THE STONE DOORS OF CAPPADOCIAN UNDERGROUNDS

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Riassunto

Dopo aver richiamato la vastissima diffusione dei sotterranei difesi da porte-macina, si ricorda come tale dispositivo di protezione sia formato da una parte mobile (la "macina" di pietra), integrata in una "camera di manovra" che, pur nella costanza delle funzioni, mostra diverse soluzioni tecniche. Per ciò che riguarda la parte mobile, le caratteristiche di durezza della roccia testimoniano che, in diversi casi, le macine sono state ricavate da rocce diverse da quelle dell'ipogeo in cui sono state installate, evidenza confermata dalla individuazione di una cava in superficie ove venivano estratti i monoliti, nei pressi di Sivasa. Un'analisi del campione di porte-macina rinvenute in quattro ipogei sembra indicare una distribuzione bimodale dei diametri che potrebbe essere collegata ad una bimodalità nelle funzioni (e nelle dimensioni) dei cunicoli sotterranei. Il foro centrale, forse necessario per il trasporto del monolito, è comunque da ritenersi elemento essenziale della evidente vocazione difensiva della struttura ipogea. Vengono descritte le diverse soluzioni adottate per le camere di manovra dei vari sotterranei sino ad ora indagati. Viene infine evidenziato il ritrovamento nell'insediamento di Filiktepe di "porte-scudo", elementi rettangolari di roccia utilizzati per bloccare lo sbocco di angusti cunicoli. Tali lastre sono fornite anch'esse di foro centrale per l'osservazione e la difesa. Origine e datazione di tali dispositivi sono infine brevemente considerati.

1. Introduction

The recurrent evidence for massive stone doors blocking the underground passages in the artificial cavities of Cappadocia is a common but impressive features of the region. As a matter of fact, we found stone doors practically in all the investigated cavities, independently of their size or development. Extended subterranean networks, like the ones of Derinkuyu or Filiktepe, have stone doors, largely under the form of millstone doors, strategically scattered all along the system to form the rather sophisticated defensive barrier discussed elsewhere in this report. However, one finds millstone doors even in quite small systems like the "Gürlek Dere Magarasi" near Yesilöz, where the two rooms forming the whole system are connected by a short cuniculus defended by a millstone. According to such an evidence, we feel that the few undergrounds lacking of doors are probably only the result of the doors having been translated away in more recent times.

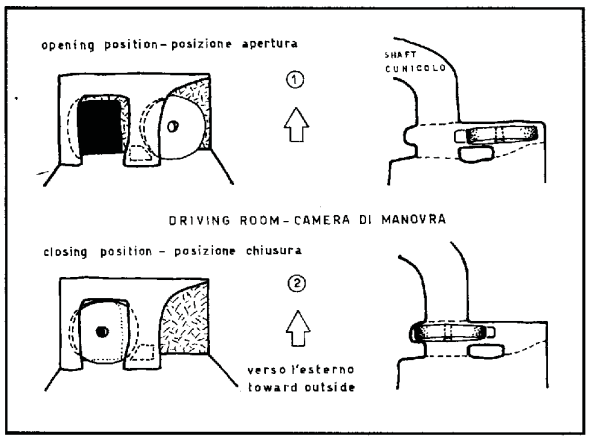


Fig. 1
View and plan of a typical millstone-door in opening (1) and closing (2) positions.
Prospetto e pianta di una porta-macina tipo, in posizione di apertura (1) e di chiusura (2).

As a whole, we found a continuous evidence for undergrounds and for millstones all along the investigated territory, which extends from Derinkuyu to the South up to Dulkadirli Inlimurat, 132 km to the North as the crow fly. Undergrounds and stone doors appear thus not an erratic occurrence but something firmly connected with the cultural and technical heritage of a population diffused over the area.

