How to tell Redox Colors from Lithochromic Colors

Soil Training Day

9-27-06

Grey Colors – the process that causes them

- **You can get gray colors several ways –**
  - **Saturation and reduction of Mn and Fe**
  - **Primary mineral color in rocks**
  - **Intense, long term leaching from an A or E horizon**
  - **Unmodified, unsaturated gray sand parent material**

Red Colors
– the processes that cause them

1. Release of Fe-bearing compounds from primary weathering.
2. Concentration of oxidized Fe minerals.
3. Precipitation of reduced Fe that comes into contact with gaseous oxygen.

Black Colors
– the processes that cause them

1. Release of dark-colored compounds from primary weathering.
2. Concentration of oxidized Mn minerals.
3. Precipitation of reduced Mn that comes into contact with gaseous oxygen.
4. Pieces of charcoal or coal.

How to tell the process?

- To rule out mistaking weathering colors from redox colors, look for the originial rock structure, rocks, and mineral structures.

How to Recognize Redoximorphic Features

1. When three colors occur within a soil horizon, and they are not associated with a rock fragment or rock structure or rock mineral weathering.

2. The soil matrix is usually gray or brown.

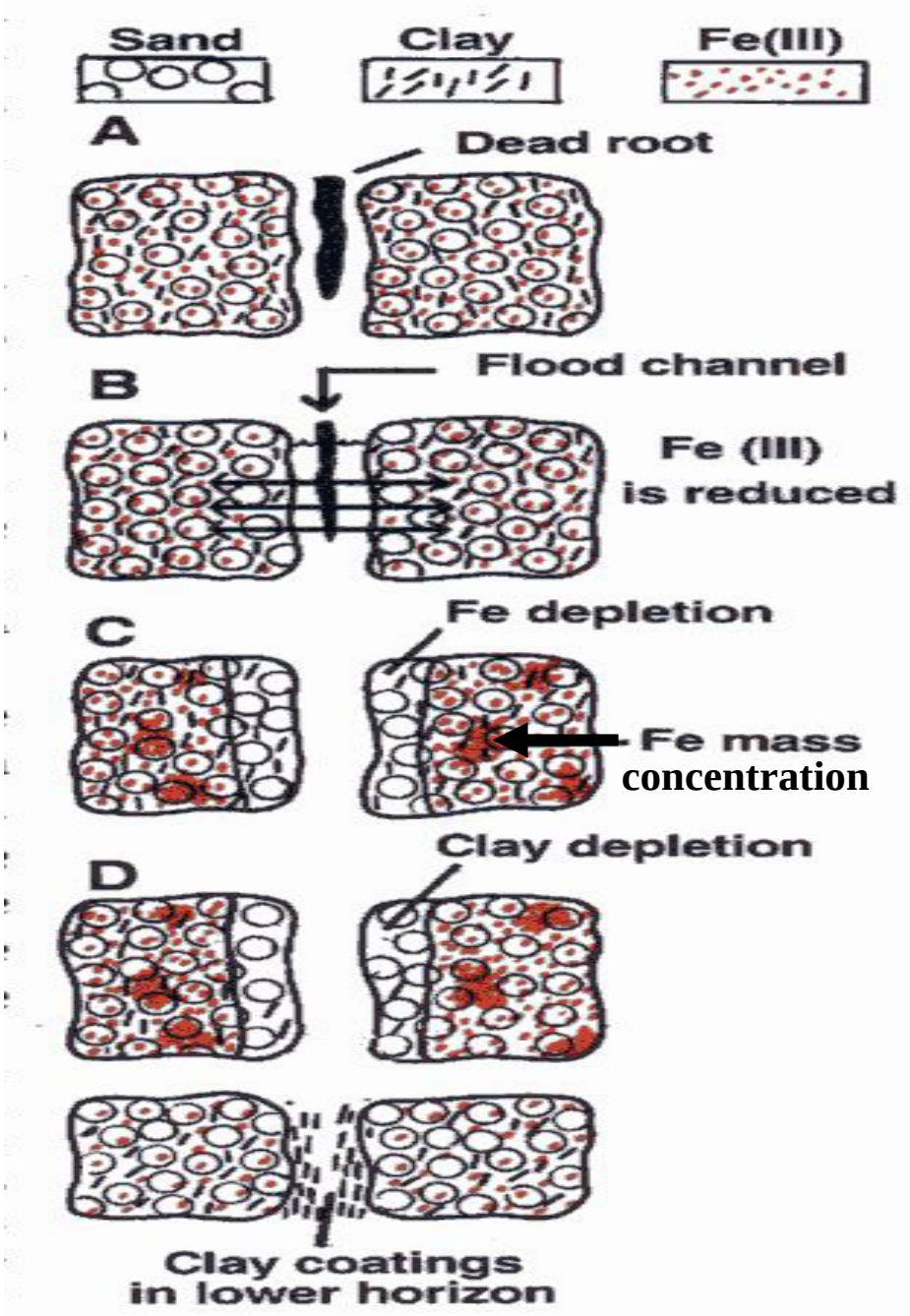
3. The color lighter (higher value) or grayer (lower chroma) than the soil matrix is the depletion.

