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# NAHCOLITE ANALYSES OF THREE DRILL CORES FROM THE SALINE FACIES OF THE GREEN RIVER FORMATION IN NORTHWEST COLORADO

By JOHN R. DYNI, P. CHARLES BECK and WAYNE MOUNTJOY

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## Introduction

Results of quantitative analyses of nahcolite ($NaHCO_3$) are reported for three core holes drilled in the nahcolite-bearing part of the oil-shale deposits in the Green River Formation in northwest Colorado. Nahcolite in large quantities was found in each core hole through sequences of predominantly oil shale ranging from 556 to 702 feet in thickness; however, two of the three wells did not penetrate the entire nahcolite-bearing sequence. The average nahcolite content for the sequence analyzed in each core hole ranges from 18 to 26 weight percent. Resources of as much as 0.3 billion tons of nahcolite per square mile are indicated.

Nahcolite is a potential source of soda ash, a basic industrial chemical. The mineral shows promise also as a chemically reactive agent for removing sulfur from industrial stack gases (Nielsen, 1969, p. 60).

The three core holes are the Joe T. Juhan core hole 4-1, and the Irvin Nielsen core holes 17-1 and 20-1. These wells, located near the saline depocenter in the northern part of the Piceance Creek basin in Rio Blanco County (index map on fig. 1), were drilled in 1965 and 1966 on Federal sodium prospecting permits to test the sodium mineral potential in the basin.

Visual determination of the amount of nahcolite in the Juhan core hole was reported earlier by Hite and Dyni (1967). Analyses given here show about 5 to 7 percent more nahcolite than had been previously reported.

The authors thank Mr. Irvin Nielsen and Mr. Joe T. Juhan for making available the cores used in this study. The nahcolite analyses were made by J. R. Dyni and P. C. Beck using a thermal technique recently developed by Dyni, Mountjoy, Hauff, and Blackmon (1971). Selected samples from each core were chemically analyzed by Wayne Mountjoy to check the accuracy and precision of the thermal technique.

## Occurrence of nahcolite

Nahcolite, dawsonite [$NaAl(OH)_2CO_3$], halite, and minor amounts of other sodium minerals form a saline facies in oil shale in the lower part of the Parachute Creek Member of the Green River Formation (Eocene) in the northern part of the Piceance Creek basin. The geology of the saline facies was described briefly by Hite and Dyni (1967) and Dyni, Hite, and Raup (1970), and stratigraphic sections of the deposits were published by Trudell, Beard, and Smith (1970).

The three core holes are located near the south and east edges of the halite deposits which mark the saline depocenter of the basin. (See index map on fig. 1.) Some halite is present in the Nielsen core hole 17-1, but it is absent in the other core holes owing partly to nondeposition and partly to leaching by ground water. The depth from ground surface to the top of the nahcolite-bearing oil shale in the three core holes ranges from 1,399 to 1,850 feet. This top is a dissolution surface above which a zone of oil shale, several hundred feet thick, has been leached of saline minerals, mostly nahcolite and halite. The total thickness of nahcolite-bearing rocks in the Juhan core hole is 556 feet. The Nielsen core hole 20-1 penetrated 679 feet of nahcolite-bearing rocks whose total thickness in this locality is estimated to be about 780 feet. The Nielsen core hole 17-1 penetrated 702 feet of nahcolite-bearing rocks whose total thickness there is estimated to be about 900 feet.

## Method of analysis

Composite samples of each core were prepared by sawing slabs or quarters of core, then crushing and grinding this material to pass about a 100-mesh screen. The samples from the Juhan core hole represent arbitrary 2-foot lengths of core as they appeared in the core boxes. The samples from the Nielsen core holes represent lengths of core that were selected (1) to yield maximum concentrations of nahcolite, and (2) to coincide with lithologic units. Core lengths are as much as 8 feet, but most are 5 feet or less.

