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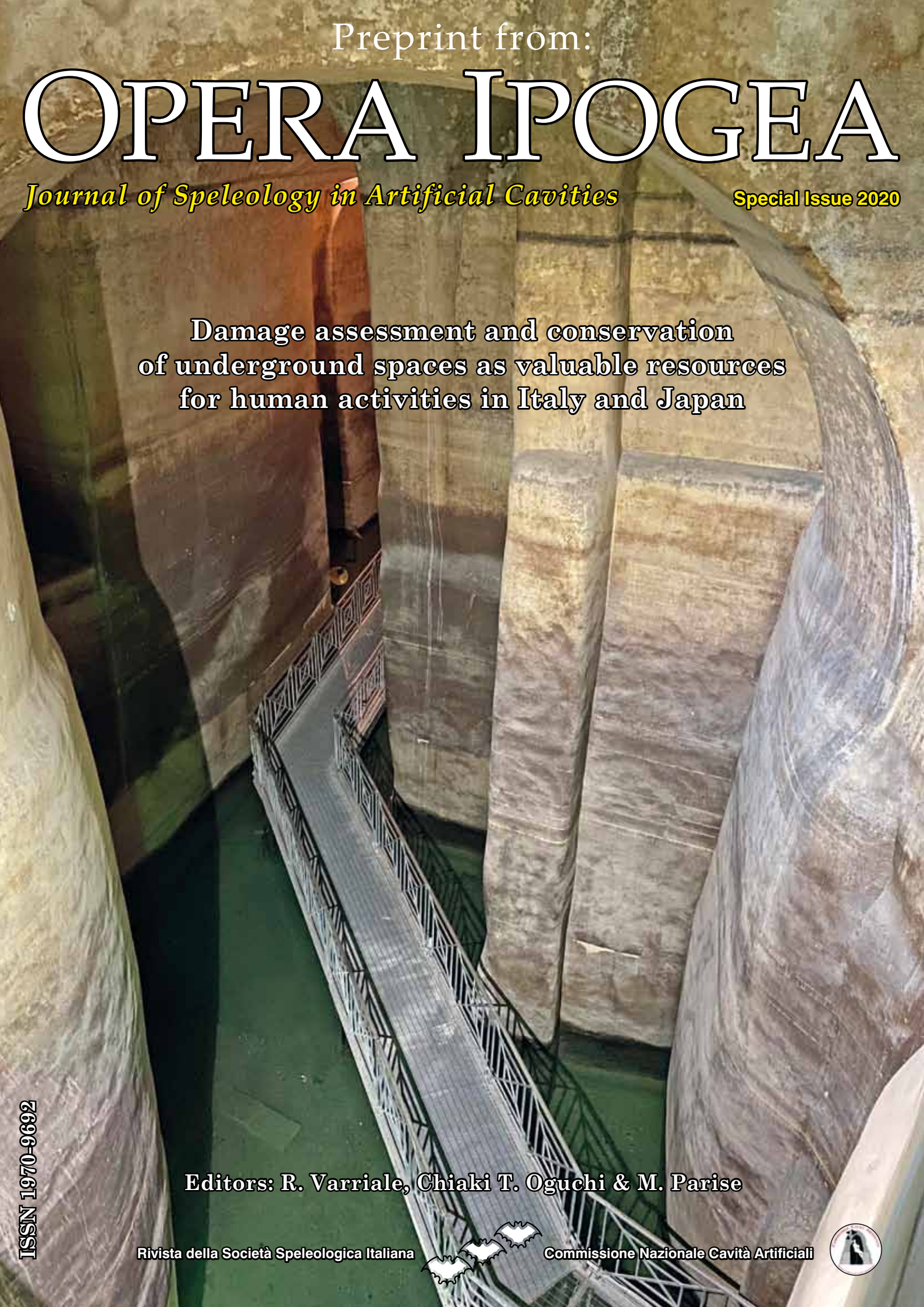

Damage assessment and conservation of underground spaces as valuable resources for human activities in Italy and Japan

Editors: R. Varriale, Chiaki T. Oguchi & M. Parise

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Palombaro Lungo water tank in Matera, Basilicata, Italy (photo: Antros Archive – Matera)

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Chiesa K4c a Göreme, Cappadocia, Turchia (foto: Archivio Centro Studi Sotterranei – Genova)
K4c church in Göreme, Cappadocia, Turkey (photo: Centre for Underground Study Archive – Genoa)

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Underground built heritage in Italy and Japan: from a general classification to the case studies of Pizzofalcone and Yoshimi Hyakuana Hills

Patrimonio culturale sotterraneo in Italia e in Giappone: dalla classificazione generale ai casi studio delle colline di Pizzofalcone e Yoshimi Hyakuana

Roberta Varriale[1]

Abstract

Japanese and Italian undergrounds have historically managed several environmental conflicts and social interactions of the aboveground world, both in urban and rural contests. Nowadays those artifacts represent significant segments of local cultural heritage and with rising frequency they are at the basis of strategic planning, as demonstrated by the increasing number of project addressed towards their regeneration and valorization, financed in both the countries. Such actions depend on the various levels of re-use: re-invention, re-introduction and re-interpretation. This paper focuses on two homogenous case-studies: Pizzofalcone Hill in Naples (Italy) and Yoshimi Hyakuana Hill in the Saitama area (Japan). After a brief introduction to the adopted methodology and the application to the general Underground Built Heritage (UBH) scenario in Italy and in Japan of two dedicated charts, the paper illustrates the functional classification of the most significant elements of UBH in the two selected case-studies. It then analyses the historical transformations occurred in the corresponding *properties* and the state of the art of re-uses and valorization actions of the sites by adapting the new theoretical charts recently published by the Author. Data used in this last step are the results of the onsite visits and inspections realized during the bilateral project JSPS/CNR "Damage assessment and conservation of underground space as valuable resources for human activities use in Italy and Japan" (2018/2019).

Keywords: underground, functional classification, history, hills, re-use, valorization.

Riassunto

I sottosuoli giapponesi ed italiani hanno sopportato storicamente molti conflitti ambientali e interazioni sociali del mondo superficiale, sia in contesi urbani che rurali. Oggigiorno quei manufatti rappresentano significativi segmenti del patrimonio culturale locale e, sempre più frequentemente, sono alla base di processi di pianificazione, come dimostra il crescente numero di progetti indirizzati alla loro rigenerazione e valorizzazione in entrambi i paesi. Queste azioni sono connesse a vari livelli di ri-uso (re-invenzione, re-introduzione e re-interpretazione) che possono riguardare questa tipologia di elementi e mirano a valorizzare il potenziale comunicativo di quei manufatti in riferimento alle loro funzioni storiche. Nell'introduzione, si definisce la classe dell'*Underground Built Heritage (UBH)*, oggetto dell'articolo, e viene illustrata una nuova metodologia di classificazione e di analisi di recente pubblicazione ad essa dedicata. Questo nuovo approccio di studio è volto proprio alla ricostruzione di tutte quelle potenzialità; la sua applicazione permette di analizzare le azioni di valorizzazione messe in atto su questi manufatti, integrarle degli elementi eventualmente mancanti o di indirizzare future progettualità in questo settore. Il lavoro, poi, rivolge la sua attenzione nei confronti del caso comparativo fra Italia e Giappone prendendo in considerazione alcuni siti oggetto di studio nell'ambito delle attività del progetto bilaterale JSPS/CNR "Monitoraggio del rischio e conservazione del sottosuolo antropico come risorse per le attività umane in Italia e Giappone" (2018/2020). I due grafici affiancati rappresentano le funzioni storiche espresse dai casi studio oggetto dell'azione. Per l'Italia sono stati presi in considerazione elementi del patrimonio culturale che comunicano informazioni rispetto a tre diverse funzioni relative alla gestione di conflitti ambientali (acque, monito ambientale e spazio abitato) mentre per il Giappone solo rispetto a due di queste (acque e monito ambientale). Sia per l'Italia che per il Giappone, con riferimento alle funzioni che permettono la ricostruzione di alcune interazioni sociali, sono stati studiati elementi che riconducono alla funzione della religione, della difesa e dell'economia. Definito il quadro generale, l'articolo si focalizza quindi sull'analisi dettagliata di due casi-studio

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omogenei: la collina di Pizzofalcone di Napoli (Italia) e la collina di Yoshimi Hyakuana nell'area di Saitama (Giappone). Il lavoro analizza le trasformazioni storiche di cui sono state protagoniste le corrispondenti proprietà e lo stato dell'arte dei processi di riuso e valorizzazione dei siti mediante l'adozione dei nuovi strumenti di analisi recentemente introdotti dall'autore. Questa ultima fase è stata possibile grazie ai i risultati delle visite e delle ispezioni realizzate proprio durante il progetto bilaterale e utilizza materiale fotografico di prima mano realizzato dall'Autore in quel contesto.

Parole chiave: sottosuolo, classificazione funzionale, storia, colline, ri-uso, valorizzazione.

