Bio Sheen Fact Sheet

What are bio sheens?

USGS website: "Slimes, oil-like films, and rock coatings are often made by bacteria that are reacting to the presence of iron and manganese in the water. Bacteria live on the water surface, in the water column, in the sediment, and at the sediment-water interface. Certain bacteria, the oxidizers, fix oxygen onto iron and manganese. Other bacteria, the reducers, remove the oxygen."

Linda Grashoff's website**:** "*Leptothrix discophora* is a bacterium that uses iron the way we use oxygen. Some people describe this process as "breathing iron." *L. discophora* embeds itself in an iridescent film of its own making. The film is visible to the naked eye and often looks like an oil slick. The bacterium itself is too small to be seen except under a microscope. Other species of iron bacteria, also too small to be seen by the naked eye, can be detected by their products, called "flocculates," or "flocs" for short. Flocs have a variety of textures, depending on the bacteria producing them, but most have the color of rusted iron and are, in fact, iron oxide."

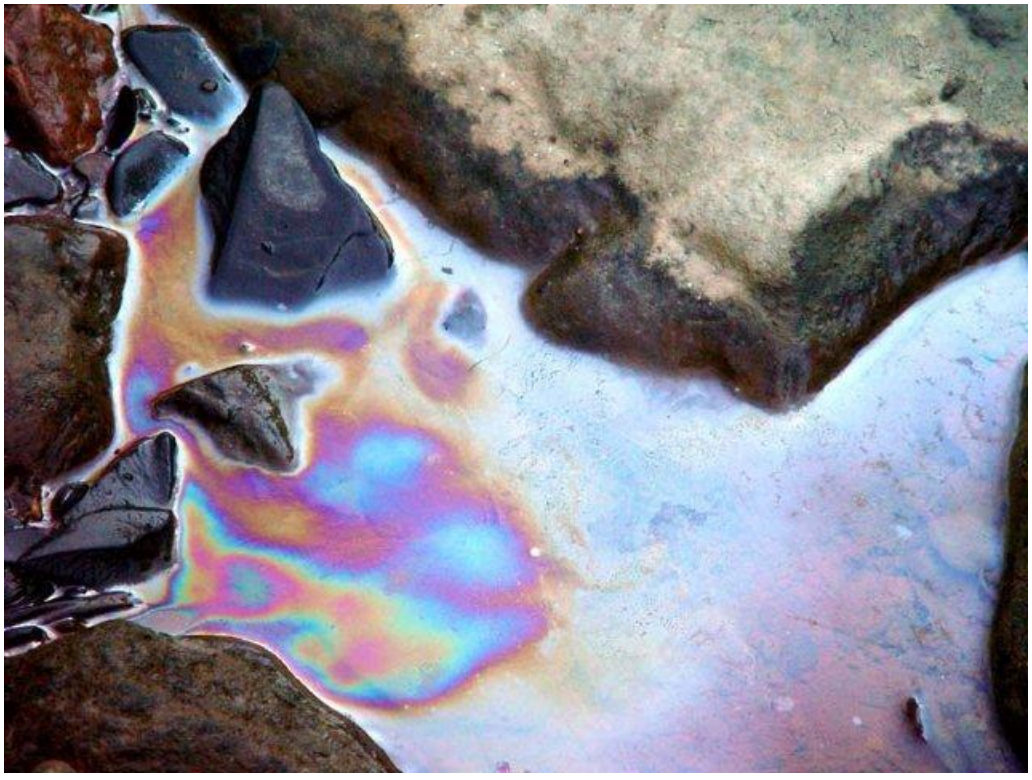
Bio sheen forming due to decomposition of organic matter.

Bio sheen forming on top of a flocculate.

What do bio sheens look like?

***Dr. Ghiorse*:** "The best field signs for *Leptothrix* are the color and mechanical properties of the metallic film. A *Leptothrix* film will be a silvery or golden in color when you look at it in reflected light and yellowish brown to dark brown or dull rust colored and granular when you blot it on white paper."