As already quoted, the large majority of stone doors we found in the hypogea was under the form of millstone doors. As shown in Fig.1, in its basic conception a millstone door is simply a rocky cylinder which can be rolled on the ground to fill a passage. It turns out that millstone doors are in all cases devoted to block the passage along a cuniculus or the exit of a cuniculus into a larger room. However, as shown in the same Fig.1, the millstone is only the movable portion of a more complex closing system, worth to be discussed in some details.

2. The millstones

The millstones are made up by a monolithic stone in form of a large and heavy wheel with a central hole about 10/20 cm wide. Evidences have been found for the millstones having been cut out of a rock sensitively harder than the rock of the surrounding hypogeum. As a matter of fact, in many cases one easily recognizes the millstone door as formed by a darker rock, with a finer texture. Test performed by P. Maifredi with a sclerometer in the system of Sivasa has revealed for all the millstones a value of the Schmidt index larger than 40, which implies a resistance to compression of the order of 700-800 Kg/sq.cm. On the contrary, the value of the Schmidt's index for the rock of the hypogeum was in all cases between 15 and 25, corresponding to a much lower resistance (200-300 kg/sq.cm).

According to such an evidence, one has to conclude that at the least in many cases millstone doors were cut outside the hypogea. A conclusion which has been supported by the discovery near the hypogeum of Sivasa of an open quarry for millstones, with the forms of the already produced millstones still evident in the rock and with a millstone abandoned just before the final completion and the detach from the rock. All these evidences indicates that the hardness of the stone was an important requisite for the rolling doors, for which the doors have been cut by a stone much harder than necessary for supporting the simple task of being only partially rolled from time to time. We regard this fact as an evidence, to be added to the further evidences we will discuss later on, that stone doors must be regarded much more as a defensive instrument rather than as a simple closure system.

Analysis of the dimension of the millstones, as given on Fig.2, shows that the diameters mainly distribute in the range 100 to 160 cm with a "giant" by 170 cm from Filiktepe and a microstone of only 67, again in Filiktepe. Inspection of the hypogea disclosed, as a general rule, that these diameters appear to be calibrated on the dimension of the cuniculus to be closed, so that the distribution in Fig. 2 gives in the same time an indication of the distribution of the heights of the cuniculi. In this context one may notice in Fig. 2 the curious lack of millstones with diameters in the range 130 to 140 cm, a lack which appears of not negligible statistical

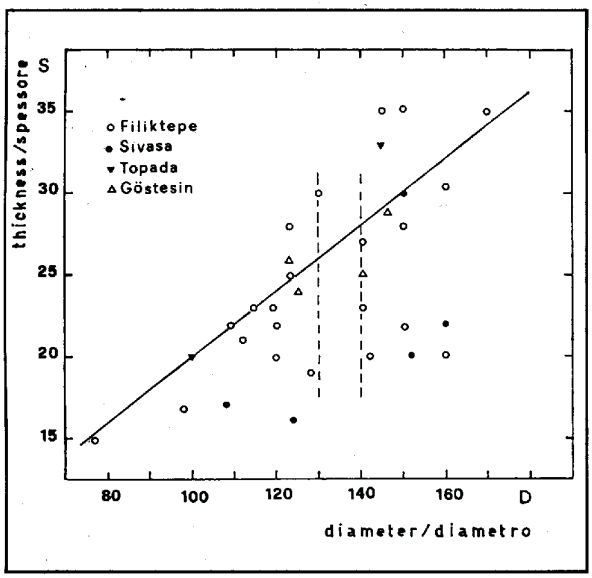


Fig. 2
The diameters of millstones plotted against their thickness for millstones from various undergrounds, as labeled.
Diagramma di raffronto tra il diametro e lo spessore delle porte -macina, rilevate nei diversi siti sotterranei, come indicato dalla grafica.

significance. We are strongly tempted to interpret the gap in diameters as an evidence of a bimodal distribution in the height of the cuniculi as due to the existence of two kinds of cuniculi whose evidence has been already discussed in these reports. The group of higher cuniculi should correspond to galleries open to the free passage of people and animals. On the contrary, the group of low cuniculi would be formed by connecting links kept low for the sake of defense.