Introduction

The paper is the first attempt in the comparative study of a selection of cultural sites within the class of Underground Built Heritage (UBH) (Varriale, 2019) in Italy and Japan. The class under analysis includes all the historical artefacts realized in the underground of those countries which, despite the interruption of their primary function or their transformation for different reasons, have become significant elements of the local material and immaterial cultural heritage.
The hypothesis that stimulated international cooperation on this topic considers both the nature of local cultural heritage and its exposure to geological and climatic risks. With reference to the first aspect, in both the countries, the underground location is an element that reflects so much of the identity of local cultural heritage that traces of this linkage can also be found in the descriptions of the correspondent properties within the UNESCO list. This list includes 55 properties in Italy (50 cultural and 5 natural) and 23 in Japan (19 cultural and 4 natural) (UNESCO, 2019). A keyword search conducted in the documents that illustrate the applicability of criteria to be inscribed in the UNESCO list, referred to each site, confirmed the connection to the under 0 level of most of them. In fact, even though the word "underground" is mentioned only twice among Italian *properties* and once among the Japanese ones, and "cave" was found four times for Italy and once for Japan, "mine" is present in 22 descriptions of Italian *properties* and in 18 Japanese ones, and "tomb" showed up twice for Italy 8 and 3 times for Japan. With reference to the second aspect, both in Italy and in Japan the cultural heritage under protection is exposed to similar risks due to the geological and morphological settings, and to the incidence of geological hazards such as earthquakes.
On the basis of these premises, the thesis formulated in the project was that the standardization of procedures for the preservation and the valorization of selected elements within the UBH class in Italy and Japan could be developed by the two teams involved in the JSPS/CNR project, in order to address future local and regional policies regarding monitoring and valorization in this specific issue.
The selection of case-studies was a fundamental task; the main challenge was to include the wider variety of elements in the experimental phase in order to cover

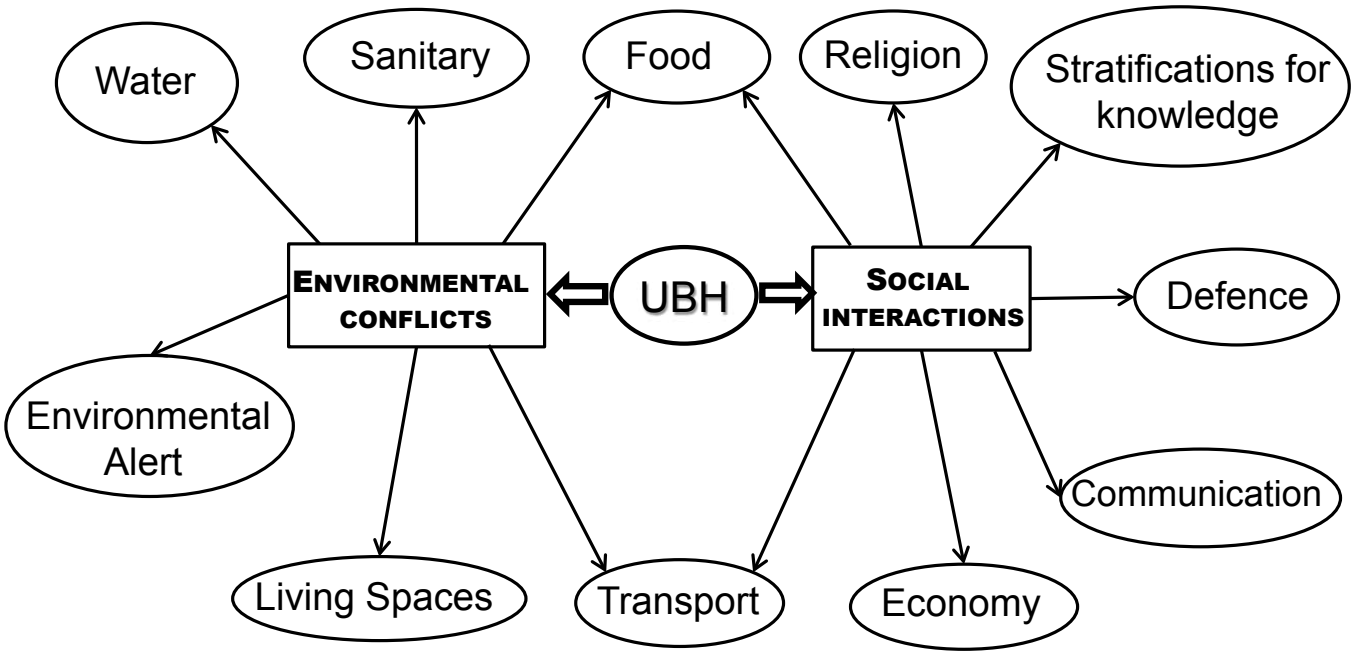

Fig. 1 – Underground Built Heritage (UBH) basic chart (graphic: R. Varriale).
Fig. 1 – *UBH grafico generale (grafica: R. Varriale).*

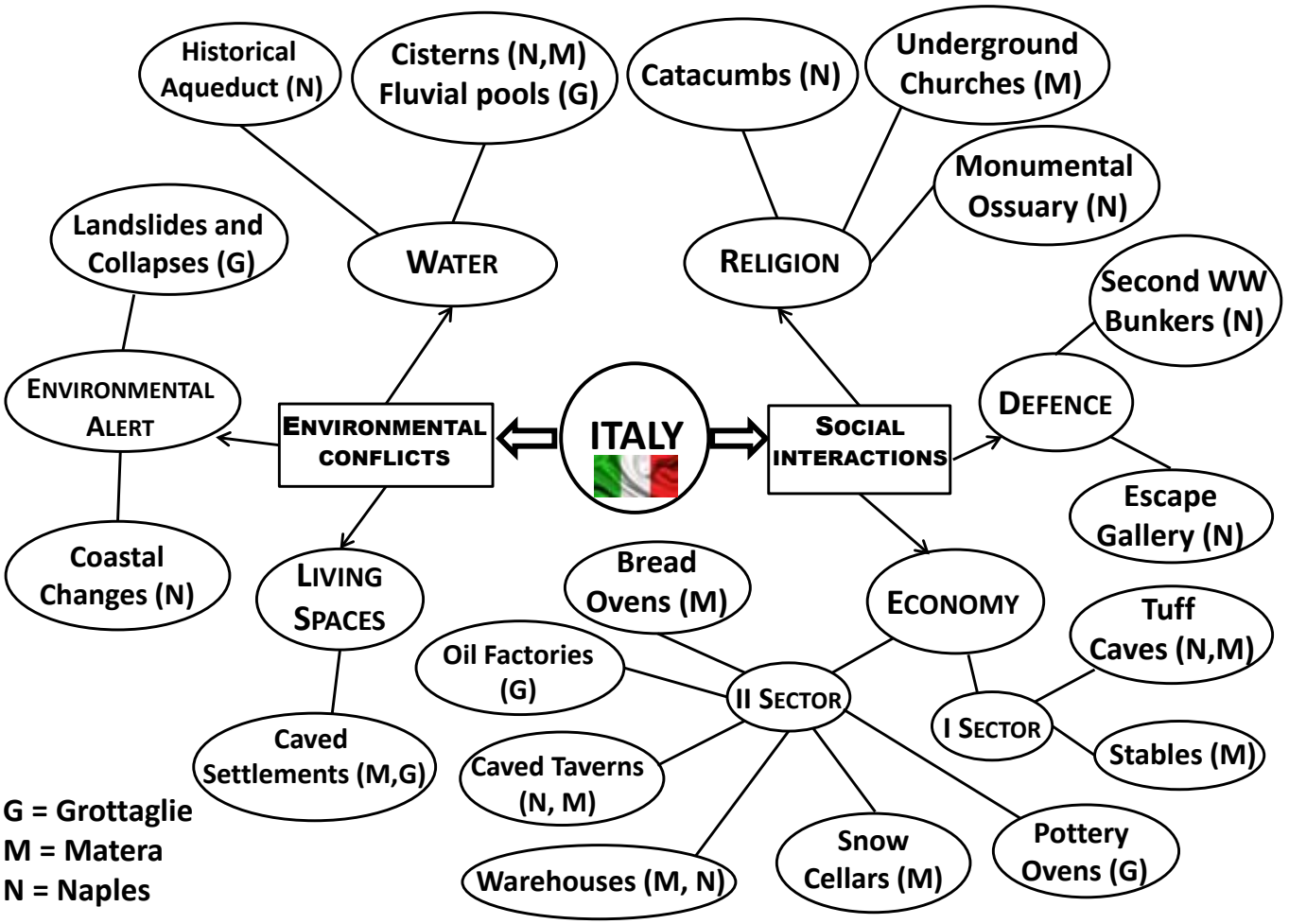

Fig. 2a – UBH case studies in Italy (graphic: R. Varriale).
Fig. 2a – UBH in Italia (grafica: R. Varriale).

the most significant properties built or absorbed into the underground space, while at the same time, examining those properties that detain the most efficient narrative potential about the local culture. This preparatory phase took into account that UBH can be at the core of processes for the enhancement and valorization of cultural sites in order to generate extensive social and economic benefits through effecive communication of the historical values of the artefacts.
The methodology adopted for the classification of Italian and Japanese UBH case studies selected for the project was recently introduced by the Author (Varriale, 2019) and consists in the transposition of the general chart (fig. 1) to the local contexts. The basic chart analyses eleven classes divided in two main groups: the first is dedicated to elements of cultural heritage located in the underground that possess potential to provide information and communicate values to understand local dynamics connected to Environmental Conflicts; the second refers to sites that can be considered as underground physical signs of aboveground Social Interactions. In the case of this project, two different charts were elaborated and published side by side for an easier visual conceptual comparative analysis (figs. 2a and 2b).

