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Distribution and Subdivision of Precambrian and Lower and Middle Paleozoic Rocks in the Subsurface of Nebraska

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University of Nebraska-Lincoln

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Distribution and Subdivision of Precambrian and Lower and Middle Paleozoic Rocks In the Subsurface of Nebraska

Detailed sample examination provides the data for delineation of lithostratigraphic units of the Precambrian through Mississippian rocks in Nebraska's subsurface. The extent, thickness, lithology, and stratigraphic relations of these units suggest eqivalency with rocks outcropping in adjoining states. The terminology applied in these states has been informally illustrated to allow regional interpretation. The figures included in this report were submitted as a dissertation to the Department of Geology, University of Nebraska (Carlson, 1969). The graphic logs and typed sample descriptions prepared for this investigation are on file at the Nebraska Geological Survey.

Nebraska is mantled by a variable thickness of Pleistocene and Tertiary sediments, except for localized valley-side outcrops of Cretaceous, Permian, and Pennsylvanian sediments. The regional bedrock geology of the area including Nebraska is illustrated on Figure 1. Rocks ranging in age from Precambrian to Recent are present within Nebraska but there is a great variation in the sequence present in any specific area because of nondeposition and erosion.

The principal structural features of Nebraska are shown on Figure 2. Major movement on many of these features occurred in Early Pennsylvanian time and thus these features had little influence on the pre-Pennsylvanian depositional pattern. Most of the structures are apparent on the Precambrian surface (Figure 3); however, many of the irregularities on this surface are interpreted as being paleotopographic features of various ages.

The general distribution of rock type at the Precambrian surface is shown on Figure 4. These patterns were delineated by considering: (1) the available samples and the configuration map (Carlson, 1967), (2) the stratigraphic relations with overlying rocks, (3) the available radiometric ages (Figure 5), and (4) the trends suggested by both the gravity data (Figure 6) and the magnetic data (Figure 7). No formal terminology has been applied to the subdivision of the Precambrian within Nebraska. However, the Sioux Quartzite extends into northeastern Nebraska and the Keweenawan Basalts and associated sediments are present in eastern Nebraska.

Figures 8 through 17 show the subdivisions and distribution of the Cambrian, Ordovician, Silurian, Devonian, and Mississippian rocks in the subsurface of Nebraska. These rocks have been subdivided into lithostratigraphic units which do not necessarily have time significance but do furnish a framework within which geologic history can be reconstructed. Tentative correlations were made with formally defined units in adjacent states. All of the present zero edges illustrated on the thickness maps are erosional features.

A better understanding of the Precambrian-Paleozoic relationships can be obtained by combining the various thickness maps. Figure 18 is a suprageologic map or "worm's-eye" view of the age of the rocks immediately overlying the Precambrian surface. This illustration shows the overlap of Middle Ordovician

rocks onto the Southeast Nebraska Arch and the Siouxana Arch. The major unconformity at the base of the Pennsylvanian is revealed by the truncation and absence of pre-Pennsylvanian rocks.

The paleogeologic map at the base of the Pennsylvanian (Figure 19) shows extensive areas of Precambrian rock. Uplift in the Early Pennsylvanian along the Chadron and Cambridge Arches and the Nemaha Uplift resulted in removal of progressively older Paleozoic rocks toward the crest of these structures. The thicker sections of these older Paleozoic rocks are preserved in the present-day structural basins.

The figures included in this report illustrate the Precambrian and Lower and Middle Paleozoic stratigraphic patterns in the subsurface of Nebraska. It is anticipated that within this framework detailed economic or technical studies of local areas and/or specific rock units can be more easily accomplished.

SELECTED REFERENCES

Bayley, R. W. and Muehlberger, W. R., 1968, Basement rock map of the United States (exclusive of Alaska and Hawaii): U.S. Geol. Survey Spec. Map.

Berry, W. B. N. and Boucot, A. J., in press, Correlation of the North American Silurian rocks: Geol. Soc. America Spec. Paper 102.

Carlson, M. P., 1961, Contour map of the Precambrian surface in Nebraska: Nebraska Geol. Survey.

———, 1963, Lithostratigraphy and correlation of the Mississippian System in Nebraska: Nebraska Geol. Survey Bull. 21, 46 p.

———, 1967, Precambrian well data in Nebraska including rock type and surface configuration: Nebraska Geol. Survey Bull. 25, 123 p.

———, 1969a. Basement rock distribution and paleotopography in western Nebraska (abs.): Geol. Soc. America Abstracts with Program for 1969, pt. 2, p. 5.

———, 1969b, Stratigraphic framework of Precambrian and Lower and Middle Paleozoic rocks in the subsurface of Nebraska: Univ. of Nebraska, Lincoln, unpublished Ph.D. thesis.

——— and Berry, W. B. N., 1969, Late Middle Ordovician graptolites from the subsurface of eastern Nebraska: Jour. Paleontology, v. 43, p. 712–715.

——— and Boucot, A. J., 1967, Early Silurian brachiopods from the subsurface of southeastern Nebraska: Jour. Paleontology, v 41, p. 1121–1125.

Collinson, Charles, 1967, Devonian of the north-central region, United States, *in* International Symposium on the Devonian System, v. I, p. 933–971: Alberta Soc. of Petroleum Geologists, Calgary, Alberta.

Condra, G. E., Schramm, E. F., and Lugn, A. L., 1931, Deep wells of Nebraska: Geol. Survey Paper 10, 25 p.

———, 1959, The geological section of Nebraska: Nebraska Geol. Survey Bull. 14A, 82 p.

Condra, G. E., Schramm, E. F., and Lugn, A. L., 1931, Deep wells of Nebraska: Nebraska Geol. Survey Bull. 4, 288 p.

Goldich, S. S. and others, 1966, Geochronology of the Midcontinent region, United States, 2. Northern region: Jour. Geophys. Research, v. 71, p. 5389–5408.

Kinney, D. M., 1966, *Map showing* Geology, *in* National Atlas: U.S. Geol. Survey, Separate Sales Edition 8–66.

Lee, Wallace, 1943, The stratigraphy and structural development of the Forest City basin in Kansas: Kansas Geol. Survey Bull. 51, 140 p.

———, 1956, Stratigraphy and structural development of the Salina Basin: Kansas Geol. Survey Bull. 121, 167 p.

———, and others, 1946, Structural development of the Forest City Basin of Missouri, Kansas, Iowa, and Nebraska: U.S. Geol. Survey Oil and Gas Invest., Prelim. Map 48, 7 sheets.

Lidiak, E. G., 1964, Correlation of basement rocks with the mid-continent gravity anomaly in Nebraska and Kansas (abs.): Soc. Exploration Geophysicists Yearbook 1964, p. 207.

Lugn, A. L., 1934, Pre-Pennsylvanian stratigraphy of Nebraska: Am. Assoc. Petroleum Geologists Bull., v. 18, no. 12, p. 1597–1631.

Muehlberger, W. R. and others, 1967, Basement rock in continental interior of United States: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 12, p. 2351–2380.

Reed, E. C., 1948, The possibility of a land bridge across Nebraska in Mississippian time: Jour. Geology, v. 56, no. 4, p. 308–312.

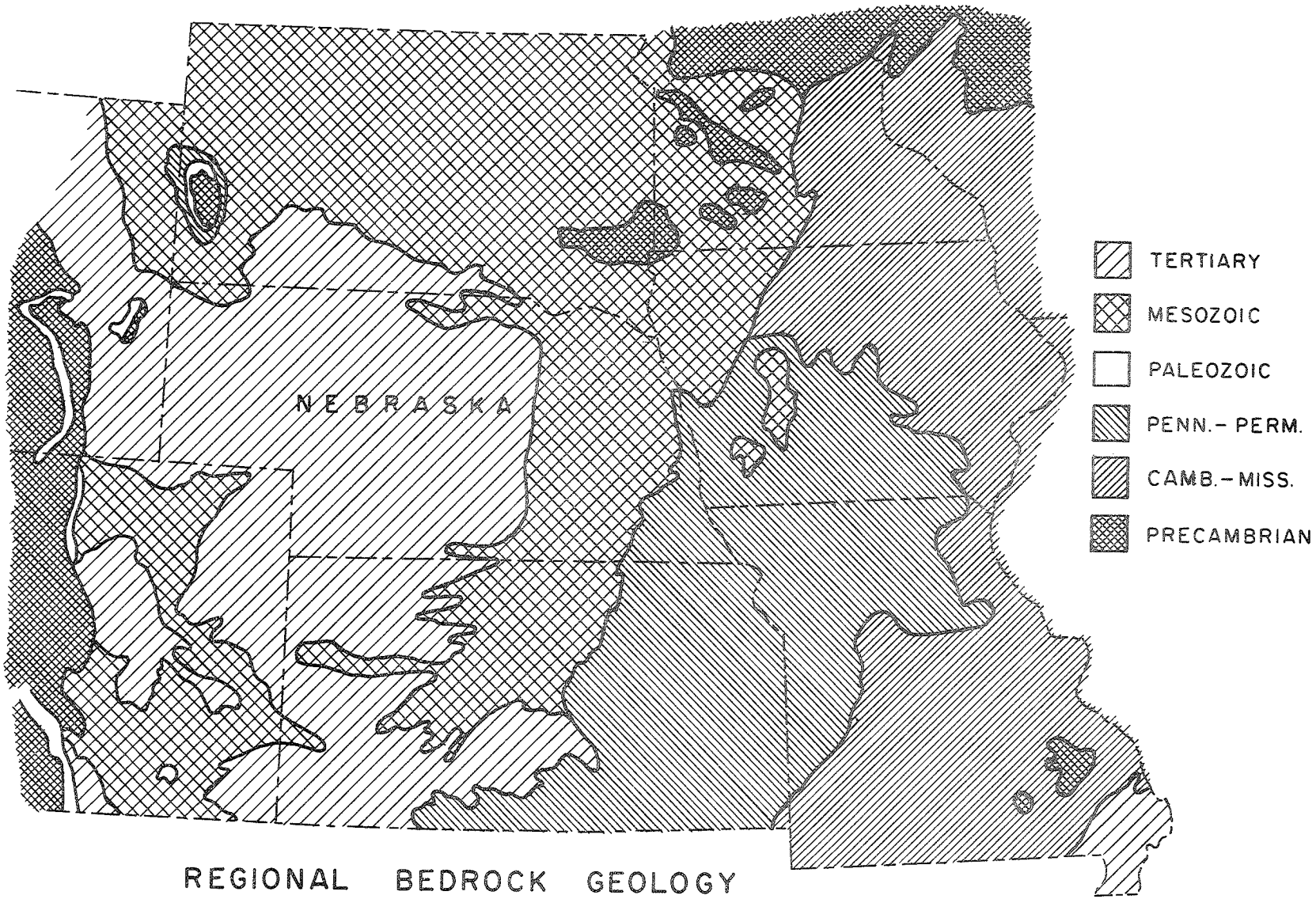
——, 1954, Central Nebraska has possibilities: World Oil, v. 139, no. 6, p. 113–116.