One has to notice that the close correspondence between the diameters of millstones and the dimension of the cuniculi, when added to the quoted evidence for an external origin of -at least- several millstones, reveals the adoption of not a trivial procedure in the production of the undergrounds. As a matter of fact, the rather accurate fitting of millstones to the cuniculi discloses that the excavations were much more than a rough "dig-and-go" procedure one could at first sight assume. On the contrary, it reveals the existence of a project. In the simplest form, the quoted fitting requires that the dimension of the cuniculi where measured and the measures were translated to the exterior to quarry suitable doors. However, one can also suspect that both the dimensions of the cuniculus and of the millstone were predetermined according to a working plan. In all cases, one is facing the evidence for a well-reasoned procedure, to be taken into account before disregarding as "casual" other features of the undergrounds.

As shown in Fig. 1 and with only one exception, millstones are all characterized by the occurrence of a central hole, with a typical dimension of 10 - 20 cm. Holes have both cylindrical or conical shapes : in the latter case, the smaller section is on the surface of the millstone facing the cuniculus. No doubt these holes have to be regarded as a necessary implementation for the purpose of defense. A millstone without a hole would be a rather inefficient defense, putting both invaders and defenders in quite similar conditions at the opposite sides of the doors. On the contrary, the hole allows the defenders to watch out for the presence or for the moves of an opponent. Moreover, either lances or arrows can be used through the hole to prevent the approach of the opponent, who, as constrained in a small cuniculus in front of the door, represents an easy target for the defenders. The evidence for conical holes is obviously related with such an opportunity, making easier and more efficient the use of arms from the interior, while safely keeping a small section of the hole in front of the opponent.

According to such an evidence, we regard the occurrence of the millstone without hole as an

evidence for an unfinished work, possibly to be related with the scattered evidences for the occurrence of a few millstones in inadequate locations and for the occurrence of interrupted cuniculi which both suggest that at least some undergrounds were abandoned and depopulated after a sudden unforeseen emergency.

3. The operating room

As shown in Fig.1 millstones are only the movable elements of the closing systems. To operate the door one needs obviously room left on one side of the front of the cuniculus to allow the stone being rolled closing or opening the passage. However, a simple millstone facing a cuniculus does not represent a very effective defense, since it could be quite easily knocked over by the assailants. To overcome such an intrinsic weakness of the system one finds in all cases that millstones in their closure positions are supported by further stable elements protecting the stone against a possible overturning. Fig.1 illustrates the most common and perhaps the most efficient system devoted to this purpose.

The philosophy of the system is to insert the millstone in the body of the cuniculus, in such a way that the central portion of the millstone closes the cuniculus whereas the two lateral wings remain secured by the cavity in the wall of the cuniculus on one side and by a rocky pillar on the other side.

With reference to the scheme of Fig.1, one recognizes the large opening on the right used to put the millstone in the appropriate housing and to operate the millstone which can be easily rolled from the bottom to firmly close the cuniculus. As shown in the same Fig.1, evidences have been found that the millstones were held in their positions (either in the "open" or in the "close" position) by a stone shaped as to form a wedge preventing the rotation of the millstone. Experiments performed on the spot demonstrated that the millstones can be easily operated by 2 people in spite of an estimated weight of 1-1.5 tons.

Whereas the scheme given in Fig. 1 exhaustively illustrates the basic characteristics of a door, one finds several variations in the elements forming the operating room. Figs. 3 and 4, "1" to "8" show some of these variants we found in the undergrounds. Fig. 3.1 give details of a door in the underground 6 of Sivasa (Gökçetoprak). The door is quite similar to the "standard" one presented in Fig.1. However, one has to notice that the height of the millstone is now exceeding that of the cuniculus. This allows to shape the housing of the rolling stone in such a way that in this case the stone is protected against the overturning not only by the lateral locks, but also by the rocky cornice holding the upper portion of the millstone. As a whole, a sensitive improvement to the standard model.

