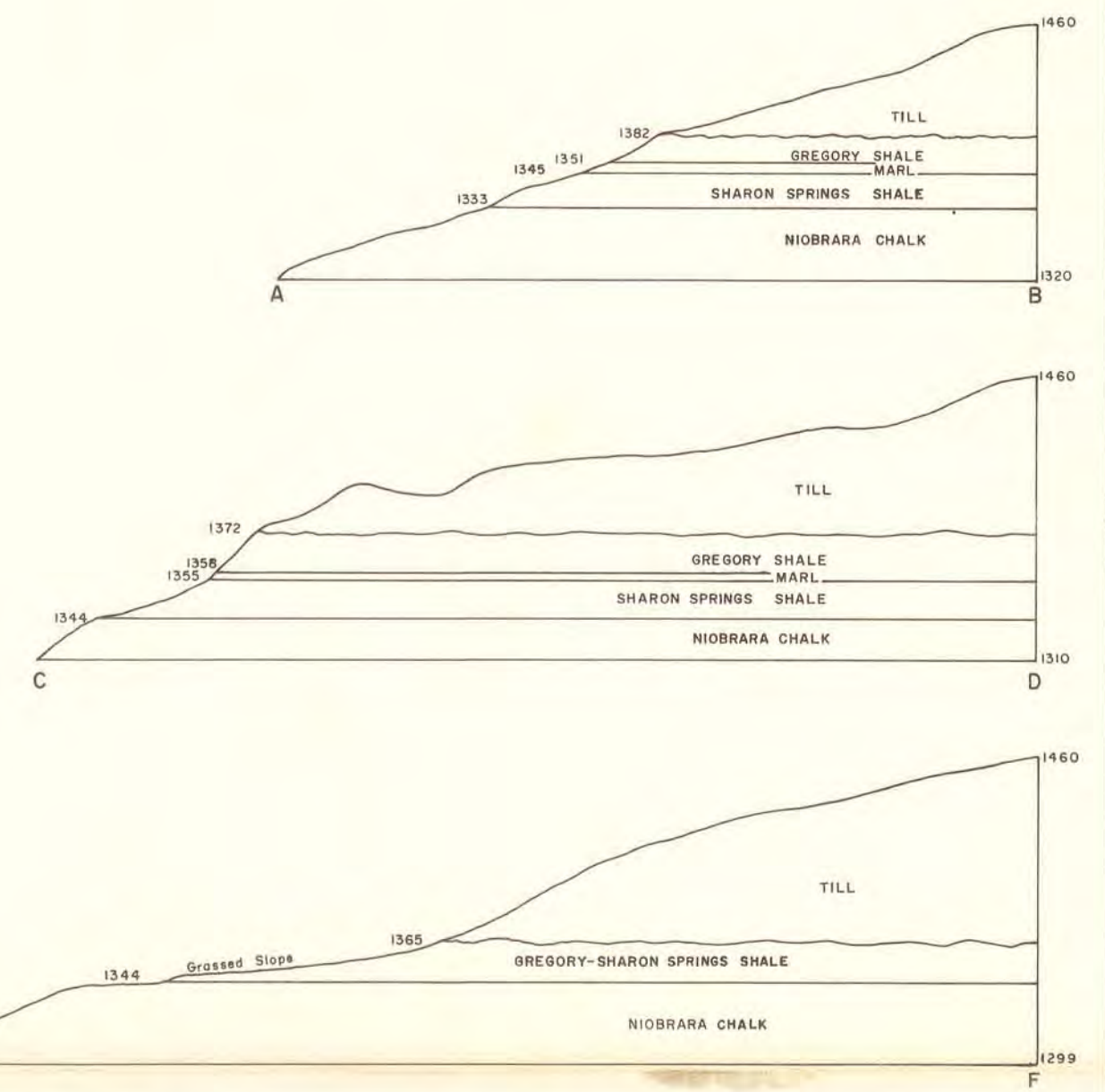
