heritage

MDPI

Article

"Underground Built Heritage": A Theoretical Approach for the Definition of an International Class

Roberta Varriale

Institute for Studies on the Mediterranean, National Research Council of Italy (CNR), 80134 Naples, Italy; varriale@ismed.cnr.it

Abstract: Although nowadays sustainable reuse of underground cultural heritage has become a global trend, as yet Underground Built Heritage (UBH) is not regarded as a distinctive class eligible for protection. After a critical overview of previous attempts at defining underground heritage by associations such as UIS, SSI and UNESCO, this article updates the definition of the new-born class of UBH on the basis of three main criteria: position (by introducing the concept of Geographical Zero Level), manmade character, and cultural relevance, both material and immaterial. Building on the outputs of several projects devoted to this topic and the results of academic expertise in this field, the author proposes a new dedicated methodological approach consisting of a chart for the classification of artefacts as historical UBH and a strategy for their reuse based on a four-level scale: Re-inventing, Re-introducing, Re-interpreting and Re-building.

Keywords: underground built heritage; definition; classification; reuse

Citation: Varriale, R. "Underground Built Heritage": A Theoretical Approach for the Definition of an International Class. *Heritage* **2021**, *4*, 1092–1118. https://doi.org/10.3390/heritage4030061

Academic Editor: Monica Alvarez De Buergo

Received: 1 June 2021
Accepted: 28 June 2021
Published: 30 June 2021

1. Introduction

Although today, regeneration of Underground Built Heritage (UBH) for sustainable reuse is becoming increasingly popular, being the focus of several internationally funded projects, no generally accepted common definition has been proposed so far. The lack of such a definition appears even more regrettable when compared with the clearly formulated definition of a cognate class, namely, Underwater Cultural Heritage (UCH). This is defined as heritage lying underwater and is safeguarded under the UNESCO convention on the protection of the Underwater Cultural Heritage [1,2], signed in 2001. No such definition has been proposed for Underground Cultural Heritage so far.

It is worth stressing that UNESCO's acknowledgement of the UCH class was only the final step in a very long process that had both national and international antecedents, and whose long history dates back to the very first attempt in this regard, made in the United Kingdom in 1886 [3].

On the contrary, the class of Underground Built Heritage was introduced very recently. The definition was adopted for the very first time in Horizon2020 proposal SC5-21-2017, "Cultural heritage as a driver for sustainable growth: Heritage-led rural regeneration", to refer to designated cultural heritage selected for local rural regeneration plans [4].

Despite the very short history of UBH, however, the adoption of the term "underground" as part of a definition for specific valuable historical artefacts in the framework of local social and economic development plans has a significant scientific background. The National Research Council of Italy (Consiglio Nazionale delle Ricerche, abbreviated as CNR), for example, has developed solid expertise in this field, having supported several projects regarding underground heritage. The first of these was the project "Undergrounds in Naples", launched in 2007 as part of the activities of the Institute of Studies on Mediterranean Societies (subsequently renamed Institute of Studies on the Mediterranean) [5,6].

The project was based on the case study of Naples, which can be regarded as the archetype of the underground city, for three reasons: the physical and morphological configuration of its historical centre, which is mostly based upon the use of underground

spaces; local expertise in the management of collapse risks posed by the existence of underground cavities underneath buildings; and innovative experiences in promoting underground cultural heritage [7].

In Naples, all the existent underground cavities were excavated by human beings since the solid yellow-tuff subsoil contains no natural caves. When the approach to the study of underground space in Naples was transferred to other case studies, however, a change in perspective was called for because in these other cases, natural caves were present as well as artificial ones.

The need for a full acknowledgement of the manmade character of underground space arose within the CNR project "Urban Undergrounds in the Mediterranean" [8,9]. In the context of this project, the designation "Negative Built Space" was adopted to emphasize the manmade character of the objects of the study. On that occasion, for the first time, such artefacts were regarded as results of the application of special skills to the management of local natural resources. This perspective reflected the environmental-historical approach of the research effort "Natural Resources and Historical Sources" that the "Urban Undergrounds" project was a part of [10].

When, in 2015, the CNR interdepartmental agreement "Undergrounds in Southern Italy" was signed, following in the wake of previous experiences, once again, the adopted multidisciplinary approach took only manmade caves into consideration. Five institutes (ISSM, IMAA, ICVBC, ISSM and IRPI) focused on several new technologies for the management of collapses and on the promotion of underground cultural heritage in the hostile habitat of the Murge plateau [11].

A comparative case study on Italian and Chinese cave settlements—carried on as part of a bilateral agreement between the CNR and the Chinese Academy of Cultural Heritage (CACH) [12]—focused on the promotion of a selection of minor sites [13]. The emphasis was on the underground character of two settlements: the troglodyte villages of southern Italy and the Yaodong in China. The many analogies found suggested that underground villages existed at a given latitude and in given geographical conditions [14]. A first attempt to define a coherent strategic approach to the tourist development of underground settlements in Italy and in China was also carried out [15].

Two further projects on selected underground spaces employing a comparative approach were funded in the framework of a bilateral agreement between the Italian CNR and the Japan Society for the Promotion of Science (JSPS) [16]. The first project investigated the area of the Prefecture of Saitama and a case study in Naples, with a special focus on burial places and tunnels [17]. On this occasion, for the very first time, the subject of the tourist development of dismissed mines was introduced [18].

The second Italo-Japanese project, still ongoing, focused on the tourist development of dismissed Italian mines in Sicilia and Sardinia within dedicated geo-parks. The plans to promote the material and immaterial value of these sites were based on the Japanese experience with Hashima Island, which was included in the UNESCO list in 2015 [19].

From 2019 onward, the CNR has also been leading a European project for the exchange of expertise regarding the study and promotion of UBH, viz., the Cost Action 18110 "Underground Built Heritage as a Catalyzer for Community Valorisation" [20].

In the operative phases, while collaborating with members from 30 European countries, a Near Neighbour Country (Tunisia) and an International Partner (Mexico), I began to feel that a theoretical approach was called for. I used what we could call an inclusive approach to the issue, assuming that all the proposed case studies could be legitimate members of the new class of heritage the project was named after. I took account of pre-existent definitions of caves, cavities and artificial cavities were quoted [21,22].

In the same year, a first attempt at defining UBH was made with reference to the underground settlement of Matera, which in 2019 was the European Capital of Culture [23,24]. I made further attempts to conceptualize UBH as part of the activities of CA18110 [25,26]. All these efforts, however, were tailored to the selected case studies. Their results, therefore, cannot be used to establish universal guidelines.

However, why was the introduction of UBH as a new class of heritage perceived as a priority in all the above-mentioned contexts when terms such as "cave" and "cavity" have been used for decades by scholars worldwide? What are the limits that scholars have found in the technical terminology employed so far, the limits that required the coining of a new definition, including the term "underground"?

Based on the hypothesis that the terms "cave", "cavity" and "underground" have already been adopted within several academic and technical contexts to describe specific elements of cultural heritage, the thesis of the present paper is that none of these terms are closed concepts and that we need to introduce a new class named "Underground Built Heritage" (UBH). I, therefore, propose a definition of this new class and, on the basis of this definition, a classification chart of the historical functions of UBH allowing static, comparative and dynamic analysis of selected worldwide case studies. In conclusion, I introduce a scale of appropriate reuses for sites included in the UBH class as a means to facilitate future actions to promote and develop these sites.

2. Caves, Cavities and Underground Spaces: The Terminological Dilemma

Even though the category of UBH is a relatively new one, many international groups of scholars have been studying caves, cavities and, more generally, all underground structures identified since the 1960s.

The International Union of Speleology (UIS) [27]—an international body established in 1965 that gathers cavers and speleologists worldwide and coordinates and reports on expeditions in natural and manmade caves—has been very active in developing dedicated instruments for the description and classification of caves.

Since the UIS has been stimulating interaction between local institutions, it has given special attention to the definition of a shared methodological approach to be adopted in the descriptions of cavities. To allow better communication among its own members from all over the world, in 2019, the UIS published a multilingual dictionary of caving and speleological terms in order to facilitate exchanges among members speaking different languages [28]. This effort gave birth to the first global systemic terminological source for caves and cavities, a very useful tool for speleologists and cavers who need to report on their expeditions.

What words were listed in the UIS's multilingual dictionary? What are their definitions? In addition, why is this dictionary not exhaustive and, on the contrary, aggravates the terminological dilemma that is one of the reasons for the coining of the definition "Underground Built Heritage"?

The 344 words included in the multilingual dictionary display several limits and inconsistencies. Just look at the most common term in it, "cave" (no. 18 in the list) is described in the dictionary as a synonym of "cavern". This contrasts with the definition we find in the current Cambridge Dictionary, where "cave" is said to designate "a large hole in the side of a hill, cliff or mountain, or one that is underground", while the term "cavern" designates "a large cave". The UIS thus ignores this difference, which is a matter of size. Let us turn to the word "cavity" (nos. 320 and 339). It is described in the multilingual dictionary as synonymous with "grotto". In the Cambridge Dictionary, however, "cavity" designates a "hole, or an empty space between two surfaces" while "grotto" is "a small cave, especially one that is made to look attractive". The two terms are thus very different: "cavity" refers to a partially closed area between two physical spaces, while "grotto" is a "small cave", a space delimited by three elements. The multilingual dictionary does not make any reference to their mode of formation For neither "cave" nor "cavity".. It considers this aspect for the first time in its definition of "cavity development" (no. 265 in the list). The locution is said to designate formation and transformation processes whose origin (natural or manmade), however, is not specified. As to the term cave, it is adopted in the locution "cave dweller" (nos. 32 and 342 in the list), described as a synonym of "troglodyte"–the latter term being a term that evokes the artificial nature of caves. The term "underground" (no. 98 in the list) is described, instead, as synonymous with "subsurface"

and "subterranean", and is connected neither to the term "cave" nor to the term "cavity". The word "niche" (no. 157 in the list) is defined as a synonym of "rock shelter", but its nature, natural or manmade, is not specified. The definition of the word "catwalk" (no. 170 in the list), instead, contains a reminder of its manmade nature. The word is described as synonymous with "crawl", "drain pipe", "inch way" and "rabbit run". Subsequently, to circumscribe my analysis only to manmade features, the locution "manmade cave" (no. 296 in the list) is introduced. This confirms that, according to the UIS, by themselves, the terms "cave" and "cavity" do not tell us if they refer to natural or manmade features; to specify this, we need to add an adjective to them.

All the inconsistencies I have underlined are mostly due to the fact that both natural and manmade caves are examined in the same document and that this dictionary appears not to be the output of an interdisciplinary academic project but merely a practical handbook gathering the words used most often during onsite inspections.

In 1988, the UIS formed a workgroup on artificial cavities to allow for better communication among all the groups involved in their study. In 1993, this workgroup was made into a dedicated body under the name the Artificial Cavities Commission [29].

