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Abstract

Fuenterrabía, one of the most outstanding strongholds of the Basque Country, has historically been a strategic checkpoint on the land crossing between France and the Iberian Peninsula. Due to its military interest, it was many times besieged between the sixteenth and nineteenth centuries for its possession and territorial control, main reason for the extraordinary importance of the development in its fortification system. Military engineers developed continuous fortification projects to adequately resist the advances in artillery and siege warfare tactics. This progress also affected the urban development, including the social and economic living standards of its inhabitants. This paper attempts to analyse the relationship between the evolution of the fortress and the urban development of Fuenterrabía through the recovery of the missing trace of its fortifications at its present location. By precise graphic overlays and research on the perfection of the outlines in historical drawing, the different traces of fortifications can be accurately determined, anticipating the location of foundations and buried vaults.

Keywords: Fuenterrabía, Fortifications, Urban Development, Military Engineers, Modern Age

Introduction

Defensive methods enjoyed supremacy over offensive weapons during the Middle Ages. But after the evolution of artillery in the second half of the fifteenth century, only a radical change in the fortification concept could offer to guarantee defence forces surviving a long siege. Italy was the nation that played the major role in the transformation during the last decades of the fifteenth century based on the French example. The military architects of the Renaissance began to transform the old medieval tower in a building capable of hosting artillery pieces. Low and massive towers were built able to resist and accommodate the emerging artillery, and introduce cross-flank shots. In most cases, existing strongholds were transformed. The fact is that the application of triangular polygonal shapes as a solution to the problems created by the technical advances on artillery was the origin of the bastion[1]. Vasari spoke about Sanmicheli as its inventor, while De la Croix suggests that was Antonio de Sangallo[2]. But actually, the invention of the bastion was the result of a gradual evolution over several decades, emphasized by specific landmarks[3].

Also in Spain, due to the permanent state of war during the Middle Ages, the progress of the bastion occurred during the fifteenth and sixteenth centuries, building interesting fortifications that influenced the European treatises. Along with these changes, new border fortifications were also executed in which innovative approaches were made. The Crown made a major effort in the various European and American dominions, but a renewal of the peninsular defensive fortification could not be made according with the modern requirements[4]. The only defence sensitive areas were, initially, the Pyrenees and then, the coast, especially in Mediterranean area. After the capture of Granada, Ferdinand and Isabella, aware of their future confrontations with France, took a series of measures to defend the northern border of their states. The strongholds of San Sebastian, Fuenterrabía and Pamplona were reinforced with various fortifications, among others. Under the reign of Charles V border fortifications continued being reinforced, besides building extraordinary fortifications in coastal cities such as Majorca, Cadiz, Gibraltar, Malaga and La Coruña were done.

After Philip II came to power, huge changes in the area of the fortification were made, among which it is worth noticing the efforts of the monarch by enhancing technical and scientific training of the engineers subjects, creating the Mathematics Academy of Madrid. This way, expert engineers and writers

[1]Tzonis, A., Lefaivre, L. 1991. *El bastión como mentalidad.* In SETA, C. De and LE GOFF, J. (eds.). *La ciudad y las murallas.* Ed. Cátedra. Madrid, p. 321.
[2]Croix, H. de la. 1960. *Military architecture and the radial city plan in sixteenth century Italy,* In The Art Bulletin, n. 42, p. 267.
[3]Rocolle, P. 1989. *2000 ans de fortification française.* Vol. 2, *Du 16e siècle au mur de l'Atlantique.* Lavauzelle. Paris, p. 321.
[4]Quatrefages, R. 1984. *La fortificación en España durante el Renacimiento (II),* In *Ejército*, february 1984, p. 74.

as Rojas, Medina Gonzalez Barba and Lechuga appeared[1]. But Philip II continued importing from his dominions in Italy prestigious engineers for the Crown fortifications, as Fratín[2], Tiburcio Spanochi[3], Juan Bautista Antonelli, both for the fortifications of the Peninsula -including Fuenterrabía- and possessions in Europe and overseas.

