shows in males and unsexed adults a clear shift towards higher values, to a large extent outside the range of the basic subtype. All other types and subtypes (also type B IV in females) fit well into the range of the basic subtype.

In height (figure 6) similarly homogenous blocks of basic subtype B II-A are apparent. While subtype B II-B, C and type III fit well into the range of the basic subtype, types IV and especially type I are shifted towards higher values, to a large extent outside the range of the basic subtype.

#### Reconstruction of the Character and Order of Double Burials

In the case of double burials the data of the age dependent growth of the burial chambers (table 3) enable to determine if the burials were simultaneous or successive. This was not possible to be observed in the field due to robbers' destruction of the stratigraphy (VILA 1984 : 179). Moreover, in successive burials we can reconstruct the order of the burials, i. e. for whom of the two individuals the burial chamber was built and who was added in it later on (table 5). The seven analysed cases of double burials (occurring only in 2.8 % of the total of Ballanean burials) were not included in the previous analysis.

Demographically, the double burials comprised two burials of two children (nos. 86 and 459, in which the second individual could have been a juvenile), four burials of adults with their children (two males, nos. 411 and 528, one female, no. 408, accompanied by a juvenile, and one unsexed adult, no. 552) and a single burial of two indetermined, possibly adult persons (no. 495).

In the majority of six cases, the double burials were successive or probably successive. According to dimensions of the burial chambers (corroborated in tomb no. 408 by observed superposition) in the adult-child burials the tombs were built for the adults, while in the children burial for the younger of the two children. The order cannot be determined in burial no. 495. Only grave no. 552 betrays by the substantially larger burial chamber the probable contemporaneity of its adult-child burial.

#### Reconstruction of Probable Age of Demographically Undetermined Persons

Other 14 tombs could not be used in our previous analysis of dimensions of burial chambers because they lacked demographic data on their occupants. Human remains were either removed or destroyed by robbers or dispersed and fragmented to such an extent that they could not be demographically determined. According to dimensions of their burial chambers, however, we may try to reconstruct the probable age of the original occupants of each respective grave (table 6).

By this procedure we may add to the individuals with determined age other two 0—1 year-old infants, one 0—4 year-old child, two 2—4 year-old children, one 5—9 year-old child, one 5—14 year-old child, one 10—19 year-old child or juvenile, one 15—19 year-old juvenile, two juveniles or adults and three adults. The reconstructed individuals complete the demographic data of the cemetery.

#### Demographic Survey of the Ballanean Burials at Missiminia

Demographic survey of the Ballanean burials at Missiminia (table 7) has been composed of data on single and double burials of the various types, complemented by the 14 reconstructed individuals and a 8—10 year-old child from tomb no. 579, not included in the previous analysis due to missing dimensions of its burial chamber (VILA 1984:150). The gained results, slightly differing from the data by VILA (1984:180), can be compared with the demographic data on the Wadi Qitna cemetery (STROUHAL 1986 b).

The main difference consists in the relative representation of infants on the one hand and of children on the other hand. Infants occur more than three times more often at Wadi Qitna than at Missiminia. The single age groups of children are represented twice more at Missiminia (if we divide the 2—10 year-group into two lots and add them to the 2—4 and 5—9 year-groups) than at Wadi Qitna. The distribution seems to be more natural at Wadi Qitna, reflecting the largest mortality of infants and the decreasing mortality of age groups of children. The reason for the anomalous distribution at Missiminia can be only tentatively supposed. It seems probable that a large number of infants were not buried in the cemetery. The greater mortality of children could have been caused by worse socio-economic conditions and/or by severe epidemics.

All infants and children — and similarly all immatures — were more numerous at Missiminia than at Wadi Qitna, and inversely were represented the adults. The proportion of both sexes shows a dominance of females over males at Wadi Qitna, while an equilibrium appears at Missiminia. However, because more than one third of the adults were unsexed at Missiminia, the real proportion could have been quite different there.

#### Comparison of Growth of Burial Chambers at Missiminia and Wadi Qitna

To enable a comparison, data on the age dependent growth of the burial chambers at Wadi Qitna (table 8) were redrawn in the same scale as the growth curves from Missiminia (figures 7—9).

Comparing these data with table 3 and figures 1—3 we may observe that the growth of burial chambers was less intensive at Wadi Qitna than at Missiminia, reaching in adults 157.9 % of the initial value of length in age group 0—2 years, similarly 157.6 % of the initial value of breadth and only 140.9 % of the initial value of height.

In the same time, the initial value of length was at Wadi Qitna only slightly smaller, but the initial value of breadth almost twice and that of height twice as high as at Missiminia.

Comparing the growth curves of length (figures 1 and 7), the small initial difference increases by a continuous diver-

gence of the curves. Burial chambers at Missiminia become more and more longer than at Wadi Qitna and their ranges only partially cover each other. The variability is at the beginning greater at Wadi Qitna, later at Missiminia.

On the other hand, burial chambers are broader at Wadi Qitna during the whole course of the curves than in Missiminia (figures 2 and 8), with only a partial overlap of their both  $x \pm s$  ranges. The variability is constantly greater at Wadi Qitna than at Missiminia.

Similarly, burial chambers are higher at Wadi Qitna during the whole course of the curves than in Missiminia (figures 3 and 9) and the difference is still greater than in breadth. Both ranges of variability are practically apart. The variability of height is great at Wadi Qitna, still more than in breadth, but only less than half of it at Missiminia.

The significance of the mean differences in dimensions of the burial chambers of both cemeteries was tested in adults (table 9) with regard to three numerically sufficiently represented types at Missiminia. Differences in variability were taken into account, too.

Length of the burial chambers was at Wadi Qitna highly significantly shorter than in the compared types of Missiminia. In spite of larger variability of types B II-A and especially B IV, no significant results were obtained by F-tests.

In breadth, the Wadi Qitna burial chambers lie between significantly shorter type I and highly significantly shorter subtype B II-A on the one hand, and highly significantly broader type B IV on the other hand. Variability of type B I and subtype B II-A was smaller than at Wadi Qitna, the difference being proved only in the later case as significant.

