

Estratto da:

OPERA IPOGEA

Journal of Speleology in Artificial Cavities

1 / 2013

**Proceedings of the international workshop
on speleology in artificial cavities**

“Classification of the typologies of artificial cavities in the world”

Torino/Italy – May 18-20, 2012



ISSN 1970-9692

Editor: M. Parise

Rivista della Società Speleologica Italiana



Commissione Nazionale Cavità Artificiali



Underground refuges and war tunnels (France, Cappadocia, Afghanistan, Vietnam and Lebanon)

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Abstract

We have been studying underground cavities dug by man, with particular reference to underground refuges, for 25 years. Thanks to this research, the function and the organization of underground refuges in France and other countries have been better understood. Recently, a synthetic work about the use of underground cavities during war has been published in the book "La guerre souterraine" (Underground Warfare). Through this work, we are able to present two categories of underground cavities dug by man during war: underground refuges and war tunnels. For the two categories, we present in this article several examples of cavities dug in different countries and used at different times. Our purpose is to show that, despite the historical and geographic differences, all the cavities included in each of these categories present an important architectural unity. This common architecture is related to an identical function. We will also point out the existing differences between underground refuges and war tunnels.

KEY WORDS: underground refuges, war tunnels, war.

Riassunto

RIFUGI SOTTERRANEI E GALLERIE DI GUERRA (FRANCIA, CAPPADOCIA, AFGHANISTAN, VIETNAM E LIBANO)

Negli ultimi 25 anni ci siamo intensamente impegnati nello studio di cavità sotterranee scavate dall'uomo, con particolare riferimento ai rifugi sotterranei. Grazie a questa ricerca, le funzione e l'organizzazione dei rifugi sotterranei in Francia ed in altre nazioni sono state meglio comprese. Di recente, una sintesi dei lavori prodotti, relative all'utilizzo di cavità antropiche sotterranee nel corso di eventi di guerra, è stata pubblicata nel libro "La guerra sotterranea". Grazie a tale lavoro, siamo in grado di presentare due categorie di cavità sotterranee scavate dall'uomo durante le guerre: rifugi sotterranei e gallerie di guerra. Per le due categorie, presentiamo in questo articolo diversi esempi di cavità scavate in nazioni differenti e utilizzate in epoche diverse. Il nostro obiettivo è dimostrare che, nonostante le differenze storiche e geografiche, le cavità incluse in ciascuna delle su indicate categorie costituiscono una rilevante unità architettonica. Tale architettura comune è legata alla identica funzione. Nell'articolo saranno inoltre evidenziate le differenze esistenti tra rifugi sotterranei e gallerie di guerra.

PAROLE CHIAVE: rifugi sotterranei, gallerie di guerra, guerra.

In the North West and South West of France researchers have mapped more than 600 underground refuges (called *souterrains-refuges* in French; Fig. 1). The smallest underground refuges feature a single room served by a single access corridor. This elementary form can accommodate a few people. Most underground refuges are larger and include 3 or 5 rooms connected by corridors, with a total length of 30 to 50 m (Fig. 2). These rooms could accommodate dozens of people. The larger refuges are often divided in two branches, but

they also have a single entrance corridor (TRIOLET & TRIOLET, 1995, 2002, 2003, 2011).

Vital facilities have been dug into the galleries and mainly into the rooms. There are vent pipes drilled in the ceiling or ceramic vent pipes installed in air shaft, big niches dug in the wall, small niches made to receive fat lamps, grain silos excavated in the soil or the wall of rooms, stone benches and water wells. All these equipments indicate that people could live for a few days inside the cavity.

¹ www.mondesouterrain.fr

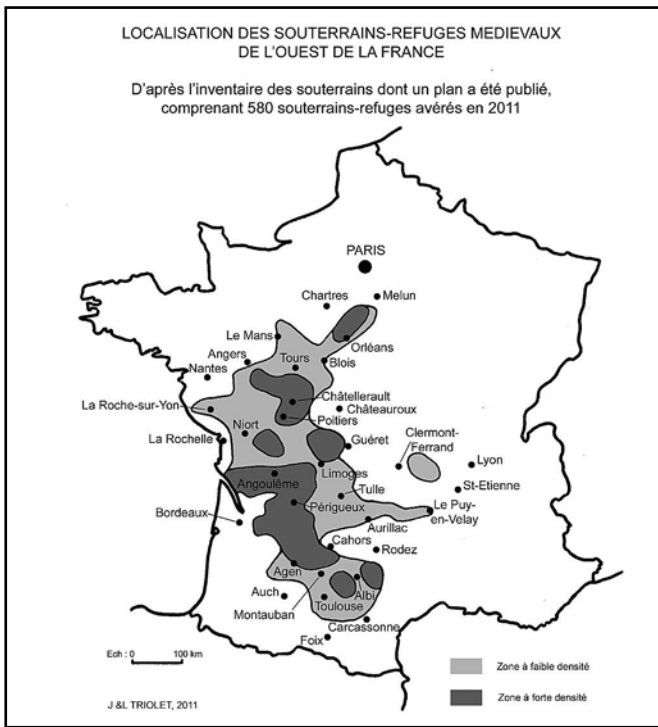


Fig. 1 - Distribution map of small underground refuges (souterrains-refuges) in North-western and South-western France.

Fig. 1 - Carta della distribuzione dei rifugi sotterranei nella Francia Nord-occidentale e Sud-occidentale.

