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Preliminary Report on MATLOCK TACONITE BODY

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Prepared in part with information from:
Geology of Minnesota, a Centennial Volume, 1972; by P.K. Sims and G.B. Morey
and
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The Matlock Taconite body is a deposit of alternating bands of black (metallic) magnetite and white chert (?), at least 187 feet thick and lying at a depth of about 472 feet below the surface. The body was encountered in a test core hole about 2 1/2 miles west of Matlock in eastern Sioux County, 3/4 miles south of the Sioux/Lyon County line. Evidence indicates that the taconite body and the rocks which surround it are of Precambrian age. The taconite body is roughly circular in shape with a diameter of a few miles and an indeterminate maximum thickness.

The body was first discovered as a strong positive anomaly in a 1963 aeromagnetic survey of NW Iowa (Map 1) conducted under a contract with the Iowa Geological Survey. In that same year the New Jersey Zinc Company drilled 12 exploration holes on the anomaly, collecting over 7,000 feet of Precambrian core. Map 2 displays the location of these test holes. Only test hole C-1 encountered the body. This hole penetrated an 187 foot interval of taconite at a depth of about 472 ft. The other test holes (see Table 1 for location data) primarily encountered serpentinitic(?) Precambrian rocks.

A detailed study of the cores obtained by New Jersey Zinc Co. has not been completed, however a cursory examination of a few of the cores, as well as a look at available geophysical data and Precambrian rock sequences in the area allows speculation as to the origin of the ore body.

Scant well control suggests that the Precambrian basement in the area west of Matlock is composed primarily of rhyolite of undetermined thickness. Aeromagnetic data has been interpreted as indicating a relatively thin rhyolite underlain by rocks of basic or intermediate composition.

Examination of a selected few of the New Jersey Zinc Co. cores provided information on the local Precambrian rocks in the area of the Matlock anomaly. The body is composed of thin (~.5 inches) alternating bands of a dark metallic iron mineral (presumably magnetite) and a white, translucent material (believed to be chert). Overlying the body and to its north, northeast, and northwest the country rock has been serpentinized to ? various degrees. North of the body a core hole encountered rock similar in appearance to the white gangue material (possibly crystalline) but displaying green mottles.

Two models have been proposed to explain the Matlock Anomaly. One possible explanation describes the body as an erosional remnant of a sedimentary iron deposit similar to the Biwabik, Gunflint, or Trommald Iron-Formations in Minnesota. The Matlock ore body may be correlative with the cherty type deposits, thought to be indicative of agitated, shallow water environment in the Minnesota Iron-Formations. The source of the iron and silica for this model is either weathering of a surrounding basic terrain or, more likely, contributions from contemporaneous volcanic activity in the area. As a part of the same depositional regime argillaceous, magnesium rich carbonates may have formed and could, theoretically, have been metamorphosed to produce the serpentinitic rocks. This appears to have been the case on the northern end of the Biwabik

Iron-Formation where it has been truncated by intrusion of the Duluth Gabbro. If this model is accepted the date of deposition may be contemporaneous with the Middle Precambrian age of the Minnesota ores (about 2 billion years) or as young as the 1.5 billion year age of similar Wisconsin iron formations.

The second model includes alteration of existing intrusives, extrusive, and pyroclastic rocks by hydrothermal fluids rich in iron. The Soudan Iron-Formation in the Vermilion District of northern Minnesota is an example of an ore body believed to have been generated according to this model. The Soudan ore grades from magnetite to high-grade (specular) hematite, thinly laminated with white to greenish white chert or jasper. The ore is found in close association with the basaltic and adesitic lavas, tuffs, and pyroclasts of the Ely Greenstone belt. The ore-forming process is thought to include metamorphism of the Greenstones accompanied by hydrothermal alteration. Injection of hydrothermal fluids was a direct product of volcanic exhalative processes. Mineral indicators suggest that temperatures ranged from 350°-400°C for most of the time of mineralization, and that the process probably occurred about 2.6 billion years ago.