Height of the burial chambers at Wadi Qitna equals the height in type B I. In the same time, it is only insignificantly greater than in type B IV. On the other hand, the height of subtype B II-A differs from all the others by its highly significantly lower value and also by its significantly lower variability.

The found differences in dimensions of burial chambers between two cemeteries belonging to the same Ballanean (X-Group) culture cannot be explained by different rite, because in both of them dead were buried in flexed position and at least partly

on burial beds. Differences in orientation (mostly head to south at Missiminia, variable from east to south at Wadi Qitna) are irrelevant. We may, however, explain the differences ecologically: At Missiminia, simple pits (type I) or shaft tombs (types II—IV) provided with lateral or axial burial chambers could have been easily excavated in the soft aluvium. At Wadi Qitna, however, rocky slopes could not have been easily cut out and the people had to build burial chambers in roughly circular manner of large stones directly on the surface or in shallow pan-like pits. Some of them were leaning at ground boulders or outcropping rock, some were set in a rock cleft (for details see STROUHAL 1984, 1986 a). Therefore, the burial chambers are long, narrow (except in type B IV) and low (except type B I and to some extent type B IV) at Missiminia, being shorter, broader and higher at Wadi Qitna.

## Summary

Statistical analysis of dimensions of the Ballanean burial chambers at the Missiminia cemetery disclosed an age dependent growth of them. Males possessed greater burial chambers than females, but the difference was statistically insignificant. Graves of types B II and B III were found practically identical in dimensions of their burial chambers, graves of type B I differing by very high burial chambers (represented by simple rectangular pits), graves of type B IV by extraordinary broad and somewhat higher burial chambers. The knowledge of dimensions of the burial chambers in the respective age group enabled to reconstruct the character and order of double burials as well as the probable age of demographically undetermined persons. Comparison with the dimensions of burial chambers in the 500 km distant Ballanean cemetery Wadi Qitna showed that they grew less intensively and in adulthood were shorter than in all types of Missiminia, in breadth being between types B I and B II-A on the one hand and type B IV on the other hand, and as high as the highest Missiminia type B I.

## Literature

- Hintze F.* (1981), Die Grössen der meroitischen Pyramiden. In: *Studies in Ancient Egypt, the Aegean and the Sudan. Essays in honor of Dows Dunham on the occasion of his 90th birthday.* Edited by W. K. Simpson and W. M. Davies. Museum of Fine Arts, Boston, pp. 91—98.
- Hintze F.* (1982), Statistische Beobachtungen zu den meroitischen Opfertafeln und Stelen. *Meroitic Studies, Meroitica* 6, Berlin, pp. 123—147.
- Neustupný E.* (1983), Demografie pravěkých pohřebišť. Archeologický ústav ČSAV, Praha.
- Strouhal E.* (1984), Wadi Qitna and Kalabsha South. Late Roman — Early Byzantine Tumuli Cemeteries in Egyptian Nubia. Volume I. Archaeology. Charles University, Prague.
- Strouhal E.* (1986 a), Statistical evaluation of the dimensions of Wadi Qitna tumuli. *Wissensch. Zeitschr. d. Humboldt-Univ. zu Berlin* 35/1 : 88—94.
- Strouhal E.* (1986 b), Demography of the Late-Roman — Early Byzantine cemetery at Wadi Qitna. *Studien zur altägyptischen Kultur, Beiheft*, Hamburg.
- Strouhal E.* (1986 c), Demographic analysis of multiple and clustered burials at Wadi Qitna, Egyptian Nubia. *Anthropologie (Brno)*, 24/2—3 : 249—256.
- Strouhal E.* (in press), Wadi Qitna and Kalabsha South. Late Roman — Early Byzantine Tumuli Cemeteries in Egyptian Nubia. Volume II. Anthropology and Conclusions. Charles University, Prague.
- Vila A.* (1980), La prospection archéologique de la vallée du Nil, au sud de la cataracte de Dal (Nubie Soudanaise). Fascicule 12. La nécropole de Missiminia. I. Les sépultures napatéennes. CNRS, Paris.
- Vila A.* (1982), La prospection archéologique de la vallée du Nil, au sud de la cataracte de Dal (Nubie Soudanaise). Fascicule 13. La nécropole de Missiminia. II. Les sépultures méroïtiques. CNRS, Paris.
- Vila A.* (1984), La prospection archéologique de la vallée du Nil, au sud de la cataracte de Dal (Nubie Soudanaise). Fascicule 14. La nécropole de Missiminia. III. Les sépultures ballanéennes, IV. Les sépultures chrétiennes. CNRS, Paris.

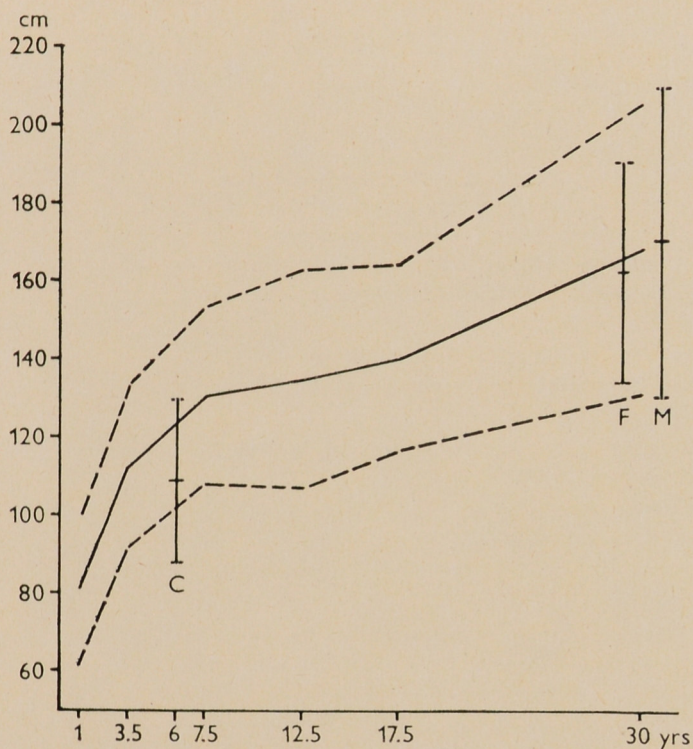


Fig. 1 Growth of length of the burial chambers (subtype B II-A) of the Ballanean burials at Missiminia (n = 173)

