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Investigating the Variable Durability of Malta's Lower Globigerina Limestone to Soluble-Salt Damage.

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The millenary use of Lower Globigerina Limestone (LGL) as a building stone in the Maltese Islands, and its export to other Mediterranean countries in the past, is confirmation of its validity. Notwithstanding the diminishing economic importance of this once principal resource of the local building industry, the ever growing need for conservation of Malta's rich patrimony of archaeological/historical buildings and structures built of this stone, emphasise the need for on-going research particularly that investigating its variable durability. The research under discussion here forms part of a wider research programme on the characterisation of this locally very important resource. In this investigation the durability of the LGL is considered in terms of two main climatic features, namely a temperate Mediterranean climate involving i) a salt-laden marine environment together with ii) relatively short spans of heavy precipitations alternating with longer periods of virtual drought.

It is virtually impossible to all but the quarry owners to identify 'good' from 'bad' quality stone simply through the visual observation, as LGL is a fine-grained, white to yellow, homogenous limestone. On the other hand, it is empirically known that LGL is a moderately weak limestone, characterized by the predominance of the mineral calcite (86 - 99%) and by a high total porosity (up to 40%) of which, over 85%, is microporosity below 5μm. In theory, these physical properties should render such stone-type particularly susceptible to deterioration involving a) mechanisms of capillary salt-laden moisture accumulation and movement together with, b) thermo-dynamic changes of soluble-salts during dissolution and crystallization cycles.

The adopted research methodology investigating durability being discussed here, , focuses on accelerated crystallization-damage test results vis-à-vis measureable micro-porosity variations and minute yet quantifiable fluctuations of the minor geochemical constituents of the stone. This is being achieved by systematic sampling and rigorous testing involving retrieved core and other samples extracted from several dimension-stone quarrying areas in Malta. Experimental analyses being carried out include Salt Crystallization, Acid Insoluble Residue, Helium Pycnometry, Mercury Intrusion Porosimetry and Micro-CT Imaging. These data will also lead to the detailed characterisation of the stone, within which programme the durability factor is being studied.

Down-column tabulations and plots of these test results should help establish correlations between the varying durability of LGL to salt-damage, its porosity and pore-size distribution and minor geochemical components.