The Renaissance Fortifications of Fuenterrabía

As was the case with population centres in strategic locations, Fuenterrabía, in the Bidasoa mouth and French border, had medieval city walls dominated from the inside by a defensive tower since its original foundation. But it was after the annexation of Navarre to Castile, in the historical and cultural birth of modern states, when it experienced a boom of defensive buildings and got a new bastioned enclosure. The Catholic Kings built over the old defensive tower a castle, being later enlarged and restored by order of Charles V[4]. In 1476 and 1477 Fuenterrabía suffered two sieges by French troops during the campaigns of defence of the rights of Queen Isabella against Joanna *la Beltraneja*. From the second decade of the sixteenth century, the towers, battlements and walls were lowered to provide embanked masses of soil contained by masonry walls finished with meticulous ashlar. The first bastions were built. But the truth is that the real transformation came later, once the design of the modern bastion had matured. A modern defensive belt wrapping the existing medieval was decided to be built due to the constraints of the terrain, removing some old medieval towers or substituting other by bastions. This can be appreciated in the first graphic document of the fortifications, previous to 1530, preserved in the Archives of Simancas[5].

[1]Cobos Guerra, F. and Castro Fernández, J. J. 2005. Los ingenieros, las experiencias y los escenarios de la arquitectura militar española en el siglo XVII. In Cámara Muñoz, A. (coord.), *Los ingenieros militares de la Monarquía Hispánica en los siglos XVI y XVII*, Madrid, Ministerio de Defensa, 71-95.

[2]Cfr. Viganò, M. 2004. *«El fratin mi ynginiero». I Paleari Fratino da Morcote ingegneri militari ticinesi in Spagna (XVI-XVII secolo)*, Bellinzona, Edizioni Casagrande.

[3]Camara Muñoz, A. 1988. *Tiburzio Spannocchi, Ingeniero Mayor de los reinos de España,* In *Espacio, Tiempo y Forma*, n. 2, 77-90.

[4]Astiazaráin, M. I. 2004. El Patrimonio Militar de Fuenterrabía: el Castillo de Carlos V y las Murallas. In Orella Unzué, J. L. *Historia de Fuenterrabía*. Fuenterrabía, Hondarribiko Udala, 477-482.

[5]AGS. M. P .y D. XIII-55.

Figure 1. *Own Production: Overlay of AGS. M. P. y D. XIII-55 and Aerial Orthophoto from ftp.geo.euskadi.net*

In the Castilian Cortes of 1532 the ending of the fortifications was proposed. In Fuenterrabía, as happened in Pamplona with the bastion of San Llorente or San Lorenzo[1], they were lifting two heart-shaped bastions: the Imperial one and the Leyva one. Originated after the 1521 French assault, the remaining bastions built were significantly smaller. Two were made during those years: The bastion of the Queen and a pentagonal one in the new wall. According to Astiazaráin, they were the work of Pedro de Guevara and Benedito de Ravenna, which had replaced the prestigious engineer Gabriel Ladino di Martinengo[2]. A few years later, other bastions of larger scale and artillery capacity were undertaken, such as Magdalena and San Nicolas. In 1539 Charles V visited the fortifications of Fuenterrabía. He sent Captain Luis Pizaño shortly after to supervise the works of San Sebastián and Fuenterrabía. Its main instruction was to raise the bastion of the Queen, who undertook the master builder Domingo de Eztala in 1545.

Years passed and Philip II came to the throne. It would be the architect of a series of fortifications that would astonish the world[3], as the citadel of Antwerp. In 1571 he ordered to the Fratín design a same style pentagonal citadel in Pamplona. He visited Fuenterrabía together with the viceroy Vespasian Gonzaga -expert poliorceta-, and decided to build a new more capable bastion in the south, the stronghold of San Felipe, as well as numerous repairs on the fortified place. He designed a trace that the prestigious engineer Tiburcio Spanochi changed or adjusted later, around 1580. In 1603, he wrote a

[1]Cfr. Echarri Iribarren, V. 2000. *Las Murallas y la Ciudadela de Pamplona*, Pamplona, Departamento de Educación y Cultura-Institución Príncipe de Viana, Gobierno de Navarra, 92-108.