Explanations:

— = mean ( $\bar{x}$ )

- - - = mean  $\pm$  standard deviation ( $\bar{x} \pm s$ )

yrs = years (means of the respective age groups)

C = children (2—10 year-old)

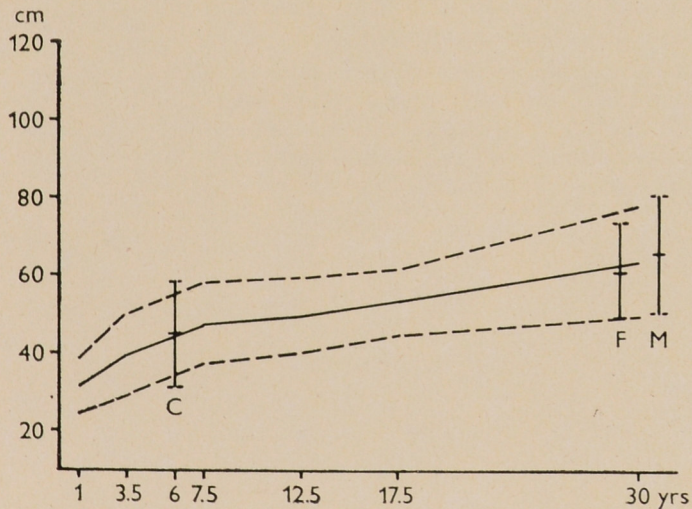
F = females

M = males

n = number of cases

Fig. 2 Growth of breadth of the burial chambers (subtype B II-A) of the Ballanean burials at Missiminia (n = 173)

For explanations see fig. 1





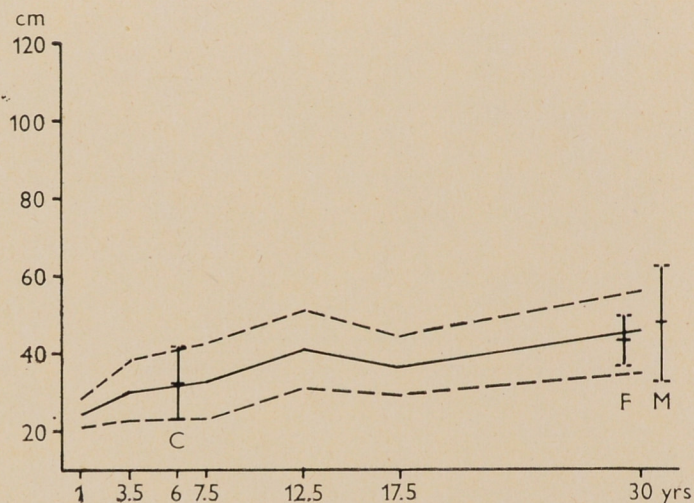


Fig. 3 Growth of height of the burial chambers (subtype B II-A) of the Ballanean burials at Missiminia ( $n = 168$ )  
For explanations see fig. 1

Fig. 4 Frequency polygons of individual values of length of the burial chambers of the Ballanean burials at Missiminia in adults ( $n = 114$ )

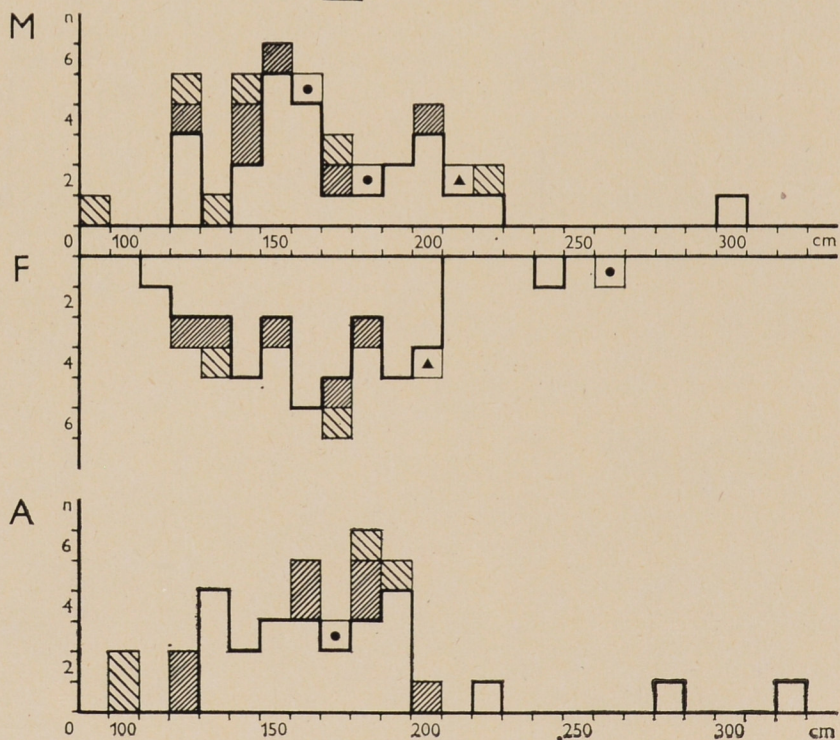
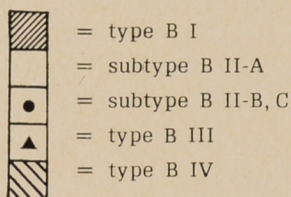
Explanations:

