



Shapes and way of inhabiting the excavated architecture: knowledge and comparison of the cave dwellings in Bamyán and Matera

Ali Yaser Jafari
Marianna Calia

Abstract

Rock-cut architecture is an essential yet little-known type of vernacular architecture whose nature is different from what we understand by the term 'architecture'. This research seeks to define the comparison between cave dwellings in Italy (Sassi di Matera) and Bamyán in Afghanistan. In Bamyán, more than 750 Buddhist caves were hollowed out along cliff. The caves consist of several types of construction: two niches of standing Grand Buddhas, five niches of Seated Buddhas, domed-ceiling caves, vaulted-ceiling caves, *laternendecke-ceiling* caves and flat ceiling caves. About fifty caves have murals remaining inside; various types of figures are depicted in these: buddhas, decorated buddhas, *bodhi satva* figures (particularly Avalokitesvara) and circular mandala motifs are popular designs were influenced by Sassanian art. Sassi di Matera, located in the southern Italian region of Basilicata comprises a complex of houses, churches, monasteries and heritages built into the natural caves of the Murgia. The research shows, the model of two dwellings are same in generally, since a place to settle is dominant keyword for two contexts. In detail, environmental conditions (climate and material) and religion have shaped different form of architecture.

Keywords

Cave Architecture, Bamyán, Matera, Vernacular Architecture, Earth-Shelter



Landscape Views of Bamyán
and Sassi di Matera.

Introduction

Building space through hollowing out solid rock in the absence of common building materials is an extraordinary architecture technique whose study demands special attention. Rock-cut architecture, as a type of earth-shelter architecture, enjoys considerable diversity, which have taken different forms and functions due to climate considerations [Mangeli et al. 2022, p. 1]. In rock-cut architecture, common building materials and techniques are not utilized. Instead, space is created by excavating a natural solid environment, such as a level horizontal plain beneath which the rock-cut structures are dug or the steep slope of foothills or gently sloping to upright hills, which give the best backdrop for rock-cut architecture.

This type of home has been used for centuries in mountainous regions worldwide and many archaeologists, anthropologists, architects and social scientists believe that cave dwellings still serve as the primary form of housing to mountain communities across the globe including Italy, Afghanistan, Spain, Turkey [Earle 2006]. One report by Ellis [Ellis 2014] indicated that, in the Province of Guadix in Spain, an updated report by Genova [Genova 2018] confirmed that around 2,000 residents still live in cave homes.

Since this kind of site is considered cultural heritage, to better understand its architectural characteristics, research must be done. In this process, this research tries to explore what lies deeply in carved architecture in Bamiyan-Afghanistan (Asia) and what is the engrained experience of buildings in its, that make feel differently or similarly from western one in Sassi di Matera-Italy (Europe).

Research method

It seems to be challenging to compare characteristics of western architecture and eastern architecture. But despite the difficulties and the inevitable logical leap of making a comparison between each pair, it is believed that the insight gained from the findings of different cases between two areas will help identify new researches. Present research methodology is based on a romantic ideology that "tries to clarify something that was obscure (the concept of people) with the help of something even more obscure (the concept of language, architecture in this paper). Thanks to the symbiotic correspondence thus instituted, two contingent and indefinite cultural entities transform themselves into almost natural organisms endowed with their own necessary laws and characteristics" which is told by Giorgio Agamben [Solomon 2014].

In this article, can be proposed two different stages in architecture; one is explicitly mentioned architectural conceptions including plan, section and typology and the other is intrinsic architectural conceptions in human mind 'neighboring'.

Theoretical Foundations: case study of Bamiyan

The Bamiyan Valley in Afghanistan is located at a height of 2500m around 250km NW of the capital Kabul within the Hindu-Kush mountain range backed by 4000-5000m high massive peaks. The Buddhist monastic cave sanctuaries and dwellings line up for several kilometers on the north side of the valley facing south leaving the fertile plane open for agriculture [Toubekisa et al 2009, p. 1] (fig. 1).

The site of the Giant Buddha figures extends for 1,5km comprising more than one thousand caves located at the broadest part of the valley. Situated within the crossroads of the civilizations of the East and the West, Bamiyan is regarded as an exceptional testimony and outstanding representation of Buddhist art in the Central Asia region. During many centuries, these valleys served as passageway for the intercontinental trade along the routes of the Silk Road. The caves at the site of the Bamiyan Buddhas have been carved into the cliff during the 3rd to 8th century A.D.

