

The stone as constant presence: vernacular structure of the cultural heritage of Porcuna (Andalusia, Spain)

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Topic: T1.3. Studies of traditional techniques and materials

Abstract

Human settlements, throughout history, have been characterised by the proximity of places of natural wealth, in order to perpetrate life and to strength their own anthropological and material culture. This is the case of Porcuna, a village in the province of Jaén (Andalusia, Spain), with more than sixty centuries of interrupted human presence. The main natural resource of the area is a deposit of sandstone used for three million years. The above-mentioned stone has been the constructive material in this territory for all the ages, marking not only its material culture but also its own social anthropology. Considering the durability of this material, it is possible to appreciate that its use has remained unvaried in spite of continuous changings concerning techniques or demands. The presentation deals with several cultural heritage buildings in Porcuna, carried out with the same local sandstone, from the Roman amphitheatre (I century b.C.) to the so-called Casa de la Piedra (XX century). Starting from this analysis, it is possible to observe that the same material has been used, over the years, in different cultural heritage buildings that have been affected by the same stone deteriorations. Basically, a single material has produced a vernacular culture conformed to different moments in the history of the village, allowing to preserve some relevant cultural heritage architectures.

Keywords: stone, cultural heritage, Porcuna, stone deteriorations.

1. Porcuna, stone and water

Porcuna is a municipality located in the province of Jaén (Andalusia, Spain). In spite of the fact that it is suffering a process of depopulation exacerbated in the inland villages, in ancient times it was one of the most important villages in the south of the Iberian Peninsula. Its location on a promontory and the geological structure of the subsoil have been the conditioning factors that have configured Porcuna as an urban nucleus with more than sixty centuries of uninterrupted presence in the same place.

Although being surrounded by an extensive and fertile countryside, that guaranteed a future in terms of agricultural production (especially wheat and oil), it was even more important to be

located on a sandstones soil of exceptional characteristics, as well as the existence of water levels between these strata. The above-mentioned characteristics allowed this village, with previous settlements of the copper and bronze age, to develop a settlement that has lasted until the present. The stone, therefore, has been the *fil rouge* of this millenary culture, representing the feature that has allowed Porcuna to have its archaeological and architectural heritage (Chapa et al., 2009).

The stone has been generating its own construction systems, organization strategies and even characteristic typologies. These features highlight how the derived heritage, over the years, has been the result of a concrete way of applying this material with specific limitations.



Fig. 1. Subsoil section of Porcuna, in which it is possible to observe the different stone strata alternated by soft betas. (Source: Belmondo, Millán, 2022).

Nowadays, the quarries are still open and the stone is still worked. In some of the cases reported, each historical era has been carrying out a concrete way of building, both technically and aesthetically.

At present, though it is still a natural resource of the territory, the incursion of new materials on the construction industry has blurred the vernacular image of Porcuna. However, the Porcuna sandstone still has a relevant presence in the main representative monuments and buildings. In the context of heritage enhancement, the current government team aims to recover the stone of Porcuna as the key element of the municipality. The promotional campaign “Porcuna, a paradise in stone” aims to underline that this material can generate a rich heritage and could represent a bet for the future.

This research wants to analyse the historical use of stone as building material as well as the different developed constructive typologies. For this purpose, a deductive methodology, based on

the patrimonial vestiges that still remain, has been carried out, showing how, finally, the construction processes have been conditioned by this local material. Consequently, the research has been structured in order to establish the common factors that have remained unchanged throughout history, from Roman ruins to the medieval and contemporary architectures.

2. Characterization of the Porcuna stone

Porcuna sandstone is a sedimentary rock widely used as a construction material (Cultrone et al., 2012) that, like all stone materials, can present alteration problems because of its formation in strata of different thickness and hardness. They vary depending on the composition, texture and environmental conditions (Charola, 2004). These rocks, due to their optimal characteristics as a construction material, have been widely used in the Andalusian architectural heritage and in particular in the area of the Jiennense countryside (Urosevic et al., 2011). The main

problems of alteration of these rocks consist in the formation of surface deposits (salts and black crusts) as well as biological colonization. Though deteriorations typologies have been specifically studied and some technical solutions have been found for their treatment, the primary problem of the soft strata sandblasting still remain.



Fig. 2. Detail of the quarry with the alternance of soft and hard layers. (Source: Belmondo, Millán, 2022).

