

Typology 6: military structures

Structures or environments for various purposes, strictly connected to wartime defence and offence. Although castles hold undeniable appeal, it was the collective notion of their 'secret underground passages' that first led to their exploration. Its very 'genre' is ascribable to the type of activity dealt with in speleology. For example, in relation to the position occupied by the ancient *Praeneste*, Strabone tells us that it not only had a natural defence but that it had underground walkways in all directions leading to the plains, which were both utilised as 'secret passages' and for the purposes of water supply. The point of the exploration is therefore to document other types of underground structures: wells, cisterns, warehouses, prisons, underground passages and connecting tunnels. Without of course calling off exploration and cognitive activity in those environments that only appear to be underground.

Prior to the use of firearms, underground works inside the walls were not strictly necessary for defence purposes. Following their introduction, underground works immediately became a part of the fortification's defence. In bastioned buildings, countermines and demolition installations generally constitute the most important defensive element. It should also be taken into account that over time and following partial destruction and burial or subsequent urban repairs, raised sections could end up below the level of adjacent ground.

Defence works have been created almost everywhere, using different types of materials and sometimes using existing works. They can be used in the defence of houses, in territory control or in the defence of obligatory passages through valleys or along rivers. Various types of fortification are used in the defence of ports and the hills are guarded by towers and forts.

Artillery magazine

In permanent of field fortifications, this is a small room for the storage of munitions.

A small, bomb-proof room situated in proximity to the defensive line, sometimes between emplacements and sometimes used as a transverse. Its purpose was to supply munitions to the line sections.

Expense magazine: a small room in the terreplein of a traverse situated between two emplacements or artillery units, already used in bastioned XVIII century fortifications. It serves as a munitions and artillery magazine.

Bastion

Fortified work consisting of a terreplein enclosed in a thick polygonal support wall perimeter, also known as a rampart.

In a defensive system, a bastion is built to defend and provide corner support to the curtains or to provide additional strength to straight sections, such as the walls around Lucca. Usually pentagonal in shape, a bastion has four external sides: two faces forming a salient angle and two flanks, connected to the curtains. The demi-bastion has only one flank, one face and a second flank on the capital of the salient angle.

Various types of environment were created within or under the bastions. There may be communication and service tunnels leading to artillery posts, such as those of the Grosseto bastions or of the Astagno Hill citadel in Ancona, the construction of which was overseen by Antonio da Sangallo the Younger until 1534. There are also many examples of bastions granting access to countermining systems.

Sortie: passage or small tunnel giving access to the ditch and used to laterally surprise an enemy. The *sortie* is normally accessed from within the bastion, as exemplified by the Venetian belt of Bergamo.

Battery

In fortifications, this is the part of the work, which holds defence artillery.

The term battery refers to a terreplein or reinforced concrete permanent post, sheltering permanent or field artillery. In this specific case, we shall consider those batteries which are not part of a fort but which are part of the defensive enceinte, of a wall, of a general defence system. Such batteries take on the name of the section to which they belong, such as mountain battery, anti-aircraft battery etc.

Bonnet

Military ditch defence work, equipped with gunholes suitable for various types of weapon.

In XIX and XX century fortifications, the term refers to a casemated work with gun or machine gun and rapid fire cannon positions, which transversally protrudes over the ditch. It is used in the protection (flanking) of the fort or fortified work and over the years perfected the use of oblique fire to sweep over the ditch. The type of bonnet depends on its position.

Rear bonnet: serves to protect the area behind a fortified work (rear) and faces into the fortified square. Externally, this work remains opposite the supposed enemy attack directive (attack front).

Counterscarp bonnet: serves to defend the ditch and can be constructed in counterscarp wall salients. This type of work communicates with the counterscarp gallery by means of covered walkways.

Castle

Mediaeval fortified work, generally surrounded by walls with towers and having various rooms and which was used either to house and defend rich or noble owners or as a territory control point.

