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SURVEYING SOME OF THE TOURISTIC UNDERGROUND CITIES OF CAPPADOCIA (TURKEY)

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Abstract
The region known as "Cappadocia" with its ancient name includes the provinces of Nevşehir and Kayseri in Turkey. Tuffaceous rocks spewing out of the active volcanoes in the late Pliocene and Pleistocene period in this region were used for many different purposes such as houses, barns and churches by the locals for centuries. However, the most interesting of these underground structures are, no doubt, the underground cities. These structures, carved for defensive purposes probably between 7 to 12th centuries, are available almost in each part of Cappadocia. There are more than 200 underground cities hitherto identified in the region. Only a small part of those underground cities have been searched and only a small part of the searched ones had been opened to tourism. Maps of only 12 underground cities, of which some are only sketches, are available. All of the researches carried out in the region from the beginning of the 20th century only cover a specific field or subject and, furthermore, a comprehensive survey or a detailed inventory of underground cities has not been executed in Cappadocia up to now. As OBRUK Cave Research Group, we had been invited to survey and map four underground cities of Cappadocia. Among them, Derinkuyu and Tatlarin underground cities were previously surveyed and mapped. Mazikoy and St. Mercurius underground cities have not been surveyed before. Due to our previous underground structure projects, our team had an experience of surveying artificial cavities. Yet, none of those previous projects had tens of chambers at 3, 4 even 5 different floors which were connected to each other through long tunnels.
Keywords: Cappadocia, Underground city, Derinkuyu, Tatlarin, Mazikoy.

Riassunto
La regione conosciuta con l'antico nome di "Cappadocia" comprende le province di Nevsehir e Kayseri in Turchia. Le rocce tufacee, prodotte dall'eruzione dei vulcani attivi nel tardo Pliocene e Pleistocene in questa regione, sono state per secoli utilizzate dagli abitanti del luogo per molti scopi diversi: case, stalle e chiese. Tuttavia le strutture ipogee più interessanti sono, senza dubbio, le città sotterranee. Queste, scavate a scopo difensivo probabilmente fra il VII e il XII secolo d.C., si rinvengono in quasi ogni parte della Cappadocia. Fino ad oggi sono state identificate più di 200 città sotterranee nella regione. Solo una piccola parte di esse è stata oggetto di specifiche ricerche e solo una piccola parte di quelle analizzate è stata aperta alla fruizione turistica. Sono infatti disponibili le cartografie (a volte semplici schizzi) di solo 12 città sotterranee. Tutte le ricerche condotte nella regione a partire dall'inizio del XX secolo coprono solo un campo o un argomento specifico e fino ad oggi non è stata eseguita un'indagine completa e un inventario dettagliato delle città sotterranee della Cappadocia. Come OBRUK Cave Research Group, siamo stati invitati a rilevare e mappare quattro città sotterranee della Cappadocia. Tra queste, le città sotterranee di Derinkuyu e Tatlarin erano già state censite e mappate in precedenza, mentre quelle di Mazikoy e St. Mercurius non erano ancora mai state esaminate. Grazie ai nostri precedenti progetti sulle strutture sotterranee il nostro team ha acquisito esperienza nel rilievo delle cavità artificiali. Ma nessuno dei nostri progetti si era confrontato con il rilievo di decine di camere, su 3, 4 e anche 5 livelli diversi, collegati tra loro per mezzo di lunghe gallerie.
Parole chiave: *Cappadocia, Città sotterranee, Derinkuyu, Tatlarin, Mazikoy.*