—— and others, 1958, Map of Nebraska showing areal distribution of pre-Pennsylvanian rocks, anticlines and basins, oil and gas fields, pipelines, and unsuccessful tests wells: U.S. Geol. Survey Oil and Gas Invest., Map OM 198.

Woollard, G. P. and Joesting, H. R., 1964, Bouguer gravity anomaly map of the United States (exclusive of Alaska and Hawaii): U.S. Geol. Survey Spec. Map.

Zeitz, Isidore and others, 1966, Crustal study of a continental strip from the Atlantic Ocean to the Rocky Mountains: Geol. Soc. America Bull., v. 77, p. 1427–48.

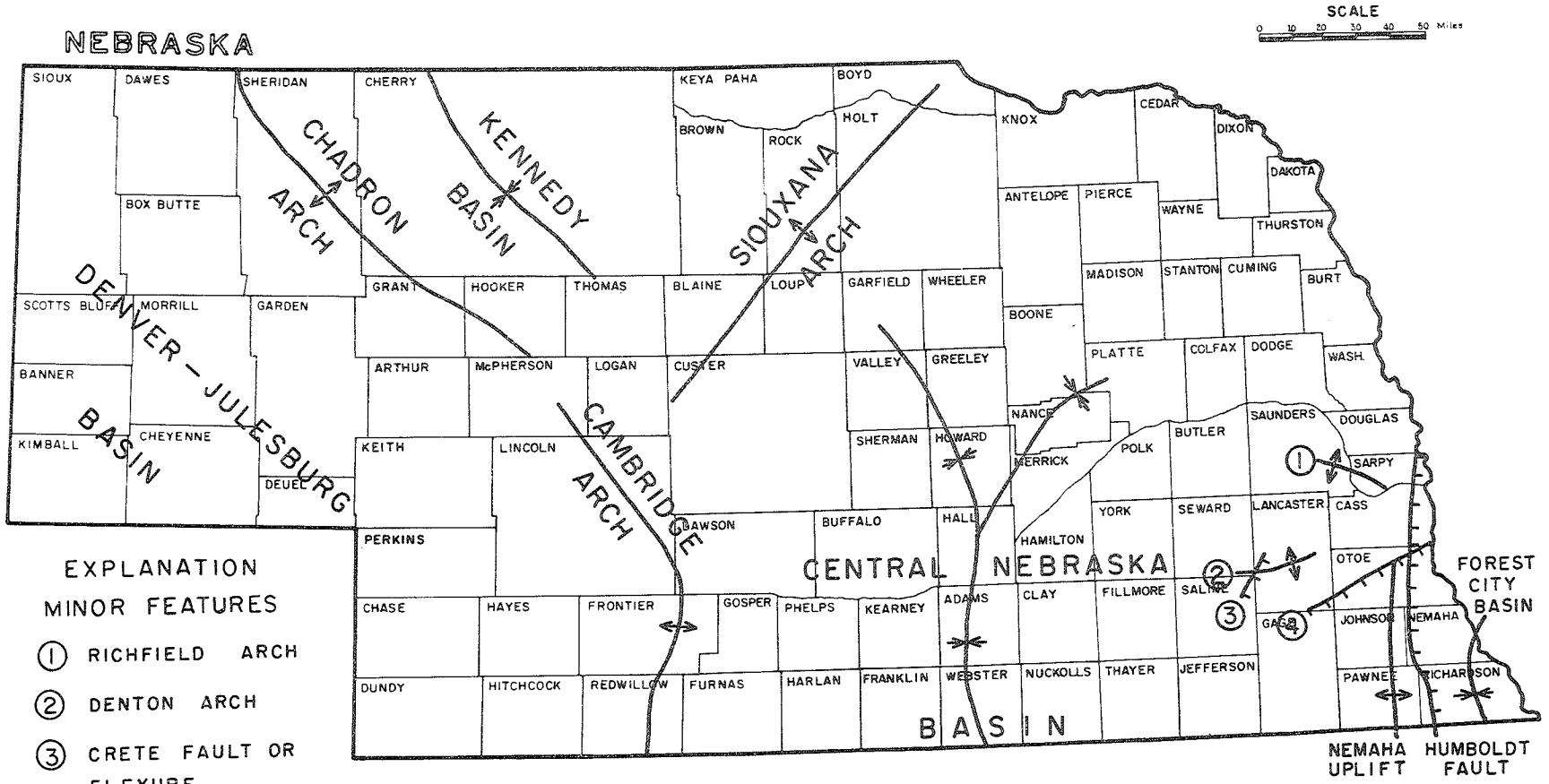
LIST OF ILLUSTRATIONS



REGIONAL BEDROCK GEOLOGY

(After Kinney, 1966)

