affirmed to be modern; for they have probably been in progress ever since the land first emerged from the ocean so that air and water could begin the work.

In the destruction of the iron-bearing minerals of surface rocks, the iron oxide combined with a humus acid is often carried into marshes to make "bog iron ores." The ores thus formed have much value, although likely to contain phosphates as impurity, because of the animal and vegetable matters that live and die, or find burial, in swamps.

The consolidation of beds of sand and gravel, or layers of rock, is another of the constructive effects of the iron oxide that is distributed through the material of the beds. In the simplest form of it, the waters, filtering through soil and gravel, take up enough oxide of iron to cement a bed of pebbles lying at a lower level on another layer sufficiently close in texture to hold the water and give the iron a chance to deposit; and this is one way in which what is called *hard-pan* is sometimes made. The underlying impervious bed is not absolutely necessary to the result, although promoting it. The pebbles wet with the ferruginous waters, when they dry in times of drought, take a deposit of iron; and this process may end in complete consolidation. In other cases the oxide is produced throughout the deposit under the action of infiltrating waters, and slowly becomes a cement as it solidifies.

This mode of consolidation without aid of heat is not the most common nor the most efficient.

The beds of sulphur of the world have been made by the two processes mentioned on page 125, and chiefly the former.

Hydration, or the Chemical Absorption of Water.

Many minerals take up water on "weathering." But this usually is an accompaniment of commencing decomposition. An example of simple hydration of geological importance is the change of anhydrite ($CaO.SO_3$) to gypsum ($CaO.SO_3.2H_2O$). As the minerals are very unlike in cleavage, and both occur in large beds, the change is strikingly noticeable.

Carbonic Acid, Humus Acids.

1. *General action.* — Carbonic acid (CO_2) is ever present in the atmosphere, of which it constitutes 3 parts in 10,000 by volume, and in all rain water, river water, and sea water. It is often given off by mineral springs, and occasionally escapes in large volumes from fissures in volcanic regions. In the northeast corner of Yellowstone Park is "Death Gulch," where the gas rises freely from the waters of Cache Creek, to the destruction of bears and other wild animals. Butterflies and other insects, besides skeletons of bears, elk, squirrels, etc., attest to its deadly character (W. H. Weed, 1889). Death's Valley in Asia Minor, and the Dog's Grotto at the Solfatara near Naples, are other localities of escaping carbonic acid.