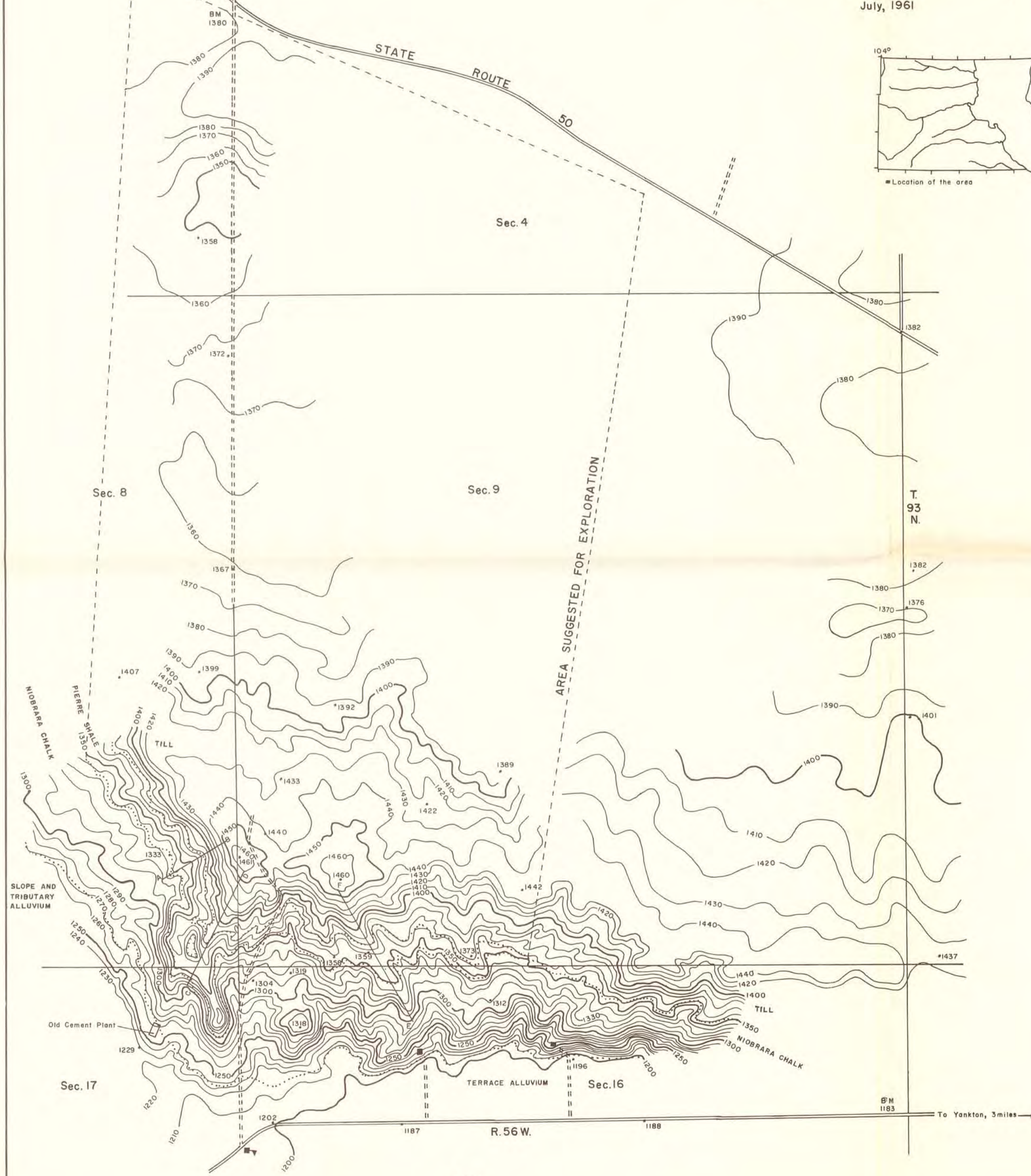


