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Geology and Mineral Resources of Boone, Greeley, Nance, and Wheeler Counties, Nebraska

Raymond R. Burchett
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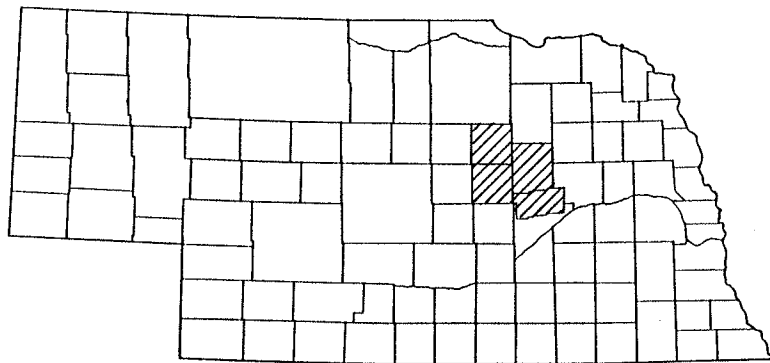
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Geology and Mineral Resources of Boone, Greeley, Nance, and Wheeler Counties, Nebraska

Raymond R. Burchett



OPEN - FILE REPORT

Nebraska Geological Survey
Conservation and Survey Division
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln



June 1993



TABLE 1. Generalized Geologic Column of Boone, Greeley, Nance, and Wheeler Counties, Nebraska

| System | Series | Group | Formation | Thickness, Ft. | General Characteristics | Geologic Age in Million Years | |
|-----------------------------|------------------|----------|--------------------|---------------------------|---|-------------------------------|---------------------------------|
| Quaternary | Recent | | | 0 to 400+ | Alluvium (silt, sand and gravel) | 1.7 | |
| | Pleistocene | | | | Loess and sand | | |
| Tertiary | Miocene | Ogallala | | 0 to 500+ | Limy siltstone, sandstone, and shale | 66 | |
| | | | | | Fine to coarse gravel | | |
| | | | | | Irregular beds of silt, sand and gravel | | |
| | | | | | Light-gray to buff, friable sand | | |
| Cretaceous | Upper Cretaceous | Montana | Pierre | 0 to 500+ | Light-brown shale | 66 | |
| | | | | | Soft, limy shale | | |
| | | | | | Slightly calcareous mudstone | | |
| | | | | | Calcareous shale | | |
| | | | | | Shale and claystone | | |
| | | | | | Slightly bituminous shale | | |
| | | Colorado | Niobrara | 0 to 400 | Chalky limestone | | |
| | | | | | Chalky limestone | | |
| | | | | | Clayey siltstone | | |
| | Colorado | Carlile | 200 - 300 | Shale | | | |
| | | | | Medium to dark-gray shale | | | |
| | | | | Greenhorn | 20 to 30 | | Limestone |
| | | | | Graneros | 20 to 60 | | Shale with silt and sand layers |
| Lower Cretaceous | Dakota | Omadi | Under 300 to 1000+ | Buff to rusty sandstone | | | |
| | | Fuson | | Light-gray sandy shale | | | |
| | | Lakota | | Light-gray sandstone | | | |
| Jurassic | | | | Absent | 138 | | |
| Triassic | | | | Absent | 205 | | |
| Permian | | | | Absent | 240 | | |
| Pennsylvanian | | | | 150 to 1050 | Limestone shale and sandstone | 290 | |
| Mississippian | | | | 0 to 200 | Limestone and dolomite | 330 | |
| Devonian | | | | 0 to 200 | Dolomite and limestone | 360 | |
| Silurian | | | | Absent | | 410 | |
| Middle and Upper Ordovician | | | | 250 to 500 | Dolomite, shale, and sandstone | 435 | |
| Lower Ordovician | | | | 0 to 275 | Dolomite and sandstone | 570 | |
| Cambrian | | | | | | | |
| Precambrian | | | | | Igneous and metamorphic rocks | | |

**GEOLOGY OF BOONE, GREELEY, NANCE, AND WHEELER COUNTIES,
NEBRASKA**

Raymond R. Burchett

The surface geology of Boone, Greeley, Nance, and Wheeler counties is composed mostly of loess (wind-blown silt) overlain by dune sand or of alluvium that consists of silt, sand and gravel. These unconsolidated deposits are of Quaternary age and all are less than 1.7 million years old.

Underlying the unconsolidated deposits are partly to wholly consolidated bedrock consisting of sedimentary rocks of Tertiary, Cretaceous, Pennsylvanian, Mississippian, Devonian, Ordovician, and Cambrian ages. Rocks of Tertiary age crop out in the southwestern part of Greeley County and in the central and southern parts of Nance County, and they consist mostly of sandstones, siltstones, and chalky limestones (marl) that range in age from 1.7 million years to 66 million years old. An outcrop of Niobrara chalky limestone (Cretaceous age) also was observed in the south-central part of Nance County. No outcrops of bedrock were observed in Boone or Wheeler counties.

The older sedimentary rocks of Pennsylvanian, Mississippian, Devonian, Ordovician, and Cambrian ages consist mostly of limestones, dolomites, shales, and sandstones and only occur in the subsurface of the four-county area.

The basement or oldest deposits in these counties consist of igneous (granitic) and metamorphic rocks of Precambrian age.

Structurally, these counties lie within the Central Nebraska Basin. The younger bedrock formations appear to be flat-lying but have a gentle dip of approximately 10 to 35 feet per mile to the northwest.

**MINERAL RESOURCES OF BOONE, GREELEY, NANCE, AND WHEELER
COUNTIES, NEBRASKA**

Raymond R. Burchett

PAST

Mineral resource production in Boone, Greeley, Nance, and Wheeler counties has been limited to chalk (marl), sand and gravel, volcanic ash and water. Several tests have been drilled for oil and gas but no production has resulted.

A 4.5 to 7 foot thick chalk (marl) southwest of Scotia, in Greeley County, has been quarried and mined since the 1870's. The mine is in the NW SW sec. 16, T. 17 N., R. 12 W. and the chalk originally was quarried and later on mined for building foundations and walls. Closed by a cave-in in the early 1900's, the mine was not opened again until 1930, when the Nelson Paint Company of Omaha mined the chalk for fillers in paint products. Shortly after 1930 the mine was closed and since has not been used for commercial mine production. In 1967, the Nebraska Game and Parks Commission established the Chalk Mine State Wayside Park, which lasted as a tourist attraction until a roof cave-in closed it permanently in 1983.

Seventeen wells exploring for oil and gas have been drilled in the four-county area. Of these, one was drilled in Boone County, seven in Greeley County, three in Nance County, and six in Wheeler County.

Mining of sand and gravel has occurred at 39 locations in this four-county area. Of these, 8 were in Boone County, 11

in Greeley County, 18 in Nance County, and 2 in Wheeler County.

Volcanic ash was once mined in Greeley County but the exact location is not known. Barbour (1916, p.378) reported "Good mines opened near Scotia...are worked intermittently." He also reported (1916, p.398) the following constituents of pumicite from Greeley County (analysis by the University of Nebraska, Department of Chemistry).

| | Percent |
|---|---------|
| SiO ₂ | 72.06 |
| Al ₂ O ₃ | 14.26 |
| Fe ₂ O ₃ | 0.88 |
| CaO..... | 1.32 |
| MgO..... | 0.37 |
| SO ₂ | 0.33 |
| Na ₂ O + K ₂ O..... | 6.40 |
| Water and volatile matter lost on ignition..... | 4.38 |
| Total..... | 100.00 |

Uses of raw volcanic ash include abrasives and aggregate in concrete, road construction material, ceramic fluxes, fillers, absorbents, soil conditioners, and filters. Bloated or "popped" volcanic ash can be used in plaster, for insulation, and in filtration processes.

Sources of water, include wells producing from the sand and gravel of Quaternary age and from sandstones in the Ogallala Group.

PRESENT

Present mineral resource production in the four- county area is limited to sand and gravel and water. Currently only two sand and gravel pits are active in the area and both are in Nance County. Sources of water include wells producing from sands and gravels of Quaternary age and from sandstones in the older Ogallala Group. Currently no oil and gas exploration tests are being drilled in the area and no significant metallic mineral resources are known to exist.

FUTURE

Future potential for mineral exploration in the four- county area might include chalk (marl), oil and gas, sand and gravel, sandstone or siltstone, volcanic ash, and water. Outcrops of bedrock in Nance County include the younger Ogallala sandstone or siltstone overlying the older Niobrara Chalk. The Ogallala might be crushed and used for county road surfacing material as it is in several other counties. In Nance County the Niobrara Chalk has several potential uses such as in cement manufacture, construction materials, and agricultural lime products. The abandoned cement plant at Superior, Nebraska, used the chalk, and the Webster County Department of Roads uses crushed Niobrara Chalk for secondary road resurfacing. Two quarries in Cedar County have produced rock used for rip-rap along the Missouri River. Near Nelson, in Nuckolls County another producer manufactures finely ground chalk for agricultural purposes. Although several oil and gas drill holes were tested, only the operator of the Pflugge #1

in the center of NE NE SE sec. 20, T. 22 N., R. 11 W.,
(Wheeler County) reported dead oil stains from the Devonian
dolomite interval between depths of 2774 and 2805 feet.
Because sand and gravel are in continuing demand for
resurfacing of county roads and for other construction
purposes, new sources should be explored for in the alluvial
deposits bordering the creeks. If large deposits of volcanic
ash were to be found, there is a potential market in
insulation products. Additional large and deeper sources of
water may also be present in the Niobrara Chalk, the Greenhorn
Limestone, and the Dakota
Sandstone.

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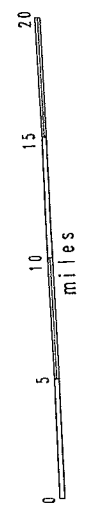
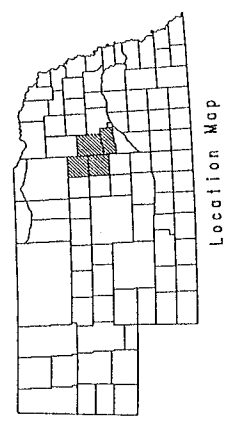
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SURFACE ELEVATION

Holt Co.