This international effort was echoed by similar initiatives at the local level. Most were confronted with the problem of the classification of underground artefacts. Only in Italy, however, was the terminological issue addressed, too. The local Italian Commission, founded in 1981 as an extension of the pre-existent Italian Speleological Society (SSI) [30], drafted a document on terminological issues in the classification it produced [22]. The authors of this document assume from the beginning that only the term "cavity" should be employed to designate artificial cavities. The document adheres to this recommendation insofar as it uses the phrase "artificial cavities" only at the beginning, substituting it with the word "cavity" in the rest of the text. This document also introduces for the very first time the concept of "underground space" and employs the phrase "underground cavities" as a synonym of "artificial cavities". This terminology is maintained in all the issues of Opera Ipogea, the journal published by the SSI from 1999 onward, which gathers papers from the association's annual conferences as well as featuring special issues [31].

The above brief overview reveals the existence of a terminological dilemma regarding the use of the words "cave" and "cavity" to refer to manmade cavities. In the analysed contexts, it seems that this problem can be solved only by employing dedicated locutions such as "built cave", "manmade cavity", "troglodyte architecture" or "negative built space". However, could this be due to the fact that the cavities under discussion are not exclusively manmade and part of local cultural heritage? What if we were to focus only on manmade underground heritage and use as our source the descriptions of the properties inscribed in the UNESCO list?

3. "Cave" and "Underground" According to the UNESCO

On 16 November 1972, the General Conference of UNESCO adopted the Convention concerning the Protection of World Cultural and Natural Heritage [32]. This was the final step in a long process based on the acknowledgment that selected elements of worldwide natural and cultural heritage are so unique and their values so outstanding that their conservation and protection should be a concern of the international community [33]. When, in 1975, the Convention came into effect, 20 nations ratified it, and the first list of properties was drawn up. By March 2021, 1121 properties from 167 countries had been inscribed in the list [34].

Even though the range of cultural heritage is very wide, the first document signed in 1972 and regarding the definition of the very concept of cultural heritage already mentions cave dwellings in the category "monuments", specifically, in the first article of the Convention [32].

However, what words did UNESCO adopt in the following years to describe properties falling under this heading? Additionally, can a terminological analysis of these words

definitely solve the issue of the correct use of the terms "cave", "cavity" and "underground" to designate cultural heritage?

In the descriptions published by UNESCO of the properties inscribed in its list [34], the most common words are "cave", with 131 occurrences (83 for cultural heritage, 31 for natural heritage and 17 for mixed sites) and "underground", with 86 occurrences (for 70 cultural sites, 15 natural sites and 1 mixed site), while the word "cavity" and "cavities" are used only in 4 descriptions (Table 1).

Table 1. Occurrences of the words "cavity/cavities", "cave" and "underground" in the UNESCO list (by the author, updated on 10 February 2021).

Key Word	Number of Properties	Cultural	Natural	Mixed
cavity/cavities	4	4		
cave	131	83	31	17
underground	86	70	15	1

While these data confirm the importance of this sector of cultural heritage among the properties inscribed in the list, they do not say anything about the meaning that UNESCO gives to these words. Are they indiscriminately used for natural and manmade sites, or are they used differently for the former and the latter? In the absence of a glossary providing an answer to this question, how can we investigate this issue? The only way to answer these questions is to study and classify the descriptions of the properties thus designated. This section may be divided into subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

3.1. "Cave"

Out of the total of 131 properties designated by the word "cave", I considered only those inscribed in the UNESCO list as cultural or cultural/natural sites, for a total of 100 (83 + 17) (Table 1). They lie in 105 countries since four sites happen to be transboundary, and I, hence, counted them only once in my statistical analysis. In eight cases, according to their descriptions, the properties consisted of natural caves. The term is used in 2 cases without a description of the manmade vs. natural character of the cave. In one case, the term "cave" refers to a local academy. I did not consider any of the above in my analysis. As regards the remaining 89 cases, I analysed the descriptions to determine what features determined the choice of the designation "cave". The properties turned out to fall in the following categories: Art, Burial Places and Tombs, Religion, Cellars, Shelters, Mines, Tunnels and Water Systems. I made a count of the features of each property; some combined more than one (Table 2).

Table 2. Properties inscribed in the UNESCO list designated as "caves" (by the author, updated on 10 February 2021).

N	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
1	2003 (2003 D)	Afghanistan	Cultural Landscape and Archaeological Remains of the Bamiyan Valley	Cultural	Manmade	Buddhist monasteries, tunnels	R
2	1974	Algeria	Tassili n'Ajjer	Cultural/Natural	Natural	Burial mounds, rock art	B
3	1999	Argentina	Cueva de las Manos, Río Pinturas	Cultural	Natural	Cave art	A
4	2000	Armenia	Monastery of Geghard and the Upper Azat Valley	Cultural	Manmade	Churches and tombs cut into the rock	R/B
5	1981 (87/92)	Australia	Kakadu National Park	Cultural/Natural	Natural	Cave paintings, rock carvings	A
6	1982 (89)	Australia	Tasmanian Wilderness	Cultural/Natural	Natural	Caves occupied by humans	Sh
7	1997	Austria	Hallstatt-Dachstein/ Salzkammergut Cultural Landscape	Cultural	Manmade	Salt mines	M
8	2007	Azerbaijan	Gobustan Rock Art Cultural Landscape	Cultural	Natural	Rock art	A
9	1998	Bolivia	Fuerte de Samaipata	Cultural	Manmade	Sculptured rocks	A
10	2001	Botswana	Tsodilo	Cultural	Natural	Rock paintings, shelters and caves	A/C/ Sh
11	1991	Brazil	Serra da Capivara National Park	Cultural	Natural	Rock shelters, cave paintings	Sh/A
12	2016	Chad	Ennedi Massif: Natural and Cultural Landscape	Cultural/Natural	Natural	Rock art	A
13	1995	Chile	Rapa Nui National Park	Cultural	Not specified	Rock art in caves	A
14	1987	China	Mogao Caves	Cultural	Manmade	Cells and cave sanctuaries	R/B
15	1987	China	Peking Man Site at Zhoukoudian	Cultural	Natural	Human remains, fossils and rock art	Sh/A
16	1990	China	Mount Huangshan	Cultural/Natural	Natural	Caves (not applicable)	-
17	1996	China	Lushan National Park	Cultural		Deer Cave Academy (NO CAVE)	-
18	1999	China	Dazu Rock Carvings	Cultural	Manmade	Cave temple art, rock carvings	R/A
19	2000	China	Longmen Grottoes	Cultural	Manmade	Caves and carved niches	R/B
20	2001	China	Yungang Grottoes	Cultural	Manmade	Buddhist cave art	R/B
21	2006	China	Yin Xu	Cultural	Manmade	Royal Tombs Area	B
22	2009	China	Mount Wutai	Cultural	Not specified	Caves	B/R
23	2014	China (trans)	Silk Roads: The Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Buddhist cave temples, tombs	R/B
24	2018	Colombia	Chiribiquete National Park–"The Maloca of the Jaguar"	Cultural/Natural	Natural	Rock shelters, rock art	Sh/A
25	1995	Czechia	Kutná Hora: Historical Town Centre, Church of St Barbara, Cathedral of Our Lady at Sedlec	Cultural	Manmade	Silver mines	M
26	1978	Ethiopia	Rock-Hewn Churches, Lalibela	Cultural	Manmade	Cave churches	R
27	1991	Finland	Old Rauma	Cultural	Manmade	Cellars	L
28	1979	France	Prehistoric Sites and Decorated Caves of the Vézère Valley	Cultural	Natural	Decorated caves	A/Sh
29	1997 (99)	France (trans)	Pyrénées-Mont Perdu	Cultural/Natural	Natural	Prehistoric Caves	Sh
30	1999	France	Jurisdiction of Saint-Emilion	Cultural	Manmade	Monastic catacombs	R/B
31	2001	France	Provins, Town of Medieval Fairs	Cultural	Manmade	vaulted cellars and warehouses	C
32	2014	France	Decorated Cave of Pont d'Arc, known as Grotte Chauvet-Pont d'Arc, Ardèche	Cultural	Natural	Rock prehistoric art	A/Sh

Table 2. *Cont.*

N	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
33	2015	France	Champagne Hillsides, Houses and Cellars	Cultural	Manmade	Underground cellars	C
34	2007	Gabon	Ecosystem and Relict Cultural Landscape of Lopé-Okanda	Cultural/Natural	Natural	Caves and shelters,	C/Sh
35	2017	Germany	Caves and Ice Age Art in the Swabian Jura	Cultural	Natural	Caves with carved figurines	A/Sh
36	1999	Greece	The Historic Centre (Chorá) with the Monastery of Saint-John the Theologian and the Cave of the Apocalypse on the Island of Pátmos	Cultural	Manmade	Cave	R
37	1987	Hungary	Old Village of Hollókő and its Surroundings	Cultural	Manmade	Cellars	C
38	1999	Hungary	Hortobágy National Park-the Puszta	Cultural	Manmade	Burial mounds	B
39	2002	Hungary	Tokaj Wine Region Historic Cultural Landscape	Cultural	Manmade	Carved wine cellars	C
40	1983	India	Ajanta Caves	Cultural	Manmade	Cave monuments, decorated caves	R
41	1983	India	Ellora Caves	Cultural	Manmade	Buddhist cave monuments	R
42	1983	India	Taj Mahal	Cultural	Manmade	Group of rock-carved sanctuaries	R
43	1984	India	Group of Monuments at Mahabalipuram	Cultural	Manmade	Group of rock-carved sanctuaries	R
44	1986	India	Khajuraho Group of Monuments	Cultural	Manmade	Temple, partly rock-carved	R
45	1987	India	Elephanta Caves	Cultural	Natural	Rock art	A
46	2004	India	Champaner-Pavagadh Archaeological Park	Cultural	Manmade	Unexcavated archaeological remains	L
47	2019	India	Khangchendzonga National Park	Cultural/Natural	Natural	Caves	-
48	2015	Iran	Cultural Landscape of Maymand	Cultural	Manmade	Cave dwellings	Sh
49	2012	Israel	Sites of Human Evolution at Mount Carmel: The Nahal Me'arot/Wadi el-Mughara Caves	Cultural	Manmade	Burials and early stone architecture	B/R
50	2014	Israel	Caves of Maresha and Bet-Guvrin in the Judean Lowlands as a Microcosm of the Land of the Caves	Cultural	Manmade	Cave quarries	B/C
51	1993	Italy	The Sassi and the Park of the Rupestrian Churches of Matera	Cultural	Manmade	Troglodyte settlement	Sh
52	2000	Italy	Assisi, the Basilica of San Francesco and Other Franciscan Sites	Cultural	Natural	Caves occupied by Saint Francis	R
53	2005	Italy	Syracuse and the Rocky Necropolis of Pantalica	Cultural	Manmade	Rock-cut tombs	B
54	2014	Italy	Vineyard Landscape of Piedmont: Langhe-Roero and Monferrato	Cultural	Manmade	Cellars and storehouses	C
55	2014	Japan	Tomioka Silk Mill and Related Sites	Cultural	Manmade	Galleries	T
56	2011	Jordan	Wadi Rum Protected Area	Cultural/Natural	Natural	Rock art	A
57	2015	Jordan	Baptism Site "Bethany Beyond the Jordan" (Al-Maghtas)	Cultural	Manmade	Caves and pools	P
58	2014	Kazakhstan (trans)	Silk Roads: The Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Buddhist cave temples	-
59	2009	Kyrgyzstan	Sulaiman-Too Sacred Mountain	Cultural	Natural	Caves with petroglyphs	A
60	2014	Kyrgyzstan (trans)	Silk Roads: The Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Buddhist cave temples	-
61	1998	Lebanon	Ouadi Qadisha (the Holy Valley) and the Forest of the Cedars of God (Horsh Arz el-Rab)	Cultural	Manmade	Troglodyte habitat, natural and carved caves	Sh
62	2013	Lesotho (trans)	Maloti-Drakensberg Park	Cultural/Natural	Natural	Caves, rock shelters, pools	Sh/W
63	1985 (2016 D)	Libya	Rock-Art Sites of Tadrart Acacus	Danger	Natural	Cave paintings	A
64	2001	Madagascar	Royal Hill of Ambohimanga	Cultural	Manmade	Burial site	B
65	2012	Malaysia	Archaeological Heritage of the Lenggong Valley	Cultural	Natural	Cave sites with Palaeolithic tool workshops	A/ Sh

