ments do not warrant any immediate change in my theory of root-hair growth.

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Geology of the Iron Deposits of the Congonhas District, Minas Gerais, Brazil

Large iron deposits in the state of Minas Gerais, Brazil, have been the subject of a continuing study by geologists of the U.S. Geological Survey and its Brazilian counterpart, the Departmento Nacional da Produção Mineral under the sponsorship of the Institute of Inter-American Affairs. These deposits are very large and will unquestionably have great future importance, although they have not yet been extensively developed because of their remoteness from the world centers of heavy industry. Reports and maps on the Congonhas district (600 km^2) and other parts of the ferriferous region, which has a total area of several thousand square kilometers, will be published as the work in each district is completed.

The deposits are of three general types: (i) laminated iron formation, or itabirite, consisting of varying proportions of specular hematite (Fe_2O_3) and magnetite (Fe_3O_4), quartz (SiO_2), and lime-magnesia carbonate; (ii) masses of nearly pure specular hematite enclosed in the iron formation; and (iii) surficial cappings of limonite ($Fe_2O_3 \cdot nH_2O$).

Itabirite is a metamorphosed sedimentary rock that occurs principally as the middle member of the pre-Cambrian Minas series. Within the Congonhas district, it ranges in thickness from about 100 to 600 m or more. The average iron content is estimated to be 40 percent. Quartzite and mica schist underlie the itabirite conformably; phyllite with lenticular quartzite, dolomite, minor amounts of itabirite, and some volcanic rocks overlie it. It is believed that the unusual ferruginous sediments were deposited as chemical precipitates of iron oxide, colloidal silica, and alkaline earth carbonates brought into a restricted marine environment by one or more large rivers. The landmass was low; hence, little or no clastic material was introduced. Somewhat acid conditions inhibited the precipitation of carbonates over most of the period of deposition. An offshore volcanic arc probably cut off circulation between the basin and the open ocean, and volcanic emanations may have aided in lowering the pH below the "limestone fence."

Regional metamorphism accompanying severe folding produced specularite and quartz from the siliceous precipitates and magnetite, dolomite, and quartz from the carbonate-bearing sediments. Platy specularite was partially oriented to form an incipient cleavage.

Faulting, in the course of superimposing several large thrust slices, brecciated the iron formation and opened channelways for hydrothermal solutions of unknown source. These solutions replaced the quartz and dolomite with new specularite, giving rise to the local development of high-grade ore deposits. Preexisting bedding, cleavage, and breccia structures were faithfully preserved by fine-grained (average 0.01 mm), unoriented, interlocking hematite that contrasts sharply with the unreplaced platy specularite. Magnetite octahedra, some a centimeter across, were partly or completely altered to hematite. Both proximity to faults and variations in the carbonate content of the original formation localized replacement; the largest known deposit of the district occurs where dolomitic itabirite was overridden by a thrust block.

Descending ground water has leached most of the carbonate and part of the quartz from the itabirite above the water table. Hydration and reprecipitation of iron as limonite over most of the outcrop areas have formed hard cappings, which protect the underlying softened material from rapid erosion. Remnants of old surfaces several hundred meters above present-day intermontane valleys indicate intermittent uplift in recent geologic times.

Surficial leaching has dissolved minor quantities of iron from some hematite ores, destroying the intergranular cohesion and producing friable or powdery material. Mosaic-textured ore with interlocking, sutured grain boundaries resists this leaching better than ore with tabular, oriented specularite grains; and weathering, therefore, exhumes original sedimentary structures that were preserved during metamorphism and replacement.

As the Congonhas deposits have many features in common with numerous iron formations and hematite ores on all continents, their genetic environment, although unusual, was presumably not unique.

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Special-Purpose Terrain Evaluations

The U.S. Geological Survey in collaboration with the Soil Survey of the U.S. Department of Agriculture has been engaged for more than 10 years in making special terrain evaluations for application to military planning and operations. This work has been supported mainly by the Corps of Engineers, U.S. Army.

The major military problems considered in the work deal with two main types of use of terrain. The first is construction on and below the ground surface of a wide variety of structures, some peculiar to military activity, but most having counterparts in civilian life. The basic terrain problems in construction have been formalized as a result of extensive and prolonged world-wide research in engineering geology and soil engineering for military and civilian purposes.

The second broad use of terrain is in rapid move-