The thermal method for quantitative determination of nahcolite in oil shale is fully described by Dyni, Mountjoy, Hauff, and Blackmon (1971). Basically, the technique measures weight loss of a sample of nahcolite-bearing oil shale heated for 14 hours at 105°C. The weight loss is due to thermal decomposition of nahcolite and is proportional to the amount of nahcolite in the sample. The amount of nahcolite is calculated from the following equation: Nahcolite (weight percent) = percent weight loss X 2.690 + 0.375. Interferences are slight. The accuracy of the thermal method is ±2 weight-percent nahcolite at 95-percent confidence limits as determined by analysis of samples from the Juhan core (Dyni and others, 1971) and by comparative analyses of samples randomly selected from the Nielsen cores as shown by table 1.

Table 1.--Comparison of chemical and thermal analyses for nahcolite.

[Chemical analyses (method of Smith and Young, 1969) by Wayne Mountjoy; thermal analyses by J. R. Dyni].

| Sample depth (feet) | Nahcolite (weight percent) | |
|---|---|---|
| | Chemical analysis | Thermal analysis |
| **Nielsen core hole 17-1** | | |
| 1859.8-62.5 | 93.5 | 94.2 |
| 1907.9-12.0 | 23.0 | 22.1 |
| 1988.5-91.5 | 74.5 | 75.3 |
| 2048.7-53.2 | 18.0 | 17.6 |
| 2114.9-18.6 | 43.1 | 44.1 |
| 2186.0-90.3 | 67.2 | 65.1 |
| 2275.3-78.1 | 72.7 | 73.9 |
| 2333.0-36.0 | 5.5 | 5.6 |
| 2403.7-07.4 | 54.8 | 55.3 |
| 2532.8-35.5 | 32.5 | 33.0 |
| **Nielsen core hole 20-1** | | |
| 1496.7-1500.8 | 30.4 | 29.9 |
| 1510.4-12.0 | 80.8 | 80.4 |
| 1593.5-98.8 | 40.2 | 40.0 |
| 1627.6-32.3 | 30.4 | 29.8 |
| 1724.5-28.0 | 60.3 | 60.8 |
| 1778.6-79.6 | 92.4 | 91.9 |
| 1803.2-09.0 | 9.1 | 10.1 |
| 1814.7-20.5 | 21.2 | 21.0 |
| 1860.0-63.0 | 2.2 | 3.0 |
| 2034.5-39.5 | 51.2 | 50.2 |
| 2070.0-73.0 | 69.8 | 70.4 |

## Results of analyses

The abundance of nahcolite in each core hole varies widely (tables 2-4, fig. 1). Individual samples contain from 0 to 94 weight percent nahcolite. Nahcolite is most abundant in Nielsen core hole 20-1. In this well three particularly nahcolite rich units were found that range from 6 to 8 feet in thickness and contain 84 to 92 percent nahcolite. Nahcolite is slightly less abundant in Nielsen core hole 17-1, because of dilution by halite. The least amount of nahcolite was found in the Juhan core hole.

Tabulated below are the average grade and total thickness of the nahcolite-bearing sequence in each core hole. A figure for the tonnage of nahcolite that is represented is also given, based on an average density for the nahcolite-bearing rocks of 2.15 grams per cubic centimeter, or 134.22 pounds per cubic foot.

| Drill hole | Total thickness of nahcolite sequence (feet) | Average grade (weight percent of nahcolite) | Tonnage of nahcolite per square mile (millions of short tons) |
|---|---|---|---|
| Juhan 4-1------ | 556 | 18.0 | 187 |
| Nielsen 20-1--- | 679 | 26.4 | 335 |
| Nielsen 17-1--- | 702 | 22.2 | 292 |

Although the lithology and stratigraphy of the saline facies have not been studied in detail, one important relation is suggested by the histograms on figure 1. In the Nielsen core hole 20-1, the rocks at the depths 1,566.9 to 1,574.8; 1,598.8 to 1,600.0; and 1,616.7 to 1,623.1 are beds of nearly pure coarsely crystalline pitted white nahcolite. These beds seem to grade laterally toward the center of the saline basin into beds of halite in the Nielsen core hole 17-1. Thus the halite is likely a basin-center facies of the nahcolite. Moreover, the beds are richest in nahcolite where they are immediately adjacent to the halite facies, which may be a useful guide in exploring for minable sections of nahcolite-rich rocks in the basin.