Introduction

Although the underground cities in Cappadocia (Fig. 1) have been known for a long time, the first scientific studies began during 1960's (Ongor, 1965; Akok & Gurcay, 1967). In following years, some of these underground cities have been searched, mapped and opened to tourism. Today, there are 14 touristic underground cities in Cappadocia. Nevertheless, the scientific studies of these structures within this period have fallen behind the new discoveries. There are only a few articles about Kaymakli and Derinkuyu underground cities, where thousands of tourist visit each year, and some overall studies about other underground cities. Most studies are based on engineering and there is almost no reference concerning archaeological or historical background. We even do not have a precise inventory of all the known underground cities of Cappadocia. Total number of the listed and known underground cities prepared up to date in three different inventories (Yorukoglu, 1989; Bixio, 2002; Ayhan, 2004) is about 200, out of which more then 40 maps and sketches are available (see Bixio et al., 2012). As far as the underground cities open to the public are concerned,12 maps are available, some of them being simply sketches. Two touristic underground cities had not been mapped yet. Hence, OBRUK Cave Research Group happily accepted the invitation from the Director of Nevsehir Archaeological Museum for the survey of Derinkuyu, Tatlarin, Mazikoy and St. Mercurius underground cities. Among them, Derinkuyu and Tatlarin underground cities were previously surveyed and mapped, whilst Mazikoy

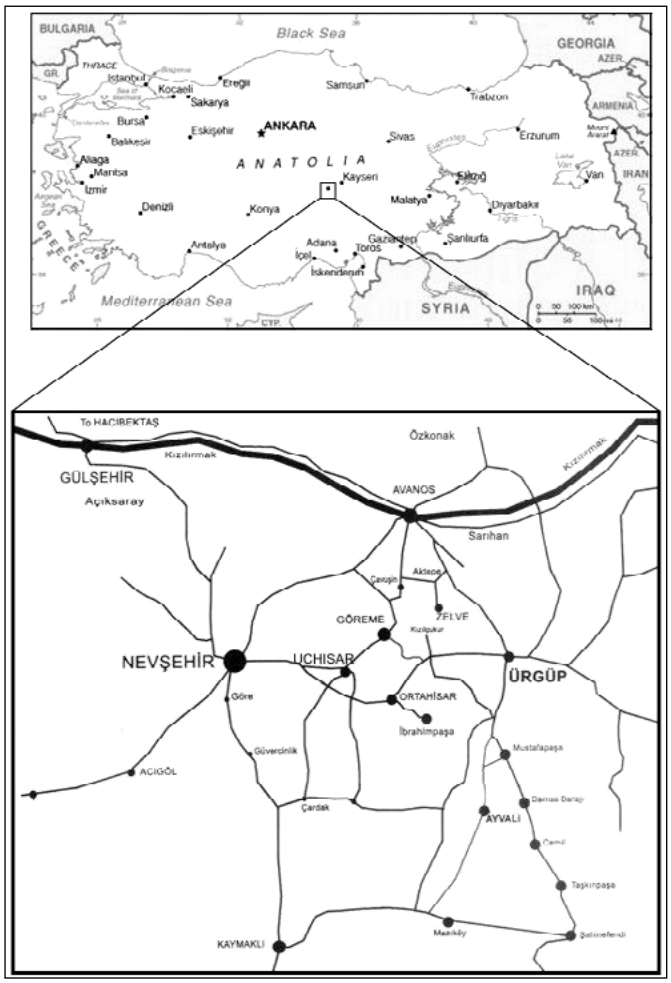

Fig.1: location map of Cappadocia (A. Yamaç).
Fig.1: localizzazione della Cappadocia (A. Yamaç).

Underground City was surveyed before the clearance of tunnels and St. Mercurius Underground City have not been surveyed before.

Execution of Surveys

Although we have carried many artificial cavity surveys before, most of them were one or two storey underground structures: Under Hagia Sophia of Istanbul there were almost only long tunnels and under Topkapi Palace there were cisterns and few galleries. In Gaziantep, there were mostly independently single chambers. Although some artificial cavities in Gaziantep were as large as 90.000 m^2, none of those previous projects had tens of chambers separated with 3,4, even 5 different storeys which were connected to each other through long tunnels as in Cappadocia underground cities. So, for this new project we choose a different survey technique from what we usually used.