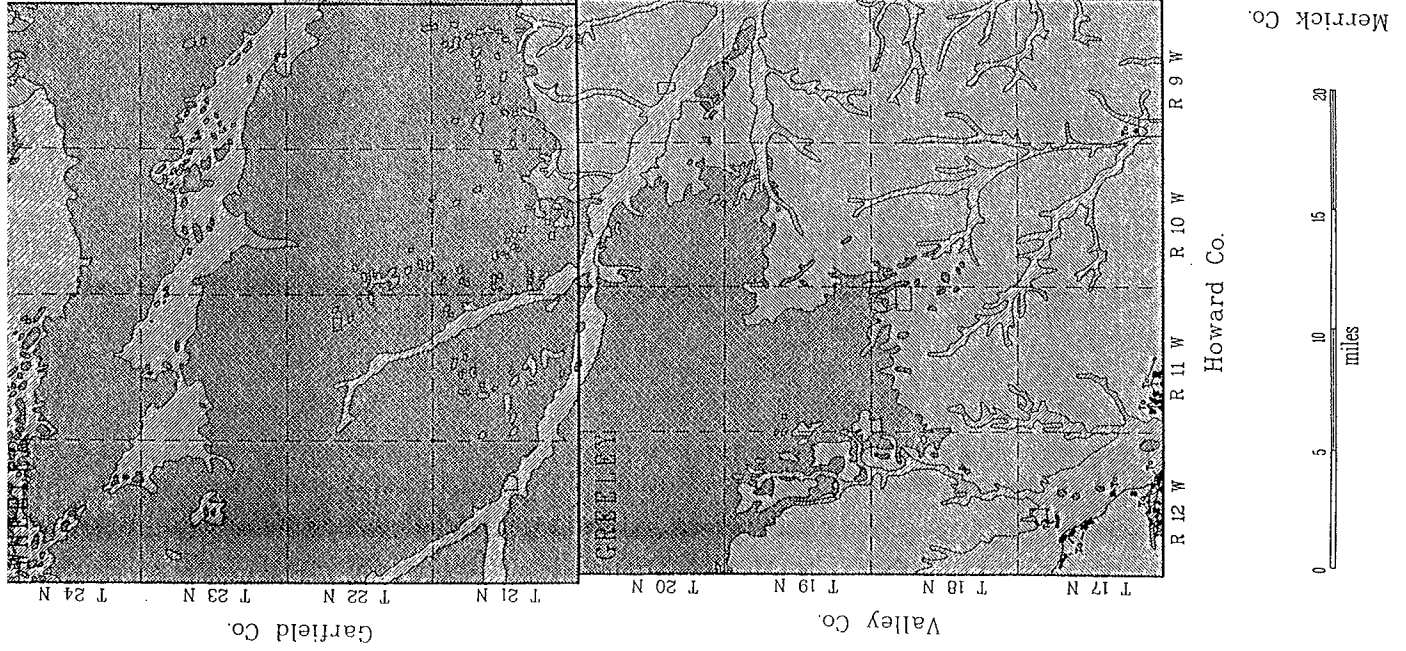


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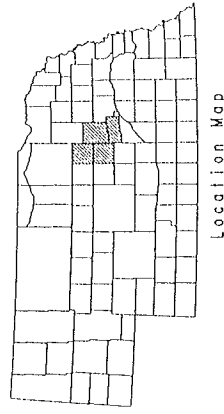


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GEOLOGIC MATERIALS MAP

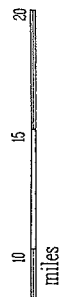


- QUATERNARY SYSTEM**
 Alluvium (silt, sand and gravel)
- Sand**
- Loess (wind-blown silt)**
- Bedrock outcrops**
 to - Tertiary System: Ogallala Group - sand, sandstone, silt and siltstone.
 Cretaceous System: Niobrara Group - chalky limestone or shale.



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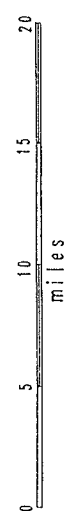
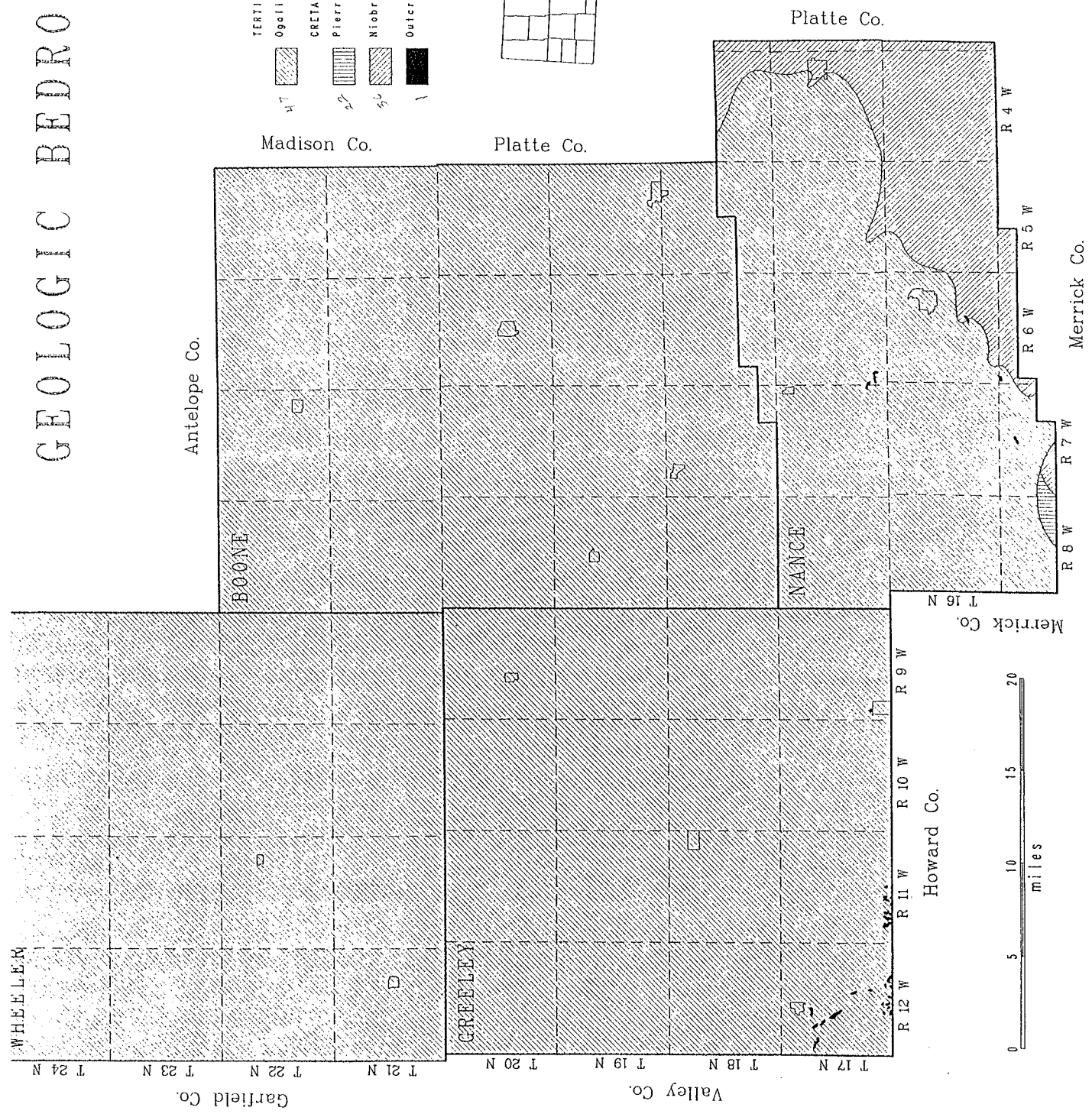
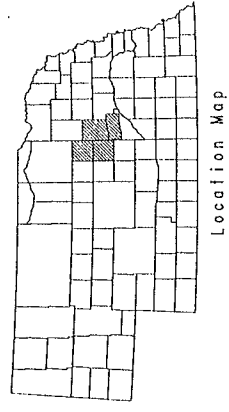
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GEOLOGIC BEDROCK MAP

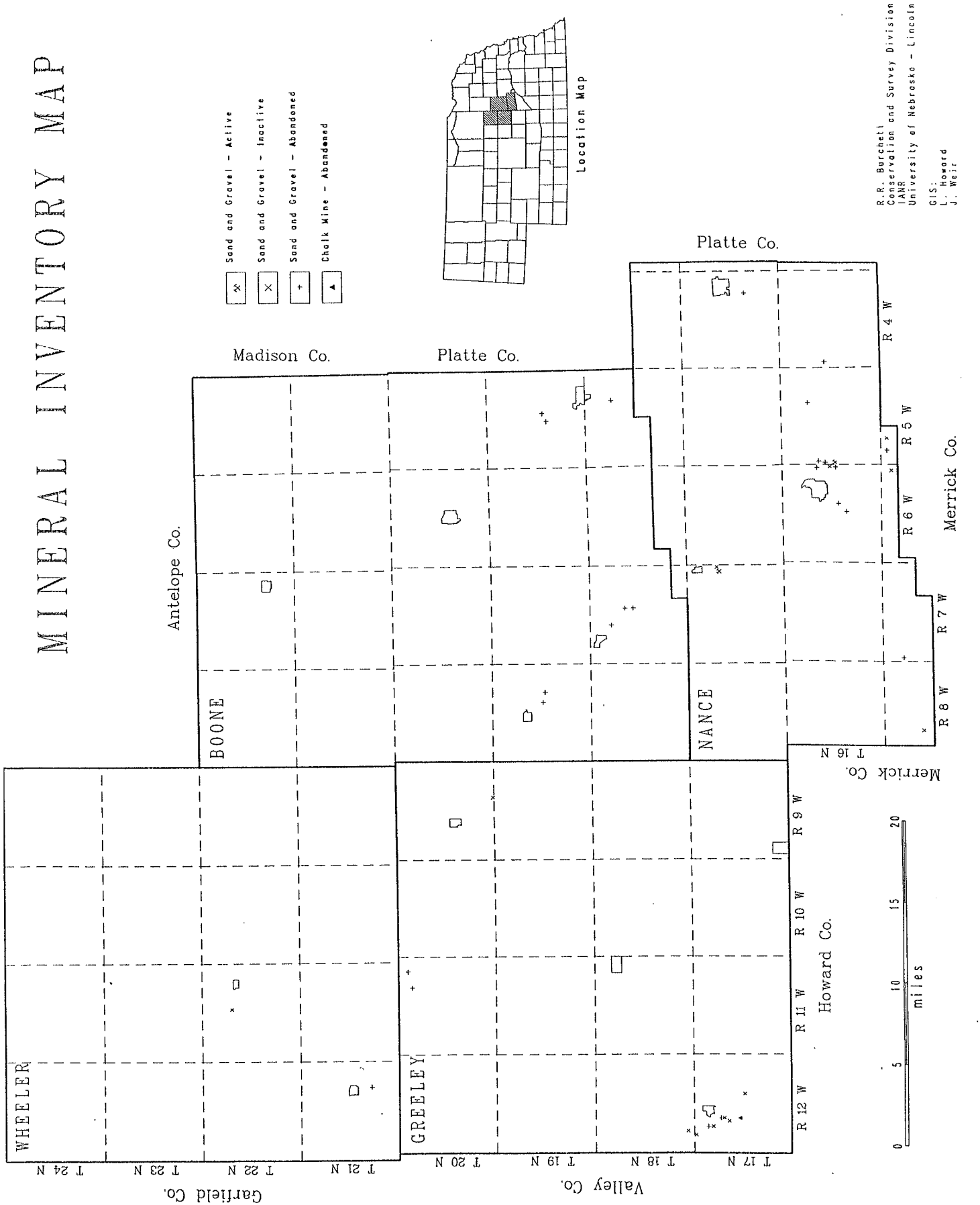
Geologic Survey

- TERTIARY SYSTEM
 - Ogallala Group 93
- CRETACEOUS SYSTEM
 - Pierre Formation 46
 - Niobrara Formation 68
- Outcrops 27