Although the rhyolitic rocks from northwest Iowa have been dated at 1.43 billion years, there are no dates available for underlying rocks. With the Matlock Anomaly lying only about 100 miles from rocks in the Minnesota River Valley which have been dated at 3.8 billion years, it is possible that rocks similar in age and composition to the Greenstones may underlie the rhyolites and could provide the host rocks necessary for development of a Soudan-like ore body. The deposit may also relate to the emplacement of the Keweenawan basalts which created the Midcontinent Geophysical Anomaly about 1.1 billion years ago. These basalts occur less than 100 miles to the southeast of Matlock and could have produced the host rocks required for Soudan-like iron deposits. There are, however, no known iron deposits which can be related to Keeweenawan volcanism.

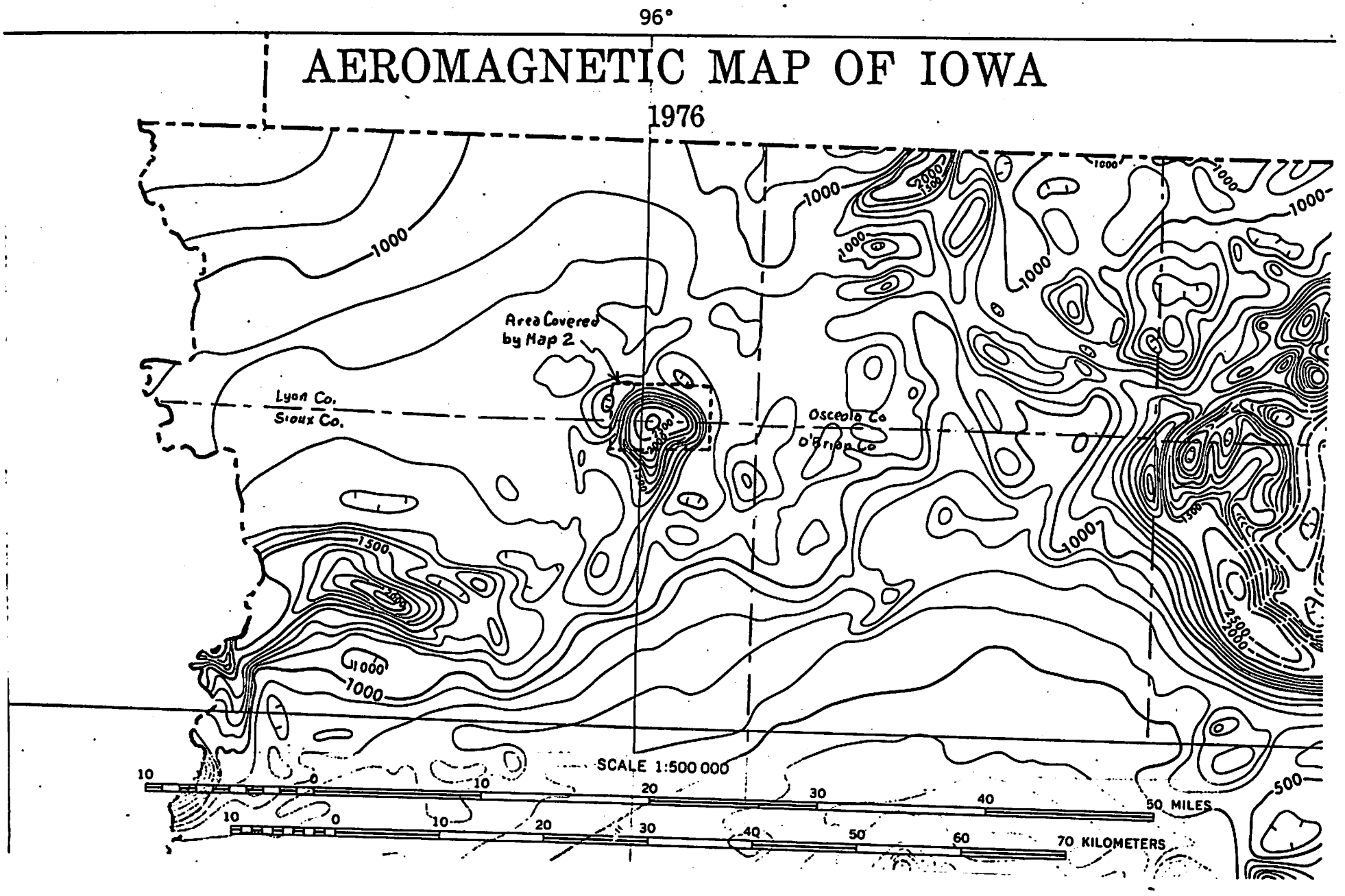
It is also possible that the ore body may have been emplaced at any time in the intervening 1.5 billion years, a period for which we have almost no information.