On the contrary, one finds several solutions based on simpler procedures but giving a weaker protection. As shown in Fig. 3.2, one finds several doors realized without digging an operating room, but with the millstone kept in its position by a stony slab fixed in the ground with the function of the rocky pillar of the standard door. A similar door in the closing position will be fastened by the cavity in the wall on one side and by the slab itself on the opposite side of the cuniculus. The choice between the two systems appears rather erratic and not correlated with other features of the hypogea. Here let us only notice that the slab system is the more appropriate for a quick installation of a door in front of a previous undefended cuniculus.

In a few cases the adoption of stony slabs has been extended to replace even the joint in the rock, so that the millstone is constrained only by two slabs Fig. 3.3. Note that a similar procedure is the only one possible to defend an opening into an artificial wall made up of stones, as reported in Fig. 3.4 from the hypogeum of Sivasa 1. A further alternative solution, as found in the undergrounds of Özkonak, is finally shown in Fig. 4.5. The millstone is moving along a track deeply excavated in the rock, in such a way that the stone is protected against the overturning by a rocky parapet extending on both sides in front of the cuniculus. Let us summarize all these evidences concluding that in the undergrounds we found four different systems to hold the millstones, namely:

I) Pillar/doors, the most common ones, using a rocky pillar dug out from the surrounding rocks,

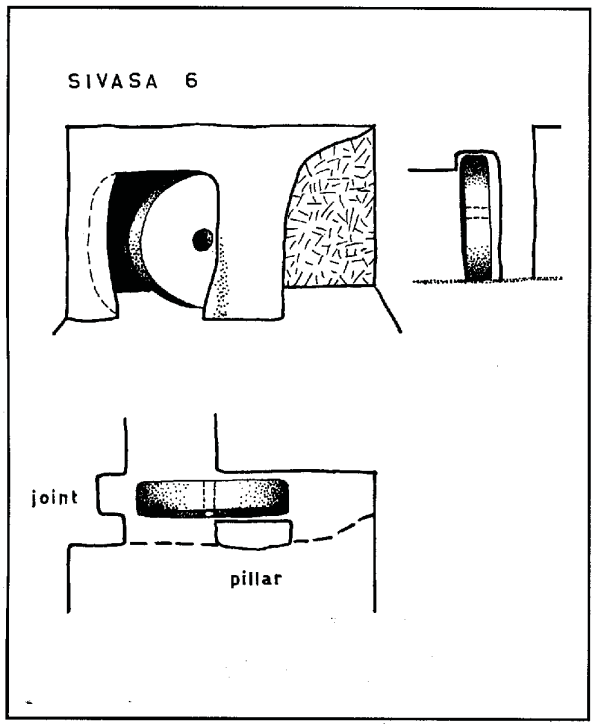
II) Slab/doors, rather numerous, with the stone slab replacing the pillar, with the much more rare occurrence of

III) Two slabs/doors, and, finally

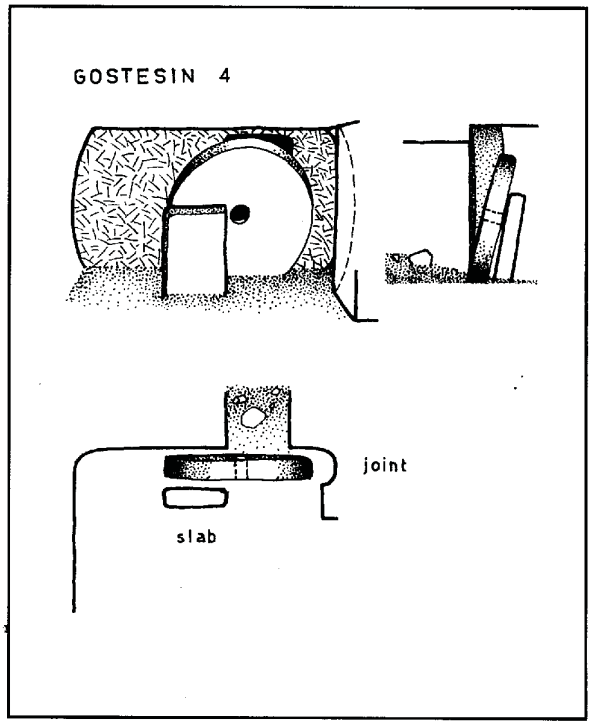
IV) Parapet/doors.