Figure 1



EXPLANATION

MINOR FEATURES

(1) RICHFIELD ARCH

(2) DENTON ARCH

(3) CRETE FAULT OR FLEXURE

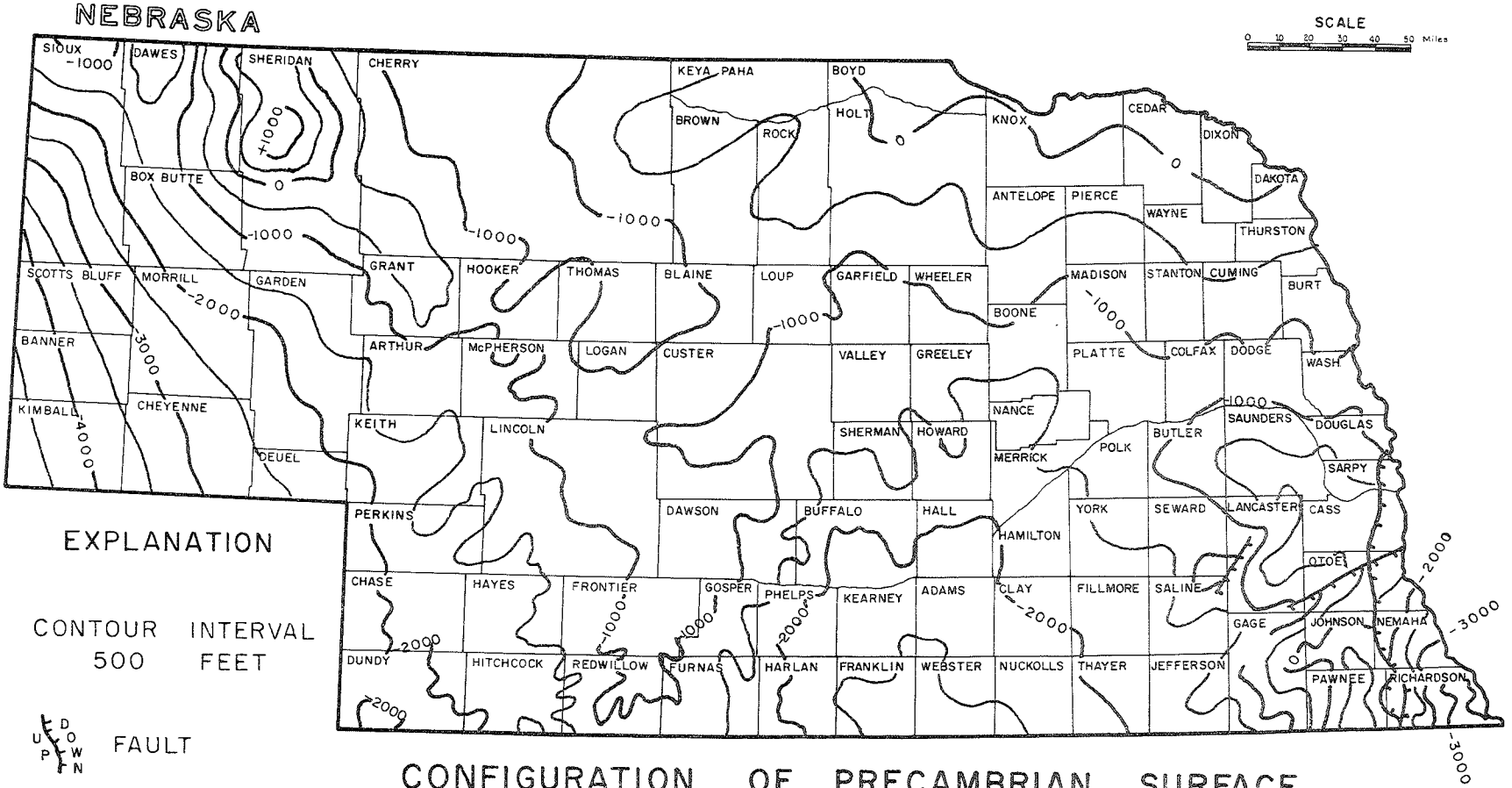
(4) UNION FAULT OR FLEXURE

PRINCIPAL STRUCTURAL FEATURES OF NEBRASKA

MARVIN P. CARLSON

1969

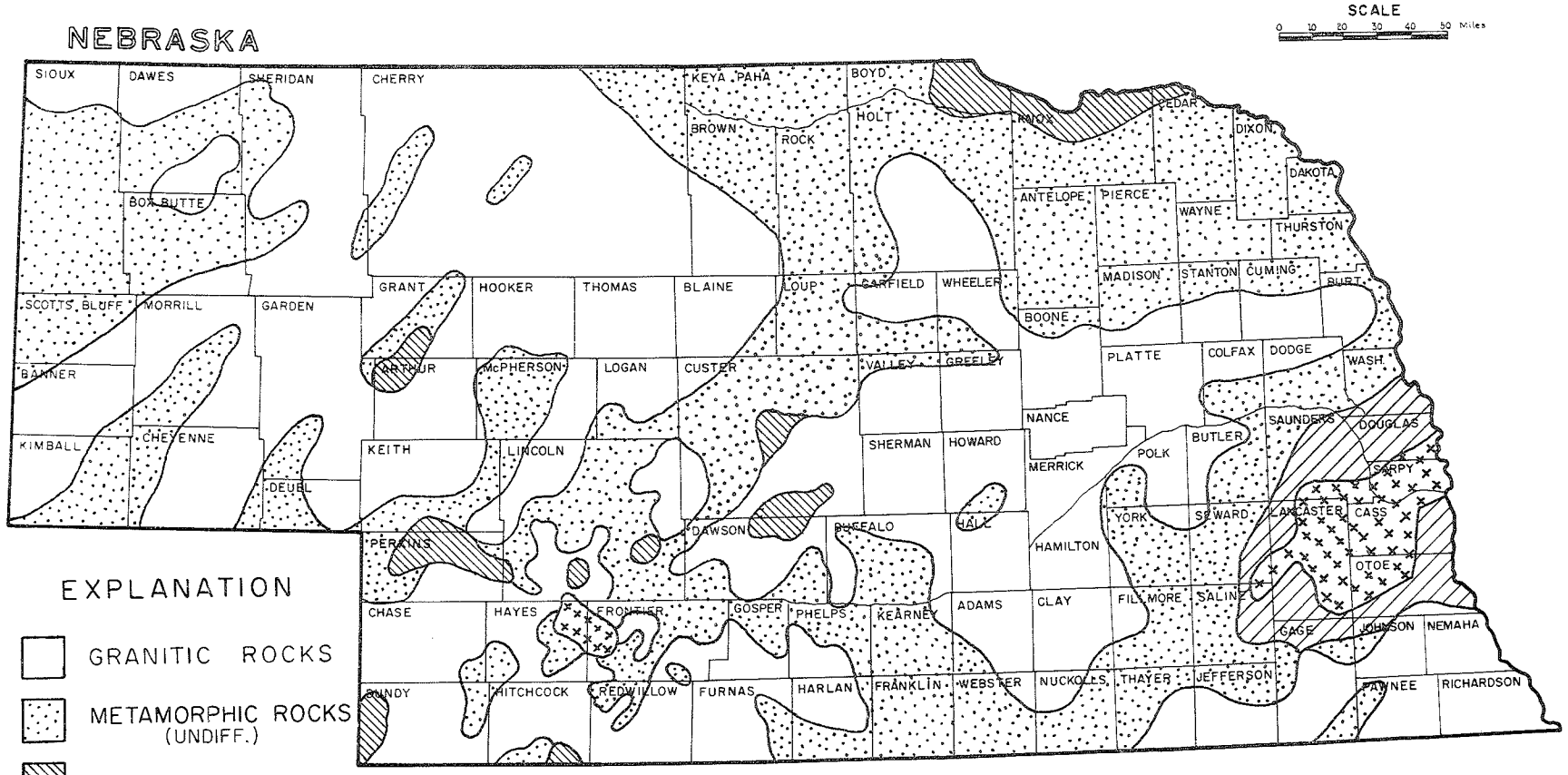
Figure 2



CONFIGURATION OF PRECAMBRIAN SURFACE

(AFTER CARLSON, 1967)

Figure 3



ROCK TYPE OF THE PRECAMBRIAN SURFACE

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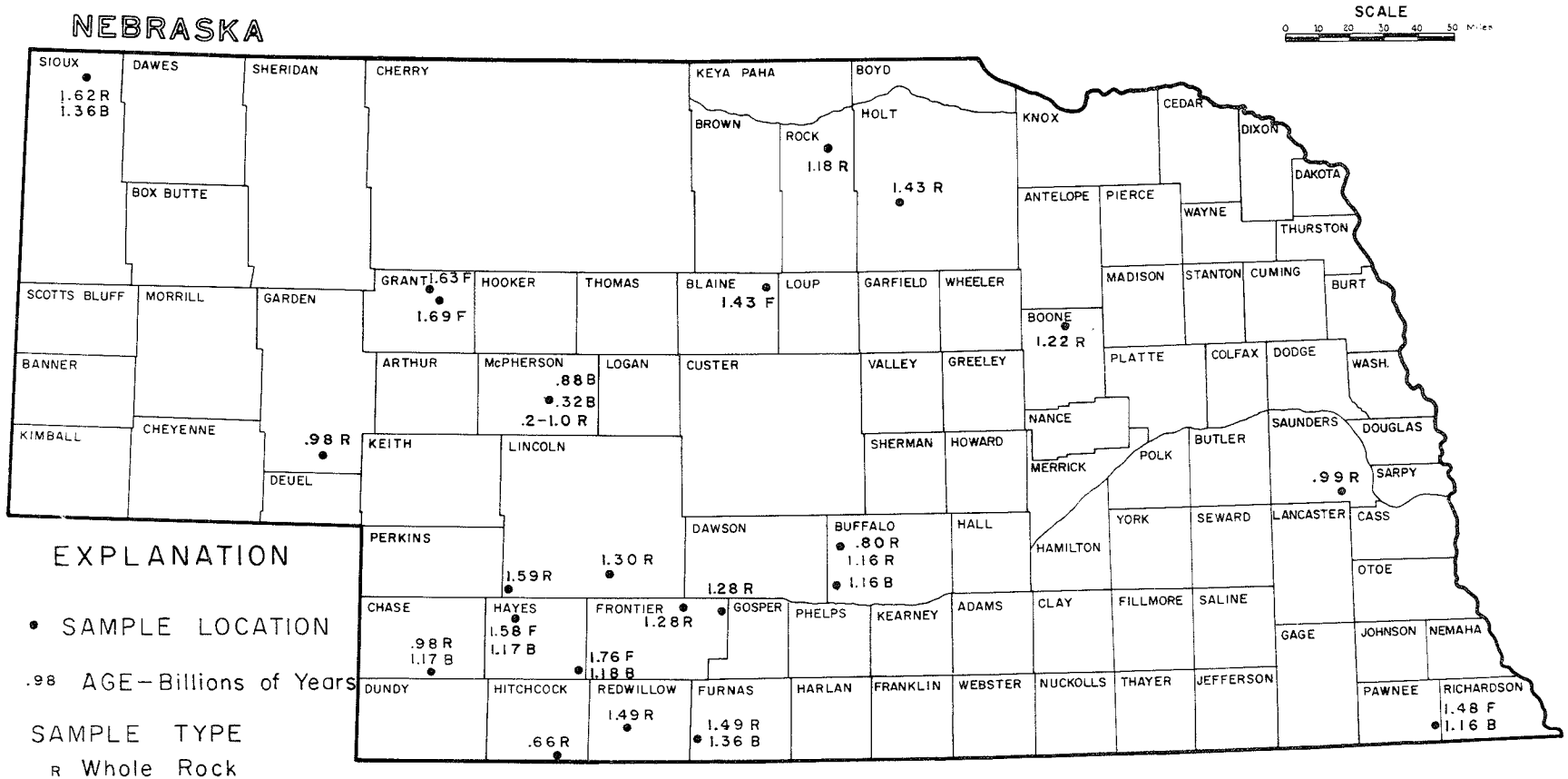
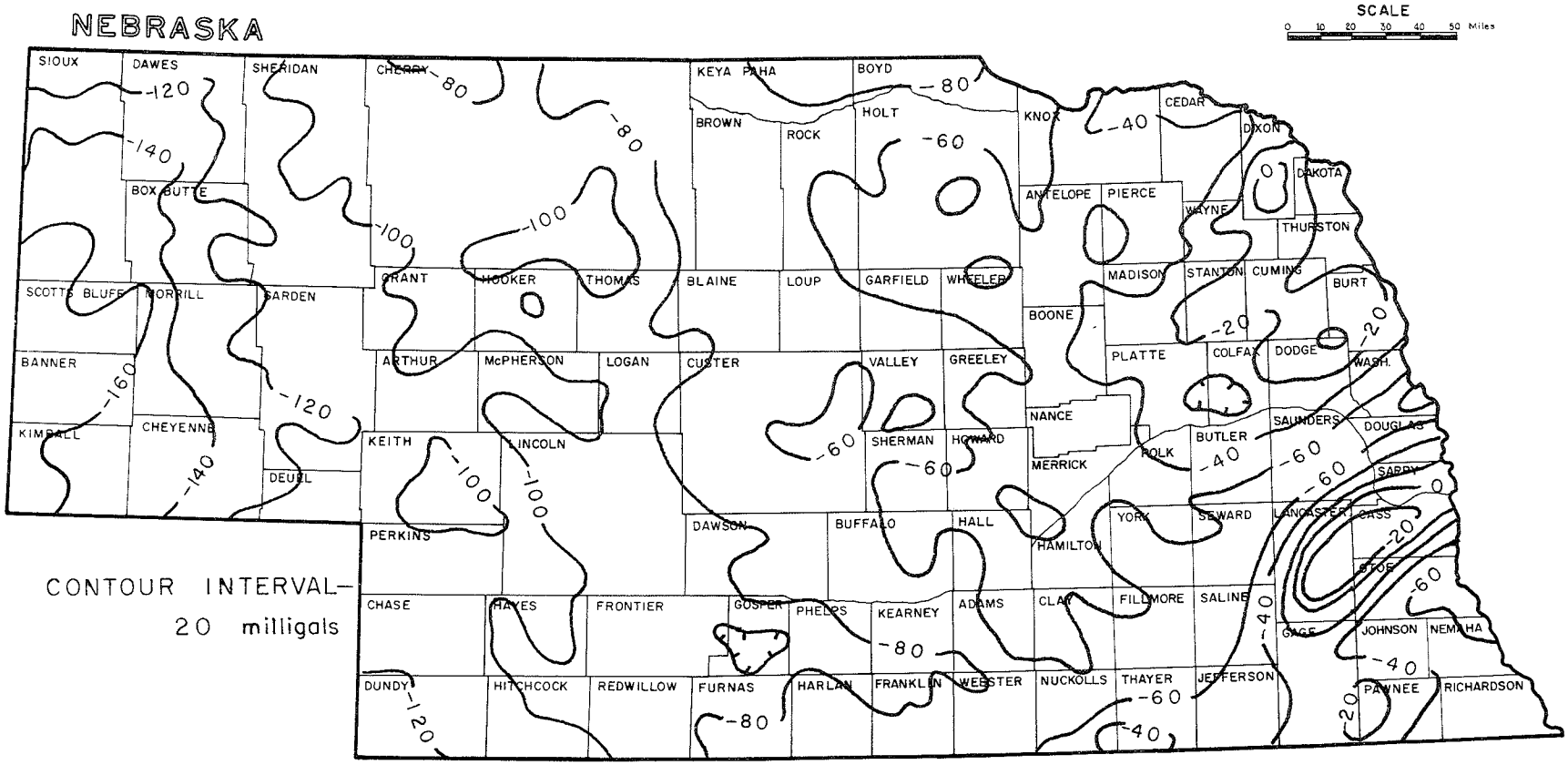
Figure 4