Rainbow, or metallic, bio sheen



Rainbow, or metallic, bio sheen

Where do bio sheens form?

***Linda Grashoff's website*:** "Four conditions that favor the growth of iron bacteria are: 1) slowly moving or still water, 2) warm air and water, 3) lack of recent heavy rainfall, and 4) water that contains little dissolved oxygen."

***Dr. Robbins*:** "The film former*, L. discophora*, lives at a particular redox boundary--the one with the highest oxygen in contact with low oxygen. That is typically in shallow water. So, it doesn't sound like *L. discophora* is forming a film at depth, particularly in an environment where petroleum is sucking oxygen out of the water.

Bio sheen forming at edge of standing water

Bio sheen forming on pool of standing water

How long do bio sheens take to form?

Dr. Robbins: "To get to the stage where we can see the film takes a couple of days."

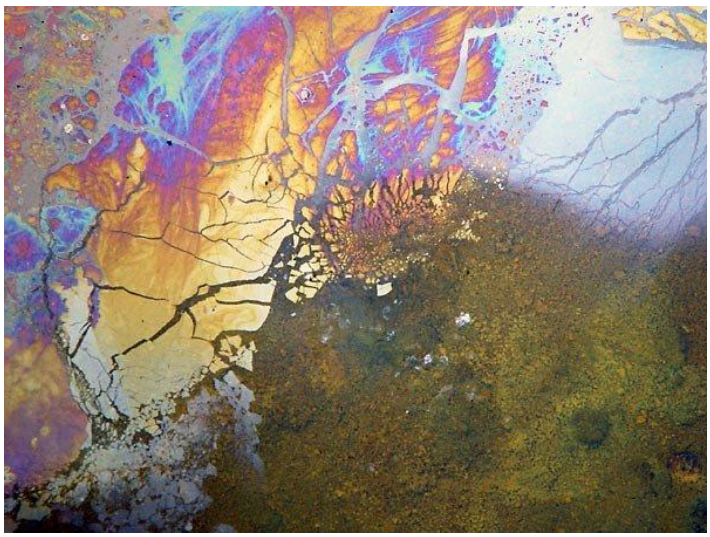
"I've watched them form within a day after it quits raining (and washing away the sheens). I've seen them in boreholes too--at the top of the borehole/piezometer where oxygen is present. The film-former is an aerobe that requires molecular oxygen."

What happens to bio sheen when disturbed?

Dr. Robbins: "The L. discophora film busts up when touched; no possibility of even tiny pieces staying intact when shaken."

"As soon as there is moving water, it busts up... agitation separates the cells from each other, so the film breaks up. The film is bridging from one bacterium to the next."

Dr. Ghiorse: "The film should look fractured, not oily, when you draw a stick through it. An oil film will not fit these criteria."



Typical fracturing that occurs when bio sheen is disturbed. Sheen characteristically breaks apart into platelets.

Bio Sheen Fact Sheet prepared by K. Churchill (kim.churchill@westonsolutions.com) from excerpts taken from email correspondence with Dr. Eleanora Robbins (Biogeologist) and Dr. Bill Ghiorse (Microbiologist) and also Linda Grashoff's website which contains responses from Dr. Robbins and Dr. David Benzing (Biologist) and USGS's website publication by Dr. Robbins.

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http://www.lindagrashoff.com/Text_Pages/Frequently_Asked_Questions.html#What_is_Leptothrix_discophora - Linda Grashoff

http://pubs.usgs.gov/gip/microbes/intro.html - USGS

Iron bacteria (*Leptothrix discophora*) photos taken by Linda Grashoff and provided via email by Dr. Robbins, with photo captions provided by K.Churchill. For additional information and photos visit: http://www.lindagrashoff.com/Text_Pages/Living%20in%20the%20Vermilion%20River%20Watershed%20-%20Biofilms.pdf