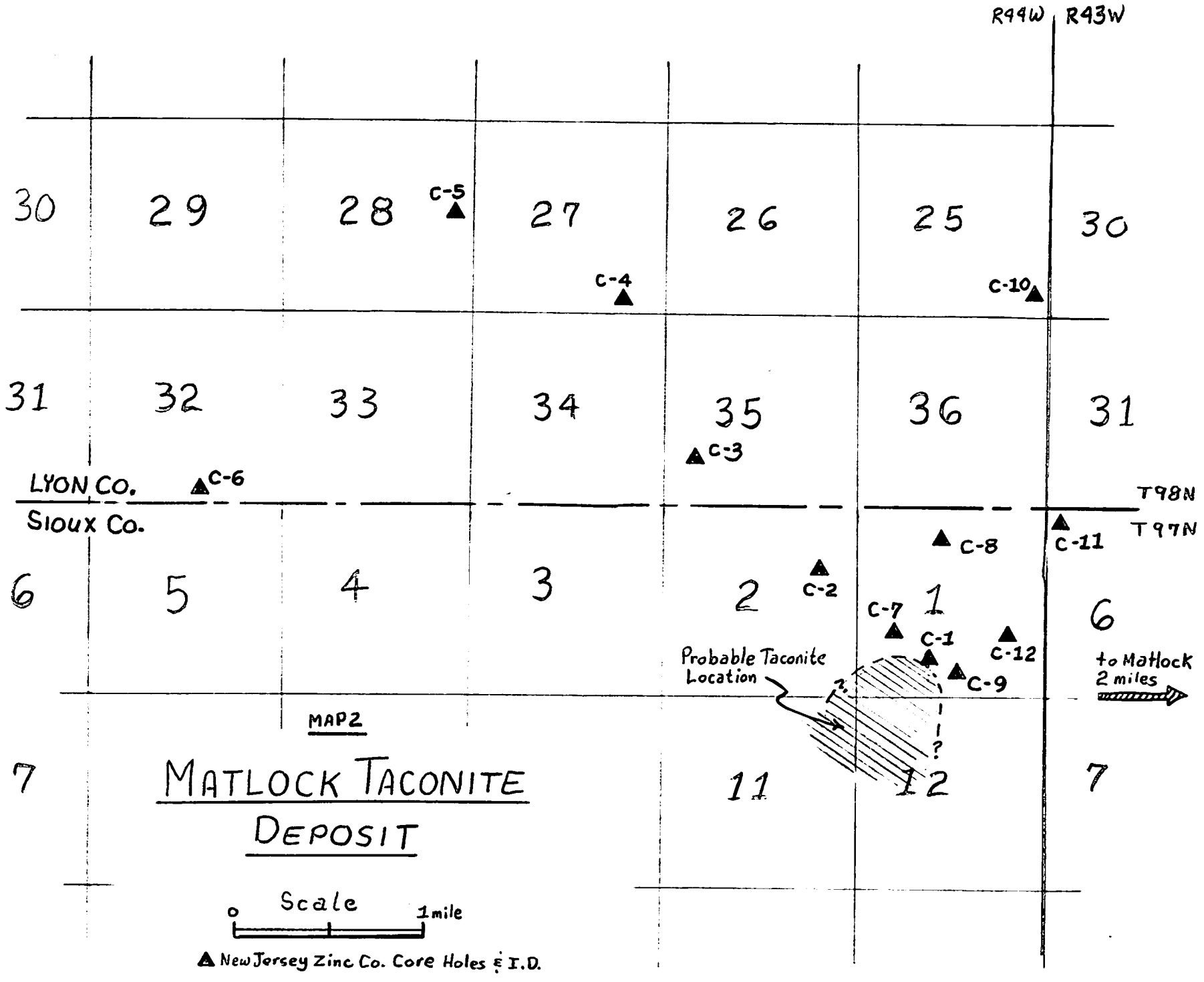
Although much more work needs to be completed before any definitive statements can be made, evidence tends to favor the second of these models. The existence of the surrounding serpentinites strongly suggests metamorphism of igneous rocks rather than sediments. In fact there seems to be no evidence of the existence of any of the clays, silts, or carbonates associated with the first model.