Table 2.--Nahcolite analyses, Joe T. Juhan core hole 4-1; 1,859 feet south of north line, and 1,947 feet west of east line; SW¼NE¼ sec. 4, T. 2 S., R. 98 W., Rio Blanco County, Colo.
Ground elevation (sample depth datum): 6,660.5 feet above MSL.
/Analyst: P. C. Beck/

| Depth (feet) | Nahcolite (weight percent) | Depth (feet) | Nahcolite (weight percent) |
|---|---|---|---|
| (1842 --- Top of saline rich zone) | | | |
| 1841-43 | 11.4 | 1921-23 | 10.9 |
| 1843-45 | 12.9 | 1923-25 | 24.1 |
| 1845-47 | 36.1 | 1925-27 | 23.5 |
| 1847-49 | 40.8 | 1927-29 | 5.9 |
| 1849-51 | 46.7 | 1929-31 | 5.4 |
| 1851-53 | 62.9 | 1931-33 | 15.2 |
| 1853-55 | 71.5 | 1933-35 | 66.1 |
| 1855-57 | 4.1 | 1935-37 | 54.4 |
| 1857-59 | 60.3 | 1937-39 | 30.1 |
| 1859-61 | 28.1 | 1939-41 | 18.7 |
| 1861-63 | 36.0 | 1941-43 | 12.6 |
| 1863-65 | 22.6 | 1943-45 | 8.5 |
| 1865-67 | 18.0 | 1945-47 | 11.8 |
| 1867-69 | 37.7 | 1947-49 | 24.0 |
| 1869-71 | 27.4 | 1949-51 | 21.1 |
| 1871-73 | 13.0 | 1951-53 | 21.8 |
| 1873-75 | 16.8 | 1953-55 | 19.5 |
| 1875-77 | 15.0 | 1955-57 | 40.6 |
| 1877-79 | 13.7 | 1957-59 | 54.0 |
| 1879-81 | 13.9 | 1959-61 | 26.9 |
| 1881-83 | 24.4 | 1961-63 | 37.6 |
| 1883-85 | <2.0 | 1963-65 | 47.3 |
| 1885-87 | 12.6 | 1965-67 | 32.1 |
| 1887-89 | 31.8 | 1967-69 | 24.4 |
| 1889-91 | <2.0 | 1969-71 | 11.6 |
| 1891-93 | 13.8 | 1971-73 | 12.8 |
| 1893-95 | 35.3 | 1973-75 | 29.2 |
| 1895-97 | 14.9 | 1975-77 | 6.9 |
| 1897-99 | 15.4 | 1977-79 | 14.8 |
| 1899-1901 | 15.1 | 1979-81 | 40.0 |
| 1901-03 | 14.8 | 1981-83 | 10.5 |
| 1903-05 | 21.0 | 1983-85 | 3.2 |
| 1905-07 | 2.0 | 1985-87 | <2.0 |
| 1907-09 | <2.0 | 1987-89 | 12.2 |
| 1909-11 | 34.4 | 1989-91 | 31.7 |
| 1911-13 | 16.9 | 1991-93 | 14.8 |
| 1913-15 | 48.8 | 1993-95 | 19.4 |
| 1915-17 | 25.6 | 1995-97 | <2.0 |
| 1917-19 | 64.7 | 1997-99 | <2.0 |
| 1919-21 | 18.2 | 1999-2001 | <2.0 |

