



## **“Piedra Dorada”: a natural stone as an intrinsic part of two World Heritage Cities in Andalusia (Spain)**

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“Piedra Dorada” was used to construct some of the most important heritage buildings in the cities of Úbeda and Baeza, in Jaén (Spain). UNESCO declared these cities World Heritage Cities in 2003. Although there are some Iberian or Roman ruins in which is already possible to see the use of this stone, it is from the XVI century when “Piedra Dorada” is extensively used in the construction of the main historical buildings. Some of well-known monuments are Vázquez de Molina Palace or chain Palace (XVI), San Salvador Church (Sacred Chapel of El Salvador) (XVI) o the Royal Colegiata of Santa María la Mayor de los Reales Alcázares (XVI) in Úbeda or the Justice House-The House of the Corregidor (XVI), the Saint Cathedral of the Natividad de Nuestra Señora (XVI) or Jabalquinto Palace (XV), in Baeza, among many others. “Piedra Dorada” includes several varieties with similar mineralogical and chemical characteristics, called “Piedra Viva” or “Jabaluna”, more cemented and used mainly with structural purposes (ashlars, columns, etc) and “Piedra Franca”, less cemented and used mainly with decorative purposes (façades, statues, etc). From a geological point of view, “Piedra Dorada” is a medium to fine grain size bioclastic calcarenite, part of the upper Miocene-Pliocene deposits of the Guadalquivir Basin (Post Orogenic Neogene Basins of the Betic Chains). It is made up of quartz (8% to 29%), calcite and/or dolomite (34% to 80%), and some feldspar. The intergranular calcite cement proportion varies between 7% and 33%. Physical and mechanical properties are highly variable depending on the variety. “Piedra Viva” has an open porosity of 5,2%, bulk density of 2,63 g/cm<sup>3</sup>, water absorption at atmospheric pressure between 1,5-2,7 %, compressive strength (dry) between 20,1-18,0 MPa, flexural resistance (dry) between 87,3-77,0 MPa and salt crystallization loss of mass of 2,5%. “Piedra Franca” has an open porosity of 24,3%, bulk density of 2,00 g/cm<sup>3</sup>, water absorption at atmospheric pressure between 12,15-14,02 %, compressive strength (dry) between 1,4-1,6 MPa, flexural resistance (dry) between 8,5-9,8 MPa and salt crystallization loss of mass of 30,4%. The main observed deterioration in the buildings made up of this natural stone is salt crystallization due to the combined action between water infiltration from rain and the application of different mortars due to the overlapping of different phases of construction. Black crust and biological colonization are important decay agents too. “Piedra Dorada”, because of its relevance in the main buildings in the World Heritage Cities of Ubeda and Baeza and its optimal aesthetic characteristics and behaviour, can be considered as one of the most important natural stone in Andalusia. Its nomination as Global Heritage Stone Resource will help to preserve the material, both in quarries and in historical buildings, avoiding the extreme deterioration and the application of proper restoration when needed.

This is a contribution of the Spanish network CONSTRUROCK.