1997

Field Trip Guide (for the Nebraska Well Drillers Association) Western Nebraska Geology

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FIELD TRIP GUIDE

(for the Nebraska Well Drillers Association)

WESTERN NEBRASKA GEOLOGY

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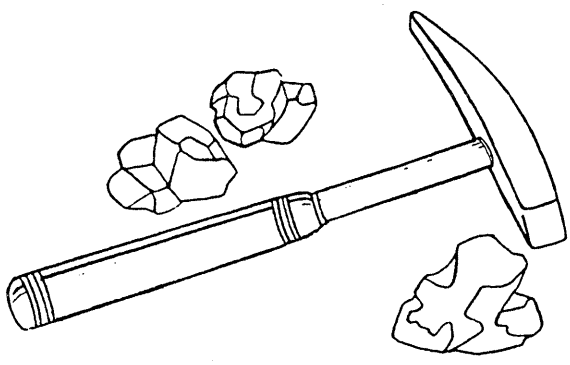
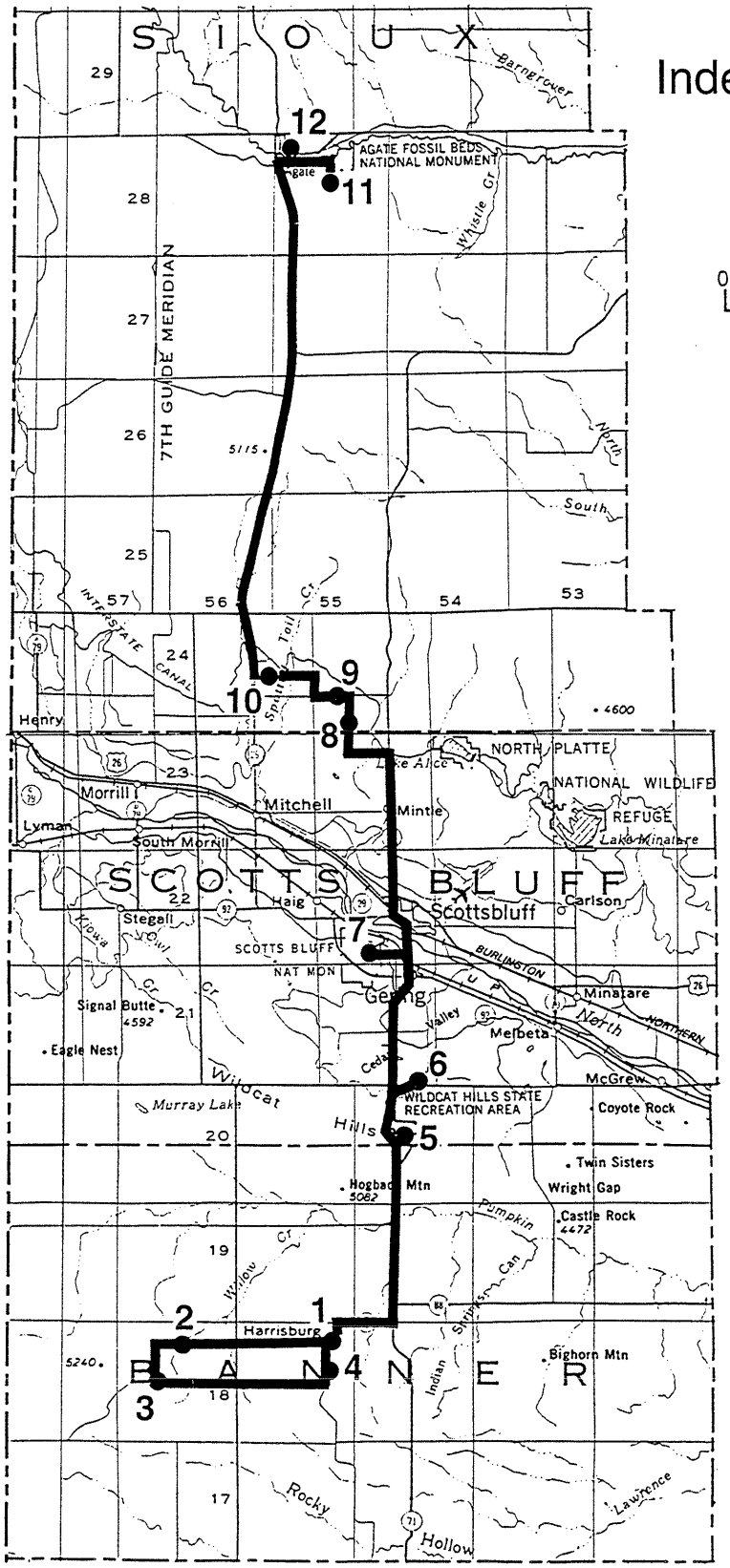