The cliff was formed in three parts. The western cliffs are the largest at 680 m in length and 150 m in height; next are the eastern cliffs at 510 m in length and 100 m in height; the

smallest are the central cliffs at 110 m in length and 60 m in height. The western and central cliffs continue in a straight line, but an angle intervened between the central and eastern cliffs, after which the latter extend straight (fig. 2).

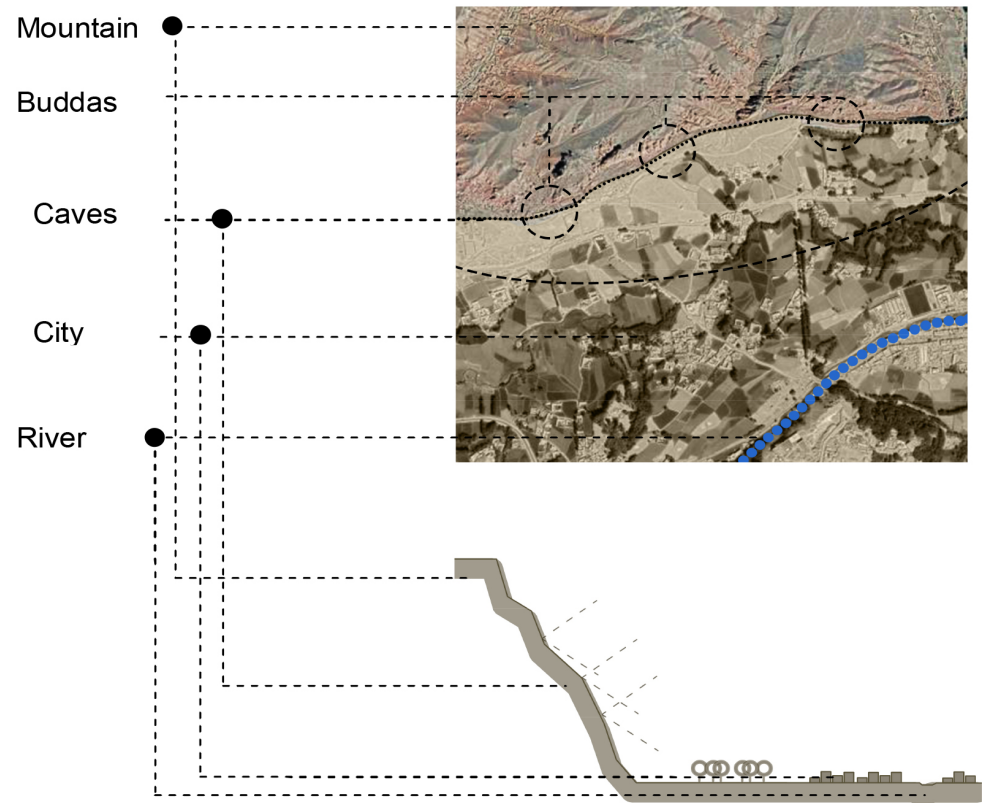


Fig. 1. Site plan and schematic section of Bamyan valley. Graphic elaboration by A. Y. Jafari.



Fig. 2. Panorama of the Bamyan Buddhas and its caves (Day and night). G. Gonzalez Brigas, General view of the Bamyan Valley, 2005. © UNESCO, Creative Commons Attribution-ShareAlike 3.0 IGO <<https://whc.unesco.org/en/list/208/gallery/>>.

Architecture and cave function in Bamyan

The Bamyan caves come in a variety of forms, including square, rectangular, octagonal, and round. Ceiling types include flat, vaulted, domed and *laternendecke*. Each of these components comes from a different source. The architecture of Iran Sassanian Dynasty may be traced back to the origins of squinch arch technology (early half of the third century AD). The *laternendecke* technique is visible in the wooden houses of the forest zone in Western Europe and Central Asia. The concept of a domed ceiling over a square plan is evident in Sassanian and Byzantine palaces (third and fifth centuries AD, respectively). [Higuchi and Barnes 1995]. Influences from these different areas intermixed in the Bamyan region and the variations of shape and ceiling form combined with each other to make fifteen different types of caves (Tab. 1). The dominant usage in cave architecture of Bamyan is dwelling and other usage such bar, coffee shop, etc. due to tradition and poor situation of people have not been defined.

Type				Number in Type
A	Square caves	1	Domed ceiling with horizontal band	8
		2	Domed ceiling with tambour	15
		3	Domed ceiling with squinch arches	16
		4	Laternendecke	22
		5	Flat ceiling	01
B	Octagonal caves	6	Domed ceiling with horizontal band	3
		7	Domed ceiling with tambour	13
		8	Laternendecke	6
		9	Cross-vault ceiling	2
C	Circular caves	10	Domed ceiling	6
D	Regular caves	11	Flat ceiling	Many
		12	Vaulted ceiling	Many
		13	Laternendecke	1
		14	Cross-vaulted ceiling	1
		15	Vaulted ceiling	9

Tab. 1. Cave architectural variation in Bamyan. Higuchi, Barnes 1995, pp. 282-302.