RADIOMETRIC AGES OF BASEMENT ROCK

(From Goldich and others, 1966)

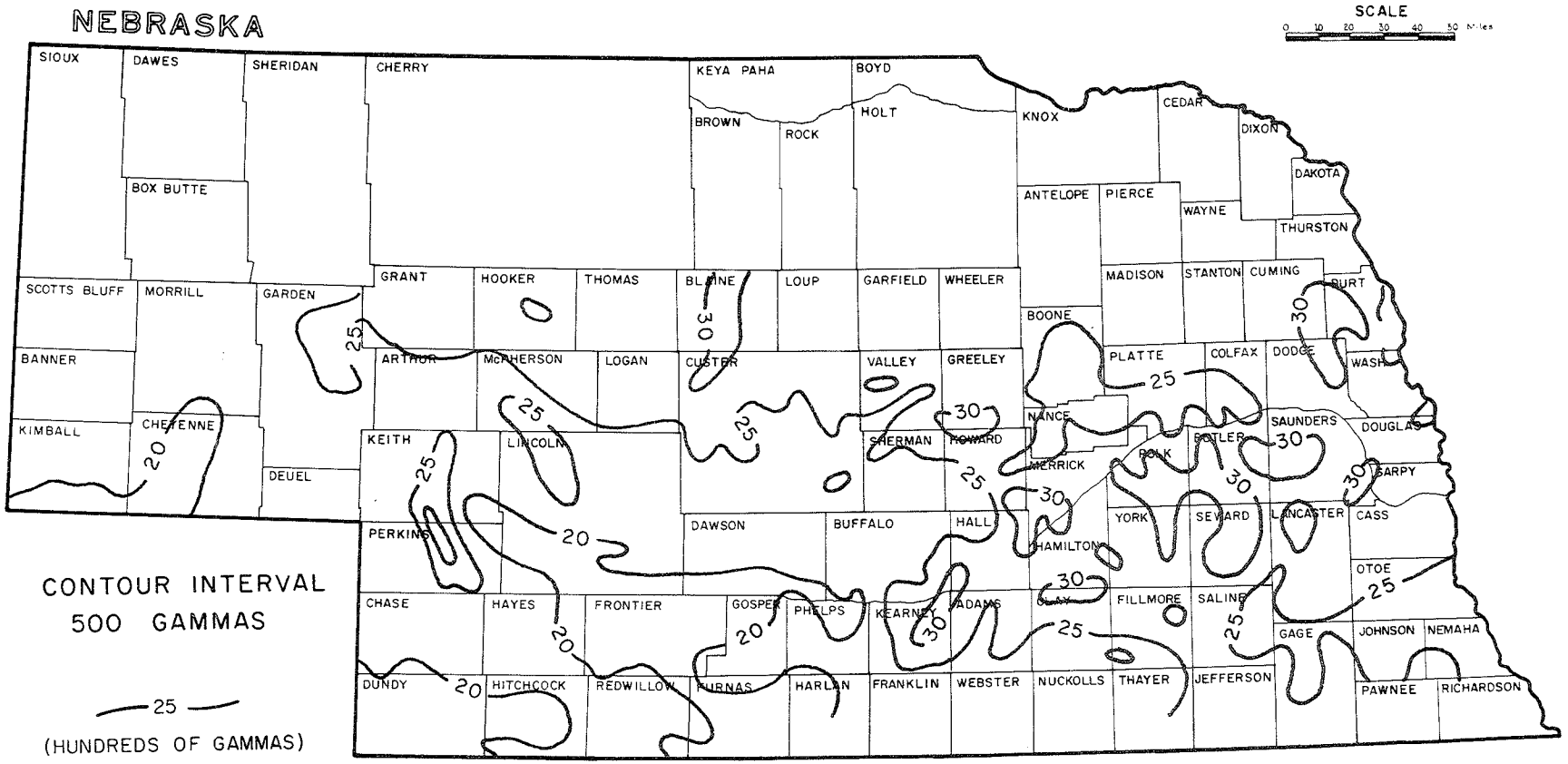
Figure 5



BOUGUER GRAVITY ANOMALY MAP

(From Woollard and Joesting, 1964)