In Italy (fig. 2a), the case studies were selected in the south of the peninsula: Naples, Matera and Grottaglie. They refer to six sub-classes: three connected to Environmental Conflicts and three to Social Interactions. With reference to the first group, UBH elements included in the sub-classes "Water", "Environmental Alert" and "Living Spaces" were examined. "Water" was represented in Naples by the cisterns and the pipes connected to the historical aqueduct of Bolla. This network was the first dynamic water system built in Magna Graecia colonies and represents the transition mark from static to dynamic systems in western urban history. In Matera, the complex system of private and public cisterns in correspondence to the urban caved settlement was analyzed. This system optimizes the management of rain waters in an area where other sources are absent and in presence of climatic conditions that generally cause wet winters and very dry summers. The property was considered by the commission UNESCO to be the most innovative element in the dossier written for the inclusion of the Sassi district of Matera in the list, and strongly influenced the decision to include it in 1993 (Laureano, 1993). The hydraulic system was studied as a cascade type system where the priority in supply was given to

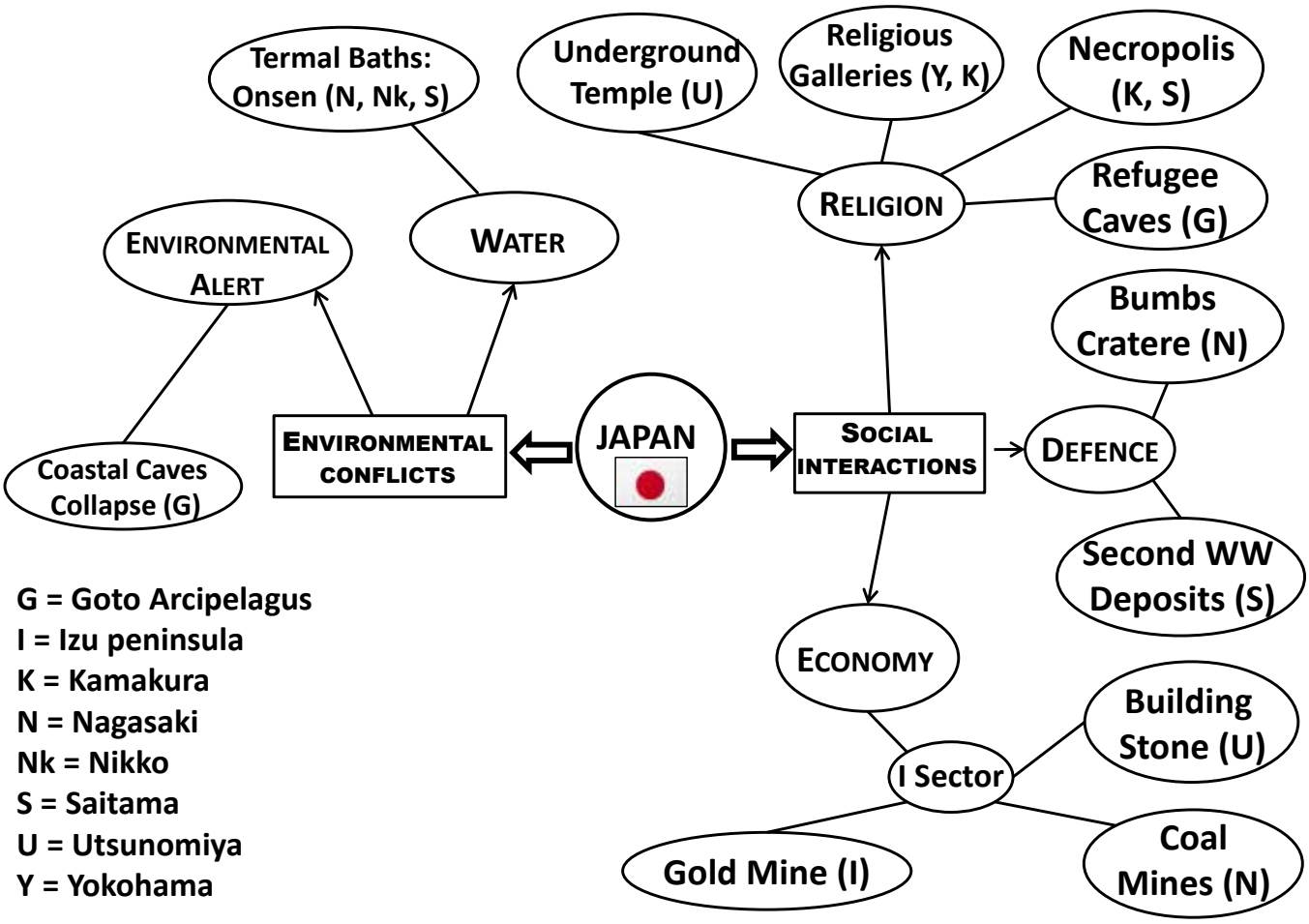

Fig. 2b – Underground Built Heritage (UBH) basic chart (graphic: R. Varriale).
Fig. 2b – UBH grafico generale (grafica: R. Varriale).

private pools. As a result, only when family cisterns were completely full of water, they started contributing, with their extra supply to the public district cistern. The system worked thanks to a complex network of one-way pipes connected to the water limits of private pools and it is emblematic of the principle of solidarity applied at municipal level in the management of natural resources. This case is completely different from the third case study analyzed for this sub-class: the stone fluvial pools in Grottaglie. In this case, the open air fluvial pools were managed at collective level for the conservation of waters to be used during recurrent summer drought (Parise *et al.*, 2013). The "Environmental Alert" sub-class was represented in this project by coastal caves of the Posillipo district in Naples, a continuous system of dismissed tuff caves with open front on the water. Used and adapted throughout their history for several functions, and sometime still in use as recovery areas for ships, or transformed into recreational spaces, their stability is continuously in danger due to sea water erosion, climatic changes and pressure from the aboveground uncontrolled urban development and growth of tree roots. In addition, they are also the perfect places to monitor Naples coastal changes. The second case-study of this sub-class is represented by collapsed artificial caves within the Gravina of Fantiano (*gravina* is the local term to indicate deep karst valleys in Apulia; see Parise *et al.*, 2003). These caves have been abandoned after centuries of continuous use and their conditions now reveal the fragility of the gorges habitat in the Murgia Plateau.

A special attention was given to the sub-class "Living Spaces" because it reflects the attitude to urban and economic development on the Murge Plateau (Lapenna *et al.*, 2015). Matera and Grottaglie were the selected case studies of this sub-class representing the extreme levels in conservation and valorization, being the first, the most celebrated underground settlement in the world and, as concerns Matera, the current European Capital of Culture (2019), whilst the second is an almost abandoned site, poorly managed at local level (fig. 3).

It is also worth noting that while the very popular case of the Sassi district in Matera is a perfect example to warn against the risks of gentrification of abandoned city centers, exclusively valorized as cultural heritage sites (Varriale, 2019), Grottaglie is striving to preserve the communication of its original uses in the valorization processes currently being conducted,

Fig. 3 – Grottaglie (above) and Matera (below) caved settlements (photo: R. Varriale).

Fig. 3 – Insediamenti ipogei a Grottaglie (in alto) e (in basso) a Matera (foto: R. Varriale).

and maintain its connection to the natural surrounding habitat, helping it to survive.

With reference to elements of UBH that communicate social interactions, the Roman Catacombs of Saint Gennaro, the Dominican Catacombs of Saint Gaudioso and the Monumental Cemetery of Fontanelle in Naples were selected within the sub-class "Religion". The first two are managed by the Cooperative La Paranza and they are successful examples of how, with the involvement of young people, the valorization of cultural heritage sites can influence the local social and economic development in marginal districts (Varriale, 2018). The Cemetery, on the other hand, is currently managed by the Municipality of Naples and was the site selected for the first living lab within the COST ACTION "Underground for Value" (CA18110, 2019/2023) to experiment the transition toward the involvement of local actors in the management of historical sites within the UBH class.