Types 11 and 12 are the most common and consist of the most basic architectural shapes; they also lack mural embellishments and relief sculptures. As a result, these sorts may have been employed for everyday living activities or as storerooms.

The space around the Buddha feet was sculpted in the round, allowing worshipers to circumambulate. Caves of various shapes were also carved around it (fig. 3). Approximately fifty of the 751 caves have mural decorations inside. The topics are diverse, including buddhas, bodhisattvas (salvation figures), attendants, devotees and so on.

The physical-spatial structure

As in figure 4, the sloped paths connect these caves to each other and also they act as statistic point to have panoramic view toward natural landscape and city. Furthermore, the caves have been constructed in linear way and are not set around a public space and paths acts as a branch and terraced pattern; so It can be said a linear neighboring unit (door and windows as horizontal ventilation), without vertical path inside the caves toward another caves or vertical ventilation, is dominant in these carved dwellings, except caves that were set around the

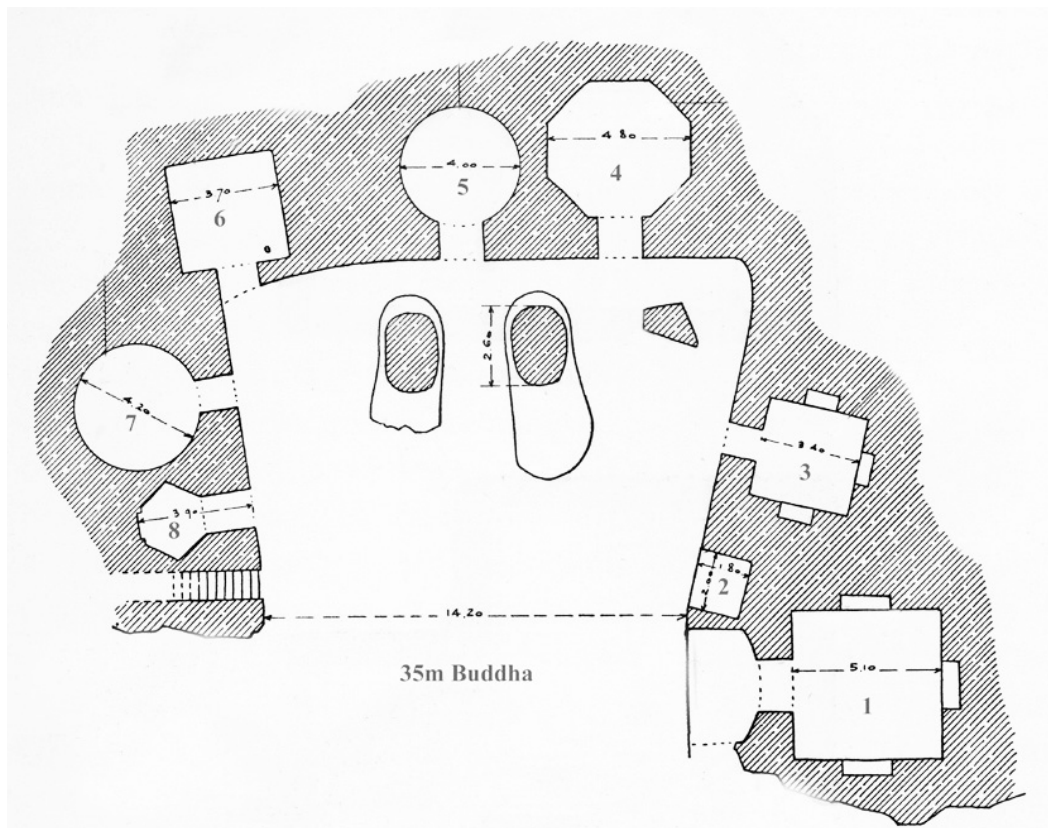


Fig. 3. Plan of larger Buddha showing feet carved and cave chapels around. P.J. Captain Maitland, A. Godard, Y. Godard, J. Hackin. Wikimedia Commons <https://commons.wikimedia.org/wiki/File:Buddha_cave_of_chapels.jpg>.

feet of Buddha figures (Public space) and for every family between caves, there is a correlation corridor. Summarily, a cave as minimum point is inside a huge volume of mountain area as maximum mass and complex of caves and paths shape a complexity and they are such a statistic points to observe a view (Tab. 2). It should be mentioned that due to long time war, this cultural heritage has not been restored and total structure is in natural way with some human intervention based on their need.