We started to search a system to work in Derinkuyu Underground City. The ultimate best solution was to form a main axis with short stations and which could be measured as precisely as possible. All other branch surveys would be joined to at least two stations of this main axis. In the "main axis" measurement, each station was marked permanently. We began that main axis survey from the entrance and close the loop from the bottom floor to the top of ventilation shaft and again to the first station at the entrance. Total length of that main axis was 436 m. and, after closing the loop, the error of this first measurement was only 43 cm. While one of the teams carried out this precise measurement, other two teams were surveying the branches of the main axis and connecting their surveys to main axis' fixed stations (Figs. 2 and 3). From the second storey downwards this method definitely worked, yet the big

Fig. 2: branch gallery survey at Derinkuyu 2. Floor (photo C. Cankirili).
Fig. 2: diramazione studiata a Derinkuyu, 2° piano (foto C. Cankirili).

Fig. 3: survey of 3. to 4. floor connection at Derinkuyu (photo C. Cankirili).
Fig. 3: indagine lungo il collegamente tra il 3° e il 4° piano a Derinkuyu (foto C. Cankirili).

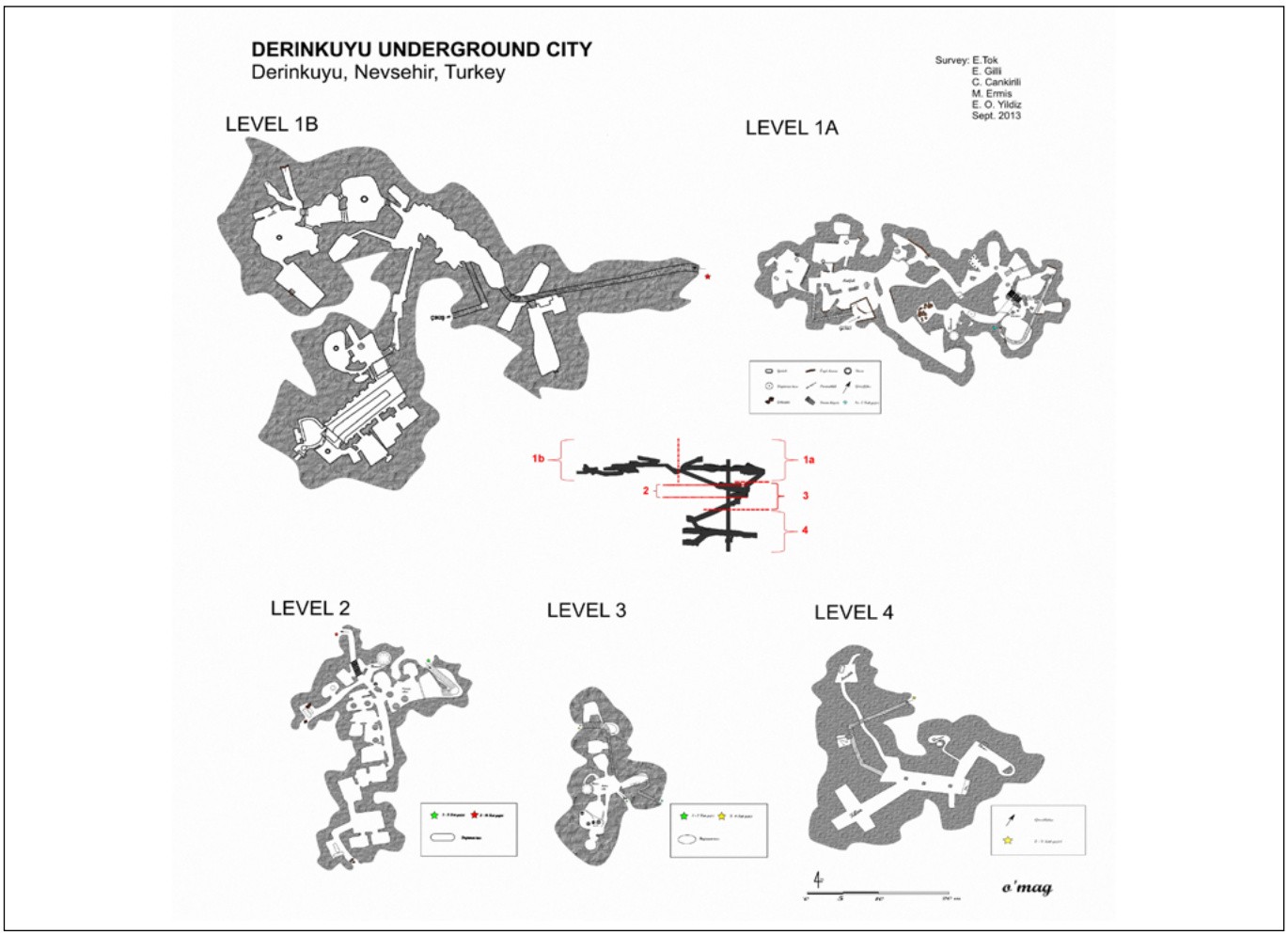

Fig. 4: plan of Derinkuyu Underground City (drawing E. Tok).
Fig. 4: planimetria della Città Sotterranea di Derinkuyu (elaborazione E. Tok).