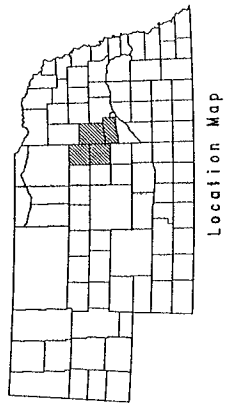


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MINERAL INVENTORY MAP

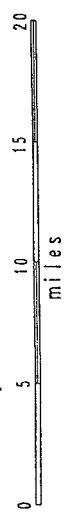


- x Sand and Gravel - Active
- x Sand and Gravel - Inactive
- + Sand and Gravel - Abandoned
- ▲ Chalk Mine - Abandoned

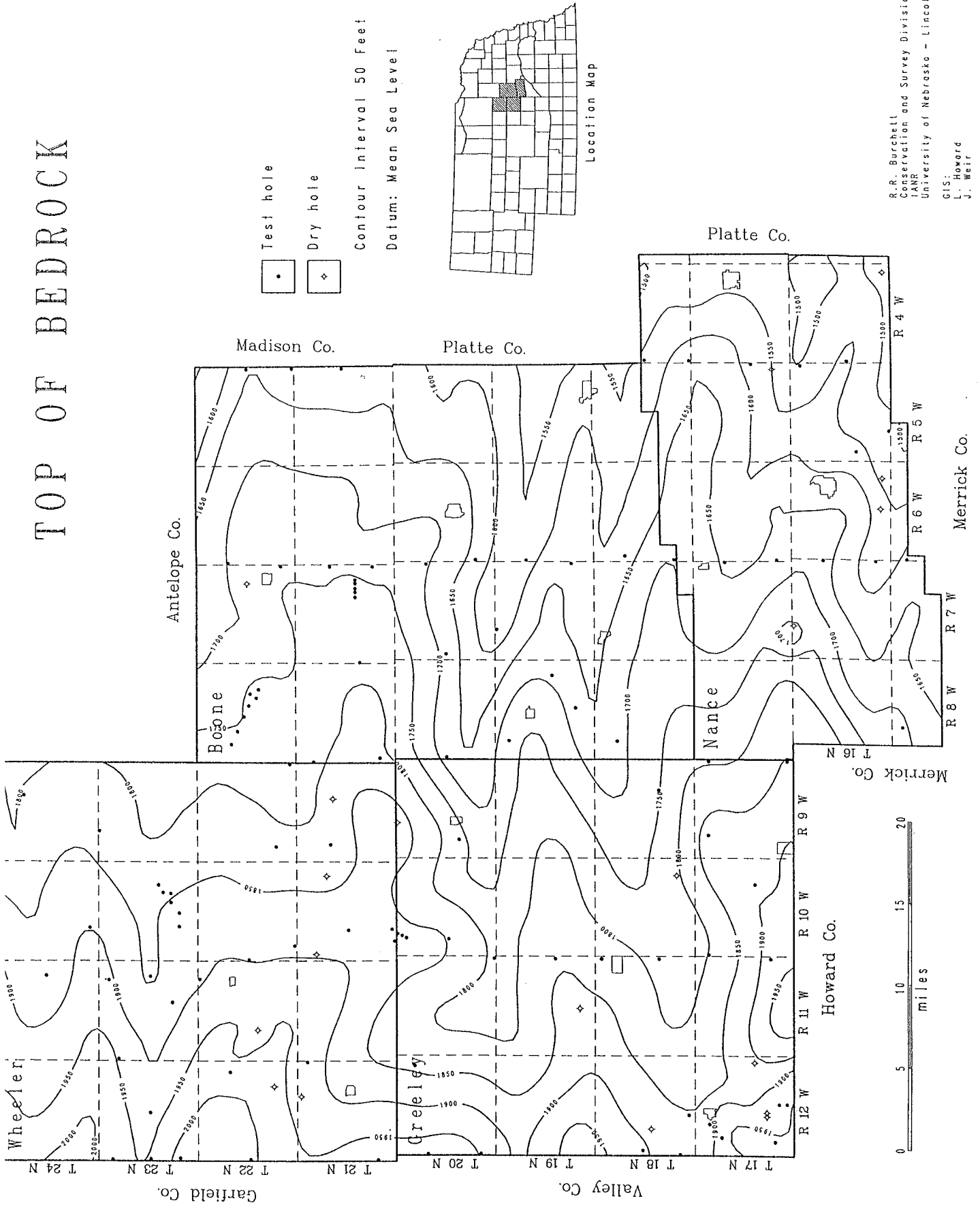


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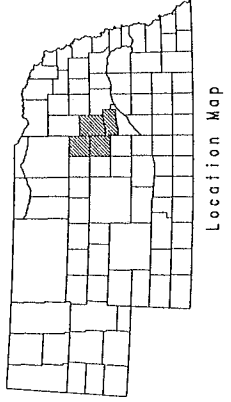


TOP OF BEDROCK



• Test hole
 ◊ Dry hole

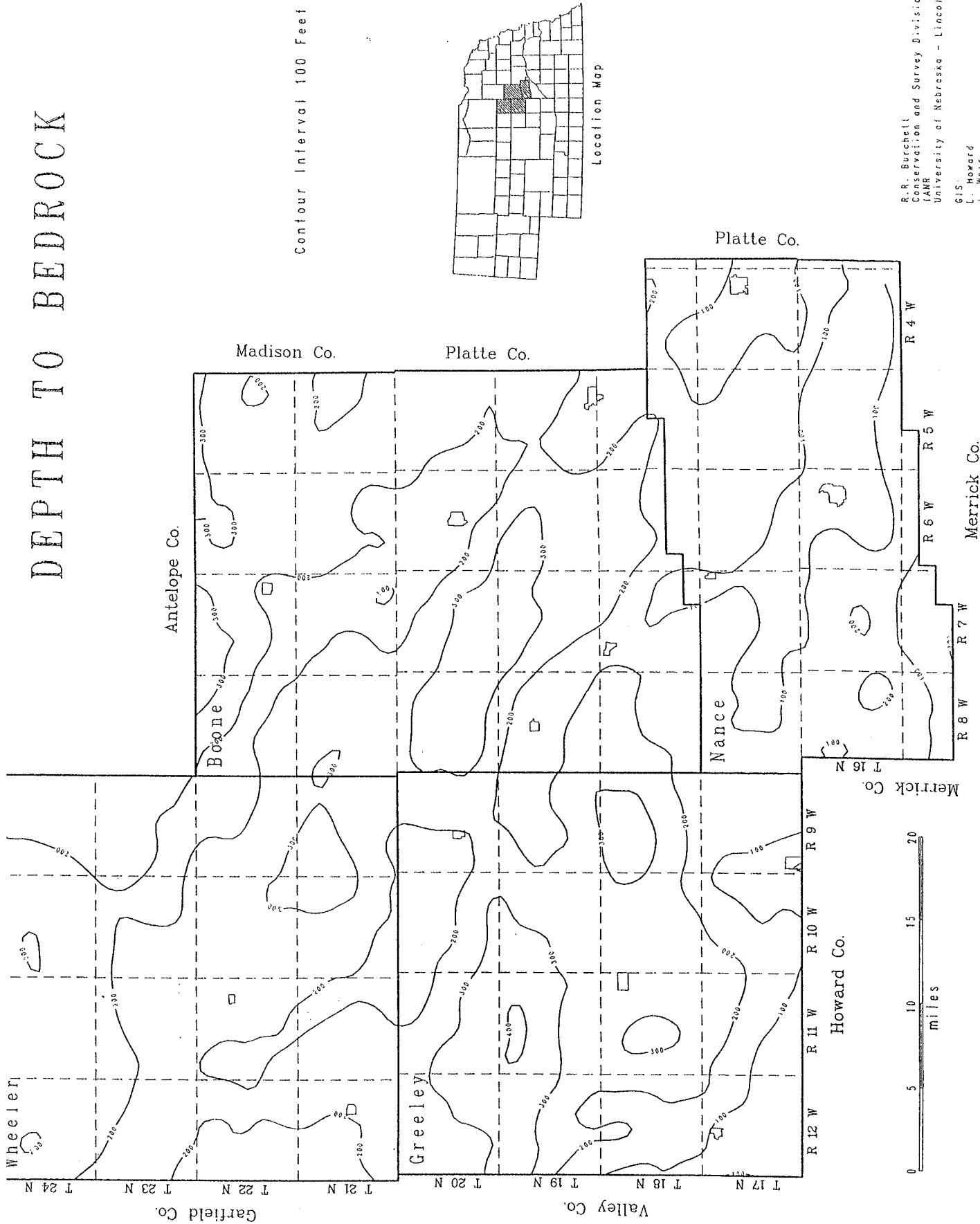
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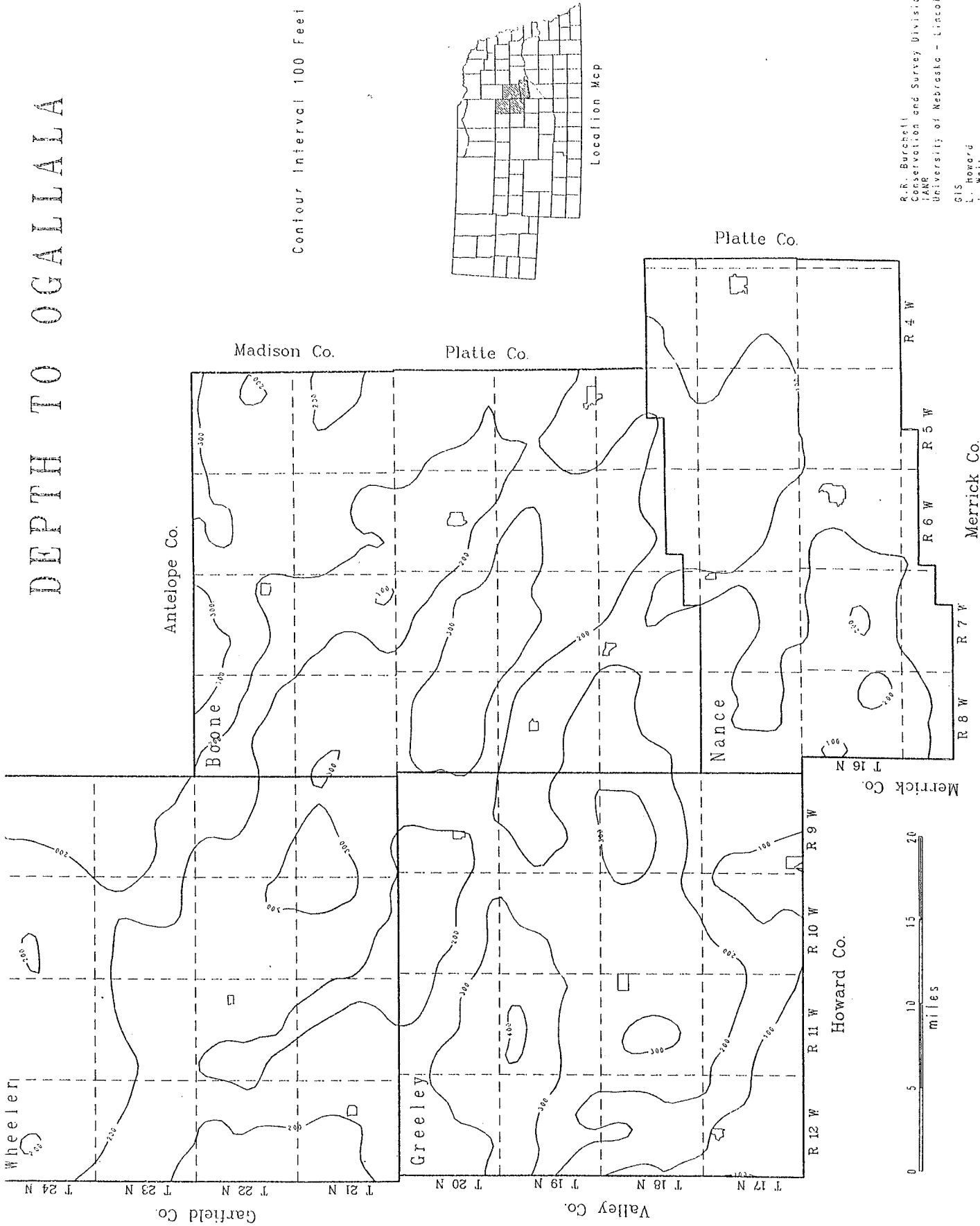
DEPTH TO BEDROCK