Case study of 'Sassi di Matera'

The 'Sassi di Matera' (Sassi Districts) is the surprising rupestrian old town of Matera, in southern Italy, spectacularly dug in a soft rock. The origins of Matera are very remote and evidence of this is the discovery in the surrounding area of some settlements without solution of continuity since the Paleolithic age. In fact, in the caves scattered along the ravines of Matera several objects dating back to that era have been found, testifying to the presence of groups of hunters. This rupestrian settlement is perched in the upper part of the right side of the 'Gravina di Matera', a canyon cutting the so called 'Murgia Materana', the barren rocky high in front of the town [Conte 2014, p. 123; Tropeano 2018] (figs. 4-5).

Architecture and cave function

The white calcareous limestone that covers the terrain of Sassi di Matera has a strong impact on the beauty and shape of the city. The cathedral of Madonna della Bruna rests on the high slope that divides the two *sassi* areas and a more typical Italian neighborhood with stone-paved pedestrian pathways lined with stores, restaurants, churches, and historic square [Conte 2014, pp. 218-219]; moreover, there are cave with diverse plans, ceilings and sections (regular and irregular) (fig. 6).

	Characteristic	Form
1	Neighboring	Dwelling part (Minimum inside Maximum)
		Near to worship place
		Vertical form neighboring (Statistic points toward view)/ Complexity/ horizontal ventilation
2	Terraced pattern/ View	
3	Access path (Branch form)	

Tab. 2. Setting of neighboring and branch pattern of paths among cave dwellings. Edited by A. Y. Jafari.

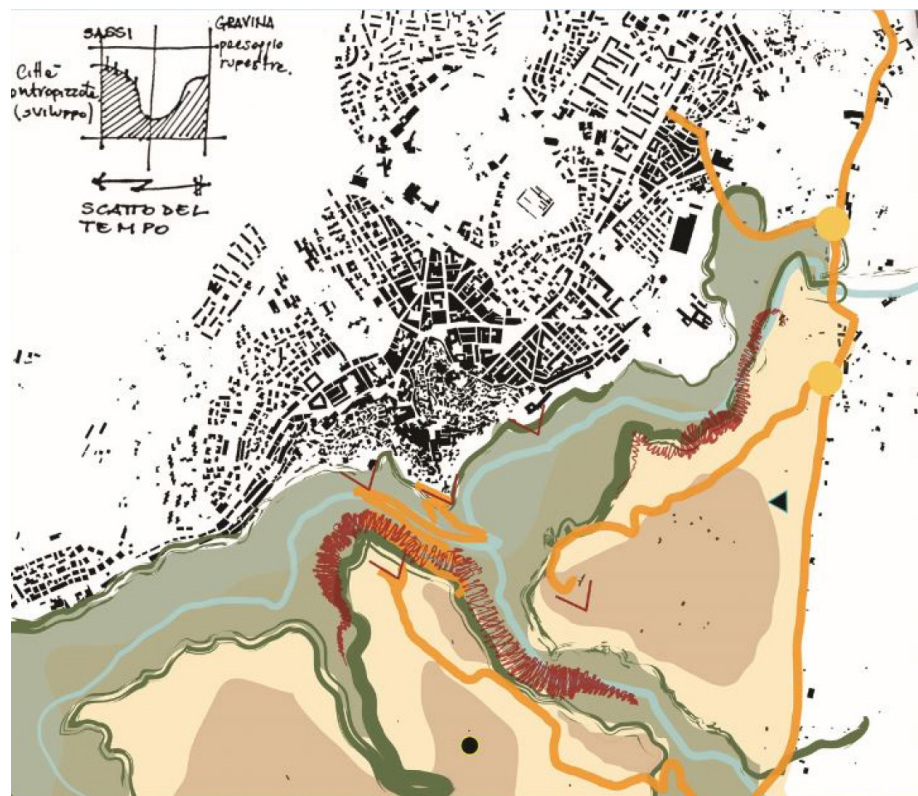


Fig. 4. Site plan and schematic section of Sassi. Conte 2014, p. 202. Courtesy A. Conte.