The deterioration provoked by salts is one of the major degradation mechanisms affecting historic buildings (Rodríguez-Navarro and Doehne, 1999), especially when salts are highly soluble in water and are transported into the porosities of the rock. From the geological point of view, the *Piedra Dorada* (commonly called in geological contexts) is a fine-medium grained bioclastic calcareous sandstone, which belongs to the deposits of an age between the Upper Tortoconian and the Messinian of the Guadalquivir Basin (Postorogenic Neogenic Basins of the Betic Mountain Ranges; Roldán, 2011). On a macroscopic scale it is very hard to distinguish the different varieties. The colour varies from yellowish-orange to greenish-grey. It occurs in very continuous strata ranging between 10-20 cm thickness with interspersed centimetric loamy strata (Gisbert et al., 2017).

In the Porcuna area, the deposits are dated back to the Messinian age, and the stratification is composed by an initial interval of about 20 m thickness of a sandy, massive, partially cemented part, with abundant content in bioclasts, followed by a part of about 14 m composed by an alternation of cemented bioclastic sandstones between which

centimetric levels of grey-bluish loams are interspersed. This initial interval is followed by a part of about 6 m of rhythmic alternation of sandstones, blue-grey marls, grey-blue and white marls (Cárdenas et al., 2008).

This characterization of the Porcuna sandstone has been the cause of all the morphologies and constructive developments of the village. By alternating hard and soft strata, the constructive limitations have been overcome applying new techniques. It is worth to emphasize that, although everything is limited by the thickness of the hard strata, there have been constructions carried out with ashlar of large stone thicknesses. Because of such circumstance, these buildings have been damaged by relevant deteriorations no more solvable. It is also worth noting that, thanks to the geomorphological limitations described, Porcuna has an architecture and a stone constructive technique which are very specific and exclusive of this municipality.

3. The extraction of the Porcuna stone as the genesis of a vernacular process

The process of extraction of the stone is determined by the banks or deposits of stone from which the extraction is proceeding. As described above, there is an alternation of layers of different hardnesses. This is what defines the process by which the stone is obtained from the quarries of Porcuna. Though previously there were more places of extraction, due to the decrease of demand, today only three fronts of extraction remain.

The process by which the stone is extracted is still the traditional one dated back to centuries ago, by levers in the first place and then by mechanical processes when the stone block has been extracted. The first moment is the selection of the terrace on which the stone will be removed. Once selected and after delimiting the size, various steel wedges are nailed to the head of the piece and are gradually introduced into the soul of the stone. These wedges are

usually located on the soft board, so that quickly, once they are beaten, they break the hard-stone reef and the stone slab comes out. This system allows to extract large pieces but with minimum thicknesses as mentioned before. This extraction process generates numerous small pieces or wedges of stones that are used to settle the large slabs in the construction.

4. Stone construction systems

Considering all the limitations that the Porcuna stone has due to its geological formation, throughout history it has been used, overcoming those limits and generating different forms or

constructive systems. These systems have configured not only a way of building, but also a way of occupying the territory and a peculiar aspect for the future generations.

4.1. A *hueso* constructions and *emparejos*

The architecture made of this stone does not allow, in most cases, the use of mortars. It only allows the use of mortars or lime consolidants. Due to the properties of sandstone, if cement is used, it would cause relevant pathologies. When the cement enters the stone (considering that it is a very porous stone), it breaks its structure reducing its bearing capacity. Lime, on the other

