



## **Sierra Nevada serpentinites. An important element in the architectonic heritage of Granada (Spain).**

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Serpentinites are widely used in historic buildings in the whole world, from Ancient Greek or Egypt to more recent colonial buildings in the USA. Serpentinites from Sierra Nevada (S of Spain) have been traditionally used as ornamental elements in historic buildings of Granada city, both indoors and outdoors. The Cathedral, Carlos V Palace, Royal Chancery and some others are good examples of their use. Some other important cases can be found outside Granada, like El Escorial monastery, Las Salesas Reales convent, etc. . . all of them part of Madrid architectonic heritage. There are two quarries located in Sierra Nevada that supplied all the material to make the different elements in the cited buildings. In this work, a thorough characterization of the main serpentinites from Sierra Nevada, their uses, and their state of conservation in selected buildings from Granada has been performed. Samples from the main original quarry and from one historical building (Real Chancillería) have been analysed, determining the mineralogical and geochemical composition, texture, water parameters (absorption, porosity, density) and possible alteration by salt formation. It has been observed that the mineralogical and geochemical compositions are similar in both sets of samples, although the ones coming from the historical building show a highly advanced state of alteration. Regarding physical and mechanical parameters, samples from the quarry have very low water absorption values, while the porosity of serpentinites sampled from the Real Chancillería is comparatively much higher. We explain this difference as due to the weathering of the emplaced serpentinites by salt crystallization processes (mainly gypsum or epsomite), that generate strong internal pressures causing the disintegration of the whole natural stone. In addition, the increase of the porosity can be caused by dissolution processes related to the presence of acid solutions related to oxidation and hydrolysis of iron, chrome and nickel sulphides that were present in the original rock, and/or air pollution-derived SO<sub>2</sub>-attack. Knowing the condition of some of the serpentinite architectonic elements in Granada's historic buildings as well as the original quarry materials will help to face restoration in a more appropriate way than what has been done so far. Our work can be used as the base to establish future methods of remediation / conservation to prevent the deterioration of the serpentinite built heritage, but as well to recognize a natural stone that has been profusely used in the past in the construction of a magnificent heritage of an important city and historical quarries should be protected to provide original material if needed.

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