

ochre, it is precipitated from the waters of chalybeate springs containing green vitriol derived from the oxidation of iron-sulphides.¹⁹ It is a common decomposition product in rocks containing iron among their constituents. It is thus always a secondary or derivative substance, resulting from chemical alteration. It is the usual pigment which gives tints of yellow, orange and brown to rocks. The pseudomorphous forms of limonite show to what a large extent combinations of iron are carried in solution through rocks. The mineral has been found replacing calcite, siderite, dolomite, hæmatite, magnetite, pyrite, marcasite, galena, blende, gypsum, barytes, fluor-spar, pyroxene, quartz, garnet, beryl, etc.

Magnetite (Fer oxydulé, Magneteisen, Fe_3O_4) occurs abundantly in some schists, in scattered octohedral crystals; in crystalline massive rocks like granite, in diffused grains or minute crystals; among some schists and gneisses (Norway and the Eastern States of North America), in massive beds; in basalt and other volcanic rocks, as an essential constituent, in minute octohedral crystals, or in granules or crystallites. It is likewise found as a pseudomorphous secondary product, resulting from the alteration of some previous mineral, as olivine, hæmatite, pyrite, quartz, hornblende, augite, garnet and sphene. It occurs with hæmatite, etc., as a product of sublimation at volcanic foci, where chlorides of the metals in presence of steam are resolved into hydrochloric acid and anhydrous oxides. It may thus result from either aqueous or igneous operations. It is liable to weather by the reducing effects of decomposing organic matter, whereby it becomes a carbonate, and then by exposure passes into the hydrous or anhydrous peroxide. The magnetite grains of basalt-rocks are very generally oxidized at the surface, and sometimes even for some depth inward.

Titanic Iron (Titaniferous Iron, Menaccanite, Ilmenite, Fer titané, Titaneisen (FeTi_2O_3)) occurs in scattered grains, plates and crystals as an abundant constituent of many crystalline rocks (basalt-rocks, diabase, gabbro and other igneous masses); also in veins or beds in syenite, serpentine and metamorphic rocks;²⁰ scarcely to be distinguished from magnetite when seen in small particles under the microscope, but possessing a brown semi-metallic lustre with re-

¹⁹ Sullivan, Jukes' "Manual of Geology," p. 63.

²⁰ Some of the Canadian masses of this mineral are 90 feet thick and many yards in length.