World War II bunkers and the Bourbon escape tunnel in Naples were selected to represent the category connected to "Defence", while Middle and Modern ages tuff caves, eventually re-used as warehouses, were chosen to represent the first and the second sector of the class "Economy". In Matera, instead, rupestrian churches of the city center and of the Murgia Plateau represented the sub-class "Religion" with their frescos realized during the Middle Ages byzantine iconoclastic war by pilgrims escaped from persecutions in their native countries (Dell'Aquila & Messina, 1998). The case studies included a role model and several potential replicators: the completely restored Cripta of the Original Sin, considered a role model, is characterized by an efficient storytelling through the dedicated virtual tour with limited access, and by climatic control, while other potential replicators include several less valorized and monitored churches. Tuff caves and animal stables represent the first sector of "Economy" on the Murgia Plateau, while snow cells, food warehouses, caved taverns and bread ovens are connected to the second sector of the same class. In Grottaglie the team selected elements of UBH connected to the second sector of local "Economy" are: oil factories, medicines pharmacies and pottery ovens. Those productive spaces reflect the adaption to local climatic and territorial conditions, on one hand, and the leading sector of local economy, on the other, representing the rural character of the area.

In Japan (fig. 2b), two sub-classes connected to Environmental Conflicts and three sub-classes related to Social Interactions were examined in the following study areas: Goto Archipelago, Izu Peninsula, Kamakura, Nagasaki, Nikko, Saitama, Utsunomiya and Yokohama. As concerns the UBH connected to the sub-class "Water", the sites selected included local thermal facilities and natural springs, some of which were realized in underground caves: the typical and iconic *Onsen* in Nagasaki, Nikko and Saitama. Coastal caves of Goto Archipelago were, instead, perfect examples for the sub-class "Environmental Alert" since they are exposed to coastal changes, tropical climate and typhoons. For the section dedicated to Social Interactions, the underground temples of Utsunomya, built under the Chinese influence, and the religious galleries of Taya Cave and the Hase temple in Kamakura were selected within the sub-class "Religion". Both are success case-studies in the application of protocols for their enhancement and valorization. In the case of Taya Cave, the involvement of local communities was investigated because this process is at the center of a project supported by the homonymous Executive Committee (Tamura *et al.*, 2020). The Committee works on the divulgation of local identity represented by the religious cave and is supported by the participation of young generations who contribute to the development of their "sense of place" by studying the role it played historically. Within the Hase complex, instead, three built caves were investigated: one of them is an inland artificial cavity and two consist of natural coastal caves adapted for religious use. The Benten-kutsu cave is an artificial cave carved for religious use; it celebrates the devotion to the sea goddess Benzaiten, the only female among the Seven Lucky Gods of Japan. She is the patron of music, the fine arts and good fortune in general and usually carries a *biwa* (Japanese mandolin) or plays a lute. Sixteen children are chiseled out of the rock walls, and artificial lights and warning signals along the path allow safe visits of crowd of tourists since, in terms of visitors, the cavity benefits from being valorized within the itinerary of the site and of its gardens. In the same complex is the Enoshima Iwaya Cave consisting of two natural coastal caves (respectively, 152 and 56 meters long) located on the homonymous island. Their valorization is based on their value both as significant element of local history and cultural landscape, and with reference to the geology and morphology of the area and its transformations. The location, the candle light visit and the legends linked to the mythology of the Heavenly Maiden and the Five Heads Dragon are all well enhanced, making of this UBH element one of the most visited and appreciated sites by tourists in the area. Historical necropolis in the same area were included in the same sub-class but, unlike the other cavities, revealed to be poorly managed by the private sector with inadequate divulgation initiatives.

The coastal caves of the Goto Archipelago, with their inherent storytelling about religious minority persecutions, were selected within the sub-class "Religion" as well (fig. 4). The use of natural coastal caves as underground shelters represents the extreme signs of minority religions resilience during the persecutions of Portuguese catholic people across the 16th-17th centuries. The coastal tour is integrated with the visit to a series of catholic churches built in the archipelago in order to honor the memory of victims, and represent a significant symbol of the "sense of place" for local residents.

No other site could better represent the sub-class "Defence" for Japan than the Nagasaki World War II crater and associated memorial museum, but the inclusion of the underground military storage area in Yoshimi Hyakuana introduces the less known element of resilience for the same conflict.

Fig. 4 – Goto Archipelago: catholic pilgrims caves (photo: R. Varriale).
Fig. 4 – Arcipelago di Goto: grotta dei pellegrini cattolici (foto: R. Varriale).

In Japan, the first sector of the sub-class "Economy" was analyzed with a selection of dismissed extraction caves, which are emblematic of the urban and economic history of the country. The astonishing stone cave of Oya (fig. 5) and its connected Oya stone museum and divulgation center (Utsunomiya) was considered to be the symbol of urban development in Japan, due to the fact that its building materials were extracted there starting from the Edo period (1603 - 1868) onwards. The stone mine became a substantial industry during the Meiji era (1868 - 1912) since its material was used in the urban development of cities such as Tokyo and Yokohama. Its dismissal corresponds to the adoption of concrete in building techniques in Japan which was introduced for the very first time during the Sixties of last century on Gunkanjima island, which is also the case study selected to represent the energy sector within the sub-class "Economy". The island is the place where the abandoned coal mine of Hashima is located; the site was included in the UNESCO list in 2005, being the national symbol of energy production and industrial revolution in Japan (fig. 6). The visit to the site is guided by former workers of the mine and concludes with a visit to the museum and the divulgation center. The story telling adopted takes into consideration the social aspects connected to daily life on the island: problems connected to population density, facilities built for the families of workers with special focus on structures related sustainable living, such as the early introduction of green roofs in residential buildings.

The dismissed coal cave of Ikeshima (Nagasaki), with its divulgation center and residential facilities for workers, for the most part abandoned (a few families involved in the reconversion project as cultural site are still living there) was also included in the same group. Both the dismissed mines are perfect examples of the Japanese approach to valorization of UBH elements with the inclusion of former workers or retired local people in the process of consolidation and diffusion of their "sense of place". Always in the same subclass, but with reference to precious metals extraction, the TOI Gold Mine in the Izu Peninsula covered the segment connected to precious metals extraction.

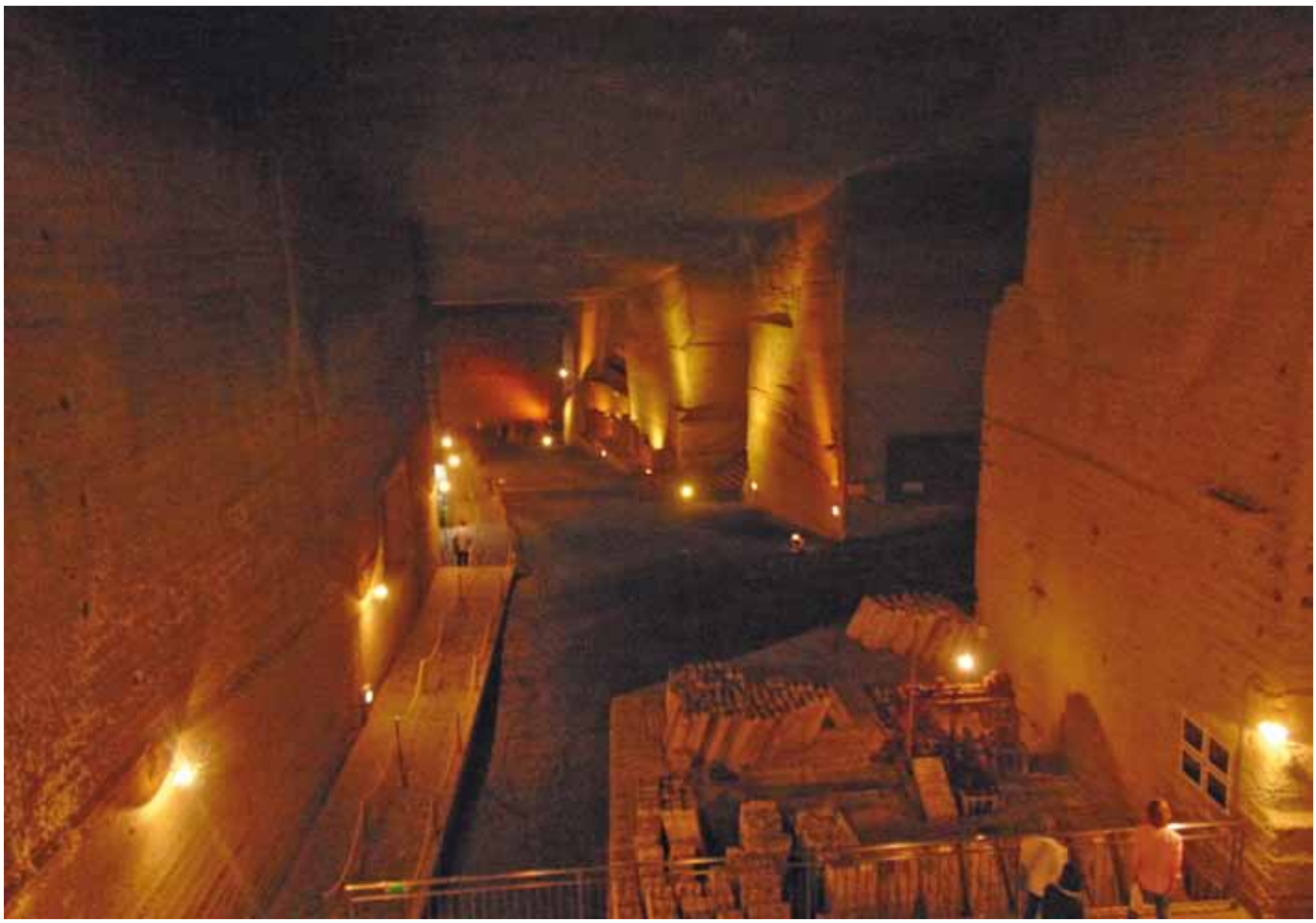

Fig. 5 – Oya stone cave (photo: R. Varriale).
Fig. 5 – Miniera di pietre di Oya (foto: R. Varriale).