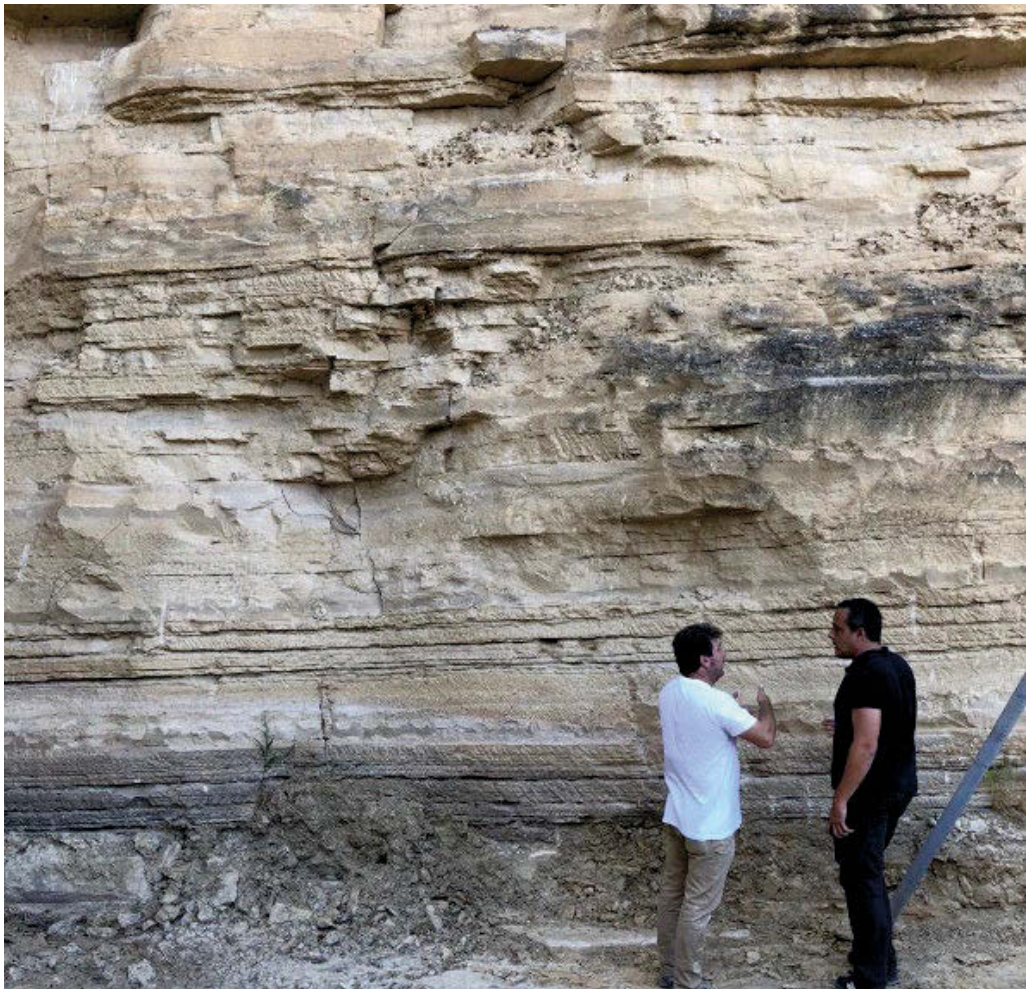


Fig. 3. Image of one of the historical quarries operating until recently. (Source: Belmondo, Millán, 2022).

hand, would be a natural hardener. However, the recommended and most used system in Porcuna, is the so-called *emparejados* system, that is, a system by which stone is used without mortars and is minted with small slabs of the same stone. This is the system known as *a hueso*.



Fig. 4. Detail of a wall in Porcuna without mortar (*a hueso* construction). (Source: Belmondo, Millán, 2022).

4.2. Partition walls of *losetas*

Due to the internal structure of each of these hard-stone strata, it is easy to extract pieces of large flat dimensions, with large slabs. These, throughout history, have been used as separations of rooms, as partitions of solid stone, arranged in the so-called position *de canto* (“sailor” courses), known in the municipality as partitions *de losetas*. Although the boundaries were not usually regular, master stonemasons used wooden wedge systems to adjust them. After this, with a

minimum amount of plaster, they managed to adjust them in a stable and safe way.



Fig. 5. Detail of a partition wall of *losetas* (blocks on “sailor” courses). (Source: Belmondo, Millán, 2022).

4.3. Load-bearing walls

Considering the small dimensions of thickness of each stone strata, the load-bearing walls used to be made of small volumes of stone but of great thickness. These load-bearing walls, although to the outside they showed an orderly configuration, the interior (known as the “soul” of the wall) was configured by small fragments and a minimum mortar that gave consistency to the wall.

All the residential constructions of the village have been built using this system. Once the structural enclosure of the house was delimited, all the interior separations would be carried out by means of the already described system of partitions with *losetas*.



Fig. 6. Test about the internal composition of the façade of the Royal Butchers (16th century) in Porcuna, during the restoration process. It is possible to observe that the façade is characterized by an orderly configuration, instead the “soul” of the wall is composed of filling material without any consistency. (Source: Millán, 2014).



Fig. 7. Detail of the process of extracting the stone from a load-bearing wall to analyse its internal composition. It is possible to observe that the wall is without mortar but just a mud poor in lime. (Source: Millán, 2014).

4.4. Unique elements

The Porcuna stone generates, fundamentally, two types of stones. A very hard and waterproof stone, called *viva* and a softer one called *arena*. The first one has been used for the development of all the unique and specific elements in the monumental constructions. Thanks to this double type of stone, a large part of the unique heritage elements remains intact. Likewise, this double nature of the stone allows to establish two directions in the construction: the massive elements, whose objective is to support the structure, and the more stereotomic elements, which require a better definition in the design.