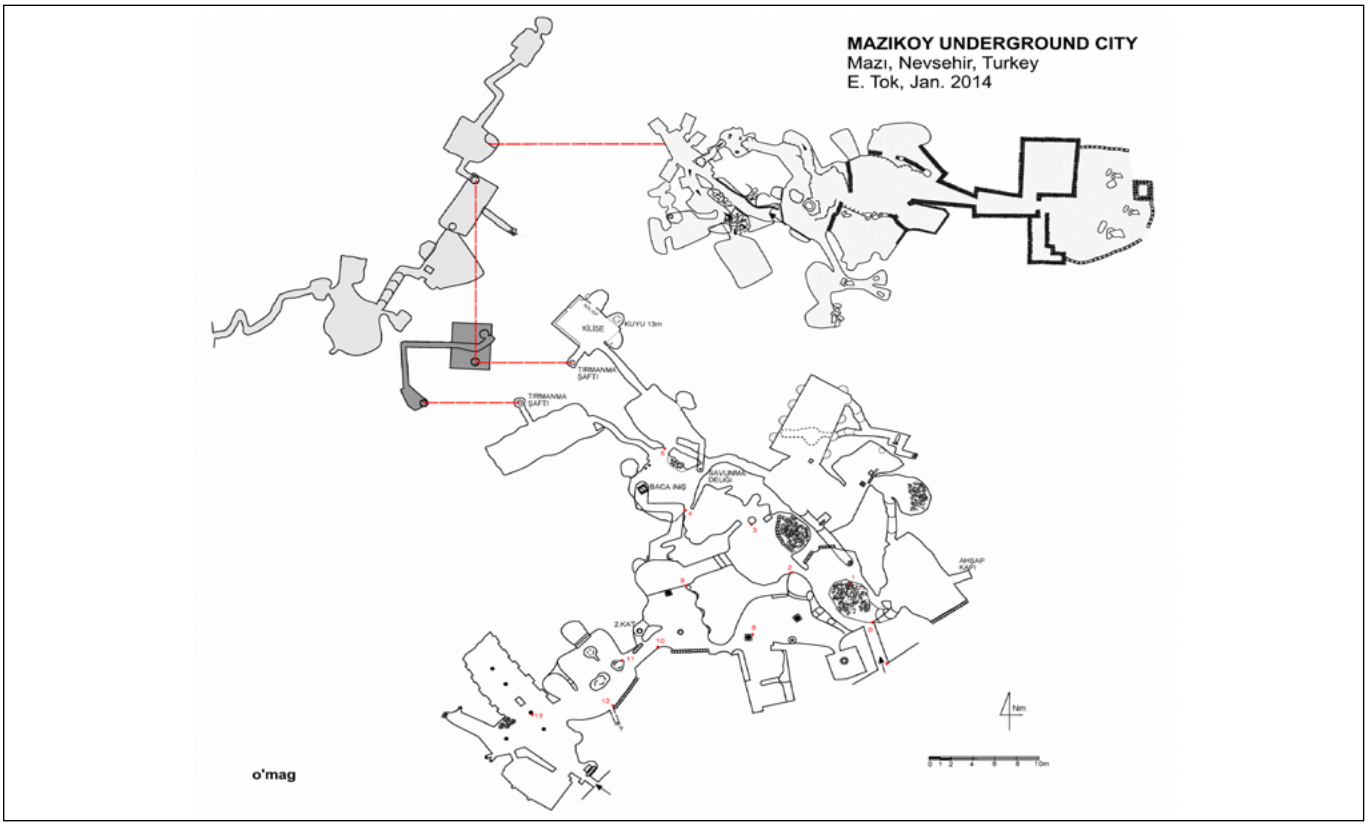

Fig. 5: plan of Mazikoy Underground City (drawing E. Tok).
Fig. 5: planimetria della Città Sotterranea di Mazikoy (elaborazione E. Tok).

