

https://dspace.org/

Deterioration Presentation

Ballim, Y

2012-01-30
http://hdl.handle.net/10539/11196

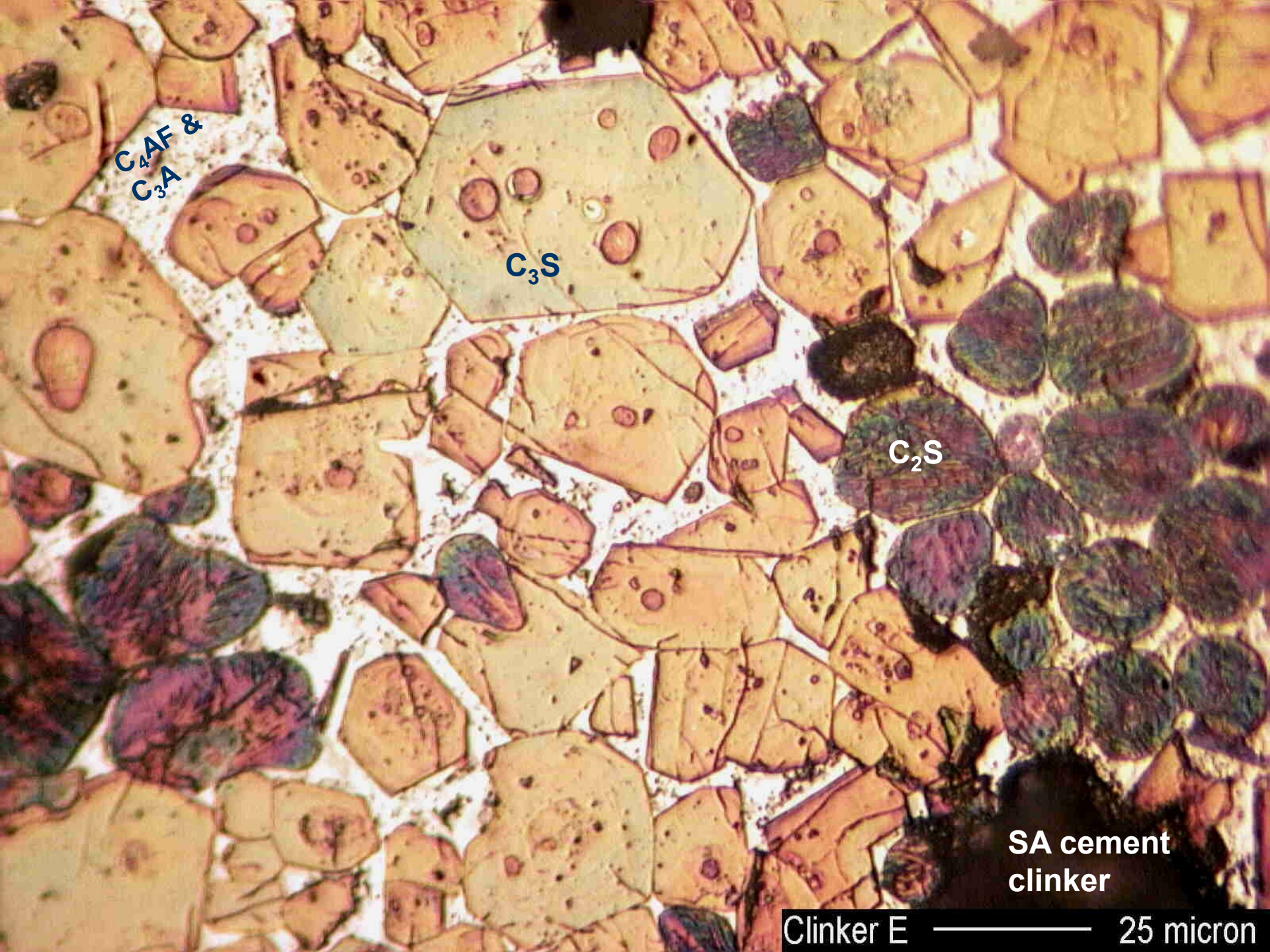
Downloaded from a DSpace repository. https://dspace.org/

ISSUES IN CONCRETE DURABILITY

Prof. Y. Ballim
School of Civil & Environmental Engineering
University of the Witwatersrand

Outline

- Durability and the Chemistry of Cement Hydration
- Forms of Deterioration
- Physical Properties of Concrete Affecting Durability
- Carbonation and Reinforcement Corrosion
- Chloride Ion Diffusion and Reinforcement Corrosion
- Rate of Corrosion of Reinforcing Steel