M = males

F = females

A = unsexed adults

n = number of cases



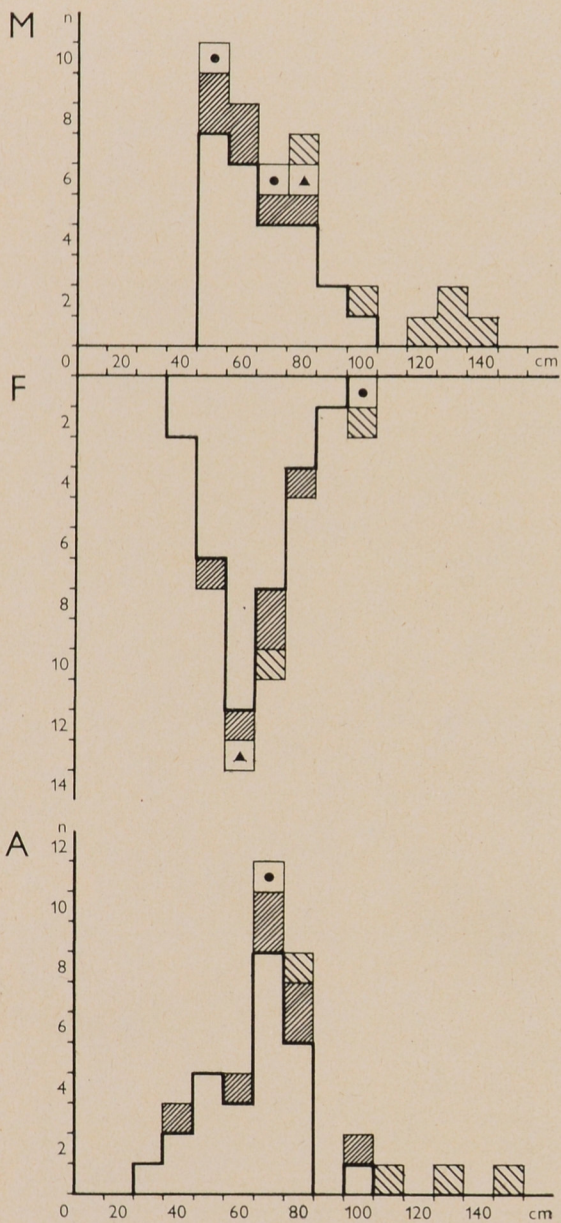


Fig. 5 Frequency polygons of individual values of breadth of the burial chambers of the Ballanean burials at Missiminia in adults ( $n = 114$ )  
For explanations see fig. 4

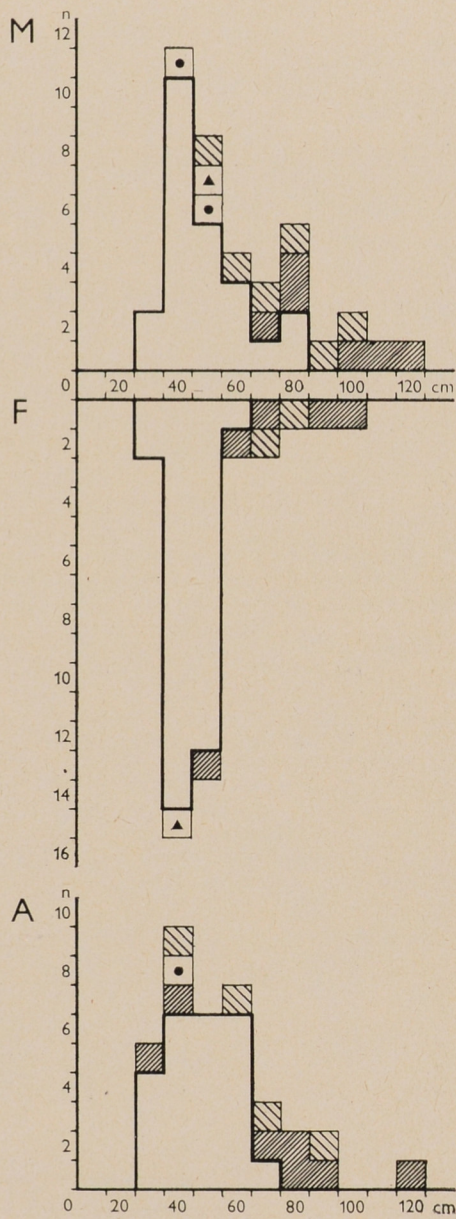


Fig. 6 Frequency polygons of individual values of height of the burial chambers of the Ballanean burials at Missiminia in adults ( $n = 110$ )  
For explanations see fig. 4