4. The color right next to the depletion that is redder, oranger, or yellower than the matrix is the concentration.

5. Redox features gradually change colors.

Redox Depletions

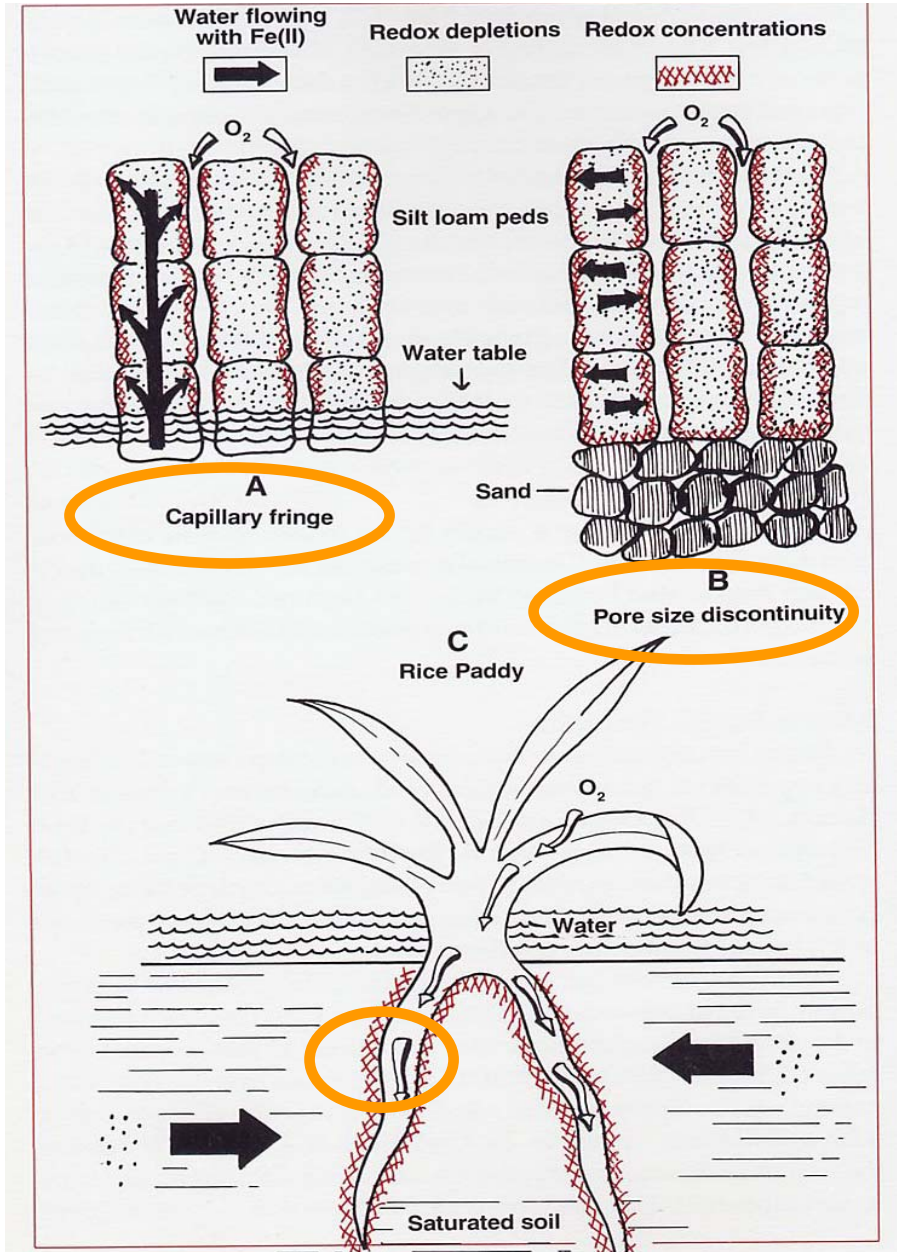