Table 2. *Cont.*

N	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
66	1989	Mali	Cliff of Bandiagara (Land of theDogons)	Cultural/Natural	Natural	Sanctuaries	R
67	1980	Malta	Megalithic Temples of Malta	Cultural	Not applicable	Caved stones (not applicable)	-
68	2008	Mauritius	Le Morne Cultural Landscape	Cultural	Natural	Shelters, settlements	Sh
69	1987	Mexico	Pre-Hispanic City of Teotihuacan	Cultural	Not applicable	Excavations	-
70	1988	Mexico	Pre-Hispanic City of Chichen-Itza	Cultural	Manmade	Excavations, water facilities	W
71	1999	Mexico	Archaeological Monuments Zone of Xochicalco	Cultural	Manmade	Water system, disused mines	W/M
72	2010	Mexico	Camino Real de Tierra Adentro	Cultural	Manmade	Mines	M
73	2010	Mexico	Prehistoric Caves of Yagul and Mitla in the Central Valley of Oaxaca	Cultural	Natural	Prehistoric caves and rock shelters	Sh
74	2010	Mexico	Tehuacán-Cuicatlán Valley: Pristine habitat in Mesoamerica	Cultural/Natural	Manmade	Canals, wells, aqueducts and dams	W
75	1979	Norway	Urnes Stave Church	Cultural	Not applicable	Excavated elements	-
76	1980	Pakistan	Taxila	Cultural	Natural	Mesolithic cave	Sh
77	1980	Palau	Rock Islands Southern Lagoon	Cultural/Natural	Natural	Rock art	A
78	2012	Palestine	Birthplace of Jesus: Church of the Nativity and the Pilgrimage Route, Bethlehem	Cultural	Natural	Birthplace cave	Sh
79	1992	Peru	Río Abiseo National Park	Cultural/Natural	Natural	Rock shelters	Sh
80	1980	Poland	Historic Centre of Warsaw	Cultural	Not described	Not described	-
81	1997	Poland	Medieval Town of Toruń	Cultural	Manmade	Vaulted cellars	C
82	1998	Portugal (trans)	Prehistoric Rock Art Sites in the Côa Valley and Siega Verde	Cultural	Natural	Rock Art Sites	A
83	2004	Portugal	Landscape of the Pico Island Vineyard Culture	Cultural	Manmade	Wine-cellars	C
84	1995	Korea	Seokguram Grotto and Bulguksa Temple	Cultural	Natural	Buddhist temple in grotto	B
85	1993	Russian Fed	Architectural Ensemble of the Trinity Sergius Lavra in Sergiev Posad	Cultural	Not specified	Not specified	-
86	2003	Russian Fed	Citadel, Ancient City and Fortress Buildings of Derbent	Cultural	Not applicable	Excavations	-
87	2008	Saudi Arabia	Al-Hijr Archaeological Site (Madâin Sâlih)	Cultural	Manmade	Monumental tombs, cave drawings	B/A
88	2012	Senegal	Bassari Country: Bassari, Fula and Bedik Cultural Landscapes	Cultural	Natural	Natural caves	-
89	1999	South Africa	Fossil Hominid Sites of South Africa	Cultural	Natural	Archaeological caves	Sh
90	2013	South Africa (trans)	Maloti-Drakensberg Park	Cultural/Natural	Natural	Caves, rock shelters, pools	-
91	1985	Spain	Cave of Altamira and Palaeolithic Cave Art of Northern Spain	Cultural	Natural	Palaeolithic cave art	Sh/A
92	1997	Spain (trans)	Pyrénées-Mont Perdu	Cultural/Natural	Natural	Prehistoric caves	-
93	1998	Spain (trans)	Prehistoric Rock Art Sites in the Côa Valley and Siega Verde	Cultural	Natural	Rock-art sites	-
94	1998	Spain	Rock Art of the Mediterranean Basin on the Iberian Peninsula	Cultural	Natural	Rock art	A
95	2000	Spain	Archaeological Site of Atapuerca	Cultural	Natural	Fossil caves	Sh
96	2016	Spain	Antequera Dolmens Site	Cultural	Not specified	Not specified	-
97	1991	Sri Lanka	Rangiri Dambulla Cave Temple	Cultural	Natural	Cave-temple complex	R
98	1992	Thailand	Ban Chiang Archaeological Site	Cultural	Manmade	Excavated prehistoric settlement	Sh
99	1985	Turkey	Göreme National Park and the Rock Sites of Cappadocia	Cultural/Natural	Manmade	Cave cities	Sh
100	2016	Turkey	Archaeological Site of Ani	Cultural	Manmade	Tunnels and caves	T

Table 2. *Cont.*

N	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
101	1990	Ukraine	Kyiv: Saint-Sophia Cathedral and Related Monastic Buildings, Kyiv-Pechersk Lavra	Cultural	Manmade	Underground churches; burials	R/B
102	1984	UK	Gorham's Cave Complex	Cultural	Natural	Archaeological caves	Sh
103	2006	UR Tanzania	Kondoa Rock-Art Sites	Cultural	Natural	Natural rock shelters, rock paintings	A/Sh
104	2014	Viet Nam	Trang An Landscape Complex	Cultural	Natural	Archaeological caves	Sh
105	2003	Zimbabwe	Matobo Hills			Natural shelters, rock paintings	A/Sh

Legend: A = Art, B = Burial Places and Tombs, R = Religion, C = Cellars, Sh = Shelters, M = Mines, T = Tunnels, M = Pipes and Water Systems (W) and D = at risk from (year). The dates in brackets are the dates when a listing was updated. The properties shared by Tables 2 and 3 are in red.

Table 3. The word "underground" in the properties inscribed in the UNESCO list (by the author, updated on 10 February 2021).

N.	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
1	2004	Australia	Royal Exhibition Building and Carlton Gardens	Cultural	Manmade	Underground water tanks	W
2	1997	Austria	Hallstatt-Dachstein/Salzkammergut Cultural Landscape	Cultural	Manmade	Salt mines	M
3	2000	Belgium	Neolithic Flint Mines at Spiennes (Mons)	Cultural	Manmade	Ancient mines	M
4	2012	Belgium	Major Mining Sites of Wallonia	Cultural	Manmade	Coal-mining sites	M
5	2000	Bolivia	Tiwanaku: Spiritual and Political Centre of the Tiwanaku Culture	Cultural	Manmade	Underground drainage	W
6	2017	Brazil	Valongo Wharf Archaeological Site	Cultural	Manmade	Archaeological layers	L
7	2006	Chile	Sewell Mining Town	Cultural	Manmade	Underground copper mine	M
8	2000 (03, 04)	China	Imperial Tombs of the Ming and Qing Dynasties	Cultural	Manmade	Tombs' underground chambers	B
9	2014	China (trans)	Silk Roads: the Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Underground water channels	W
10	1995	Colombia	National Archeological Park of Tierradentro	Cultural	Manmade	Underground tombs	B
11	2019	Czekia (trans)	Erzgebirge/Krušnohoří Mining Region	Cultural	Manmade	Underground mine installations	M
12	2004	Republic of Korea	Complex of Koguryo Tombs	Cultural	Not applicable	No underground feature indicated	-
13	1979	Egypt	Memphis and its Necropolis–the Pyramid Fields from Giza to Dahshur	Cultural	Manmade	Underground archaeological remains	L
14	1980	Ethiopia	Aksum	Cultural	Manmade	Underground structures	L
15	1982 (2009)	France	From the Great Saltworks of Salins-les-Bains to the Royal Saltworks of Arc-et-Senans, the Production of Open-pan Salt	Cultural	Manmade	Underground hydraulic gallery	W
16	2012	France	Nord-Pas de Calais Mining Basin	Cultural	Manmade	Underground coal seams	M
17	2015	France	Champagne Hillsides, Houses and Cellars	Cultural	Manmade	Underground cellars	C
18	1987 (05, 08)	Germany (trans)	Frontiers of the Roman Empire	Cultural	Manmade	Underground archaeological remains	L
19	1992 (2010)	Germany	Mines of Rammelsberg, Historic Town of Goslar and Upper Harz Water Management System	Cultural	Manmade	Tunnels and underground drains	W
20	2004	Germany	Town Hall and Roland on the Marketplace of Bremen	Cultural	Manmade	Underground wine cellars	C

Table 3. *Cont.*

N.	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
21	2014	Germany	Carolingian Westwork and Civitas Corvey	Cultural	Manmade	Underground dwellings for guests and servants	Sh
22	2019	Germany (trans)	Erzgebirge/Krušnohoří Mining Region	Cultural	Manmade	Underground mine installations	-
23	1996	Greece	Archaeological Site of Aigai (modern name Vergina)	Cultural	Manmade	Underground tombs, underground museum	B
24	1987 (2002)	Hungary	Budapest, including the Banks of the Danube, the Buda Castle Quarter and Andrássy Avenue	Cultural	Manmade	The European continent's first underground railway	T
25	1999	Hungary	Hortobágy National Park-the Puszta	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
26	2000	Hungary	Early Christian Necropolis of Pécs (Sopianae)	Cultural	Manmade	Underground burial chambers	B
27	2004	Iceland	Þingvellir National Park	Cultural	Manmade	Hypothetical presence of underground remains	L
28	1993	India	Humayun's Tomb, Delhi	Cultural	Manmade	Underground clay pipes	W
29	2019	Indonesia	Ombilin Coal Mining Heritage of Sawahlunto	Cultural	Manmade	Underground mining tunnels	M
30	1979	Iran	Tchogha Zanbil	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
31	2004 (2007)	Iran	Bam and its Cultural Landscape	Cultural	Manmade	Underground irrigation canals	W
32	2015	Iran	Cultural Landscape of Maymand	Cultural	Manmade	Semi-underground houses	Sh
33	2016	Iran	The Persian Qanat	Cultural	Manmade	Underground water tunnels	W
34	2017	Iran	Historic City of Yazd	Cultural	Manmade	Qanat system, underground water	W
35	2018	Iran	Sassanid Archaeological Landscape of Fars Region	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
36	2005	Israel	Biblical Tels-Megiddo, Hazor, Beer Sheba	Cultural	Manmade	Underground water-collecting systems	W
37	2014	Israel	Caves of Maresha and Bet-Guvrin in the Judean Lowlands as a Microcosm of the Land of the Caves	Cultural	Manmade	Underground chambers	B
38	1997	Italy	Archaeological Area of Agrigento	Cultural	Manmade	Network of underground aqueducts	W
39	1999	Italy	Villa Adriana (Tivoli)	Cultural	Manmade	Cryptoportici and galleries	B
40	1998	Italy	Historic Centre of Urbino	Cultural	Manmade	NO UNDERGROUND FEATURE MENTIONED	-
41	1987	Italy	Archaeological Areas of Pompei, Herculaneum and Torre Annunziata	Cultural	Manmade	Archaeological excavations	L
42	2000	Japan	Gusuku Sites and Related Properties of the Kingdom of Ryukyu	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
43	1985	Jordan	Petra	Cultural	Manmade	Copper mines and underground galleries	M

