COMPILATION OF PROXIMATE AND ULTIMATE ANALYSES OF COAL, IMPURE COAL, AND CARBONACEOUS MUDROCK (PENNSYLVANIAN) FROM MASSACHUSETTS AND RHODE ISLAND

Compiled
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INTRODUCTION

The Narragansett basin of southeastern Massachusetts and Rhode Island has had a long disrupted history of coal exploration and mining beginning with the opening of the Portsmouth, RI mine in 1809. The last major effort to determine the coal potential of this basin was made during World War II (Chute, 1979). Recently, following the Arab oil embargo of 1973, renewed interest occurred in the coal resources of the Narragansett basin. Federal funding, beginning with National Science Foundation Grant AER76-02147 in February 1976 (Weston Observatory, 1976) and later Bureau of Mines Contract No. J0188022 beginning in November 1977 (Skehan and others, 1979) is now around one million dollars. This money together with support from state, regional, and private sources has gone into research on the quality and quantity of coal in this area and the feasibility of its development. Chemical information is of primary importance towards understanding the quality of the coal. With this in mind, the authors have compiled virtually all the chemical data on the coal of the Narragansett basin to make them available for public and private decision-making.

SOURCE AND PRESENTATION OF DATA

Table 1 is a compilation of 149 ultimate and proximate analyses of samples of coal beds collected from Pennsylvanian rocks in Massachusetts and Rhode Island. It does not include trace-element data stored in the U.S. Geological Survey's National Coal Resources Data System. Some trace-element information is found in Skehan and Murray (1978).

Locality, physical, and stratigraphic data are also included in Table 1. The samples from the coal beds are located by state, county, town or city, site (e.g., coal mine; see Fig. 1), and longitude and latitude. Name and thickness of the sampled coal beds are given when such data are available. Also included is information on rank, the nature and condition of sample, date of analysis, laboratory number, heat value, fusibility of ash, and specific gravity.

