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URBAN HYDROGRAPHIC NETWORK OF GENOA'S HISTORIC CENTRE: THE UNDERGROUND COURSE OF THE FOSSATELLO STREAM

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Abstract
A hidden but very articulate underground hydrography extends bellow the town of Genoa maintaining the memory of the historical urban area in toponyms and evidences embedded in the wall structures covering the watercourses. In origin these streams, placed both in the area of the Historic Centre and in the suburbs, flowed at the surface; over the centuries they have been gradually covered. The ancient courses of the waters still flow underground in correspondence of open spaces and road axis: streets and squares trough their names often tell us the ancient nature of the sites, such as, Via delle Fontane, Piazza Fontane Marose, Via del Lagaccio, Passo dell'Acquidotto, Spianata Acquasola, Vico Acquacalda, and Via Rio Torbido (these names can be literally translated as Fountains Street, Billow Fountains Square, Bad Lake Street, Aqueduct Pass, Solitary Water Esplanade, Hot Water Alley, Cloudy Stream Street). Even in the case of Piazza Fossatello (Ditch Square), the toponym clearly denounces the primitive morphology of the site. Already in the Middle Ages the course of Fossatello stream, in the part of the city within the sixteenth century walls, was underground. In its final part, about to discharge into the water of the Ancient Port, the stream bordered the eastern boundary of the ancient Ghetto district where Jews living in Genoa were restricted and segregated. The exploration of this underground hydraulic pipe has reserved some surprises due to the discovery of interesting remains such as two ancient artifacts designed for transport and distribution of drinking water.
Keywords: Genoa, urban hydrography, hydraulic tunnels, drainage basin, floods, Ghetto, Fossatello stream, aqueducts.

Riassunto
Una idrografia nascosta, ma assai articolata, si estende nel sottosuolo di Genova conservando memoria del tessuto urbano storico nei toponimi e nei reperti inglobati nelle murature di copertura. Questi rivi, localizzati sia nell'area del centro storico che nelle periferie, in origine scorrevano in superficie, ma nel corso dei secoli sono stati progressivamente tombati. Gli antichi rivi scorrono tuttora sotto i nostri piedi in corrispondenza di spiazzi ed assi viari: strade e piazze che, nella loro attuale titolazione, spesso ci raccontano l'antica natura dei siti come, ad esempio: Via delle Fontane, Piazza Fontane Marose, Via del Lagaccio, Passo dell'Acquidotto, Spianata Acquasola, Vico Acquacalda, Via Rio Torbido. Anche nel caso di Piazza Fossatello, il toponimo denuncia chiaramente la primitiva morfologia del sito. Già in epoca medievale il tracciato del Rio Fossatello, nel tratto cittadino ricompreso all'interno delle mura cinquecentesche, era in sotterraneo. Nel suo tratto terminale, prossimo allo sbocco nello specchio del Porto Antico, delimitava a levante il perimetro dell'antico quartiere del Ghetto ove, dal 1660, era confinata la comunità ebraica residente a Genova. L'esplorazione di questa asta idraulica ipogea ha riservato alcune sorprese con l'individuazione anche di interessanti reperti quali due antichi manufatti destinati al trasporto e alla distribuzione dell'acqua potabile.
Parole chiave: *Genova, idrografia urbana, gallerie idrauliche, bacino di drenaggio, inondazioni, Ghetto, Rio Fossatello, acquedotti.*

The city of Genoa

"The city is beautifully situated as an amphitheatre on the sea. Between the mountain, high four times Montmartre, and the sea there is only space for three horizontal streets ... At the highest point of the bare mountain a fort is built".

This is the description that Henry Stendhal (1837, in Bo, 1966) makes of Genoa (Liguria, NW Italy) admiring it from the sea while he was arriving there on board of the Sully.

The city of Genoa, squeezed between the sea and the mountains, historically developed in a natural amphitheatre in a triangle shape that has two of three summits overlooking the sea (to the W the San Benigno promontory and on the E the Sarzano hill); the third one (coinciding with the summit of Peralto Mount[1]) pointed towards the hinterland. This portion of the territory is geographically bounded by two rivers whose paths are perpendicular to the coastline: the Bisagno stream to the E and the Polcevera stream to the W.

The steep coastal area, the shortage of level land and a mountainous and barren hinterland have always been an obstacle to agricultural development and land-based communications. These factors have pushed the

1) The fort quoted by Stendhal (1837) is *Forte Sperone*, a fortified construction within *Mura Nuove* (New Walls), built on the top of Peralto Mount (m 489) in the point where the two branches of the city walls meet.