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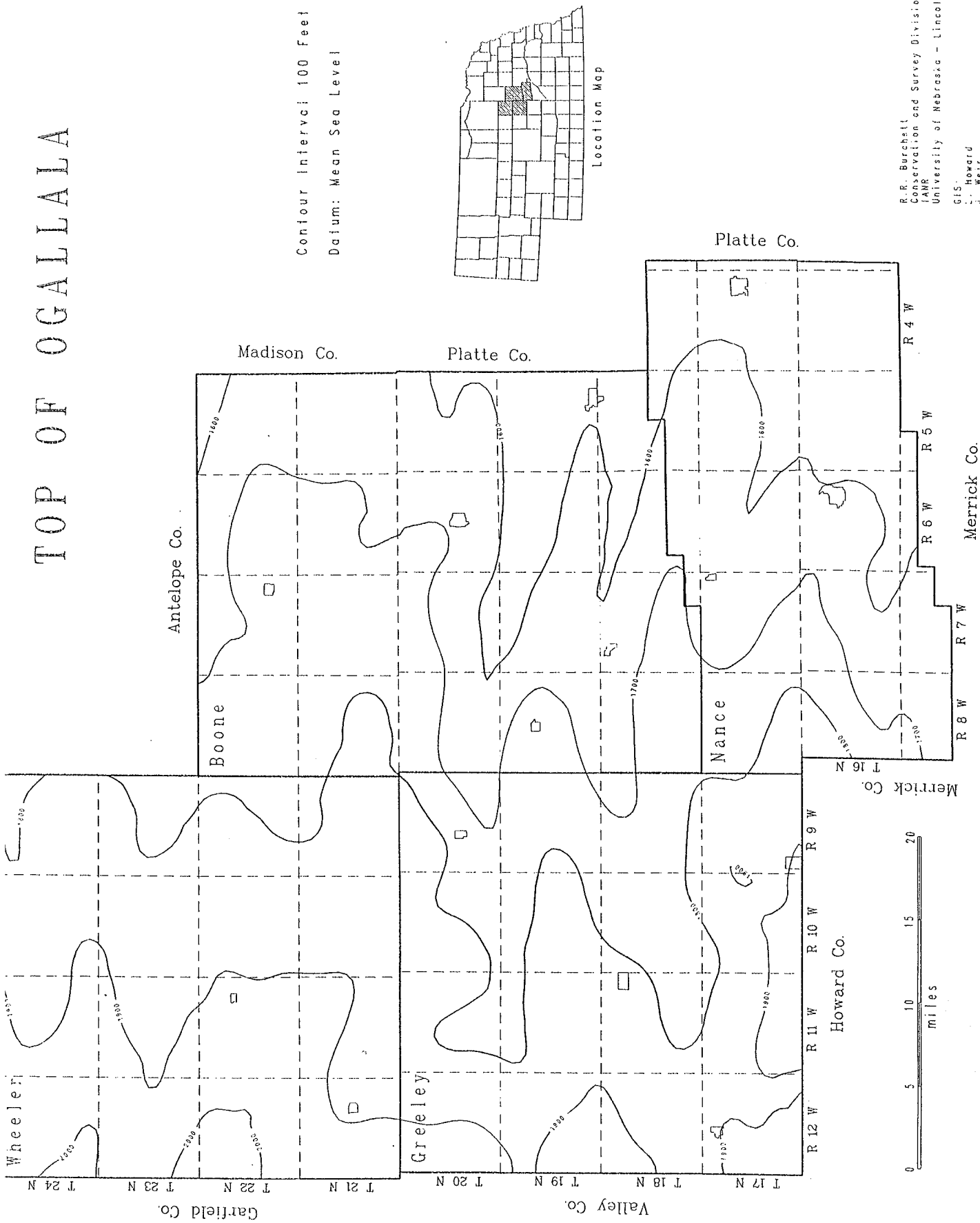
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DEPTH TO OGALLALA



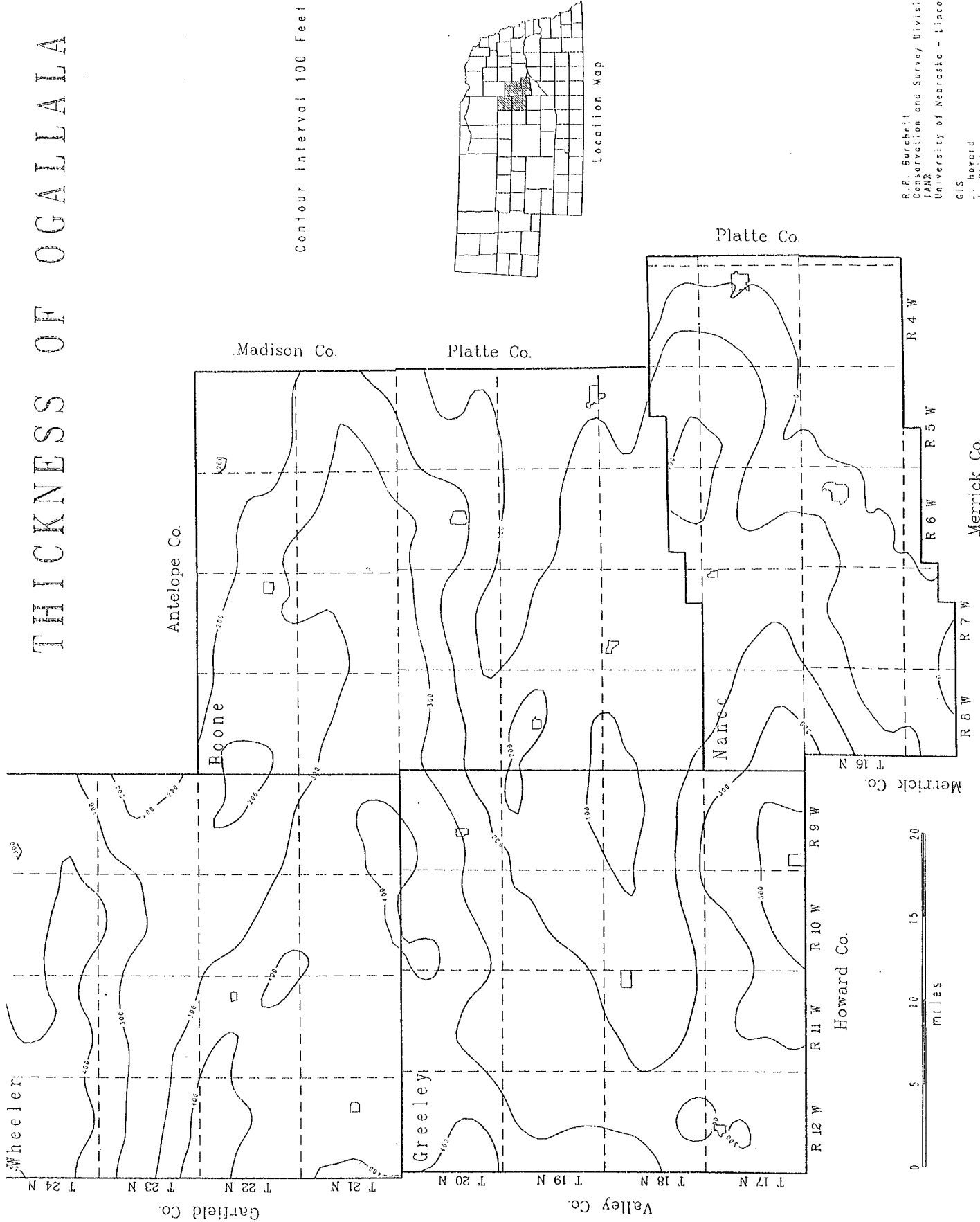
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TOP OF OGALLALA