Table 3. *Cont.*

N.	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
44	2014	Kazakhstan (trans)	Silk Roads: the Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Underground water channels	-
45	2014	Kyrgyzstan (trans)	Silk Roads: the Routes Network of Chang'an-Tianshan Corridor	Cultural	Manmade	Underground water channels	-
46	1986 (2016 D)	Libya	Old Town of Ghadamès	Cultural	Manmade	Underground network of passageways	T
47	1980	Malta	Ħal Saflieni Hypogeum	Cultural	Manmade	Underground cemetery	B
48	1988	Mexico	Historic Town of Guanajuato and Adjacent Mines	Cultural	Manmade	Underground mines, underground streets	M/T
49	1988	Mexico	Pre-Hispanic City of Chichen-Itza	Cultural	Manmade	Excavated underground ruins	L
50	1985	Morocco	Medina of Marrakesh	Cultural	Manmade	Underground drainage galleries	W
51	1987	Oman	Bahla Fort	Cultural	Manmade	Underground water channels	W
52	2006	Oman	Aflaj Irrigation Systems of Oman	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
53	2014 (2014 D)	Palestine	Palestine: Land of Olives and Vines–Cultural Landscape of Southern Jerusalem, Battir	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
54	1978 (08, 13)	Poland	Wieliczka and Bochnia Royal Salt Mines	Cultural	Manmade	Underground chapels and statues in the salt mines	M/R
55	2017	Poland	Tarnowskie Góry Lead-Silver-Zinc Mine and its Underground Water Management System	Cultural	Manmade	Underground mine and water management system	M/W
56	2019	Poland	Krzemionki Prehistoric Striped Flint Mining Region	Cultural	Manmade	Underground mining structures	M
57	2003	Russian Federation	Citadel, Ancient City and Fortress Buildings of Derbent	Cultural	Manmade	Several underground water reservoirs	W
58	2012	Slovenia (trans)	Heritage of Mercury. Almadén and Idrija	Cultural	Manmade	Underground mercury mines	M
59	2011	Spain	Cultural Landscape of the Serra de Tramuntana	Cultural	Manmade	Underground network for water management	W
60	2012	Spain (trans)	Heritage of Mercury. Almadén and Idrija	Cultural	Manmade	Underground mercury mines	-
61	2019	Spain	Risco Caido and the Sacred Mountains of Gran Canaria Cultural Landscape	Cultural	Manmade	Underground cisterns (troglodyte settlement)	W/ Sh
62	1992	Thailand	Ban Chiang Archaeological Site	Cultural	Manmade	Underground excavations	L
63	1979	Tunisia	Amphitheatre of El Jem	Cultural	Manmade	Underground passages	T
64	1985	Turkey	Göreme National Park and the Rock Sites of Cappadocia	Cultural/Natural	Manmade	Underground towns (troglodyte villages)	Sh
65	2016	Turkey	Archaeological Site of Ani	Cultural	Manmade	Underground tunnels	T
66	1999	Turkmenistan	State Historical and Cultural Park "Ancient Merv"	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
67	2011	United Arab Emirates	Cultural Sites of Al Ain (Hafit, Hili, Bidaa Bint Saud and Oases Areas)	Cultural	Manmade	Underground irrigation systems	W
68	1990	Ukraine	Kyiv: Saint-Sophia Cathedral and Related Monastic Buildings, Kyiv-Pechersk Lavra	Cultural	Manmade	Underground churches	R
69	1987 (05, 08)	UK (trans)	Frontiers of the Roman Empire	Cultural	Manmade	Underground archaeological remains	-

Table 3. *Cont.*

N.	Year	Country	Name of the Site	Type of Site	Type of Cave	Description	Use
70	1997	UK	Maritime Greenwich	Cultural	Manmade	Underground archaeology	L
71	2000	UK	Blaenavon Industrial Landscape	Cultural	Manmade	Coal mine	M
72	2006	UK and Northern Ireland	Cornwall and West Devon Mining Landscape	Cultural	Manmade	Underground mines	M
73	1992	USA	Taos Pueblo	Cultural	Manmade	Underground ceremonial chambers	B
74	1993	Uzbekistan	Historic Centre of Bukhara	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-
75	2000 (2016 D)	Uzbekistan	Historic Centre of Shakhrisyabz	Cultural	Manmade	Network of underground conduits	W
76	2011	Viet Nam	Citadel of the Ho Dynasty	Cultural	NOT APPLICABLE	NO UNDERGROUND FEATURE MENTIONED	-

Legend: M = Mines, W = Water Management, C = Cellars, L = Archaeological Layers or Archaeological Remains, T = Tunnels for Transport, Sh = Shelters B = Burial Places and Tombs, R = Religion and D = at risk starting from (year). The years of updating are in brackets, and the properties shared by Tables 2 and 3 are in red.

The word "cave" is most commonly used for properties falling in the category Shelters (Sh in the table), which number 29. Among those historically used as permanent shelters, we can distinguish two groups. One includes shelters used in the context of a transition from nomadic to sedentary settlement, the other shelters whose use can be regarded as an adaption to local climatic and geographical conditions by using local skills. The first group encompasses natural caves adapted for human uses, or simply caves where signs of human presence were found. Sometimes the focus of the description is on the use itself, and the sites are thus defined as caves occupied by humans or as rock shelters. In other cases, instead, the emphasis is on their belonging to a given historical period, and their description thus qualifies them as "prehistoric", "Mesolithic", "Palaeolithic", or simply "archaeological". Those historically used as temporary shelters are described by locutions such as "cave dwelling", "stone architecture", "troglodyte habitat" or "troglodyte" settlement.

The use of caves for Art (A in the table) is the second most numerous in the list, with 26 occurrences. Properties falling under this heading form a homogenous group described by adopting an extravagant range of synonymous locutions such as "rock art", "cave painting", "rock carving", "sculptured rock", "rock carving", "carved figurine", and "cave drawing".

The third most frequent use of caves in the list is for Religion (R in the table). The 20 properties with this feature designated as "caves" are mostly manmade. Only in one case, however, is the cave explicitly designated as such, while in another, the nature of the cave is not specified. In this group, the main character of the cave is described with words such as "monastery", "church", "sanctuary", "temple", "catacomb", and "monument".

In 17 cases, the word "cave" refers to Burial Places/Tombs (B in the table); the descriptions qualify these with words such as "burial mound" or "burial site", "tomb", "niche" and "quarried cave".

In 10 descriptions, the word "cave" designates Cellars (C in the table). Only two of these descriptions refer to natural sites. Most refer to extensions of main buildings used as wine cellars or storehouses. Only in four cases is the word "cave" employed to describe mines (M in the table). In another four, it describes Pipes and Water Systems (W in the table), and in two more, Tunnels (T in the table).

Overall, the list records 110 functions for 89 designated as "caves".

3.2. "Underground"

Among the 86 properties whose description includes the word "underground", 70 are inscribed as cultural sites, 15 as natural sites, and 1 as mixed, for a total of 71 (Table 3). Since four of these properties are transboundary (with one spanning three countries and the other three spanning two), I counted 76 countries with this kind of property.

In 11 cases, the word "underground" is not used to describe an underground location. In the remaining 60, the properties are classified with reference to their historical uses and to the same features indicated in the previous section, with the addition of one more: Archaeological Layers or Remains. Some of these properties are considered at risk by UNESCO.

The most numerous properties fall in the Pipes and Water Systems category (W in the table), with a total of 21 entries. The words used in their descriptions are "drainage" or "drains", "pipes", "irrigation channels", "water channels", "water management system", "water tunnel", "water collecting system", "drainage galleries", "cisterns", "irrigation systems" or "irrigation canals", "tanks" and "network of conduits".

The second most frequent category is disused mines (M in the table), in which I have counted 15 properties. In all cases but one, the words "mine" or "mining" are used in the description. Only once is the site is described as a "coal seam", although the word "mine" is used in the name of the property.

The term "underground" is used to describe nine properties falling in the category "Archaeological Layers and Archaeological Remains" (L in the table). The words occurring in their descriptions are "layers", "remains", "structures", "ruins", "excavations" and "archaeology".

Eight properties are classified as Burial Places and Tombs (B in the table). They are described as "tombs", "burial chambers", "subterranean cryptoportici", "cemeteries" and "ceremonial chambers".

In five cases, Tunnels (T in the table) are described, using terms such as "underground railways", "passageways", "tunnels" and "subterranean street".

In four cases, the properties that include the word "underground" in their description are categorized as Shelters (Sh in the table). Their descriptions employ expressions such as "troglodyte settlements" or "troglodyte villages", "semi-underground houses" or "semi-underground dwellings".

Two properties are classified as Religious places (R in the table) and specifically as underground chapels or churches.

In two more cases, the word "underground" is used to describe wine cellars (C in the table).

In conclusion, the word "underground" is used 66 times in the description of the above 60 properties.

3.3. The Failure of the Experiment and the Reason Why We Do Need the Definition "Underground Built Heritage"?

My terminological analysis of property descriptions in the UNESCO List highlighted several critical issues.

In the first place, the scarce occurrence of the term "cavity" reveals that the distinction between "cave" and "cavity" introduced by the SSI is disregarded in the UNESCO list. The term "cavity" is never used to designate manmade cavities as opposed to "cave" for natural features.

Secondly, my analysis shows that, when the term cave is used, the emphasis is not on the underground character of the described feature. This is confirmed by the fact that, with the exception of 10 properties (in red in Tables 2 and 3), the cases analysed do not refer to the same properties.

On the contrary, my analysis shows a trend to preferring one term over the other in consideration of function, although with some exceptions. While the term "cave" is used to describe, in descending order of frequency, shelters and troglodyte dwellings,

rock-art sites, religious and burial places, and only in a few cases cellars, disused mines, historical water infrastructure and ancient tunnels. When we turn to consider the term "underground", the situation is almost reversed. This term is most frequently used to refer to water infrastructure, secondly for disused mines and thirdly for archaeological layers, a class not occurring at all in the first list. The descriptions of burial places, tunnels, shelters and troglodyte dwellings, religious places and cellars also sometimes emphasize their underground character.