[2]Astiazaráin, M. I. 2004. *El Patrimonio Militar de Fuenterrabía: el Castillo de Carlos V y las Murallas.* In ORELLA UNZUÉ, J. L. *Historia de Fuenterrabía.* Fuenterrabía, Hondarribiko Udala, p. 486.

[3]Porreño, B. 1639. *Dichos y hechos del Señor Rey Felipe Segundo, el Prudente, Potentísimo y Glorioso Monarca de las Españas y de las Indias.* Sevilla, Pedro Gómez Pastrana, cap. XII.

report on the state of the fortifications once he was appointed Senior Engineer of the Spanish Kingdoms. It formed the basis for a new improvement project made by the engineer Jerome de Soto after Spanochi died in 1609.No other works were carried out during the reign of Philip IV, until the siege of 1638. Some exterior works were done following that fact: a ravelin in front of the gate of St. Nicholas and a tenaille in the northeastern part. It would be the beginning of a new modernization of the walled enclosure that would be developed throughout the seventeenth century, but it is beyond the subject of this investigation.

Figure 2. *Own Production: Overlay of Fuenterrabía Plan Published on the Matteo Neroni Atlas and Aerial Orthophoto from ftp.geo.euskadi.net*

The Siege of 1638: Graphical and Technical Description

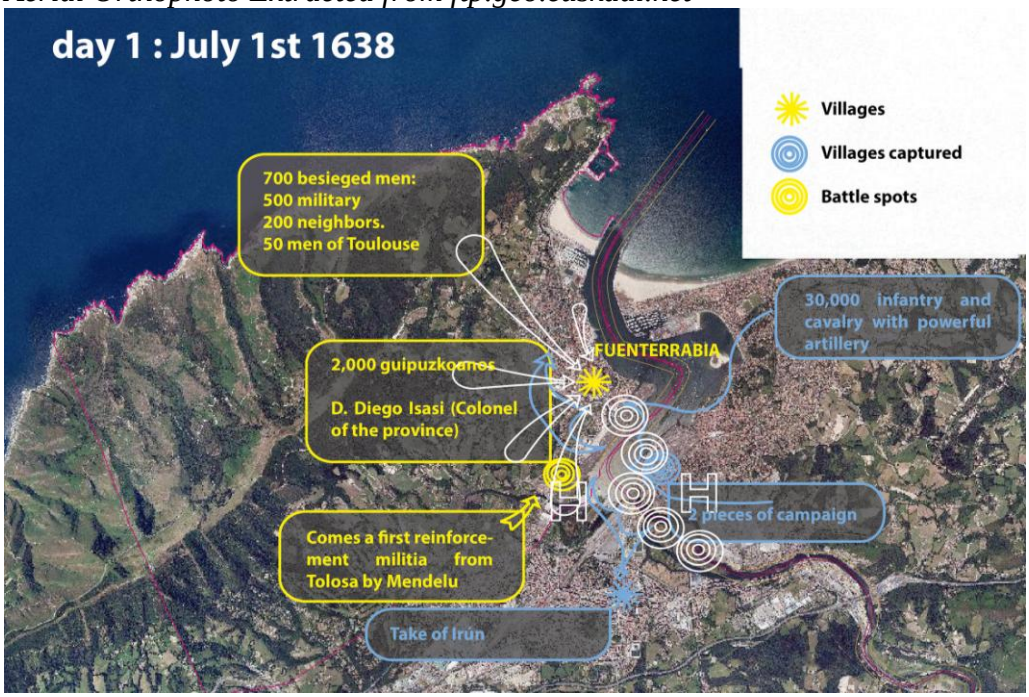
In the early spring of 1638 war rumour was heard, since the French armies were moving and a siege attempt was expected in any stronghold on the southern side of the Pyrenees. Troops began to gather in Navarre and Pamplona is manned due to this imminent danger. Men and women began to prepare the city walls in order to withstand an attack. Moret says the French troops' strategy was to make a feint on one side of the border to actually release elsewhere and surrender Fuenterrabía more easily[1].