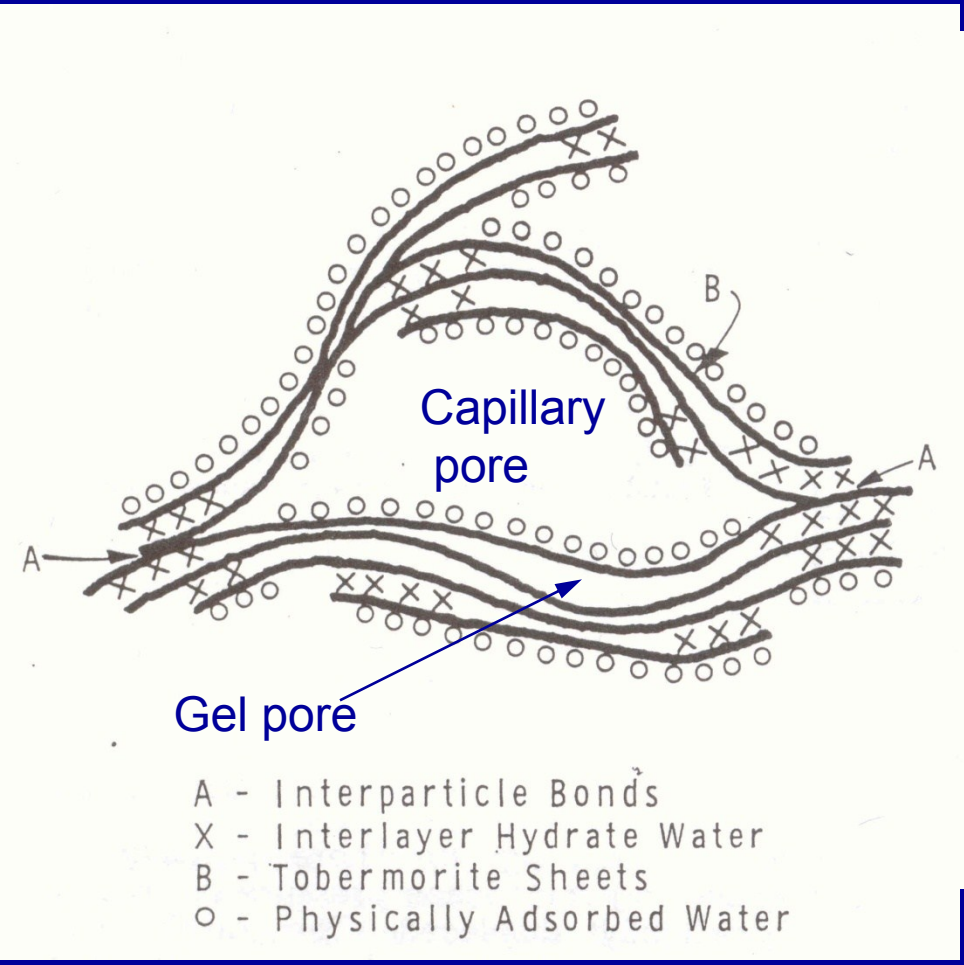

C_4AF &
C_3A
C_3S
C_2S
SA cement
clinker
Clinker E
25 micron

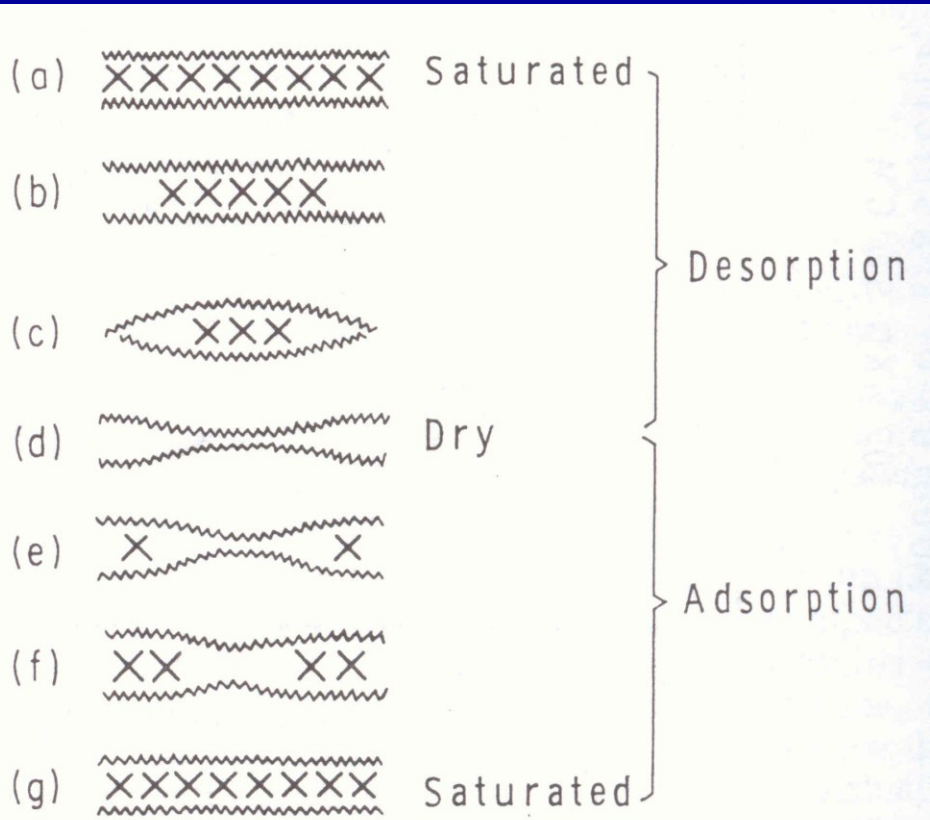
Cement Hydration

