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Chemical Weathering

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Chemical Weathering

–Definition: transformation/decomposition of one mineral into another

–Mineral breakdown

- carbonate dissolves
- primary minerals --> secondary minerals (mostly clays)

–Net loss of elements retained in the soil.



Chemical Weathering

- Chemical alteration of minerals.
- Results in new minerals and ions in solution.
- Water and acid are essential.

Decomposition - alterations in chemical composition



Types of Chemical Weathering

1. Hydration
2. Hydrolysis
3. Oxidation
4. Carbonation
5. Solution
6. Reduction
7. Chelation
8. Bio-Chemical weathering

1. Hydrolysis - any reaction in which water participates.

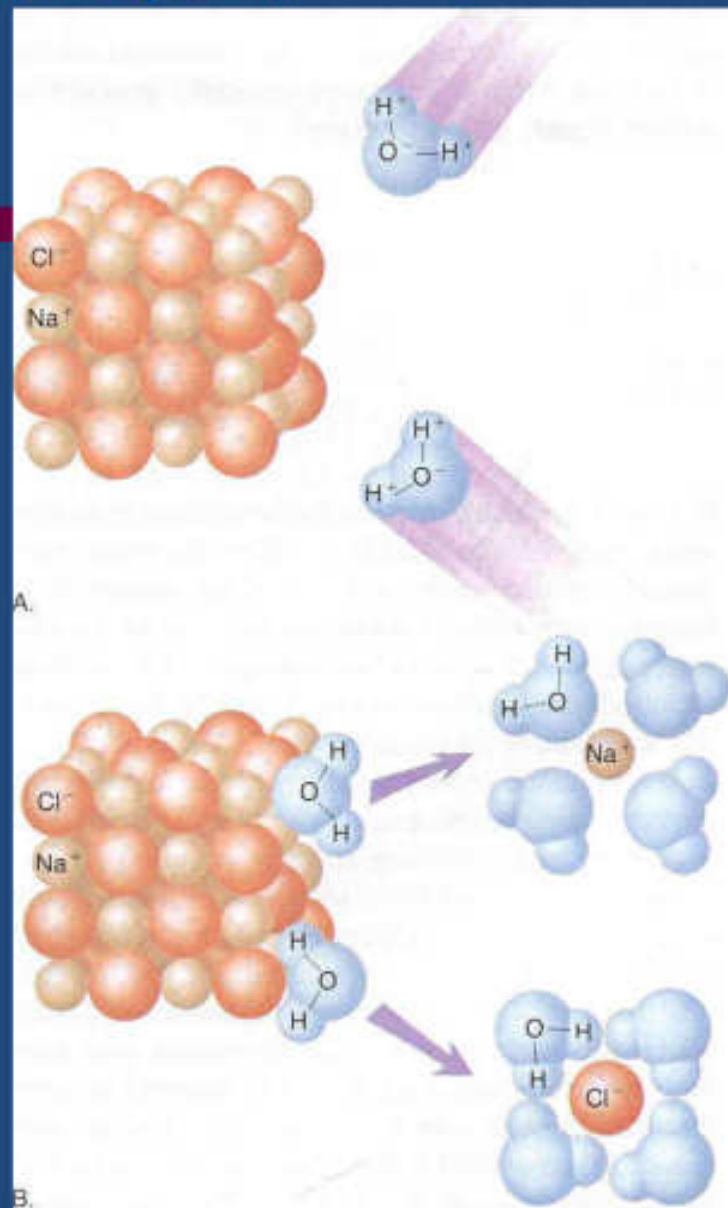
Dissolution - mineral completely dissolves, leaving only ions in solution.