The list of selected case-studies includes almost all of the most significant Italian and Japanese types of artefacts that can be classified as UBH elements but, of course, it is not exhaustive. In fact, preference was given to sites, or types of sites, that emphasize local environmental and social issues. The selection took into consideration also the potential of the selected sites in the comparative analysis between the two countries, and in the narrative role with reference to the corresponding social and economic histories.
In view of the above, with reference to the class connected to Environmental Conflicts for example, the study of the selected sites was at the basis of a comparative research about the exposition to different climatic risks and different approaches to the management of natural waters. With reference to Social Interactions, different religious rituals and burial procedures can be compared, and also the different role in World War II can be studied. With reference to "Religious" sites, the cases of Taya Cave and the Catacombs of Naples demonstrated that the involvement of local young generations in the diffusion of underground local culture was fundamental in the definition of cultural routes for historical underground spaces. The comparative analysis proved how such actions were carried out, in both the countries, on the basis of inclusive procedures that support the aboveground social and inter-generational involvement and cooperation, and the diffusion of local and regional sustainable development on the basis of the material and immaterial values of the correspondent element of UBH. In the same class, the Basilian Churches of Southern Italy and the complex of the coastal caves of Goto Archipelago were considered the iconic representation of minority religions resilience and a warning against religious discrimination in general. Also, the roots of Italian and Japanese economies can be studied through the case studies included: while the Italian cavities refer to Southern Italy rural context, perfectly interpreting it, the Japanese cavities possess a strong narrative power with reference to its energetic transition and the correspondent industrial and urban development.

Italian and Japanese case-studies: the methodological approach

As reported, UBH charts were used to give a static representation of the analyzed systems in Italy and Japan. However, the study of the functional dynam-

Fig. 6 – UNESCO Hashima cultural site from the sea (photo: R. Varriale).
Fig. 6 – Sito culturale UNESCO di Hashima, visto dal mare (foto: R. Varriale).

ics historically affecting those elements and the valorization processes eventually carried on the basis of their enhancement, require a deeper analysis. This should consider, on the one hand, the historical transformations that the UBH elements have undergone, and on the other, the level of re-use adopted in their contemporary valorization processes. To carry on this work, two geographically homogenous case-studies were selected: the Pizzofalcone Hill in Naples (Campania) and the Yoshimi Hyakuana Hill in Hiki District (Saitama).

The chart in figure 7 represents the functional evolutions of the selected cavities, starting from their very first use. The chart emphasizes the potential in the communication of knowledge about the selected topics. In the Pizzofalcone Hill case study (green colour) three types of cavities were studied. Starting from the left lower corner of the chart, the first cavities under analysis, the pipes of the Greek Aqueduct named Bolla, are included in the class "Water". This aqueduct was the first one built in the city of Naples and the one which supplied water until the current Serino acqueduct of Naples was built in late XIX Century. The pipes located in the Pizzofalcone Hill have a good potential for the reconstruction of the history of natural resources management in the city of Naples. The second cavity initially included in the sub class "Defence" has a very complex history, having been built as an escape tunnel in 1855 to connect the Royal Place to the port, even if it was never actually used. After a long period of abandonment, it was transformed, during World War II, into a bunker which walls were used for communication by refugees. At the end of the war it was finally used by the municipality as a storage area for impounded cars. As a result of all the mentioned historical re-uses, the Bourbon tunnel provides information on the military asset of the Bourbon Maritime Army. It is a significant sign of resilience of citizens during World War II, and of the communication of their emotions through wall graffiti. Finally, it perfectly interprets the abuse of underground space as waste disposal during the post-war reconstruction and as storage space for impounded vehicles seized by the Municipality. The third cavity represents several applications in the sub-class "Economy": it was initially realized as a tuff cave to build the aboveground Carafa Palace in the 18th century but, after its dismissal, was mostly reused as a stable for sheep and goats by local shepherds in the first sector of "Economy".

In Yoshimi Hyakuana hill (yellow colour in fig. 7) we considered two groups of cavities. The first refers to stone cavities connected to the first sector of "Econo-

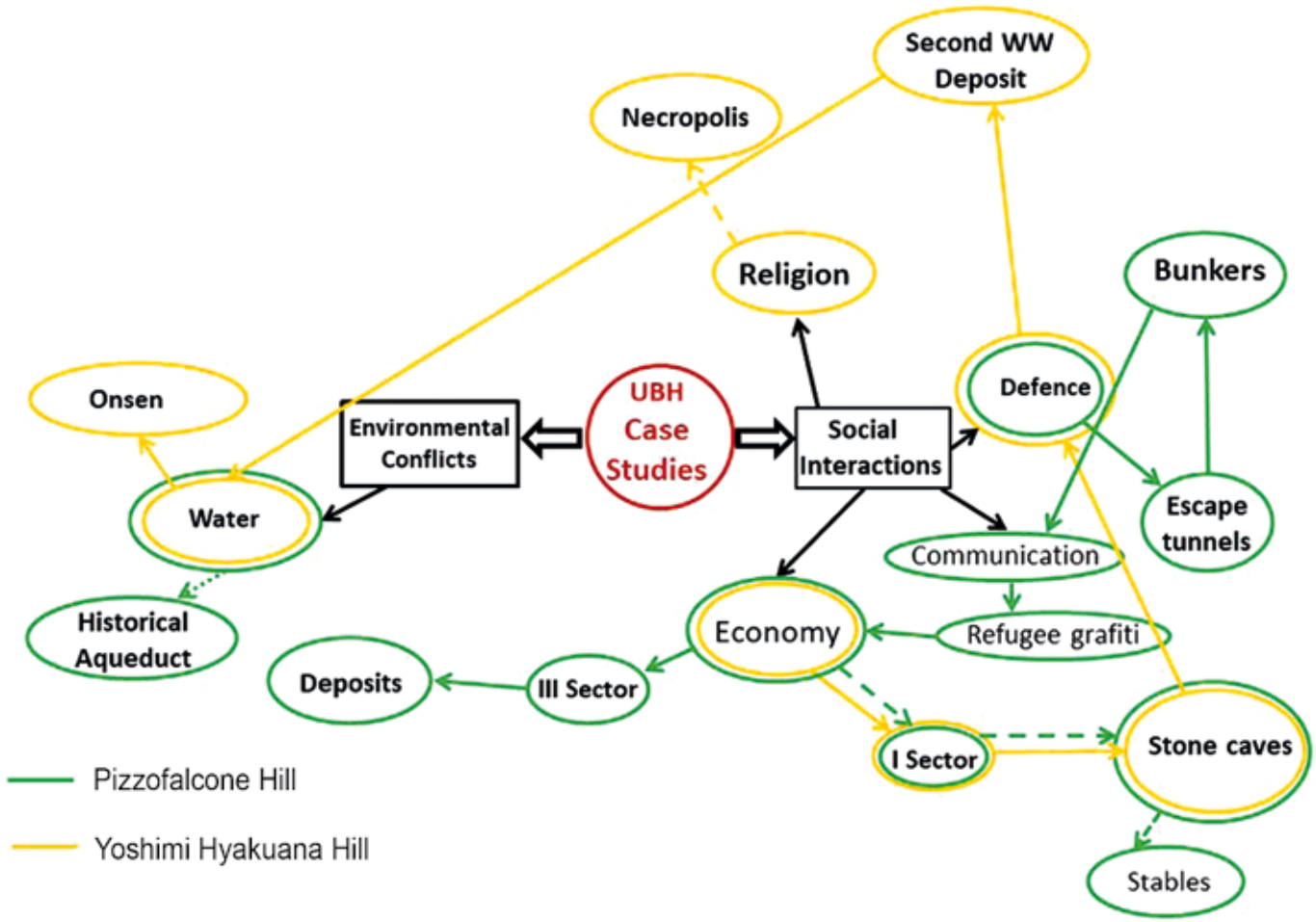

Fig. 7 – UBH in Italy and Japan: Pizzofalcone and Yoshimi Hyakuana hills UBH case-studies' chart (graphic: R. Varriale).