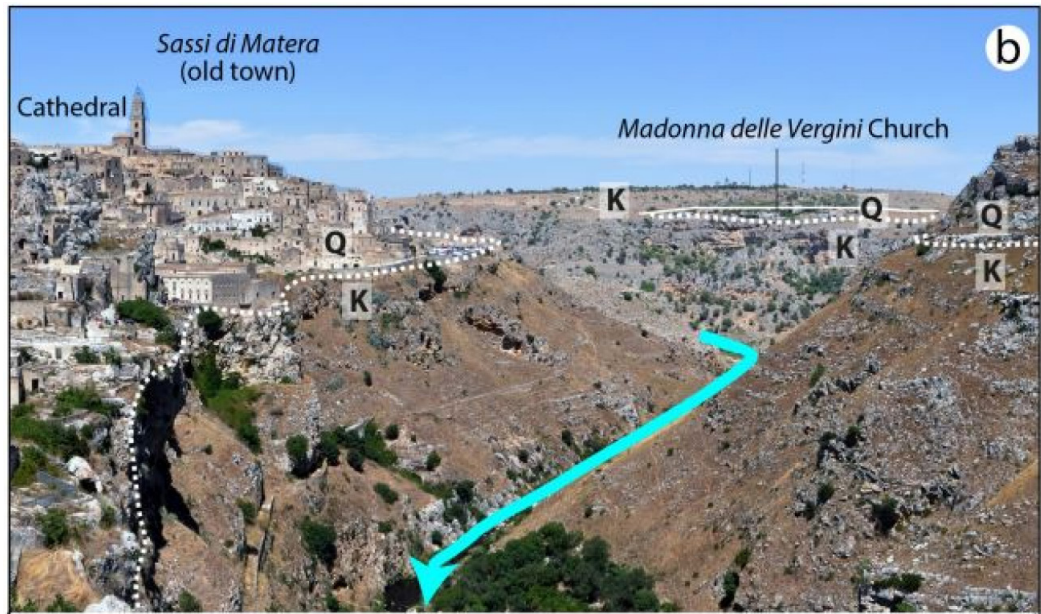


Fig. 5. Panoramic view of the canyon 'Gravina di Matera'. Geographically, left and right flank of a valley are defined in relation to the river flow direction. <<https://www.panoramio.com/photo/39789706>>.

The absence of right angles, the rejection of geometric precision makes the shift from wall to wall, from floor to ceiling all but invisible; as a result, what is viewed is a single plastic element, a continuous sculptural shape that virtually blurs up and down. The presence of buildings erected and dug into the rock, which extended farther on the cave entrance, become independent elements and realized the fundamental constructive cell, termed '*lamia*' or '*lamione*'. This one room structure, characterized by a considerable thickness bearing walls on the long sides, supporting the stone vaults [Guida 2008, p. 2]. The only source of illumination is the opening access. It has an internal arrangement area pretty like the cave, but it seems to be a 'constructed cave', not 'excavated cave'. The interaction between the rocky slope and the excavated cave has a significant impact on the design of the building. Its most common depiction is the '*lamione*' leaning against the slope, almost as an extension of the excavated buildings.

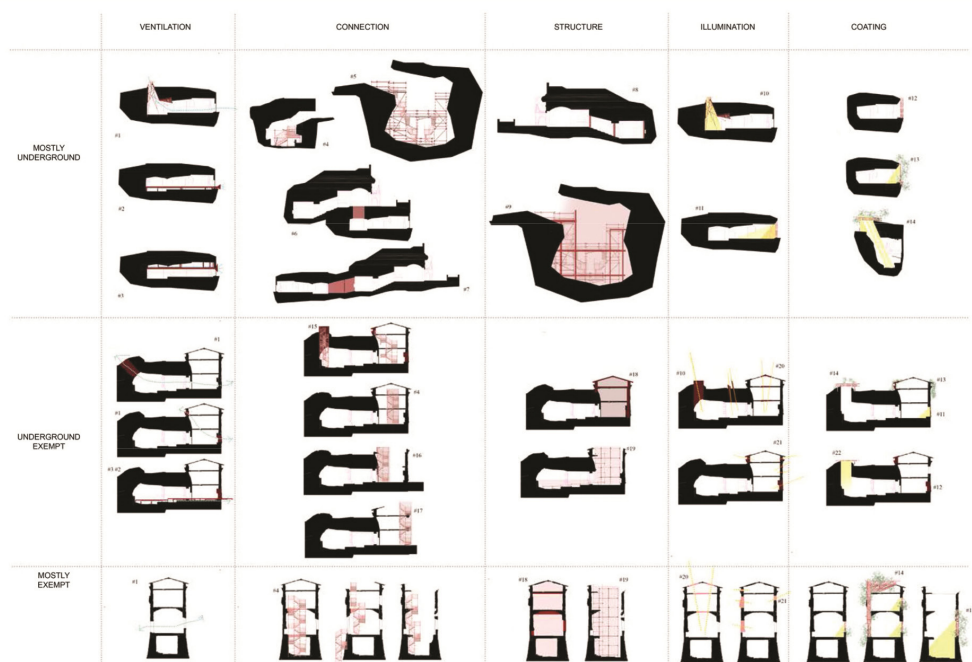
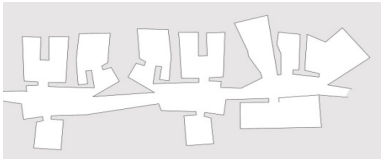

