

IDENTIFYING SULFIDIC MATERIALS AND ACID SULFATE SOILS

Soil color is usually a good indicator of the presence of sulfidic materials. Expect a potential acid-sulfate problem if the soil materials have a chroma of 1 or less, and a color value of 4 or less when moist (Munsell color notation). If the soil is mottled and the matrix has these color properties, then sulfides may be present.

To determine if sulfidic materials are present:

1. Take freshly excavated material with a pH of 3.5 or higher.
2. Incubate a layer of material 1 cm thick under moist aerobic conditions (field capacity), at room temperature for 8 weeks. Drying and remoistening is acceptable during the incubation, but it should not remain dry for long periods.
3. Check pH after 8 weeks of incubation. Take pH measurements 1: 1 in water or the minimum amount of water to permit pH measurement.
4. Sulfidic materials are present if there is a drop in pH of 0.5 units or more to a pH of 4.0 or less.

"Sulfidic materials accumulate as a soil or sediment which is permanently saturated, generally with brackish water. The sulfates in the water are biologically reduced to sulfides as the materials accumulate. Sulfidic materials most commonly accumulate in coastal marshes near the mouths of rivers that carry noncalcareous sediments, but they may occur in freshwater marshes if there is sulfur in the water. Upland sulfidic material may have accumulated in a similar manner in the geologic past.

If a soil containing sulfidic materials is drained, or if sulfidic materials are otherwise exposed to aerobic conditions, the sulfides oxidize and form sulfuric acid. The pH value, which normally is near neutrality before drainage or exposure, may drop below 3. The acid may induce formation of iron and aluminum sulfates. The iron sulfate, jarosite, may segregate to form the yellow mottles that commonly characterize a sulfuric horizon. The transition from sulfidic materials to a sulfuric horizon normally requires very few years and may occur within a few weeks. A sample of sulfidic materials, if air-dried slowly in shade for about 2 months with occasional remoistening, becomes extremely acid." Source: Keys to Soil Taxonomy. 1998. USDA Natural Resources Conservation Service, 8th edition.

Color is also used to identify jarosite. Jarosite has hue of 2.5Y or yellower, and normally has chroma of 6 or more. Jarosite is an indicator of past or current, highly acidic conditions in soils since it does not form above a pH of 3.5 or 4. Jarosite forms only at low pH, but it remains stable in oxidized conditions even after the acid sulfate weathering has ceased, and the soil pH stabilized at about 4.5 or higher. Therefore, jarosite is not necessarily an indicator of current, severely acidic conditions.

Conventional soil tests indicating high levels of sulfate salts ($> = 0.05$ % water soluble sulfate) or high total sulfur (more than about 0.3 % S) in conjunction with low chroma soil colors, should warrant concern and further analysis (i.e. 8 week incubation). One problem with relying entirely upon total sulfur in the soil is that this test cannot account for the soil's ability to buffer the acid produced. This would overestimate the potential acidity of sulfur bearing materials in some cases.