Fig. 7 – UBH in Italia e in Giappone: grafico dei casi studio UBH relativi alle colline di Pizzofalcone e di Yoshimi (grafica: R. Varriale).

my", successively used as a storage space during World War II and, finally, equipped to be a typical Japanese thermal facility known as *onsen,* even though it was never used for this purpose. The site possesses a strong potential for storytelling about the stone mine industry in Japan, about the role of the country in the War, the involvement of rural citizens in the conflict and of the technologies adopted. The second refers to 219 mound tombs caved during the Kofun period (6th-7th centuries) and happens to be the largest historical burial site in Japan. This site is a perfect example of private management of historical sites.

Once the historical uses are analyzed, the actions carried out for their re-use were studied. Three different levels of re-use for UBH can be pointed out:

- Re-inventing UBH: communication of historical functions, restoration, fruition as a cultural site (e.g. installations of technological instruments to diffuse underground culture, reconstruction of underground life, etc.);
- Re-introducing UBH old functions: the historical sites restored and used again according to new parameters (e.g. productive spaces with the adoption of contemporary hygienic and security standards);
- Re-interpreting UBH: the sites are restored and new functions are located but the communicative role is preserved (e.g. shops, hotels, restaurants, urban facilities in pre-existent underground spaces)".

In the following paragraphs, the different levels of re-use in the Pizzofalcone Hill and the Yoshimi Hyakuana Hill are analyzed.

Re-uses in Pizzofalcone Hill

The Pizzofalcone Hill is believed to be part of the oldest area of the city of Naples: archaeological evidence indicates that it had been inhabited by Mediterranean sailors and settlers since the 7th century b.C. (Ferraro, 2010). Initially, the city was named Parthenope in honor of the legend of the mythic mermaid who landed there and founded the city. The edification of the city of Naples (*Neapolis*, i.e. new city) in the coastal area, in proximity of the natural gulf, marginalized the hill of Pizzofalcone with reference to the city center, and influenced its functional purposes until the Modern Ages. After the construction of the Royal Palace, the

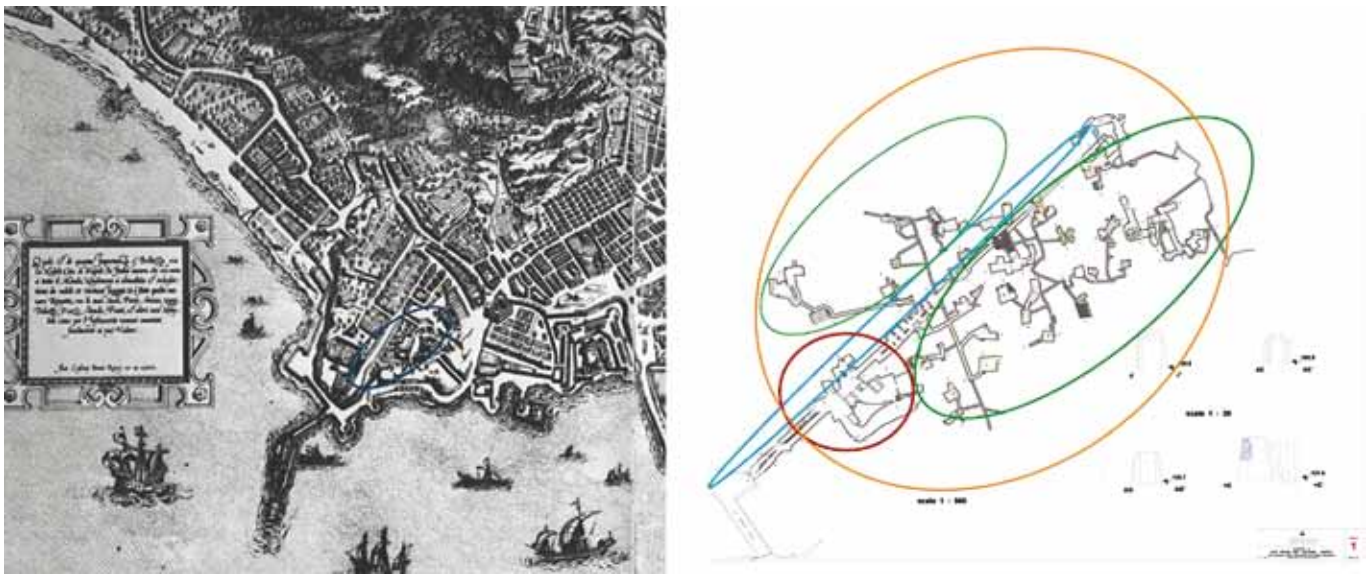

Fig. 8 – The Pizzofalcone Hill: to the left, the aerial historic map from Lafréry (1566), adapted by the Author; to the right, interior maps from the Municipality of Naples©, adapted by the Author (graphic: R. Varriale).

Fig. 8 – La collina di Pizzofalcone: a sinistra, veduta aerea di Lefréry (1566), adattata dall'Autore; a destra, mappa sotterranei del Comune di Napoli©, adattata dall'Autore (grafica: R. Varriale).

hill became very appealing to the upper classes and many residential buildings were erected by the local elites.

The secret of the bi-millenary uninterrupted history of the hill is written in its variegated underground networks and cavities which include: aqueducts, cisterns, caved houses, tuff caves and galleries; all of these spaces have been used and re-used by the inhabitants of the hill. The following paragraph focusses only on the central part of the hill, classified in the Metropolitan Archive of the Municipality of Naples as C13 (fig. 8).

The case study reflects the classification of cave no. C13 in the Archive of the Municipality of Naples which includes both the tuff cavities dug into the hill to collect the yellow tuff used in the construction of the aboveground Carafa Palace, as well as several other buildings in that area starting from the 16th century (in red in fig. 8) and the Bourbon Gallery, built in the 19th century to connect the Royal Place to the port, but never used for its primary purpose (in blue in fig. 8). The map includes historical water networks (in green in fig.8); all the complex of cavities was enlarged, transformed and inter-connected during World War II to be used as a pubblic bunker (in orange in fig. 8) (Minin & De Lutio, 2012).

Historical iconographic research shows the transformation of the area from the sea front. In figure 9, circled in blue, the Carafa Palace is shown from the period of its edification to nowadays, while circled in red is the *dependence* (absent in the first painting since it was built later). The underground cavities are completely covered by sea front buildings in the first painting, but can be clearly seen in the second and in third pictures. Historical re-uses of those cavities are evident in the second picture; once dismissed, the tuff caves were used to support local agriculture as animal shelters and to allow the construction of semi-troglodytic rural buildings. There is no evidence of re-use in the naval sector but the nearby shipyard depicted in fig. 9 (fourth picture) likely used the caves located beyond the beach (orange circle) as an in walled space, as it was common in Naples during winter times, both for ship construction and repair or seasonal maintenance.

The Carafa cavities interact with the final segment of the Bourbon Gallery, the second case study at the Pizzofalcone Hill. The primary function of the tunnel was to allow easier, two way transfer from the Royal Palace to the portal area. Its original purpose was to provide an escape route for the king and his family in case of danger, so that they could safely board the Royal Ships and, also, as a dedicated route for the Naval Army to support terrestrial soldiers in case of attacks. Built in the period 1853-1855, during the reign of Ferdinando II, the gallery was designed by the famous architect Enrico Alvino who successfully managed the assembly of the new structure and the connections to the existing and still functional pipes and cisterns of the Greek aqueduct of Bolla (Celano, 1692; Abate, 1840; Melisurgo, 1889). The tunnel was officially inaugurated on May 25, 1855, when it was brightly illuminated to welcome all the authorities invited to the opening ceremony, and it was opened to the public during the following three days. Following the celebrations, the tunnel was never used again, and when, in 1860, the Reign of Italy was founded, the underground defensive route was definitively forgotten. The tunnel was rediscovered during World War II: it was enlarged and equipped with facilities

