of actual conditions. Qualitative modelling approaches (for general considerations on qualitative modelling on the Earth Sciences see Pilkey and Pilkey-Jarvis 2007) that take into account the diverse factors are reviewed here. The diverse aspects of the design of built elements and field assessments of previous performances would be the best way to make predictions on the usability of a given material under a given scope of exposition conditions.

This review also aimed to update the existing knowledge in this field for future application in studies of the deterioration of building materials due to pollution. It is important to identify the pollution sources that actually affect a given building element, both to understand the decay processes and to plan the intervention procedures. Different tracers has been considered in order to attribute the damage on building materials to sources such as dry and wet deposition, groundwater or the same (or other) building materials, and to elucidate if damaging atmospheric pollutants are generated by distant industrial gaseous and particulate emissions or nearby sources. This is important as urban planning could contribute to prevent deterioration problems in buildings derived from different air pollution sources.

Atmospheric particulate materials, minor gaseous compounds and ions in solution can be used as tracers. The analysis of trace elements on some damaged materials has provided valuable information just in some cases. However, in the last years the use of some stable isotopes has been especially successful in geochemistry and atmospheric sciences, and we reported here the main achievements of its use in the matter of circulation of solutions, interaction with minerals and damage on building materials. Stable isotopes of some light elements such as C, O and S have been used to understand the diffusion on pollutants in air, solutions and decay of building materials. Although other stable isotopes of light elements have been studied (e.g. H, N), there is a great scarcity of data concerning building materials but it is proposed that these isotopes have a great potential for the fingerprinting of pollution sources. In this review were also proposed some radioactive isotopes that have been very useful in the study of pollutants cycles in air and water in other fields (e.g. deposition on sediments) and that might have promising applications in the study of the damage of building materials. In particular, tritium, radiocarbon and radioactive isotopes of heavy elements (e.g. U, Th and K) have potential application as tracers of pollution and damage on the building environment.

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