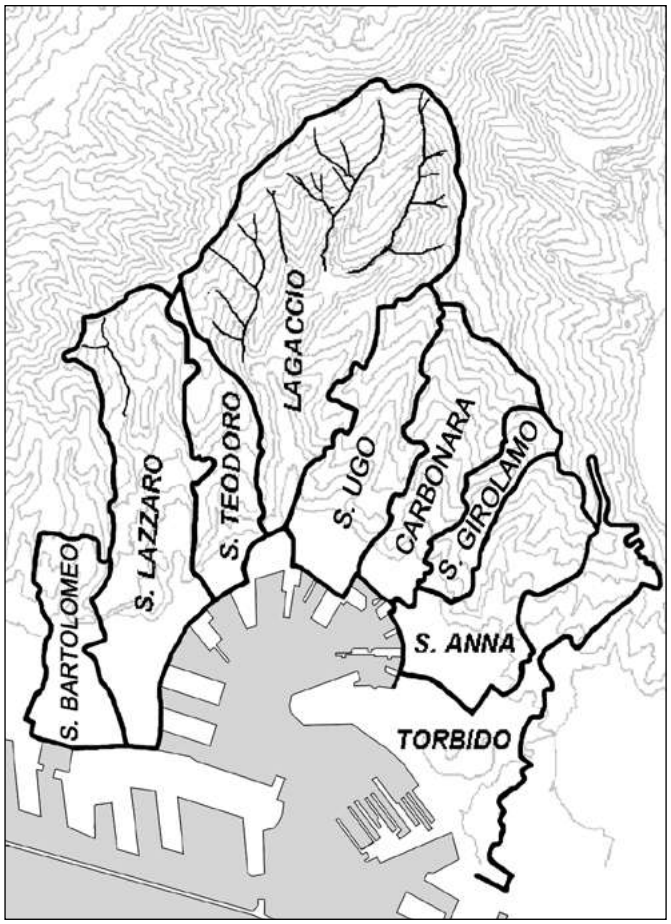

Fig. 1: Genoa. The nine catchment basins of the historic city (by courtesy of Prof. Luca Giovanni Lanza - DICCA Department of Civil, Chemical and Environmental Engineering, University of Genoa).
Fig. 1: Genova. Rappresentazione dei nove bacini idrografici della città storica (per gentile concessione del Prof. Luca Giovanni Lanza – DICCA Dipartimento di Ingegneria Civile, Chimica e Ambientale dell'Università degli Studi di Genova).

Genoese to look more towards the sea than mainland in order to strengthen their economy and are the basis of the historical events that led progressively Genoa to become one of the most rich and powerful city. *"The story of this city, grew up without a territory but pushed out in unlimited spaces [...] open to steady international experience, seems to be already outlined around Year 1000, when, after centuries of silence, suddenly it shines with its own light at the time of the first West Renaissance"* (Airaldi, 1989).
The rapid rise of Genoa in the Middle Ages is based on the development of a technical, maritime cartography, shipbuilding, ship-owner, merchant and financial culture. The Genoese, after taking part in the First Crusade (1097-1099) – event that traditionally opens the chapter of relations between Europe and the Mediterranean – first started to create logistical bases and then real company of colonial exploitation all over the Mediterranean and Black Sea.
The first bank, in modern sense, was born in Genoa, named *Casa delle Compere e dei Banchi di San Giorgio*, then named *Banco di San Giorgio*. It was an institution that not only has influenced Genoa's history for four centuries (1407-1805), but also played a pivotal role in the evolution of credit structures and financial techniques (Felloni, 2006).
Genoa was not a centre of goods production but rather a core of business and goods mediation and especially of capital accumulation with which the Genoese bankers financed many kings and emperors, from Frederick II to Charles V.
Throughout the sixteenth century the city reached its greatest political stability and economic prosperity; '500 was named "*el siglo de los genoveses*", The Century of the Genoese.
Today we find traces of this wealth in the beautiful architecture of monumental churches and palaces, richly decorated and painted.

Hydrography of the historic city
In its long story, Genoa had been built seven defensive walls[2] which progressively continued to be developed[3]. Every time the new fortified work embedded wider areas, allowing urban and demographic development[4]. The evolution of its architectonical shapes was the answer to the development of military technique and to new range of artillery (Forti, 1971).
Mura Nuove (New Walls) are the last and largest city walls, built in 17th century. The walls extended for almost twenty kilometres, of which 6,910 meters along the coastline and the other 12,650 metres along two ridges, the western and the eastern, of the mountainous amphitheatre which represented the natural bastion surrounding the historical city (Quaini, 2005).
Nowadays these amazing walls are still largely preserved and the area circumscribed by them, shaped like a natural amphitheatre, is the historical city's drainage basin afferent to the original natural harbour, now called *Porto Antico* (the Ancient Port). This area is divided into nine main catchment basins feedings as many streams, listed as follows from E to W: Torbido, Sant'Anna, San Gerolamo, Carbonara, Sant'Ugo, Lagaccio, San Teodoro, San Lazzaro and San Bartolomeo (Fig. 1).
Due to the peculiar morphology of the site, the waterbodies are characterized by short and steep hydraulic-flues: this factor emphasizes the torrential nature of the watercourses increasing the risk of overflow caused by high intensity weather events.
Originally, creeks and streams flowed at the surface in riverbeds which, sometimes, were the moat on the fringe of the city walls as in the case of the final part of Vastato stream (now Carbonara stream) that, in the 12th century, was contiguous to a stretch of the third walls. Still today at that point there is the ancient city

2) The 1st wall: 5th-9th century - the 2nd wall: 11th century - the 3rd wall: 12th century (1155-1163, named also Barbarossa Walls) - the 4th and 5th walls: 14th century (1227 e 1320-47) - the 6th wall: 16th century (1536) - the 7th wall: 17th century (1626-1633, named also New Walls).

3) We go from 20 hectares of the second town wall (9th -10th century), the first circle of which we have clear evidence, to 900 hectares of the seventh walls (De Negri et al., 1969).

4) Around 1000 year the city had about 4,000 inhabitants; on the eve of the plague of 1656 the population was about 100,000 inhabitants.