Possible Expanded Shale Resources near Yankton, South Dakota

by
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Text
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Bedrock and overlying material in the area of the old Cement Plant (Secs. 8, 9, 16, 17, T. 93 N., R. 56 W.) Yankton County, South Dakota are Cretaceous shale and chalk, and the Pleistocene glacial drift.

The glacial drift (field notes of K. Y. Lee, April, 1956) consists of till that is gray to brownish yellow, silty, and contains abundant pebbles and boulders in a sand matrix. The till is as much as 95 feet thick.

The bedrock includes the Pierre Formation (above) and the Niobrara below. The Pierre is divided as follows:

Gregory Member (at top) - Black, fissile shale with many white to cream thin bentonite layers. As much as 31 feet thick. Curtiss (1950?) described the upper 8.3 feet of Gregory as a bentonitic marl. This part of the Gregory was seen only near the old quarry; however, it may be present locally to the north and west, depending on the thickness of the glacial drift.

Basal Gregory unit - Buff to yellowish-brown marl and very calcareous shale which weathers light gray. As much as 6.3 feet thick. Curtiss (1950?) reports a basal pebble zone about 2 feet thick, which consists of quartz grains and gray shale pebbles.

Sharon Springs Member - Black carbonaceous fissile shale, as much as 11.7 feet thick. Curtiss (1950?) stated that this member is an oil shale which contains fish scales and vertebrae of marine reptiles. Melanterite or "yellow bloom" (hydrous iron-sulfate) is abundant in veins that cut this member.

The Pierre rests directly on the Niobrara light-gray argillaceous marl, which weathers to a cream color.

The bedrock is essentially flat-lying. The Niobrara-Pierre contact is about 11 feet lower at cross-section A-B than at the other two cross-sections, but this is probably a local effect and should not hinder mining, although it will affect the calculations of ore and waste. Close-spaced exploratory drilling may thus be necessary.

Chemical and Physical Properties

A sample collected by the State Natural Resources Commission from the "Middle Gregory" (Karsten, 1956, p. 19) gave a "highly expanded product" in tests by the Mines Experiment Station at the School of Mines and Technology in Rapid City. This "Middle Gregory" is probably the same as the upper marl of the Gregory Member as described above.

Analyses of the different units of the Pierre (Curtiss, 1950?) are as follows:

	1	2	3	4
SiO ₂	26.66%	55.10%	33.36%	60.98%
Fe ₂ O ₃	6.00	1.36	3.20	3.20
Al ₂ O ₃	8.12	20.38	7.54	16.84
CaO	28.85	1.74	25.31	1.84
MgO	1.66	2.76	3.71	1.69
SO ₃	None	0.45	None	None
Volatile Matter	23.78	9.24	23.43	5.14
Moisture	3.71	0.51	3.22	5.14
	98.78%	91.54%	99.77%	97.22%

1. Gregory Member, upper marl
2. Gregory Member
3. Basal Gregory unit
4. Sharon Springs Member

Analyses by State Cement Plant, Rapid City, except for No. 2, which was analyzed by State Chemical Laboratory, Vermillion.

Thus, samples 1 and 3 show possibilities as a source for light-weight aggregate.

The mapping suggests that exploration should be carried out at least in the area outlined on the map. The basal Gregory unit, conservatively estimated to average 4.5 feet thick, is present throughout the area--totaling 3½ million cu yd. The upper marl of the Gregory, conservatively estimated to average 7.5 feet, is present in the southern third, and is probably present in the rest of the area--totaling 2 million and probably 6 million cu yd. Thus a total of 5½ and probably 9½ million cu yd of potential expandable shale is present in the 3/4-square mile area.

However, to remove this material, waste (glacial drift overburden and discarded Pierre shale) will have to be removed. This will total approximately 12½ million cu yd in the southern third of the area. In the northern two-thirds of the suggested area, an additional 13½ million cu yd is present. The estimated ratio of overburden to "ore" in the southern third is about 3 to 1, and in the northern two-thirds is 2½ to 1 or possibly as low as 1½ to 1.

References

- Curtiss, R. E., (1950?), Cement Materials near Yankton, South Dakota: Unpubl. Rept. in files of State Geological Survey, Vermillion.
- Karsten, Andrew, 1956, Characteristics and Behavior of Certain South Dakota Shales under Expansion to Produce Lightweight Aggregate: Published in June, 1956 by the State Natural Resources Commission, Pierre.