Table 2 (continued)

| Depth (feet) | Nahcolite (weight percent) | Depth (feet) | Nahcolite (weight percent) |
|---|---|---|---|
| 2001-03 | <2.0 | 2101-03 | <2.0 |
| 2003-05 | <2.0 | 2103-05 | <2.0 |
| 2005-07 | <2.0 | 2105-07 | <2.0 |
| 2007-09 | <2.0 | 2107-09 | <2.0 |
| 2009-11 | 19.9 | 2109-11 | <2.0 |
| 2011-13 | <2.0 | 2111-13 | <2.0 |
| 2013-15 | 18.8 | 2113-15 | <2.0 |
| 2015-17 | 22.0 | 2115-17 | 19.0 |
| 2017-19 | 7.2 | 2117-19 | <2.0 |
| 2019-21 | 8.5 | 2119-21 | <2.0 |
| 2021-23 | 15.7 | 2121-23 | <2.0 |
| 2023-25 | 17.5 | 2123-25 | 6.5 |
| 2025-27 | 6.4 | 2125-27 | 3.9 |
| 2027-29 | <2.0 | 2127-29 | 15.5 |
| 2029-31 | <2.0 | 2129-31 | 5.9 |
| 2031-33 | 5.7 | 2131-33 | <2.0 |
| 2033-35 | <2.0 | 2133-35 | <2.0 |
| 2035-37 | 6.9 | 2135-37 | <2.0 |
| 2037-39 | <2.0 | 2137-39 | <2.0 |
| 2039-41 | <2.0 | 2139-41 | <2.0 |
| 2041-43 | <2.0 | 2141-43 | <2.0 |
| 2043-45 | <2.0 | 2143-45 | <2.0 |
| 2045-47 | <2.0 | 2145-47 | <2.0 |
| 2047-49 | 29.4 | 2147-49 | <2.0 |
| 2049-51 | 65.2 | 2149-51 | <2.0 |
| 2051-53 | 33.1 | 2151-53 | <2.0 |
| 2053-55 | 28.1 | 2153-55 | <2.0 |
| 2055-57 | 23.5 | 2155-57 | <2.0 |
| 2057-59 | 55.8 | 2157-59 | <2.0 |
| 2059-61 | <2.0 | 2159-61 | <2.0 |
| 2061-63 | <2.0 | 2161-63 | <2.0 |
| 2063-65 | <2.0 | 2163-65 | <2.0 |
| 2065-67 | 35.9 | 2165-67 | <2.0 |
| 2067-69 | 31.0 | 2167-69 | <2.0 |
| 2069-71 | 16.1 | 2169-71 | <2.0 |
| 2071-73 | 9.5 | 2171-73 | 9.8 |
| 2073-75 | <2.0 | 2173-75 | <2.0 |
| 2075-77 | <2.0 | 2175-77 | <2.0 |
| 2077-79 | <2.0 | 2177-79 | <2.0 |
| 2079-81 | 64.2 | 2179-81 | 5.3 |
| 2081-83 | <2.0 | 2181-83 | 9.5 |
| 2083-85 | <2.0 | 2183-85 | 42.5 |
| 2085-87 | <2.0 | 2185-87 | 17.6 |
| 2087-89 | <2.0 | 2187-89 | 30.4 |
| 2089-91 | <2.0 | 2189-91 | 26.5 |
| 2091-93 | <2.0 | 2191-97 | 21.0 |
| 2093-95 | <2.0 | 2197-99 | No sample |
| 2095-97 | 18.0 | 2199-2201 | 51.2 |
| 2097-99 | <2.0 | | |
| 2099-2101 | <2.0 | | |

Table 2 (continued)