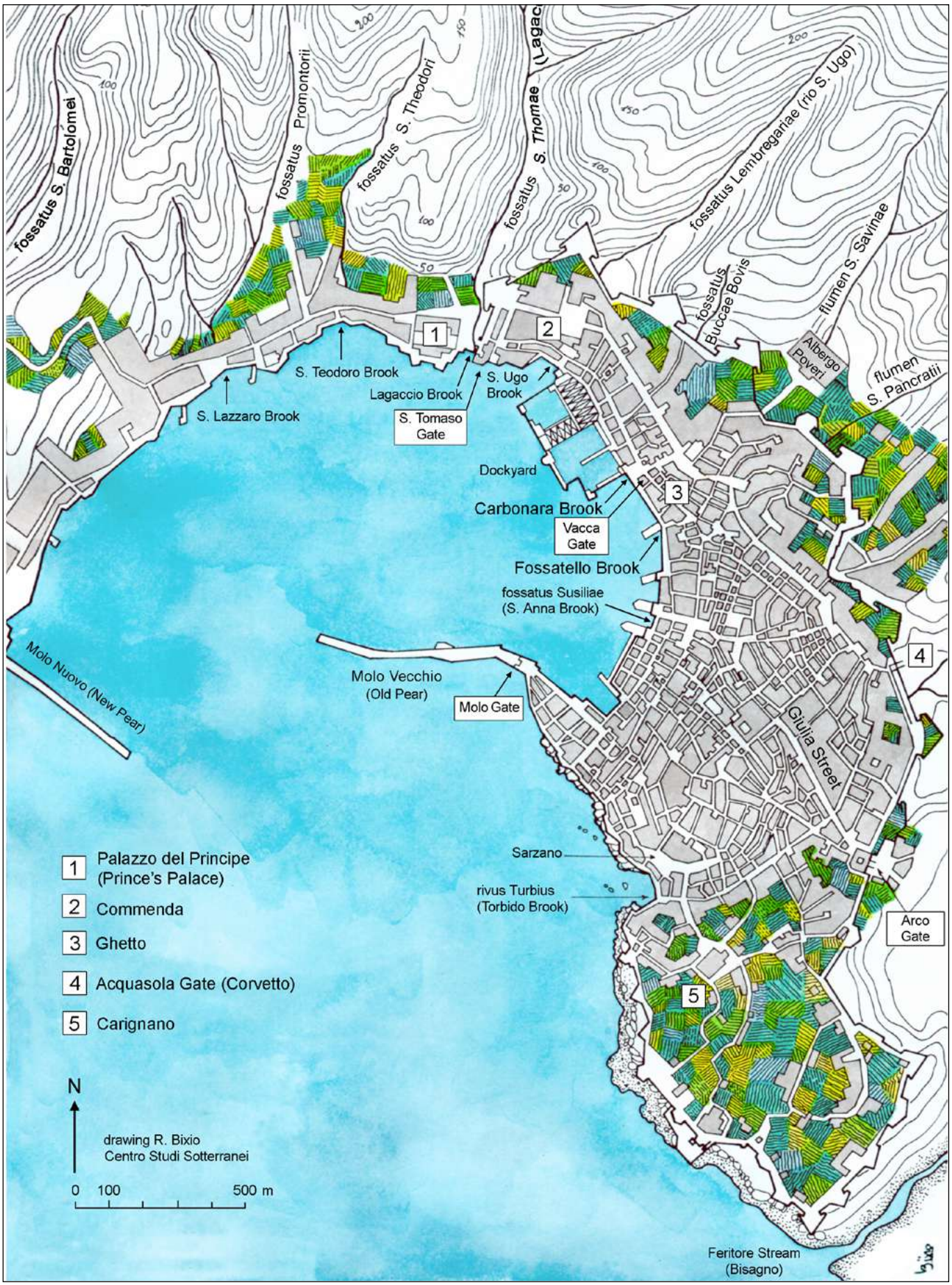

Fig. 2: Genoa's city map of 1750, still widely within the walls of 1536: lay of the land in the environment and streams (covered and uncovered) (Barbieri, 1938: drawing modified by R. Bixio).

Fig. 2: Genova: mappa della città, ancora largamente racchiusa nelle mura del 1536 con l'indicazione della conformazione del territorio circostante e dei corsi d'acqua (coperti e scoperti) (Barbieri, 1938: grafica modificata da R. Bixio).