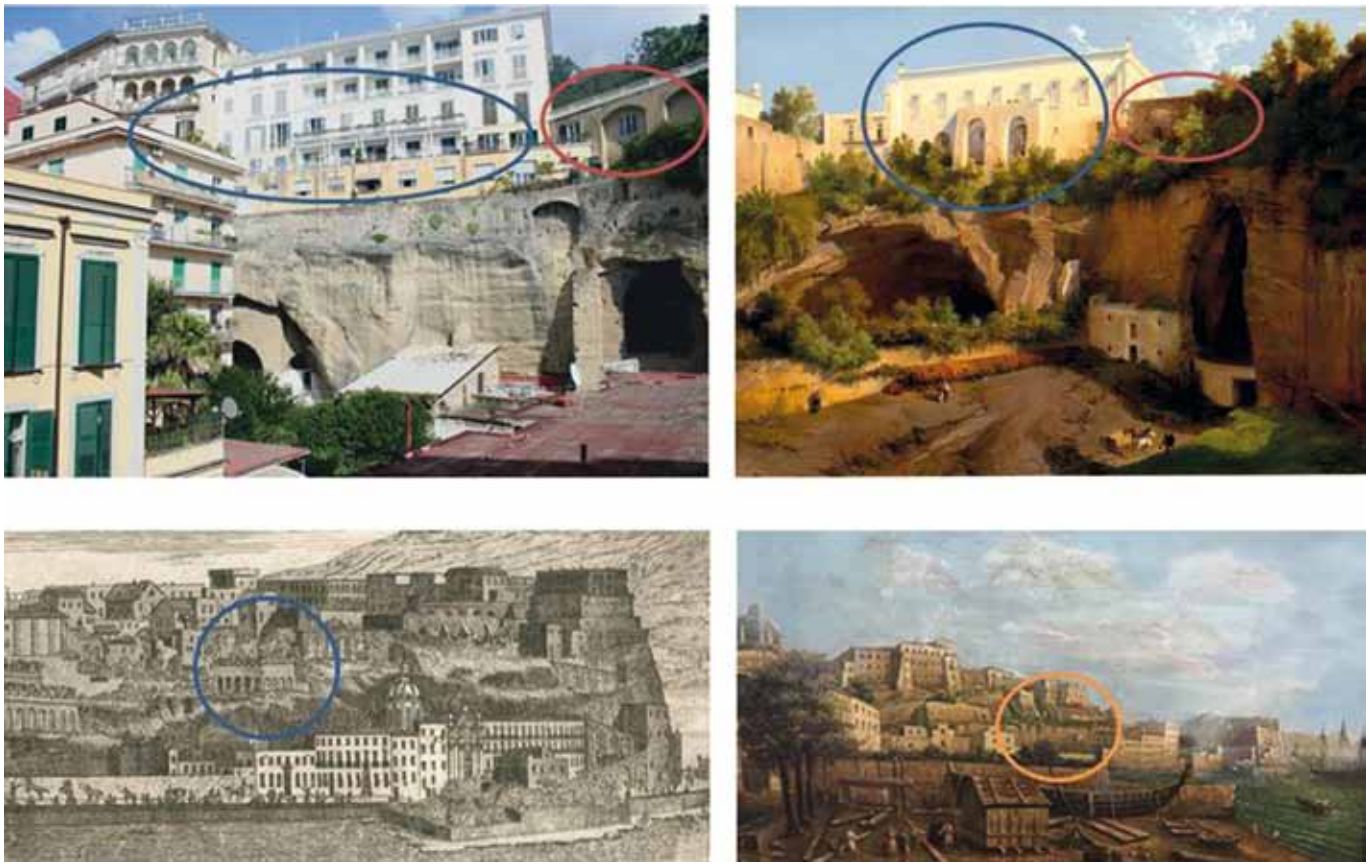

Fig. 9 – Pizzofalcone Hill in the history (graphic: R. Varriale).
Fig. 9 – La collina di Pizzofalcone nella storia (grafica R:Varriale).

to be used as a bunker for up to 10000 refugees. After the war it was closed again and rubble from buildings destroyed during bombings that devastated the city were dumped into the gallery through the pools that connected the Bolla aqueduct to the aboveground courtyards (Del Prete & Varriale, 2007). In line with with this uncontrolled use by the local population, from 1945 to 1970 the gallery was officially used as storage area for impounded cars by the Municipality of Naples. Afterwards, it was abandoned and finally, in 2007, a group of speleologists rediscovered it, and without funding or external support started to voluntarily remove all the debris accumulated over the years. It was the beginning of a virtuous circle that transformed the Bourbon Gallery in one of the best known and appreciated cultural attractions in Naples (http://www.galleriaborbonica.com/it/home/home/).
The historical functions and historical and contemporary re-uses of the Pizzofalcone Hill underground complex are illustrated in figure 10. The chart shows the evolution of the different uses of both the Carafa tuff caves and the Bourbon Tunnel, starting from their original functions to their contemporary uses with the application of the different approaches for their re-use: in green the original function, in blue the historical re-uses, and in red the contemporary re-uses.
To go into further detail, the Middle Age tuff cavity was opened as a public parking space in 2011. At the moment it hosts a multi-level parking service for 250 cars. The project was designed by architects Fabrizio Gallichi and Felice Lozano and consists in the re-introduction of the dismissed function as a storage area for impounded cars of the closed Galleria Borbonica. The Parking structure was proclaimed the "most beautiful European parking area" in 2011 by the European Parking Association (Visconti & Capozzi, 2018), and the "World Coolest Car Park" in 2018 by the commissions DesignCurial and Looking4.com (Dieffe, 2018). At the center of the cavity a glass lift connects the parking area to Agorà Morelli, a multi-functional space for exhibits, workshops, concerts and private events; its realization is a perfect example of the re-interpretation of UBH. Re-inventing is the action directed to the case of Galleria Borbonica which was opened to the public in 2011 and at the moment is the top attraction in Naples in terms of visitors and positive feedbacks (https://www.tripadvisor.it/Attraction_Review-g187785-d2161503-Reviews-Galleria_Borbonica-Naples_Province_of_Naples_Campania.html).

4 Re-uses in Yoshimi Hyakuana Hill

Located in the Hiki District, in a rural area of the Saitama prefecture, the Yoshimi Hyakuana Hill is an exceptional synthesis of Japanese cultural heritage.

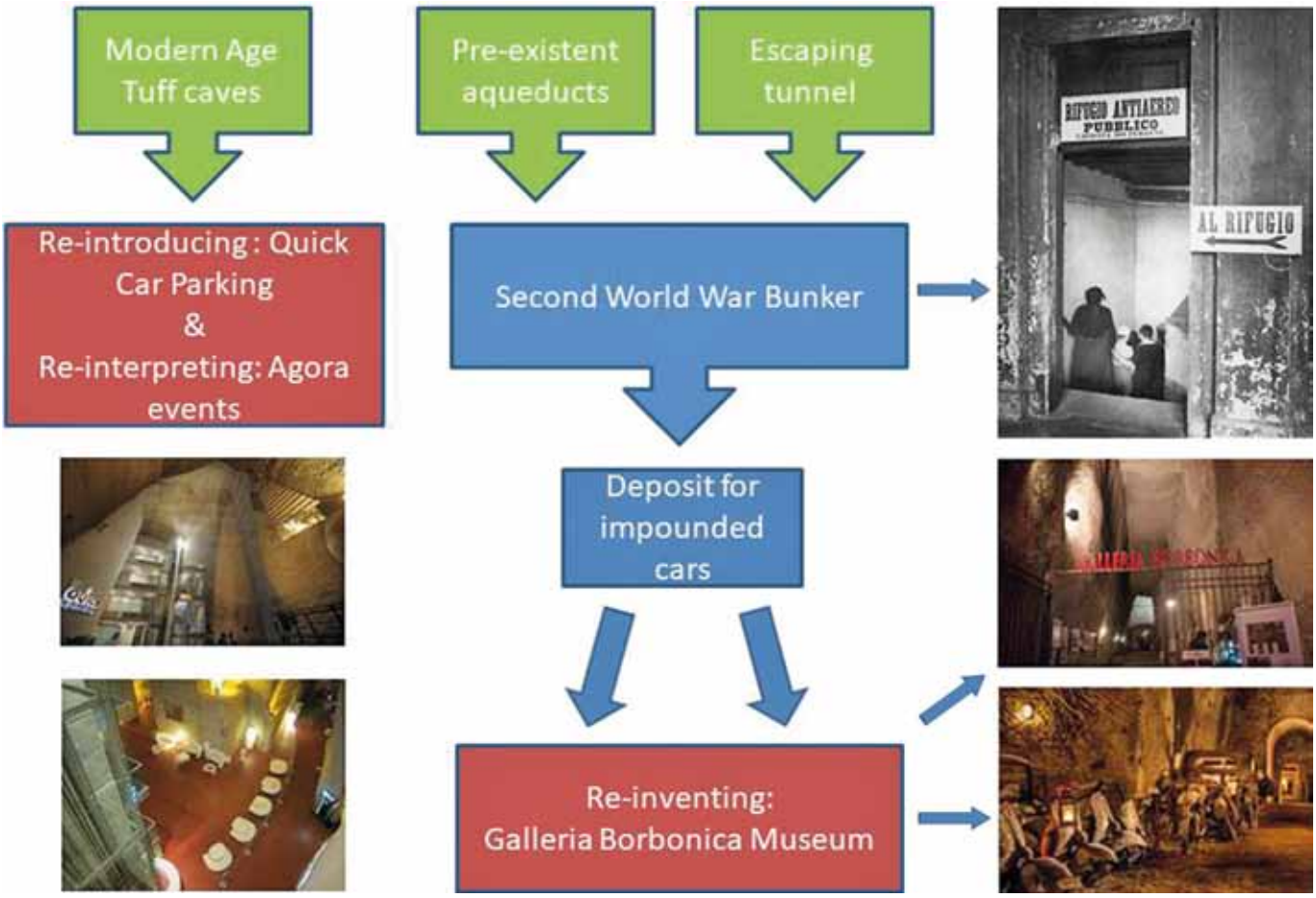

Fig. 10 – Re-uses in Pizzofalcone hill case-study (graphic: R. Varriale).
Fig. 10 – Ri-usi nel caso studio della collina di Pizzofalcone (grafica R:Varriale).