A castle built in an elevated position may have internal underground works such as wells, cisterns, storerooms and communication passages. Occasionally, especially when in a high position, a castle's perimeter defence can be provided by the rocky flanks into which it is carved. One example is the *rock castle* of Sperlinga (Enna) in Sicily. Built on a sandstone spur, on the remains of previous rock settlements possibly dating to the XII-VIII centuries B.C., the castle first appears in literature dating to the XI century. Several of its rooms are carved into the rock and a rock village lies south of the castle.

Ricetto: a typically mediaeval enceinte wall with towers for the protection of houses, stables and warehouses and used as a shelter by those living in the countryside in times of peril. The *ricetto* in Candelo (Biella) is well preserved.

Stronghold (rocca): built in an elevated position, this is generally smaller yet more solid than a typical castle. This particular type of stronghold was established in the Renaissance period.

Caponier

Additional fortification typical of bastioned work, used in the flanking of ditches; not necessarily positioned in the ditch scarp it could be of any shape and size.

A caponier normally takes on the form of a protected open-air post (also known as caponniere). Sometimes, especially with the development of offensive and defensive systems, it developed into a casemate. Normally used by riflemen, the caponier served in defence of the bottom of the ditch by

means of enfilade fire or, where there was no ditch, in the defence of the curtain wall. It may communicate with other works by means of underground tunnels.

Casemate

Initially, these defence works were built at the base of the external escarp for ditch defence purposes. They were later built inside the bastion itself and used to shelter cannons; by extension the term is used to describe any type of fortification providing shelter to fire arms. In the modern day, the term normally refers to an armoured cannon shelter: casemates with revolving steel cupolas are the basis of modern forts.

One of the requirements of a fortification is that it must be able to provide as much protection as possible to the garrison during combat and in particular, it must be able to protect artilleries from enemy counterbattery fire. During the XVII and XVIII centuries, the use of mortars and the new “ricochet” bombing techniques (rebound), first used by the Vauban in the siege of the city of Ath in Belgium (XVIII century) make the need to provide defence works with bomb-proof rooms, impenetrable to enemy artillery fire, all the more evident. Environments sufficiently large to hold both cannons and their operators and with gunholes for external fire were created behind curtain walls and sometimes above the ramparts (as in the Citadel of Alessandria).

The term casemate was later used to describe any bomb-proof work, even those with only light artillery loopholes or those used as military quarters or storerooms. Today the extensive range of casemates includes the many types of fortification all over the world. There are long range cannon, anti-tank cannon, howitzer and machine gun casemates.

Block: the term was adopted in 1929 (and corresponds to the Italian term *malloppo*) to indicate an isolated casemate or a group of casemates within a single fortified building in French Maginot works.

Blockhaus: This German term literally means a house made out of tree-trunks. By extension, the term also refers to a defensive work, originally constructed from tree trunks and surrounded by a small ditch or by accessory defences, for protection of a garrison. The first examples date back to the American War of Independence (1778). Since the XIX century, the term has been used to refer to a *guard-house*, or a generic casemated work.

Bunker: this is another German term which refers to a reinforced concrete casemate. This is normally an underground armoured dugout, with one or two entrances providing access to the surface or adjacent works. The term is also synonymous with reinforced concrete pillbox, a semi-subterranean work or a work having rooms beneath the surface section. This may be circular in shape with a rounded or flat ceiling and horizontal loopholes for firearms.

Malloppo: this is a modern, post World War I work is normally a visual combat position, with a loophole and either cave or casemated battery. The Alpine Wall, an Italian defensive line built in the period of time between the two world wars, provides many examples. Underground passages and/or ramps of stairs sometimes linked the *malloppi* to other parts of the work.

7000-type work: also known as “Pariani Posts” in honour of the Italian general who instigated their creation in 1938, this is a casemate consisting of a single concrete block. Designed to withstand small and medium calibre weapons, it was armed with one or two machine guns and sometimes with 47/32 anti-tank guns, positioned behind metal armour set in concrete.