A review of their formation



(Fig. 9 from Vepraskas 1995)

Redox Concentrations

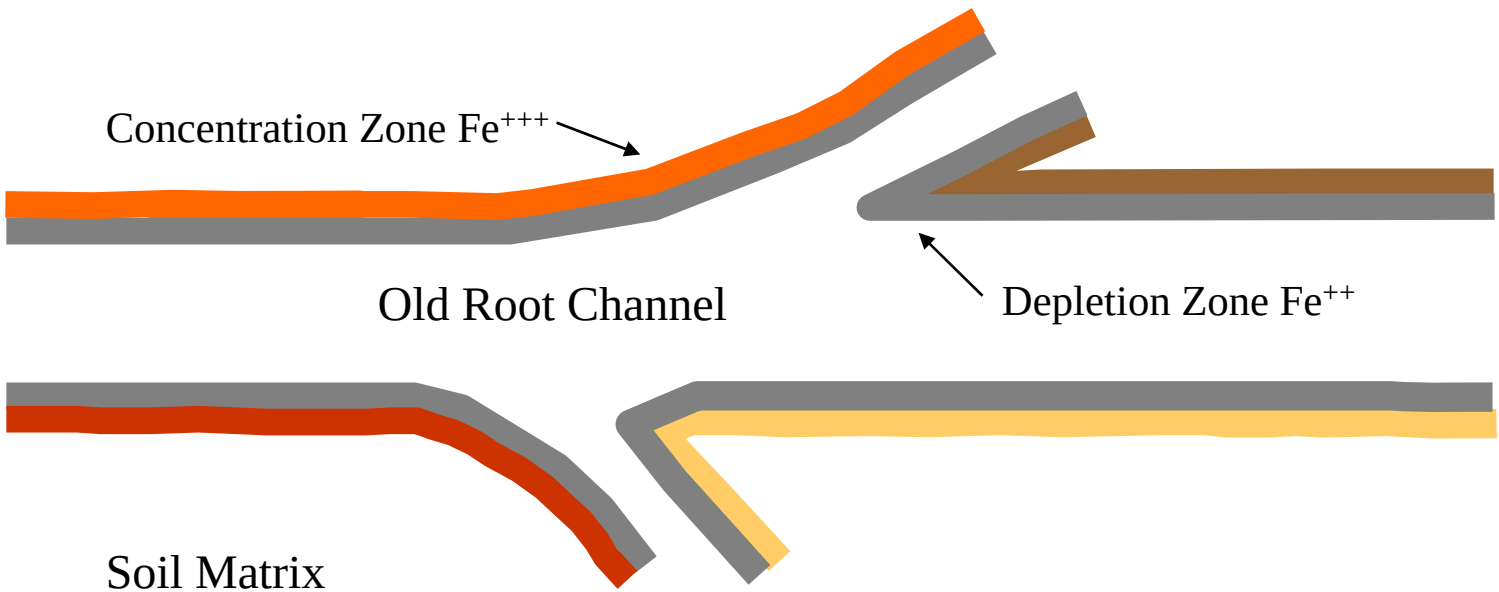
A review of their formation



(Fig. 9 from Vepraskas 1995)