On July 1st, from Fuenterrabía could be spotted the French cavalry on the mountains of Hendaye. With low tide, they crossed the Bidasoa river at five

[1]Moret, J. 1655. *Empeños del valor, y bizarros desempeños, o Sitio de Fuente-Rabia.* Translated from latín '*De obsidione Fontirabiae: libri tres*' by Silvestre de Arlegui, M. & J. M.Ezquerro, in Pamplona 1763. Tolosa, Imprenta, librería y encuadernación de Eusebio López, 1893, 30-32.

points between the city walls and Behovia[1] and made Spanish troops withdraw, seizing Irún that same day, Oyarzun, Lezo and Rentería on July 2nd and Pasajes and its port on July 3rd. On July 4th the stronghold was besieged by land, and by sea the rescue was very difficult[2].

Figure 3. *July 1st 1638. Own Production: Warfare Diagrams Overlayed with Aerial Orthophoto Extracted from ftp.geo.euskadi.net*



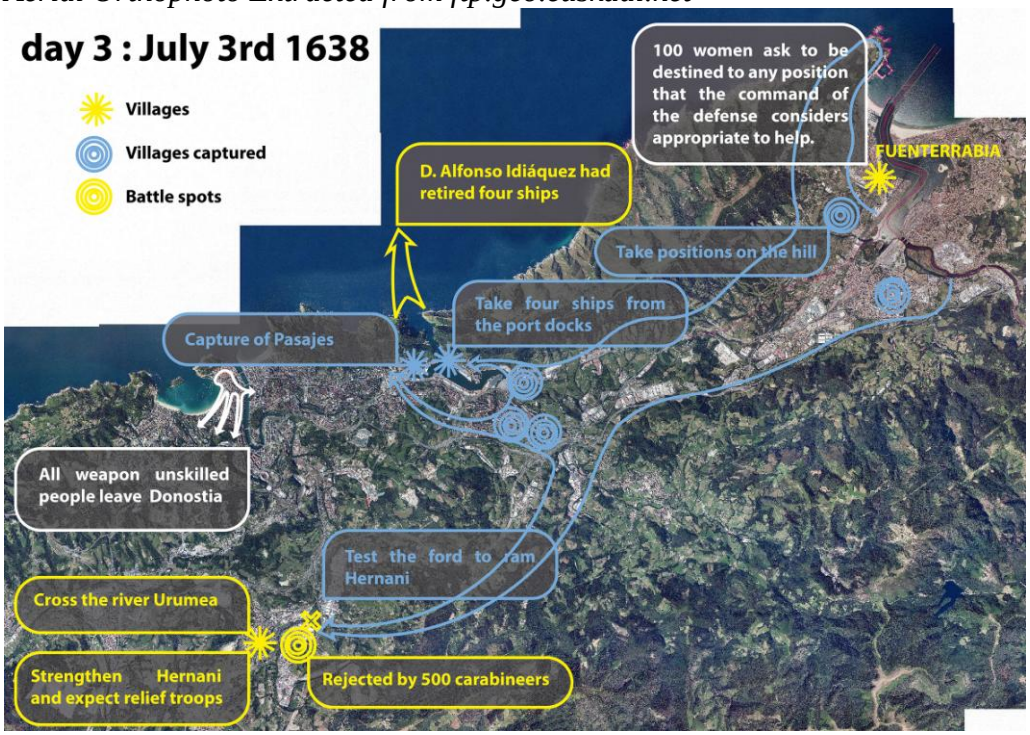
On July 6th the rescue troops arrived noticing at dawn the next day that the enemy was opening two branches to the moat in front of the gate of St. Nicholas, 200 steps from the walls, apart from building small forts. When reaching the moat, they started a third trench. These branches were built with a curvature that prevented any cannon to be arranged straight against the workers thereof. The gates of the city were bricked up to prevent easy access to the fort, except the one facing Hendaye.