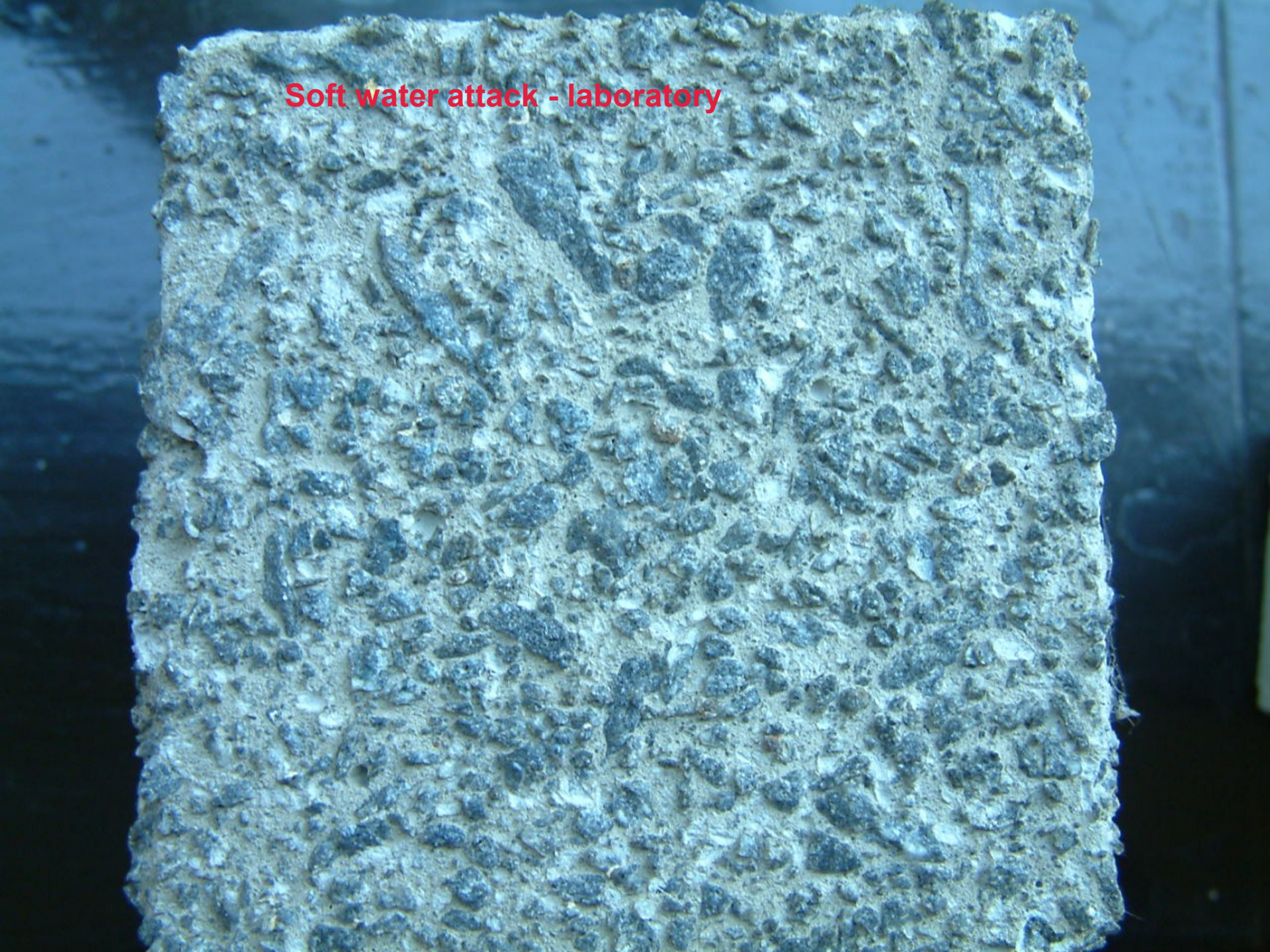
Cement + Water → CSH + Calcium Hydroxide

Calcium Hydroxide +
Alkali Metals (Sodium and Potassium Oxides)
gives concrete its characteristic high pH (~13,2)