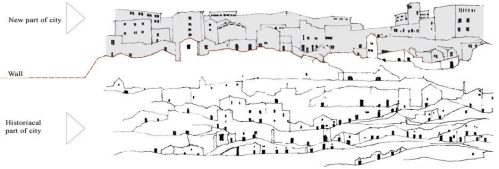
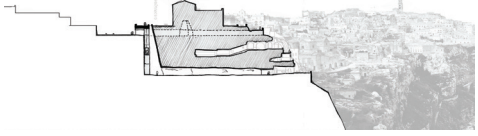



Fig. 6. Example of section of carved architecture. Conte 2014, p. 213. Courtesy A. Conte.

The physical-spatial structure

The *sassi* are spread throughout two different neighborhoods: Sasso Barisano and Sasso Caveoso, both of which descend towards the Gravina Gorge in a series of twisting, narrow alleyways and staircases. In other word, the sloped paths connect caves to each other and also they act as stand point to have panoramic view toward natural landscape and city. Furthermore, several caves have been gathered around an open space to define neighboring and complexes of them are set beside each other in horizontal way. Also, units connect with others through staircase. The paths act as a branch and terraced pattern [Conte 2014, pp. 228-229]. The opening such door and windows act as horizontal ventilation inside the caves. Summarily, a cave as minimum point (Void) is inside a huge volume of mountain area as maximum mass (Solid) and complex of caves and paths shape a complexity and they are such a statistic points to observe a view (Tab. 3). Based on previous restorations, paving, terraces and edge are well defined.

	Characteristic	Form	
1	Neighboring	Horizontal	
		Around public space	
		Vertical form neighboring (Statistic points toward view)/ horizontal ventilation	
2	Terraced pattern		
3	Access path (Branch form)		

Tab. 3. Setting of neighboring and branch pattern of paths among cave dwellings. Edited by A. Y. Jafari.

Element for the comparison between the two cases study

Based on the previous discussion the following table can be explained to understand similarity and difference (Tab. 4).

		Bamyan	Sassi	
1. Religion		Buddism	Christianity	
2. Material		Sandstone	Tuff	
3. Worship place		Around Buddha	Church	
4. Context		L-shaped Cliff	V-shaped Valley	
5. Architecture	Plan	Geometric	Geometric and non-Geometric	
	Condition	Non-Restorated	Restorated	
	Building	Dig into the rock	Erected and dig into the rock	
		One-storeyed	One-storeyed - Multi storey	
	Ceiling	Similarity	vaulted, domed and flat ceilings.	
		Different	Laternendecke	Sloping ceiling
Roof	Non-visible (Carved inside cliff)	1. Non-visible (Carved inside valley) 2. Visible: Sloping roof		
6. Neighboring	General	Three neighboring surrounding of three Buddhas	Two neighboring	
	In detail	Horizontal- Vertical	Horizontal-Vertical	
		Terraced	Terraced- Stair	
		Gathering around public space cannot be seen in dwelling part (Just around Buddhas). There are no Complex of gathered carved spaces spread in linear way in dwelling part	Gathering around public space can be seen mostly. Complex of gathered carved spaces spread in linear way in dwelling part	

Tab. 4. Difference and similarity. Edited by A. Y. Jafari.

Research trajectories on excavated architecture.

This research has ancient histories and reopens topics and themes of comparison thanks to the inclusion in the research group of a Ph.D. student of Afghan nationality with an established scientific basis about the 'excavated city'. We intend to set up and develop a path of knowledge through the drawing and design of forms and materials with a comparison and classification that characterizes the ways of inhabiting 'the excavation' in both the East and the West.

With the belief that "every form of knowledge and every cognitive act is always profoundly marked by the culture that generates them and within which these activities take place" [Conte 2014, p. 13], the research topic on the architecture of subtraction in the material that can be rock, tuff or beaten earth, starts from the recognition of the historical and cultural value of the heritage that characterizes the identities and the memory of the different places under study. Initial results show the presence of numerous elements of similarity, highlighted in the study and comparison diagrams, all sharing the theme of dwelling, finding refuge and protection in complex territories.