Dissolution

Minerals dissolve in water

For example: salts





2. Hydrolysis

Ione exchange – H^+ , OH^-



3. Dissolution & Solution

Solution - water dissolving rock particles limestone

– **Carbon Dioxide + Rain**



– **Becomes Acid**



– **Dissolves Minerals (i.e. carbonates such as calcite)**



– **Carries away--- Ions**



Acid Hydrolysis & Secondary Minerals –Carbon Dioxide + Rain

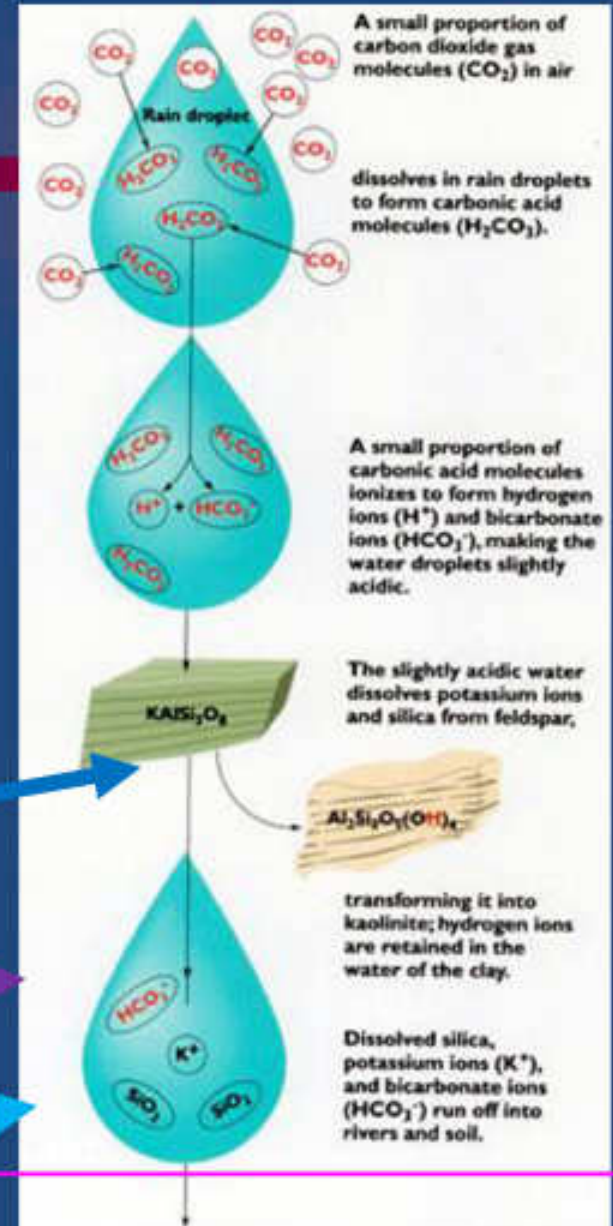
↓
–Becomes Acid

↓
–Dissolves Minerals (i.e. silicates)

↓
– Leaves ----Clay

↓
–Carries away---Ions

↓
–Silica





4. Carbonation

- Carbonation - CO_2 & H_2O = carbonic acid
 - carbonic acid dissolves limestone & creates caverns
 - feldspar \rightarrow clay

– **Carbon Dioxide + Rain**



– **Becomes Acid**



– **Dissolves Minerals (i.e. carbonates such as calcite)**

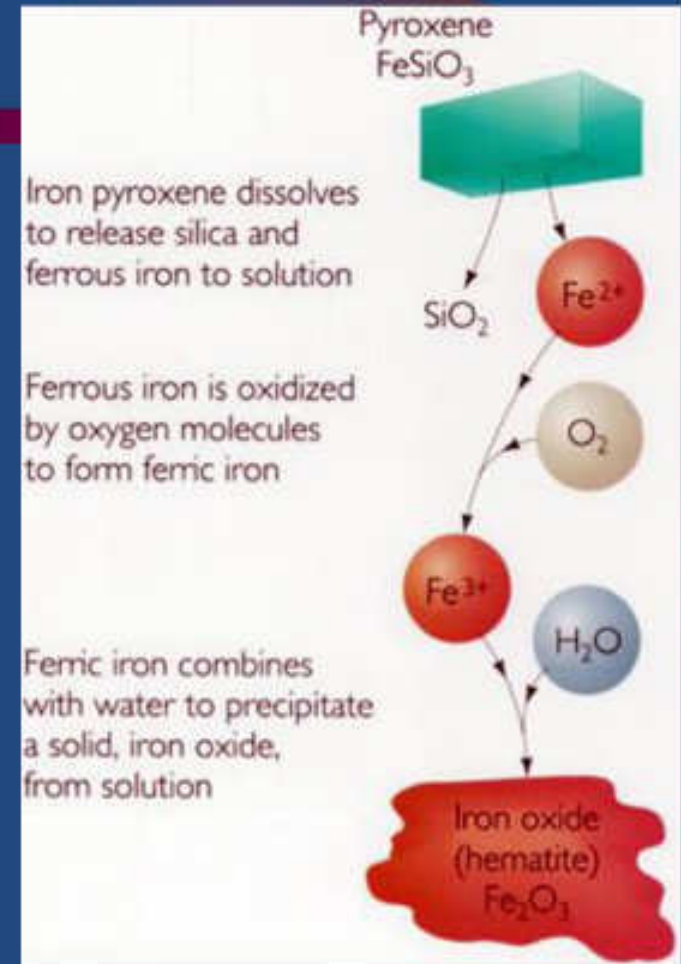


– **Carries away---** **Ions**

5. Oxidation

Oxidation - reaction in which elements gain or lose electrons (example: rust).