Tobruk e Ringstände: small casemated works. Others were set up to contain anti-aircraft pieces or flame-throwers while tank-turrets such as the Vf 236, Vf 237 etc. originating from the Vf 67 were positioned on top of others still.

Cave works

Term referring to underground military works, used to store artillery and normally excavated into mountain-sides or rocky slopes; hence the term “cave battery”.

Underground excavations for defensive purposes have taken place since antiquity. Underground works are sometimes carved into rocky flanks and even complete surface works. In the latter part of the XX century in particular, there is widespread use of works cut into reliefs, used to shelter light and heavy weaponry positions, observatories and logistic services.

Cave battery: also known as *galleria cannoniera* (cannon tunnel), this type of battery consists of one or more artillery positions, which are generally cut directly into a rocky wall and can be either isolated or linked together by a tunnel, which may in turn be equipped with accessory works.

Countermine

Tunnel or underground passage for the interception and destruction of enemy mines; these were sometimes used against siege positions or enemy troops.

This has been the counter-measure of preference against enemy mines since antiquity. It is a tunnel or a simple underground passage, excavated towards a similar enemy work, in order to intercept, occupy and destroy it.

From the end of the XVI and the beginning of the XVIII centuries, fortifications are systematically equipped with underground tunnels, usually directly below the primary defensive perimeter. In the event of siege, their purpose was to identify and intercept enemy excavations and interrupt their advancement by underground combat or by using explosives to destroy the attack passage. During the XVIII century the wartime experience ensured that a permanent system of countermine tunnels, beneath and under a fortification itself, provided an advantageous and lasting defence and became an efficient, if costly, instrument of war.

The tunnels were built using the cut and cover method or were tunnelled underground; they generally had a masonry facing and a vaulted roof to protect them from water infiltration and humidity, both necessary for the use of black powder.

Counterscarp gallery

This work is set into and runs along the length of the ditch counterscarp wall.

Normally equipped with loopholes, the counterscarp gallery provides cover for the troops inside the passage, allowing them to attack any enemies with the ditch with ‘reverse fire’. The term reverse means that the shot is not fired from the Body of the Place in an outwards direction, but is fired inwards, from the counterscarp wall. The counterscarp gallery may have avant-corps, casemates and caponiers.

Cupola

Type of hemispherical armoured casemate, inclusive of those which spin on their own axis.

Also known as gun turret, the cupola is made of metal and is armed with a howitzer or cannon; alternatively, it can house machine guns or photoelectric cells. It can also be used as an armoured observation post to direct artillery fire. It is more commonly hemispherical in shape although it comes in many shapes according to its purpose. Its element can be of the “disappearing” variety, that is, it has systems which enable it to retract inside the casemate thus avoiding both visual exposure and enemy fire. It is generally the main active element of modern forts. Whether isolated

or linked to defence works, it is an integral part of a fixed defence as are the *wall*, the *centre of fire*, the *blockade*, etc.

Defensive Tambour

Bomb-proof defensive work with a purpose similar to that of the bonnet.

This is a cylindrical casemate (hence its name), in the magisterial wall of a fortified work, protecting the ditches and glacis by means of artillery fire. The tambour may be in a detached position from where it provides defence of the rear of a work.

Demolition passage

This refers to an underground work or work built within the defence perimeter when it has become indefensible.

In bastioned fortifications, the demolition passage is created below accessory works such as tenaille lines, counterguards and ravelins. It may be part of a system consisting of a main tunnel allowing rapid access to demolition passages with chambers. As previously mentioned, its purpose is that of rendering useless that which has become indefensible.

Fougasse: very similar to a countermine, a fougasse is less deep. A fougasse is placed beneath the glacis in traverses and demilunes, at a depth of no more than 4 m below the natural ground level; its purpose is to detonate in the front of advancing enemy infantry. In XIX and XX century works, a fougasse is part of various systems used in the demolition of pedestrian, road and railway systems.