NEBRASKA GEOLOGICAL SURVEY

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

May 30, 1997

Index map showing location of stops



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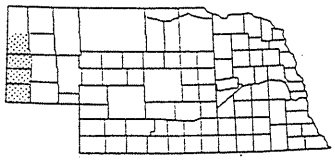


NEBRASKA WELL DRILLERS ASSOCIATION-FIELD TRIP
PANHANDLE GEOLOGY
MAY 30, 1997

7:30 a.m. Leave Scottsbluff, arrive at Harrisburg 8:00 a.m. Discuss water quality and quantity problems in the Brule Formation at Harrisburg and Harrisburg's new well field.

8:15 a.m. Leave Harrisburg, drive west and arrive at Ogallala outcrop at mouth of Long Canyon at 8:30. Examine and discuss difference facies in the Ogallala and their hydraulic character.

8:40 a.m. Leave Ogallala outcrop, drive up Long Canyon looking at outcrops of Ogallala overlying Arikaree, and Brule Formation. Arrive at gravel pit in the Ogallala at 9:00 a.m. Coffee will be available during the stop.

9:15 a.m. Leave Pleistocene gravel pit and arrive at Ogallala outcrops at Van Pelt ranch at 9:40 a.m. Examine Ogallala outcrops and discuss ground water quality issues associated with the oil industry.

10:10 a.m. Leave Van Pelt ranch and drive to Wild Cat Hills Nature Center. (Arrive 10:30 a.m.) Discuss Wild Cat Ridge geology and hydrogeology. Rest Stop.

10:45 a.m. Leave Wild Cat Hills Nature Center and drive to Brule channel outcrop, arrive at 11:00 a.m., examine channel outcrop and discuss problems with "layer cake" geology.

11:20 a.m. Leave Brule channel and arrive at Scotts Bluff National Monument at 11:30 a.m. Drive to top of Scotts Bluff Monument looking at geology at the Brule Formation and Arikaree Group. Discuss ground water quality and quantity issues in North Platte Valley while eating lunch.

1:00 p.m. Leave Scotts Bluff Monument and drive to Broadwater outcrop (1:20 p.m.) And discuss topographic inversions and weathered Brule.

