Radiochemical treatment of concrete samples from a nuclear reactor bioshield for ^{41}Ca AMS measurement at CNA Seville (Spain)

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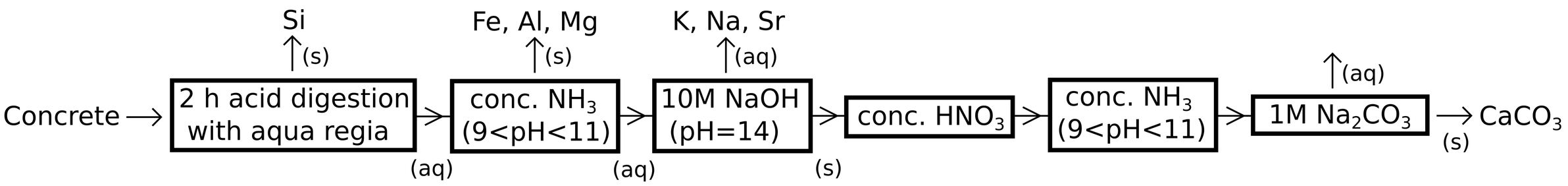
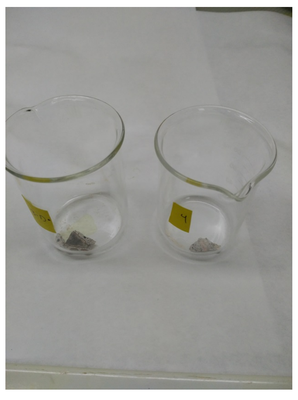
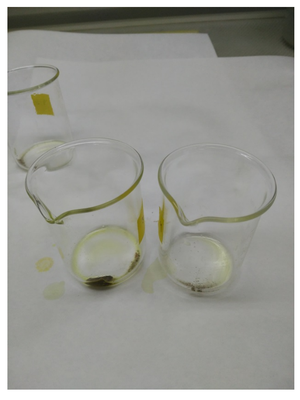
Calcium isolation from concrete samples

First part from chemical preparation is the isolation of calcium as calcium carbonate. The process is based on different pH precipitations in order to get rid of other main metal elements presents in concrete:



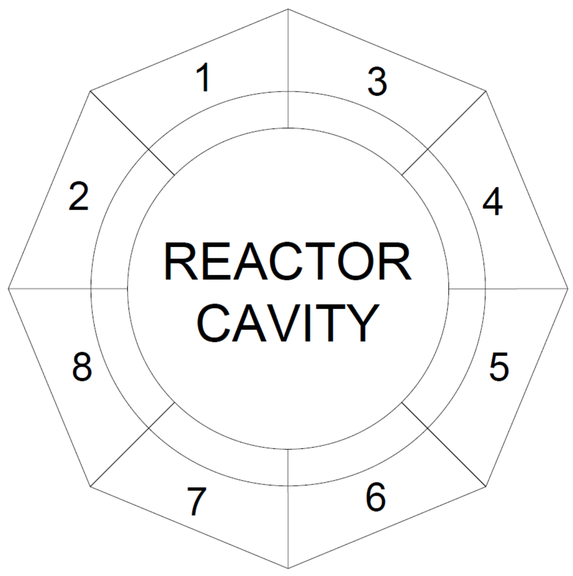



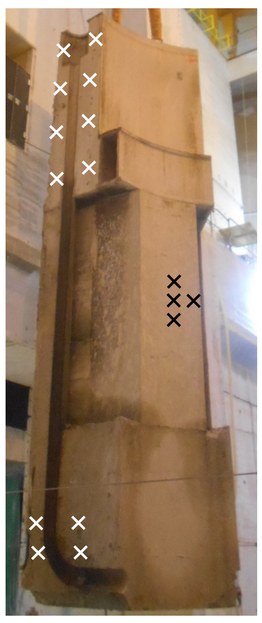

That carbonate precipitate is washed with Milli-Q water and, afterwards, with acetone, and dried $\sim$1 h at 70°C.
For final CaF_2: + HNO_3 $\rightarrow$ if expected $^{41}Ca/^{40}Ca$ ratio $> 10^{-8}$, + ^{41}Ca-free $CaCO_3$ $\rightarrow$ + HF $\rightarrow$ washed with Milli-Q water $\rightarrow$ dried overnight at 105°C.
Final fluoride samples is mixed with Ag in a CaF_2:Ag weight ratio of 1:4.
$(^{40}CaF_3)^-$ currents and $^{39}K/^{40}Ca$ ratios are equivalent to those from blanks and standards, even when ICP-MS measurements show that carbonate sample purity is typically 50-75 %.

The José Cabrera Nuclear Power Plant and extraction of the concrete samples

Picture from 'La Opinión de Murcia'

José Cabrera Power Plant
Location: Almonacid de Zorita (Guadalajara)
Operating years: 1969-2006
First nuclear plant in Spain
Reactor: 160 MW PWR, Westinghouse
Starting of decommissionning process: 2010
Vessel removal: 2015
Cutting up of the concrete shield: 2016
Extraction of the samples: ENRESA

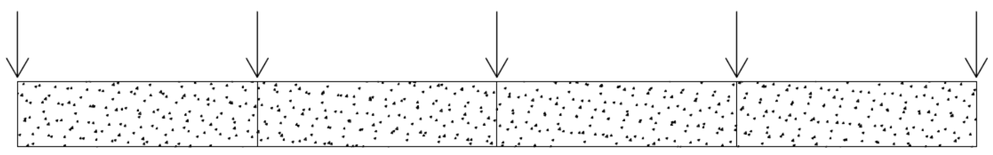




White: Lateral samples

Black: Drill cores

Drill cores samples (total length: $\sim$ 110 cm):



Performance example: block 3

We received several grams from each sample, but only used 100-500 mg.
Measurements on the 1 MV AMS system at CNA.