The inconsistent use of the terms "cave", "cavity" and "underground" by the UIS, the SSI and the UNESCO suggests that only the introduction of a dedicated expression can solve the problem of univocally distinguishing all underground manmade cultural heritage. I, therefore, settled on the expression "Underground Built Heritage" (UBH) in consideration of its inclusive and communicative power, based both on the meaning of the three words it is made up of and on the fact that its meaning is clearly circumscribed.

4. A Semantic Analysis of the Terms "Underground", "Built" and "Heritage"

I chose Underground Built Heritage (UBH) as the locution that, better than others, clearly circumscribes and describes the main features of underground sites constituting significant local material or immaterial cultural heritage and, as such, can orient social and economic regeneration plans based on the ability of these places to communicate their historical functions. A semantic analysis of the terms that compose the expression "Underground Built Heritage" will illustrate why it was considered exhaustive and hence employed in several projects by the CNR.

4.1. Underground

The concept of "underground" implies the definition of a Zero Level (ZL) with respect to whether a feature is included or excluded from the UBH class. However, what is the most suitable ZL for this newly coined class? The concept of ZL is susceptible to different interpretations when referred to as physical, cultural heritage. For example, Sea Level (SL) is a perfect means to determine the inclusion in the UCH class of elements whose SL is negative but does not give any information useful to determine inclusion in, or exclusion from, the UBH class.

For this reason, I have studied and tested two new and more adequate benchmarks for measuring the ZL: the Functional Level (FL) and the Geographical Zero Level (GZL).

The measuring of the FL is limited to the entrance to a site. To verify the adequacy of the FL as a demarcation line between aboveground and underground, I have tested several artefacts potentially eligible for inclusion in the UBH group. In the case of tunnels, for example, the FL is calculated compared to the level of the road system of which the underground element happens to be an extension. Very often, although not in all cases, this road system lies at the same elevation as the underground artefact. In the case of pools, underground settlements and mines, instead, the FL is located, respectively, at the level of the courtyard served by the facility, at the street level of the village, and at the location of the extraction industry. It generally corresponds to the highest elevation of the artefact, but this is not always the case since sometimes internal corridors can rise to a higher elevation than the entrance of the artefact.

In the light of the above considerations, if we use the FL as a ZL, we could run the risk, not only of leaving out certain elements that actually qualify as UBH but also of including only those sections of the selected elements whose elevation is lower than the FL.

The GZL is the land equivalent of the SL. When adopting the GZL as a ZL, each point of the ceiling of the artefact under evaluation must be measured in relation to it and, if all these points are located underneath the GZL, the artefact in question can be regarded as being underground. I tested this approach for all categories of potential UBH: tunnels, cave settlements, burial and religious places, pools and mines. For all these artefacts, the use of the GZL allows them to be included in the definition. Following these experiments, I decided to use the GZL as a ZL, but in correlation with the FL: for a site or artefact to be

considered to be underground, the GZL must be ≥0 the FL. Figure 1 shows a test of this principle on a section of a prototypal UBH site.

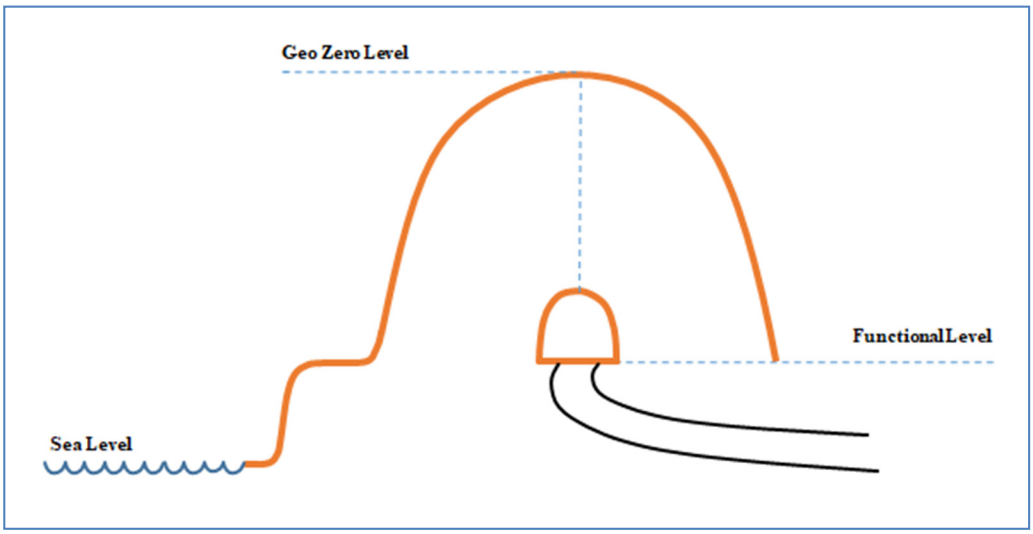

Figure 1. Sea Level, Geographical Zero Level and Functional Level (image by the author).

However, once we have established that the main body of the artefact must lie below the GZL, what about its aboveground extensions, if any? On the basis of an evaluation of all possible morphologies, I adopted the following general rule: aboveground annexes of UBH structures can be regarded as belonging to the same class as the main part of the structure only if they do not significantly characterize the structure itself and do not play a major role in its main function. For example, Lamioni—stone-built aboveground expansions of caves—neither play a substantial role in the use of the Sassi of Matera as troglodyte shelters nor alter the basic character of these underground structures, being mere facilities allowing better use of the caves. The same reasoning can be extended to mines, tunnels, pools, churches and burial sites; in all these cases, aboveground expansions can be categorized as being one with the main UBH structure if they do not affect the principal function that is performed in the underground and if this function could be successfully performed even without the said expansions.

4.2. Built

The use of the word "built" is only applicable to manmade structures. However, if artefacts built by removing rather than adding material—and thus classifiable as products of "negative building" or as troglodyte architecture—are automatically included in UBH, what about sites created through adaptation of natural caves?

In all the projects regarding UBH that involved the CNR, the problem was solved by adopting the criterion of prevalence. According to this approach, natural caves can only be classified as UBH when they have been adapted by actions such as modelling, shaping and expanding to transform them into spaces for human use, changing their shape, size and colour to such a degree that its cultural value prevails over its natural value. A perfect example of this group is painted prehistoric caves; here, human action not only gave these spaces their unique cultural value but also tells us about the daily life, society and economy of the community the paintings issued from.

4.3. Heritage

The adoption of the term "heritage" in the definition of the new class implies that any structures to be considered for inclusion in it must be a significant expression of local material and immaterial heritage [35].

As regards the material value of these structures, the technologies adopted to build them are physical signs of local environmental management skills. As regards their immaterial value, very often, they are places that perfectly answer the broad definition of an "immaterial manifestation of culture" [36]. They may bear witness to cultural hybridization, be a symbol of social and political dynamics, reflect a local economic pursuit, or be used as venues for traditional local festivals and performing arts; [37] a good example is the Flamenco festival held yearly in La Unión (Spain) [38].

For all these reasons, UBH is not only a significant component of the local heritage but has also developed a special relationship with local communities. UBH sites have generated such a sense of belonging that they seem to be perfect concrete realizations of the theoretical concept of sense of place [39], referring, in this specific case, to the special sense of attachment and identity inspired by certain architectural spaces [40].

Working together with local communities, agencies and institutions, one can develop strategic approaches to the use of UBH to promote social and economic development at rural and urban levels.

5. A Definition for UBH

On the basis of the outputs of projects focusing on UBH that involved the CNR, a study of previous attempts at a classification of artificial cavities, a semantic analysis of the phrase "Underground Built Heritage", and an analysis of caves and underground structures in the UNESCO List, the definition of the UBH class can be updated—taking account of previous attempts in this direction [24]—as follows:

Underground Built Heritage (UBH) is the class of elements of cultural heritage encompassing all underground historical artefacts. To classify an artefact as "underground", the elevation of each point of its ceiling should be measured in relation to the Geographical Zero Level. To qualify for inclusion in this class, the artefacts must have been made using local skills and technologies. If their making involved the transformation of natural caves, this transformation must have been such as to transform the said caves into significant elements of local material and immaterial culture. Based on the application of the concept of "sense of place", the use or reuse of UBH artefacts can be the springboard for local social and economic regeneration actions with the involvement of local communities.

5.1. From Environmental Conflicts to Social Interactions: Eight Functions for UBH

On the basis of the above definition of UBH, I analysed the historical functions of these artefacts. I began by dividing them into two main groups: artefacts built for the management of Environmental Conflicts (EC) and artefacts built to allow Social Interactions (SO). After this first articulation, I defined eight subclasses corresponding to as many functions: Sanitary, Water and Living Spaces, as subcategories of EC; Religion, Defence and Economy as subcategories of SO; and Food and Transport as a subcategory of both.

The basic chart in Figure 2 shows, for each incognita–an asset, an artefact, or a group of artefacts, indicated by "?", all the connected functions that could potentially be at the core of promotion plans and dedicated projects.

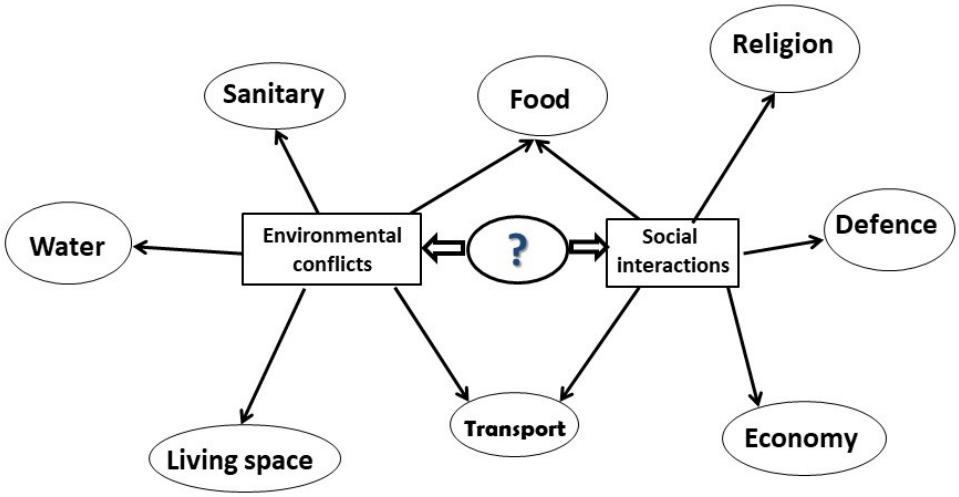

Figure 2. The basic chart for the classification of UBH (image by the author).

This new chart updates a previous one [24] (Figure 3), including three more functions, which I decided to discard upon reflection. Initially, I had included a class "environmental alert", encompassing all artefacts not originally built in the underground but absorbed into it as an effect of environmental changes so that their location underground serves as a warning against the violation of natural laws.