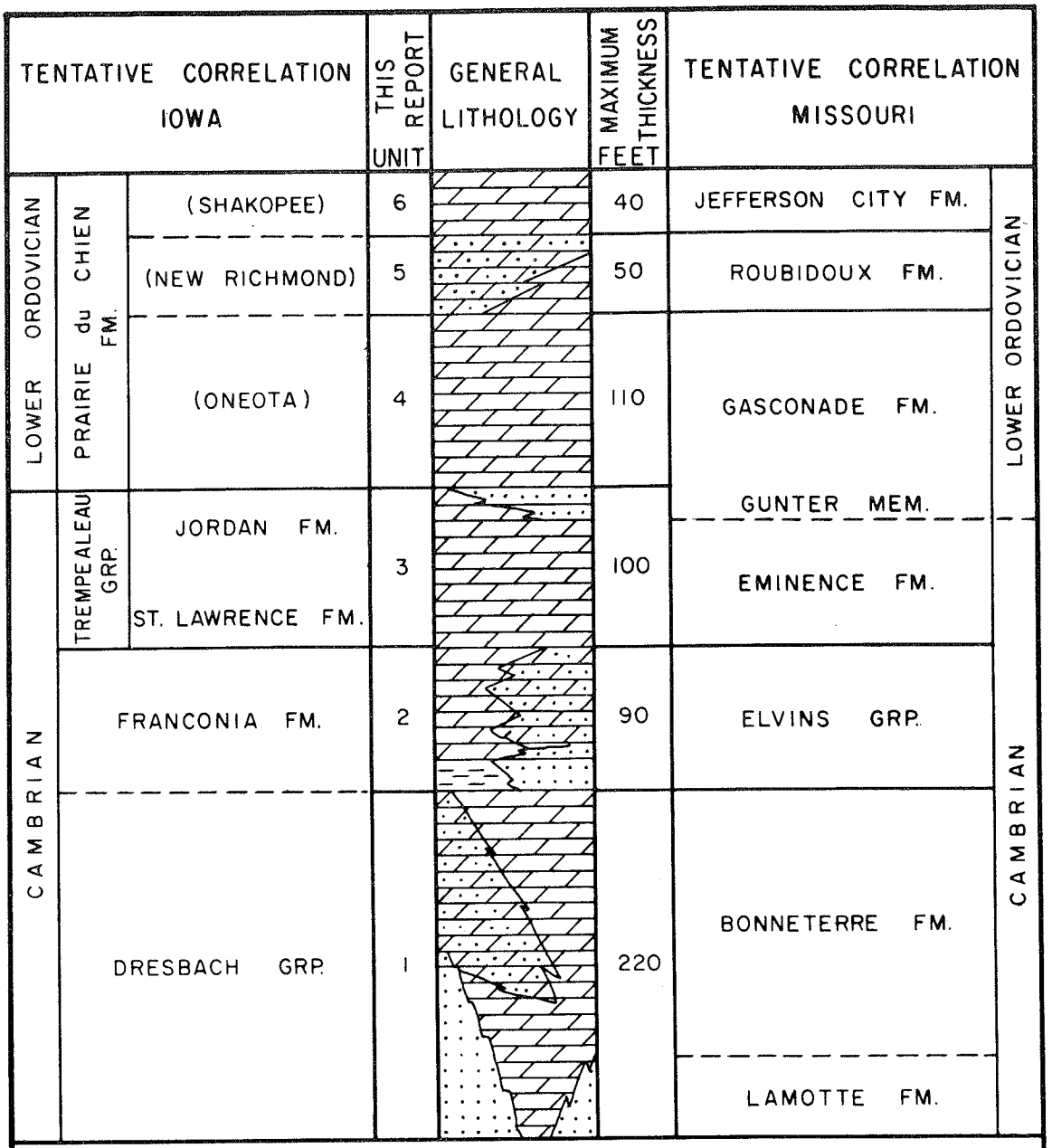
Figure 6



TOTAL MAGNETIC INTENSITY MAP

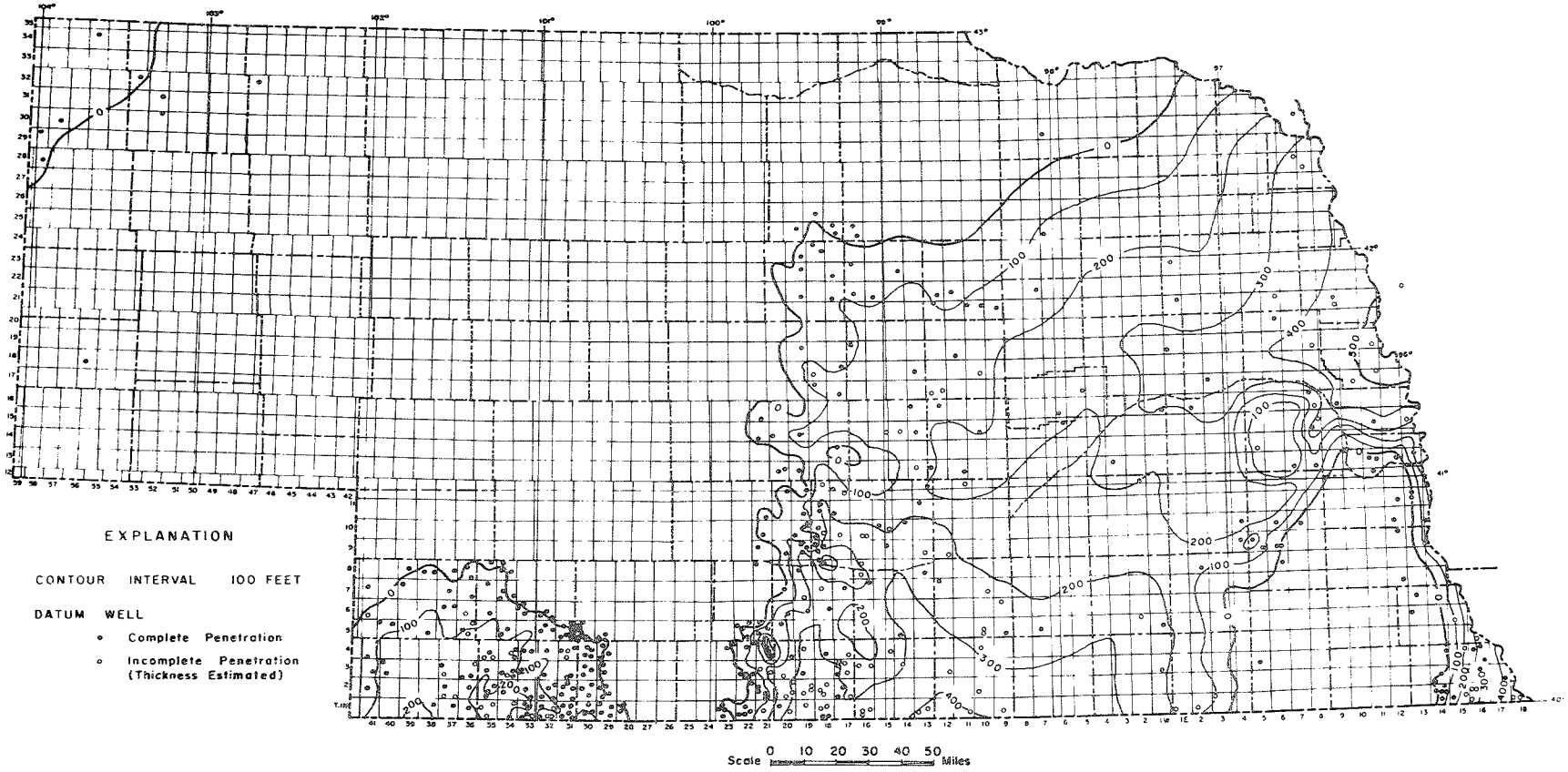
(From Zeitz and others, 1966)

Figure 7



LITHOLOGIC SUBDIVISION OF CAMBRIAN – LOWER ORDOVICIAN IN NEBRASKA

Figure 8



THICKNESS MAP OF CAMBRIAN–LOWER ORDOVICIAN

Figure 9

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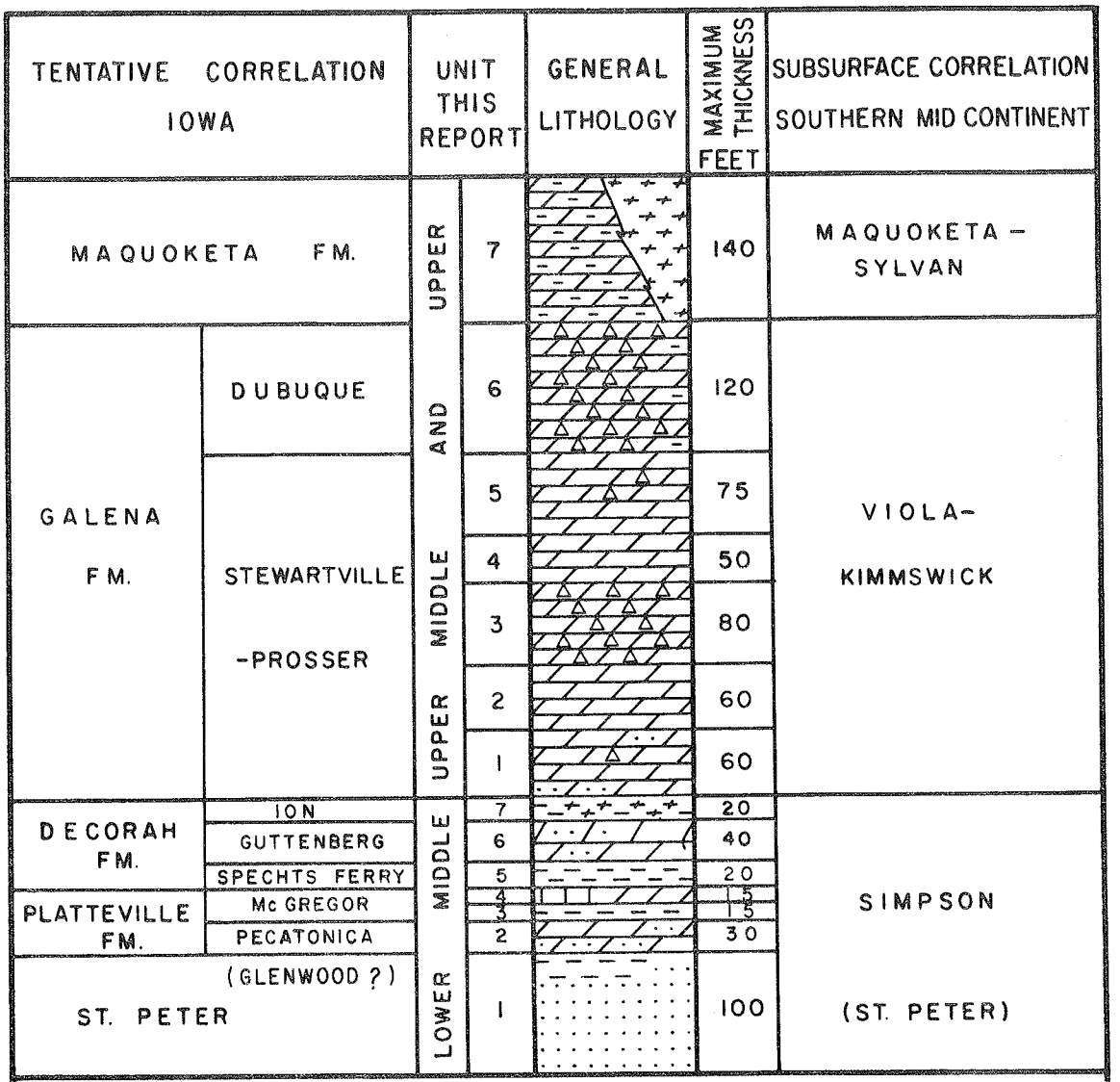
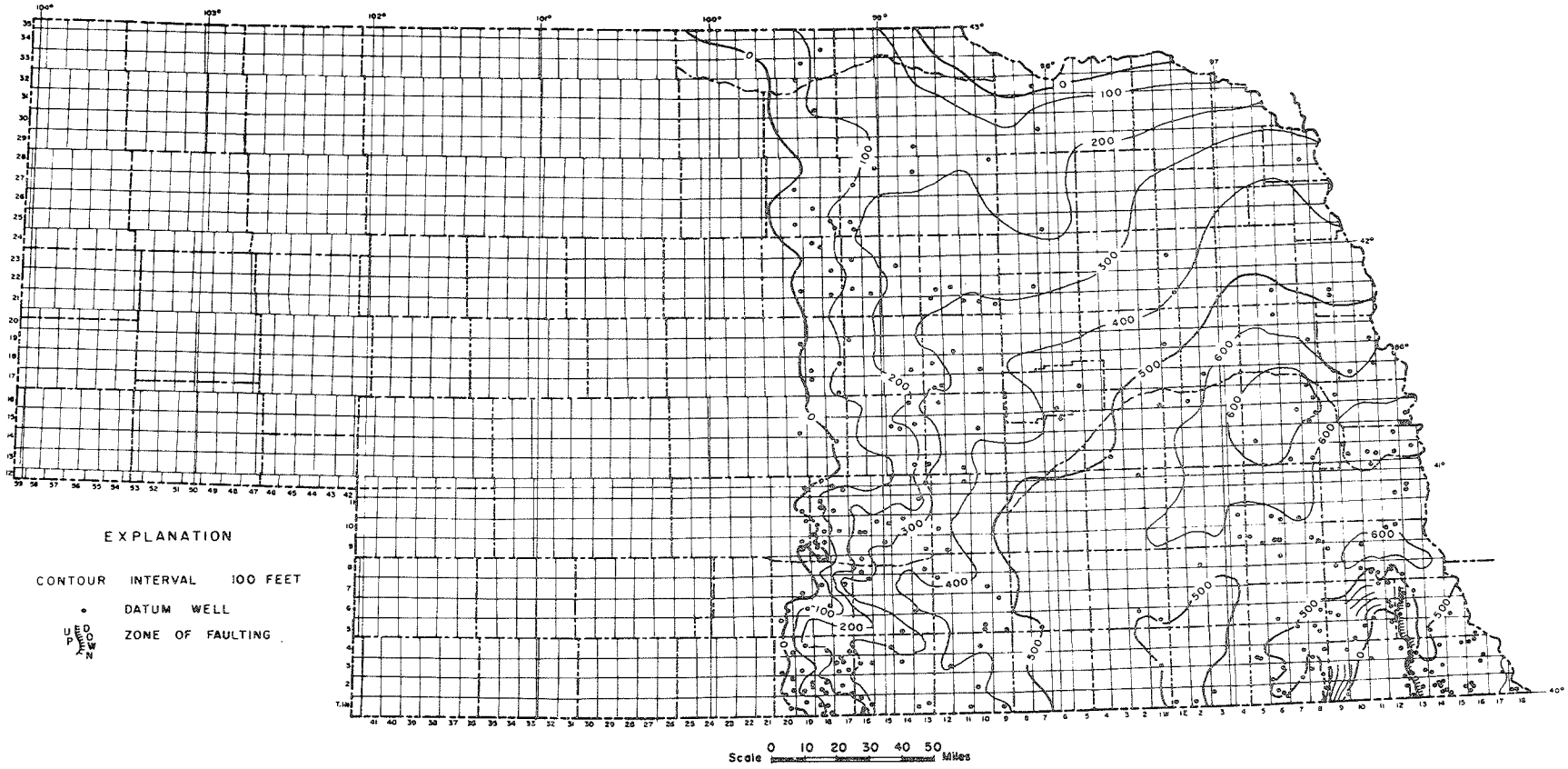