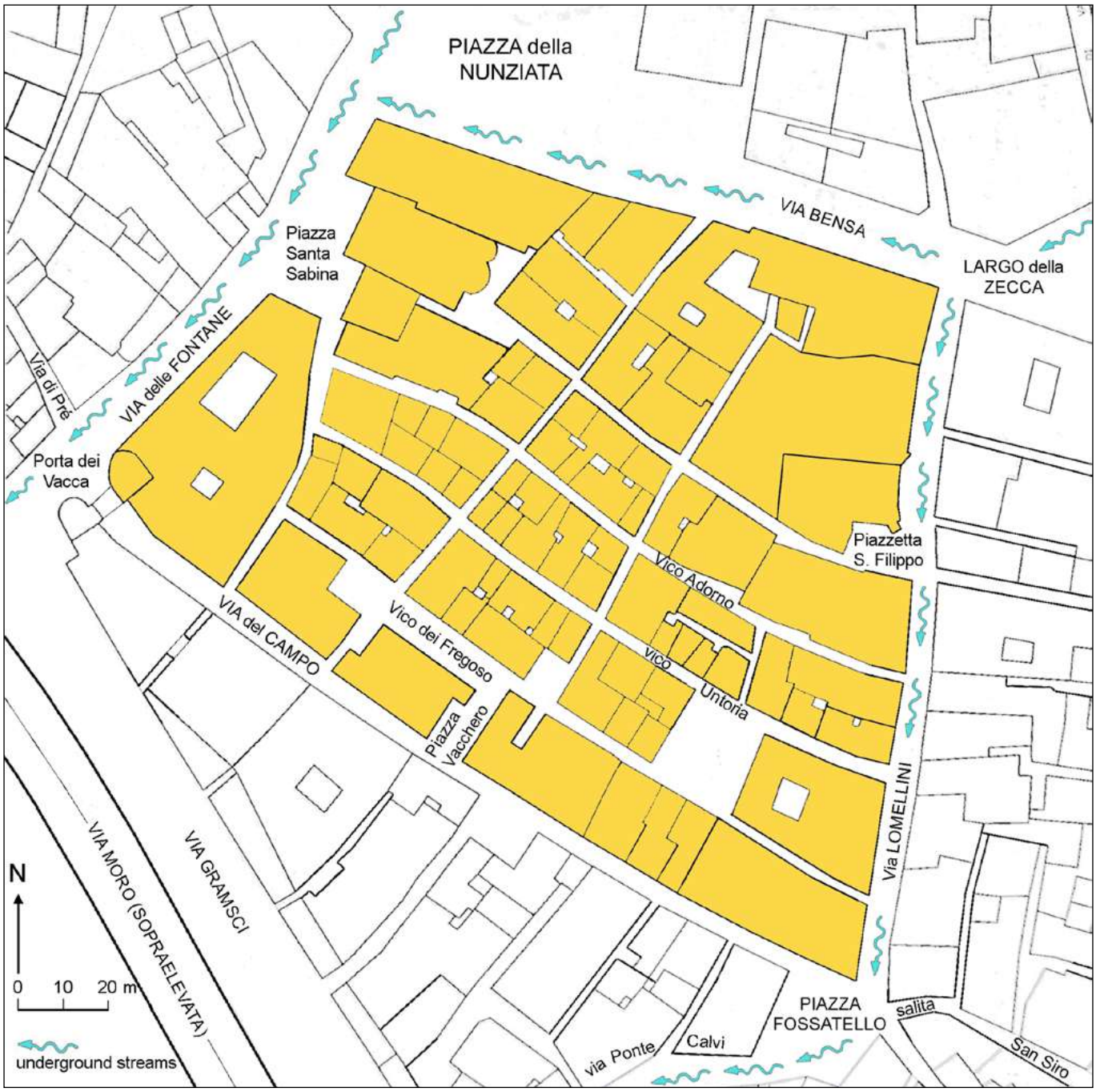

Fig. 3: plan with the boundary of the ancient Genoa Ghetto and the course of streams currently flowing underground into the sea (source: Centro Studi Sotteranei's documentation center).

Fig. 3: planimetria con evidenziata la perimetrazione dell'antico Ghetto di Genova e il tracciato dei torrenti che ne delimitavano tre lati, oggi defluenti a mare per vie sotterranee (fonte: Centro Documentazione del Centro Studi Sotterranei).

gate named *Porta dei Vacca*. In the 14th century, due to the expansion of the city to the W, new walls were built along a western route using as the natural moat the bed of San Tommaso (or Tomaso) stream, today called *Rio Lagaccio* (Finauri, 2007).

Up to 800 this late medieval wall represented the fence within which the city developed, and therefore it was characterized by a very constrict topographical arrangement. This congenital lack of space was one of the reasons that led to the gradual covering of the watercourses (Fig. 2) in order to exploit every single part of the urban area, above all to make road infrastructure. *"Covering the streams to benefit of the mobility has been a cultural constant"* (Rosso, 2014).

Even today under streets and squares the waters of the streams, frequently mixed with waters coming from the old town building's sewage, flow within the ancient water tunnels, following the original riverbed.

This slow but continuous process of covering streams carried on until all the 20th century. The great canalization and covering works of the end part of Bisagno torrent, for instance, were implemented from 1928 to 1934 (Barisone et al., 2004). On this new 53 hectares, new streets and squares were built where fairs, exhibitions and theatrical performance were held. Later an important avenue – which still link the Foce area with the Brignole railway station area – was opened. This and other rash covering works which were realized after the II World War, during strong concrete processes in suburbs and hill areas, were among the

Fig. 4: Genoa. Via delle Fontane (Fountains Street) under which the Carbonara stream flows. On the right, the Porta dei Vacca (Vacca Gate), one of the five city gates in the 12th century walls (Barbarossa Walls) (photo R. Bixio).
Fig. 4: Genova. Via delle Fontane sotto la quale scorre il Rio Carbonara. Sulla destra la Porta dei Vacca, una delle cinque porte di accesso alla città che si aprivano nelle mura del XII secolo (le Mura del Barbarossa) (foto R. Bixio).

main factors that contributed to increase the damages related to the devastating and mournful floods which have also hit the city in recent times[5].

Water in the city centre's toponymy

The names of certain squares and streets remind to the ancient urban arrangement characterized by the presence of water in some parts of the city.
Via e Passo Rio Torbido, Piazza e Salita Sant'Anna, Vico San Gerolamo, Salita e Scalinata di San Gerolamo, Corso Carbonara, Rampa e Salita di Carbonara, Via Sant'Ugo, Scalinata e Passo di Sant'Ugo, Piazza San Teodoro, Rampa e Voltone di San Lazzaro, Via San Bartolomeo del Fossato, Via del Lagaccio, Piazza e Via di Fossatello, Passo del Fossato di San Barnaba, are toponyms of streets, roads and way built thanks to the covering of the watercourses in the past centuries (In English, they can be literally translated as – in inverted commas, the names corresponding to the underground streams – Cloudy Stream Street and Pass, "Sant'Anna" Square and Ascent, "San Gerolamo" Ascent and Alley, "Carbonara" Avenue, "Carbonara" Flight and Ascent, "Sant'Ugo" Street, "Sant'Ugo" Stairway and Pass), "San Teodoro" Square, "San Lazzaro" Flight and Archivolt, "San Bartolomeo" Ditch Street, Bad Lake Street, Ditch Street and Square, "San Barnaba" Ditch Pass). On the other hand, *Via delle Fontane* (Fountains Street), *Piazze Fontane Marose* (Billow Fountains Square), *Spianata Acquasola* (Solitary Water Esplanade), *Piazza Acquaverde* (Green Water Square), *Passo e Vicolo dell'Acquidotto* (Aqueduct Pass and Alley) are names that remind the presence of the water in those places or remind their closeness with the hydraulic infrastructures