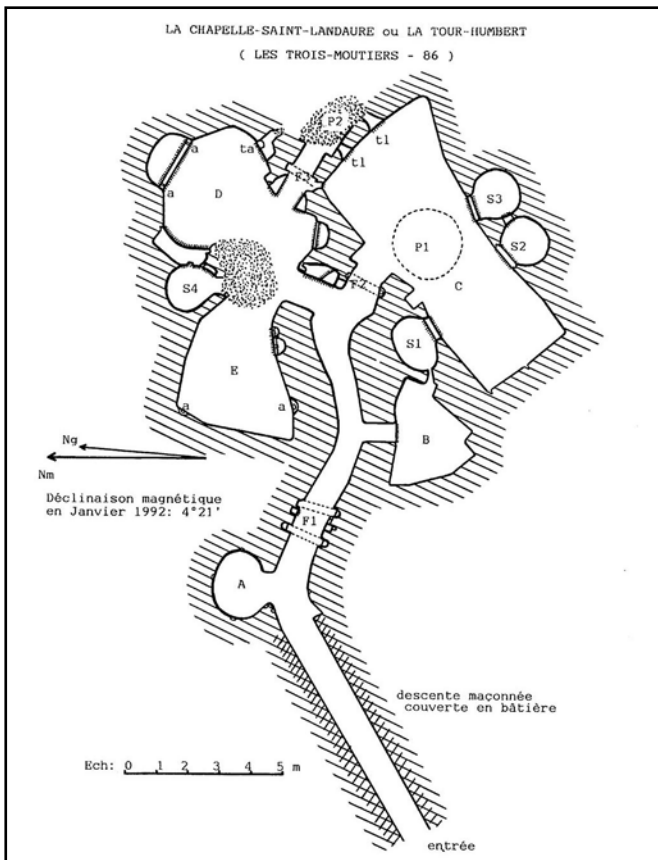


Fig. 2 - Plan of a small underground refuge with passive defense, La Chapelle-Saint-Landaure, region of Poitiers, France (topography J. & L. Triolet 1992).

Fig. 2 - Pianta di un rifugio sotterraneo con strutture di difesa passiva a La Chapelle-Saint-Landaure, nella regione di Poitiers, in Francia (rilievo J. & L. Triolet 1992).

In underground refuges, the narrow and winding corridors often change direction. The narrowness and the bends make the progression difficult in the gallery. Together with the dissimulation of the entry, it provides a first line of protection for refugees. Various defense systems dug into the rock complement this first line. Grooves have been carved in the walls to install thick wooden doors which close the corridors or the entrances of the rooms (Fig. 3). Narrow passages with diameter of 50 or 40 cm force the visitors to crawl in order to progress inside the refuge (Fig. 4). Wells or silos especially excavated in the soil of the gallery are very dangerous booby traps. Doors, narrow passages and traps are passive defense systems.

In addition to passive defense systems, in some underground refuges there is a very efficient active defense system. The wall of the access gallery is pierced with one or several loopholes. The loophole is associated with a passive defense system, most frequently with a door. Blocked by the obstacle, the assailant was obliged to remain in front of the opening of the loophole. It was very easy to shoot and hit the target (Fig. 5).

In the North West and South West of France, underground refuges were dug by small rural communities to protect themselves against attacks from looters.



Fig. 3 - Corridor with grooves carved in the walls to install a thick wooden door, region of Poitiers, France. Height: 1,75 m (photo J. & L. Triolet).

Fig. 3 - Corridoio con scanalature scavate nelle mura per installare una porta in legno, regione di Poitiers, Francia. Altezza: 1,75 m (foto J. & L. Triolet).



Fig. 4 - Room for refugees protected by a narrow passage, underground refuge of Bournan, region of Tours, France. Height: 1,80 m (photo J. & L. Triolet).

Fig. 4 - Ambiente all'interno di un rifugio, protetto da uno stretto passaggio, rifugio sotterraneo di Bournan, regione di Tours, Francia. Altezza: 1,80 m (foto J. & L. Triolet).

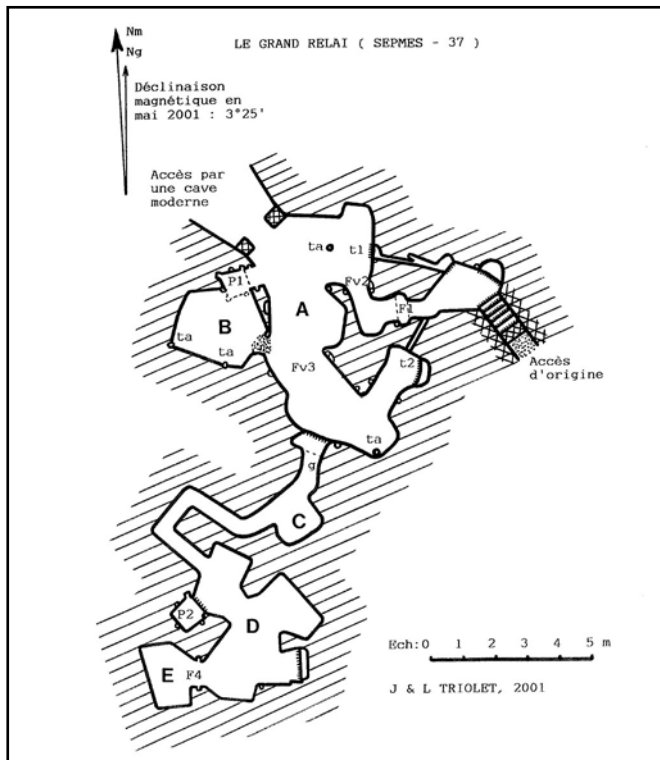


Fig. 5 - Plan of a small underground refuge with active defense, Le Grand-Relai, region of Tours, France (topography J. & L. Triolet, 2001).

Fig. 5 - Pianta di un rifugio sotterraneo con strutture di difesa attive a Le Grand-Relai, regione di Tours, Francia (rilievo J. & L. Triolet, 2001).

They date back to the medieval period (from the 12th to the 16th century; Fig. 6). Many of them were dug because of the Hundred Years War (14th - 15th century) and the Wars of Religion (second half of the 16th century).