The first 11 days the French strengthened their forts, and thereafter they started to beat with large artillery pieces. From the dawn they targeted the buildings next to the wall, especially the Palace and the two warehouses, expecting to disable their ammunition. The defence answered with cannons from the bastion of the Queen, because the bastion located near the chapel of Mary Magdalene was beaten with cannons placed on the hill.

[1]Alberdi Lonbide, X., Rilova Jericó, C. and Pérez Centeno, J.M. 2008. *Relación Diaria Del Gran Asedio De Hondarribia (1638)*, Hondarribiko Udala, Zehazten Z.K. http://www.hondarribia.org/dokumentuak/menu/2009720124543_0_relacion_diaria_del_gran_asedioR.pdf [30 april 2014], p. 2.

[2]Palafox y Mendoza, J. 1639. *Sitio y socoro de Fuenterabia y sucesos del año de mil y seiscientos y treinta y ocho.* 4Th print, 1793, Madrid, Don Gerónimo Ortega y herederos de Ibarra, p. 127.

Figure 4. *July 3rd 1638. Own Production: Warfare Diagrams Overlayed with Aerial Orthophoto Extracted from ftp.geo.euskadi.net*



Although the city wall resisted the attack and its height was increased with gabions trying to reduce the destructive effect, the ruin of the houses located over the cordone was unavoidable. The 23rd day of the siege, the walls suffered great havoc. On the left side of the bastion of Leiva, overlooking the portal of St. Nicholas, the ceiling was ruined uncovering the casemate. All things exposed were destroyed and its ruins filled the moat. The bastion of the Queen was without cordone and the French battery was placed at the same height of the wall and the rampart of the bastion, disabling many pieces firing from there. The Governor ordered the construction of a small shelter, bringing elsewhere soil and placing sheaf in the middle so defenders were well covered, but the enemies were already near the moat.

Heavy rain began on July 24th, troubling enemy's position especially in their works near the moat. The Night of Santiago, the enemy was very near the bastion of Mary Magdalene and the day before they had concluded a fort wall in front of it, near the coast. Next night, July 26th, the French seized the moat. They built a strong caponier to be defended and mine the bastion. Besieged ttacked from the bastion of Leiva, located alongside, destroying the caponier. The 5th assault came mostly from Ondarraizo, located in the sand, and targeted the walls. The day after the 6th attack happened: 3 cannons beated St. Nicholas wall, while Fuenterrabía counter-attacked with cannons placed on the palace[1].

[1]Moret, J. 1655. *Empeños del valor, y bizarros desempeños, o Sitio de Fuente-Rabia.* Translated from latín '*De obsidione Fontirabiae: libri tres*' by Silvestre de Arlegui, M. & J.

On July 28th they carried barrels and gabions with very thick sides and placed a firm cover while the French were working two mines on the bastion of the Queen. Two days after, 200 steps ahead from its ravelin, the French placed three cannons and beat the side angle on their 7th attack, ruining most of it.

Figure 5. V*iew of the Stronghold of the City of Hondarribia during the Assault of the French Army in 1638. Municipal Archives of Hondarribia*

On August 1st they had evidence that the French were working in a mine and the next day, the two sides of the bastion of Leiva fell into the moat and gabions were placed to increase the height the wall. Local forces began to fail inside the fortifications of Fuenterrabía, while the French were very advanced in the process. The heavy rains of the past days made the French stockade collapse, and they used a sailing ship to hide the mine they were building. The high tide made it difficult to withdraw because the water was reaching the trench and they did not enter the breach they had opened. The besieged encircled the inner space of the old fortifications sticking beams and built a rampart, being able to use this second fortification when the first one failed.

