bination, as carbonic acid, it may take the FeO and make iron carbonate. Or if the acid is a *humus* acid, this acid may combine with the FeO, and, as such a compound is soluble, the waters may carry it to the marshes for deposition and re-oxidation.

Since the compounds so made are colorless or nearly so, fragments of a plant in a rock may whiten the rock around them, thus making blotches in red sandstones, or a zone may be bleached around stems and roots. Also, the soaking down of soil waters may make a whitish streak along the top of the less permeable layers.

In like manner iron sulphate or copperas, $FeO.SO_3.7$ aq (which oxidation of FeS_2 often produces, as above explained), may be deoxidized and reduced to FeS_2; that is, either pyrite or marcasite. Fossil wood may be replaced by pyrite or marcasite as decomposition goes on, and shells may be changed in like manner, as acid waters at hand dissolve and remove the calcareous material.

Calcium sulphate, or gypsum, is, by similar deoxidation, converted into calcium sulphide, CaS; zinc sulphate, into zinc sulphide, ZnS, the mineral, sphalerite; and lead sulphate, into lead sulphide, PbS, which is the common lead ore, galena. After the deoxidation of a sulphate, as gypsum (calcium sulphate), to calcium sulphide, the re-oxidation of the sulphide may take place, and hydrogen sulphide (sulphuretted hydrogen) may result through the agency of the water at hand, thus: Ca takes oxygen from the water, making CaO, or lime (which may combine at once with CO_2 to make $CaO.CO_2$, or calcium carbonate), and the sulphur, S, takes the hydrogen thus set free from the water, making SH_2, or hydrogen sulphide (sulphuretted hydrogen); for $CaS+H_2O=CaO+H_2S$. This is the ordinary process by which the gas of sulphur springs is made, as for example those of western New York and Virginia.

By the oxidation of the hydrogen of the hydrogen sulphide making H_2O, or water, the sulphur, S, becomes deposited. This is a very prominent source of sulphur; and it accounts for its frequent association with gypsum and limestone.

Further, hydrogen sulphide, SH_2 (sulphuretted hydrogen), by action on zinc sulphate, will deoxidize the sulphate and make zinc sulphide; on iron sulphate, it will make an iron sulphide; on lead sulphate, lead sulphide.

But under warm and moist conditions the sulphur may oxidize and make sulphuric acid, SO_3+water; and some sulphuric acid springs in New York have this source. Gypsum may be formed by such waters if limestone is within their reach. Pfaff states that at depths in water under a pressure of 40 atmospheres anhydrite will probably form, and not gypsum. Anhydrite is gypsum *minus* the water.

It may be added that sulphurous acid, SO_2, is formed by the combustion of sulphur (as in volcanoes); and when this gas comes into contact with hydrogen sulphide (SH_2), the sulphur of both is deposited, the oxygen and hydrogen combining to form water; and this is one source of the sulphur about volcanoes.

With heat, carbon deoxidizes iron oxide and oxides of other metals, producing the pure metal.

4. *Destructive effects.* — Since nine tenths of rocks not limestones contain one or more of the common iron-bearing silicates, pyroxene, hornblende (or other species of the hornblende family), or black mica, and almost all rocks have a sprinkling of pyrite or marcasite, the oxidation process is all-pervading in its destruction. The presence of water and air being necessary, the more porous the rock, the deeper and more rapid the decay. The rocks where the