The historical and social reasons that generated the first settlements in the two case studies are, for Bamyan, the religious vocation linked to the cult of the great Buddhas embedded in the rock, while in Matera, the first rock settlements have very ancient origins and were born

as a refuge and place of rituals, as testified by the numerous frescoes that still today enrich the walls of the rock churches and the vast hypogea of Matera.

The environment, the geomorphology of the site and the climate, are factors that define and differentiate the type and forms of the architectural elements that characterize the different constructions by subtraction: small openings, reduced space width to ensure static sustainability, alternating voids and solids in both horizontal and vertical development.

The urban paths excavated in the Mediterranean area, represent one of the most ancient and archetypal ways of building spaces to inhabit places. "The ancient city of Matera was formed on the boundary between the calcarenitic rocks of the Murge plateau and the clayey hills of the Lucanian hinterland, along the 'karstic' fissure of the deep canyon crossed by the Gravina stream. In this complex geological rock system, man has found favorable conditions for his settlement" [Conte 2014, p. 13].

In Bamyán, excavated architecture with a predominantly sacred character and no relationship to water, is also located on the boundary between the rocky outcrop and the plain in which the city developed. The research aims to establish connections and elements of relationship and comparison between the parts and elements that characterize these complex and stratified urban conformations.

The study of the different techniques and ways of building to 'inhabit the earth' will be the subject of further investigation, starting, in the case of the city of Matera, from the consolidated experience of the manuals and codes of practice published in the 1990s and the texts on the history and construction of Afghan architecture (figs. 7-9).

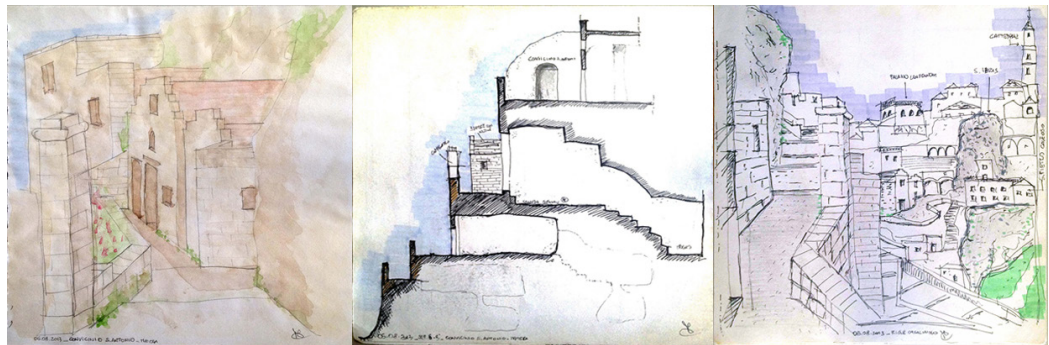


Fig. 7. Travel and knowledge sketch book of 'Sassi di Matera'. Graphic elaboration by M. Calia.