All these kinds of doors are generally found protecting the connection of a cuniculus with a more or less large room. However, in several cases one finds that millstone doors have been placed right along a cuniculus, digging a small chamber to allow the operation of the door. Figs 4.7 and 4.8 report the schemes of similar operating-chambers as equipped with a pillar or a slab/door. As shown in these figures, the chamber is opened on one side of the cuniculus, to allow the installation and the operation of the millstone, whereas the opposite side of the cuniculus runs untouched along the original path. In some cases, as in the underground of Filiktepe, one finds millstone

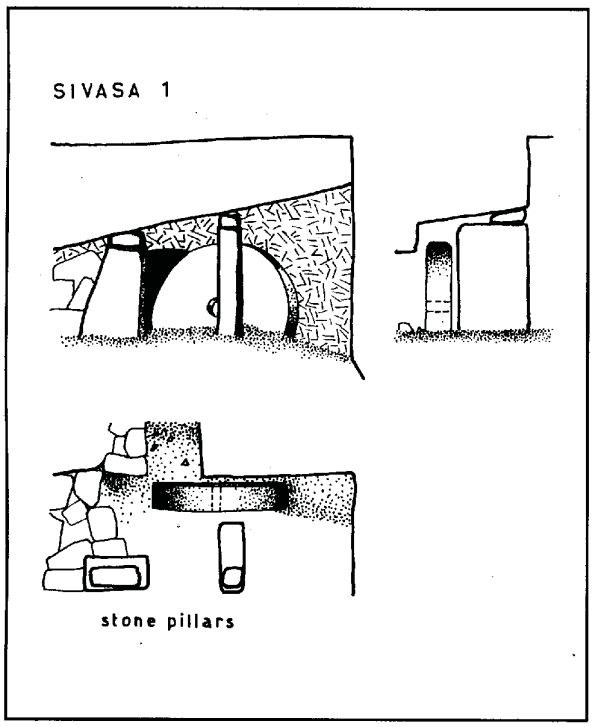
Fig. 3
Views, plans and cross sections of various solutions adopted for the closing devices.
Prospetti, piante e sezioni rappresentanti le diverse tipologie dei dispositivi di chiusura.



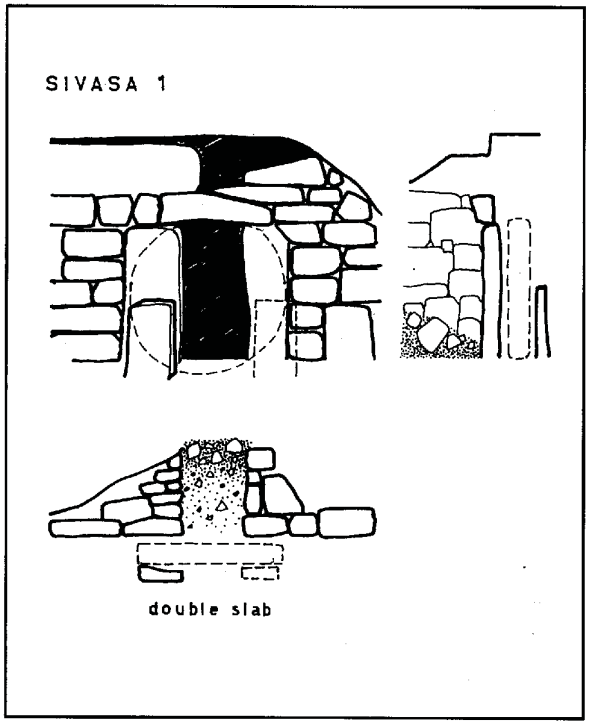
- 3.1) Open operating room with pillar and joint.
Camera di manovra aperta a pilastro e incastro.