VILLAGE UNDERGROUND REFUGES

Cappadocia, Turkey (8th - 15th century)

In Cappadocia more than 50 “underground cities” (Fig. 7) have been listed (TRIOLET & TRIOLET, 1993, 2011;

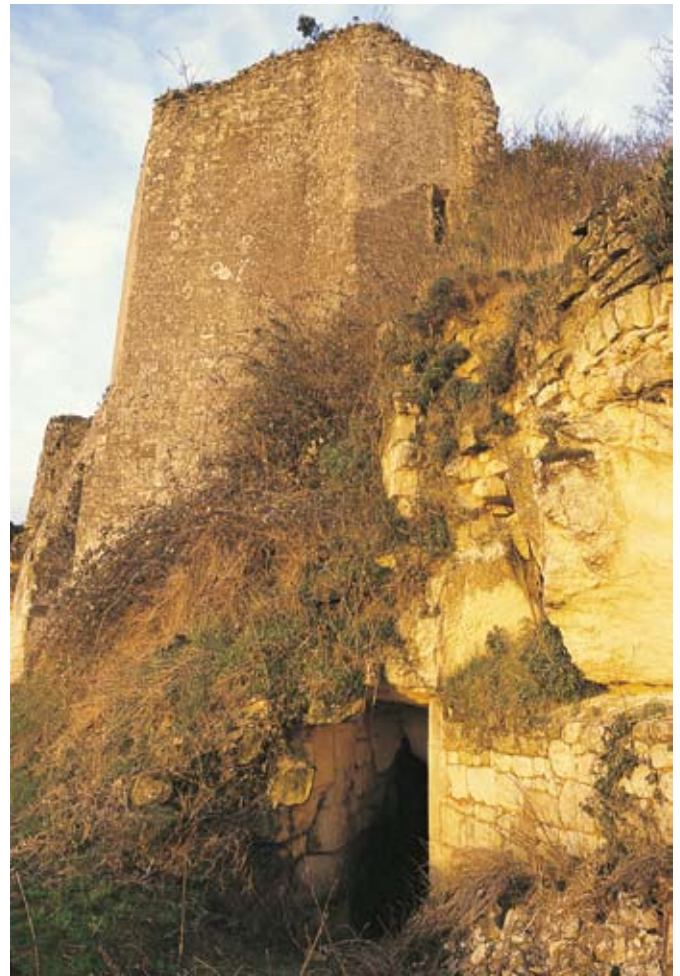


Fig. 6 - Entrance to the underground refuge of the medieval fortress of Crissay-sur-Manse, region of Tours, France (photo J. & L. Triolet).

Fig. 6 - Ingresso del rifugio sotterraneo della fortezza medievale di Crissay-sur-Manse, regione di Tours, Francia (foto J. & L. Triolet).

BERTUCCI et al., 1995; BIXIO et al., 2002; BIXIO & DE PASCALE, 2012). Those “underground cities” are very complex networks including several dozen rooms connected by narrow and long corridors. One of the widest is the famous underground city of Derinkuyu, that includes several levels and slopes down to a depth of 45 m. Despite the impressive dimensions of the network of Derinkuyu, which could probably shelter about 700 to 1000 people, the capacity of most of these underground complexes did not exceed a few hundred people. Therefore, it should be more realistic to call them village underground refuges.

Cappadocian underground refuges and French underground refuges have a similar organization; the difference lies in the size and the number of entries. A Cappadocian village underground refuge amounts to the addition of several small French underground refuges and it has several accesses.

The Cappadocian refuges have got the same vital facilities: vent pipes, big and small niches, water wells and grain silos. For the defense, in a few village underground refuges, there are grooves carved in the rock to install wooden doors and narrow passages, but the most characteristic defense system is the stone door, that is a stone disc similar to a millstone (Figs. 8 and 9).