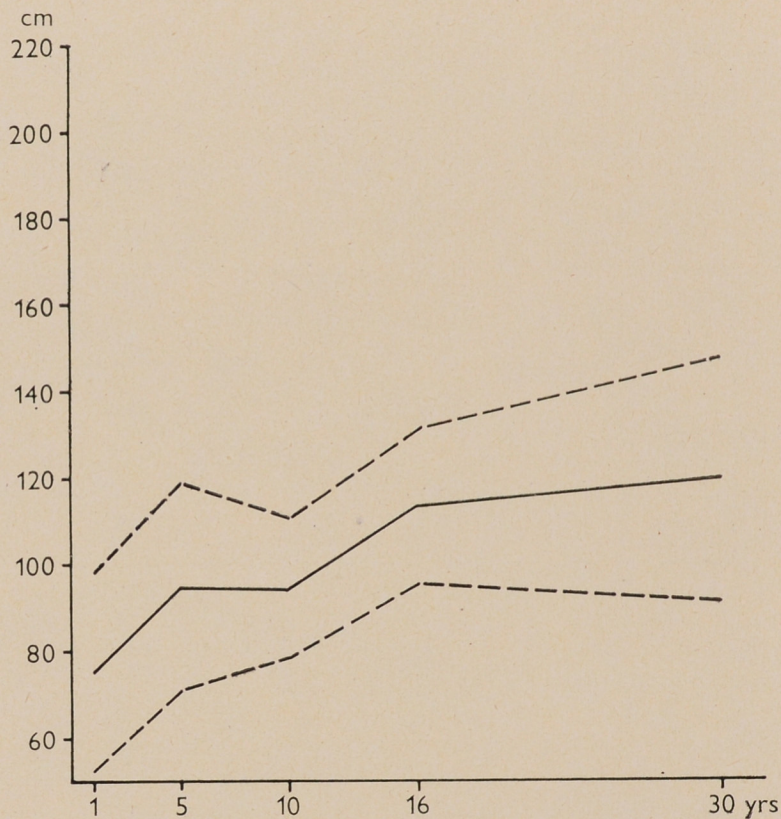
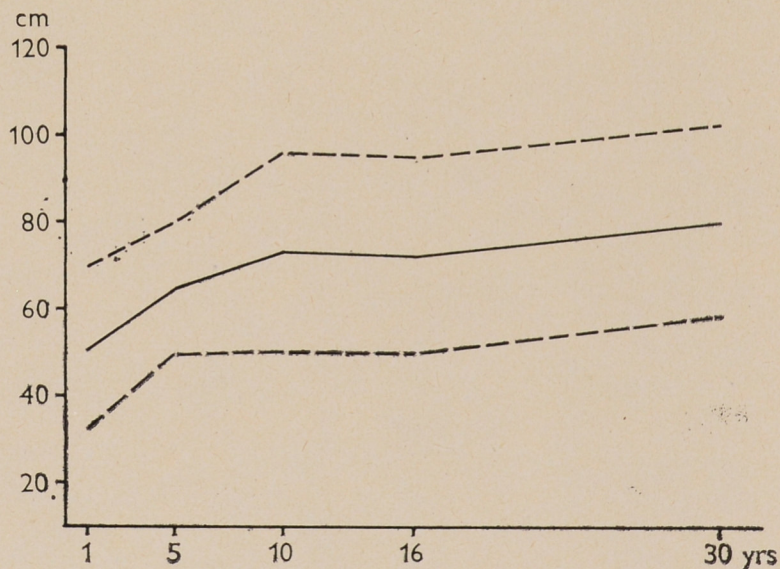


Fig. 7 Growth of length of the burial chambers of the tumuli cemetery at Wadi Qitna (n = 235)  
For explanations see fig. 1

Fig. 8 Growth of breadth of the burial chambers of the tumuli cemetery at Wadi Qitna (n = 235)  
For explanations see fig. 1



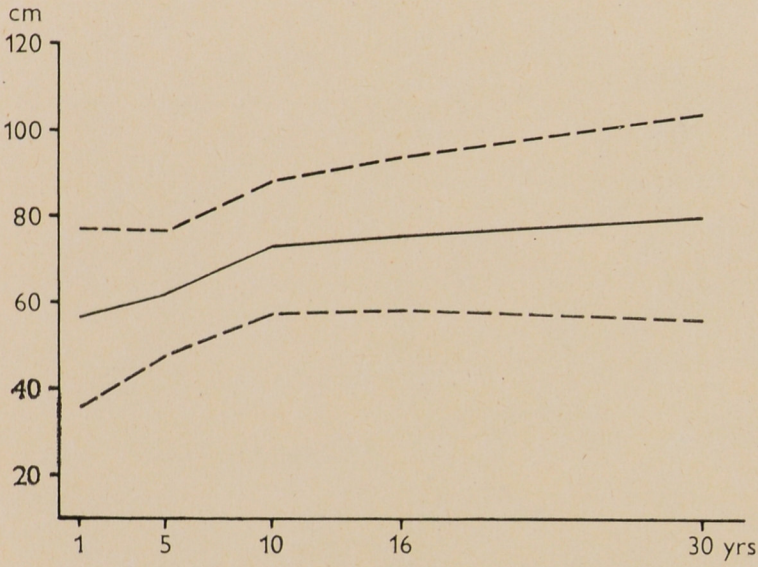


Fig. 9 Growth of height of the burial chambers of the tumuli cemetery at Wadi Qitna (n = 225)  
For explanations see fig. 1

Table 1 Dimensions of individual burial chambers of the Ballanean burials (type B II-A) at Missiminia according to age and sex

Age and sex group	Tomb no.	Length	Breadth	Height	Note
0 — 1	57	100	40	35	
	157	70	30	25	
	181	100	30	25	
	208	100	30	25	
	254	90	30	20	
	326 <sup>+</sup>	50	20	20	
	328	50	25	20	
	577	90	30	-+++	
	§ 9	80	40	30	
2 — 4	62	120	40	40	age determined according to Vila (1984 : fig. 93)
	94	120	40	40	
	109	90	20	20	
	126	90	65	35	
	141	115	30	40	
	154	110	25	30	
	156	110	40	30	
	174	110	30	30	
	175	110	30	25	
	178	120	40	20	
	201	150	50	40	
	215	150	60	40	
	230	150	40	35	
	410	110	50	25	
	420	120	40	30	
	460	65	40	40	
	533	95	40	20	
	539	120	45	25	
	554	90	30	20	
	560	100	35	20	
2 — 10	9	100	30	30	
	76	110	30	25	
	77	60	40	30	
	87	110	40	35	
	102	120	30	30	
	111	110	50	30	
	113	80	30	35	
	115	100	35	25	
	133	105	80	30	
	134	130	50	40	
	202	130	65	50	
	424	110	50	55	
	436	100	40	20	
	449	95	50	35	
	472	140	50	35	