- 3.2) Open operating room with slab and joint.
Camera di manovra aperta, a lastra e incastro.

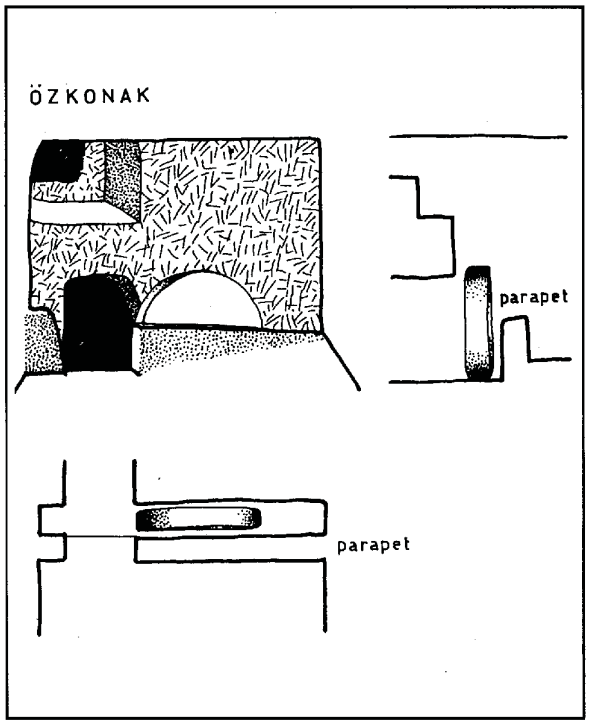


- 3.3) Open operating room with stone pillar.
Camera di manovra aperta con pilastro monolito.

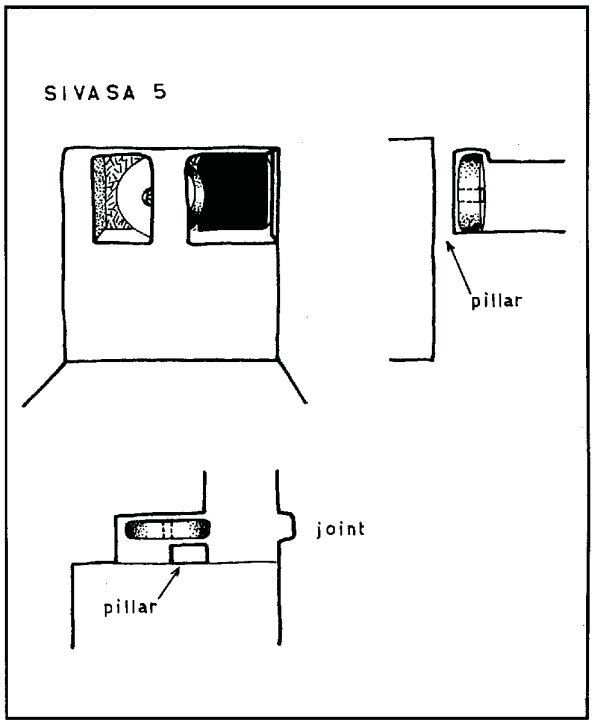


- 3.4) Open operating room with double slab.
Camera di manovra aperta, a doppia lastra.