Feldman & Sereeda Model





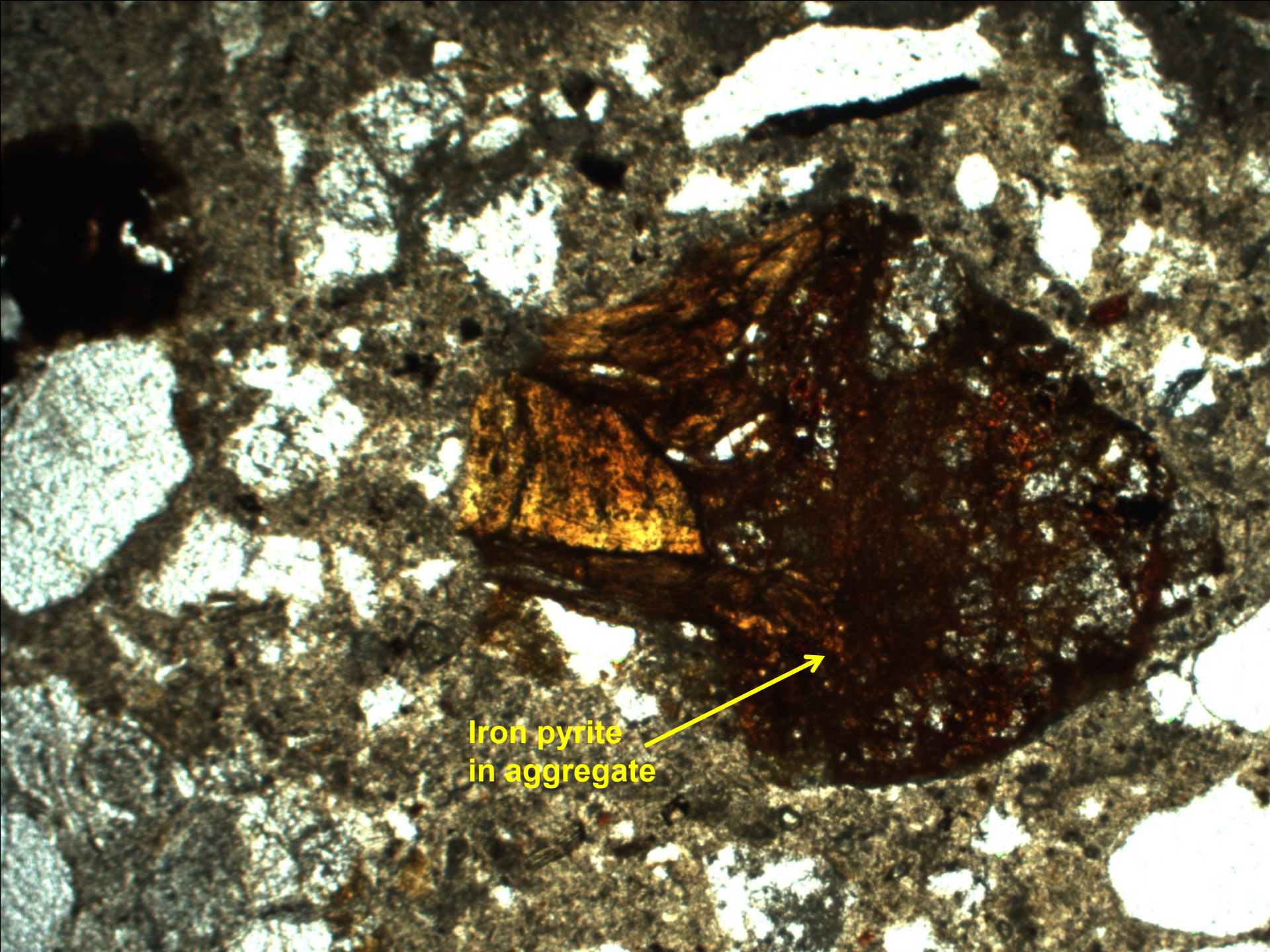

Soft water attack - laboratory

Soft water attack – in situ



Sulphate attack