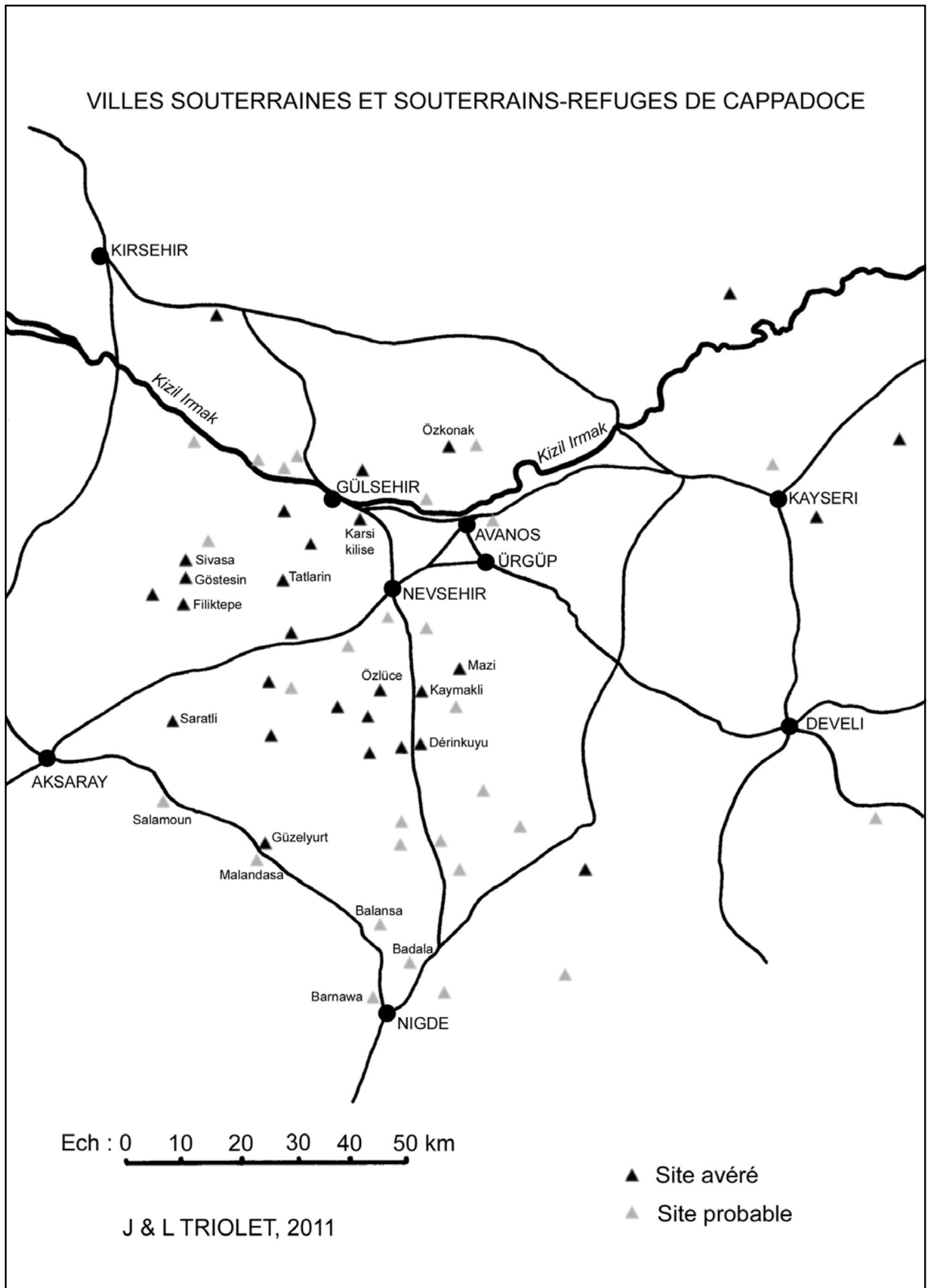


Fig. 7 - Distribution map of underground refuges in Cappadocia.
 Fig. 7 - Carta della distribuzione dei rifugi sotterranei in Cappadocia.



Fig. 8 - Room protected by a stone door still closed, village underground refuge of Sivasa, Cappadocia. Height: 1,9 m (photo J. & L. Triolet).

Fig. 8 - Stanza protetta da una porta in pietra, ancora chiusa, nel villaggio sotterraneo di Sivasa, in Cappadocia. Altezza: 1,9 m (foto J. & L. Triolet).



Fig. 9 - Stone door kept in its position by a rocky pillar, village underground refuge of Göstesin, Cappadocia. Diameter of the door: 1,4 m (photo J. & L. Triolet).

Fig. 9 - Porta in pietra mantenuta nella sua posizione da un pilastro in roccia, villaggio sotterraneo di Göstesin, Cappadocia. Diametro della porta: 1,4 m (foto J. & L. Triolet).

All the “underground cities” of Cappadocia are protected by stone doors, some of them being very impressive in scale. The biggest stone door of the village underground refuge of Özkonak is 1,8 m high and 0,67 m wide, with a total weight of 3,5 tons. The hole located in the centre of numerous stone doors was probably used as a loophole. In many Cappadocian refuges, there are also other loopholes pierced in the walls or the ceiling and opening in front of the door. In village underground refuges of Cappadocia, the multiple successive doors and the loopholes offer a complex and very efficient active defense.

Cappadocian village underground refuges were dug by rural communities to accommodate the population of the village. They were dug to protect it against Arabian raids (from the 8th to the 10th century) and against the attacks of the Ottomans and the Turkomans (from the 13th to the 15th century).

Northern France (15th - 18th century)

In Northern France, in an area straddling the regions of Picardie and Nord-Pas-de-Calais (Fig. 10), research-

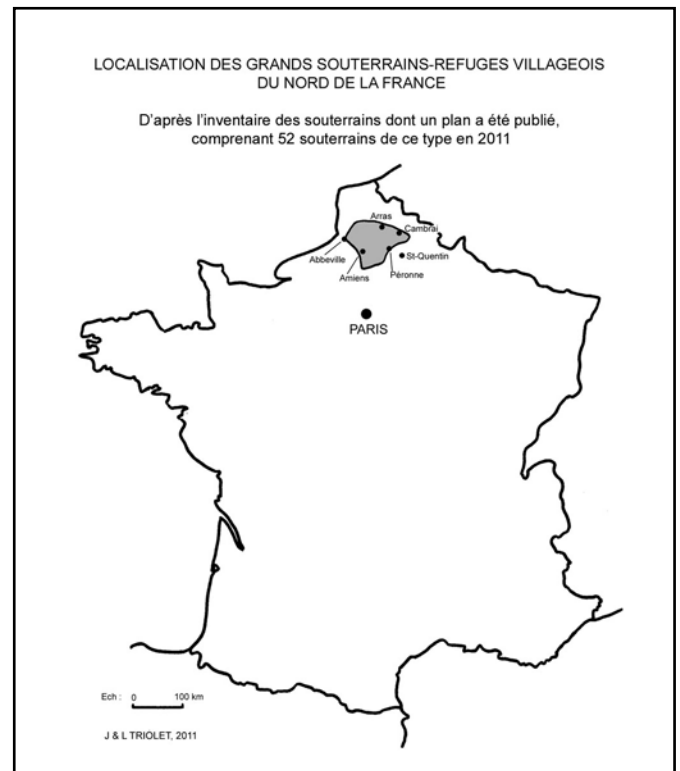


Fig. 10 - Distribution map of village underground refuges in Northern France.

Fig. 10 - Carta della distribuzione dei rifugi in villaggi sotterranei della Francia settentrionale.

chers have mapped more than 50 village underground refuges (FOURDRIN, 1979; TRIOLET & TRIOLET, 1995, 2011; PETIT, 2001; DEWERDT et al., 2009).