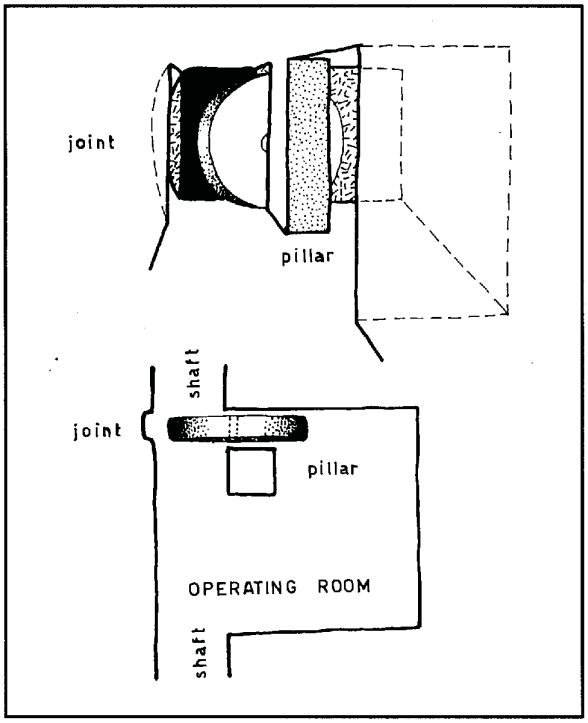
Fig. 4
Views, plans and cross sections of various solutions adopted for the closing devices.
Prospetti, piante e sezioni rappresentanti le diverse tipologie dei dispositivi di chiusura.



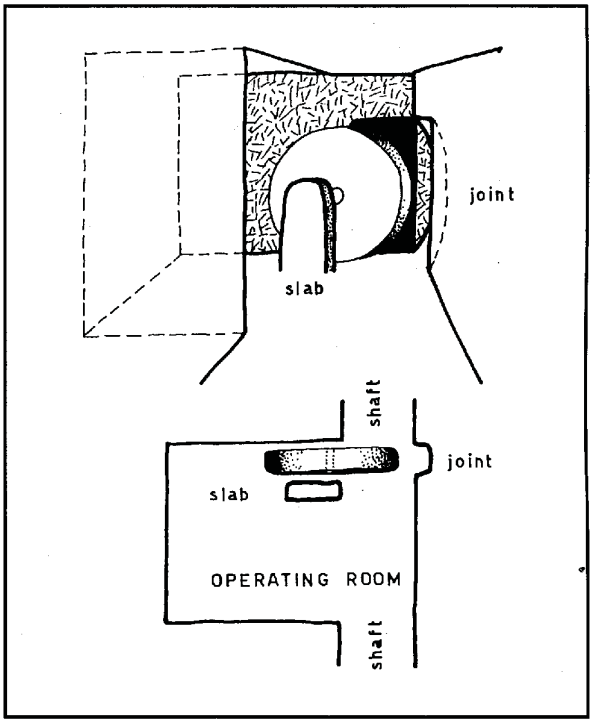
- 4.5) Open operating room with parapet.
Camera di manovra aperta, a parapetto.



- 4.6) Hanging operating room with pillar and joint.
Camera di manovra sospesa, a pilastro e incastro.



- 4.7) Scheme: closed operating room with pillar.
Schema di camera di manovra chiusa, a pilastro.



- 4.8) Scheme: closed operating room with slab.
Schema di camera di manovra chiusa, a lastra.

in operating-chambers added along a cuniculus but very near the millstone door protecting a room, doubling in such a way the defense of the room.

Fig. 4.6 finally shows the curious occurrence of a hanging pillar door, as found in a room of the system Sivasa 5. The occurrence of cuniculi coming out in a room at some height on the floor has been found in several cases. This could be taken as a system to protect the cuniculus against the room. However, the occurrence of the door discloses that -at least in this case- it was not the cuniculus but the room to be protected. We conclude that, again at least in this case, the different levels were probably due only to an error in the driving the cuniculus to reach the room. An error which cannot be corrected because further lowering the floor of the cuniculus would imply an increase of the height of the cuniculus, thus supporting the undesired practicability of the cuniculus and preventing the use of a millstone door with reasonable size.

