INTRODUCTION

Mining and smelting of iron ore in Alabama, northwestern Georgia, and eastern Tennessee date almost to Revolutionary War days, but substantial production in the Southeast was not attained until after 1850. Numerous furnaces were erected in the region, especially in and near Birmingham, Ala., which is still the principal iron and steel-making center of the area. Locally mined iron ores formed the principal feed of the furnaces, and much of the ore was mined from red beds of Silurian age. These red beds are an abundant resource of iron ore, and they account for a large part of the total production in the Southeastern United States. Exhaustion of near-surface ore, which was easily mined and the best grade, combined with improved transportation and economies of large-scale operations elsewhere, forced most of the furnaces to shut down (Dept. of the Interior, 1959, production statistics and tables 4-9).

Geological studies have determined the lithology and approximate extent of the red iron ores of Silurian age in the Southeast. Detailed investigations have been made by private companies and government agencies. Most of this work has been in the Birmingham, Ala., district, and the remainder of the region has had relatively little study in recent years.

This report is restricted to the red iron-ore beds of Silurian age in the Southeastern United States exclusive of the Birmingham district (fig. 1). It is based on published and unpublished reports and other data. Of special interest are reports by McCallie (1908), Burchard (1913), and Burchard and Andrews (1947) because they contain chemical analyses, locations of prospects and mines, and some discussion of origin. Many organizations and individuals cooperated in this effort and their assistance is gratefully acknowledged:

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RED IRON-ORE BEDS

The red iron ores in the Southeast are sedimentary strata comprising iron oxides; varying amounts of calcium carbonate ($CaCO_3$), quartz (SiO_2), alumina (Al_2O_3) in clay; and minor amounts of other material, especially phosphorus and manganese. Hematite (Fe_2O_3) is the principal iron oxide. The most important red beds were deposited in Silurian time, when iron oxides were deposited in many places from southern New York State to central Alabama. The name Clinton, which is commonly applied to these beds, is from New York State. Iron-bearing rocks of Silurian age are in the Red Mountain formation in Alabama and the Rockwood formation in Tennessee. Both formation names are used for the rocks containing the red iron-ore beds of Silurian age in Georgia, but Red Mountain formation is the preferred name (Butts and Gildersleeve, 1948, p. 35-38).

The hard, unweathered rock of the red iron-ore beds is generally compact and is dark red, commonly speckled white and brown with calcium carbonate and limonite respectively. The unweathered rock that is used for iron ore is mostly in the form of oolites (flaxseedlike particles) or casts of crinoid stems, bryozoans, and corals. Weathered red rock is derived from the hard red beds by leaching of the calcium carbonate. The weathered beds vary from a friable, unconsolidated material to a rather hard, compact mass. The transition zone between the unweathered beds and weathered beds ranges from a few inches to a foot or more in thickness. Iron content of both the unweathered and the weathered beds varies widely, and the iron ores from these beds are classified as hard and soft ores primarily on the calcium carbonate content.

Chemical analyses of the ore beds (McCallie, 1908, p. 60-143; Burchard, 1913, p. 76-154; Haseltine, 1924, p. 214-216; McMaster, 1946, p. 6; Burchard and Andrews, 1947, p. 53-357) have been assembled on sheets 1 and 2. Analyses of weathered red beds—the soft ores—are more numerous on the sheets because mining along outcrops to shallow depths was extensive. Actually, more analyses of unweathered red beds—the hard ores—are available; but they are concentrated in small areas where the unweathered beds were mined. Most of the analyses for hard ores on sheets 1 and 2 are averages or ranges of many analyses from separate mines; these analyses are significant because they represent the bulk of the iron-bearing material. Iron content of the unweathered red beds ranges from as much as 47.7 percent (McCallie, 1908, p. 91) to less than 20 percent. Iron content of the weathered red beds ranges from 59.9 percent (Haseltine, 1924, p. 216) to far below acceptable ore grade, which is generally between 35 and 40 percent. A general difference in composition between hard and soft ore is indicated in table 1; the analyses are from Burchard (1913, p. 76), who sampled a section that extends from hard unweathered ore into soft weathered ore near the surface.

