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# Scaling on a limestone flooring

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Natural stone can be use on nearly every surface, inside and outside buildings, but decay is more commonly reported from the ones exposed to outdoor aggressively conditions. This study instead, is an example of limestone weathering of uncertain origin in the interior of a residential building.

The stone, used as flooring, started to exhibit loss of material in the form of scaling. These damages were observed before the building, localized in the South of Spain (Málaga), was inhabited. Moreover, according to the company the limestone satisfies the following European standards UNE-EN 1341: 2002, UNE-EN 1343: 2003; UNE-EN 12058: 2004 for floorings.

Under these circumstances the main objective of this study was to assess the causes of this phenomenon. For this reason the composition of the mortar was determined and the stone was characterized from a mineralogical and petrological point of view. The last material, which is a fossiliferous limestone from Egypt with natural fissure lines, is mainly composed of calcite, being quartz, kaolinite and apatite minor phases. Moreover, under different spectroscopic and microscopic techniques (FTIR, micro-Raman, SEM-EDX, etc) samples of the weathered, taken directly from the buildings, and unweathered limestone tiles were examined and a new mineralogical phase, trona, was identified at scaled areas which are connected with the natural veins of the stone. In fact, through BSE-mapping the presence of sodium has been detected in these veins.

This soluble sodium carbonate would was dissolved in the natural waters from which limestone was precipitated and would migrate with the ascendant capilar humidity and crystallized near the surface of the stone starting the scaling phenomenon which in historic masonry could be very damaging. Therefore, the weathering of the limestone would be related with the hygroscopic behaviour of this salt, but not with the constructive methods used. This makes the limestone unable to be used on restoration in spite of satisfying flooring European standards.