Trinity College
HARTFORD CONNECTICUT

Trinity Concrete Analysis

Sample from:
[redacted]
Manchester, CT 06042

Date: November 11, 2020 ID: MC018 A,B

Analyses performed by: Dr. Christoph Geiss and Dr. Jonathan Gourley of Trinity College's Environmental Science Program

The Trinity Concrete Analysis detects the presence of pyrrhotite through a thermo-magnetic measurement and quantifies the amount of sulfur through elemental chromatography. Pyrrhotite is an iron sulfide mineral that is believed to be responsible for the premature deterioration of concrete basement walls. The two tests combined can estimate pyrrhotite in a sample to as low as 0.5% pyrrhotite. Assuming all the sulfur in the concrete sample is bound in pyrrhotite, the concentration of pyrrhotite is approximately 2.5 times the value of the concentration of sulfur. Since pyrrhotite is unlikely the only sulfur mineral present, this value should be considered a maximum estimate of pyrrhotite concentration. As of this report's date there is no State or Federal standard for pyrrhotite concentrations in concrete. This test simply confirms the presence of the mineral pyrrhotite in the sample(s) provided, estimates the maximum concentration and compares it (them) to the results obtained from other similar samples. The test cannot predict what will happen to the concrete in the future.

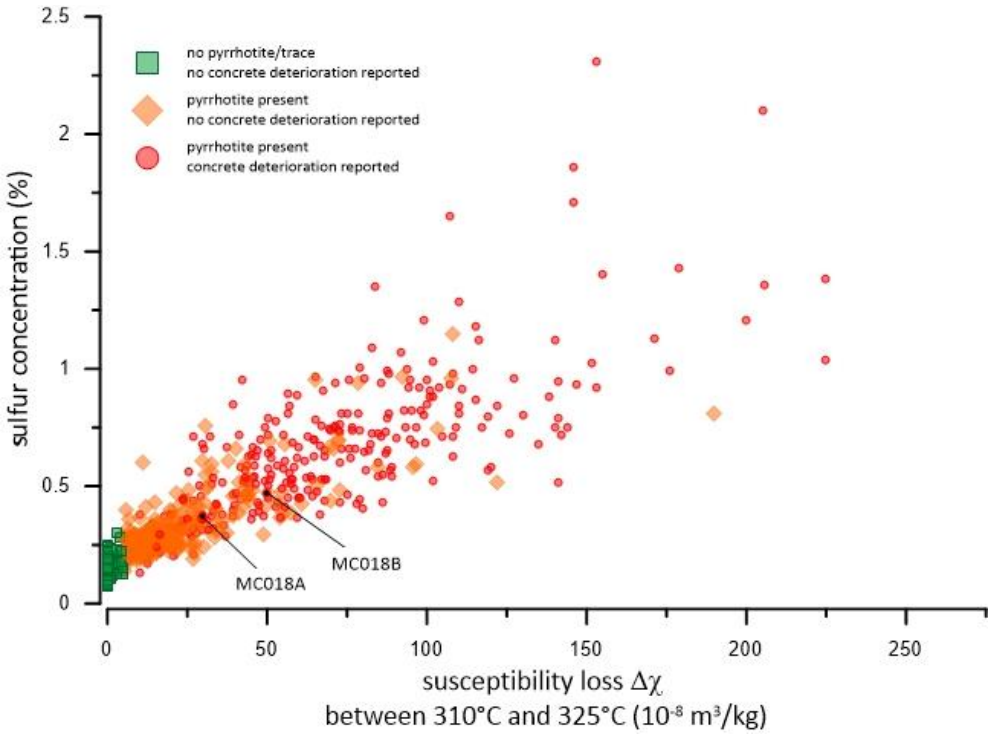
Results:

SAMPLE	Loss in Magnetic Susceptibility ($10^{-8}m^3/kg$)	Average concentration of Sulfur (%)	Estimated Pyrrhotite max concentration (%)
MC018A (E wall)	29.7	0.37	0.93
MC018B (N garage wall)	49.9	0.47	1.18