Genoa's historic centre, Prè and the Jewish Ghetto of Genoa

The medieval core of the historical city cover an area of about 113 hectares and it is made up of Prè, Molo and Maddalena districts. It is characterized by a high building density[6] and by an intricate maze of alleyways named "*caruggi*".
The beauty of this urban reality was internationally sanctioned in 2006 when 42 "Rolli Palaces"[7] were inserted by UNESCO in the list of the World Heritage of Humanity.
The district of Prè is located just before the most ancient port area where the Arsenal, the *Darsena delle Galere* (Dock of Galleys) and the *Darsena delle Barche* (Dock of Boats) were located[8]. In the past was one of the districts in which the city was divided [9].
From a strictly geographical point of view Prè occupies the most downstream part of the basin of Sant'Ugo, Santa Brigida and Carbonara streams. It is bordered to the W by San Tommaso stream (called also Lagaccio stream) and to the E by Fossatello stream. Today all these little streams are covered under this district area.
Following the Spanish edict issued on 31 March 1492 (Buti, 2006), a community of about 300 exiled Israelites

5) List of floods which had hit Genoa in the last 50 years: October 9-10, 2014; November 4, 2011, September 23, 1993; September 27, 1992; October 7, 1970. The total balance amounted to 72 victims.

6) The building volume of this urban portion is approximately 10 million cubic meters, divided into about 2,500 buildings, compared to a settled population of approximately 23,000 inhabitants.

7) At the time of the ancient Republic of Genoa, the *Rolli*, or more precisely, *Rolli degli alloggiamenti pubblici di Genova*, formed a list of palaces and residences of the great and most prestigious noble families. These families hosted, from a public lottery, the eminent personality, including kings and queens, who transited from Genoa for state visits. The full list included 114 buildings. There are 72 other buildings, which still retain their original structure, but even today they have not been included on UNESCO's World Heritage Sites.

8) From the historical documents there are evidence of the presence of shipyards in that area in 1163. In the second half of 13th century, a dock with an adjacent arsenal was built. In 1973 the names *Darsena delle Galere* (Dock of Galleys) and *Darsena delle Barche* (Dock of Boats) was on the planimetry drawn by architect Michele Codeviola that it is now at Ligustica Accademy Museum in Genoa.

9) Once, the historic city of Genoa was divided into six districts: Pre, Portoria, Molo, Maddalena, San Vincenzo and San Teodoro. This name are still in the municipal toponymy.

Fig. 5: the confluence of San Gerolamo and Carbonara streams, under the Piazza della Nunziata (Nunziata Square) (photo M. Traverso).
Fig. 5: la confluenza del Rio San Gerolamo nel Rio Carbonara nel tratto sottostante Piazza della Nunziata (foto M. Traverso).

arrived in the Republic of Genoa. According to the custom of that time, influenced by religious prejudices against Jews, they were confined in the Prè's area, within the old Barbarossa Walls.
In spite of restrictions, the Jews were allowed to open a synagogue of which, however, today there remains no trace. Around the middle of the 17th the area became a real fenced ghetto with guarded access in order to prevent contacts between Jewish and Christians.
The area occupied in the past by the ancient Jewish Ghetto of Genoa was an irregular quadrilateral circumscribed by *Via del Campo* (Campo Street), *Piazza Fossatello* (Ditch Square), *Via Lomellini* (Lomellini Street), *Via Bensa* (Bensa Street), *Piazza della Nunziata* (Announced Square) and *Via delle Fontane* (Fountains Street) (Fig. 3). The external belt consisting of these streets and characterized by ancient aristocratic palaces and religious buildings encloses humble houses which were historically given to the lower classes. Today most of these houses are in a state of decay.
Over the centuries, the area of Ghetto, little know by the Genoese, had undergone a progressive both building and social deterioration.
Starting from the second post-war the Ghetto, abandoned by most of its original inhabitants, became one of the principal site for illegal and criminal activities.
This phenomenon unfortunately affected the great part of the historic city centre that registered a progressive marginalisation process causing social problems even more serious and concentrated.[10].
In 2004, during the event of "Genoa European Capital of Culture", the public administration started urban recovery projects that also included the Ghetto.

10) The Alhambra Decree, also know as the Edict of Granada, issued by the joint of Catholic Monarch of Spain (Isabella I of Castile and Ferdinand II of Aragon) was a document which made mandatory conversion of Jews to Catholicism and ordered the expulsion of those not converted from the territories and possessions of Kingdoms of Castile and Aragon by 31 July of that year.