1. Iron silicate dissolves
2. Iron oxidizes
3. Oxidized iron combines with water
4. Leaves iron oxide





6. Reduction

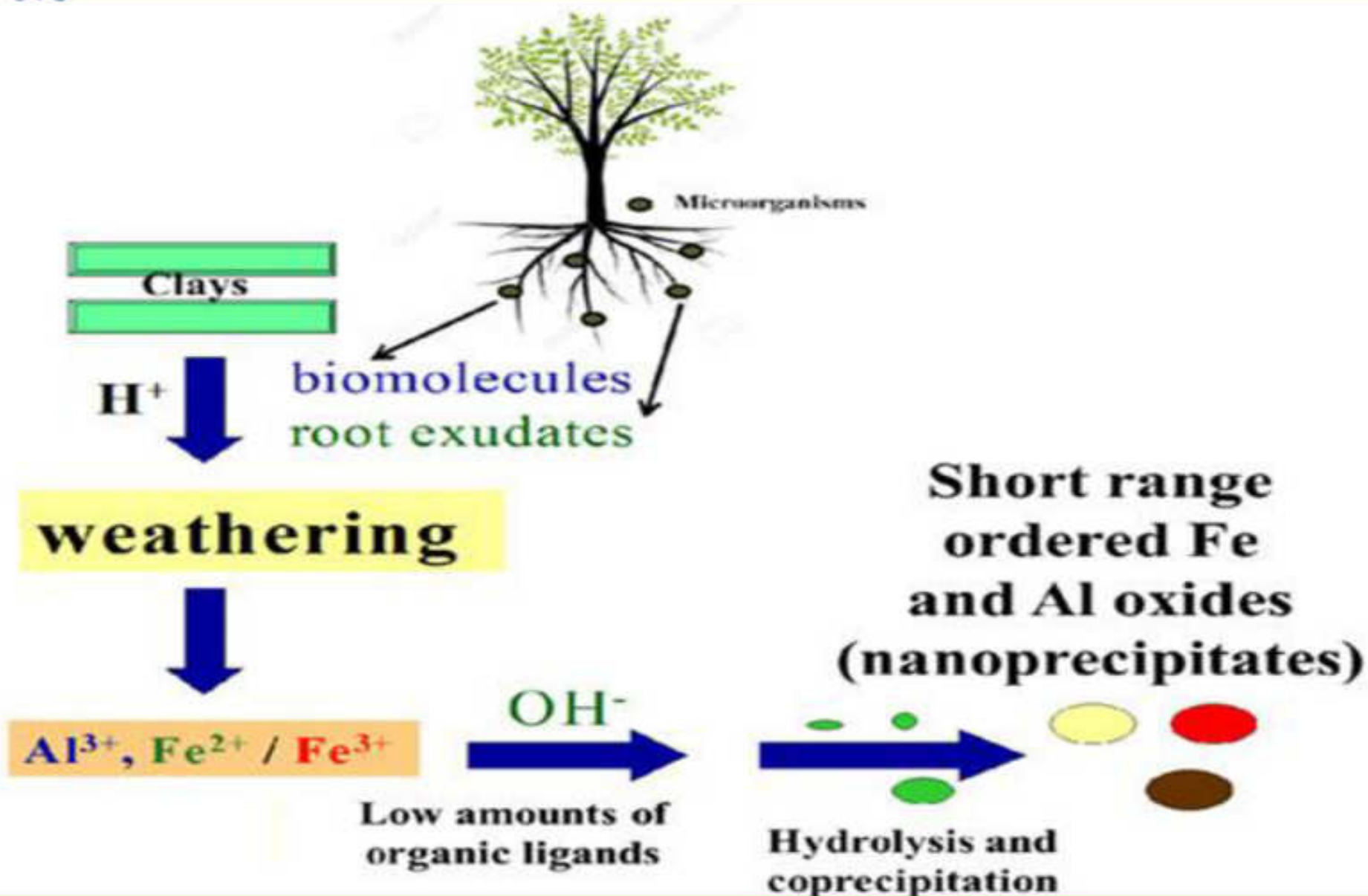
The process of removal of oxygen and is the reverse of oxidation and is equally important in changing soil color to grey, blue or green as ferric iron is converted to ferrous iron compounds. Under the conditions of excess water or water logged condition (less or no oxygen), reduction takes place.





7. Chelation

- Chelation is a complex biochemical process, in which chelating agents are released from the decaying humus in the soil and cause a change in the chemical structure of the surrounding rock
- Rainfall percolating through humus becomes an organic acid. (e.g. fulvic acid).
- Organic acids or chelating agents attack clay minerals, releasing iron and aluminium into the soil.
- Chelation is Greek meaning 'To claw'.
- The chelating agents combine with the metallic ions (Fe, Al) to form organic-metal compounds called chelates.
- Chelates are soluble and are washed down the profile to accumulate at depth.



8. Bio-chemical Weathering (Lichens & other plants secrete acids)





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Thank You