Demolition tunnel

Demolition work within defence works or under roads.

Underground demolition works, for the obstruction of roadways were created in addition to fortifications systems, particularly in the XIX and XX centuries. Demolition tunnels and demolition chambers completed the defences of blockade fortifications and road cuttings; similar works were also placed inside railway and road tunnels.

Fort

Defensive work of limited dimensions, containing only military works within its walls.

A fort is a work which may be isolated and is utilised in the surveillance and defence of a locality or an obligatory passage. It may also be part of a trenched field or a fortified region. Once its defensive function becomes redundant, the work is often used for other purposes, as a depot, gunpowder magazine or detention centre. In Italy, XX century forts are known as *armoured batteries*, *armoured forts* or simply *works*.

Fortress: fortification work, with basic, continuous enceinte and additional internal or external works; the term is sometimes synonymous with stronghold. One example is that of the city-fortress of Palma, modern-day Palmanova (Udine), the construction of which began on 5 October 1593 under the *La Serenissima Republic of Venice*. Completed in 1623, its nonagon structure corresponds to a bastioned star work with nine ramparts in the first enceinte. A second enceinte was again built by *La Serenissima* from 1658 and 1690 and a third was built during the Napoleonic period, from 1806 to 1809.

Fortification: this term refers to the construction of defence works, including the pentagonal, walled *bastioned-front fortification* with ditch, scarp and counterscarp. These may be subdivided as follows: *permanent fortification*, *semi-permanent fortification* and *field fortification*.

Fortlet: a small defence work normally armed with light weapons and small calibre artillery.

Stronghold: this refers to a fortified work, generally from the late Renaissance period, which more or less surrounds a village or city, its type of defensive systems depending on its period of construction. This work was used to shelter garrisons defending an area and as a logistics base.

Blockade or road block: a blockade or fortified blockade generally controlling access to a valley road carriage or obligatory passage.

Fortified cave

Term referring to natural cavities, of which, at least the entrances are protected by a defence work. Over time, natural cavities, particularly those with wide entrances and horizontal structure, were often equipped with fortification works. These may have a basic closure wall or may be articulated defence works in the tunnel below the parapet. There are many fortified caves in the karst area of Honglin (China). The large entrance of the Shui Xiang Dong cave, located directly beneath the village of Honglin, is approximately 120 m high and is crossed by a small, external watercourse. The cave is partially blocked by an imposing dry wall created from local, grey-coloured limestone chips, often set in irregular rows. The upper part of the best conserved section of this defence work has square and rectangular loopholes.

Corona (crown) and covalo (or covelo): these terms refer to castles built in a cave or in large rock shelters (Gorfer 1985, pp 178-179), such as San Gottardo Castle in Mezzocorona (Trento).

Gun powder magazine

Room, or rooms, for the storage of gunpowder and munitions.

Given the intrinsic danger of the stored material and the destructive effects that accidental explosion would have on surrounding buildings, a gunpowder magazine must have specific characteristics. Some fortifications or military complexes have underground gunpowder magazines, while in others the magazines are on the flank or in the flank of another fortification. They generally have wooden floors, air gaps to provide thermal and protection against humidity and groundwater flow and sometimes have a small guard-house. Some XIX and XX century examples also have a “Faraday cage”.

Mine

Underground passage providing access to a fortified work. This normally refers to both a defensive and offensive work, placed under either permanent or field works, with a bore hole at its summit for its future demolition.

The aim of a siege is the conquest of the fortress or walled city by surrender of its occupants or by direct assault. In the case of the latter, the defensive perimeter can be scaled or alternatively a gap can be created (breach) with siege weapons or by undermining the support stones at the foot of the wall, causing it to collapse. These specific siege techniques have been known and used since antiquity.

