

## Gypsum outcrops in the Benestare village: a geological, architectural and anthropological treasure of the Locride area (South Calabria).

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multidisciplinary method that integrated geological, anthropological, mineralogical and architectural analyses (ALFIERI *et alii*, 2010).

### INTRODUCTION

Gypsum is a sulfate mineral composed of calcium sulfate dihydrate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). It is also known as evaporite mineral that forms as an anhydrite hydration product. Gypsum is a common mineral in the Messinian sedimentary sequences in association with Messinian sedimentary rocks.

In the Mediterranean area, the origin of gypsum deposit, is referred principally to the Messinian salinity crisis epoch (RUGGERI *et alii*, 1967) when evaporation, concentrated hypersaline seawater solution in the basin, forming huge thickness of evaporite deposits, that covered the seafloor (GAUTIER *et alii*, 1994).

In Italy the Messinian evaporite deposits, outcrops mainly in the north-central region of the Appennines belt, in Sicily, and in South Calabria, along the ionian coast.

According to CAVAZZA (1997) the Messinian depositional sequence, in south Calabria, is composed of basal marine-transitional pre-evaporitic unit overlay by a coarse-grained alluvial-fan conglomerates unit. The third and most recent unit is composed of thin, shallow-marine-to-continental progradational units that indicates the reestablishment of normal marine conditions at the end of the salinity crisis.

The main target of this study is the understanding of the cultural and environmental relevance of gypsum for the community of Benestare (small village sited in the Locride area in South Calabria) approaching our research by a

### THE BENESTARE GYPSUM

#### *Location and use of Benestare gypsum*

At north west of Benestare Messinian evaporite outcrops extensively on a strip of territory sites and border the eastern side of Monte Verraro. In Timpa and Pignataro localities the gypsum deposit present huge length and thickness and is interested by two open-pits (Fig. 1).

For decades, mining of gypsum fueled the development of the community and of the urban nucleus of Benestare. Modern and ancient buildings, small and large houses, are made of gypsum in this village. The villagers named “*vena*” the gypsum outcrops, due to the use of this evaporitic deposits.

In Benestare, mining of gypsum started in the second half of 1800 AD, initially using hand tools and later by modern mechanical equipments supplied by mining companies.

The use of modern technologies and the industrial approach quickly changed the landscape morphology of Benestare, in particular due to the rapid progress of outcrops excavation.

#### *Mineralogical characteristic*

Selenite is the most abundant mineral of gypsum that we found in Benestare outcrops. This type of mineral is generally found in various macrocrystalline species. It may be primary, generated by the crystallization of mother liquors, or secondary, generated by the deposition of supersaturated solutions into the cavities of rocks. During the growth phase, crystals share the same growth-plane and this lead the crystals to a particular gemination. Gypsum crystals that we sampled in Benestare present two species of germination called “*ferro di lancia*” the first (Fig. 2A) and “*coda di rondine*” the second (Fig. 2B).

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Fig 1- Benestare open-pits location in *Timpa* (a) site and *Pignataro* site (b)

#### *Gypsum deposits and depositional environment in Benestare*

Messinian Benestare gypsum were deposited in a continental environment when the seawater overflowed into a marginal basin and underwent to an intense evaporation becoming a supersaturated solutions in salt minerals. Due to the limited supply of fresh water from inland, the solutions rich in salts, crystallized in a lagoon bed giving rise to evaporate deposits. The cyclic repetition of this process lead to the formation of huge thickness gypsum deposits.

#### *Building constructive character of the Benestare village*

Traditional employ of gypsum in the building of Benestare most of all concerns a stonework technique called “*muratura formacea*”, created combining fired gypsum dust whit inert material and water. These combined elements were placed into a wood formwork creating a compact core. Already during Roman period this technique was known and used to made stonework in uncooked clay called “*opus caementicium*”.

Initially, in Benestare, gypsum was quarry manually in blocks from the mountains by the villagers.