Iron pyrite
in aggregate

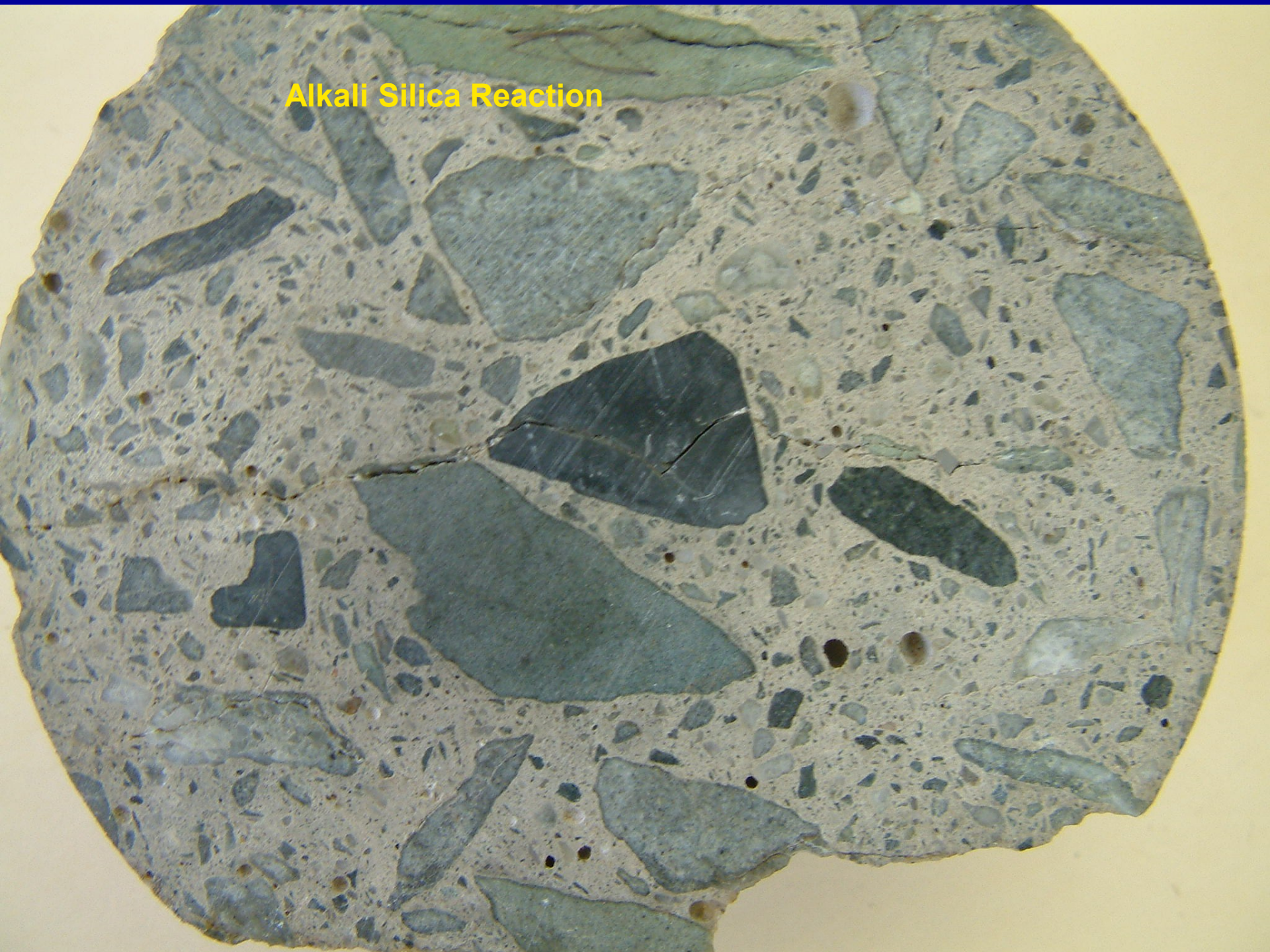
Effect of pyrite oxidation

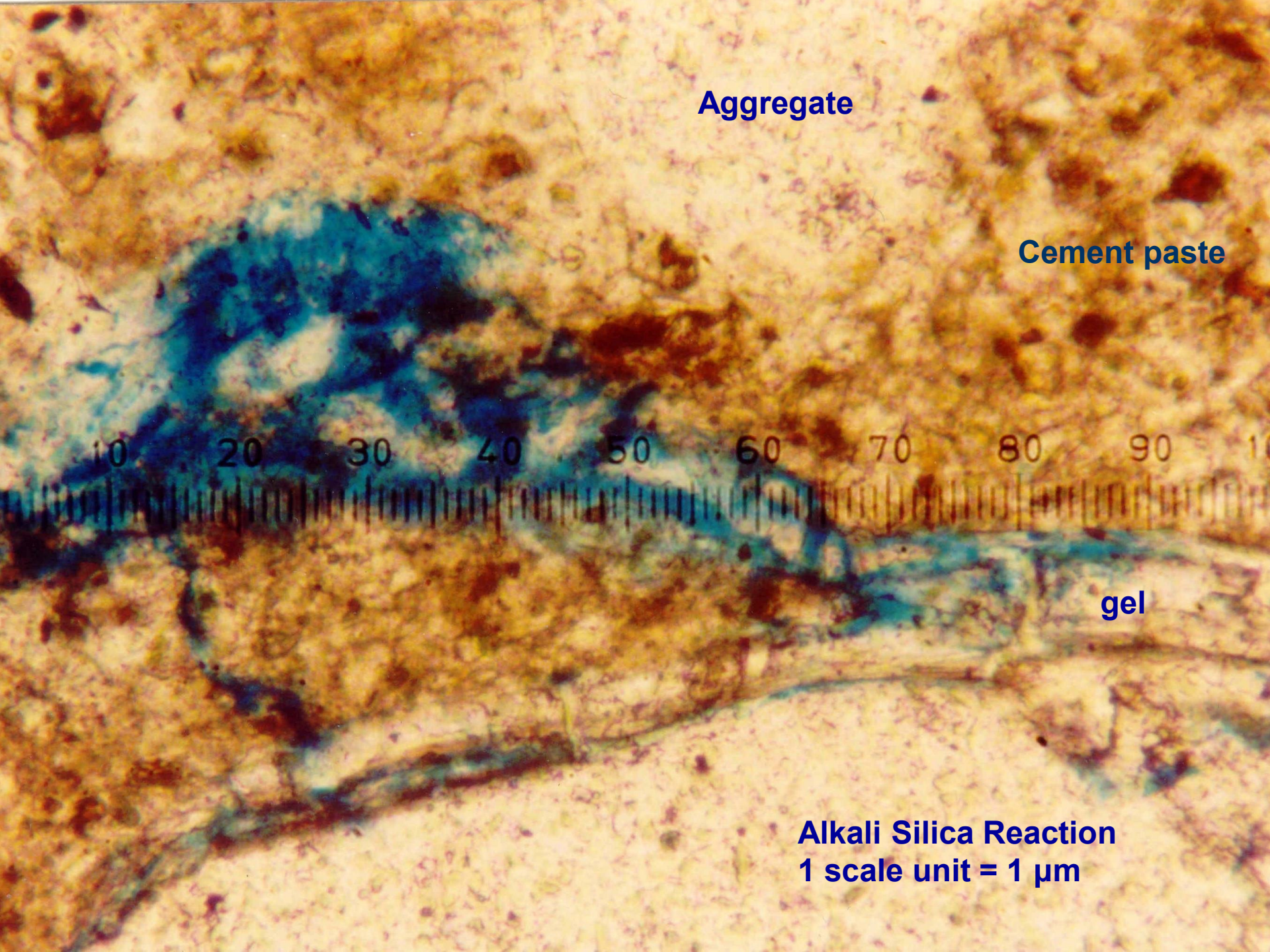