Age and sex group	Tomb no.	Length	Breadth	Height	Note
	478	115	65	50	
	496	140	60	35	
	516	65	30	40	
	518	120	30	30	
	523	120	50	30	
	551	90	35	15	
	555	130	60	30	
	564	100	40	20	
	576	130	35	25	
5 — 9	90	120	50	30	
	106	180	70	40	
	107	160	40	30	
	114	105	40	25	
	142	140	55	35	
	152	150	45	20	
	168	100	40	40	
	310	130	30	25	
	321	120	40	40	
	361	90	40	- + +	
	409	135	55	30	
	468	140	40	30	
	470	150	60	40	
	486	140	55	30	
	513	110	40	30	
	562	120	60	20	
10 — 14	99	150	45	35	
	129	160	60	50	
	149	110	40	30	
	166	125	45	40	
	220	190	65	45	
	249	130	50	35	
	252	70	30	25	
	349	150	50	50	
	359	140	60	35	
	431	120	40	40	
	433	145	60	55	
	527	150	50	60	
	578	115	50	30	
15 — 19	84	100	45	40	
	124	135	60	50	
	151	180	75	40	Bi: 14—16 y-o F ?
	163	175	60	45	
	170	140	50	35	
	173	170	50	40	
	176	105	60	40	Bi: 18—20 y-o F, Vi: young adult F
	180	140	50	30	
	371	130	50	30	

Age and sex group	Tomb no.	Length	Breadth	Height	Note
	429	160	50	35	Bi: 14—16 y-o F
	494	130	50	30	Bi: 15—16 y-o F ?
	500	130	40	20	
	505	130	50	35	
Adult M	97	215	50	40	
	108	190	80	40	
	112	120	50	35	Bi: 50—60 y-o M, Vi: old adult F
	128	200	90	55	
	130	165	55	45	Bi: 40—50 y-o M
	131	300	85	80	
	138	180	55	50	Bi: 50—60 y-o M
	171	160	70	60	Bi: 20—25 y-o M
	198	150	70	40	Bi: 40—50 y-o M
	212	140	45	- + + +	Bi: 25—30 y-o M
	263	150	60	30	
	342	150	60	50	
	347	160	55	35	Bi: 40—50 y-o M
	358	190	80	35	
	367	120	70	60	
	400	150	50	40	Bi: 40—50 y-o M
	417	200	100	70	Bi: > 60 y-o M
	441	210	70	45	Bi: 20—30 y-o M
	442	135	50	40	
	447	120	50	25	Bi: > 60 y-o M
	473	150	45	40	
	488	160	60	40	
	490	160	80	50	
	503	200	80	80	Bi: 20—30 y-o M
Adult F	13	150	60	40	Bi: 18—25 y-o F
	68	110	60	55	Bi: 20—25 y-o F
	82	175	40	30	Bi: 40—50 y-o F
	85	150	50	40	
	93	185	80	50	Bi: 30—40 y-o F
	96	190	60	50	
	103	160	50	30	
	105	170	80	40	
	110	190	70	50	
	121	155	70	40	Bi: 20—30 y-o F, Vi: 30 y-o M
	125	170	70	50	
	148	200	90	45	Bi: 20—25 y-o F
	160	170	60	40	
	165	240	50	50	Bi: 40—50 y-o F
	169	195	70	40	Bi: 30—40 y-o F
	219	140	60	50	Bi: 30—40 y-o F
	309	160	60	40	Bi: 30—40 y-o F
	345 A	180	80	50	
	360	140	50	40	
	362	120	40	- + + +	

Age and sex group	Tomb no.	Length	Breadth	Height	Note
	376	120	45	35	
	380	190	60	45	Bi: 30—40 y-o F
	426	200	60	40	Bi: 30—40 y-o F
	456	160	70	40	Bi: 20—30 y-o F
	465	130	55	40	
	474	160	55	45	Bi: 20—30 y-o F
	477	140	70	45	Bi: 20—30 y-o F
	493	140	50	35	Bi: 30—40 y-o F
	526	130	60	35	Bi: 20—30 y-o F, Vi: juvenile
	582	165	70	50	
Unsexed adults	4	180	35	—+++	
	6	180	50	70	
	12	150	50	50	
	34	160	70	30	
	60	320	80	60	
	61	170	70	55	
	100	280	80	45	
	104	185	40	50	
	116	130	70	35	
	132	180	80	60	
	159	190	60	50	
	183	220	80	55	
	214	190	70	40	
	240	190	100	50	
	264	125	30	30	
	375	150	70	40	
	419	150	70	40	
	469	170	60	40	
	476	155	65	60	
	479	160	70	60	
	498	130	50	30	
	519	140	75	50	
	522	140	45	35	
	561	130	55	30	

Explanations:

- § = cemetery code 2-V-20 (all other 2-V-6)  
+ = type B II-A in Vila (1984 : 108), type B II-B in Vila (1984 : 9)  
++ = roof collapsed, not measurable  
+++ = not indicated in Vila (1984 : 149, 96, 113, 17)  
M = male  
F = female  
y-o = year-old  
Bi = determined by Billy (written communication)  
Vi = determined by Vila (1984)



Table 2 Dimensions of individual burial chambers of the Ballanean burials (other types) at Missiminia according to age and sex

Age and sex group	Type	Tomb no.	Length	Breadth	Height	Note
0 — 1	B III-A	225	65	25	20	
	B I-A	§ 10	90	40	50	
2 — 4	B III-A	49	90	45	25	
	B IV-B	172	90	60	45	
	B II-B	345 B	110	30	30	
	B III-A	471	145	40	40	
	B I-A	524	90	65	20	
2 — 10	B I-A	81	130	40	20	
	B III-A	117	70	30	20	
5 — 9	B III-A	98	170	40	35	
	B III-A	120	95	40	25	
	B III-A	278	100	50	40	
	B II-B	425	70	25	20	
	B I-A	507	130	45	40	
	B I-A	535	145	70	60	
10 — 14	B 1-A 1	146	200	120	120	vault 120 X 80 X 80
15 — 19	B II-B	10	160	45	30	
	B IV-A	58	120	(150) +	90	
	B I-A 2	445	145	80	60	
	B I-A	525	120	40	50	Bi: 18—20 y-o F
	B I-A	558	170	40	40	
	B I-A 1	563	135	90	60	
Adult M	B IV-A 1	33	170	130	95	Bi: 40—50 y-o M
	B IV-A 1	80	90	80	80	Bi: > 50 y-o M
	B IV-A 1	118	130	120	60	
	B IV-A 1	119	120	130	50	
	B IV-A	122	140	100	70	Bi: 30—40 y-o M
	B II-B	155	160	50	35	
	B IV-A	157	220	140	90	
	B II-B	233	180	65	45	Bi: 25—30 y-o M
	B I-A	373	140	60	80	
	B III-B	390	205	75	45	Bi: 40—50 y-o M
	B I-A	466	195	80	110	Bi: 20—25 y-o M
	B I-A 1	504	170	60	120	Bi: 40—50 y-o M
	B I-A 2	517	*160/130	*80/60	100	
	B I-A	537	*160/125	45	65	
	B I-A	556	120	45	75	Bi: 20—30 y-o M Vi: 30 y-o F