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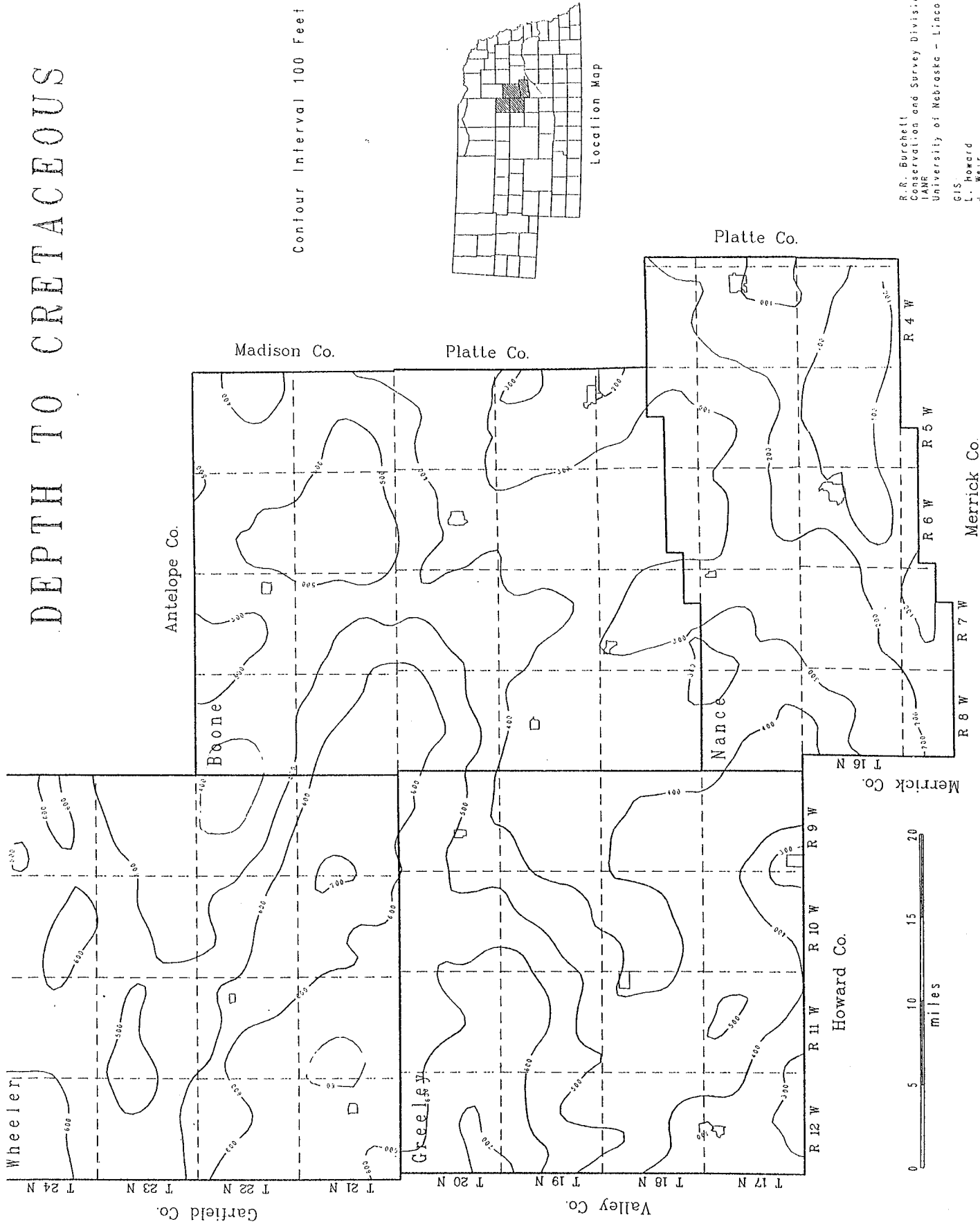
THICKNESS OF OGALLALA



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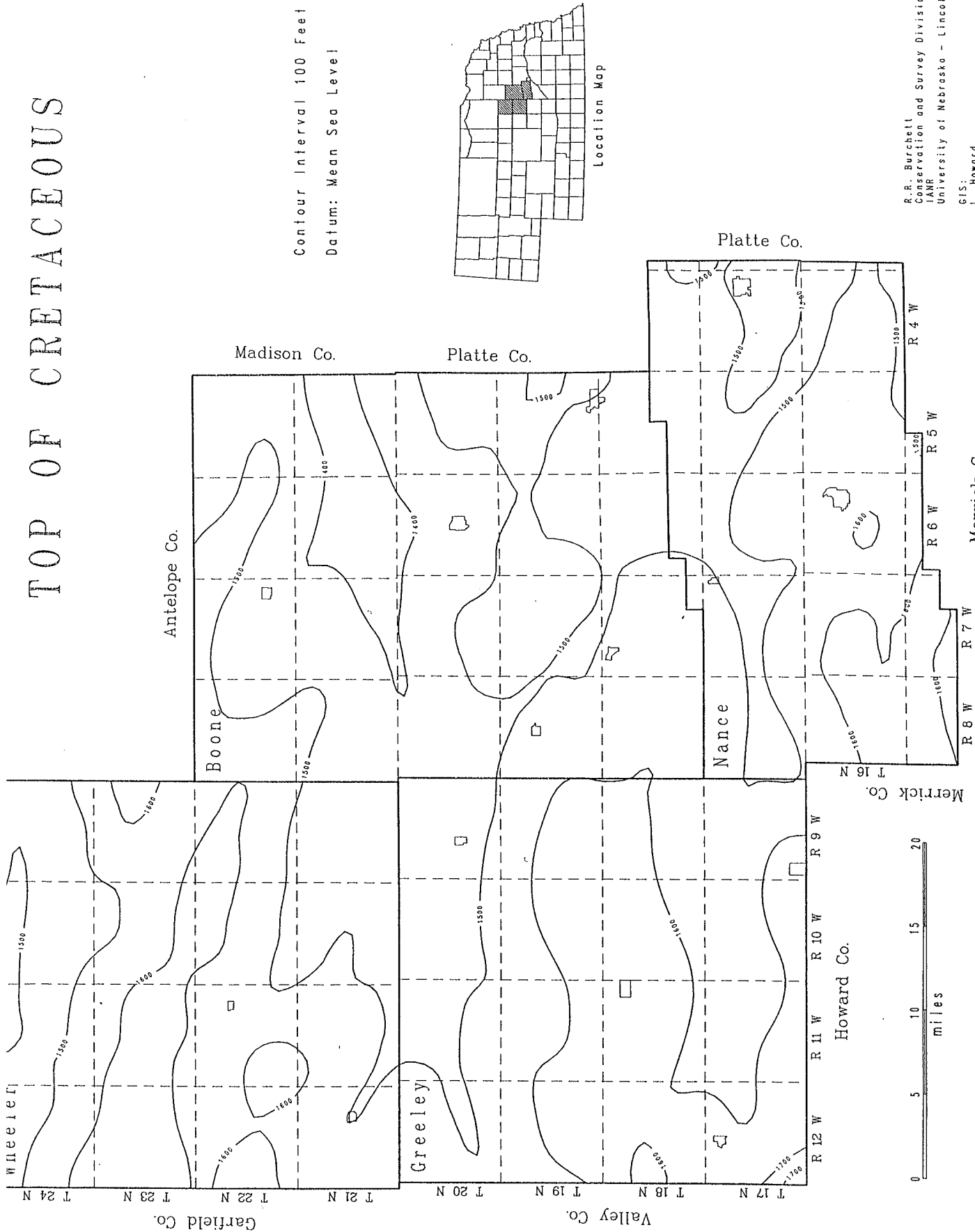
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DEPTH TO CRETACEOUS