Research on the Ghetto's subterranean spaces
The *Centro Studi Sotteranei* (Centre for Underground Studies) – on the recommendation of the Municipality of Genoa (Technical Asset Management Services, Division of Historical Centre) implementing the "Plan of action for building restoration, socio-economic recovery, safety and mobility in the old city" and in collaboration with the *Soprintendenza per i Beni Archeologici della Liguria* (State Authority for Archaeological Heritage of Liguria) and the Department of Design and Construction of the University of Genoa – conducted the survey of the subterranean spaces on the Ghetto area. The study was carried out as a support deemed necessary for a proper operation of redevelopment and building restoration of this district.
The work involved a team of twelve technician with speleological, architectonic, archaeological, urbanistic, topographic, diving, security and video-photographic skills. In some stages students of Synthesis Laboratory of the University, directed by Prof. Andrea Buti of the Faculty of Architecture, participated to the work.
The methodologies applied during underground surveys were those typical of explorations of artificial cavities which have obviously provided the implementation of all the necessary precautions to work under security conditions.
Centro Studi Sotteranei team worked analysing the

Fig. 6: Genoa: The Church of San Filippo in Via Lomellini. On the pavement a manhole connects below to the Fossatello Stream (photo R. Bixio).
Fig. 6: Genova: la chiesa di San Filippo, in Via Lomellini. Sulla pavimentazione è visibile il chiusino di comunicazione con il sottostante canale del Rio Fossatello (foto R. Bixio).

Fig. 7: the descent from the street to the Fossatello stream, using a speleological ladder (photo R. Bixio).
Fig. 7: la discesa dal piano stradale all'interno del Rio Fossatello per mezzo di una scala da speleologia (foto R. Bixio).

bottom of every building to look for some possible hypogeal structures such as ancient cisterns, conduits, passages, etc. in order to verify the possibility to penetrate into them. The team opened the manhole covers, went into the gully and walked through underground tunnels where water of the streams, not so much clear, currently flow.
Acting in pitch darkness and, in some case, overcoming waterfalls with the help, for short distance, of rubber dinghy, the technical and speleological teams explored the courses of the Carbonara, San Gerolamo and Fossatello streams, discovering evidences of an ancient historic city which is still hidden under the contemporary city.
From the survey a sort of Genoa's virtual itinerary of the past centuries is arisen, which is stud with suggestive fragments; a scientific work useful, also, to contribute to the design of the contemporary "Genoa's Map of Subsoil".
Until the 15th century, instead of Fontane Street (Fig. 4) – the northern boundary of the former Ghetto area, as mentioned above – Carbonara stream flowed in the open and creating two bends in Vastato Square, the current Nunziata Square. This stretch was covered when the square was extended exploiting exactly the cover of the ditch, carried out from 1547 and 1548 (Archivio Storico).
This urban transformation included the demolition of the block where the San Tommaso oratory and Santa Marta hotel were (Grossi Bianchi, Poleggi, 1979) in order to allow the construction of the Santissima Annunziata del Vastato church, that started in 1520. Its façade, facing the square, was finished in 1616 (Belloni, 1965).
Carbonara creek was further covered, in the upstream, in the 17th century when began the construction (1652) of the *Albergo dei Poveri*, the great complex created as an almshouse to host the poor of the city, ended only, after several pauses, in 1835 taking the current form.

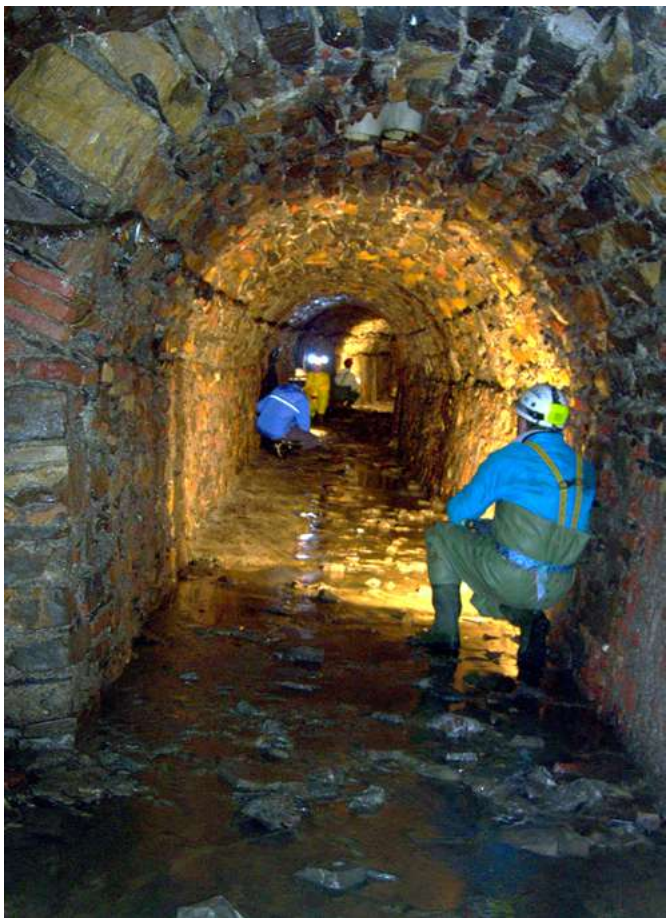

Fig. 8: the tunnel under Via Lomellini and the Fossatello stream (photo R. Bixio).
Fig. 8: la galleria sotto via Lomellini che racchiude l'alveo del Rio Fossatello (foto R. Bixio).