| Depth (feet) | Nahcolite (weight percent) |
|---|---|
| 2201-03 | 53.8 |
| 2203-05 | 36.7 |
| 2205-07 | 29.2 |
| 2207-11 | No sample |
| 2211-13 | 6.5 |
| 2213-15 | 11.2 |
| 2215-17 | 17.7 |
| 2217-19 | 5.6 |
| 2219-20 | No sample |
| 2220-22 | 29.2 |
| 2221-23 | 20.0 |
| 2223-25 | 37.7 |
| 2225-27 | 13.8 |
| 2227-29 | 40.0 |
| 2229-31 | 33.4 |
| 2231-33 | 16.4 |
| 2233-35 | 4.6 |
| 2235-37 | 44.0 |
| 2237-39 | 53.8 |
| 2239-41 | 26.2 |
| 2241-42 | No sample |
| 2242-43 | 44.9 |
| 2243-45 | 44.6 |
| 2245-47 | 57.5 |
| 2247-49 | 46.8 |
| 2249-51 | 50.4 |
| 2251-53 | 54.3 |
| 2253-55 | 22.8 |
| 2255-57 | 52.2 |
| 2257-59 | 53.2 |
| 2259-61 | 47.4 |
| 2261-63 | 50.7 |
| 2263-65 | 24.2 |
| 2265-67 | 36.4 |
| 2267-69 | 24.0 |
| 2269-71 | 9.3 |
| 2271-73 | 11.0 |
| 2273-75 | 14.7 |
| 2275-77 | 19.2 |
| 2277-79 | 23.0 |
| 2279-81 | 27.4 |
| 2281-83 | 52.3 |
| 2283-85 | 61.3 |
| 2285-87 | 11.2 |
| 2287-89 | 81.8 |
| 2289-91 | 74.3 |
| 2291-93 | 64.6 |
| 2293-95 | 35.8 |
| 2295-97 | 14.3 |
| 2297-99 | 13.9 |
| 2299-2301 | 12.1 |

| Depth (feet) | Nahcolite (weight percent) |
|---|---|
| 2301-03 | 30.4 |
| 2303-05 | <2.0 |
| 2305-07 | <2.0 |
| 2307-09 | <2.0 |
| 2309-11 | <2.0 |
| 2311-13 | 4.3 |
| 2313-15 | <2.0 |
| 2315-17 | 3.5 |
| 2317-19 | <2.0 |
| 2319-21 | 24.9 |
| 2321-23 | 77.1 |
| 2323-25 | 57.3 |
| 2325-27 | 17.3 |
| 2327-29 | <2.0 |
| 2329-31 | <2.0 |
| 2331-33 | <2.0 |
| 2333-35 | <2.0 |
| 2335-37 | <2.0 |
| 2337-39 | <2.0 |
| 2339-41 | <2.0 |
| 2341-43 | <2.0 |
| 2343-45 | <2.0 |
| 2345-47 | <2.0 |
| 2347-49 | <2.0 |
| 2349-51 | <2.0 |
| 2351-53 | <2.0 |
| 2353-55 | No sample |
| 2355-57 | <2.0 |
| 2357-59 | 31.4 |
| 2359-61 | 64.1 |
| 2361-63 | 73.7 |
| 2363-65 | 71.2 |
| 2365-67 | 38.9 |
| 2367-69 | 18.7 |
| 2369-71 | 4.9 |
| 2371-73 | <2.0 |
| 2373-75 | 7.2 |
| 2375-77 | 6.1 |
| 2377-79 | 42.2 |
| 2379-81 | 10.5 |
| 2381-83 | 10.9 |
| 2383-85 | <2.0 |
| 2385-87 | No sample |
| 2387-89 | 14.6 |
| 2389-91 | 5.3 |
| 2391-93 | 17.9 |
| 2393-95 | 14.4 |
| 2395-97 | 11.9 |
| (2397---Base of nahcolite-bearing rocks) | |
| 2397-99 | <2.0 |
| 2399-2401 | <2.0 |

Table 3.--Nahcolite analyses, Irvin Nielsen core hole 20-1; 979 feet north of south line, and 369 feet west of east line; SE¼SE¼ sec. 20, T. 1 S., R. 97 W., Rio Blanco County, Colo.
Ground elevation (sample depth datum): 6,215.1 feet above MSL.
[Analyst: J. R. Dyni]

