

READING GUIDE*

Processes of Soil Formation II: Weathering and Mineral Transformations

see Buol et al. (2011), Chapter 4, p. 141-161

OBJECTIVE: *To understand the common weathering reactions that occur in soil environments, recognize the factors that influence these processes, and know how weathering products affect soil properties.*

1. What is *weathering*? What is the distinction between *geochemical* weathering and *pedochemical* weathering? Why does weathering occur?
2. What are *primary minerals*? What are *secondary minerals*?
3. What is *physical weathering*? What processes are associated with physical weathering? What is *chemical weathering*? What processes are associated with chemical weathering?
4. What is *oxidation*? Describe an example of chemical weathering by oxidation that occurs in soils. What is *reduction*? What is *gleization*? Describe an example of chemical weathering by reduction that occurs in soils.
5. **Which soil constituents are susceptible to oxidation-reduction reactions? Which are not?**
6. **What soil morphologies are associated with alternating oxidizing and reducing conditions?** How do these morphologies differ if the pore is the site of reduction or the site of oxidation?
7. How does pH influence the stability of Fe minerals?
8. What is *ferrolysis*? Describe an example of chemical weathering by ferrolysis that occurs in soils.
9. What is *hydration*? Describe an example of chemical weathering by hydration that occurs in soils.
10. What is *hydrolysis*? Describe an example of chemical weathering by hydrolysis that occurs in soils.
11. What are the products of the hydrolysis of primary minerals in soils? What is the significance of each of these products within the soil system?
12. What is *solution*? Describe an example of chemical weathering by solution that occurs in soils.
13. What is *chelation*? Describe an example of chemical weathering by chelation that occurs in soils.
14. Describe the processes by which mica is weathered through removal of interlayer potassium. What conditions promote this process?
15. What is a *hydroxy interlayered mineral* (HIM)? How do HIM form in soils? How can HIM formation influence other soil properties? What is *gibbsite*? What conditions in the soil favor gibbsite formation?
16. **For ferric and ferrous forms of iron, which is oxidized and which is reduced? What is the ionic charge of each?**
17. Which iron minerals are precipitated under oxidizing conditions when Fe is released from primary minerals? What iron mineral can form in the soil through transformation of the other iron minerals?
18. Among primary minerals, how does the order in which they crystallize from molten rock compare to the order in which they weather in soil environments?
19. What properties of primary (sand- and silt-sized) minerals influence their stability in soil environments? (Note: There are three.) What properties of secondary (clay-sized) minerals influence their stability in soils?
20. For each of the secondary (clay-sized) minerals, describe the conditions that promote their presence, formation, or stability in soil environments.

* Questions in plain type represent basic facts and concepts. Questions in **bold** type are those that are answered in the text but require more careful consideration. The Synthesis questions at the end help you apply the facts and concepts to a relevant issue.