Redox Features

Conc. and Depl. formation



Formation of redox depletions and concentrations along root channels

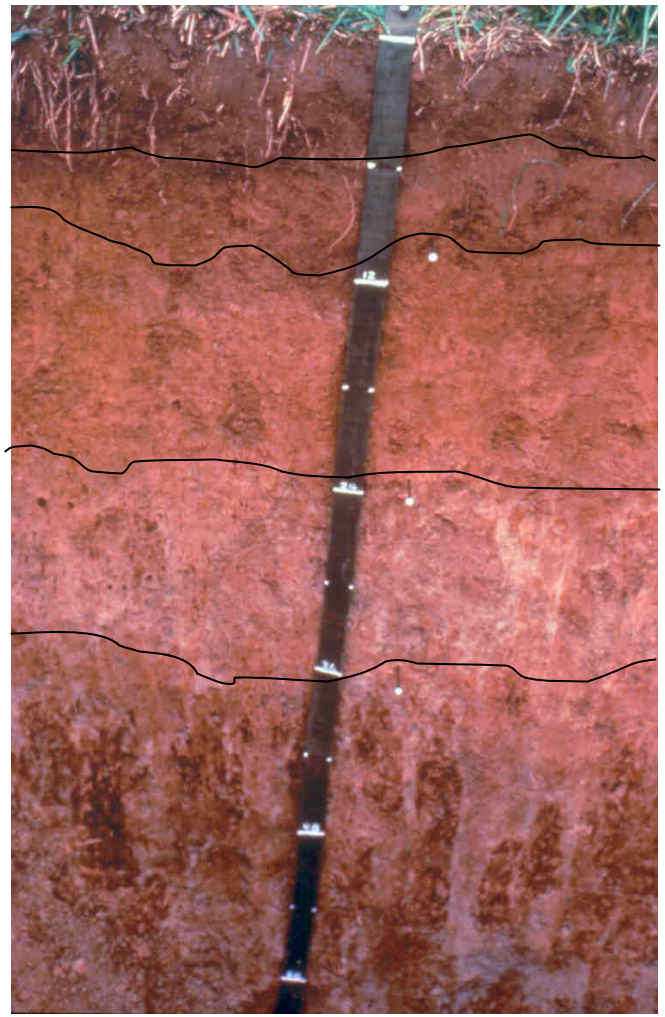
Endosaturation

evidence of an apparent water table in all layers from 2m up through the upper saturated layer

Water from below (endo)

Episaturation

Water from on top (epi)



Ap
BA

Evidence of apparent water table in a horizon above an unsaturated horizon

Bt

E/Btc

This horizon is seasonally-saturated from perched water

Btx

Fragipan = Perching horizon, unsaturated

NOTE:

1. Older depletions can become reoxidized or replenished in oxidized Fe, leaving the concentrations behind. This is often seen in coastal plain soils, when a horizon has concentrations but no depletions, but the horizon below has both.
2. Manganese and Fe can become cemented if the concentration gets high enough, as it did in many past climates. The concretions left behind may not tell us much about today's soil climate, but soft black Mn-Fe masses and thin black aggregate coatings tell us that the soil reduction processes are current.

How to Recognize Lithochromic Colors

1. Use a hand lens to see if the color pattern has sharp edges. Rocks and minerals weathering in place often do not change color gradually.