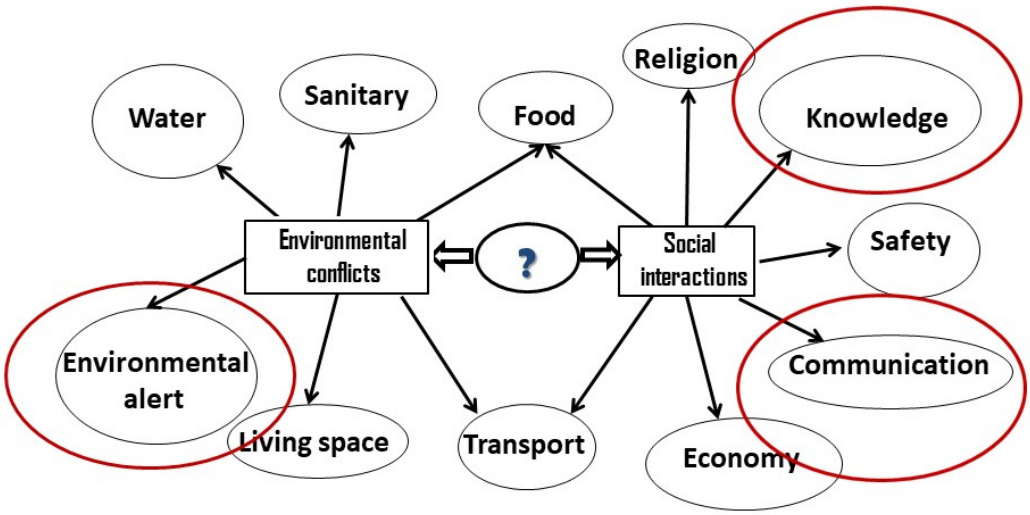

Figure 3. Updates to the earlier version of the basic chart for UBH (image by the author).

I also deleted the "knowledge" class because it referred to those archaeological stratifications, which were absorbed in the underground only as an effect of the rise of the ZL but not to elements built in the underground. I also deleted the subclass "communication", as it is subsumed in one of the above-mentioned primary functions.

5.1.1. Living Space

The first function, Living Space, refers both to the transformation of natural caves into permanent shelters involving substantial changes or such that human use put a strong stamp on them and to examples of the so-called "negative building culture" or "troglodyte lifestyle". All the artefacts classified under this function communicate material and immaterial values about local environmental management (Figure 4).

Figure 4. An underground living space in Cappadocia in Turkey (picture by the author).

While examples of prehistoric caves can be found worldwide at any given latitude and in different areas, underground built settlements are the result of the application of the same approach to the management of environmental conflicts such as sandstorms, strong annual temperature variation and water scarcity at specific latitudes; social interactions generally come into play in a successive phase. As Table 4 shows, all the main worldwide troglodyte settlements are located within a well-defined latitude range: between 32°10′ N for the latitude of the Libyan settlement of Gharyan, and 40°40′ N for that of the Sassi of Matera in Italy. Geological morphology also plays an important role in the development of such sites, as all of them occur on plateaus with altitudes ranging from 401 metres a.s.l., such as the Murge Plateau in Italy, to 2628 metres a.s.l., such as the Loess Plateau in China.

Table 4. The underground as a living space (source: Google Earth) (by the author).

Site	Country	Name of the Plateau	Altitude	Latitude
Gharyan	Libya	Jabal Nafūsah	700 metres a.s.l.	32°10′ N
Matmata	Tunisia	Matmata Plateau	600 metres a.s.l.	33°32′ N
Sassi Matera	Italy	Murge Plateau	401 metres a.s.l.	40°40′ N
Kandovan	Iran	Iran/Persian Plateau	2300 metres a.s.l.	37°47′ N
Derinkuyu	Turkey	Anatolian Plateau	1300 metres a.s.l.	38°37′ N
Ürgup	Turkey	Anatolian Plateau	1050 metres a.s.l.	38°38′ N
Göreme	Turkey	Anatolian Plateau	1104 metres a.s.l.	38°38′ N
Avanos	Turkey	Anatolian Plateau	920 metres a.s.l.	34°42′ N
Lijiashan	China	Loess Plateau	2628 metres a.s.l.	36°52′ N
Guadix	Spain	Meseta Plateau	949 metres a.s.l.	37°17′ N

5.1.2. Water

Water is the class that includes all those artefacts built in the underground to collect or manage the most precious element for life. The class includes both dynamic and static systems. These artefacts are the result of the application of local skills and available

technologies in order to manage water for both collective and private uses. They are cases of successful adoption of the most profitable system under given climatic, social and economic conditions. Their role is fundamental both in urban and rural contexts and when they were provided by local authorities or under foreign rule, their construction was celebrated by building aboveground fountains fed by them. The elements included in this class, in addition to their material values, very often reflect and interpret local immaterial traditions. Roman aqueducts, for example, besides having been vehicles of Romanization, in the absence of natural thermal sources fed thermal facilities celebrating the culture of hygiene typical of that civilization. The Arab *qanat*, in its turn, was instrumental in the development of the oasis system in the deserts and the nomadic life that went with it. Finally, Indian stepwells were meeting places for local communities, and their role in terms of sense of place is one of the reasons behind their closure during the English colonial period (Figure 5).

Figure 5. Underground Indian stepwells (picture by the author).

5.1.3. Sanitary

The sanitary class includes all underground waste management facilities that have become local heritage because they represent historical technical solutions that allowed social, cultural and economic regeneration. Although both static and dynamic systems are eligible for inclusion in this category, it does not include all historical sewers or cesspits: only those telling us something about the transformation of the corresponding aboveground contexts can be an object of research and promotion. While the location of cesspits, their uses and their stratification can shed light on social and economic issues studied by archaeologists [41], selected historical sewers, such as *les égouts de Paris*, have been celebrated by local literature because of their material and immaterial values. The Parisian sewers, in particular, have been at the core of a unique promotion action involving the establishment of their own museum [42].

5.1.4. Food

Food is the class that includes all underground structures built to preserve the quality of both raw materials and selected local productions. In some cases, they are places where

significant phases of food transformation were carried out in historical times. Artefacts, such as ice cells, canteens and snow cells, are not only the technical solutions adopted before the spread of electric refrigeration devices but very often also constitute physical elements that characterize local food production as much as aboveground structures do. The elements included in this class are sometimes annexed to buildings such as private houses and monasteries. Some are town projects created for collective use to favour selected local economic and commercial activities, or as storage facilities in the event rationing or safe storage should be necessary, or for taxation purposes. The underground storerooms of Palmyra in Syria, for example, contributed significantly to the commercial function of the caravanserai. Only spaces that have been historically used for the conservation or transformation of food at the family level are included in this class; when such underground structures were for the use of local enterprises, they are included in the Economy class.

5.1.5. Religion

The function Religion includes a wide variety of artefacts such as burial places, rock churches, catacombs and ossuaries. These structures can be assigned to two main types: on the one hand, underground places of worship, on the other, burial spaces built to celebrate deceased persons belonging to specific families or religious orders, or to put away the victims of an epidemic and thus erase its traces from a town. In the first group, we can list hermit refuges such as the Hanging Monastery in China (Figure 6); hideouts for devotees of persecuted religions, such as the coastal caves of the Goto Islands in Japan; cave church complexes built by religious migrants, such as more than 150 rupestrian churches in southern Italy, and cave churches and religious tunnels worldwide. In the second group, we find famous sites such as the temple of Petra in Jordan; the numerous Buddha caves in the East, such as the Mogao Caves, Longman Grottos, Yungang Grottos and Dazu Caves in China, and the Ellora and Ajanta Caves in India and Etruscan necropoleis and Roman catacombs in Italy. Artefacts, such as the ossuary of the St. Francis Basilica in Peru and the Cappuccini cemetery and the Fontanelle cemetery in Italy, are included in this section as well.

Figure 6. Hanging Monastery in China (picture by the author).

5.1.6. Defence

Defence is the heading under which all underground artefacts built as an extreme solution to allow escape from the enemy, to protect against external attacks or to impose

the harshest punishment on criminals considered to be particularly dangerous for the community are gathered. Underground escape routes were very often annexed to main buildings such as castles, royal palaces and monasteries. They were built, simultaneously or subsequently to the building they served, as part of an elaborate architectural and logistical operation. Such is the case, for example, for the Bourbon Tunnel of the Royal Palace in Naples, Italy. Sometimes the artefacts included in this class were the only possible escape route in extreme situations and were built using an empirical approach; the tunnels dug in the underground of the Warsaw ghetto in Poland during the Shoah are a perfect case in point. War bunkers were built during the Second World War in all the major cities involved in the conflict. During the Cold War, some were converted into anti-atomic shelters, as in Moscow (Figure 7). Finally, underground prisons are found in almost all medieval fortified castles; they were intended for the most extreme of confinements, ensuring total erasure of the presence of their inmates from the surface, often preliminary to their execution.

Figure 7. Underground anti-atomic shelters in Moscow (picture by the author).

5.1.7. Economy

The class Economy collects all underground artefacts built to support local economic development, both in the first and in the second sector: mines for the extraction of stones or minerals, stables for flocks and spaces for the processing of special local foodstuffs. Within the first group, the Hashima Island in Japan (Figure 8), the Peak District in England and the Schieferpfad Geopark in Germany are only three of the many cases of dismissed mines that have been at the core of regeneration projects exploiting their potential to evoke the technologies adopted in them, the establishment of villages and facilities for the miners and social interactions within the miners' communities. As regards this last aspect, these regeneration projects have often involved former miners. As to rural pastoral activities, very often, natural caves have been shaped and adapted as shelters for animals by providing them with systems for watering them, digging beds for them and installing gates to keep them in; in all such cases, these spaces stand as a symbol of local rural activity. In Laterza, a village with caves in southern Italy, sheep are depicted in the municipal coat of arms, confirming the strong identity bond of this community with the symbolic places of the main local industry. Finally, several underground artefacts were built to accommodate processing activities that strongly characterized the area they stood in. Moldovan underground cellars,

for example, are not only the symbol of a major local industry but also evoke the role they played in the former USSR and local identity claims subsequent to its fall. Finally, many Italian and French top-notch productions have their secret in underground sites, a secret that accounts for the organoleptic characteristics of local products and indissolubly binds them to the areas they originate from.

Figure 8. Hashima Island in Japan (picture by the author).

5.1.8. Transport

The class Transport collects a wide range of structures build to enhance aboveground mobility and manage many critical issues related to it. Underground train lines, funiculars, pedestrian tunnels, viaducts, parking lots and judicial deposits of impounded vehicles constitute the elements that have historically integrated and lightened the load on surface travel.

All these spaces, very often connected to each other to form a network, have always been dug to overcome physical obstacles to the extension of an urban core or to connect it with its suburbs. Sometimes recourse to the subsoil was necessary to overcome the obstacles imposed by local land morphology. In other cases, the recourse to the invisible world had the purpose of allowing sustainable travel.