These large refuges include up to hundreds of rooms connected by one to three access corridors, and could accommodate up to 500 people (Fig. 11). The map of those networks is different from that of the Cappadocian refuges. The single entry or the few access corridors are wider (more than 1 m) and higher (up to 2 m) to allow the movement of many people (Fig. 12). One or two thick wooden doors were installed to close this large gallery and, in some cases, there is a guardroom at the end of the gallery. Then, the access corridor leads to several galleries lined with rooms; these galleries are like streets with rooms on each side (Fig. 13). Each room belonged to a different family and was closed thanks to a lockable door; it accommodated people, grains and animals.

The defensive organization of the village underground refuges of Northern France is much simpler than that of the Cappadocian refuges. The access gallery was protected by thick wooden doors and by some guards using portable firearms like harquebuses. After this first line of defense, in each room, the refugees were only fitted with a wooden door.

In Northern France, village underground refuges were dug by the inhabitants of the villages to accommodate the population. They were dug to protect against the soldiers raids when the region was the border area between belligerents, in particular during the Wars of Religion (second half of the 16th century) and the Thirty Years' War (17th century, from 1635 to 1659).

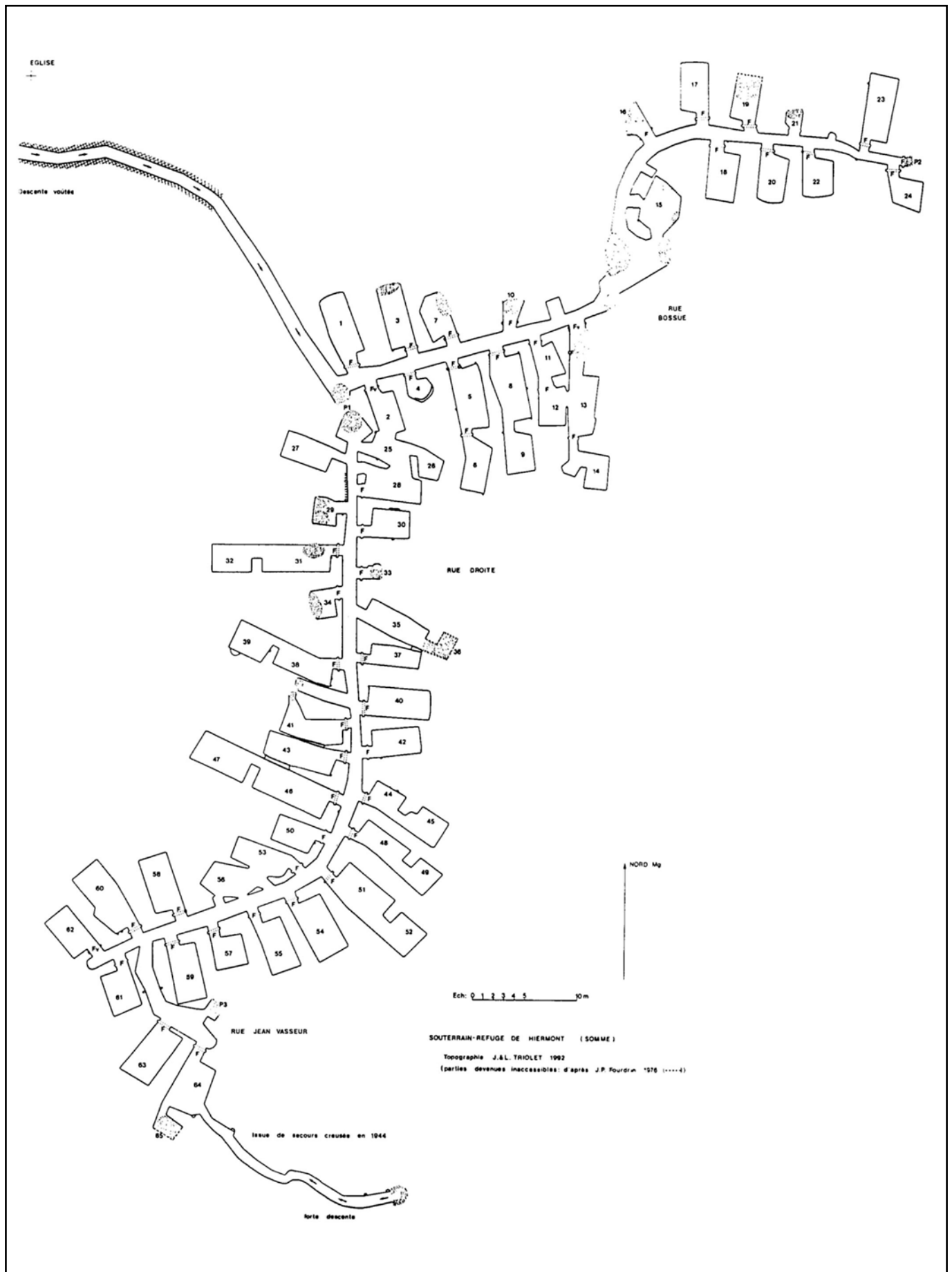


Fig. 11 - Plan of the village underground refuge of Hiermont, region of Amiens, France (topography J. & L. Triolet 1992 and after J.-P. Fourdrin 1976 for inaccessible parts).

Fig. 11 - Pianta del rifugio sotterraneo nel villaggio di Hiermont, regione di Amiens, Francia (rilievo J. & L. Triolet, 1992, e J.-P. Fourdrin, 1976 per i settori inaccessibili).