LITHOLOGIC SUBDIVISIONS OF MIDDLE AND UPPER ORDOVICIAN IN NEBRASKA

Figure 10



THICKNESS MAP OF MIDDLE AND UPPER ORDOVICIAN

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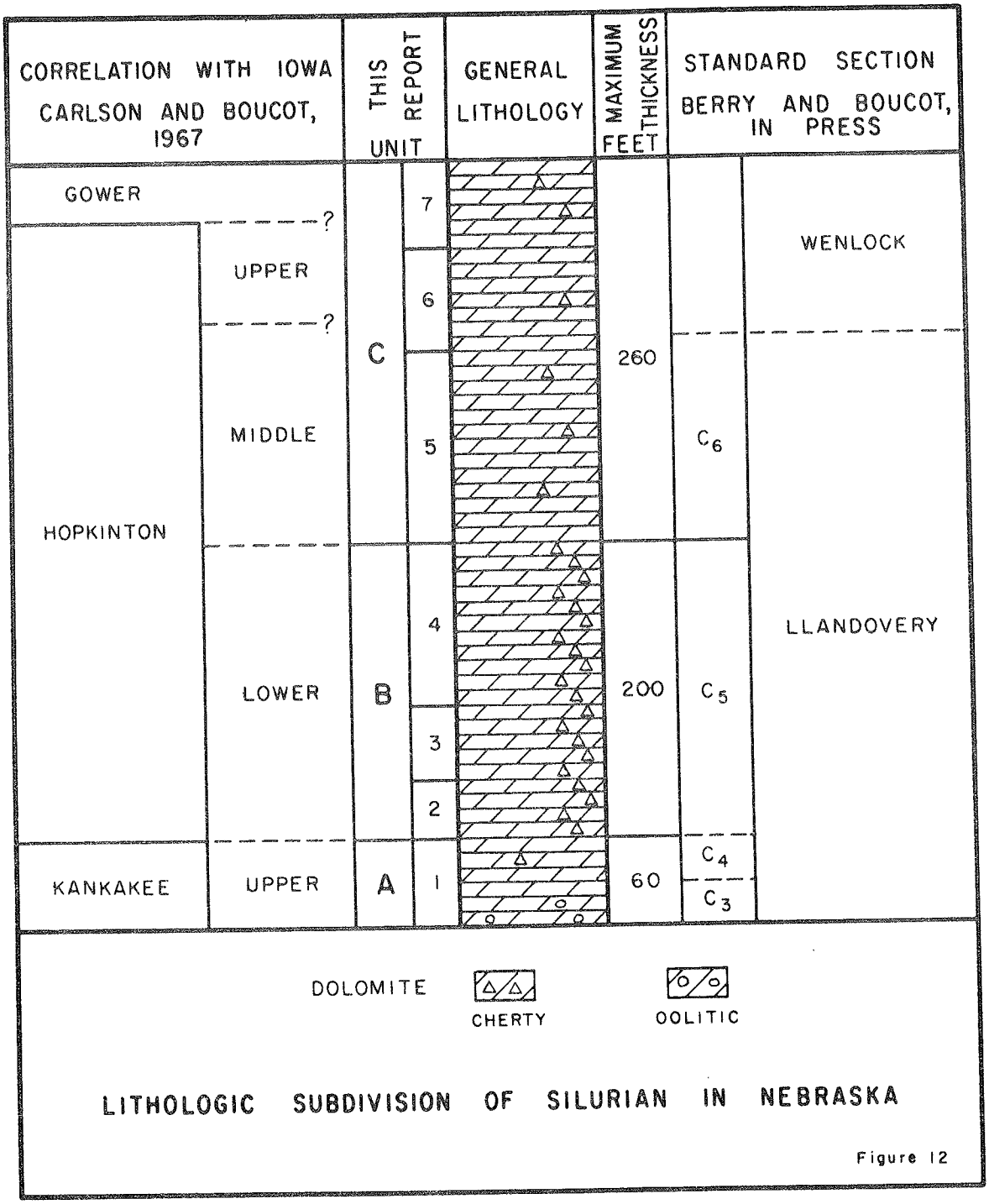
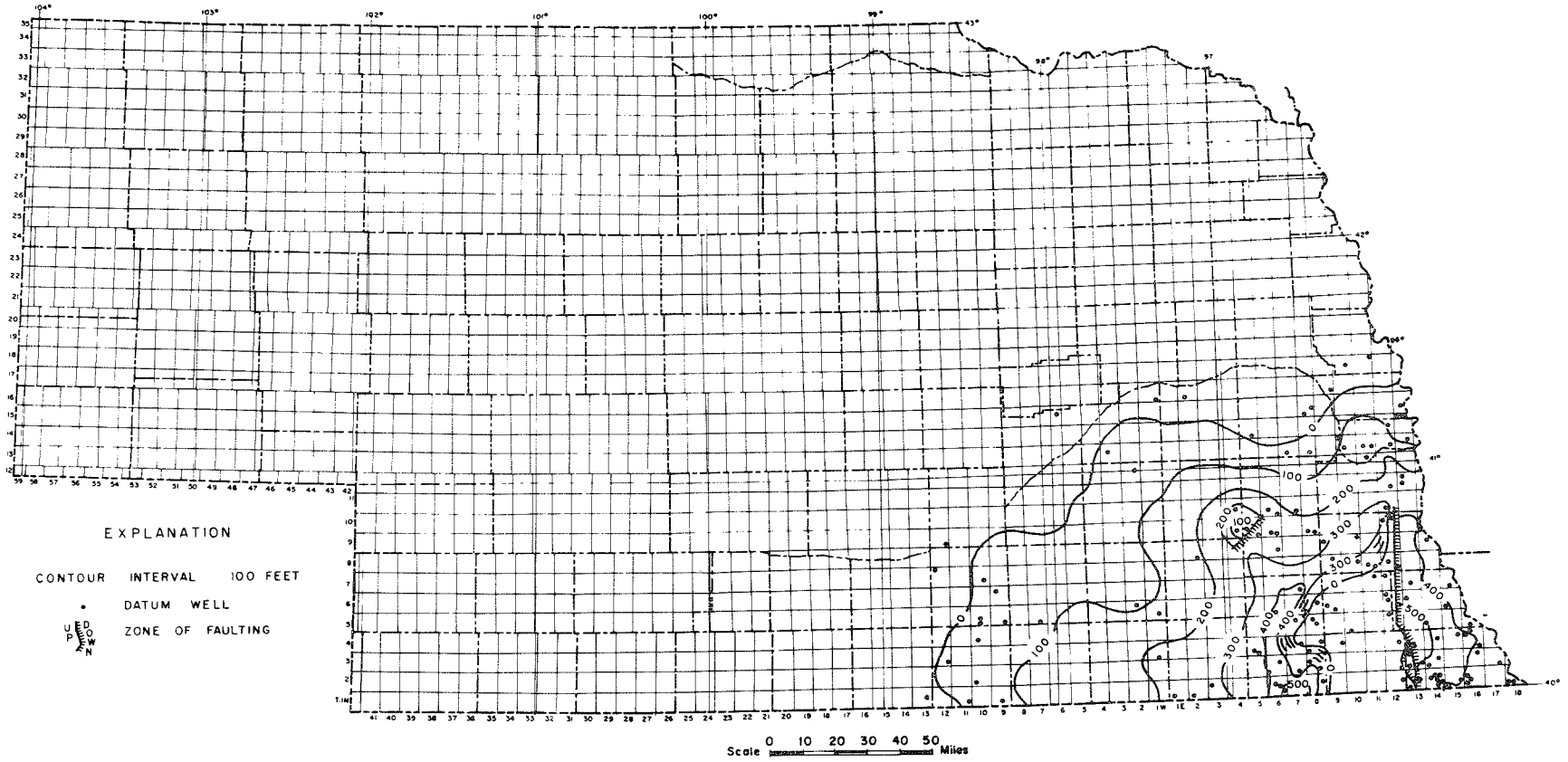
Figure 11



