

# General Pathways For Color Producing Iron Compounds in Sedimentary Rocks

1. Iron exists in two valence states and switches readily back and forth  
 $Fe^{+2}$  Ferrous ( $Fe^{+2}$ ) typical of igneous rock forming minerals  
 $Fe^{+3}$  Ferric ( $Fe^{+3}$ ) typical of hematite and limonite
2. Most iron compounds are colored and form powerful pigments & vivid colors (red, purple, green, and yellow)
3. Ubiquitous - about 5% composition of all surface rocks

**Minerals**  
Mafic Igneous  
**Redox State**  $Fe^{+2}$

The geochemistry of iron is notoriously complicated, and the behavior of iron in sediments from weathering to deposition to diagenesis makes it even worse. This flow chart just captures the main trends in sediments/sedimentary rocks. There are books more than this.

Stable at  $<130^{\circ}C$ . In acid conditions changes to hematite at  $100^{\circ}C$  in a few weeks.

Weathering

**Compounds** Greenish, bluish-green; readily oxidizes  
 $FeCO_3$   
 $FeSO_4$   
**Redox State**  $Fe^{+2}$   
**Soluble?** Very

Remains in solution only if conditions are alkaline and reducing.

Oxidizing conditions

$Fe^{+3}$  Ferric

Precipitation

Limonite and Goethite  
**Minerals**  
 $FeO(OH)nH_2O$   
 $HFO_2$   
**Colors** Yellow/Brown  
**Soluble?** Not Very

dehydration in authigenesis

Black humus masks colors due to iron compounds

Organic matter strong reducing Conditions

Mixed  $Fe^{+2}$  and  $Fe^{+3}$   
**Minerals** Chamosite (Fe rich chlorite)  
**Color** Green  
**Soluble?** Not

Moderate Reducing Conditions

**Minerals** hematite  
 $Fe_2O_3$   
**Color** Red/Purple  
**Soluble?** Not