4.5. Claddings

The structure of the stone allows to develop large flat pieces. These have been used to cover large facades. With this system, vernacular typologies of facades have been built, limited by the thickness of the stone. It is interesting to analyse how today they are still built in the same way as they were centuries ago. Being stone cladding, its layout and design have been preserved perfectly throughout history. For this type of surface typologies, various finishes have been configured, with different ways of working the stone.

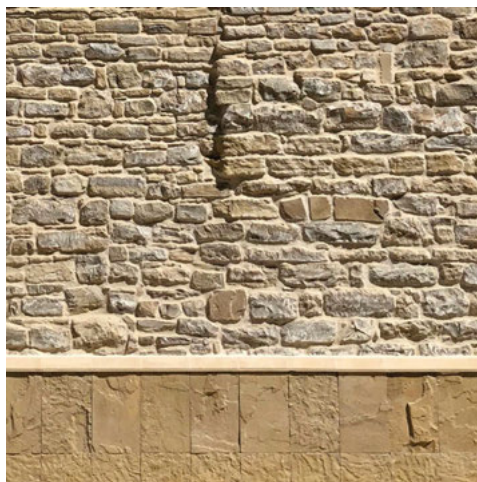


Fig. 8. Detail of a stone cladding in the lower part of the façade. (Source: Belmondo, Millán, 2022).

4.6. Constructions with *zamarrones*

The union of hard and soft strata is colloquially called *zamarrón*. This constructive element has a double nature so the rigid part remains unchanged over time while the soft part deteriorates rapidly. It is unique to see how, these stone blocks, when cut, have bearing capacity in all their dimensions, and it is over time when they lose it. This is the reason why many constructions in origin were developed with these blocks cut into large dimensions and have not stood the test of time. It is worth mentioning the example of the Parish of Ntra. Sra. de la Asunción, completed in 1885, according to the project of the architect Justino

Flores. This construction was carried out with *zamarrones*, and today this building shows relevant deteriorations due to the soft stone used in it.

4.7. Floorings

The Porcuna stone has generated numerous possibilities for the construction of other elements, such as pavements. Throughout history, there has been the use of large pieces for pavements in slabs as well as pavements in small pieces. All these have been executed with the stone called *viva*, since the so-called *arena* could not be suitable for this use.

In various archaeological campaigns, it has been possible to verify how the floorings have remained unchanged and the same technique is still used.

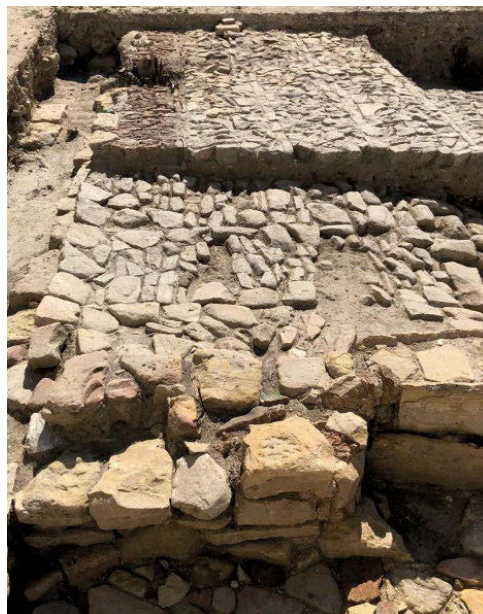


Fig. 9. Detail of the archaeological excavation in Porcuna in which the same types of pavements can be observed at different times. (Source: Millán, 2020).

5. Conclusions

The stone is what defines Porcuna and its territory from an architectural point of view. Today, it is possible to walk through each street

of Porcuna, observing its monuments, and notice different ways of working this material as well as its way of adapting to the changeable requirements.

The paper has explained some of the constructive systems applied starting from the knowledge of the characteristics of this stone. This material has allowed to develop a way of understanding the territory as well as a way of inhabiting. The vernacular architecture that has emerged from the Calcarene sandstone of Porcuna is a clear example of how, with a deep knowledge of the material, it is possible to transform something that could be limiting into an opportunity, taking it to highest levels of perfection.

The stone of Porcuna, due to its easy extraction system and physical properties, has always represented a concrete development for this municipality. Thanks to this today you can enjoy a rich archaeological and architectural heritage. Although these positive consequences, it is necessary to consider also the negative ones, represented by a series of pathologies still unresolved.

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