Member consists of a succession of lithologically distinct units that can be easily correlated with units recognized in the pit area.

The cross section in Fig. 10 prepared by using the Published data of White[7] shows that the structure of the down-dip extension of the iron-formation is simple. The rocks dip about 7° SE., equivalent to a 12 percent grade.

Hole No. 8, Calumet: The geology of this hole was discussed in detail in the main body of the report because there are no metallurgical data available—thus making the geologic interpretation all important.

APPENDIX 3

Physical Property Tests

This appendix section describes briefly the methods employed in making the physical property tests and presents the detailed results of the individual tests for Holes 2, 5 and 7 in Tables A-2, A-3 and A-4.

A. *The U.S. Bureau of Mines Twin Cities Research Center* performed tests to determine sonic velocity, Young's modulus and specific gravity, using specially prepared core samples of 10-inch length.

Sonic Velocity

Frequencies, representing sonic velocity, were measured using an electronic frequency meter with all measurements being taken at room temperature.

Young's Modulus

Dynamic Young's moduli were obtained by the usual longitudinal resonance method. The equations involved were:

(1) $V = 2 L_1 f$ and (2) $E = V^2 p$

where, V = phase velocity
L_1 = sample length
f = frequency at resonance (fundamental mode)
E = dynamic Young's modulus
p = density

For very accurate determinations of Young's modulus, the correction factors determined by Bancroft can be applied to equation (2). For these samples the correction was omitted, because it would raise the value less than 0.3 percent.

Specific Gravity

Because the taconite samples had a low porosity, and their diameters were not uniform over the length of core, the specific gravity was obtained by weighing the samples in air and then in water. The equation used was:

$$\text{specific gravity} = \frac{W_{air}}{W_{air} - W_{water}}$$

B. *The School of Mineral and Metallurgical Engineering,* University of Minnesota, performed tests for determining modulus of rupture, tensile strength and compressive strength. The modulus of rupture test was made on the 10-inch samples. The sample then was cut into two 1-inch long samples (for tensile strength tests), and one 4-inch long sample (for compressive strength tests).

TABLE A-2. Physical Property Tests—Hole No. 2 South of Biwabik

Sample Depth (ft)	Sonic Velocity (mps)	Young's Modulus (10^6 psi)	Tensile Strength (psi)	Modulus of Rupture (psi)	Compressive Strength (psi)	Specific Gravity
1718	5,760	14.77	1,940	....	78,200	3.07
1760	3,825	6.25	1,850	1,830	37,300	2.94
1804	5,480	14.15	2,580	3,730	63,900	3.25
1849	5,410	13.96	2,180	3,800	58,700	3.29
1888	5,100	11.08	1,690	3,590	41,500	2.94
1971	5,430	12.22	2,320	6,200	31,900	2.86
2002	5,150	11.66	3,070	1,940	39,800	3.02
2013	5,225	11.13	2,590	4,860	49,300	2.81
2030	5,115	11.80	1,850	5,130	32,800	3.11
2037	5,480	13.67	3,060	5,280	53,900	3.14
2049	5,235	14.19	2,150	4,650	60,700	3.57
2062	5,525	14.23	2,500	4,860	59,900	3.21
2072	5,585	14.60	3,440	4,010	52,300	3.23
2083	5,340	13.08	3,740	1,580	51,800	3.16
2092	5,460	14.65	2,500	7,110	70,500	3.39
2104	5,565	14.90	3,470	4,080	44,400	3.32
2115	5,485	15.73	1,990	....	53,600	3.60
2126	5,265	13.45	1,420	1,690	60,700	3.35
2137	5,100	12.49	1,100	6,920	26,500	3.31
2150	5,170	12.90	1,240	3,380	27,500	3.33
2159	5,325	14.09	2,860	3,920	25,500	3.43
2168	5,465	14.27	1,770	5,540	47,000	3.29
2178	5,410	14.57	1,560	6,430	60,500	3.43
2192	5,575	14.19	2,640	6,000	59,400	3.15
2206	5,200	13.16	1,640	....	40,700	3.36
2223	5,480	12.26	2,250	5,710	42,500	2.82