| Depth (feet) | Nahcolite (weight percent) | Depth (feet) | Nahcolite (weight percent) |
|---|---|---|---|
| (1399---Top of saline-rich zone) | | | |
| 1404.9-11.2 | 87.0 | 1563.6-66.9 | 42.4 |
| 1411.2-15.5 | 16.9 | 1566.9-74.8 | 84.1 |
| 1415.5-21.3 | 51.0 | 1574.8-79.5 | 65.0 |
| 1421.3-26.6 | 51.9 | 1579.5-84.2 | 22.8 |
| 1426.6-31.8 | 13.4 | 1584.2-88.9 | 15.4 |
| 1431.8-37.1 | 15.9 | 1588.9-93.5 | 14.7 |
| 1437.1-39.4 | 26.5 | 1593.5-98.8 | 40.0 |
| 1439.4-43.6 | 34.5 | 1598.8-1600.0 | 86.8 |
| 1443.6-47.3 | <2.0 | 1600.0-04.1 | 24.7 |
| 1447.3-51.4 | 8.7 | 1604.1-06.5 | 54.2 |
| 1451.4-53.8 | 6.4 | 1606.5-10.0 | 27.1 |
| 1453.8-57.5 | 35.8 | 1610.0-12.9 | 25.9 |
| 1457.5-62.0 | 45.7 | 1612.9-16.7 | 40.8 |
| 1462.0-64.8 | 2.7 | 1616.7-23.1 | 91.6 |
| 1464.8-68.3 | 16.9 | 1623.1-27.6 | 7.2 |
| 1468.3-71.3 | 27.3 | 1627.6-32.3 | 29.8 |
| 1471.3-76.3 | 28.7 | 1632.3-34.9 | <2.0 |
| 1476.3-81.4 | 51.0 | 1634.9-40.0 | 45.8 |
| 1481.4-84.3 | 13.7 | 1640.0-45.0 | 57.6 |
| 1484.3-87.2 | 3.0 | 1645.0-50.4 | 9.0 |
| 1487.2-90.7 | 2.3 | 1650.4-53.5 | 36.4 |
| 1490.7-93.1 | < 2.0 | 1653.5-56.6 | 11.4 |
| 1493.1-96.7 | 37.7 | 1656.6-60.5 | 40.4 |
| 1496.7-1500.8 | 29.9 | 1660.5-66.7 | 10.5 |
| 1500.8-05.6 | 9.4 | 1666.7-70.4 | <2.0 |
| 1505.6-10.4 | 14.9 | 1670.4-73.9 | <2.0 |
| 1510.4-12.0 | 80.4 | 1673.9-75.2 | 77.2 |
| 1512.0-15.6 | 15.1 | 1675.2-78.5 | 2.1 |
| 1515.6-20.0 | 42.6 | 1678.5-81.8 | 60.0 |
| 1520.0-21.9 | 51.2 | 1681.8-86.0 | 7.6 |
| 1521.9-26.8 | < 2.0 | 1686.0-89.5 | 21.6 |
| 1526.8-29.6 | 26.1 | 1689.5-93.0 | 15.0 |
| 1529.6-34.6 | 28.0 | 1693.0-96.2 | 5.9 |
| 1534.6-38.5 | 9.8 | 1696.2-1700.4 | 4.8 |
| 1538.5-43.7 | 15.3 | 1700.4-04.3 | 49.8 |
| 1543.7-47.7 | < 2.0 | 1704.3-07.8 | 56.5 |
| 1547.7-51.7 | < 2.0 | 1707.8-09.6 | 15.0 |
| 1551.7-55.6 | < 2.0 | 1709.6-11.5 | 69.5 |
| 1555.6-60.2 | 77.9 | 1711.5-16.5 | 22.4 |
| 1560.2-63.6 | 71.6 | 1716.5-22.5 | 14.5 |