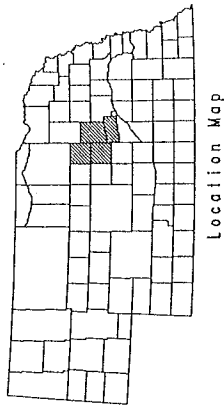


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TOP OF CRETACEOUS

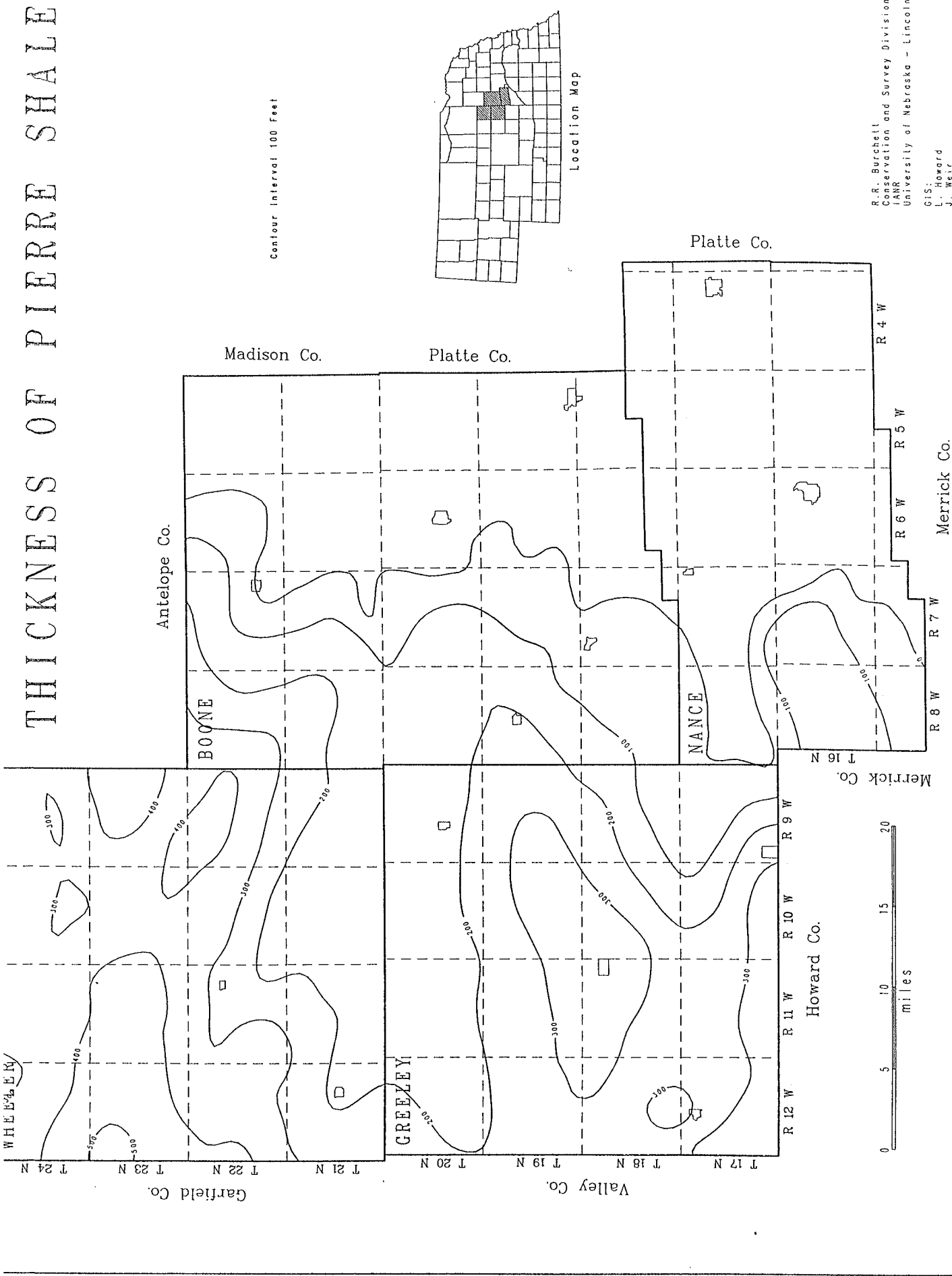


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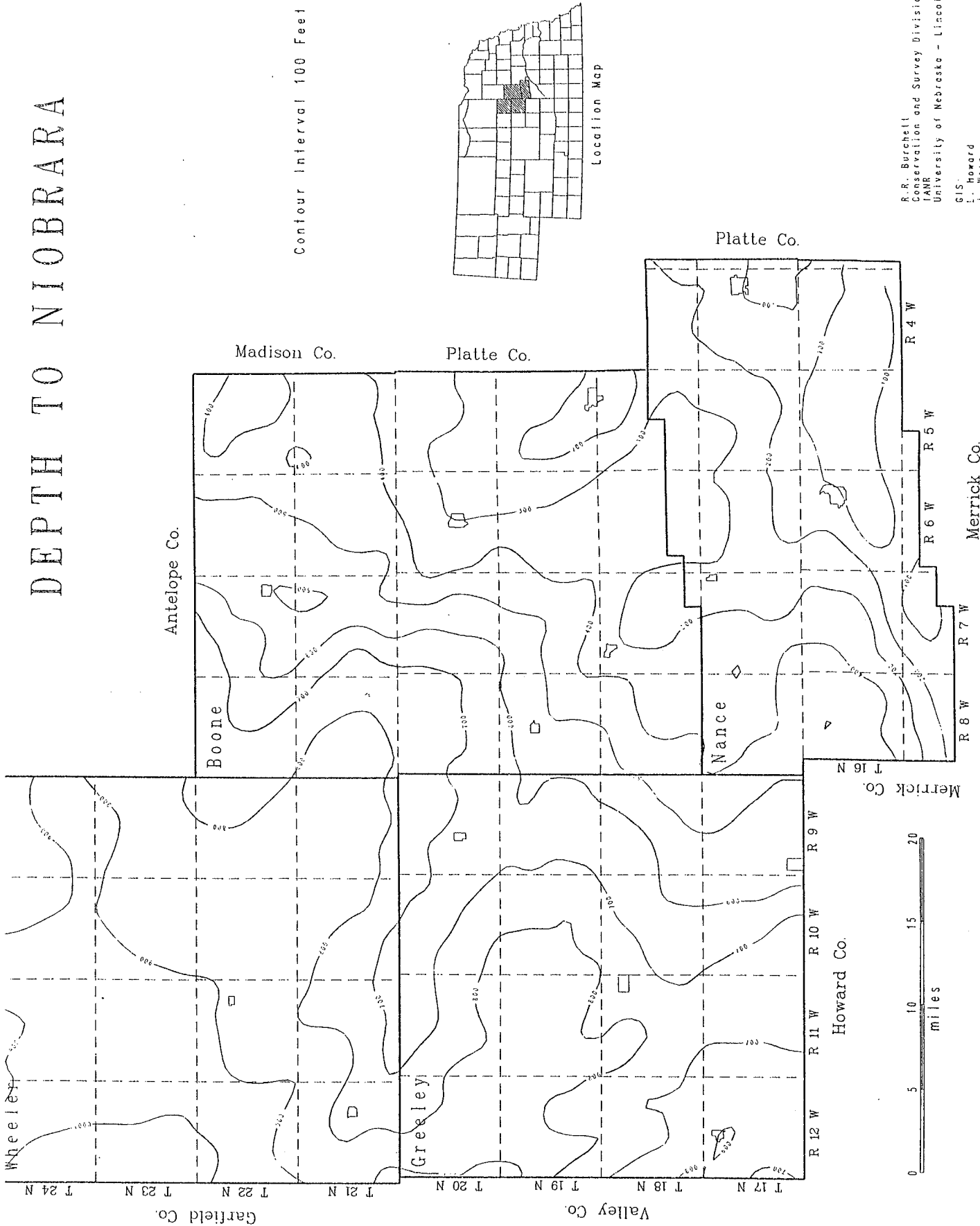
THICKNESS OF PIERRE SHALE



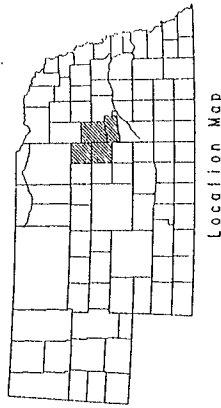
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DEPTH TO NIOBRARA

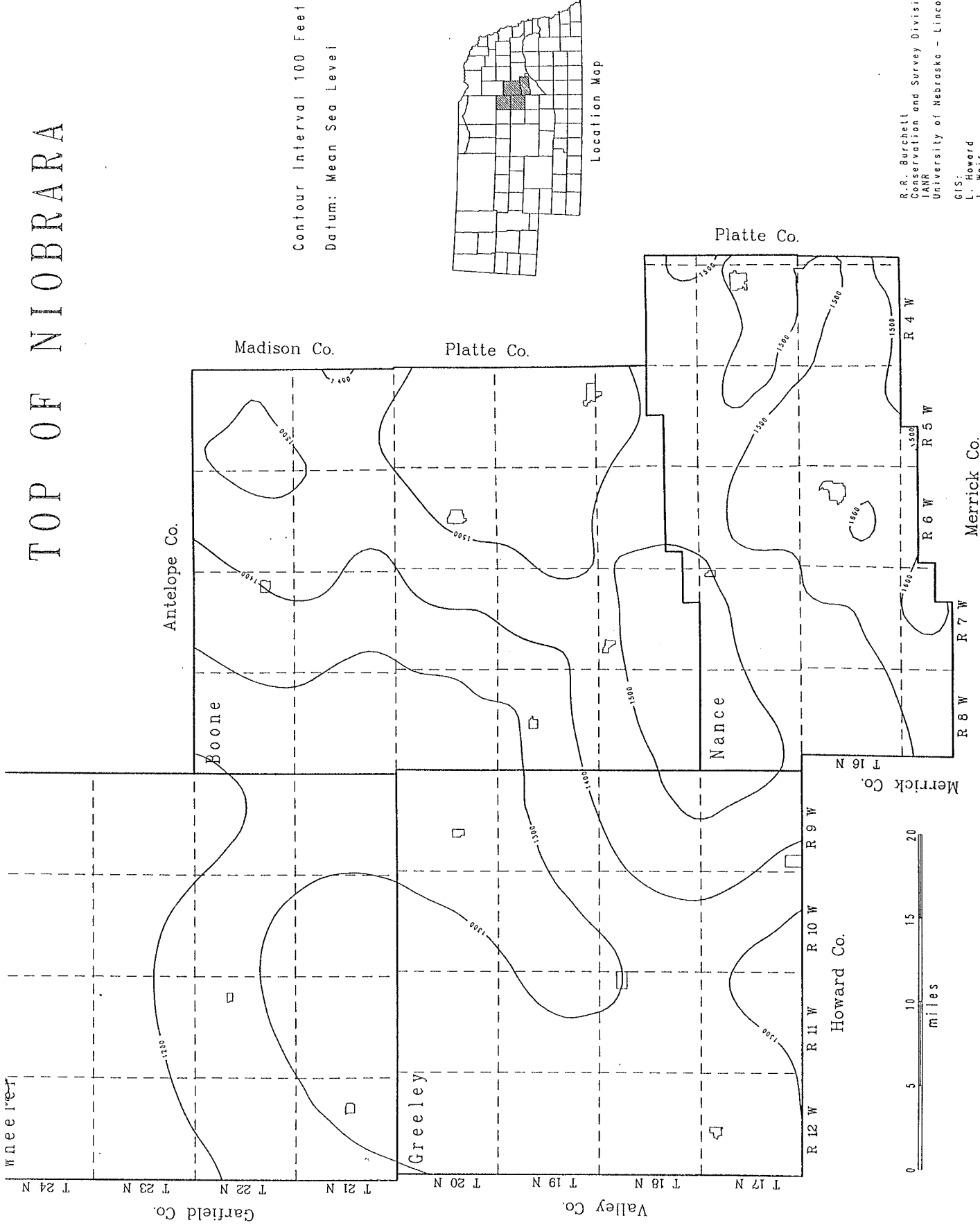


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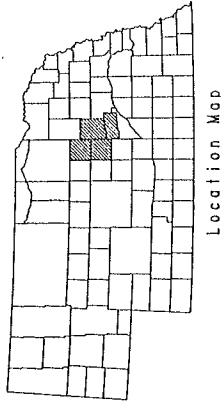