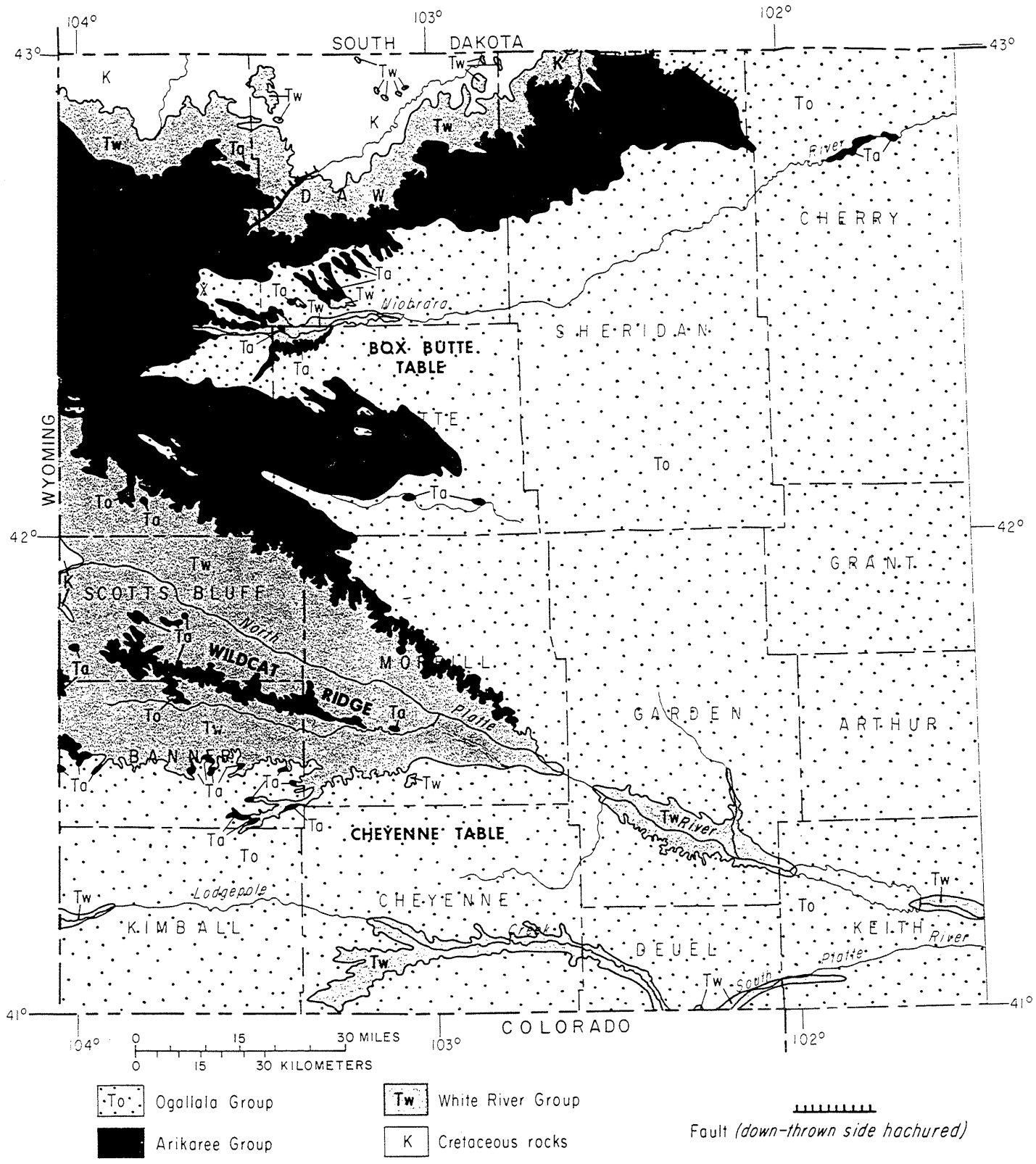
1:35 p.m. Leave Broadwater outcrop and drive to University Lake (1:40 p.m.) To discuss conjunctive use and ground water flow in the Brule Formation.

1:53 p.m. Leave University Lake, drive to volcanic ash bed outcrop (arrive at 2:00 p.m.). Discuss geology of the Brule Formation and the development of bad lands.

2:15 p.m. Leave ash bed outcrop and drive to Agate Fossil Beds Monument (arriving at visitor center 2:45 p.m.). Discuss Arikaree geology, problems with Arikaree irrigation wells in Box Butte County. Tour visitor center and hike up to view "bone beds". Discuss hydrology of Niobrara River.

4:00 p.m. Leave visitor center, drive back to Monument entrance (4:10 p.m.). Hike up short hill and observe fossil burrows and paleosol.

4:40 p.m. Leave Agate Fossil Beds Monument, arrive back in Scottsbluff at 5:30 p.m.