The enemy was building the mine and from inside the village a stake was seen next to the wall to measure it. The day after, 300 soldiers were chosen and set off for Fuenterrabía at nightfall, reaching the village 80 men at dawn. On August 8th, 258 soldiers departed from the gate of the stockade and started a

M.Ezquerro, in Pamplona 1763. Tolosa, Imprenta, librería y encuadernación de Eusebio López, 1893, p.72.

close combat battle field. Knocks are heard against the wall and Butron, who acquired much practice in America and was smart in mines and underground works, ordered to open a trench in the rampart of the bastion to cut the French mine with a countermine. On the morrow, they put stokage and cordone to the two sides of the bastion of Leiva and began to built 2 shelter walls, one on the rampart, in front of the French battery located at the hill of Grace, and another in the sandy area called Ondarraizo against the machines located by the sea. Butron verified the direction of the mine and began to break the wall. The French artillery was firing from their 7 forts, producing the greatest destruction to the bastion of Leiva, filling the moat with its ruins that could serve as an easy access to the breach for the enemy[1].

On August 10th, the French launched a vigorous battery against all the defences, but especially against the bastion of Leiva. They tried to attack the bastion of Mary Magdalene to continue building the mines. Two cannons located in the bastion of Leiva manned the breach on the side trying to contain the French advancing towards it, meanwhile beaten by French located in a higher spot. The bastion of Mary Magdalene could collapse if the mine went ahead, so a cut back was created with the soil that was extracted from the countermine, terracing it to stop the enemy that was entering the breach. On August 16th there was a bombing, the besieged had not found the French mine with their countermine and their rescue troops of the province still were in Hernani. Two days after, the bastion of the Queen is attacked, as well as the palace and the adjoining fortifications, causing havoc on the weak ravelin.

On August 19th, the enemy is discovered by the countermine at night. The French sappers realised and covered with stones and sandbags the hole of the mine. The besieged took off them, uncovering the hole and pouring water, so that the flame would not to make havoc. The French set fire to whole jars and barrels full of gunpowder, inserting in addition large number of bombs, hastily closing and giving fire to the vent. Through the mine and countermine entrances, flames and smoke came forth killing thirty French and lifting off the air 6 from inside[2]. The French gave the assault signal for a squadron to attack against the wall of St. Nicholas and other one against the front facing the sea, approaching the bastion of Mary Magdalene. Looking for some walkway to enter they found a narrow breach on the right side of the bastion of Leiva, not hard to cross.

Two days after a great rescue squad appeared on top of the Mount Jaizquibel, near the chapel of Saint Barbara. The French evacuated the closest area to Fuenterrabía, and were withdrawing from the fortifications near the chapel of Guadalupe, near the old mine entrance. On August 25th in the hill of Guadalupe troops are arranged in attack column. Butron located the mine the

[1]*Palafox y Mendoza, J. 1639. Sitio y socoro de Fuenterabia y sucesos del año de mil y seiscientos y treinta y ocho.* 4Th print, 1793, Madrid, Don Gerónimo Ortega y herederos de Ibarra, 169-170.

[2]*Palafox y Mendoza, J. 1639. Sitio y socoro de Fuenterabia y sucesos del año de mil y seiscientos y treinta y ocho.* 4Th print, 1793, Madrid, Don Gerónimo Ortega y herederos de Ibarra, p. 299.

enemy had built on the bastion of Mary Magdalene and started to open the entrance while attacking from the other side. They set fire to it but there was no damage as there was a vent that relieved the explosion.

The next day, the counterscarp of the moat was mined in front of the curtain that goes from the bastion of Mary Magdalene to the bastion of Leiva, having crossed more than a half of it with a gallery. An artillery gun was taken to the rampart of the casemate of Leiva and the gallery was sacked. But they made another attempt to open the counterscarp again, this time from above and facing the bastion of gabions from where the major attacks came[1]. Besieged were too close to defend it from the bastion of Leiva and it was not possible from the bastion of Mary Magdalene. They solved it by breaking the side of the bastion facing to the bastion of Leiva and be able to batter the French gallery, blasting the wall and putting it in the form of embrasure to shoot. The French reached that day the curtain of the gabions near the bastion of Mary Magdalene, which in this part is round due to the old way of fortifying. The mine of the French took longer to explode than estimated and many died when it unexpectedly happened. But they hastened the works in the recently taken curtain, mining the bastion of the Queen. The besieged surrounded the entire area with two stockades, built a rampart and placed two artillery guns for the enemy in case they blasted the bastion.