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TOP OF NIOBRARA

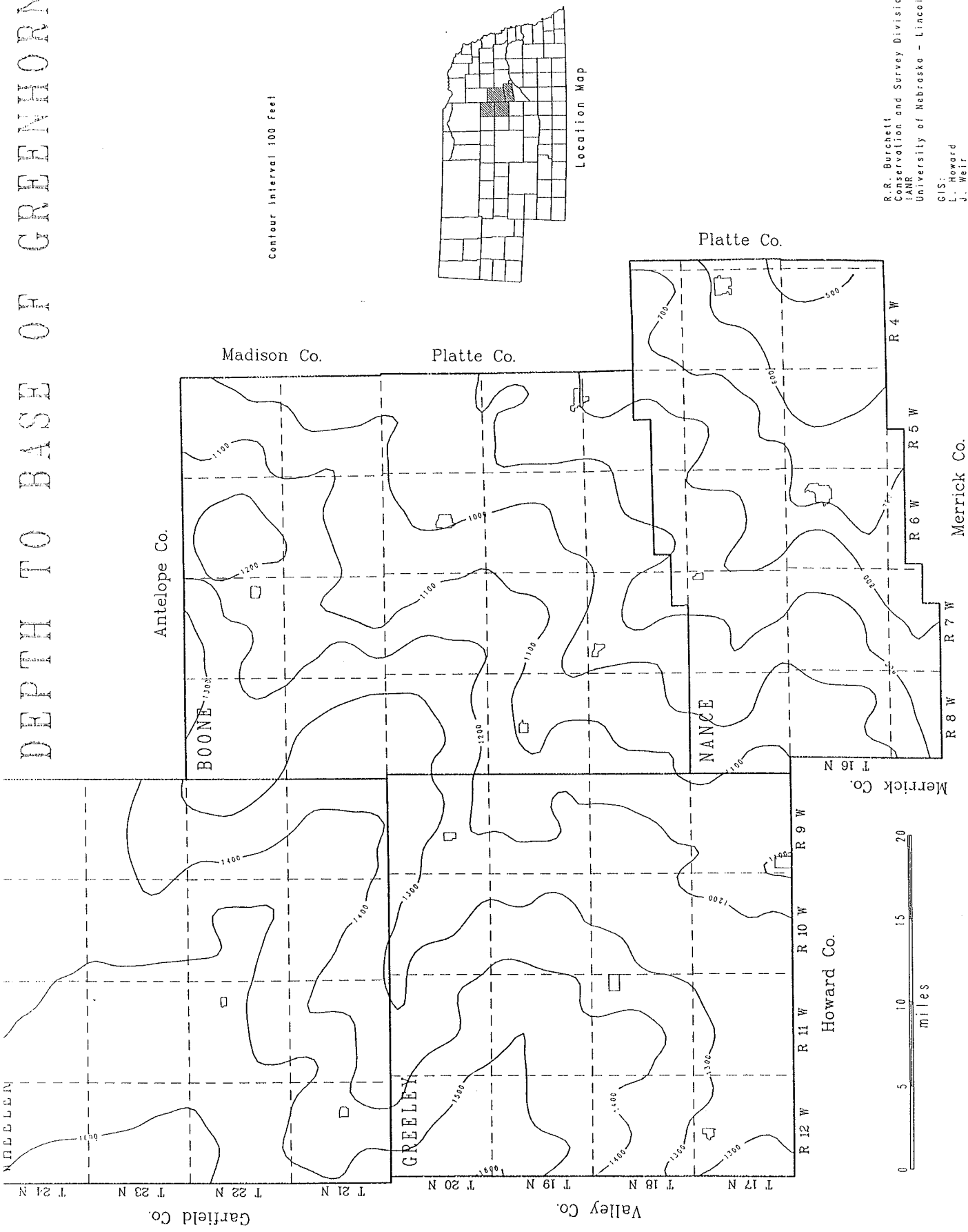


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DEPTH TO BASE OF GREENHORN

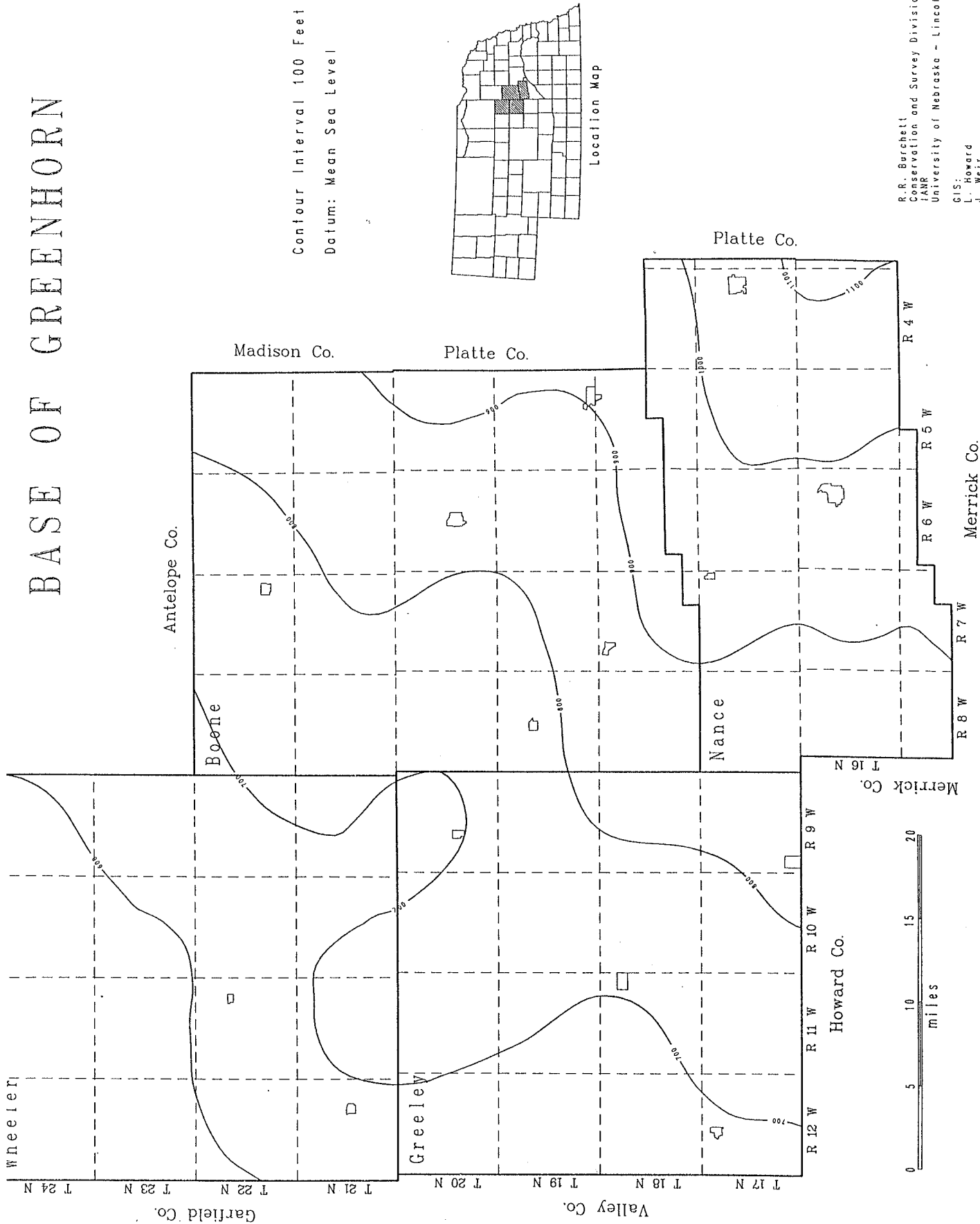


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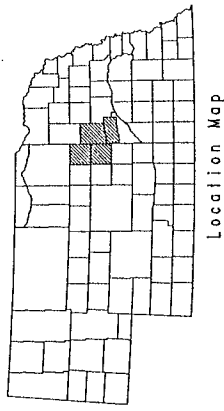
Location Map

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BASE OF GREENHORN

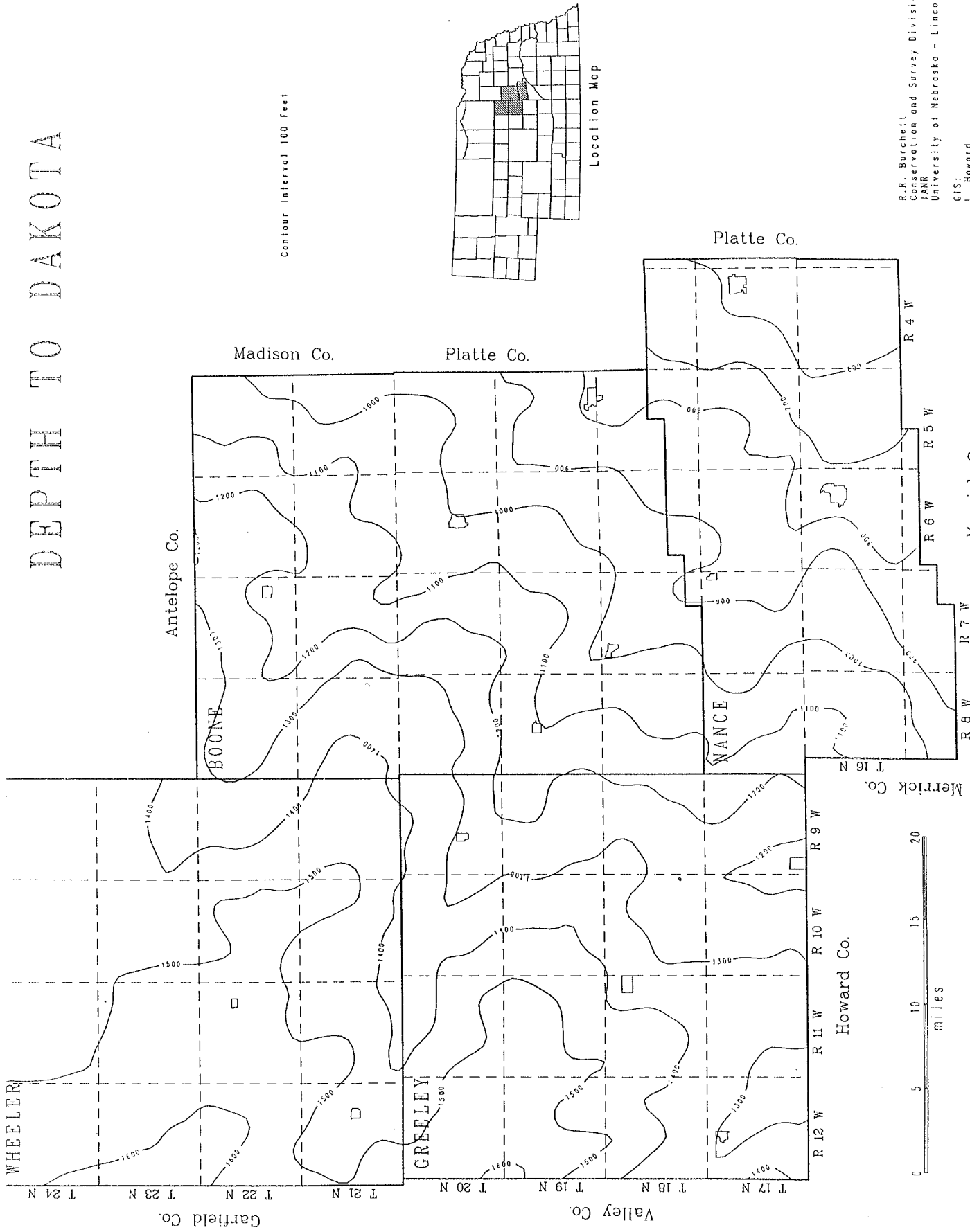


Contour Interval 100 Feet
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DEPTH TO DAKOTA