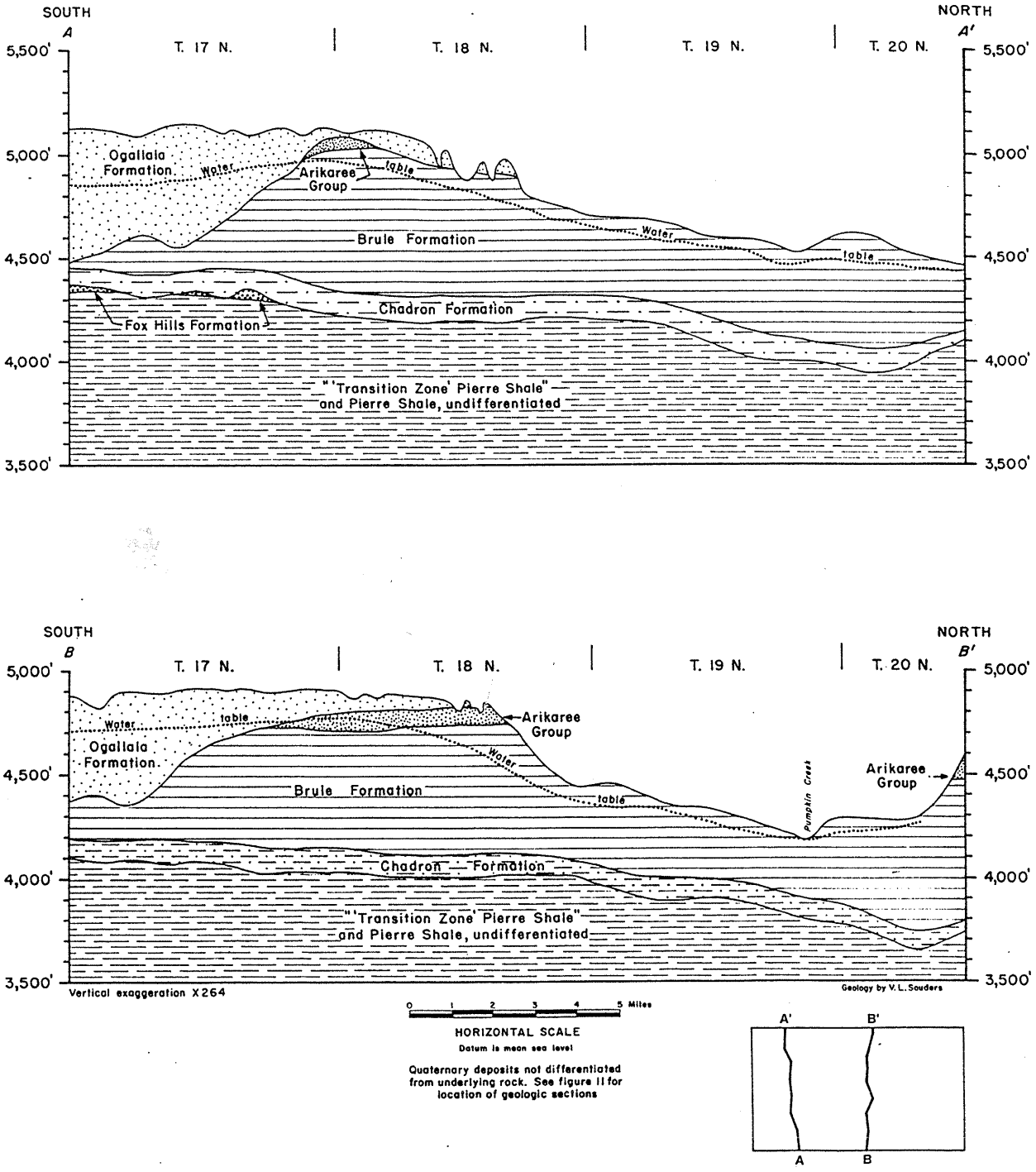


Generalized geologic map of western Nebraska. Post-Ogallala rocks (Pliocene and younger) not shown. Cretaceous rocks refer to Pierre Shale in the north and Fox Hills Sandstone in Scotts Bluff County. Only known faults with apparent throws in excess of 100 ft (30 m) are shown.