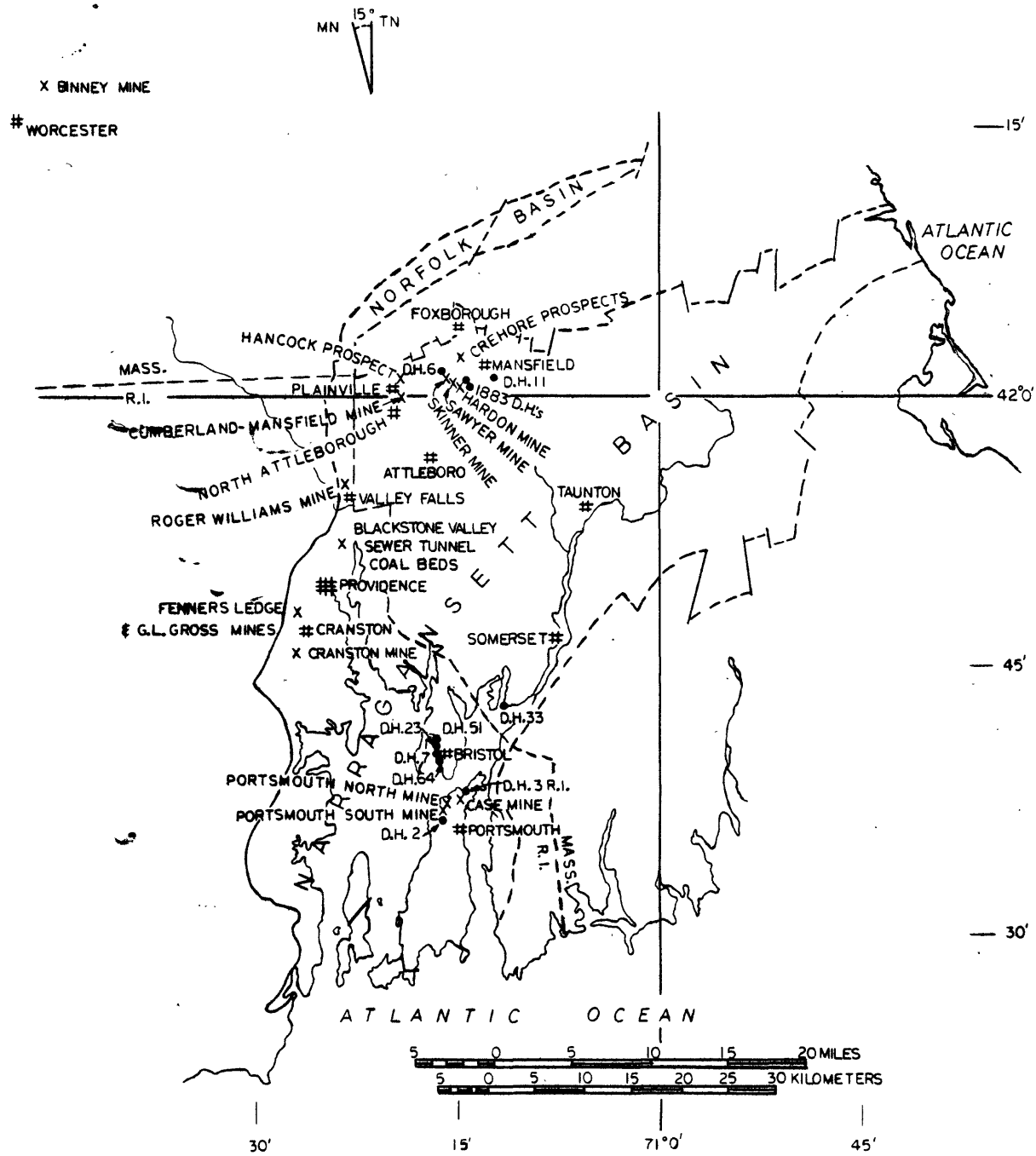

FIGURE 1. -- Geologic sketch map of the Narragansett basin showing general locations of mines, prospects, drill holes, and other sites referred to in Table 1.

Detailed information on the thickness of the coal bed at the sample site is not known for most analyses dated before 1974. However, the range and average thickness for several coal beds are included.

Almost all of the compiled data are from Pennsylvanian coal beds of the Rhode Island Formation of the Narragansett basin. This formation is Middle to Late Pennsylvanian in age and equivalent to Westphalian C to Stephanian A or B in western Europe (Lyons, 1979). Three analyses (no. 28, 29, 30) on a coal bed in the abandoned Binney Mine in Worcester, MA, are also included. This coal bed is also of Pennsylvanian age (Grew and others, 1970).

Information in Table 1 is obtained from both published and unpublished sources. Almost all analyses reported from the Narragansett Basin Project are quoted directly from coal-analysis reports. Some data reported in Barton and others (1977) and Skehan and Murray (1978) are incomplete or in error. Other published data are as old as 1840 (Jackson, 1840, Hitchcock, 1841, and Taylor, 1848). Although much older information is of limited use because of different analytical standards used in the 19th century, it is included for historical purposes. All analyses from 1974-77 are of samples collected by the Narragansett Basin Project (Skehan and Murray, 1978). This project produced a wealth of new data on the chemical composition of coal from drill cores in the Narragansett basin.

RANK AND QUALITY OF COAL OF THE NARRAGANSETT BASIN

The rank of the coal beds was determined using procedures of the American Society of Testing and Materials (1974). Because of the absence of data on sampling procedures, standard ranks could not be determined. Thus, all ranks are to be considered apparent ranks as provided for under ASTM (1974) procedures. The apparent ranks are assigned to coal beds and not to individual samples even though rank information is present in Table 1 on a sample-by-sample basis. At

least three samples from each coal bed are needed for a rank determination (ASTM,, 1974). Thus, rank is an average value based on fixed carbon corrections using the Parr formulas (ASTM, 1974).

Coal from the Narragansett basin is generally high to very high (15-33 percent) in ash. Some samples have ash contents greater than 33 percent, the maximum ash allowed for in coal resource and reserve estimation (U.S. Geological Survey and U.S. Bureau of Mines, 1976). Samples exceeding 33 percent ash content are considered impure coal (33-50 percent ash) and those with greater than 50 percent ash are carbonaceous mudrock. When the Parr formulas (ASTM 1974) are employed the very high ash contents of "coals" of the Narragansett basin inflate the fixed carbon values. Table 1 shows several coal analyses with absurd corrected fixed carbon contents of over 100 percent. Coals from the Mansfield, MA, area (analyses 13-16) which are primarily impure coals, show such inflated values. This is indicated by the fact that Mansfield coals with moderate to slightly high ash contents (analyses 9-12, 17) always come out to be anthracite while those in the impure coal category almost invariably come out to be meta-anthracite, following ASTM (1974) procedures. This is generally true for other coals as well, with the exception of the Cranston coal bed which is in a higher metamorphic terrain (Skehan and Murray, 1978) and is a true meta-anthracite.