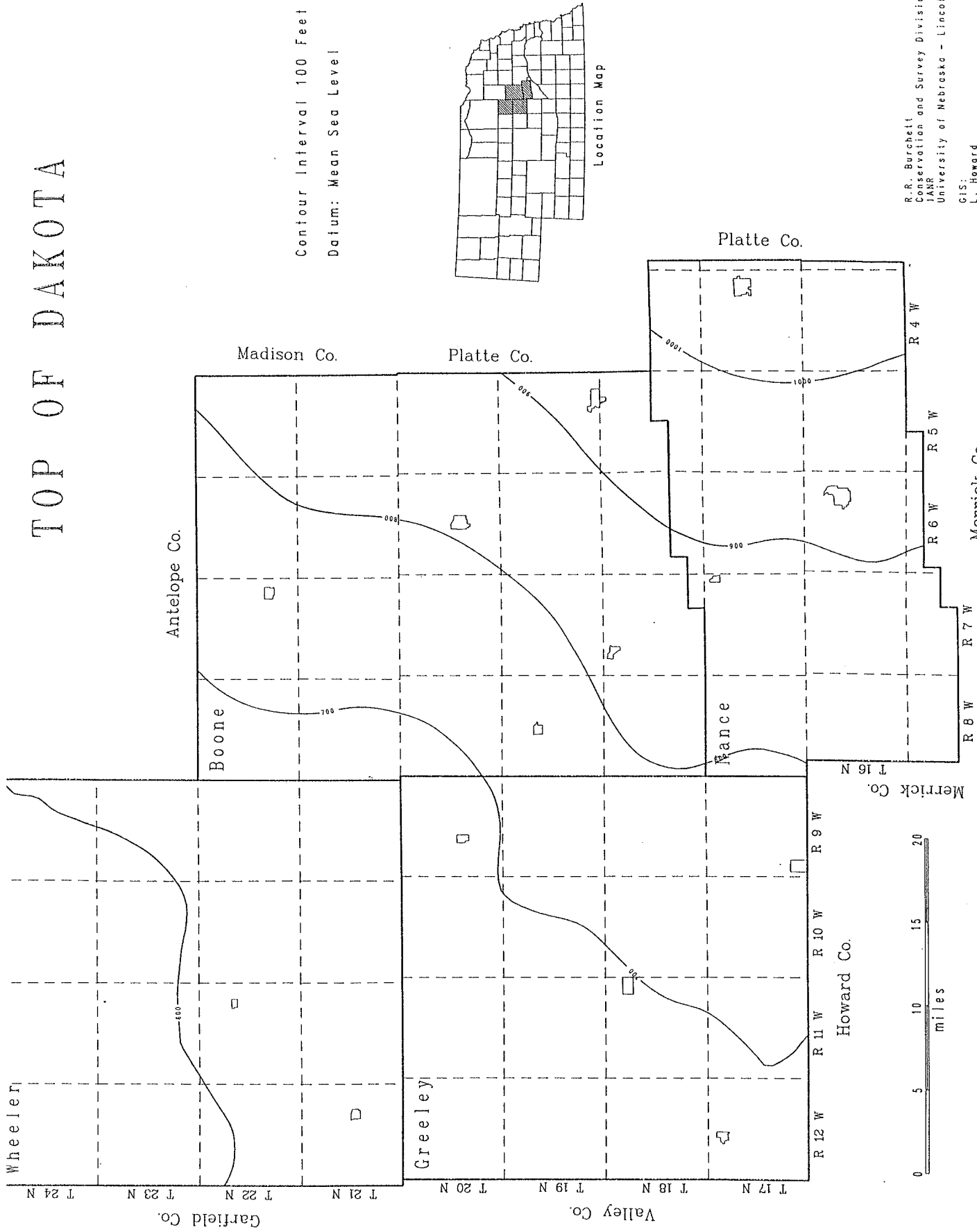


Contour Interval 100 Feet

Location Map

R. R. Burchett
 Conservation and Survey Division
 LAMR
 University of Nebraska - Lincoln
 GIS:
 L. Howard
 J. Weir

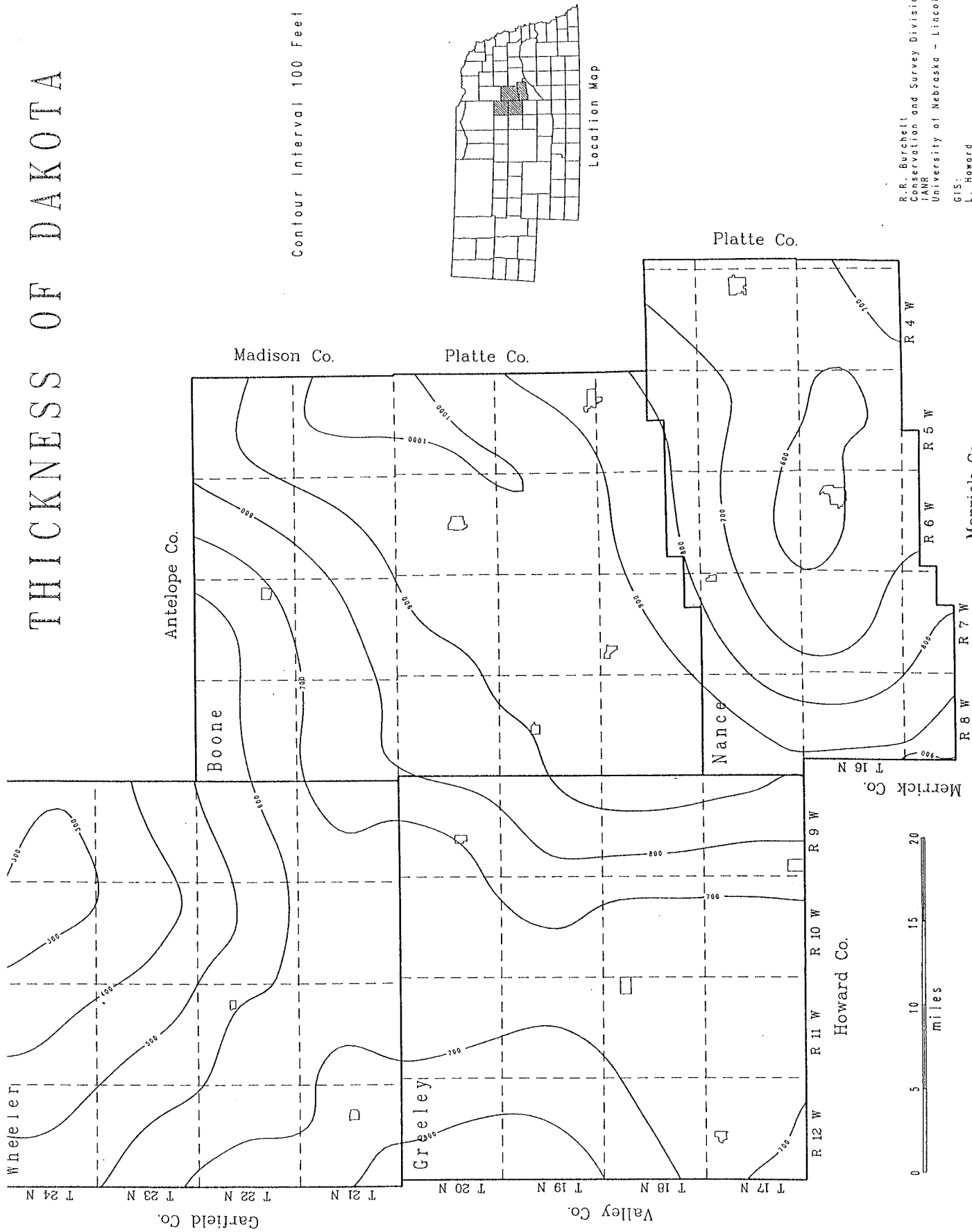
TOP OF DAKOTA



R.R. Burchett
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CIS:
L. Howard
J. Weir

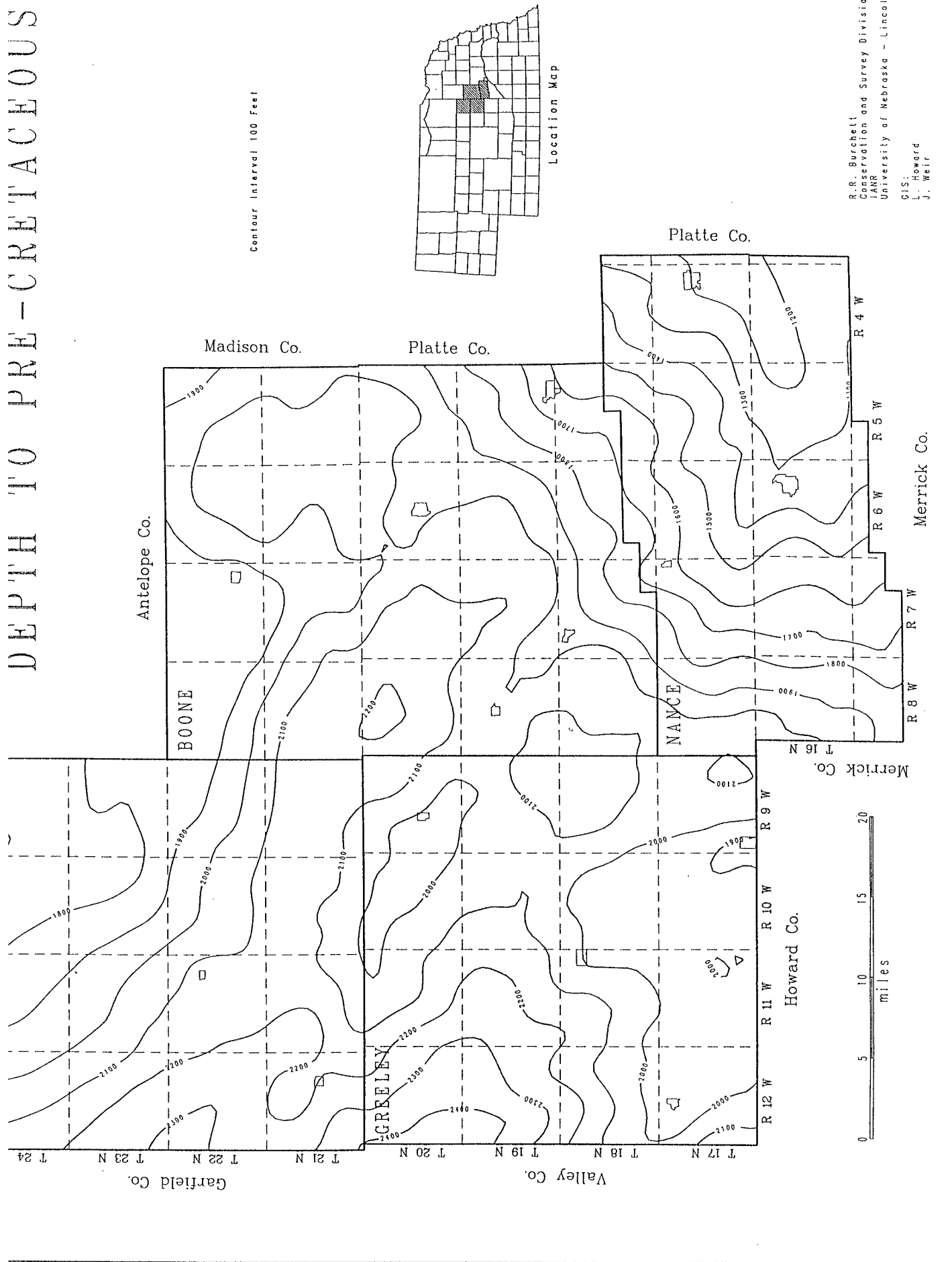
THICKNESS OF DAKOTA



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DEPTH TO PRE-CRETACEOUS



Contour Interval 100 Feet

Location Map

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TOP OF PRE-CRETACEOUS