From the historical tunnels built by the ancient Romans to the very first underground train system built in London and the historical funiculars of Naples in Italy, these facilities often constitute the most immediate link between the urban population and the stratifications of cities.

5.2. From Static to Dynamic Analysis

The chart presented here allows for both a static and dynamic analysis of individual structures and homogenous or inhomogeneous complexes in different spatial contexts. In the case of static analysis, the question mark ("?") stands for the structure or local context the structure is located in. The chart identifies all of them to provide a general overview. It also allows for comparative analysis, as shown in Figure 9, which compares Italian and Japanese UBH.

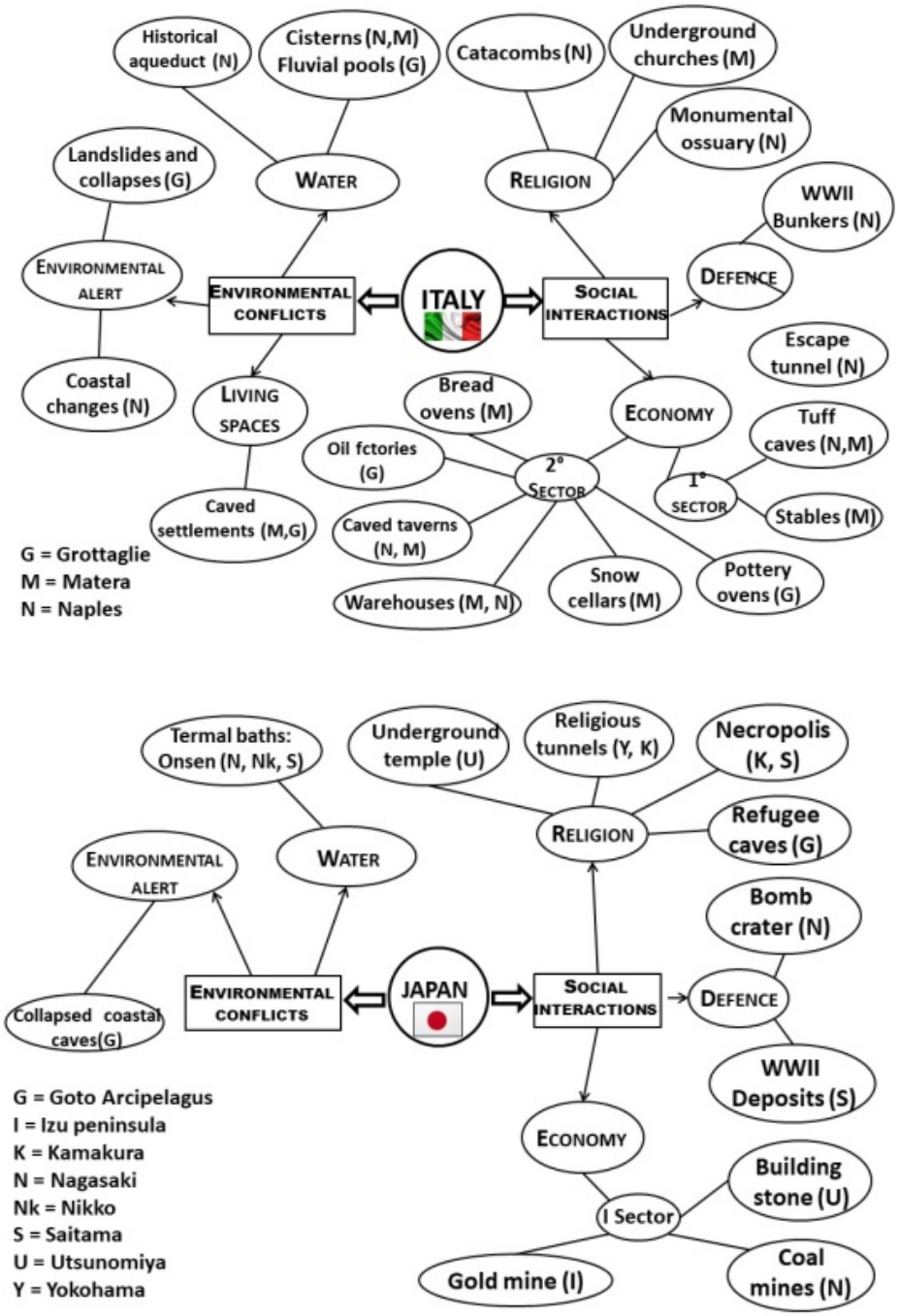

Figure 9. A comparative analysis of national UBH systems in Italy and in Japan (Varriale R., ©Opera Ipogea, 2020).

With regards to the dynamic analysis, the chart allows for a reconstruction of all the most important transformations processes undergone by the assessed case studies. In the hypothetic example in Figure 10, for example, red is used to highlight the evolution of a structure initially built to manage a water conflict, such as a cistern or a water conduit, which after falling out of use was transformed into a religious worship site, such as a burial place or a church for secretly practicing a persecuted religion, and then, after being abandoned, it was used as a cesspit to manage an aboveground sanitary conflict. In blue are highlighted cases of structures initially built as facilities for local economic activity, such as a stone quarry, then transformed into food storage facilities and finally used as shelters, such as during a conflict.

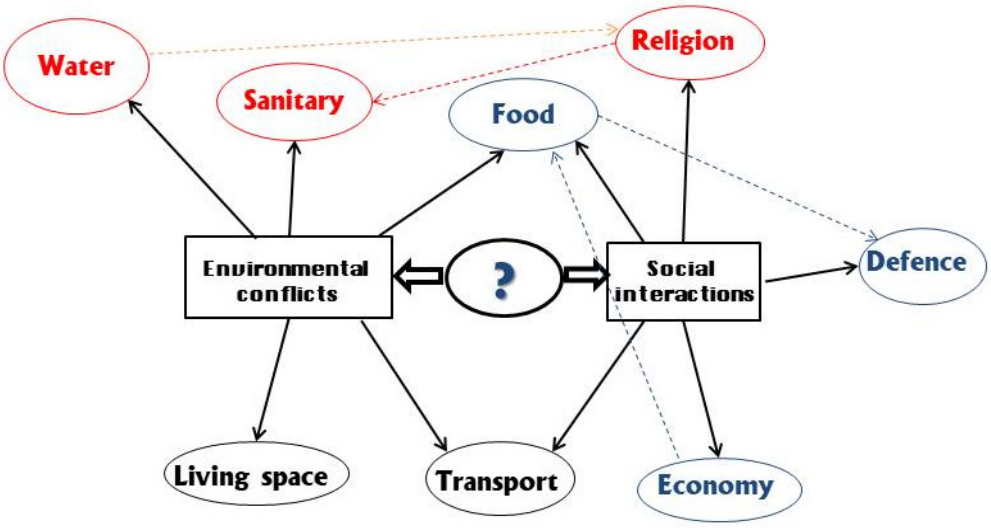

Figure 10. The dynamic analysis of UBH structures (image by the author).

5.3. Levels of Re-Use for UBH

Having introduced tools for the analysis of the original functions and historical reuses of artefacts included in the UBH class, can we move on to identify models for their reuse to communicate values connected with their past? It is possible to develop tools to allow these sites to maintain a strong link with their past in the context of local development strategies centred on the UBH class? Since this is a class that brings together structures with very different characteristics, any approach to their regeneration needs to follow paths compatible with their characteristics and their vulnerability. On the basis of this consideration, I have formulated a scale of possible actions that can be pursued. This scale envisages four possible levels of action: Re-inventing, Re-introducing, Re-interpreting and Re-building.

5.3.1. Re-Inventing Cultural UBH

This action level concerns the most significant elements of cultural heritage, unique and vulnerable artefacts whose reuse should be limited to their transformation into museums. In the case of artefacts of the UBH class, sometimes additional restrictive measures are called for to prevent any damages by visitors, such as bacterial contamination and alteration of the underground microclimate. Sometimes the vulnerability of the underground habitat imposes restrictions on the use of the sites. In the case of the Chapel of the Original Sin in Matera in Italy, for example, a controlled microclimate system and entry limitations have been introduced to protect its frescoes [43]. In the case of the Mogao caves in China, access is limited to a group of 15 caves per visit, no pictures are allowed, and replicas of the frescoes are provided for tourists in the annexed museum [44].

5.3.2. Re-Introducing Old Functions in UBH

This approach regards sites that, despite having great historical value, are widespread in an area and are suitable for the restoration of their original functions without contravening current regulations. In the reuse process, references to historical uses should always be made. This can be carried out by displaying iconographic material or through the exhibition of period tools or machinery. In this type of approach, there should be an emphasis on continuity of use in order to keep the intangible value of the sites alive.

Such is the case, for example, for the old underground pottery kilns at Grottaglie in Italy. Today, this tradition has been revived at its historical sites but in compliance with current rules on safety in the workplace. The link with traditional production is kept alive by the exhibition of historical objects and by photographs that portray historical use in the

former pottery factory Casa Vestita, which has quickly become a popular tourist attraction among tourists [45].

5.3.3. Re-Interpreting Historical Spaces of UBH

This approach concerns artefacts, which, despite having performed in the past a function that has allowed them to be included in the UBH class, are nevertheless widespread in the area they occur in and are not so unique that they cannot be converted to other uses. Even in this case, however, it is important that the link with these sites' history be maintained by activating communication relative to their past. Sometimes this link is direct, as in the case of the transformation of the Fantiano quarries in southern Italy into an open-air theatre. Sometimes it is necessary to adopt inclusive architectural solutions allowing the viewing of historical artefacts in their new functional context, as in the case of the new metro stations of Naples and Rome in Italy.

5.3.4. Re-Building UBH

There are quite a few cases in which the methods used to build artefacts included in the UBH class are replicated in contemporary times. This may happen either in continuity with the past, confirming that these building methods are still the most suitable for managing certain land management conflicts, or in the process of reviving these artefacts as cultural heritage. In the former case, sometimes the solutions adopted for underground construction are, indeed, so efficient that they can actually be revived today with appropriate technological improvements. Such, for example, is the case for the new yaodong villages in China, where the local negative building culture is revived in a contemporary key, keeping alive the troglodyte approach to urban development typical of the Loess Plateau [14]. Turning to the latter case, two main approaches can be distinguished. The first regards those properties that are so vulnerable that access to the public must be totally forbidden; in these cases, such as that of the Lascaux caves in France, faithful reconstructions allow tourist use without compromising the original property [46] (Figure 11). The second approach concerns underground sites that play such an important role in terms of the local sense of place that they are replicated to communicate the values they embody; the replica of the mine habitat—the s-called "underground experience"—in the Deutsches Museum in Munich, Germany, is a perfect example of this approach [47].

Figure 11. Re-building Lascaux caves in France (image by the author).