4. Shield doors

As already quoted, the defense of the undergrounds through the use of rolling millstone doors is a common and general rule throughout all the explored hypogea. The size of the millstones, the accurate blocking systems, the occurrence of double doors, the location of the doors, the central holes and their shape, all this tells us of a system defending the hypogea from people coming the exterior. However, the undergrounds of Filiktepe showed us that millstones were not the only system adopted to prevent the passage. As a matter of fact, in this hypogea we found evidence for cuniculi blocked not with millstones but with what we will name stone shields.

In a few rooms of Filiktepe we found broken on the ground large slabs cut in the local tuff with the profile fitting the shape of the mouths of the cuniculi opening in the rooms. In particular, in one case we found a square slab, with a hole in the center, precisely fitting the entrance of a small cuniculus, not higher than about 50 cm, reaching the room. All along the opening of the cuniculus, a frame was carved in the rock just to receive the shield. Thus we have no doubt about the use of shield doors in some cases. The shield door with the central hole defending the small cuniculus can be easily understood as an additional precaution against undesired people coming from the cuniculus and, maybe, as a device to prevent animals entering the cuniculus from the room.

The large slabs closing some large cuniculi have no holes, so that they are useless, if not detrimental, to the defense. In one case we found these slabs in the last room of a system, to close the entrance of the only cuniculus reaching the room. It is difficult to understand why people in this room should shield in such a way the entrance. The only explanation coming to the mind is again to prevent the exit of animals, but we are not happy about this solution and the problem surely deserves further attention.

5. Discussion and final remarks

No doubt, millstone doors represent a basic and intrinsic element of the defensive undergrounds scattered all along the fields of Cappadocia. Thus the problem of the origin of these peculiar defensive closures cannot disentangled from the more general problem concerning the origin and the development of the undergrounds. Such a simple approach shows convincingly that until one will not find the evidence for similar defensive undergrounds somewhere outside Cappadocia, one has to regard both undergrounds and millstone doors as a the result of a local peculiar development.

However, the use of rolling stone to close a passage is not ignored in the past. Evidences have been found for millstone closures in palestinian tombs coming back to the beginning of the present era. Incidentally, a testimony for the use of rolling stones to close burial caves can be found in well known passages of the Gospel. In particular, let us quote the closure of a burial cave near Maresha as realized by a millstone 140 cm large and 35 cm thick (Kloner 1991), i.e., quite similar in size to the Cappadocian millstones. Thus the idea of rolling millstones is present in the Semitic area, though not as a defensive device.

To go deeper in this discussion one would need some reliable information about the age of the hypogea. If these undergrounds have been produced during the Byzantine era, thus our millstone doors can be a defensive improvement of the rolling doors diffused in the Semitic area, as suggested by Nicoletti (1980). On the contrary, if the undergrounds go back, at the least, to the Phrygian period (as claimed by Urban 1986) one could speculate of a possible diffusion of millstones from Cappadocia to the Middle East. A problem which must wait for careful archaeological investigations of the undergrounds and, in particular, for archaeological excavations of the sediments at the bottom of the wells, in the hope of recovering firm evidences about the age of the hypogea. For the sake of discussion, we can notice the substantial homogeneity of the technique over the territory as an interesting feature to be explained by the final solution of the problem.

Let us finally notice that, owing to their

dimension, millstone doors should probably regarded much more as an emergency closure to be used only in case of danger, rather than normal common doors. If this is true, the large amount of doors found in the closing position, either in place or rooted out from their support, seems indicate that the undergrounds were abandoned following a successful attack of some unknown invaders. An evidence to be added to other evidences discussed in other reports devoted to the study of selected systems.

- Kloner A. 1991, "A burial cave from the early roman period at Giv`at Seled in the judean Shephelah", Atiqot, XX, 150.
- Nicoletti D. 1980, "L` architettura delle caverne", Laterza ed., Bari
- Urban M. 1986, "Geschichte unter der Erde", Jahresschrift des Arbeitskreises fur Erdstallforschung, 12, 72, Drukerei Johann Premm, Roding