Nevertheless, the chemical data generally allowed for apparent ranks to be determined on a bed-by-bed basis (Lyons and Chase, 1979). Almost all coal beds with ash contents less than 33 percent are anthracite. Two exceptions are the Cranston coal bed and the Portsmouth C coal bed which are meta-anthracite and semianthracite, respectively (Lyons and Chase, 1979).

The coal of the Narragansett basin is generally very low in sulfur and averages 0.4 percent. Its specific gravity ranges from 1.65 to 2.21, averaging 1.96. Heating value of the coal (not including impure coal) on an as-received basis ranges from 5,976 to 13,728 Btu; average is 9,961 Btu. Recent analyses indicate it has a free-swelling index of zero and, therefore, is a noncoking coal.

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FOOTNOTES TO ACCOMPANY TABLE 1

1. Condition 1, moist or as received; condition 2, dry; condition 3, dry, mineral-matter-free.

2. Using Parr formula for dry, mineral-matter-free fixed carbon from "moist" basis (ASTM, 1974).

3. M, meta-anthracite; A, anthracite; S, semianthracite.

4. Scheffy, C. C., (1920, unpub. data), private papers, Trent Process Company, Washington, D.C. to Clinton C. Scheffy, Mansfield, MA, 18 Dec. 1920.

5. Mass. Coal & Power Company, c. 1910, p. 13 gives "Water" 1.04, volatile combustible 3.75, but claims to quote from Shaler and others, 1899, (p. 191).

6. Barton and others, 1977, give inaccurate values for latitude and longitude which are nearer to the Sawyer mine than to any other.

7. BM, Bureau of Mines, Pittsburgh, PA.

8. Combined moisture and volatile-matter.

9. Massachusetts Coal and Power Company, c. 1910, 15 p.

10. Cumberland-Mansfield Coal and Power Company, c. 1910, 12 p.

11. "Southerly part of Wrentham" became Plainville, MA, in 1905.

12. Toenges and others, 1948, give 11,110 Btu.

13. Toenges and others, 1948, give 11,620 Btu.

14. Sulfur from Ashley, 1915, p. 27.

15. Sulfur and Btu from H. B. Chase unpublished data, source unknown. Special Commission, 1925, p. 23, gives Btu as 9,710, "total combustible matter", 67.0.

16. Toenges and others, 1948, p. 15, give fixed carbon as 64.3.

17. Analysis lists also: Water 7.80, carbon 39.70, silica 38.00, alumina 4.20, iron oxide and manganese 9.00, lime 1.23 = 99.93%. The ash consists of silica 8.0, alumina and iron oxide 7.0, and traces of lime.

18. Taylor, 1848, p. 694, gives ash as 52.10.

19. The ash consists of silica 7.4; iron oxide, alumina, and manganese 8.0; traces of lime.

20. Moist, mineral-matter free.

21. Proximate analysis totals to 100.59.

22. Ash consists of silica 0.333, alumina 0.233, iron oxide 2.050, manganese 0.666, lime 0.376.

23. The ash consists of silica 4.20; alumina, manganese, and iron oxide 5.00; lime 0.30.

24. Ashley, 1915 (p. 26) gives 4.30 for ultimate oxygen.

25. Ashley, 1915 (p. 26) gives 17.63 for ash.

26. Ashley, 1915 (p. 26) gives 4.21 for ultimate oxygen.

27. Ashley, 1915 (p. 26) gives 18.20 for ash.

28. Ashley, 1915 (p. 26) gives 0.12 for ultimate sulfur.

29. Ashley, 1915 (p. 26) gives 3.40 for ultimate oxygen.

30. Ashley, 1915 (p. 26) gives 15.45 for ash.