6. Conclusions

It is far from being the intent of this paper to say the final word on the definition of shared guidelines for the classification, study and regeneration of underground built historical structures. Mine should be regarded as the first attempt in this direction based upon about 20 years of experience in this field of study; I really hope that the effort of innovating the approach to this specific class of elements of cultural heritage will stimulate a debate in the appropriate forums and encourage projects involving scholars from all over the world. It is my wish that, as was the case for the elements of the

UCH class, the introduction of the first definition for the UBH class, the identification of tools of analysis for the study of the historical functions of underground elements and the definition of a progressive approach to their reuses can be the starting point for addressing the problem of the theoretical analysis of a category of cultural heritage having a distinctive identity. Finally, it is also my fervent wish that, from now on, on the basis of all the peculiarities I have identified here, artefacts included in the UBH class will be regarded as important testimonies of the past and potential drivers of social and economic development processes within the communities they belong to From my side, I am already working on the adoption of selected global UBH case studies for community behaviour, local development and, eventually, their inclusion in the both in the World Heritage and Geo-parks Lists by UNESCO.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

References

1. UNESCO. Convention on the Protection of the Underwater Cultural Heritage. 2001. Available online: http://portal.unesco.org/en/ev.php-URL_ID=13520&URL_DO=DO_TOPIC&URL_SECTION=201.html (accessed on 10 March 2021).
2. Rau, M. The UNESCO convention on Underwater Cultural Heritage and the International Law of the Sea. In *Max Planck Yearbook of United Nations Law*; Springer: The Netherlands, 2002; Volume 6, pp. 387–472.
3. Dromgoole, S. *Underwater Cultural Heritage and International Law*; Cambridge University Press: Cambridge, UK, 2013.
4. Pace, G. Underground Built Heritage as catalyser for Community Valorisation. Underground4value. In Proceedings of the 55th ISOCARP (International Society of City and Regional Planners), World Planning Congress, Jakarta-Bogor, Indonesia, 9–13 September 2019; pp. 1250–1260.
5. Fiore, S. I Segreti Della Napoli underground, Almanacco Della Scienza, N. 3–10 February 2021. Available online: http://www.almanacco.cnr.it/reader/cw_usr_view_articolo.html?id_articolo=10925&id_rub=32&giornale=10886 (accessed on 25 February 2021).
6. Institute of Studies on the Mediterranean (ISMed). National Research Council of Italy (CNR). Available online: https://www.ismed.cnr.it/it/ (accessed on 25 February 2021).
7. Varriale, R. (Ed.) *Undergrounds in Naples. I Sottosuoli Napoletani*; ISSM/CNR: Napoli, Italy, 2009.
8. Urban Undergrounds in the Mediterranean, Modulo CNR. Available online: http://www.cnr.it/commesse/ModuloRisorseNuovo.html?id_mod=2376 (accessed on 25 February 2021).
9. Varriale, R. Undergrounds in the Mediterranean: Ten urban functions from the "other" side of the Mediterranean cultural heritage in a long-term perspective. *Glob. Environ.* **2015**, *7*, 198–245.
10. Le Risorse Naturali e le Fonti Storiche. Available online: https://www.ismed.cnr.it/it/le-risorse-naturali-e-le-fonti-storiche (accessed on 25 February 2021).
11. Lapenna, V.; Leucci, G.; Parise, M.; Porfyriou, H.; Genovese, L.; Varriale, R. A project to promote the natural and cultural heritage of the underground environment in Southern Italy. In Proceedings of the International Conference of Speleology in Artificial Cavities, Cappadocia, Turkey, 6–10 March 2017; Parise, M., Galeazzi, C., Bixio, R., Yamac, A., Eds.; Dijital Düşler: Istanbul, Turkey, 2017; pp. 129d–133d.
12. Bilateral Agreement CNR/CACH. Available online: https://www.cnr.it/en/bilateral-agreements/agreement/49/cach-chinese-academy-of-cultural-heritage (accessed on 10 March 2021).
13. Valorizzazione, Turismo e Partecipazione Sociale. Sviluppo di Soluzioni Integrate Alternative Per siti Storici Meno Promossi. Available online: https://www.cnr.it/it/accordi-bilaterali/progetto/2297/valorizzazione-turismo-e-partecipazione-sociale-sviluppo-di-soluzioni-integrate-alternative-per-siti-storici-meno-promossi (accessed on 25 February 2021).
14. Genovese, L.; Varriale, R.; Luvidi, L.; Fratini, F. Italy and China Sharing Best Practices on the Sustainable Development of Small Underground Settlements. *Heritage* **2019**, *2*, 53. [CrossRef]
15. Varriale, R.; Genovese, L.; Luvidi, L.; Fratini, F. Identification and Interpretation of a Cultural Route: Developing Integrated Solutions of Enhancing the Vernacular Historic Settlements. In Proceedings of the ICOMOS—CIAV & ISCEAH 2019 Joint Annual Meeting & International Conference on Vernacular & Earthen Architecture towards Local Development, Pingyao, China, 6–8 September 2019; Yong, S., Jakhelln, G., Correia, M., Eds.; Tongji University Press: Shanghai, China, 2019; pp. 601–608.
16. Bilateral Agreement CNR/JSPS. Available online: https://www.cnr.it/en/bilateral-agreements/agreement/14/jsps-japan-society-for-the-promotion-of-science (accessed on 10 March 2021).
17. Monitoraggio del Rischio e Conservazione del Sottosuolo Antropico Come Risorse per le Attività Umane in Italia e Giappone (2018/2019). Available online: https://www.cnr.it/it/accordi-bilaterali/progetto/2945/monitoraggio-del-rischio-e-conservazione-del-sottosuolo-antropico-come-risorse-per-le-attivita-umane-in-italia-e-giappone (accessed on 1 March 2021).
18. Varriale, R.; Oguchi, C.T.; Parise, M. (Eds.) Damage assessment and conservation of underground spaces as valuable resources for human activities in Italy and in Japan. *Opera Ipogea*. 2020. Special Issue. Available online: https:

//www.slideshare.net/CNR-ISSM/damage-assessment-and-conservation-of-underground-space-as-valuable-resources-for-human-activities-use-in-italy-and-japan-113917275 (accessed on 24 June 2021).
19. Damage Assessment and Conservation of Underground Spaces as Valuable Resources for Human Activities in Italy and in Japan (2019/2020). Available online: https://www.cnr.it/it/accordi-bilaterali/final-report/1/jsps-giappone-2020-2021-final-report-signed.pdf (accessed on 1 March 2021).
20. COST ACTION 18110. Available online: https://underground4value.eu/ (accessed on 3 March 2021).
21. Padovan, G. *Archeologia del Sottosuolo. Manuale per la Conoscenza del Mondo Ipogeo*; Ugo Mursia Editore: Milano, Italy, 2009.
22. Parise, M.; Galeazzi, C.; Bixio, R.; Dixon, M. Classification of artificial cavities: A first contribution by the UIS Commission. In Proceedings of the 16th International Congress of Speleology, Brno, Czech Republic, 21–28 July 2013; Filippi, M., Bosák, P., Eds.; Czech Speleological Society: Praha, Czech Republic; pp. 230–235.
23. Plovdiv and Matera: European Capitals of Culture in 2019. Available online: https://www.europarl.europa.eu/news/en/headlines/society/20181205STO20960/plovdiv-and-matera-european-capitals-of-culture-in-2019 (accessed on 10 March 2021).
24. Varriale, R. Re-Inventing Underground Space in Matera. *Heritage* **2019**, *2*, 70. [CrossRef]
25. Varriale, R. A Methodological Framework for UBH classification. In Underground Built Heritage valorization. A Handbook. In Proceedings of the First Underground4value Training School, Naples, Italy, 10–15 February 2020; Pace, G., Salvarani, R., Eds.; CNR Edizioni: Roma, Italy, 2021; pp. 31–41.
26. Varriale, R. A Methodological Framework for UBH Classification, News Letter COSTACTION 18110. Available online: http://underground4value.eu/wp-content/uploads/2020/06/Newsletter-may-5.pdf (accessed on 27 May 2021).
27. International Union of Speleology (UIS). Available online: https://uis-speleo.org/ (accessed on 12 March 2021).
28. UIS. The Caver's Multi-Lingual Dictionary, Edition 19.1. Available online: http://www.uisic.uis-speleo.org/lexintro.html (accessed on 12 March 2021).
29. Artificial Cavities Commission. Available online: https://artificialcavities.wordpress.com/ (accessed on 16 March 2021).
30. Società Speleologica Italiana (SIS). Available online: http://www.speleo.it/site/index.php (accessed on 16 March 2021).
31. Opera Ipogea. Available online: http://www.operaipogea.it/ (accessed on 16 March 2021).
32. United Nations Educational, Convention Concerning the Protection of the World Cultural and Natural Heritage. Available online: https://whc.unesco.org/en/conventiontext/ (accessed on 17 March 2021).
33. Slatyer, R.O. The Origin and Evolution of the World Heritage Convention. *Ambio* **1983**, *12*, 138–140.
34. UNESCO List. Available online: https://whc.unesco.org/en/list/ (accessed on 17 March 2021).
35. Vecco, M. A definition of cultural heritage: From the tangible to the intangible. *J. Cult. Herit.* **2010**, *11*, 321–324. [CrossRef]
36. Lenzerini, F. Intangible Cultural Heritage: The Living Culture of Peoples. *Eur. J. Int. Law* **2011**, *22*, 101–120. [CrossRef]
37. del Barrio, M.J.; Devesa, M.; Herrero, L.C. Evaluating intangible cultural heritage: The case of cultural festivals. *City Cult. Soc.* **2012**, *3*, 235–244. [CrossRef]
38. Cante de Las Minas. Available online: https://festivalcantedelasminas.org/ (accessed on 25 June 2021).
39. Shamai, S. Sense of place: An empirical measurement. *Geoforum* **1991**, *22*, 347–358. [CrossRef]
40. Najafi, M.; Kamal, M.; Shariff, B.M. The Concept of Place and Sense of Place in Architectural Studies. *Int. J. Hum. Soc. Sci.* **2011**, *6*, 187–193.
41. Smith, D. Pondering Privies: Construction, Use, Reuse, and Other Speculations about Cesspits in the Archaeological Record. *J. Archaeol. Method Theory* **2021**, *28*, 446–469. [CrossRef]
42. Hicks, M. Underground Adventures. *Health Hist.* **2010**, *12*, 134–139. [CrossRef]
43. La Cripta del Peccato Originale. Available online: https://www.criptadelpeccatooriginale.it/index.php?lang=it (accessed on 25 June 2021).
44. Mogao Grottoes. Available online: https://www.mogaoku.net/ (accessed on 25 June 2021).
45. Casa Vestita. Available online: https://www.tripadvisor.it/Attraction_Review-g1737518-d6990470-Reviews-Casa_Vestita-Grottaglie_Province_of_Taranto_Puglia.html (accessed on 25 June 2021).
46. Passebois-Ducros, J. Innovation through Visitor Experience in Museums: The Case of the Lascaux Caves. In *Innovation in the Cultural and Creative Industries*; Pellegrin-Boucher, E., Roy, P., Eds.; ISTE Ltd.: London, UK, 2019; Volume 8, pp. 77–100.
47. The Mine at the Deutsches Museum. Down into the Depths of the Underworld. Available online: https://www.munich.travel/en/topics/arts-culture/mine-deutsches-museum (accessed on 25 June 2021).