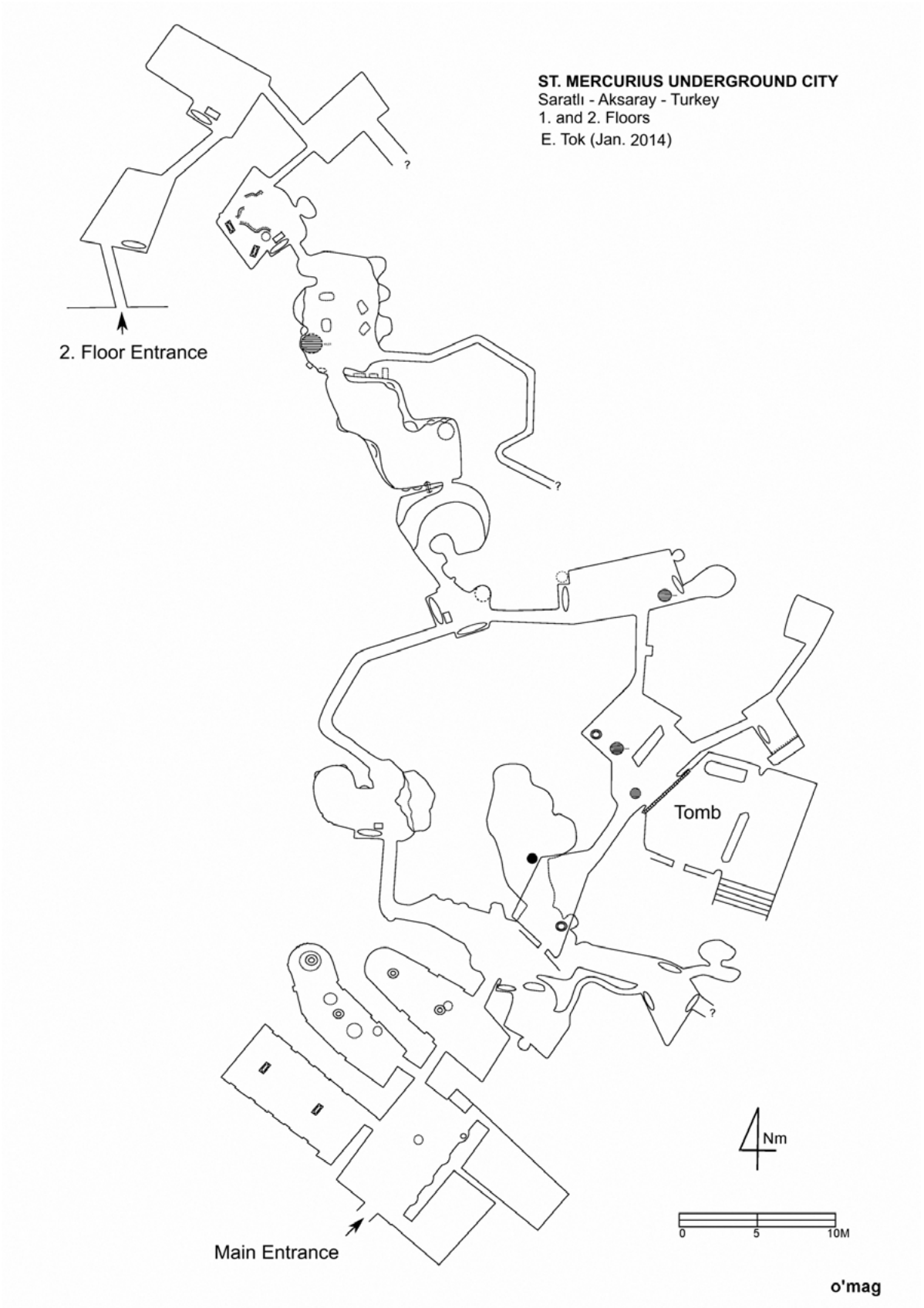

Fig. 6: plan of St. Mercurius Underground City, 1. and 2. floors (drawing E. Tok).
Fig. 6: planimetria della Città Sotterranea di St. Mercurius, 1° e 2° piano (elaborazione E. Tok).