Age and sex group	Type	Tomb no.	Length	Breadth	Height	Note
Adult F	B IV-A 1	78	130	100	80	
	B II-C	83	260	*60/140	—++	Bi: 20—30 y-o F
	B III-A	139	200	60	40	Bi: 20—30 y-o F
	B IV-A	145	170	65	70	Bi: 60 y-o F
	B I-A	255	130	80	50	
	B I-A	489	170	65	60	
	B I-A	492	150	70	70	Bi: 20—30 y-o F
	B I-A	536	120	60	90	
	B I-A	580	180	50	100	
Unsexed adults	B I-A	14	180	100	120	
	B IV-A	15	190	130	90	
	B IV-A 1	16	180	150	60	
	B I-A	24	200	80	90	
	B IV-A+++	37	100	110	70	
	B I-A	153	160	60	40	
	B IV-A	158	120/80	80	40	
	B I-A	292	160	65	70	
	B II-B	313	170	70	40	
	B I-A 2	318	180	70	70/90	
	B I-A	438	115	60/25	75	
	B I-A	553	120	80	30	

Explanations:

- § = cemetery code 2-V-20 (all other 2-V-6)  
\* = different measurements on both sides: their average used for calculations  
+ = anomalously extended to west — excluded from calculation  
++ = not indicated by Vila (1984 : 42)  
+++ = type B IV-A in Vila (1984 : 31), type B IV-A 1 in Vila (1984 : 10)  
M = male  
F = female  
y-o = year-old  
Bi = determined by Billy (written communication)  
Vi = determined by Vila (1984)

Table 3 Dimensions of burial chambers of the Ballanean burials (type B II-A) at Missiminia

Age and sex group	Length					Breadth					Height							
	n	$\bar{x}$	s	min.	max.	t-tests	n	$\bar{x}$	s	min.	max.	t-tests	n	$\bar{x}$	s	min.	max.	t-tests
0 — 1	9	81.1	19.1	50	100	—++	9	31.7	7.1	20	40	—+]	8	25.0	4.3	20	30	—+]
2 — 4	20	112.3	20.9	65	150	—++	20	39.5	10.7	20	65	—+]	20	30.3	7.8	20	40	—+]
2 — 10*	24	108.8	20.6	60	140	—+	24	44.8	13.5	30	80	—+	24	32.5	9.4	15	55	—+]
5 — 9	16	130.6	22.8	90	180	—++	16	47.5	10.3	30	70	—+]	15	33.0	9.8	20	60	—+]
10 — 14	13	135.0	27.8	70	190	—+]	13	49.6	9.5	40	65	—+]	13	40.8	10.2	25	60	—+]
15 — 19	13	140.4	23.8	100	180	—+]	13	53.1	8.4	40	75	—+]	13	36.2	7.4	20	50	—+]
Adult M	24	169.8	38.8	120	300	—+]	24	65.0	15.2	45	100	—+]	23	47.2	14.3	30	80	—+]
Adult F	30	162.8	28.8	110	240	—+]	30	61.5	12.0	40	90	—+]	29	42.8	6.4	30	50	—+]
All adults §	78	168.4	37.7	110	320	—+]	78	63.2	14.5	30	100	—+]	75	45.2	11.1	30	80	—+]

Explanations:

n = number of cases

$\bar{x}$  = arithmetic mean

s = standard deviation

min. = minimum value

max. = maximum value

\* = children not arranged into the adjoining groups

M = males

F = females

§ = males, females and unsexed individuals

+ = significantly different on p = 0.05

++ = significantly different on p = 0.01

— = insignificantly different

Table 4 Dimensions of burial chambers of the Ballanean burials  
(other types) at Missiminia

Age and sex group	Type	Length					Breadth					Height							
		n	$\bar{x}$	s	min.	max.	t-tests	n	$\bar{x}$	s	min.	max.	t-tests	n	$\bar{x}$	s	min.	max.	t-tests
0 — 1	B I+III	2	77.5	12.5	65	90		2	32.5	7.5	25	40		2	35.0	15.0	20	50	
2 — 4	B I-IV	5	105.0	21.5	90	145		5	48.0	12.9	30	65		5	32.0	9.3	20	45	
2 — 10*	B I+III	2	100.0	30.0	70	130		2	35.0	5.0	30	40		2	20.0	0.0	20	20	
5 — 9	B I-III	6	118.3	33.5	70	170		6	45.0	13.5	25	70		6	36.7	12.8	20	60	
10 — 14	B I	1	146.0	—	—	—		1	80.0	—	—	—		1	80.0	—	—	—	
15 — 19	B I, II, IV	6	141.7	18.9	120	170		5	59.0	21.5	40	90		6	55.0	18.9	30	90	
Adult M	B I	6	152.1	24.1	120	195	—	6	60.0	12.6	45	80	—	6	91.7	19.7	65	120	—
Adult F	B I	5	150.0	22.8	120	180	—	5	65.0	10.0	50	80	—	5	74.0	18.5	50	100	—
All adults §	B I	18	154.3	26.2	115	200	—	18	65.7	14.5	45	100	—	18	79.2	24.7	30	120	—
All adults	B II-B, C	4	192.5	39.6	160	260	—	4	71.3	18.2	50	100	—	3	40.0	4.1	35	45	—
All adults	B III	2	202.5	2.5	200	205	—	2	67.5	7.5	60	75	—	2	42.5	2.5	40	45	—
All adults	B IV	12	145.0	39.0	90	220	—	12	111.3	25.5	65	150	—	12	71.3	16.1	40	95	—
All adults	B II-A	78	168.4	37.7	110	320	—	78	63.2	14.5	30	100	—	75	45.2	11.1	30	80	—

For explanations see table 3!