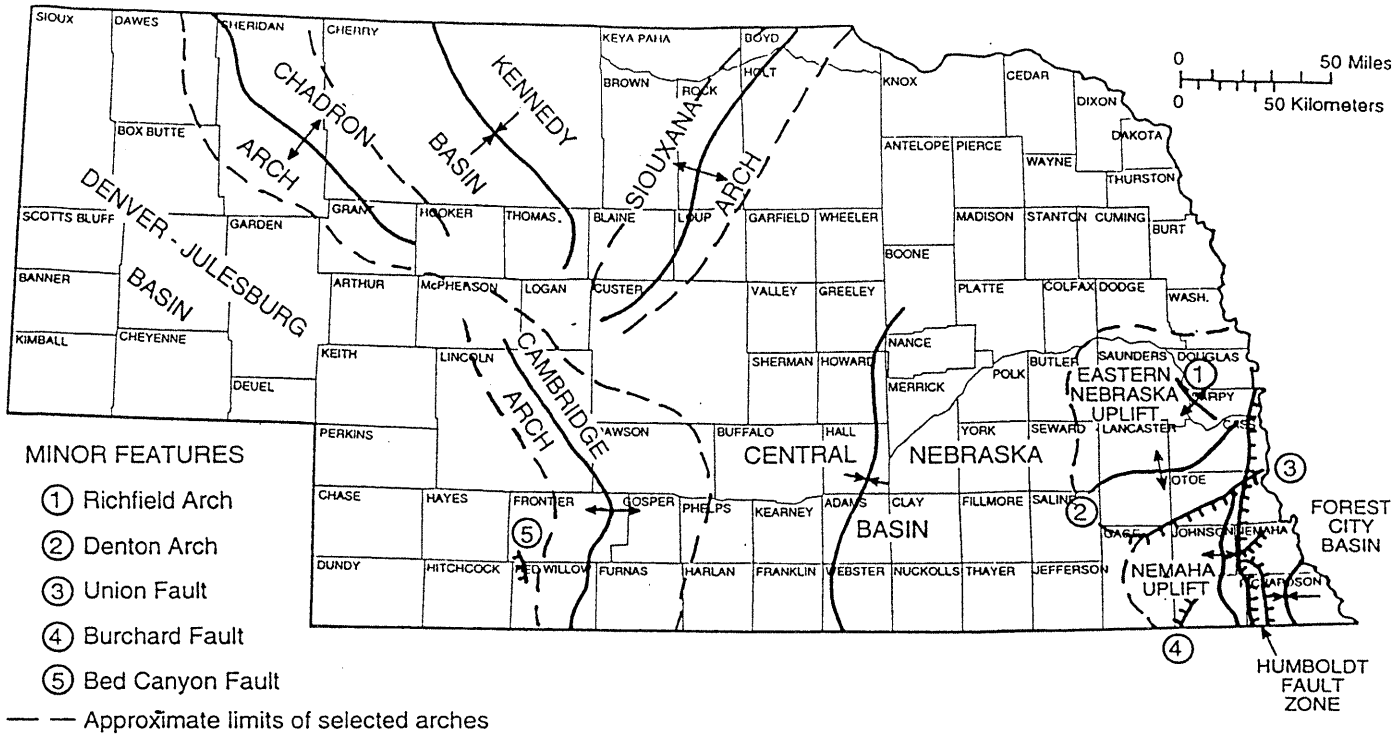
Hydrogeologic units, Western Nebraska

[stratigraphic nomenclature is from Swinehart and others (1985); gal/min, gallons per minute; <, less than]