Acidity of rain water

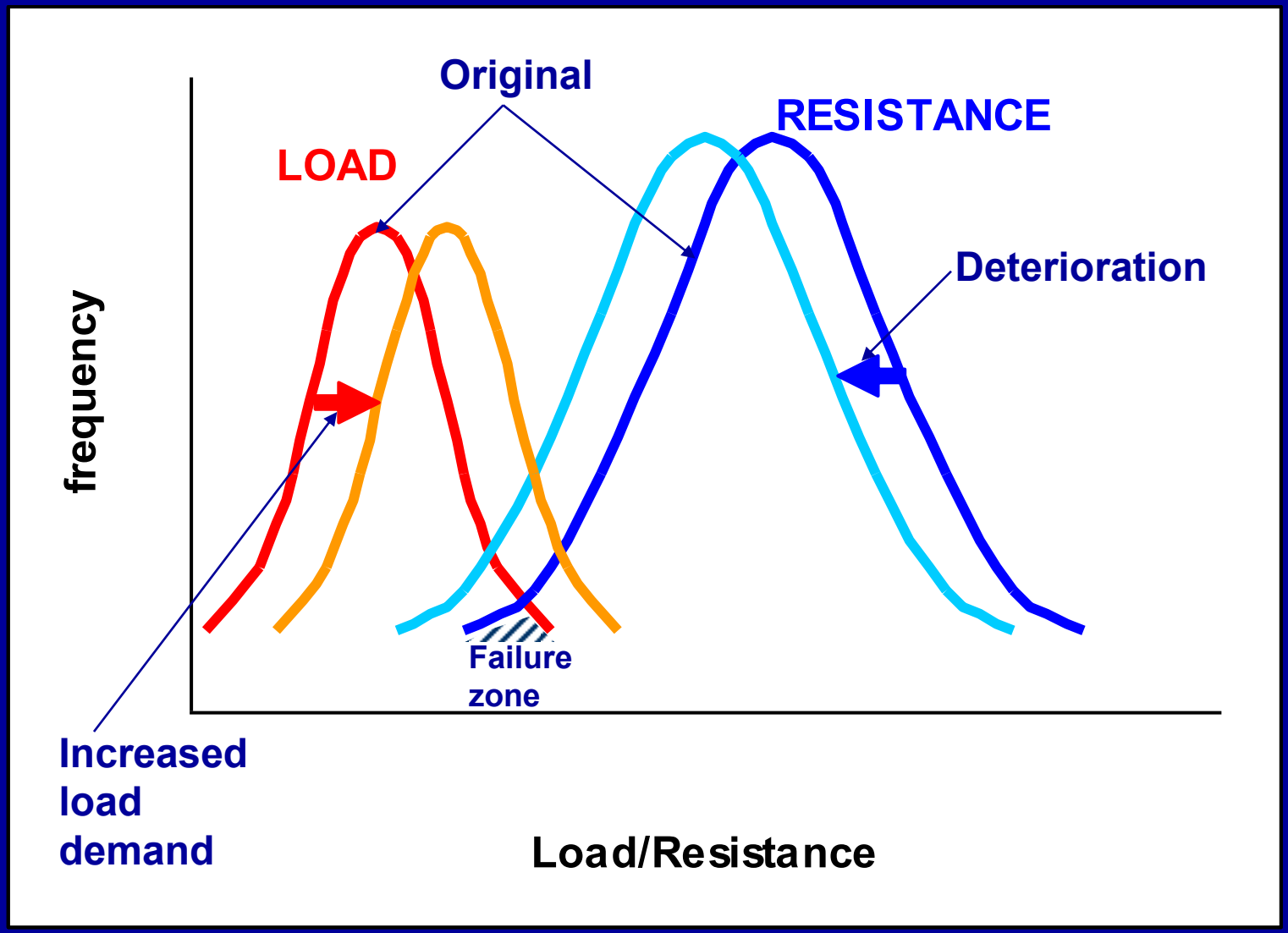

Alkali Silica Reaction


Alkali Silica Reaction
with soft water attack


Alkali Silica Reaction