Table 5 Dimensions of burial chambers of the Ballanean double burials (type B II-A) at Missiminia

Tomb no.	Length	Breadth	Height	Age and sex of individual		Timing of the burials	Evidence for the order of the burial or its timing
				no. 1	no. 2		
86	100	40	35	5 y-o child	10-12 y-o child	successive ?	dimensions
408	190	50	40	30-35 y-o F	16-17 y-o juvenile	successive	superposition and dimensions
411	165	70	50	18-20 y-o M	12 y-o child	successive	dimensions
459	110	60	50	(2-10 y-o child)	(10-19 y-o child or) juvenile	successive	dimensions
495	150	70	35	indet. (adult ?)	indet. (adult ?)	successive ?	no evidence
528	145	50	35	30 y-o M	3-4 y-o child	successive ?	dimensions
552	140	100	55	adult	(2-10 y-o child)	contemporary ?	increased breadth

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Explanations:

- M = male
- F = female
- y-o = year old
- indet. = indetermined

Data on age and sex according to Vila (1984), additions in brackets by the present author

Table 6 Reconstruction of probable age of individuals according to dimensions of burial chambers of the Ballanean graves at Missiminia

Type	Tomb no.	Length	Breadth	Height	Described human remains	Probable age group
B I-A	79	210	65	100	dispersed bones	adult
	412	90	30	80	no	0 — 4
	515	150/130	100/70	90	emptied and reused for a Christ. burial	adult
B I-A 2	487	180/155	70/45	90	25—30 y-o F probably Christian	adult
B II-A	1	140	45	70	one disturbed individual	15—19 or adult
	19	140	55	—+	dispersed bones of one individual	15—19 or adult
	227	110	20	20	no	2 — 4
	381	120	70	40	no	5 — 14
	414	110	30	20	no	2 — 4
	435	120	50	—+	no	5 — 9
	443	160	40	20	juvenile or young adult, probably Christian	15 — 19
	450	130	50	60	no	10 — 19
	529	90	30	20	no	0 — 1
557	90	30	20	no	0 — 1	

Explanations:

+ = not indicated in Vila [1984 : 24, 125]

Table 7 Demographic survey of the Ballanean burials at Missiminia compared with that of Wadi Qitna

Age and sex group	Single burials					Double burials <sup>+</sup>	Reconstructed individuals <sup>++</sup>		Tomb no. 579 <sup>+++</sup>	Missiminia — total		Wadi Qitna	
	B I	Type			B II-A		B I	B II-A		B II-A	n	%	n
		B II-A	B II-B, C	B III		B IV							
0 — 1	1	9	—	1	—	—	0.5	2	—	13.5	5.2	105	17.2
2 — 4	1	20	1	2	1	1	0.5	2	—	28.5	11.0	43.7	7.2
2 — 10	1	24	—	1	—	2	—	—	—	28	10.8		
5 — 9	2	16	1	3	—	1	—	1.5	1	25.5	9.8	52.2	8.6
10 — 14	1	13	—	—	—	2.5	—	1	—	17.5	6.7	21.1	3.5
All inf. & children	6	82	2	7	1	6.5	1	6.5	1	113	43.5	222	36.4
15 — 19	4	13	1	—	1	2.5	—	2.5	—	24	9.2	44	7.2
All immatures	10	95	3	7	2	9	1	9	1	137	52.7	266	43.7
Adult M	6	24	2	1	6	1	—	—	—	40	15.4	148.7	24.4
Adult F	5	30	1	1	2	1	—	—	—	40	15.4	176.5	29.0
Unsexed ad.	7	24	1	—	4	3	3	1	—	43	16.5	18	3.0
All adults	18	78	4	2	12	5	3	1	—	123	47.3	343.2	56.3
Total	28	173	7	9	14	14	4	10	1	260	100.0	609.2	100.0

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Explanations:

+ = see table 5  
 ++ = see table 6

+++ = dimensions of burial chamber missing (Vila 1984 : 150) — not included in previous tables

Table 8 Dimensions of burial chambers in single burials at Wadi Qitna

Age group	Length				Breadth				Height			
	n	$\bar{x}$	s	t-test	n	$\bar{x}$	s	t-test	n	$\bar{x}$	s	t-test
0 — 2	54	75.5	23.1	+++	54	56.5	20.8	-	48	50.7	19.1	+++
3 — 6	33	94.9	23.7	-	33	62.1	14.7	+	32	64.5	15.3	-
7 — 13	23	94.1	16.1	+++	23	72.4	15.5	-	22	72.7	23.0	-
14 — 18	14	112.9	17.9	-	14	75.7	18.0	-	13	71.9	22.5	-
Adults	235	119.2	28.0	-	235	79.6	23.9	-	225	79.9	22.1	-

Table 9 Comparison of dimensions of burial chambers of adults at Wadi Qitna and Missiminia

Cemetery	Type	Length				Breadth				Height			
		n	$\bar{x}$	s	t-tests	n	$\bar{x}$	s	t-tests	n	$\bar{x}$	s	t-tests
Wadi Qitna	all	235	119.2	28.0	+++	235	79.6	23.9	-	225	79.9	22.1	-
Missiminia	B I	18	154.3	26.2	+++	18	65.7	14.5	+++	18	79.2	24.7	+++
Missiminia	B II-A	78	168.4	37.7	+++	78	63.2	14.5	+++	75	45.2	11.1	-
Missiminia	B IV	12	145.0	39.0	-	12	111.3	25.5	-	12	71.3	16.1	-

Explanations:

$\bar{n}$	= number of cases	+	= significantly different on p = 0.05
$\bar{x}$	= arithmetic mean	++	= significantly different on p = 0.01
s	= standard deviation	-	= insignificantly different