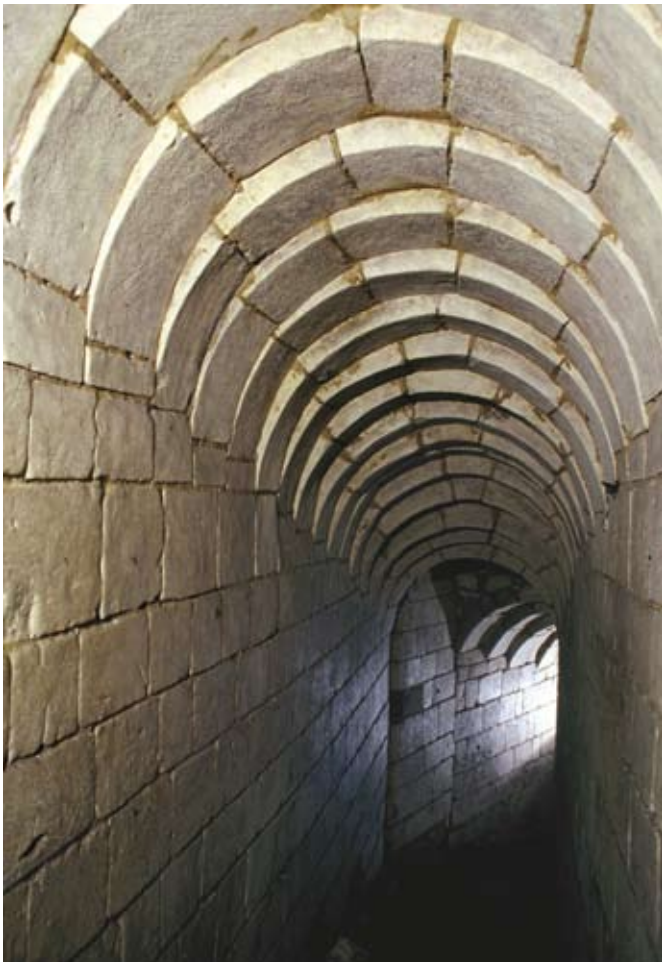


Fig. 12 - The access corridor of the village underground refuge of Filescamp, region of Arras; the vault is characteristic of the underground refuges of Northern France. Height: 2 m (photo J. & L. Triolet).

Fig. 12 - Corridoio di accesso al rifugio del villaggio sotterraneo di Filescamp, regione di Arras, Francia; la volta è tipica dei rifugi sotterranei della Francia settentrionale. Altezza: 2 m (foto J. & L. Triolet).

Vietnam (20th century)

According to Vietnamese authorities, in Northern Vietnam, in the region of Cap Lay located just north of the Demilitarized Zone (DMZ) separating Northern and Southern Vietnam (Fig. 14), 114 village underground refuges are listed (XUÂN, 2002; TRIOLET & TRIOLET, 2011). The North Vietnamese authorities dug these refuges during the Vietnam War from 1965 on. One of these cavities (the village underground refuge of Vinh Moc) is still accessible.

This refuge was excavated in the years 1965-1967 by the villagers with the assistance of border guards and the local militia. Around 250 people took part in the digging that lasted between 20 and 24 months. The network is located on the shoreline of the Southern China Sea, there are 13 entries giving access to 3 levels. It is composed of numerous rooms connected by narrow corridors, with a total length of approximately 300 m (Fig. 15). Near the surface, the upper level includes kitchens and 2 large air shafts. The intermediate level is the heart of the underground network, featuring a vast meeting room and long galleries forming streets with around forty rooms for families located on each



Fig. 13 - The central gallery with rooms on each side, village underground refuge of Hiermont, region of Amiens, France (photo J. & L. Triolet).

Fig. 13 - Galleria centrale, con stanze su entrambi i lati, nel rifugio sotterraneo del villaggio di Hiermont, regione di Amiens, Francia (foto J. & L. Triolet).

side (Figs. 16 and 17). At this level, there are also 2 water wells, a latrine and a bomb shelter. The lower level gives access to the beach, it includes a dozen rooms used to store food, weapons and ammunition.

Apart from a few doors, there is no defense system inside the large refuge, it was designed mainly to escape aerial surveillance and to provide an efficient bomb shelter. Despite this difference in function which is an adaptation to the constraints of modern warfare, the organization and the architecture of these Vietnamese underground refuges are very similar to those of underground networks existing in Northern France and even in the North West and South West of France.

HIGH MOUNTAIN UNDERGROUND COMPLEXES IN AFGHANISTAN (20TH – 21ST CENTURY)

Several underground complexes are known in the east of Afghanistan, near the Pakistan border. The Mujahideen began to dig those underground networks at the end of 1980 during the Soviet invasion. For a greater protection, they dug the cavities at high

altitude in the walls of canyons and narrow valleys. They used explosives and construction machineries to excavate large tunnels, added weapons and ammunition storages, repair workshops, garages, a kitchen, a medical center, a mosque and even in some cases a hotel! On the mountain tops surrounding these complexes, Afghan fighters installed anti-aircraft batteries and dug trenches and shelters. Thanks to these underground complexes they were able to resist the Soviet and the Occidental troops (BAHMANYAR, 2004; TRIOLET & TRIOLET, 2011).

In September 1985, the Soviet Army could not take the underground complex of Zhawar. One year later, in April 1986, with the help of the regular Afghan Army they finally took the stronghold of Zhawar but, because of the danger, they had to leave it after 5 hours! During the battle, Soviet and Afghan troops lost 24 helicopters, 2 aircrafts and many soldiers (GRAU & JALALI, 2001). In December 2001, US army and Afghan militias had serious difficulties to take the underground complex of Tora Bora and 1000 Al Qaeda and Taliban fighters managed to escape to Pakistan. In March 2002, protected by the underground complex of Chah-e-Kot, Al Qaeda and Taliban stood up to US and coalition forces during 2 weeks. Eight US soldiers were killed and 47 injured, beside the loss of two helicopters.