The exploration conducted inside Carbonara stream involved the routes under Fontane Street and Nunziata Square.
Little more than three meters under the road plan, the Carbonara stream still flow. The section of the conduct, under Fontane Street, measured about 200 cm wide and 225 cm in height. The tunnel has some vertical walls with semi-circular arch and it has stone slab paving.
The construction technique is mixed: in the vertical walls prevailed the use of the stone just rough-hewn and laid in and bound together by a good lime mortar; trace of plasterwork are evident except for the basement where there are big stone blocks. On the other hand, the covering structure is in brick masonry, also bound together by a good lime mortar which also cover intrados of the vault characterized by the presence of wooden centering.
Moving further toward the sea, the section of the duct tend to become narrower and after about 30 meters it is 150 cm, while the vault beacome a segmental arch. This part of the stream presents some critical hydraulic issues. The marks of water pressure on the tunnel are evident.
At Gramsci Street, the stream flow into the harbour sewer. In the area under Darsena Square, in parrallel to Carbonara tunnel but shifted by around 5 meters to the W, there is another channel of the same section and

Fig. 9: wall with bossed stone masonry (photo R. Bixio).
Fig. 9: tratto di parete con muratura in pietra squadrata bugnata (foto R. Bixio).

flow rate which develops under Santa Fede historical complex and goes up until the former San Tommaso oratory.
Going uphill, Carbonara stream becomes wider until it reaches a maximum of 6.5 meters in width and 3.3 m in height. The walls have an internal faint scarp and the vaulted ceiling becomes depressed arch. On the bottom of the canal there is a layer of rubber, stones and rocks. The state of conservation seems good.
Arriving at Nunziata Square, there is a litte weir of about one meter of altitude which corrisponds to a deep full of water hole (Fig. 5). The watercourse, in this point, turn first to the NW, and then, after passing another weir, to the SW, describing a broad "S" form under the square before the Santissima Annunziata del Vastato church.
Just below the ground of the church endures the ancient hydraulic branch which pre-existed the construction of the building of worship (1520).
The stream, along the side of the church toward Bandiera Square, goes up tracing the route of Bellucci Street and it carry on along Brignole de Ferrari Street until the *Albergo dei Poveri* and beyond. This stretch has an extraordinary complexity in its technical construction. It's a succession of weirs, waterfalls (with leap of up to seven meters in height) and large areas (with section of the tunnel up to five meters of light) highly complex with overlapping culverts, branches. Inside it we found also interesting archaeological and architectural ruins: pieces of ancient walls, iron gate and grating. In fact, in this point, there was the 6th city walls. (Centro Documentazione).
At the before written second bend, still under Nunziata Square, there is the intersection with San Girolamo stream. Its culvert, about 2.5 meters wide, extends along Bensa Street (upstream) until Zecca square where brush in three sides the perimeter of Patrone Palace and goes up to Vallechiara Street.

Underground course of the Fossatello stream
The stream, at present called Fossatello, has changed name and course over time. Its current name derived from the urban area it crossed which, in the toponymy contained in medieval documents, had already named "*in Fossatelli*" in 1143, "*carrubius Fossatelli*" (Fossatello Alley, current Ponte Calvi street) in 1228; "*contrata Fossatelli*" (Fossatello district) in 1255 (Basili, Pozza, 1974).
In the 12th century the course of the stream intersected the perimeter of the third fortified walls

Fig. 10: impracticable section of the tunnel, near by the outlet to the sea (photo R. Bixio).
Fig. 10: tratto della galleria impraticabile, in prossimità dello sbocco a mare (foto R. Bixio).

(Barbarossa Walls) at the point where the "*Portam S. Agnesis*" (Sant'Agnese Gate) was placed. At that time this part of the city was characterized by large agricultural and undeveloped areas[11].
The stream, thus, went through the "*Platea S. Agnesis*" (the current Lomellini Street), passed Fossatello Square which until then had been a cultivated land, and only at that time started to be interested by a urbanization process. At the end, the stream flowed into the water of the harbour after passing trough the current Ponte Calvi Street.
This urbanistic transformation led to the covering of Fossatello stream between the 13th and 14th century. At that time there was the creation of Lomellini Square (Grossi Bianchi, Poleggi, 1979, Pl. VI, p. 125 and annotation n. 9, p. 126), set in the middle of the street with the same name, while the expansion of Fossatello Square took place in 1539 due to the construction of Cipriano and Balbiano Pallavicino's palace (Grossi Bianchi, Poleggi, 1979, Pl. XVI, p. 260-61, annotation n. 43).
In the 1855's cartography of the Royal Corps of Civil Engineers of the Kingdom of Sardinia, the Fossatello stream was named Vallechiara stream – from which the name of the current street is derived. The street was built on the coverage of the watercourse and was still in hydraulic continuity with the upper stretch of San Girolamo stream.

Fig. 11: ancient clay tubes incorporated in the lateral wall of the tunnel (photo R. Bixio).
Fig. 11: resti di antichi tubi fittili inglobati nel muro laterale della galleria (foto R. Bixio).

11) The origin of the name of Prè derives from Latin "*praedia*" (small farm) or "*Borgus Praedis*", term which is named in documents dating back to 1131 as in that time it was still mainly an agricultural area (Poleggi., Cevini, 1981).

Fig.12: pillars holding up the marble pipeline of the ancient aqueduct that crosses the streambed (photo R. Bixio).
Fig. 12: pile trasversali di sostegno della tubatura in marmo dell'acquedotto storico che attraversava l'alveo del torrente (foto R. Bixio).

In other documents and maps the Fossatello stream, on the other hand, sometimes was named "*Flumen Sancti Pancratii*".
In the current documents of the company *Mediterranea delle Acque*[12] the part of brook upstream of Bensa Street (where the ancient Sant'Agnese Gate was set) is still listed as *Rio di San Gerolamo* but it is not connected with the current Fossatello stream anymore.