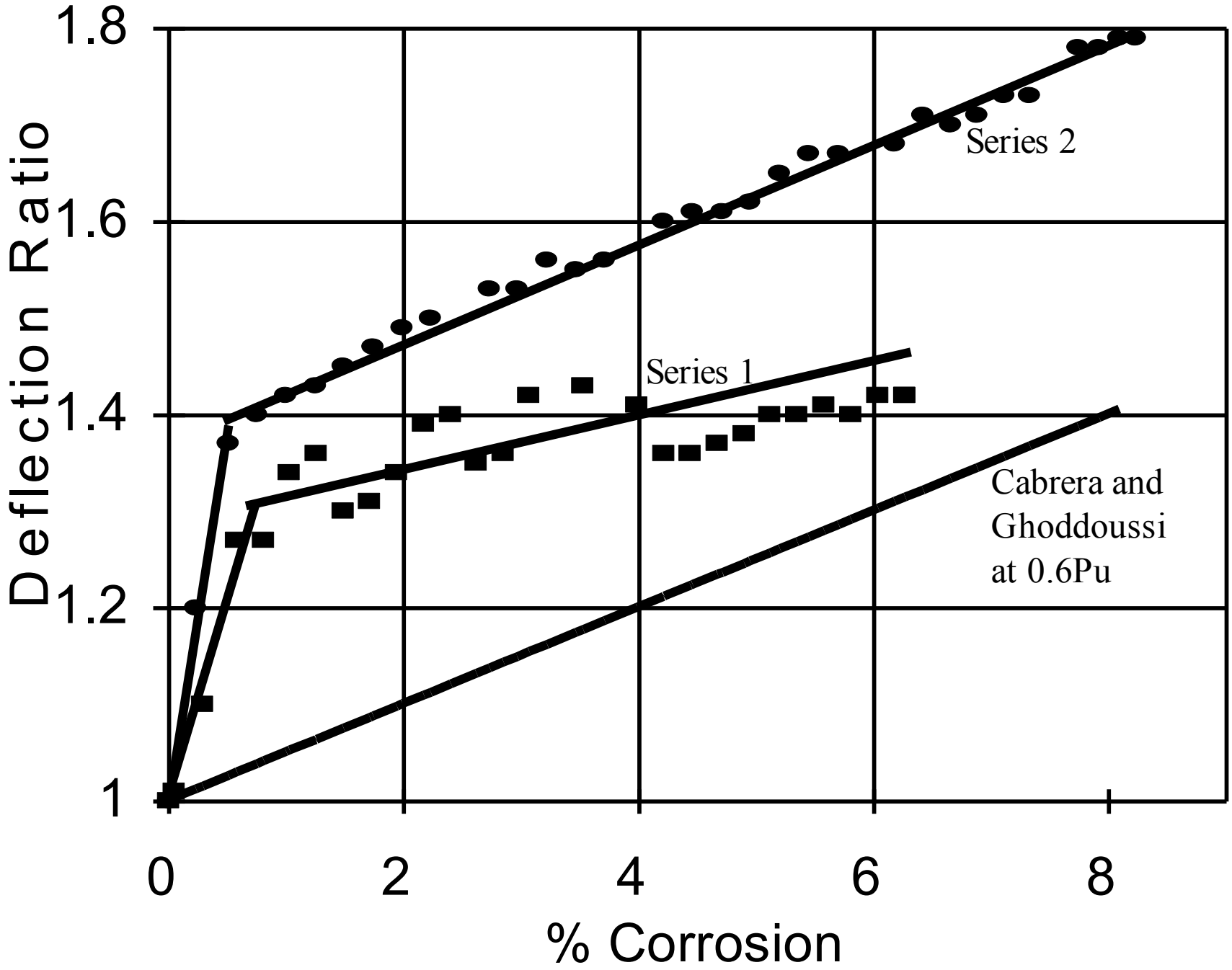

Aggregate
Cement paste
10
20
30
40
50
60
70
80
90
gel
Alkali Silica Reaction
1 scale unit = 1 µm

