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Colmenar limestone as a resource for built heritage

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The Colmenar stone (or Colmenar limestone) has been used in the construction of significant builidings of the Central area of Spain, such as the Royal Palace of Aranjuez (16th -18th centuries) or the Royal Palace of Madrid (18th century). Nowadays this building stone is still widely used, both for new construction and restoration works, as well as for the indoor ornamentation of emblematic buildings such as the Royal Theater of Madrid (20th century). There are many quarries from where this stone was exploited, being the most prestigious ones those located in Colmenar de Oreja, at 50 km Southeast the city of Madrid. The high quality of the stone in these quarries, its whiteness and pureness, made this locality the most relevant in these stone′s extractive activities, concentrating the most relevant exploitations and providing the stone the denomination of the municipality (Colmenar). It was an underground mining extraction until the 20th century in order to reach the highest quality level of the mine, the so called “Banco Gordo” (Thick Bank).

Generically known as moorland limestone, this rock belongs to the fluvial-lacustrine carbonates of the Upper Miocene Unit of the Tertiary Madrid′s Basin. Its tonality mainly ranges from white to cream and even light grey. Under a petrographic point of view, this limestone is constituted by 40% of bioclasts (characea, ostracods and gasteropods), 20-30% of micritic matrix and 30-40% of sparitic cement. Therefore, it can be classified as a biomicrite/biosparite limestone or as a bioclastic packstone.

Some particularities of these limestones regarding their appearance are related to some karstic processes they underwent linked to some dissolution phenomena during the Pliocene. All of this resulted on an abundance of cavities with terra rossa fillings, a non-soluble clayey residue, iron enriched, which is the responsible for the reddish and pinkish color that the Colmenar stone sometimes shows.

These petrographic characteristics define the petrophysical properties that make this rock a high quality building material. Its bulk density is 2580 $\pm$ 30 kg/m3 and its anisotropy grade is low (dM 3.1%). Its open porosity (accessible to water) is 3.8%, its water absorption is 0.8% and the ultrasound propagation velocity (Vp) is 5941 $\pm$ 111 m/s. Regarding mechanical strength, compression and flexural resistances are 78 $\pm$ 34 MPa and 9.1 $\pm$ 3.1 MPa, respectively. Microporosity is significant in this stone, with an 80% of the pores (accessible to mercury) with a diameter ranging from 0.01 to 0.1 μm. The particularities of this stone pore system, with scarce capillar porosity, makes difficult the entry of water towards its interior. Therefore the material shows a good hydric behavior, with a high durability against frost-defrost processes and thermal shock cycles, as well to salt crystallisation phenomena.

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