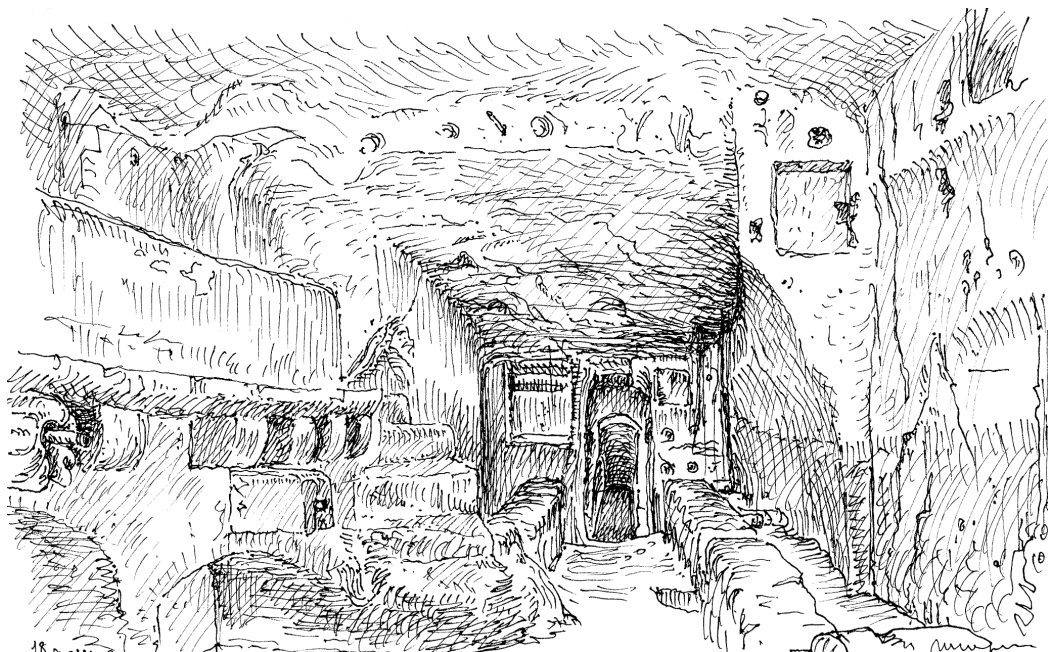


Fig. 8. M. Manganaro, Interior of an excavated dwelling in the 'Convicinio' of S. Antonio in the 'Sassi di Matera', 2006. Archive of Department DICEM, Matera. Courtesy of Antonio Conte.

Fig. 9. G. De Fiore, Drawing of landscape of excavated city of Matera from 'Sasso Caveoso', 2006. Archive of Department DICEM, Matera. Courtesy of Antonio Conte.



References

- Agamben, G. (1995). *Homo Sacer: Sovereign Power and Bare Life*. Stanford: Stanford University Press.
- Conte A. (2014). *La città scavata. Paesaggio di patrimoni tra tradizione e innovazione*. Rome: Gangemi.
- Earle A. (2006). *Home life in colonial days*. Mineola, NY: Courier Corporation.
- Ellis E. (2014). *China on the ground in Latin America: Challenges for the Chinese and impacts on the region*. New York: Palgrave Macmillan.
- Giuffrè A., Carocci C. (1997). *Codice di pratica per la sicurezza e la conservazione dei Sassi di Matera*. Matera: La Baitta.
- Godard A., Godard Y., Hackin J. (1928). *Les Antiquitésboudhiques de Bâmiyân*. Paris, Bruxelles: Van Oest.
- Guida A., Fatiguso F., Pagliuca A. (2008). Building envelopes performance qualities: the 'Sassi' of Matera (Italy). In *9th International Conference on NDT of Art. Conference proceedings. Jerusalem, Israel, 25-30 May 2008*, pp. 1-8.
- Higuchi T., Barnes G. (1995). Bamiyan: Buddhist Cave Temples in Afghanistan. In *Journal of Buddhist Archaeology*. Vol. 27, No. 2, pp. 282-302.
- Laureano, P. (2012). *Giardini di pietra. I sassi di Matera e la civiltà mediterranea*. Turin: Bollati Boringhieri.
- Mangeli M., Farshid A., Reza A., Fatemeh M. S. (2022). A New Look at Excavation Techniques and Design of Rock-Cut Architectures. In *Designs*, Vol. 6, No. 4, 64, pp. 1-23.
- Restucci A. (1998). *I Sassi. Manuale del recupero*. Milan: Electa.
- Rota L., (2011). *Matera storia di una città*. Matera: Giannatelli.
- Solomon J. (2014). Invoking the West: Giorgio Agamben's 'Romantic Ideology' and the Civilizational Transference. In *Concentric*, No. 40, pp. 126-147.
- Toubekisa G., Mayerb I., Doring-Williams M., et al. (2009). Preservation and management of the UNESCO World Heritage site of Bamiyan: Laser scan documentation and virtual reconstruction of the destroyed Buddha figures and the archaeological remains. In *XXII CIPA Symposium Proceedings*, Kyoto, Japan, 11-15 October 2009. CIPA.
- Tropeano M., et al. (2018). 'Sassi', the old town of Matera (southern Italy): first aid for geotourists in the 'European Capital of Culture 2019'. In *Journal of Alpine and Mediterranean Quaternary*, Vol. 31, No. 2, pp. 133-45.

Authors

Ali Yaser Jafari, Università degli Studi della Basilicata, aliyaserjafari@unibas.it
 Marianna Calia, Università degli Studi della Basilicata, marianna.calia@unibas.it

To cite this chapter: Jafari Yaser Ali, Calia Marianna (2023). Shapes and way of inhabiting the excavated architecture: knowledge and comparison of the cave dwellings in Bamiyan and Matera. In Cannella M., Garozzo A., Morena S. (eds.). *Transizioni. Atti del 44° Convegno Internazionale dei Docenti delle Discipline della Rappresentazione/Transitions. Proceedings of the 44th International Conference of Representation Disciplines Teachers*. Milano: FrancoAngeli, pp. 1517-1527.