Examination of the aeromagnetic map of the anomaly also suggests an igneous related origin. The anomaly is very localized and intense, and although it may represent some sort of an erosional remnant of a larger sedimentary basin, it is more likely the product of a localized intrusion. A "tail" which extends south from the roughly circular anomaly may represent the expression of a feeder dike. A linear trend to the aeromagnetic contours suggests a north-northeast trending fault forming the eastern limit of the anomaly and extending to the south. This fault is probably related to either the formation or preservation of the ore body.

Present economic conditiions indicate that the Matlock Taconite Body will not be developed in the near future. Minnesota has an estimated 37 billion tons of iron ore reserves, with 23 billion tons of that total magnetite ore similar to the Matlock Taconite. At present rates of extraction the Minnesota reserves represent a supply adequate for more than 100 years. With the proximity of the Minnesota ores to the inexpensive and direct Great Lakes shipping routes it seems unlikely that the Matlock Taconite will be developed for many decades. It does, however, represent a potentially valuable reserve. Further examination of the cores and additional geophysical surveys are needed to better understand the Matlock Taconite body.

MAP 1


96°
AEROMAGNETIC MAP OF IOWA
1976
Area Covered by Map 2
Lyon Co.
Sioux Co.
Osceola Co
O'Brien Co
1000
1500
2000
SCALE 1:500 000
10 0 10 20 30 40 50 MILES
10 0 10 20 30 40 50 60 70 KILOMETERS


R44W
R43W
30
29
28
C-5
27
26
25
30
C-4
C-10
31
32
33
34
35
36
31
C-3
LYON CO.
C-6
T98N
SIOUX CO.
T97N
C-8
C-11
6
5
4
3
2
C-2
C-7
1
6
C-1
C-12
Probable Taconite Location
C-9
to Matlock 2 miles
MAP 2
7
MATLOCK TACONITE DEPOSIT
11
12
7
Scale
0
1 mile
▲ New Jersey Zinc Co. Core Holes & I.D.

Core Name	Location					Cored Interval
	County	Township	Range	Section	¼ ¼ ¼ ¼	
C-1	Sioux	97N	44W	1	NW, NE, SE, SW	443-1300
C-2	Sioux	97N	44W	2	NE, NW, SE, NE	493-1289
C-3	Lyon	98N	44W	35	NW, SE, NW, SW	501-1095
C-4	Lyon	98N	44W	27	SW, SW, SE, SE	540- 961
C-5	Lyon	98N	44W	28	NE, SE, SE, NE	460-1325
C-6	Lyon	98N	44W	32	SE, SE, SW, SE	502- 950
C-7	Sioux	97N	44W	1	NE, SE, NW, SW	499-1214
C-8	Sioux	97N	44W	1	NE, SE, NE, NW	401-1475
C-9	Sioux	97N	44W	1	SW, NW, SW, SE	473-1000
C-10	Lyon	98N	44W	25	NE, SE, SE, SE	699- 770
C-11	Sioux	97N	43W	6	NW	543- 808
C-12	Sioux	97N	44W	1	SW, SW, NE, SE	546- 800

Table 1: Core Holes Near Matlock Anomaly