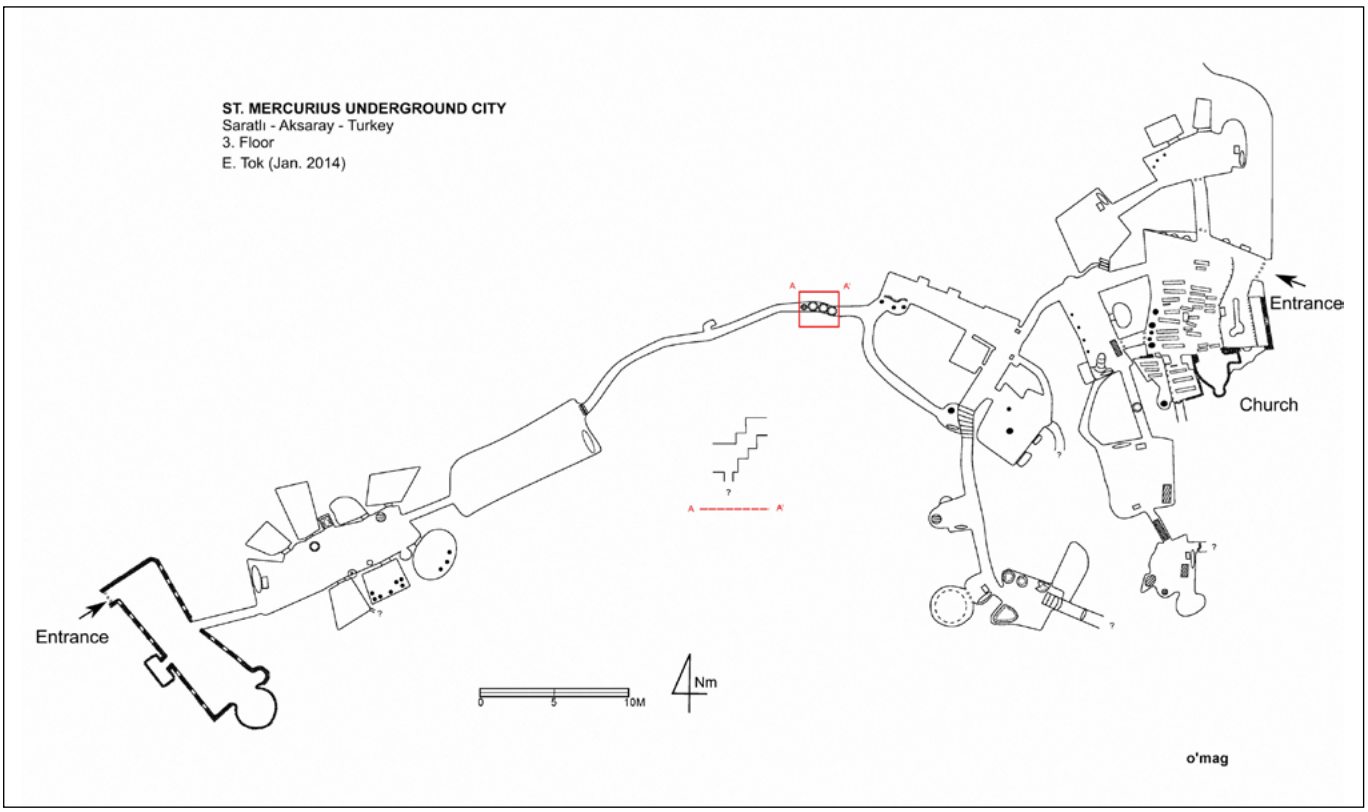

Fig. 7: plan of St. Mercurius Underground City, 3. floor (drawing E. Tok).
Fig. 7: planimetria della Città Sotterranea di St. Mercurius, 3° piano (elaborazione E. Tok).