These high mountain underground complexes are a contemporary variant of underground refuges, like the village underground refuge of Vinh moc; they are designed to escape aerial surveillance and to provide an

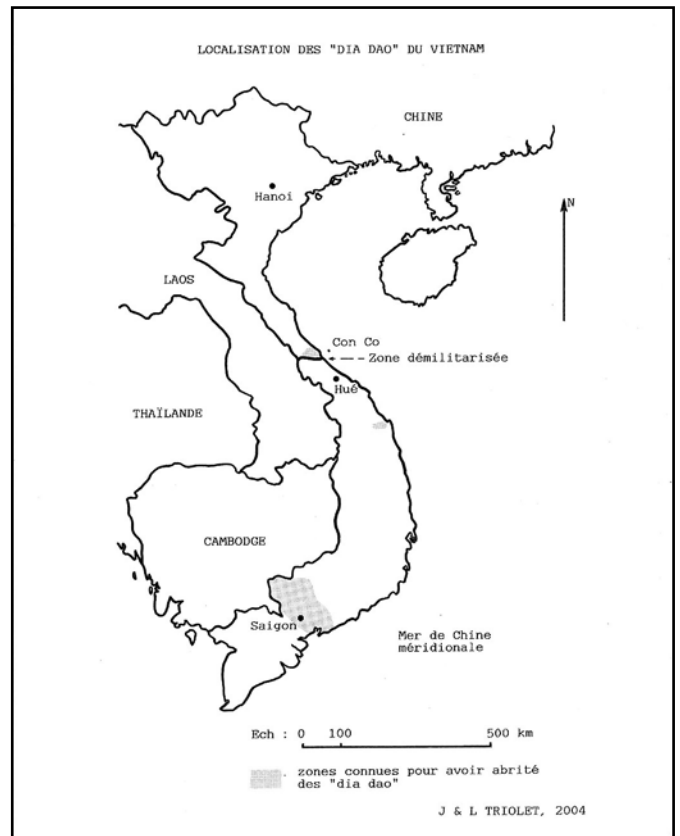


Fig. 14 - Distribution map of war tunnels and village underground refuges in Vietnam.

Fig. 14 - Carta della distribuzione delle gallerie di guerra e dei villaggi sotterranei in Vietnam.

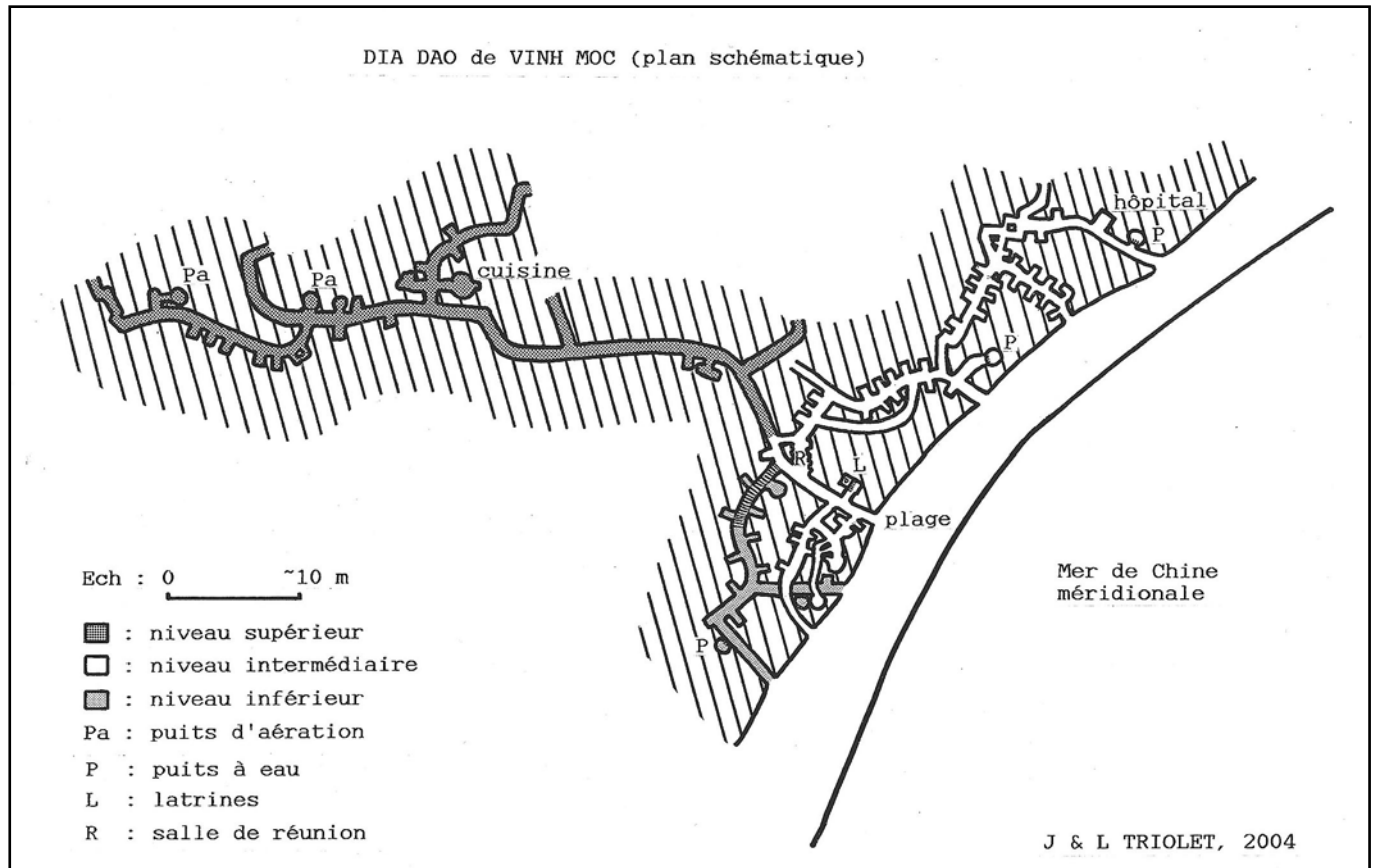


Fig. 15 - Schematic plan of the village underground refuge of Vinh Moc, Vietnam (drawing J. & L. Triolet 2004, modified after Culture and Information Administration of Quang Tri).