LITHOLOGIC SUBDIVISION OF SILURIAN IN NEBRASKA

Figure 12



THICKNESS MAP OF SILURIAN

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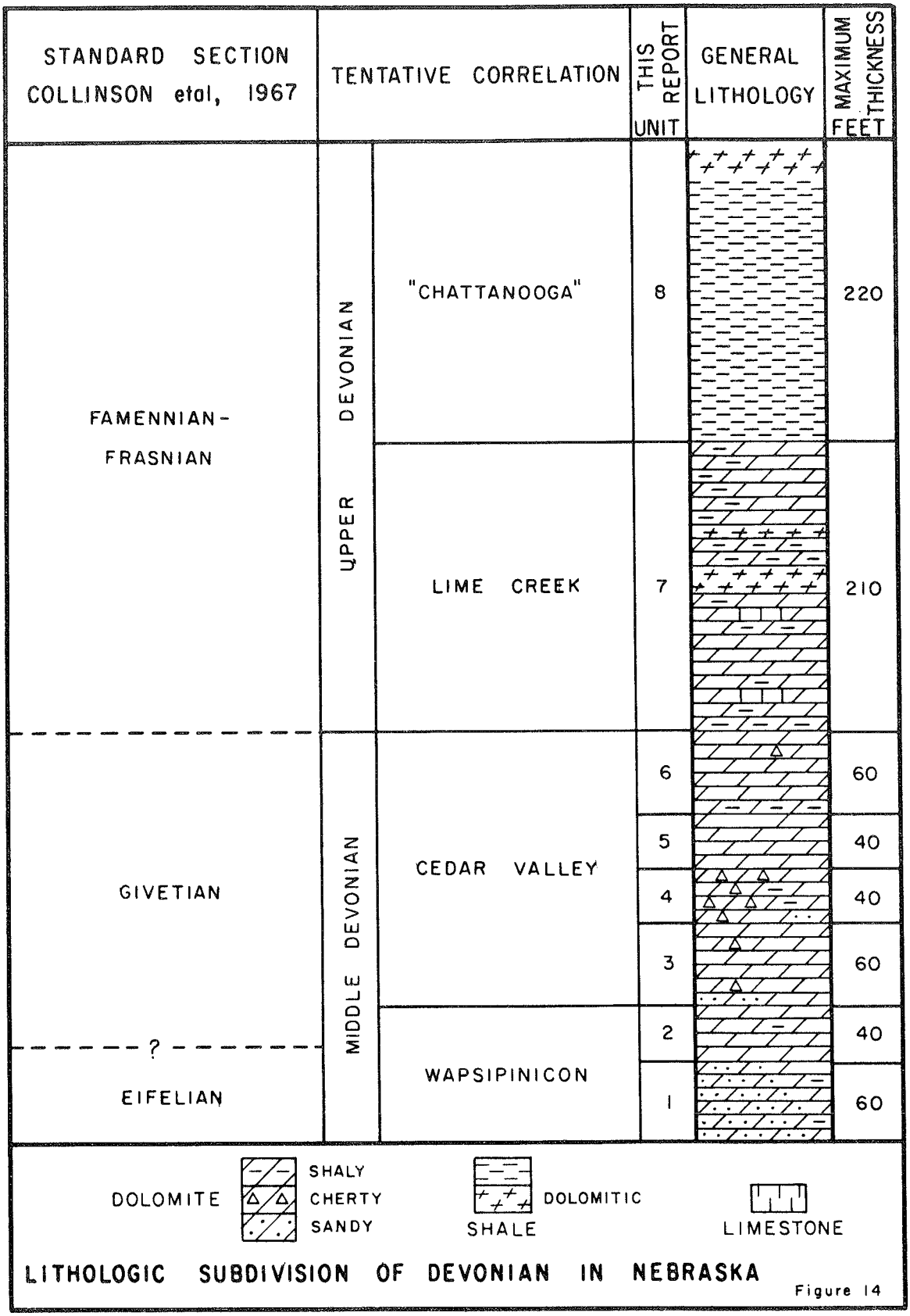
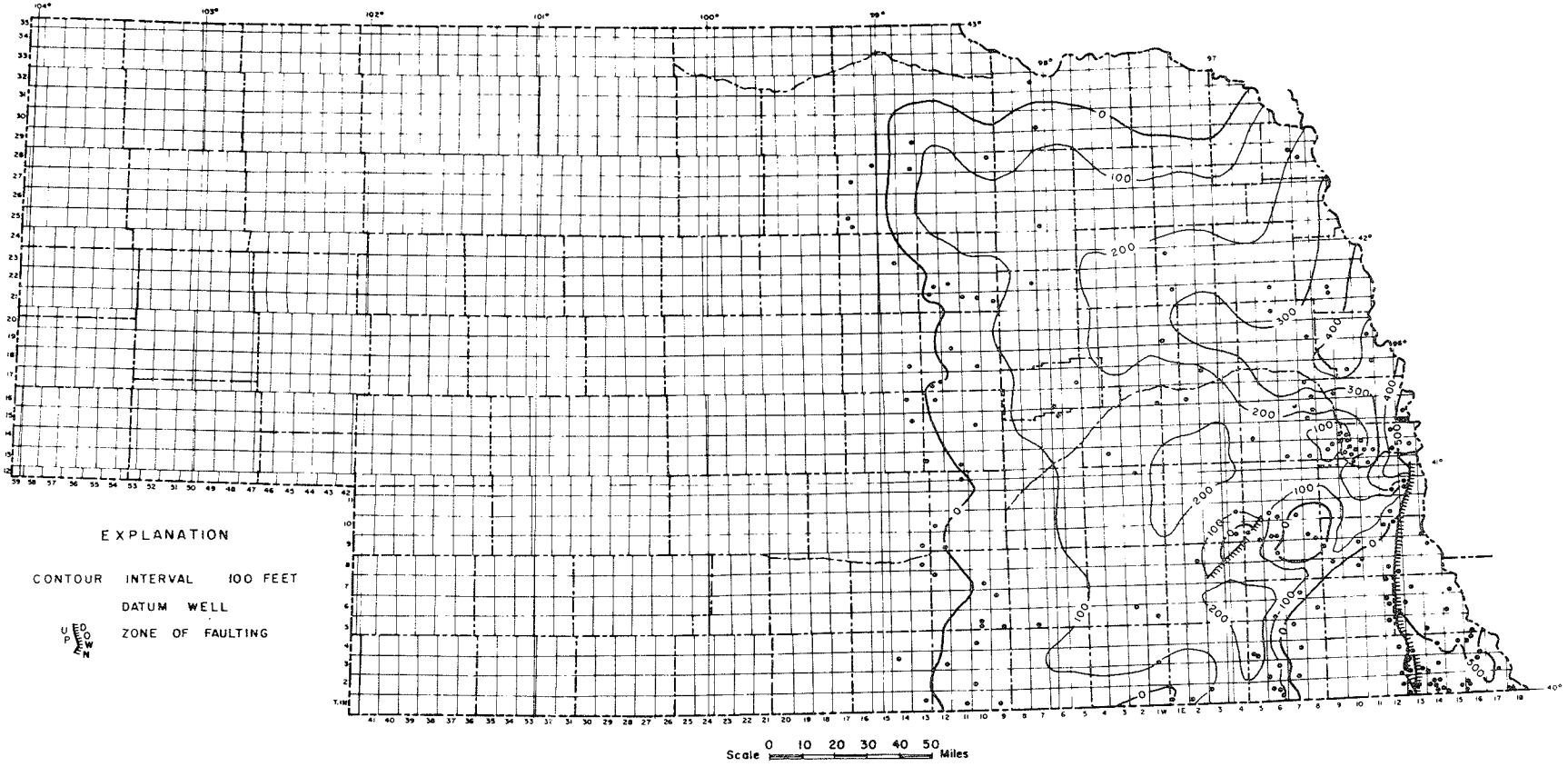
Figure 13



LITHOLOGIC SUBDIVISION OF DEVONIAN IN NEBRASKA

Figure 14



THICKNESS MAP OF DEVONIAN

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Figure 15

SYSTEM	SERIES	GROUP/FORMATION		UNIT THIS REPORT		LITHOLOGY	THICKNESS IN FEET
MISSISSIPPIAN	MERAMECIAN	STE. GENEVIEVE		9			0 – 25
		ST. LOUIS		8			0 – 30
		SPERGEN		7			0 – 35
		WARSAW		6			0 – 50
	OSAGEAN	UPPER KEOK. — BURL.		5			0 – 65
		LOWER KEOK. — BURL.		4			0 – 50
	KINDERHOOKIAN	GILMORE CITY		3			0 – 85
		CHOUTEAU–HAMPTON GROUP	EAGLE CITY – IOWA FALLS	2	D		0 – 100
			MAYNES CREEK (WASSONVILLE)		C		0 – 50
			CHAPIN (COMPTON)		B		0 – 20
			UNNAMED SILTSTONE		A		± 5
		BOICE		1			0 – 100
DEVONIAN		"CHATTANOOGA"		0			0 – 230