Underground exploration into the Fossatello stream

Throughout a manhole cover opening in Lomellini Street and placed approximately in front of the church of San Filippo (Figs. 6 and 7), it is possible to access the tunnel where the Fossatello stream flows. The canal spreads essentially below the longitudinal axis of the road, retracing the same route.
Upstream of the manhole, at the intersection with Bensa Street, the tunnel is interrupted where in the past the watercourse was connected with San Gerolamo creek. Downstream, the canalization retraces underground the trail: Lomellini Street, Fossatello Square, Ponte Calvi Street and, at Gramsci Street, it flows into Sottoripa's sewer.
The structure explored under Lomellini Street presents homogeneity in materials, shapes and construction techniques. The section, with a base of about 150 cm and a height of about 180 cm, presents vertical walls which support a semi-circular arch (Fig. 8).
The riverbed, slightly sloping towards the sea, would seem to be the natural bedrock; it is rather clearing out of debris. The construction technique, of both vault and vertical structure, is the rubble masonry where irregularly shaped little stones, bound together by a lot of mortar, prevails. The bricks, bound together with by mortar, have a reddish colour and shapes sufficiently regular. The masonry seems to be in good conditions.
According to the tree structure, small secondary channels converge into the principal tunnel of the stream. The paving, set in an upper level than the stretch of the channelling described above, is in slate sheets partially overlapped. In particular, on the orographic right side, an elevated tunnel branch off. Its outlet is protected by an ancient and enigmatic grating forged by hand. Its joints are made in such a way that, even cutting the bars, it is impossible to pinch them. Its route is perpendicular to Fossatello's direction; the section measures 60 cm in width and 80 cm in height. The vault conserves a sort of plastering of mortar characterized by a greyish colour and by the presence of the cavities of the wooden centering.
Along the stream, from the manhole to the sea, the direction was almost rectilinear for some tens of meters. Once at the above Fossatello Square, the stream creates a small pool. In this point the section of the tunnel expands until reaching a width of 2.30 meters and a height of 3.50 meters.

12) Mediterranea delle Acque is the firm which manages the Integrated Water Service of Genoa.

The walls, which turn to the right, present a masonry of squared and large size blocked stone arranged in a regular horizontal course with well-worked joints and few lime mortar. In some parts the wall is constructed in ashlar masonry (Fig. 9). Also here, as in the previous stretch, the covering structure is a vault and it is realized with irregularly shaped little stones bound with abundant mortar. The four secondary canals converge in this area increasing the flow rate.

After, the stream turns to the left to follow the road curved axis of Ponte Calvi Street. Large portions of vertical right side masonry present traces of lime plaster with "*opus signinum*" used as waterproofing. The riverbed is largely covered by debris. The section is reduced: the maximum width becomes 180 cm and the height 230 cm. The vault and the walls seem to be structurally in a good repair. On the right side there is for about fifteen meters a little masonry bank covered with stone slabs. A secondary canalization is placed within this quay.

The exploration can carry on for only some tens of meters as the ceiling with a segmental vault, steadily sloping, gradually starts to become lower towards the water level which in that point completely floods the tunnel (Fig. 10).

However, within the tunnel remains of two aqueducts were found. One was embedded along the eastern wall of the stream's tunnel below Lomellini Steet, in the stretch from Bensa Street and Fossatello Square. The pipeline was made of clay telescopic elements sealed with mortar at the joints (Fig. 11). The second one diagonally crosses the path of the same stream, in correspondence of Fossatello Square. At this point the aqueduct, coming from the St. Siro Ascent, leaps over the stream, at a height of about 140 cm from the riverbed thanks to a suspended bridge (Fig. 12) made of Carrara marble tubes, each of about 150 cm length,

Fig. 13: detail of the marble pipeline of the ancient aqueduct still incorporated in the main wall (photo R. Bixio).
Fig. 13: particolare del tubo in marmo dell'antico acquedotto ancora inglobato nella muratura di sostegno (foto R. Bixio).

and then continues towards Campo Street. The pipe segments seem to be barely drafted and they have at the ends both male and female joints; they present an external section approximately squared, of about 30 cm side, and the internal cylindrical conduit has a

Fig. 14: aqueduct's marble element removed by floods from its suspended original position (photo R. Bixio).
Fig. 14: elemento in marmo dell'acquedotto scalzato dalle piene del torrente dalla sede pensile (foto R. Bixio).

Fig. 15: ancient crypt below the main altar of San Filippo Church (photo R. Bixio).
Fig. 15: l'antica cripta sottostante l'altare maggiore della chiesa di San Filippo (foto R. Bixio).

diameter of about a dozen centimetres (Fig. 13).
The action of waters in flood conditions removed a pair of marble elements that now are lying on the bed of the stream, not far from the original location (Fig. 14). In particular, one of the two tubes still has traces of the seal with which joints were closed to the main branch of the pipeline.
Researches involved also the basements of the buildings along Fossatello's sides where regular floods occur due to the effect of the rise of groundwater.
Exploring the ancient crypt of the church of San Filippo was very interesting. In this building the 18th century structures of the religious' tombs of the annexed convent were preserved (Fig. 15). The crypt is located in the area below the main altar. Its access is possible trough a hatch, a marble slab with removable linchpins at the four corners, suitable for lifting it, placed between the way from the apse and sacristy. A staircase descends to a landing where there are two flights, symmetrically arranged, leading to a large rectangular room. At the centre there is a massive pillar which supports the groin vaults. Less than thirty masonry vertical burial recesses are distributed along the three side of the room. Every burial recess has a seat in order to bury the corpses in a sitting position. The tombs are empty; only in a few of them, some bones are still evident. The tombs were covered using large slabs of slate inscribed with the information concerning the deceased. Today these front closures are removed and placed against the wall.

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