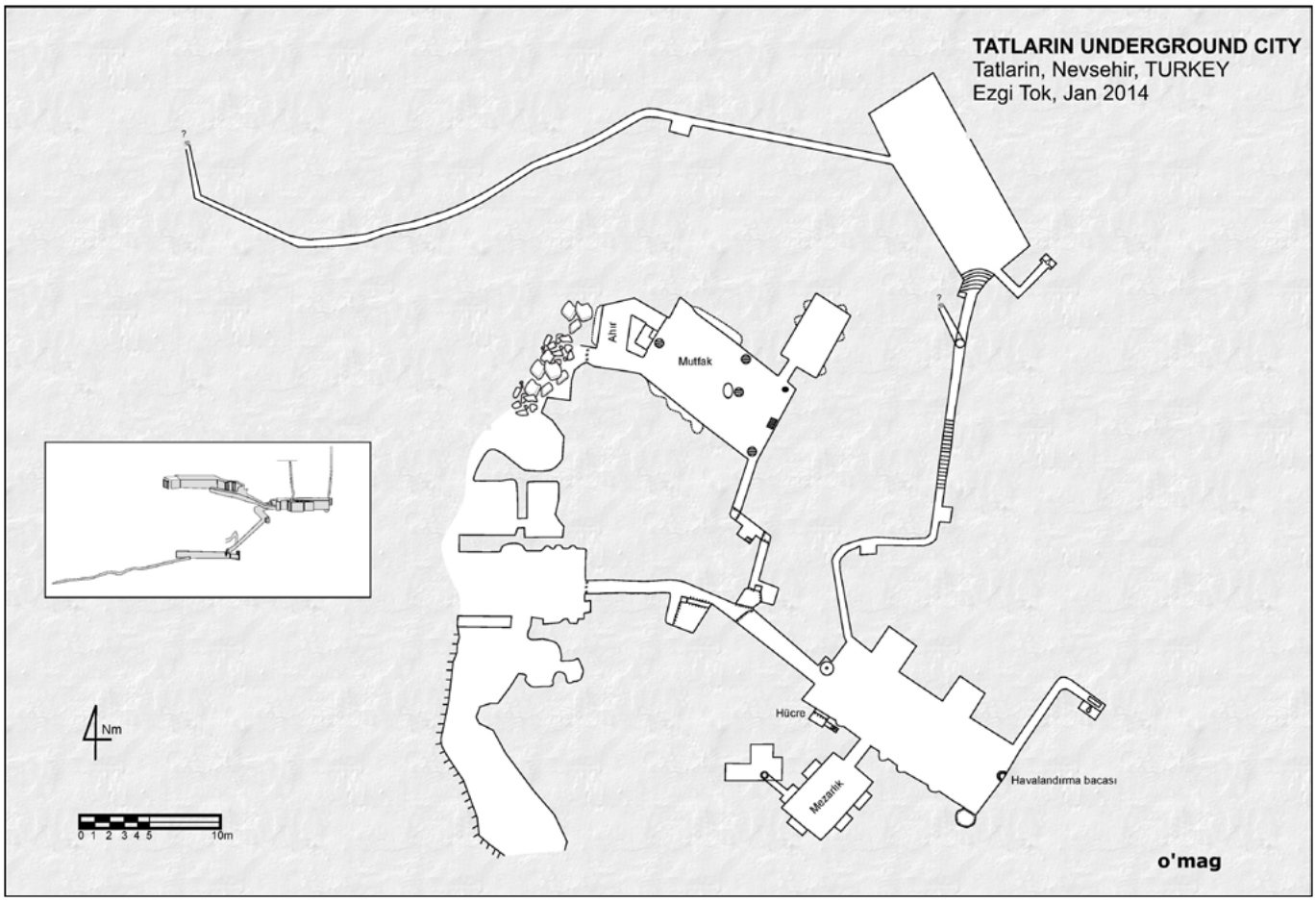

Fig. 8: plan of Tatlarin Underground City (drawing E. Tok).
Fig. 8: planimetria della Città Sotterranea di Tatlarin (elaborazione E. Tok).

chambers in the first storey would increase error ratio. Therefore, we opened "branch main axis's" connected to at least two of the main axis survey stations in the first storey and connected chambers measurements there.

After the survey, drawing the map of Derinkuyu was another problem. It could be a single, open plan showing 5 different storeys with the connections as the previous maps or, a plan with all the layers on top of each other. Finally we decided to draw it as five different plans, rather than a single one. 1880 m measurement was obtained from 489 stations in Derinkuyu Underground City and the total area of this settlement calculated as 3786 m^2 (Fig. 4). Despite having many different survey groups and complex architectural structure of the settlement, measurement error of Mazikoy Underground City is negligible due to our "main axis" survey method. With a mezzanine above the entrance floor, rooms with several divisions on each level, with several large chambers interconnecting with other large chambers, not only the survey but the mapping of Mazikoy Underground City was a real challenge. For the mapping of Mazikoy we had used similar technique as at Derinkuyu Underground City and separated all the levels. We had 439 stations and a total of 1603 meters of survey in this settlement. Due to its large chambers, total area of Mazikoy Underground City is larger than Derinkuyu; it was 4453 m^2 (Fig. 5).

Compared with the previous ones, survey of St. Mercurius Underground City was the most difficult one. It is in the centre of Saratli Village of Aksaray and carved into a rocky slope extending to the north, includes three storeys and has four different known entrances. It is one of the most authentic, cultural, historical and religious structures in Cappadocia together with an 11^{th} century church