



Geomaterials and architecture of the medieval monuments of Sardinia (Italy): petrophysical investigations on their construction materials and documentation on the architectonic aspects using digital technologies

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The Sardinia Island is in the core area of the Mediterranean Sea. Its position has made it the crossing point of many cultural and political events, but at the same time its isolation has favoured the manifestation of specific and unique Cultural Heritage phenomena. The network of several medieval monuments (i.e. Romanesque churches) disseminated all around the island clearly shows how an architectural language can be declined according to site specific materials and specific artistical and practical choices, always preserving its original logic and grammar. On the bases of different architectural characteristics and petrophysical features of their lithology, a significant number of churches have been chosen from the different medieval geographical-political areas of the Sardinia named (at that time) “Giudicati”. Each of these churches were surveyed using the following methods: photography, 3D Laser Scanner for the whole interior and exterior parts (using a Leica HDS 6000 and a Cam/2 Faro Photon units), photogrammetry (using high resolution Nikon D700 and D800e) of a selected set of the extern surface of significant altered samples (aimed to the production of high quality and highly detailed 3D digital models), direct sampling of representative rocks and ancient mortars for geochemical and minero-petrographic analysis using optical polarized microscope, electronic microscopy (SEM), X-Ray fluorescence (XRF), X-Ray diffractometry (XRD). The physical-mechanical properties (real and bulk densities, open and closed porosity, water absorption and saturation, vapour permeability, flexion and compression strengths, etc.) of various geomaterials are determined with helium picnometry, microscopic image analysis, gas-permeability thermostatic chamber, oil-hydraulic press machine, Point Load Test (PLT), abrasimeter.

For each church, when there was the occasion, some specific case study has been developed, matching the information about the materials and the specific events connected to some Cultural Heritage element; this allowed to compare differences in recent substituted capitals, important reconstruction events, signs of the evolution of the building. All data were then treated and analysed to deepen the knowledge about the most meaningful aspects of different construction techniques and use of materials, provenance of raw materials, stone alterations and static-structure decay. As the result, a base was created to read common behaviours, design choices, recursive constructive solutions, and the “models” guiding the ancient intentions. A great effort has been made to keep together all these different kind of data, from the chemical and petrophysical information on the geomaterials to the geometrical description of the building, creating a robust relationship between the architectural and geological approach to the subject. The very specific photogrammetric survey of the stones sampled will be presented in details with a clear description of the applied processing and of the reached results. This contribution will present the progress state of this research, together with some widening about the most important churches between the investigated group, like: St. Saturnino in Cagliari (South Sardinia), St. Trinità of Saccargia (near Sassari, North), St. Antioco of Bisarcio in Ozieri (North-central), St. Giusta (near Oristano, central-Western).

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