

of the United States Geological Survey by J. G. Fairchild and the analysis gave the following results:

*Partial analysis of manganese ore from Morne Macat.*

	Per cent.
Mn .....	25.8
Fe <sub>2</sub> O <sub>3</sub> .....	1.52
P .....	.028

In the course of the analysis the presence of what is probably barium was found. A little copper was identified.

As the gangue of the manganese oxides is almost entirely siliceous, probably 40 to 50 per cent of the ore analyzed is silica. Ore containing so much silica is not commercially valuable. Although the silica content of the ore might be reduced by sorting, much of the manganese oxide is so intimately mixed with the siliceous gangue that even mechanical concentration would be expensive. The lumps of pure manganese oxides are not usually large enough to be successfully hand sorted. A few small veins and masses of pure manganese oxides, 8 to 10 centimeters in width, were seen, but most of the manganese is mixed with the jasper. A large quantity of float is found on the hillside below the jasper reef, out of which lumps of high-grade manganese ore can be picked, but the percentage of lumps of high-grade ore is low. There is not enough manganese at this locality to warrant the exploitation of the deposit at the present price of manganese, but there is enough to suggest that if the price should again rise careful prospecting here as well as along the entire length of this fault zone would be warranted.

No other bodies of manganese ore were found but others may exist along the fault zone. Slight silicification of the limestone, forming limonitic jasper, bearing some stains, probably of manganese, was seen along the same fault line at Rivière Lhormand, about 5 kilometers west of Gros-Morne. (See pp. 120-121.)

**MANGANESE DEPOSITS IN THE COMMUNE OF JACMEL NEAR COTEAUX.**

Manganese deposits are reported to occur at several places in the mountains north of Jacmel, in the drainage area of the Grande Rivière de Jacmel and its tributaries. One small deposit that was examined during the reconnaissance is about 12 kilometers north of Jacmel, near the habitation called Coteaux. It is along a fault contact between the basal upper Eocene limestone and the basaltic volcanic rocks of late Cretaceous age. The structural conditions here are remarkably similar to those at the Morne Macat deposits, near Gros-Morne. The strike of the fault is nearly parallel to the strike of the limestone, about N. 60° W. The dip of the contact plane between the limestone and the basalt could not be determined but was probably very steep. The

limestone, which forms the south wall of the contact, is sharply upturned and dips  $80^{\circ}$  to  $90^{\circ}$  southward. It is dark gray to black, thin bedded, and contains numerous small Foraminifera, which are replaced by chalcedony and opal near the fault zone. For several hundred meters south of the fault the limestone is dark and thin bedded and the dip gradually decreases until, about half a kilometer down the river, it is reversed.

The structure of the basalt flows that form the country rock north of the fault can not be definitely determined, but as they were folded with the Eocene limestone they probably also dip southward. About half a kilometer north of the fault a band of metamorphic limestone underlies the basalt. (See Fig. 20, *B*, p. 322.)

Along the fault plane masses of ferruginous jasper and quartz similar to those at Morne Macat have been deposited. Near the river this zone of jasper is 9 or 10 meters wide but it appears to pinch out east of the valley. Much float of ferruginous chert and some manganese oxides, mostly pyrolusite, was seen in a ravine that joins the river just south of the fault zone. This ravine follows the contact of the limestone and igneous rock for some distance but no other large masses of manganiferous jasper were found in place.

The ferruginous jasper contains hematite and limonite and entirely replaces the limestone, for it incloses fossils. Both jasper and manganese oxides have been brecciated and have been recemented by a secondary silicification, the product consisting largely of granular and prismatic quartz. Considerable calcite and some natrolite were deposited along the fault plane. Much of the quartz was undoubtedly deposited later than the manganese oxides.

These deposits afford no evidence as to the origin of the water that produced them, but they, like those of Morne Macat, were probably formed by hot spring waters that rose along the fault plane. As the major structure in the center of the peninsula north of the fault is that of an anticlinal arch (Fig. 20, *B*), suitable structure may have existed during middle Tertiary time to permit the upward escape along the fault zone of waters under artesian pressure. No traces or other evidence of middle Tertiary volcanic eruptions have been preserved in the Southern Peninsula, though there may have been some igneous activity, deep seated or minor, during Miocene time. (See p. 320.) Hot spring waters issuing from fissures in basaltic rocks at the Sources Chaudes, in the western part of the peninsula, are possibly manifestations of late Tertiary igneous activity. (See pp. 564-566.)

The deposits near Coteaux are of no economic value whatever, as the amount of manganese they contain is negligible. They indicate, however, areas or zones along which prospecting for manganese might be attempted should market conditions warrant the expense. The continuation of the contact between limestone and basalt would be a favorable place for prospecting. Faults or bedding planes that were competent to confine

rising thermal waters appear to mark places favorable for the deposition of manganese-bearing jaspers, but an easily replaceable wall rock, such as limestone, is probably essential to the formation of large ore bodies.

#### RESIDUAL CONCENTRATIONS OF IRON AND MANGANESE.

By WILBUR S. BURBANK and JOHN S. BROWN.

##### GENERAL FEATURES.

Residual deposits of iron and less commonly of manganese are found in regions of humid climate where rather basic igneous rocks or impure limestone have long been weathered. During the reconnaissance some residual concretionary deposits of iron and manganese were seen in regions of imperfect drainage. Although no commercially valuable deposits of this kind are known in the Republic, there are numerous deposits of ferruginous clay that have attracted attention and are often reported as "iron ores." Red residual clayey soils are common at many places, both on limestone and igneous rock, and are especially widespread in areas of massive impure limestone, either around sink holes or covering level country. Some of this residual clay makes an excellent agricultural soil, and at a few places, as near Grande-Rivière du Nord, it is used for making building bricks. Where the residual material is colored bright red or yellow by admixture of iron oxide it is sometimes used as a temporary paint on mud walls.

Chemical analyses of concretionary masses of iron and manganese and of iron-rich soils that were collected during the reconnaissance show that the particular deposits sampled do not contain commercial quantities of either iron or manganese. Two ferruginous residual soils, one from basalt and one from limestone, contained about 17 per cent of iron. Concretionary deposits of iron and manganese analyzed contained 3 to 4 per cent of manganese and 15 to 20 per cent of iron. These samples probably represent some of the richer concentrations of these oxides, and the results of the analyses indicate that the deposits are of no value. Small bodies of iron ore of commercial grade may be found, but probably no valuable large bodies.

##### IRON AND MANGANESE ON THE NORTH PLAIN.

The deposits on the North Plain that were examined are on the surface of a flat, slightly dissected savanna that lies 4 or 5 kilometers northeast of Acul Samedi. The plain, which here stands 60 to 80 meters above sea level, is floored with gravel of Quaternary age. The narrow stream valleys are entrenched in the plain deposits to a depth of 5 or 6 meters. The sediments consist largely of gravel and sand derived from the quartz diorite and include some beds of finer silty material. The deposits are lenticular and crossbedded and vary greatly in composition. They are nearly horizontal, parallel to the surface of the plain.