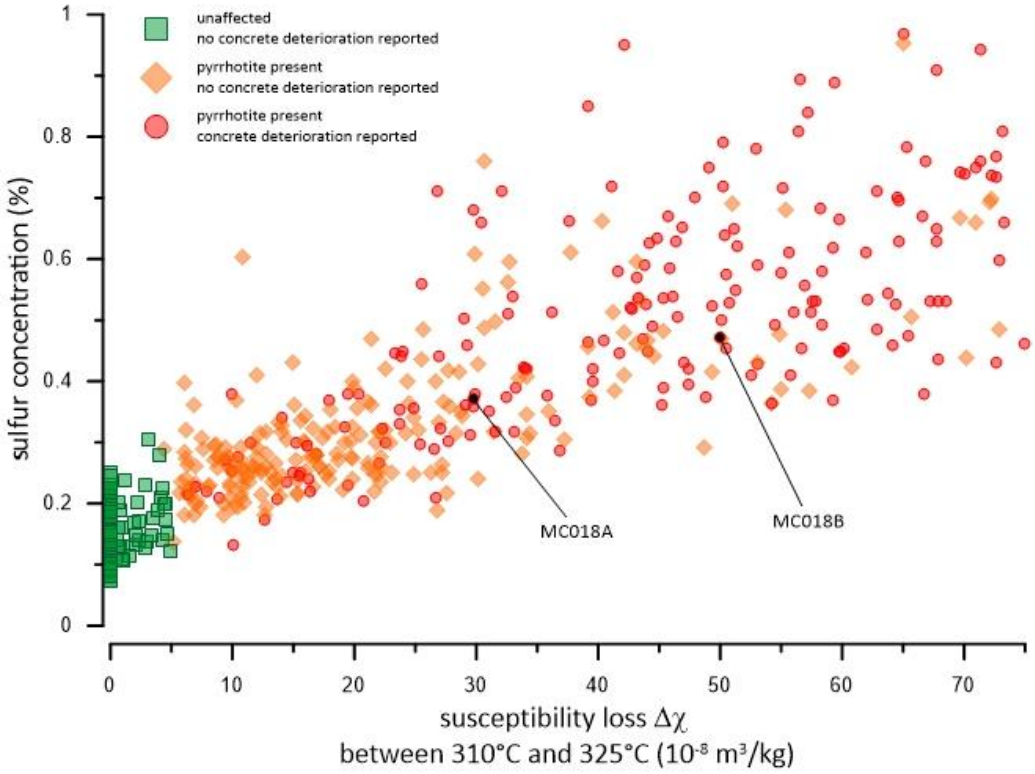
Pyrrhotite was detected in samples MC018A and MC018B.

Graphical comparison:
Samples were plotted (see reverse side) with similar concrete samples analyzed to date. The graph shows a relationship between the amount of pyrrhotite (as measured via magnetic susceptibility) on the horizontal axis and the concentration of sulfur on the vertical axis. There are other minerals that could contain sulfur in concrete and therefore samples that are clean of pyrrhotite still may show some minor sulfur concentrations (as seen in the range of sulfur concentrations for samples with no magnetic signal due to pyrrhotite).

[continued on reverse]



Samples MC018A and MC018B are classified as “pyrrhotite present, concrete deterioration reported” (red circles). We classify concrete as deteriorated due to pyrrhotite if map (spider) cracking is observed or reported on the date of coring. Map cracking was reported on the homeowner’s questionnaire (based on engineer’s initial visual inspection). To see the details of these results, a second graph is included below and covers a smaller range:



To date (11/11/20), 95% of pyrrhotite-positive concrete that we have tested, that have clear signs of detertioration due to pyrrhotite (i.e. map cracking, red dots on graph), have magnetic suceptibility values above 14 (10^{-8} m^3/kg). These values are plotted along the X-axis of the graphs. This value can change as we accumulate data (e.g. for most of 2020 we reported a value of 19 (10^{-8} m^3/kg)). For this home (MC018), map (spider) cracking was reported on the homeowner questionnaire. Values for magnetic suceptibility = 29.7 and 49.9 for the two cores. It is beyond the scope of this test to determine the future of deterioration (if any) for the concrete.

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