From the XII-XIV centuries, city walls are characterised by curtains with scarped base, better able to absorb a “mine attack”. In a letter proposing his services to Ludovico il Moro, Leonardo da Vinci affirms his ability to “bring down” (collapse) any stronghold or other fortress without resorting to bombardment, with the exception of strongholds «*non fusse fondata in su el saxo*» (built on solid rock). In later centuries, artilleries in special “breach batteries” have the task of effecting breaches. The system was frequently expensive in terms of both men and weapons and required long periods of time. Where there were no significant results, mines were utilised following one of the below methods:

- *Mine attack*: the section of curtain to be mined is reached by open-air approach. Once the external wall facing has been undermined, a small hole known as a bore hole or demolition chamber is cut into its depth and is filled with explosive. So long as these are sufficiently powerful and well placed, the detonation of two or three bore holes causes a lot of damage. Open-air approach renders this method particularly rapid but exposes excavation personnel to serious risks, which may influence its successful outcome.

- *Deep mine*: in this case the wall to be mined is approached by underground means; an underground passage is excavated, with wooden, even pre-fabricated reinforcements. This may have a continuous series of right angles in order that an explosion's blast wave cannot erupt along the passage itself. One or more bore holes are prepared under the curtain to be destroyed. Once the explosive has been placed, the passage is filled with soil, so that the explosion blasts upwards, causing far more damage than a mine attack. In the latter part of the XVIII century, Forest de Belidor, a French engineer, formulates new concepts and applies the so-called "Globe of Compression", a type of 'supermine' with devastating effect.

Demolition shaft: this is a vertical excavation, generally used in fortifications or military works, allowing access to the area in which a *bore hole or demolition chamber* is to be created.

Postern

This is a small defiled, open gate in a hidden location, situated far from the main gate and used only under specific circumstance.

In bastioned works the term normally refers to an open gate in the part of the bastion covered by the orillon; also known as a false gate, secondary or sortie gate, its use is of easy interpretation. By extension, the entire tunnel, providing access to the gate, whether this be underground or within the walls themselves, is known by the same name.

Ravelin

Work separated from the enceinte, built inside a castle or fortified work.

The ravelin was primarily used in mediaeval times to protect the castle gate and therefore its entrance. In bastioned fortifications this work, consisting of two faces or two faces and two flanks, was placed in front of the curtain. It could house casemated rooms, communication tunnels and entrances to countermine tunnels or demolition works.

Redoubt

Small fortified work, whether isolated or part of a defensive system.

A relatively unimportant military work, the redoubt may be isolated or part of a larger defensive system. Gariglio and Minola list three types:

- small bastion also known as a lunette, generally found at the foot of the glacis.
- small quadrangular or irregular shaped fort for the reinforcement of trenches or trenched fields;
- small fort providing bridge, lock protection etc.; masonry and/or casemated fort.

Reduit

Small fortified work, whether isolated or part of a defensive system.

Like the *redoubt*, this is a relatively unimportant military work, which can be either isolated or part of a larger defensive system. Gariglio and Minola list three types:

- small ravelin or demilune, inside a larger ravelin or demilune;
- temporary or permanent work, where the combatants retreat after a first defence;
- in fortified cities this is a small citadel situated opposite to the true citadel; it is normally a rear bastioned fortification.

In some cases the term 'reduit' refers to an area fortified by forts, field batteries or semi-permanent works. The area protected may contain armament or other types of production centres.

Road Tunnel

Underground carriageway, specifically used for passage to military works.

Road tunnels were normally built in mountain areas to serve both permanent and field military works. During the First World War, it became necessary to supply the front lines, scattered on mountain reliefs.

Shelter

Normally underground shelter, built and equipped to protect both people and materials; also known as "refuge".

This can be constructed from reclaimed materials or existing works such as basements and cellars can be used. Alternatively, a shelter can be planned and built for specific purposes like generic bomb shelters or atomic shelters. Some XVII-XIX century works have rooms or external or semi-subterranean works which are "bombproof".

