

Effects of Acid-S Soils on Building Materials

Orndorff et al. (2001, 2002) studied effects of disturbance of sulfidic materials by VDOT.....

Poorly
established
vegetation

Iron
staining



Stafford County, northern Virginia

Compiling a state-wide sulfide hazard map for Virginia: Tertiary marine sediments.



Chesterfield County: Proctor's Creek was redirected to this excavated channel during road construction.

Compiling a state-wide sulfide hazard map for Virginia: the Quantico Formation.



Iron-staining along curbs and sidewalks through the Hampton Oaks subdivision. Homeowners in this neighborhood apply the equivalent of 2 Mg agricultural lime per ha per month to maintain soil pH above 5.5.

Acid Attack on Concrete

- (1) Direct dissolution of cementitious materials due to their high solubility in acids,
- (2) formation and expansion of highly hydrated Ca-sulfates like ettringite under moderate to high pH,
- (3) formation and expansion of hydrated Ca-Si-sulfates like thaumasite, and
- (4) formation of complex Fe-hydroxy sulfates which may also infiltrate the concrete structure leading to significant swell and matrix shatter.

Mitigation of Direct Acid Attack on Concrete

- (1) through utilization of sulfate resistant concrete (e.g. Type V) to minimize direct sulfate hydroxy salt hydration effects and
- (2) via the use of appropriate coatings to limit acid dissolution of cement and infiltration of mixed cation-sulfate solutions.



**Compiling a state-wide sulfide hazard map for
Virginia: Devonian black shales.**



Inside the culvert at Clifton Forge.

Compiling a state-wide sulfide hazard map for Virginia: Devonian black shales.



Culvert beneath I-64 in Clifton Forge

Concrete Coatings

Various asphalt formulations,

Epoxy resins with fillers or glass fibers,

Plasticized PVC,

Polyester resins,

Multiple coats of linseed oil.

Acid-S Attack on Metal

Direct dissolution of metals at low pH.

Salt induced corrosion.



Compiling a state-wide sulfide hazard map for Virginia: Tertiary marine sediments.

Within 5 years, erosion has removed over 30 cm of sediment...



...and the guardrail is severely corroded.

Sulfate Minerals -- Expansive

Ettringite



Thaumasite



Expansive pyritic shales

Sulfides may convert to sulfate minerals that occupy several times more volume.

The forces exerted by this expansive crystal growth may result in heaving which affects overlying structures.

Heaving also may result in slope instability and landslides along roadcuts.

Expansive pyritic shales Big problem around Montreal, Canada!



A Canadian consumers group (ACQC) publishes this pamphlet to promote public awareness of expansive pyritic shales. According to this group about 10,000 houses in eastern Canada are thought to be affected by pyrite oxidation.



Cracks in basement floor due to sulfide/sulfate-induced shale heave.

Valley and Ridge: Devonian black shales.



Sulfate salts precipitated in rock fractures.

Copiapite (yellow) precipitated along the roadcut.