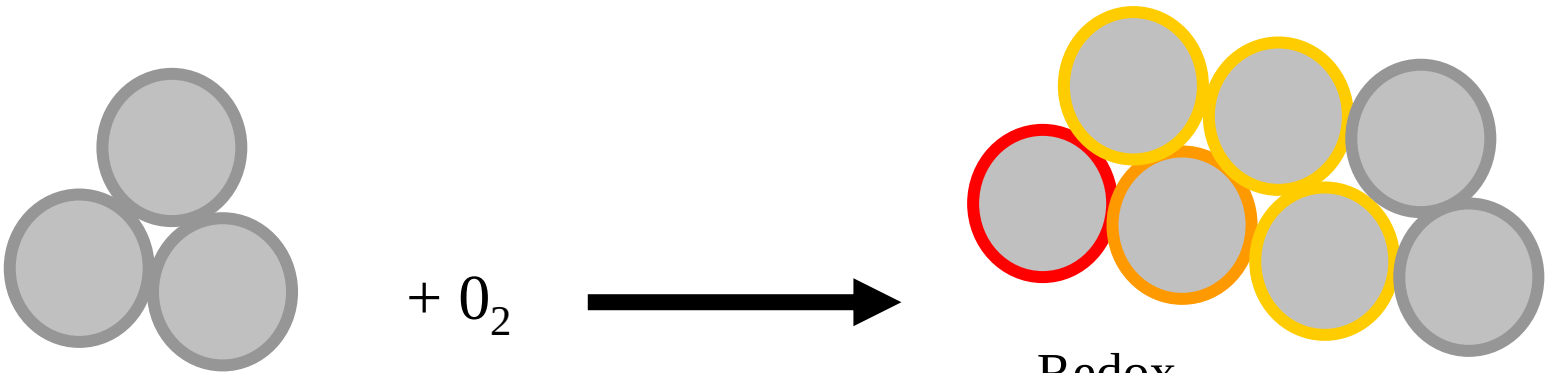
2. See if the color pattern can be extracted with a knife.

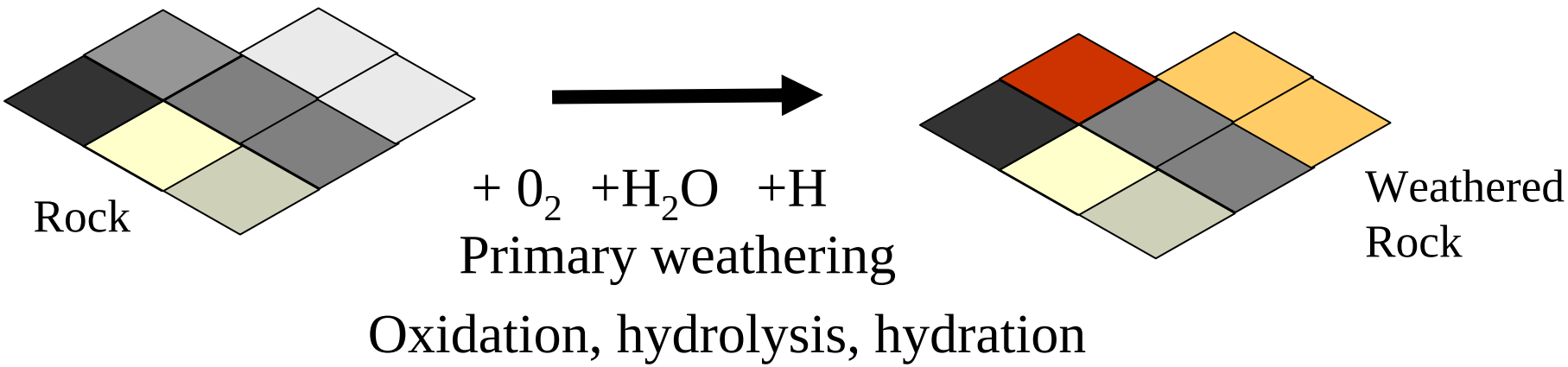
3. Look for rock fragments and rock-controlled structure.

4. Redox features should cross rock-structural boundaries, while L. C. should follow the rock-structure or mineral cleavage plains.

5. Coastal plains sediments have no rock structure but the color patterns often follow stratification from the original depositions and subsequent secondary mineral precipitation of Mn and Fe leached from above.

Oxidative Color Change Processes





Oxidation, hydrolysis, hydration

Lithochromic colors

Lithochromic Colors and Mottles

- Color patterns (may be any color from white to gray to black to red) inherited from minerals released from weathering of rock

Some of each