

# **THE STABILITY OF PYRITE IN CALCAREOUS AGGREGATE : INVESTIGATIONS IN OLD CONCRETE STRUCTURES**

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## **ABSTRACT**

The literature has reported some cases where iron sulfide-bearing aggregates have contributed to threaten the concrete durability. The Tournasian silicified limestone has been suspected to cause secondary expansive reaction in concrete as a consequence of the presence of pyrite. A chemical analysis was performed on samples from old concrete structures, sound or affected by alkali-silica reaction (ASR). The objective was to quantify the sulfide and the sulfate concentrations, expressed as a function of the aggregate and cement content respectively, and to examine if those amounts could be considered as consistent with the expected values for cement and limestone. No tendency for increasing in sulfate and decreasing in sulfide was observed: keeping in mind that the oxidation would have, for certain, created a depletion in sulfide on behalf of a higher sulfate concentration, it could be suggested that the stability of pyrite in the heart of concrete was clearly established.

A further systematic microscopical study, in backscattered electrons mode, has been performed on polished sections taken out from those concretes concerned by chemical analysis, as well as additional ones, to investigate not only the state of pyrite present in aggregates, but also to identify any indications, which could point out some pyrite deterioration.

The cubic and "framboïdal" pyrite microformations give neither evidence of morphological change, nor any modification of the S/Fe ratio that would have indicated chemical transformation. No trace of gypsum, ettringite, of other typical components resulting from pyrite weathering (ferrous and/or ferric sulfates, iron hydroxides) was detected. The SEM study confirms the diagnosis of chemical analysis, to know the resistance to oxidation of pyrite in aggregate when those are embedded in mortar protective matrix.