Here, the underground space of a countryside hill has been used and re-used throughout the centuries for various purposes. It was a burial place, then a military war bunker and, finally, the dismissed galleries were used to house artificial collective thermal facilities. The hill is also a natural site where very rare species of musk grow.
The archaeological burial site dates back to the Kofun period (6th-7th centuries) and consists of 219 mound tombs, the largest complex in Japan. Despite its extension and relevance, the site has been completely abandoned and was unknown for a very long period, having been covered by natural vegetation. Only in 1887 the historical cemetery was re-discovered, and finally in the 50's the site was recovered and became very popular at local level; the burial site became a recognized national historical site only in 1923, and since then has been managed by the owner of the hill (fig. 11).
On the right side of the hill, there is the entrance to a labyrinth of galleries dug out during World War II, used to store and assemble military equipment and components. Unfortunately, at the moment the entrance to the site is closed to the public, and only scholars are allowed inside to carry on studies about degradation and acid sulphate salt production of the walls of the cavities (Oguki, 2010). Nonetheless, the Japanese and Italian working groups have discussed the possibility of future actions for the valorization of the site; it emerged that, being such an evocative place, a dedicated storytelling about the Japanese technical approach to World War II could support its fruition as a cultural site in the future.
At the end of one of the galleries, almost erased by time, we can see the remains of what should have been a thermal *onsen*; pools and facilities were built at the end of World War II, but never used. Beautiful bleu tiles with a central cameo representing the Fuji Volcano represent the victory of life against the horror of the war. A history that should be evoked as a warning for future generations and as a celebration of traditional Japanese culture. In fact, the site could be developed both as a thermal cave facility and as a divulgation center about *onsen* culture in Japan. Due to the multiple functions historically managed in the underground in Yoshimi Hill, and the actual state of the art in terms of valorization (fig. 12), projects addressed towards the improvement of its cultural offer could be used as a role model within future protection plans for UBH in Japan.

Fig. 11 – Archaeological burial site in Yoshimi hill in history (photo on the right: R. Varriale).
Fig. 11 – Necropoli nella collina di Yoshimi nella storia (foto a destra: R. Varriale).

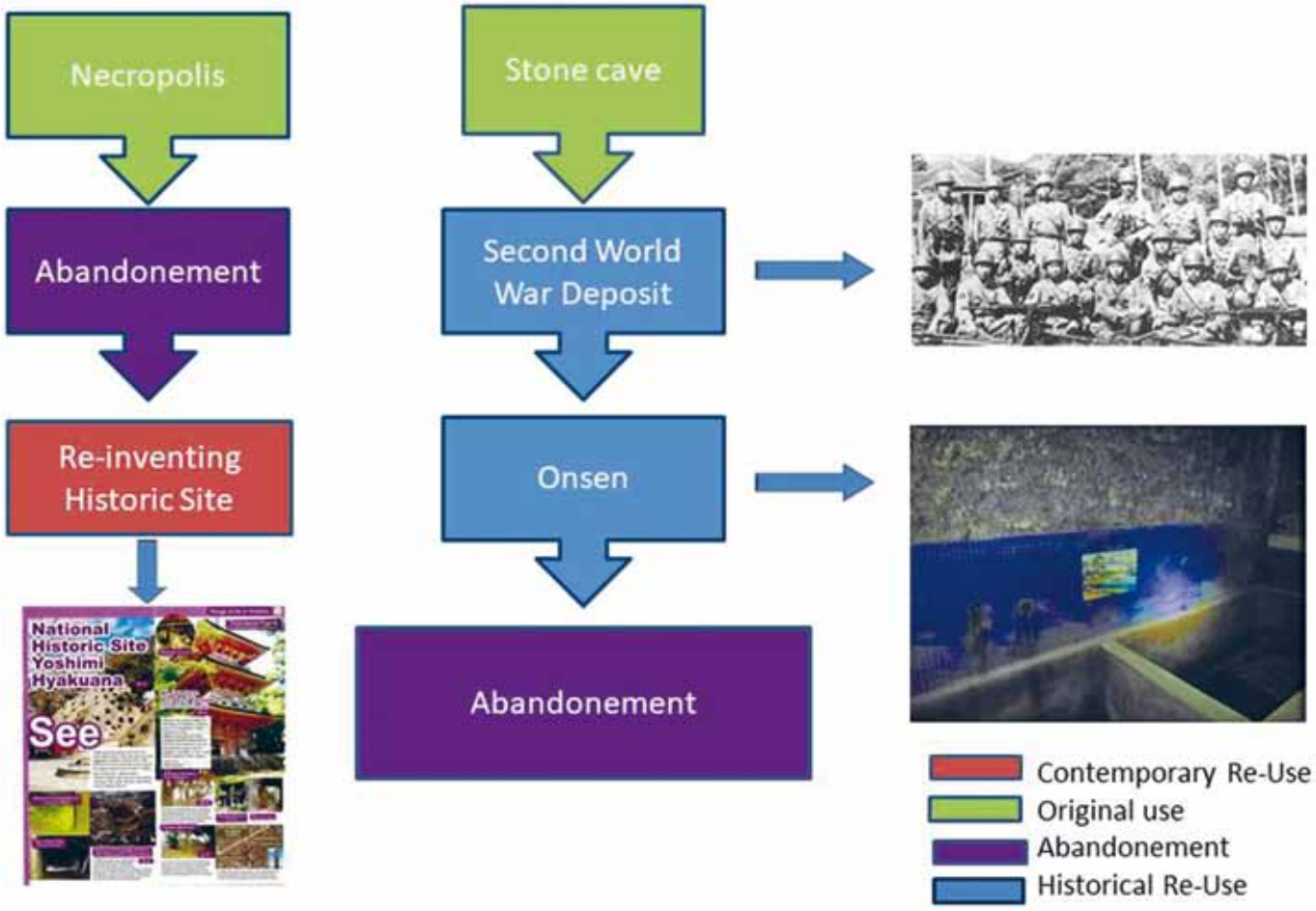

Fig. 12 – Re-uses in Yoshimi hill case study (graphic: R. Varriale).
Fig. 12 – Ri-usi nel caso di studio della collina di Yoshimi (grafica R:Varriale).

Conclusions

Italy and Japan are two very different countries from geographical, historical, cultural and political points of views. Comparative analysis of selected UBH elements in Italy and Japan showed, however, how the UBH of such diverse geographical locations have much more in common than their corresponding above-ground cultural characters. This acknowledgement confirms the hypothesis that the underground presents a parallel world,

where many differences are cancelled, and the dominant local construction know-how is often substituted by new shared underground building skills.
Italian and Japanese historical uses and contemporary re-uses of selected elements of UBH have been analyzed by adopting the same theoretical approach in order to study their valorization processes and address future actions in this direction.
During the research it emerged that, in the underground, not only are many physical differences cancelled to leave space to shared technical skills, but that mine workers, refugees from military conflicts or persecuted for religion, both in Italy and Japan, have the same relationship with their underground.
Historical evidence shows that sometimes the underground is also a place for protection from aboveground conflicts. Graffiti found on the walls of the Neapolitan underground bunker located in Cavour square no. 140, now transformed in an underground museum (http://www.ilmuseodelsottosuolo.org/), shows how during World War II the underground space allowed people to overcome many political differences giving space to the identification of common enemies. Figure 13 shows a significant painting realized by an anonymous Neapolitan recovered in underground shelters during the conflict. Under the military warning "*taci il nemico ti ascolta* (be silent, the enemy is listening to you)", the painter found the strength of pacific resilience to the war: all the leaders of the war, independently from the side they supported, had, in the dark of underground networks, the same conviction. Japanese Emperor Hirohito, German Nazi fuhrer Hitler and Italian fascist duce Mussolini, considered the main protagonists of the worldwide tragedy, were depicted in the same grotesque manner: only underground this could have been possible.

Fig. 13 – Second World anonymous graffiti in Naples' bunker: from the left, Emperor Hirohito, Hitler and Mussolini (photo: R. Varriale).

Fig. 13 – Grafito anonimo in un rifugio antiaereo napoletano: dalla sinistra, l'Imperatore Hirohito, Hitler e Mussolini (foto: R. Varriale).

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