Table 3--cont'd

| Depth (feet) | Nahcolite (weight percent) |
|---|---|
| 1722.5-24.5 | 44.0 |
| 1724.5-28.0 | 60.8 |
| 1728.0-30.3 | 27.0 |
| 1730.3-34.0 | 6.0 |
| 1734.0-38.0 | 8.7 |
| 1738.0-42.6 | 49.9 |
| 1742.6-47.4 | 27.8 |
| 1747.4-52.4 | 36.8 |
| 1752.4-57.8 | 35.9 |
| 1757.8-61.7 | 49.9 |
| 1761.7-66.3 | 12.6 |
| 1766.3-71.8 | 37.2 |
| 1771.8-75.0 | 7.8 |
| 1775.0-78.6 | 21.4 |
| 1778.6-79.6 | 91.9 |
| 1779.6-84.6 | 25.9 |
| 1784.6-89.2 | 16.2 |
| 1789.2-94.9 | 9.1 |
| 1794.9-99.7 | 13.4 |
| 1799.7-1803.2 | 2.5 |
| 1803.2-09.0 | 10.1 |
| 1809.0-12.6 | 12.6 |
| 1812.6-14.7 | 38.3 |
| 1814.7-20.5 | 21.0 |
| 1820.5-23.6 | 6.3 |
| 1823.6-27.1 | <2.0 |
| 1827.1-30.9 | <2.0 |
| 1830.9-33.8 | <2.0 |
| 1833.8-36.8 | <2.0 |
| 1836.8-39.8 | <2.0 |
| 1839.8-43.8 | <2.0 |
| 1843.8-46.8 | 58.5 |
| 1846.8-50.0 | 61.2 |
| 1850.0-55.0 | 8.9 |
| 1855.0-60.0 | 4.6 |
| 1860.0-63.0 | 3.0 |
| 1863.0-66.2 | 5.4 |
| 1866.2-71.8 | 5.1 |
| 1871.8-76.4 | 11.1 |
| 1876.4-81.4 | 47.7 |
| 1881.4-86.4 | 34.5 |
| 1886.4-91.4 | 32.4 |
| 1891.4-95.2 | 15.9 |
| 1895.2-99.2 | 57.5 |
| 1899.2-1903.1 | 53.3 |
| 1903.1-07.1 | <2.0 |
| 1907.1-11.1 | <2.0 |
| 1911.1-14.8 | <2.0 |
| 1914.8-18.0 | 61.8 |
| 1918.0-21.4 | 6.7 |
| 1921.4-25.2 | <2.0 |
| 1925.2-29.1 | 12.4 |
| 1929.1-33.7 | <2.0 |
| 1933.7-38.3 | <2.0 |
| 1938.3-41.3 | <2.0 |
| 1941.3-44.8 | <2.0 |
| 1944.8-49.8 | <2.0 |
| 1949.8-54.8 | <2.0 |
| 1954.8-59.8 | <2.0 |
| 1959.8-64.5 | 8.6 |
| 1964.5-68.7 | 5.4 |
| 1968.7-72.9 | 22.4 |
| 1972.9-77.6 | 41.9 |
| 1977.6-82.6 | 46.4 |
| 1982.6-87.6 | 57.4 |
| 1987.6-90.2 | 56.0 |
| 1990.2-95.2 | 18.6 |
| 1995.2-2000.8 | 28.5 |
| 2000.8-05.8 | <2.0 |
| 2005.8-11.0 | 5.8 |
| 2011.0-15.3 | 2.9 |
| 2015.3-20.2 | 46.7 |
| 2020.2-24.5 | 28.3 |
| 2024.5-29.5 | 63.0 |
| 2029.5-34.5 | 48.6 |
| 2034.5-39.5 | 50.2 |
| 2039.5-44.5 | 60.1 |
| 2044.5-46.7 | 68.4 |
| 2046.7-51.3 | 12.8 |
| 2051.3-54.4 | 31.8 |

Table 3--cont'd

| Depth (feet) | Nahcolite (weight percent) |
|---|---|
| 2054.4-57.8 | 48.7 |
| 2057.8-61.8 | 13.8 |
| 2061.8-65.6 | 20.6 |
| 2065.6-67.1 | 19.2 |
| 2067.1-70.0 | 82.8 |
| 2070.0-73.0 | 70.4 |
| 2073.0-76.5 | 22.0 |
| 2076.5-80.2 | 21.3 |
| 2080.2-84.0 | 16.4 |

(2084.0 --- Total depth of core hole)