Air-raid shelter: also known as bomb shelter, this is generally a casemated work built to protect military and civil personnel. Between World War I and II and during the course of the latter, shelters were built under public buildings and factories, for primarily civilian use. They had blastproof and shrapnel-proof walls, reinforced doors and ventilation systems, etc. In 1933 in Milan (Italy), a first, experimental, air-raid shelter was built inside a public building in Piazza Ascoli. This building is now the site of the "Virgilio" Institute. Many shelters were created in cellars and basements: with basic underpinned ceilings. These were basically designed to withstand not only the bombs dropped by planes but also the collapse of the overlying building.

Hochbunker: this is a particular reinforced concrete building in the shape of a large pencil, built on the surface, with one or more underground rooms. There were various types however each model had the same external feature.

Bomb-proof shelter: generic, generally casemated work for the protection of both men and materials from artillery fire and subsequently from air-raids. These were built everywhere and many forms exist: open-air, basement and underground.

Souterrain

Room or rooms, built below the ground's surface and specifically used for military purposes.

Military works can have various subterranean rooms for various purposes. During the course of time their purposes can change due to new logistic or defensive needs. Souterrains can be used for the storage of wood, coal, weapons and barrack materials. They can also be used as military or cantonment quarters in times of need.

Traditore

Battery situated in a defiled position or casemated accessory building to a fortress.

The term *traditore* refers to the barbette battery (open air) or casemated battery, hidden by the orillon and positioned in the bastion's sunken flank. Its purpose was to flank the curtain and the adjacent bastion front and to control the area in front of the ditch. In modern fortifications this is a casemate separate to the main body of the fortification, which is generally armed with machine guns and rapid fire cannons, for defilade enemy fire. It was sometimes positioned at the entrance or could be positioned to control an especially delicate section around the fort.

Trench

Field fortification work consisting of a rectangular or, more frequently, trapezoidal longitudinal excavation.

In the siege of bastioned fortifications, the approach trench was the dugout walkway from the contravallation line to the stronghold under siege. Sébastien Le Prestre, Seigneur of Vauban (1633-1707), observes that a stronghold attack depends on the pickaxe-shovel binomial for the excavation. The word “excavation” (*sape*) refers to the head of a trench which is extended and made deeper, little by little, by day and by night thus allowing men, equipment and artilleries to get closer to the place to be besieged and limiting losses. In the chapter entitled “*De la sape*” (“*Excavation*”), Vauban thus explains the abovementioned concept «Nous entendons par la sape la tête d’une tranchée poussée pied a pied, qui va jour et nuit également».

A typical Great War trench has the following primary elements:

- parapet, a wall facing the enemy;
- a platform for the shooters, elevated in respect of the area occupied by infantry.
- a walkway in the deeper part of the trench.

The use of trenches did not cease in 1918 with the end of hostilities. Although with different criteria, they are still used today, in the wars, which due to our inability to learn and apply the lessons learned, continue to inflict our planet.

Tunnel

In fortifications this is generally a passage carved into the city walls or underground and then covered.

A tunnel is a subterranean communication passage, built either underground or within curtain walls, allowing passage from one sector of the defence perimeter to another, out of enemy sight and out of the line of fire. A tunnel can have many purposes and is built with such purposes in mind.

In more recent works and in specific situations, tunnels may be carved in the rock. Such tunnels generally lead to cave works or positions outwith the main body of the work or simply provide external access which in defilade position, permit sorties or allow reinforcements and provisions to reach the fortification.

Rifleman’s tunnel: communication tunnel with loopholes for light artillery, with or without a bonnet.

War cave

Term referring to natural cavities used and adapted to serve as shelters, depots etc. during the First World War.

During the Great War, both the Austrians and Italians made use of caves, primarily in the Kras region. They used both horizontal and vertical caves in which they built depots and quarters for the troops, sometimes over several storeys, with ventilation shafts, drinking water and adequately protected entrances. Other caves were adapted and used to house light weapons and batteries. This type of work has become known as *war cave*.