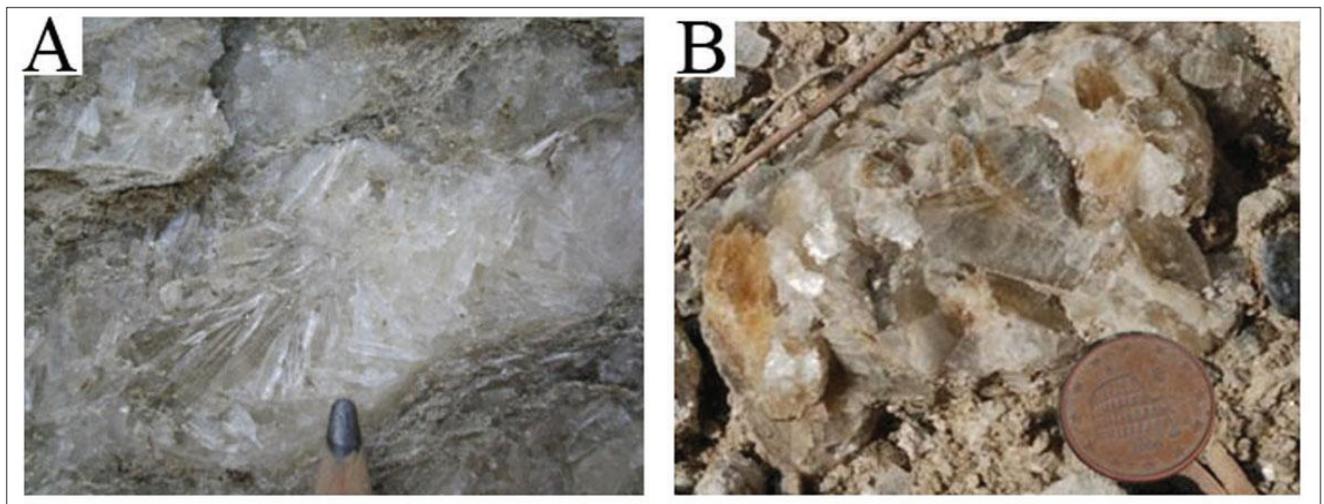


Fig 2 – “*ferro di lancia*” gemination (A); “*coda di rondine*” gemination (B)

After the extraction the blocks were carried into characteristics circular brickwork ovens called “*carcamuse*” (Fig. 3A). Here inside, the master builders of the village, named “*mastri jibbissari*”, disposed the blocks in perfect circular order, one upon the others, and cooked gypsum for many hours until it assumed a particularly white color shade. Only at this time gypsum was carried out from *carcamuse* and was ready for the building use.

The most part of the urban set of Benestare is characterized by simple buildings consisting of one or two floors plus a basement called “*basso*” used for storeroom, galley or stable (Fig. 3B).

Usually, the contiguous floors, were connected on the top using wood stairs or stairs built using a stone shell called “gooseneck”. The wheelbase between two floors was usually characterized by a wood floor plus canes lathing and gypsum mortar, that acted as fireproof material, between the different architectonic elements.

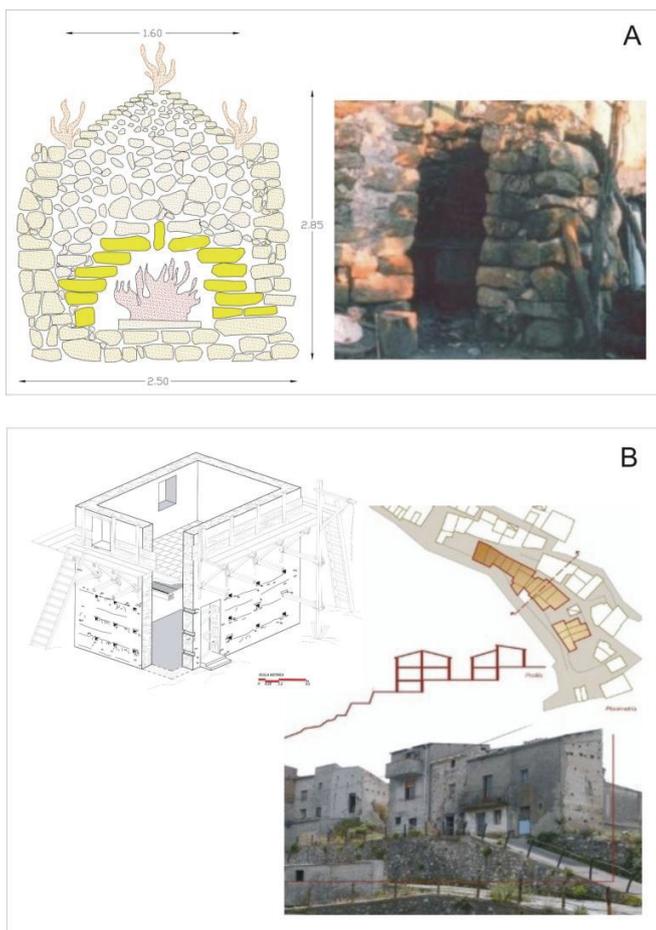


Fig 3 – *Carcamusa* ancient brickwork oven used to cook gypsum (A); example of building character of the Benestare village (B).

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