EXPLANATION

LIMESTONE — SAND EMBEDDED OOLITIC

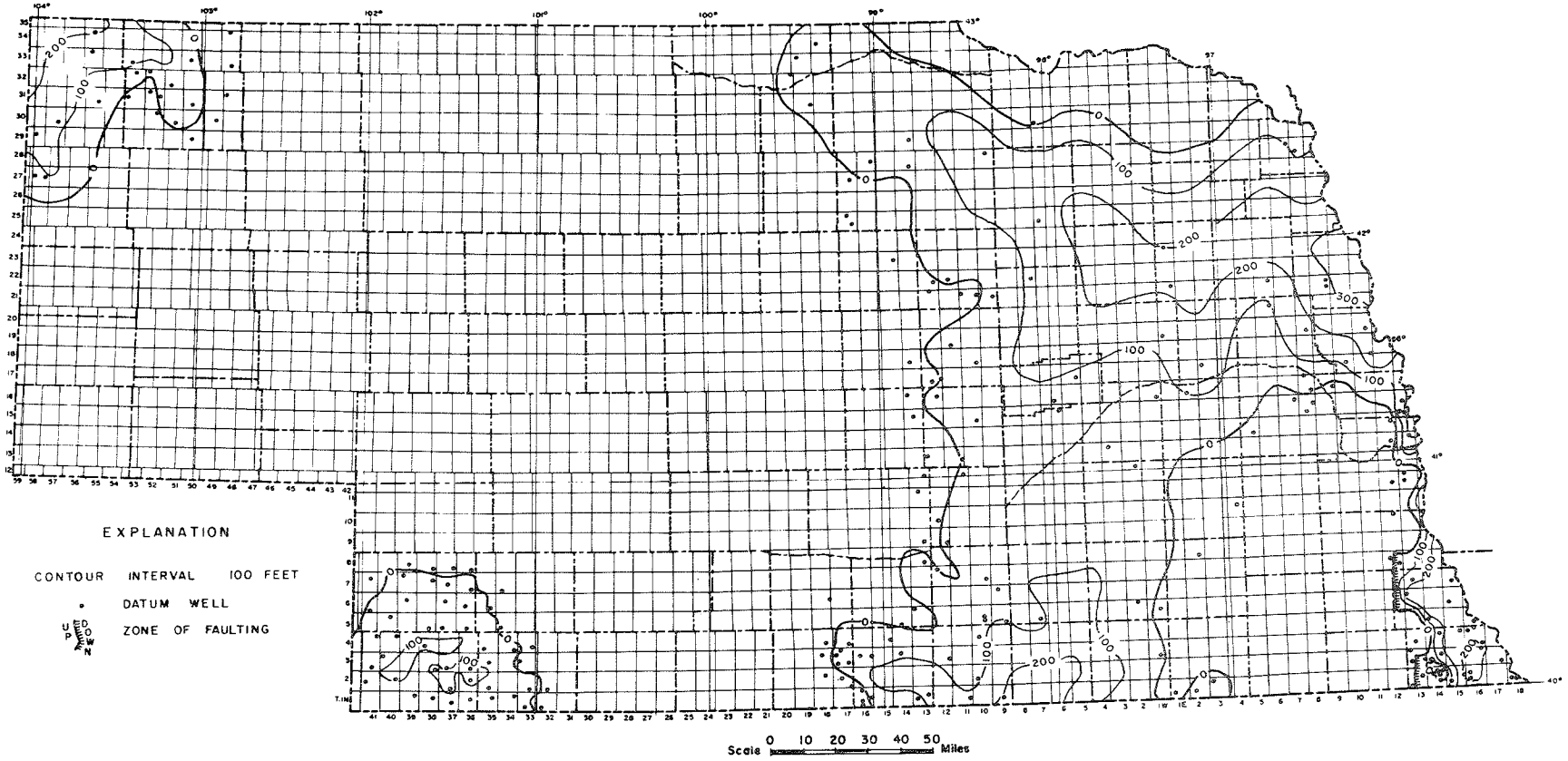
SHALE — "OOLITIC" HEMATITE

DOLOMITE — CHERTY GLAUCONITIC

SILTSTONE–SANDSTONE — DOLOMITIC

LITHOLOGIC SUBDIVISION OF MISSISSIPPIAN IN NEBRASKA

Figure 16



THICKNESS OF MISSISSIPPIAN

Figure 17

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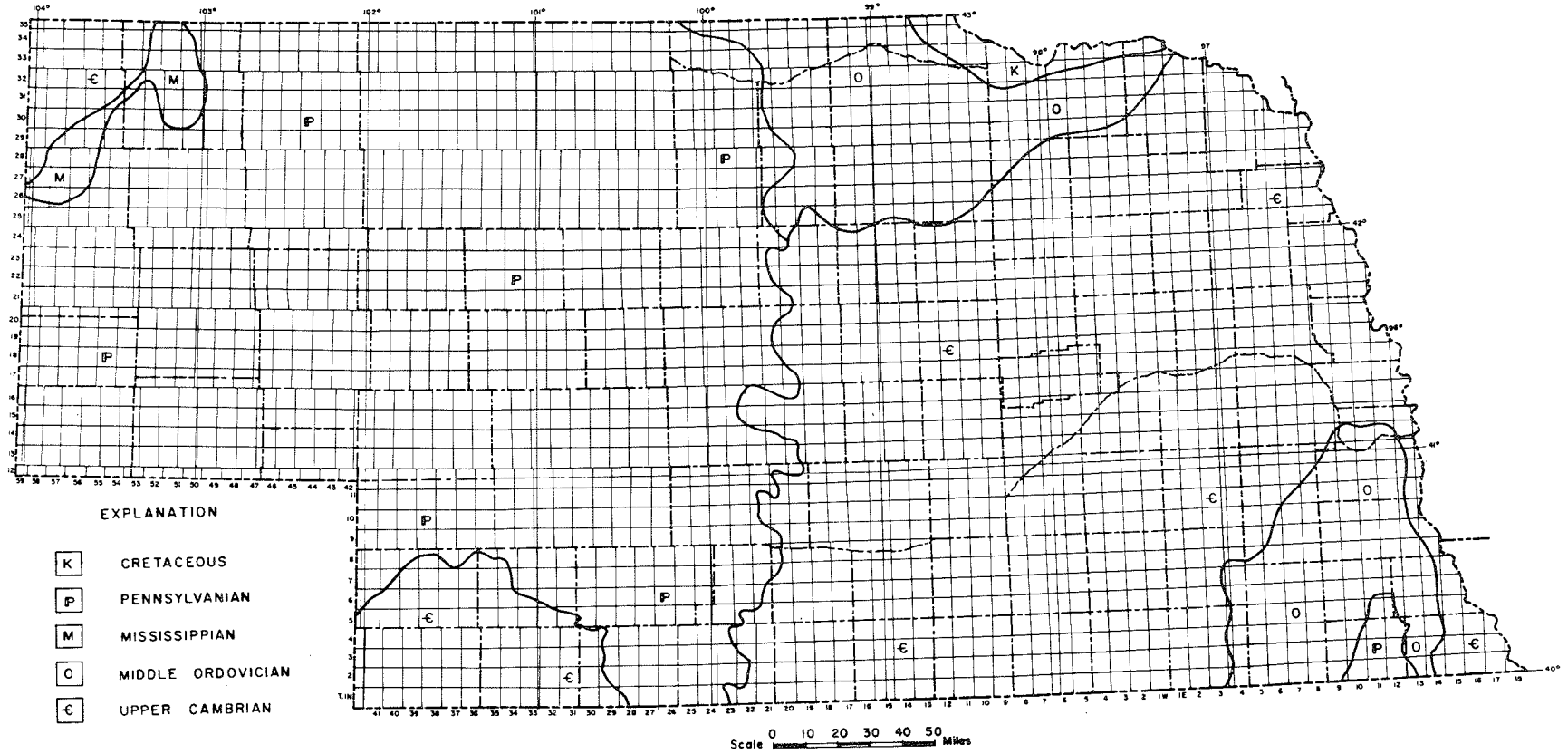

SUPRAGEOLOGIC MAP OF THE PRECAMBRIAN SURFACE

Figure 18

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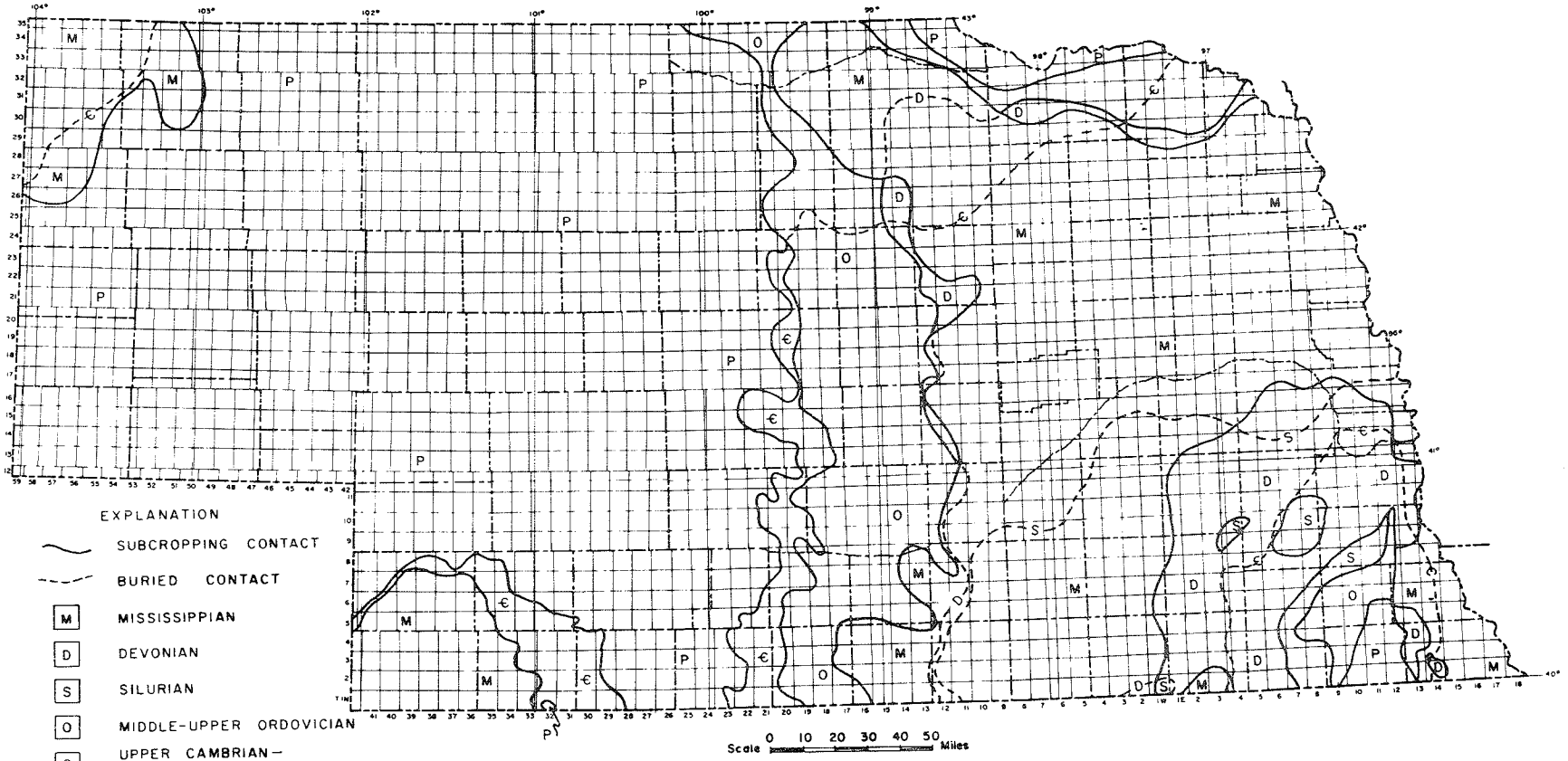

PALEOGEOLOGIC MAP – BASE OF PENNSYLVANIAN

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Figure 19