and the still visited Alewi tomb inside. Its maze-like structure within three different levels and double storeyed rooms, some of which connecting with two different levels was a problem to use "main axis survey". Correct mapping of mezzanines was a real problem, especially between the first and second storeys, whilst the galleries reaching to the Tomb was a real challenge for mapping. In this underground city we had 205 survey stations and the total measurement was 827 meters. Total area was 3905 m^2 (Figs. 6 and 7).

For the survey of Tatlarin Underground City we had three goals: correction of two previous maps, and exact measurements of ventilation shafts and the northern tunnel. After a detailed survey of this small but interesting underground city, it was obvious that the two previous maps were insufficient. Total depth of the ventilation shaft located in the ceiling of southeast wall of the main chamber is 83 m. This depth makes this ventilation shaft the deepest in Cappadocia. The narrow gallery ongoing from the third chamber is continuing for 57 meters without connecting anywhere and clogged. There are no other unopened or clogged galleries in Tatlarin except this one. Therefore, the whole secrecy of this interesting and mysterious underground structure is maybe within the rest of that narrow gallery (Fig. 8).

Conclusion

It is a deficiency that there are no detailed inventories, surveys and comprehensive studies about the underground cities which are an important part of historical and cultural value of Cappadocia. As OBRUK Cave Research Group, after those surveys we realized that these structures should be investigated in more detail and we had started the inventory of Underground Cities of Turkey within TAY Project (www.tayproject.org) which we previously prepared The Cave Inventory of Turkey. We believe that such an inventory, involving the whole underground city studies up to date, will back up the future studies.

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