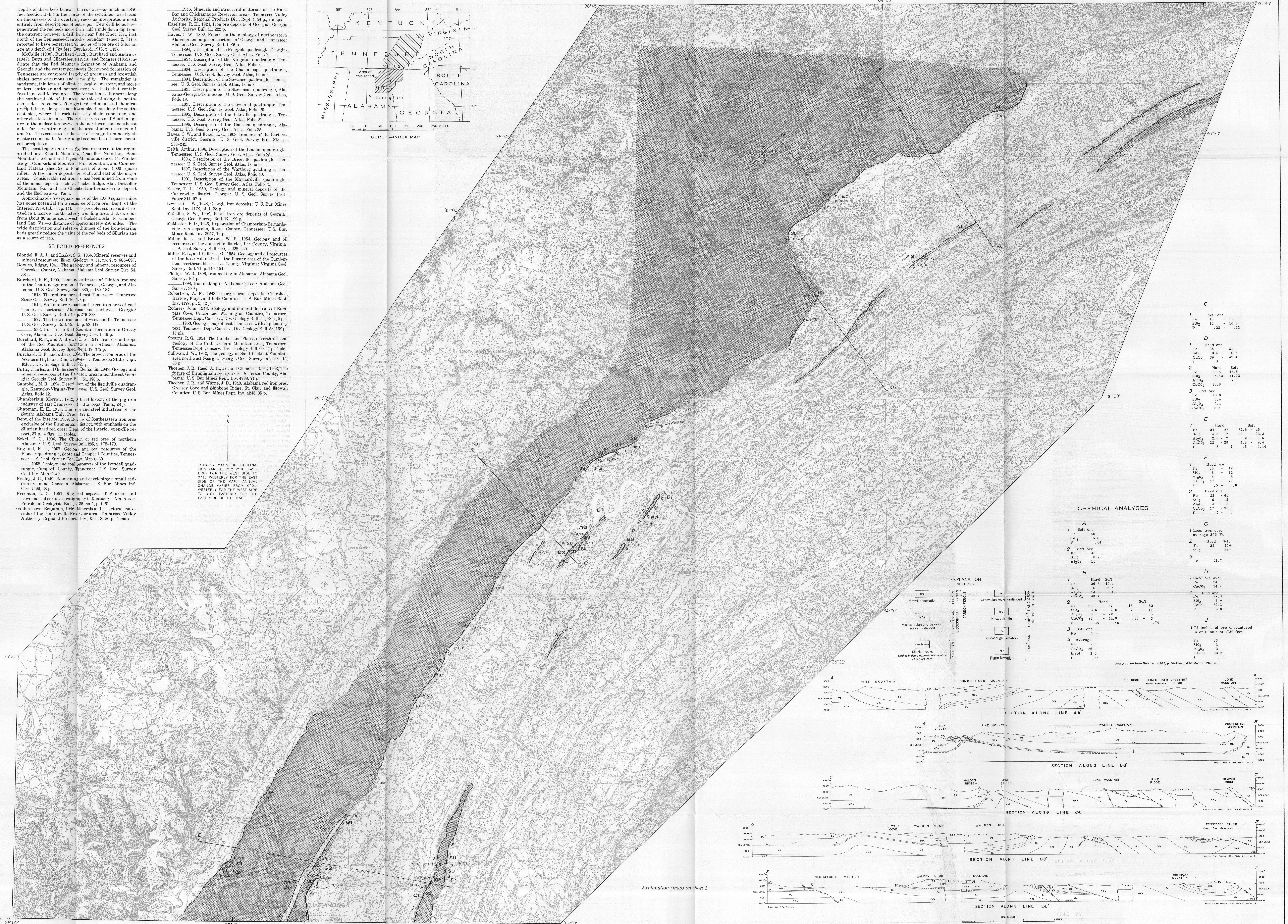
Table 1. Analyses of hard, semihard, and soft "Rockwood" iron ore from Chamberlain, Tenn., after Burchard (1913, p. 76).

	Hard	Semihard	Soft, near dividing line	Soft
Fe	27.22	37.32	52.55	50.79
SiO_2	5.00	7.92	7.63	7.62
Al_2O_3	2.82	3.07	3.64	4.31
$CaCO_3$ [a]	44.40	24.50	3.00	0.70
P	0.44	0.57	0.74	0.53
H_2O+	4.72	5.52	8.15	9.35

[a] Recalculated from CaO.

The best of the unweathered red ore that was mined in Alabama near E2 and H5 on sheet 1; in Georgia near D3, D4, D8, G2, G3, and G4 on sheet 1; in Tennessee near F1 and F2 on sheet 2 averaged approximately 37 percent iron. The hard ore in the remainder of the mined areas averaged about 26 percent iron. Possibly 30 percent iron is a reasonable average for all the hard ore in mined localities. Analyses of 187 samples of weathered red ore from mined areas in the region averaged 51.7 percent iron. However, practically all the weathered beds suitable for iron ore have been removed by mining operations. Red beds of Siluran age at some places contain less than 20 percent iron and are generally very siliceous and (or) have a high calcium carbonate content.

The red ore beds of Silurian age range from less than an inch to as much as 30 feet in thickness; however, except in the [illegible]



Base from Army Map Service sheets, scale 1:250,000

RED IRON-ORE BEDS OF SILURIAN AGE IN EAST TENNESSEE NORTH OF 35° LATITUDE AND PART OF SOUTHEASTERN KENTUCKY

By
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SCALE 1:250 000

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

1962

Compiled from available data in 1959