On August 28th they began to break the wall of the curtain of gabions that they had taken the previous day. Six sappers were excavating a countermine, but the French were doing two branches and due to the uncertainty, the besieged began to prepare a better defence building a bombproof rampart barrier in the same spot of the wall but inside the city.

The French attempted to conclude the site the first day of September, suffering heavy rains until noon. They charged with a mine against the bastion of the Queen and it collapsed. The breach was wide enough to allow fifteen men enter in a row, but behind the ruined wall they discovered a second one of ten feet thick with the same height and shape[2]. There was a countermine which served as a vent to prevent the fire from spreading from the blast, but it became a large hole through which the French tried to assault the stronghold, as there was no other possibility. The vault countermine did not allow more than two people enter side-by-side. The French, assisted by all the immediate trenches, crossed beams and loaded all waste from the mine on top of them, blocking the connection and controlling the breach and the countermine, but they had to enter the second wall. There was a bad retirata built behind the two bricked

[1]Moret, J. 1655. *Empeños del valor, y bizarros desempeños, o Sitio de Fuente-Rabia.* Translated from latín '*De obsidione Fontirabiae: libri tres*' by Silvestre de Arlegui, M. & J. M.Ezquerro, in Pamplona 1763. Tolosa, Imprenta, librería y encuadernación de Eusebio López, 1893, 118-119.

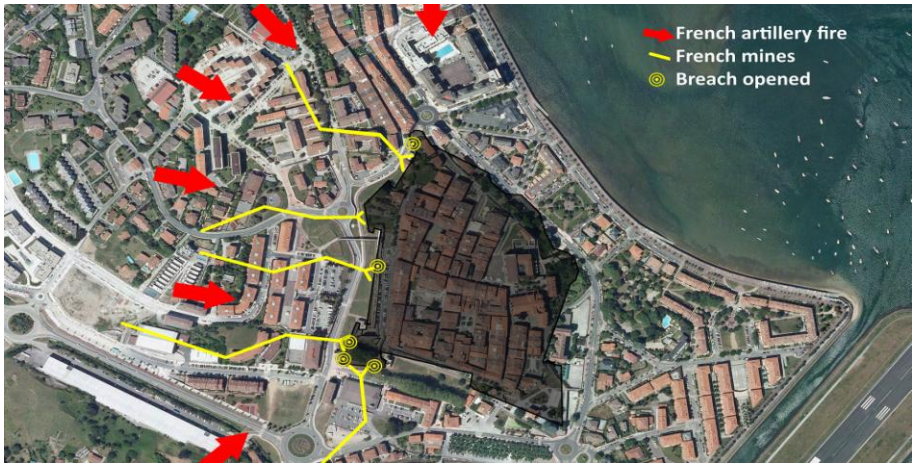
[2]Moret, J. 1655. *Empeños del valor, y bizarros desempeños, o Sitio de Fuente-Rabia.* Translated from latín '*De obsidione Fontirabiae: libri tres*' by Silvestre de Arlegui, M. & J. M.Ezquerro, in Pamplona 1763. Tolosa, Imprenta, librería y encuadernación de Eusebio López, 1893, 135-136.

gates in the fort facing the bastion of Leiva, decided to leave it like that in order to serve as a vent in case of explosion of another mine.

On September 2nd all rescue troops were positioned on Mount Jaizquibel, near the chapel of Saint Barbara. The attack would be the next day, but a great storm began lasting two whole days and it was interpreted as bad luck omen of the battle[1]. The French were placed in a lower place and protected from the wind, but the rescue troops began to desert as there was no intention of withdrawal due to the weather.