Fig. 15 - Pianta schematica del rifugio sotterraneo nel villaggio di Vinh Moc, in Vietnam (disegno J. & L. Triolet, 2004, modificato da: Culture and Information Administration of Quang Tri).



Fig. 16 - Central gallery that gives access to rooms located on each side, intermediate level of the village underground refuge of Vinh Moc, Vietnam. Height: 1,80 m (photo J. & L. Triolet).

Fig. 16 - Galleria centrale che dà accesso a stanze dislocate su entrambi i lati, nel livello intermedio del rifugio nel villaggio sotterraneo di Vinh Moc, in Vietnam. Altezza: 1,80 m (foto J. & L. Triolet).



Fig. 17 - Small room for refugees, intermediate level of the village underground refuge of Vinh Moc, Vietnam (photo J. & L. Triolet).

Fig. 17 - Piccola stanza per rifugiati nel livello intermedio del rifugio nel villaggio sotterraneo di Vinh Moc, in Vietnam (foto J. & L. Triolet).

efficient bomb shelter. Unlike all the other refuges we have presented which protected civilians, the Afghan complexes seem to be only occupied by fighters.

WAR TUNNELS

Vietnam, 20th century

In Southern Vietnam, in the region of Saigon, there is an impressive network of tunnels dug mainly during the Vietnam War. The most famous of these tunnels are the tunnels of Cu-Chi. Around Cu-Chi and in the Iron Triangle (Fig. 14), there might have been up to 300 km of tunnels with a capacity of 16,000 people (PENYCATÉ & MANGOLD, 1985; TRIOLET & TRIOLET, 2011).

The corridors are very low (0,6 to 1,1 m high) and narrow (0,5 to 0,7 m wide), each section is several hundred meters long (Fig. 18). They often change direction, are divided into numerous branches and arranged on 2 or 3 levels. Hatches carefully disguised in the ground of the forest closed the entrances of the tunnels (Fig. 19). The hatches were very small.



Fig. 18 - Connecting little tunnel enlarged for the visit, tunnels of Ben Dinh, region of Cu Chi, Vietnam (photo J. & L. Triolet).

Fig. 18 - Collegamento di piccola galleria, allargata per la visita, nelle gallerie di Ben Dinh, regione di Cu Chi in Vietnam (foto J. & L. Triolet).



Fig. 19 - Hatch carefully disguised in the ground of the forest closing the entrance of the tunnels, Ben Dinh, region of Cu Chi, Vietnam (photo J. & L. Triolet).

Fig. 19 - Tombino di accesso, mascherato con cura nel terreno della foresta, alle gallerie di Ben Dinh, regione di Cu Chi in Vietnam (foto J. & L. Triolet).

Today in the tunnels of Ben Duoc, there is a hatch that is 30 cm long and 22 cm wide, and one can pass through the narrow opening! This tunnel network was connected externally to trenches and firing positions. The long and narrow tunnels also lead to half-buried rooms in which Viet Cong spent most of the time.

They were used as kitchens, sleeping-rooms, meeting-rooms, infirmaries or operating rooms. At the lower level, the corridors lead to underground rooms, smaller and safer, that were used as bomb shelters and contained food, weapons and ammunition storages.

Thanks to the tunnels, the half-buried and underground rooms, Viet Cong fighters and Vietnamese villagers could escape aerial surveillance and protect themselves against repeated and destructive bombings. The predominance and the length of corridors show that they were also dug to allow Viet Cong fighters to escape mopping-up operations, to move secretly and to counter attack where they were not expected. The connections with trenches and firing positions confirm this function.

The US Army understood the military importance of the tunnels, and in 1966 created special units to explore and destroy the galleries: tunnel rats. On both sides, the fighting inside the tunnels was very fierce and very cruel. At the beginning of 1970, the tunnels were generally unusable by Viet Cong, but they helped to weaken the US Army. Because of the specific characteristics of Vietnamese underground networks and because of their direct involvement in the fight, they are different from underground refuges and we include them in a special category: war tunnels.

Lebanon, 21st century

In Southern Lebanon, the Hezbollah have dug tunnels

and bunkers several kilometers long, in the rock with carefully disguised entrances. In July 2006, the Israeli Army entered Southern Lebanon. Despite air power and the great technological superiority of Tsahal, well protected inside the cavities and moving secretly thanks to the tunnels, Hezbollah fighters effectively resisted the enemy. Israeli forces lost 120 soldiers and around 60 tanks.

The galleries of South Lebanon seem to be a contemporary variant of Vietnam war tunnels. Opened in May 2010 in Southern Lebanon, the Mleeta museum shows a portion of tunnels and underlines this Vietnamese influence.

Whatever the time and the place, underground refuges present the same development and the same organization, including rooms for refugees connected by corridors, vital facilities and defense systems. From the Middle Ages, underground refuges have been efficient fortresses because they were hidden and because it was easy to defend oneself inside the narrow corridors. During modern warfare they offer an additional advantage: the occupants escape aerial surveillance and are relatively well protected against bombing. War tunnels are quite different and it seems that they have emerged more recently. War tunnels also include rooms but the network of underground galleries is more important extending over a wider area. The tunnels have many entrances and are connected with trenches and firing positions.

Thus using underground refuges or war tunnels, underground warfare is the weapon of the weak against the strong. Today this underground warfare is still efficient in asymmetrical conflicts like those in Lebanon or Afghanistan.

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