Probabilistic Approach

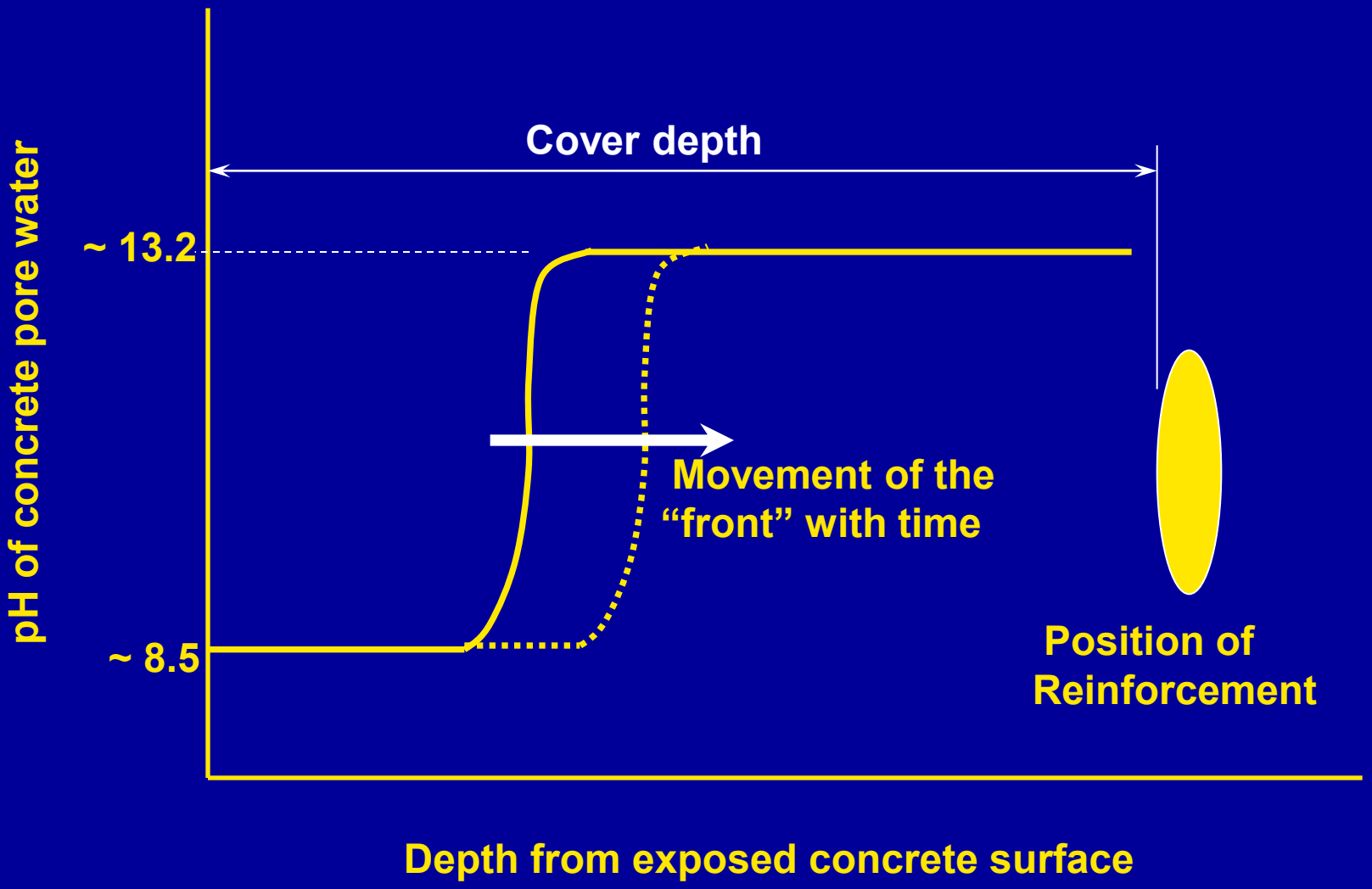


Physical properties affecting durability

- Fluid transport (“permeability”)
- w/c ratio
- Binder type
- Mixture design
- Compaction
- Curing


1.8
1.6
1.4
1.2
1
Deflection Ratio
0
2
4
6
8
% Corrosion
Series 2
Series 1
Cabrera and
Ghoddoussi
at 0.6Pu

THE CARBONATION "FRONT"



THE CORROSION PROCESS