The French prepared mines with which they blew the missing part of the bastion of the Queen and at dawn of 4th September. Even the transit of cavalry was possible through the breach, and to prevent the besieged from defending it, the French fired to distance them allowing the attackers to climb the ruins. The combat was fierce in the breach, but the besieged forced the French to withdraw. The defenders put a cannon in the casamate of the gabions facing the bastion of the Queen and, as attackers were being fired also from the bastion of Saint Mary, they dug three trenches to be covered in both sides. They built a gallery that reached the surroundings of the breach, where they were also mining the rampart. The French spoiled their own gallery and a cannon from the rampart in the bastion of Leiva definitely destroyed it. In the bastion of the gabions, the French had blasted a mine while from inside defenders arranged a stronghold and started building a trench to defend themselves in case the enemies ruined the bastion and entered that way.

Figure 6. *French Attacks. Own Production: Warfare Diagrams Overlayed with Aerial Orthophoto Extracted from ftp.geo.euskadi.net*



Hualde troops had arrived to help the besieged, who were repairing and rushing the works, and on September 6th the French released another attack entering the vanguard into the moat in a new assault. The enemy began to climb the breach while being attacked from inside to avoid it, even fighting

[1]*Palafox y Mendoza, J. 1639. Sitio y socoro de Fuenterabia y sucesos del año de mil y seiscientos y treinta y ocho.* 4Th print, 1793, Madrid, Don Gerónimo Ortega y herederos de Ibarra, 323-324.

within the city walls. The French tried a third assault, aided by their own rescue troops, and the besieged went outside the walls again and charged in the rear, dislodging them from the breach and the moat. In a fourth attack the vanguard succeeded in mounting the breach. Forty French managed to get into the angle of the ruined bastion attacking the besieged from the bastion of the gabions with half cannon, collapsing the wall where they were protecting themselves. The French decided to mine the bastion of the gabions the day after of the Nativity of Our Lady. The rescue troops of Fuenterrabía considered their attack options and decided that the best was to do it by day, after moving closer the troops to the enemies' spots on September 7th, and within their outer fortifications if possible.

Almost from the door of the chapel of Guadalupe to Justiz forest where the Iguer Castle is located, a trench with moat in front and cut angles was built. In the northern area, the terrain was rough and in the western one there were two ravelins. All paths were cut by trenches or strengthened with scaffoldings, except the ones used for communication.

When the rescue troops passed the moat and reached the redoubt, they already had dismantled the canvas, as well as the rest of the fortification. The French rejected them and tried another assault. They had difficulties to advance due to outside fortifications works, but the French withdraw when they saw the progress of the opponent troops, who had the vanguard almost touching their trenches. Entire garrisons were retreating, except from the hill of "Grace" where they were beating to Fuenterrabía with more hostility, especially against the bastion of the Queen. The French stopped fleeing to confront and complicate their victory but they finally withdraw[1].

When it started to get dark, a Spanish delegation arrived in Fuenterrabía. The cavalry came in through the breach as the portals were not able to be used as such. The next day they saw the injury and damage they had suffered: the rough handling of the city, the destroyed houses, the sick and wounded, and all prisoners they had captured[2].

[1]*Palafox y Mendoza, J. 1639. Sitio y socoro de Fuenterabia y sucesos del año de mil y seiscientos y treinta y ocho.* 4Th print, 1793, Madrid, Don Gerónimo Ortega y herederos de Ibarra, p. 351-356.

[2]Moret, J. 1655. *Empeños del valor, y bizarros desempeños, o Sitio de Fuente-Rabia.* Translated from latín '*De obsidione Fontirabiae: libri tres*' by Silvestre de Arlegui, M. & J. M.Ezquerro, in Pamplona 1763. Tolosa, Imprenta, librería y encuadernación de Eusebio López, 1893, 179-186.

Conclusions

The contemporary chronicles allow to graphically analyse the evolution of the walls due to the exhaustive description that some of them make about the siege process. Helped with the cartographic documents, the analysis allows the geometric adjustment of the plans and the situation of the destroyed walls by their missing trace. Also, thanks to the records, other military elements can be located such as countermine galleries and outworks built in the war process, but which have not been preserved to this day, as well as foundations of destroyed constructions.

This is absolutely necessary not only to increase knowledge of the built heritage and improve its conservation, but also to predict possible buried heritage elements and understand its origin and importance. Facing possible urban interventions, it facilitates the design process taking into account the information provided by previous research.