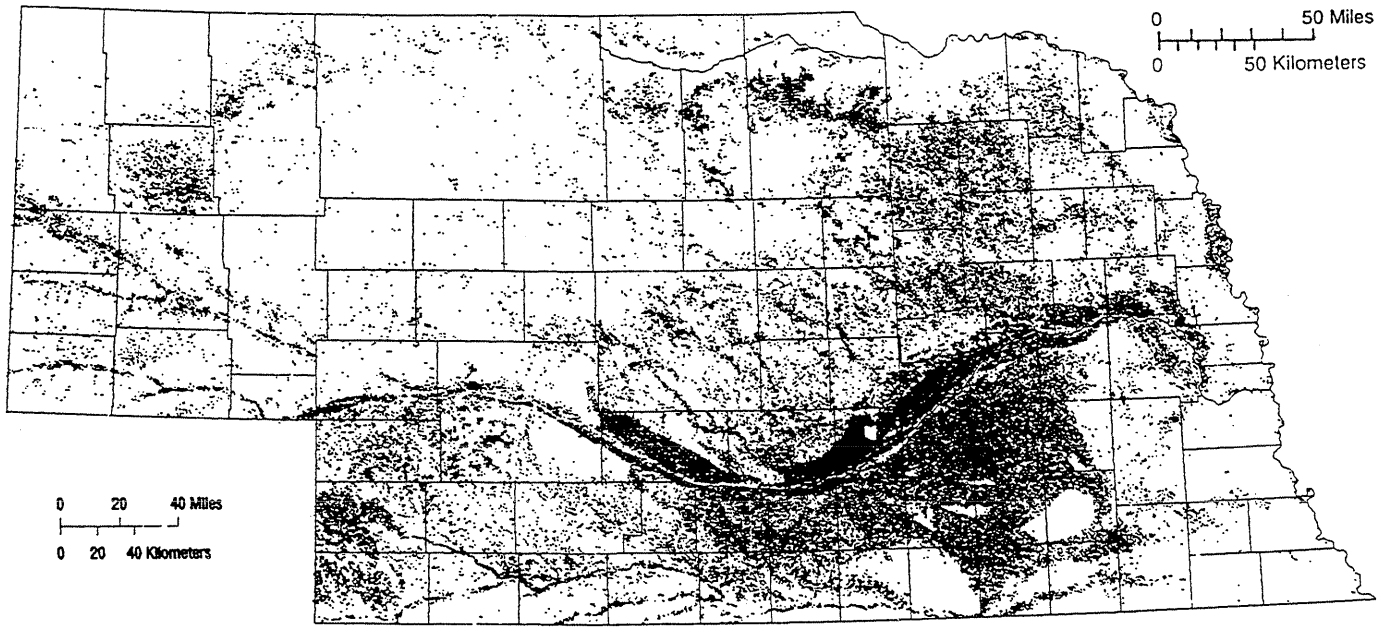
System	Series	Geologic unit	Character and description	Hydrogeologic unit		Water-yielding properties
Quaternary	Holocene Pleistocene	Undifferentiated Quaternary alluvial and eolian deposits	Holocene alluvial deposits of sand and gravel, with isolated lenses of silt and clay deposits along the North Platte and Pumpkin Creek Valleys. Eolian sand found in extensive dune fields in the Sandhills Region and in isolated areas of the North Platte and Pumpkin Creek Valleys. Pleistocene alluvial deposits of sand and gravel in the North Platte and Pumpkin Creek Valleys and residuum from sandstone and siltstone near these valleys.	Quaternary-age water-bearing units	Quaternary-age alluvial water-bearing units	Unconfined water-bearing units with wells potentially yielding more than 1,000 gal/min. Depth to water commonly is shallow. Maximum saturated thickness is about 210 feet.
					Quaternary-age eolian water-bearing units	Unconfined water-bearing units used for stock and domestic purposes, primarily in the Sandhills. Maximum saturated thickness is generally less than 50 feet.
Tertiary	Pliocene	Broadwater Formation	Predominantly alluvial sand and gravel with minor isolated lenses of silt and diatomite. Found in small isolated channel deposits north of the North Platte River from Wyoming east through Garden County. Also present as widespread deposits in southeastern Garden County.		Broadwater water-bearing units	Unconfined water-bearing units usually unsaturated. Basal part of the water-bearing units is saturated locally. Not important water-bearing units.
	Miocene	Ogallala Group	Fine- to coarse-grained sand and gravel often cemented with calcareous cement. Local ash beds and siltstone lenses are present. Located in Cheyenne and Northern Tablelands, eroded from Pumpkin Creek and North Platte Valleys.		Ogallala water-bearing units	Unconfined water-bearing units with wells potentially yielding large quantities (1,000 gal/min). Important water-bearing units in Cheyenne and Northern Tablelands.
	Miocene Oligocene	Arikaree Group	Silty, very fine- to medium-grained sandstone rich in volcanic glass shards. Local areas of coarse sand. Lenses of carbonate cementation and ash beds are common.		Arikaree Group water-bearing units	Unconfined water-bearing units in Northern Tablelands. Wells yielding only a few hundred gallons per minute are found in Sioux, northern Garden, and northern Morrill Counties. Irrigation wells often are screened in overlying hydrogeologic units and Arikaree Group for increased yields.
		Brule Formation	Brown siltstone and mudstone rich in volcanic glass shards. Regionally correlative ash beds are present. Local lenses of sandstone and gravel are present. The formation occurs throughout the area, except in a small isolated area in western Banner County.	Brule Formation water-bearing units	Fractured-bedrock water-bearing units in the Brule Formation	Generally unconfined water-bearing units may yield large volumes of water with little drawdown along Pumpkin Creek Valley and in localized areas of the North Platte Valley.
					Sand water-bearing units in the Brule Formation	Localized Brule alluvial sand channel deposits. These water-bearing units, which are generally unconfined, can yield water in small areas.
				Fractured-bedrock and sand confining unit in the Brule Formation		Not a source of water; generally considered a confining unit that separates the unconfined water-bearing units from the Chadron confining unit.
		Chadron Formation	Gray to greenish-gray bentonitic mudstone and claystone. Fine- to coarse-grained sandstone and conglomerates occur in major channel systems (fig. 6).	Confining unit in the Chadron Formation		Regional confining layer that separates the generally unconfined water-bearing units from the older confined units.
				Chadron Formation water-bearing units		Confined water-bearing units rarely used for irrigation and domestic uses due to its great depth and water quality that is unsuitable for most uses. Saturated thickness exceeds 100 feet in small areas.



Geologic sections showing approximate profile of the water table in Banner County.

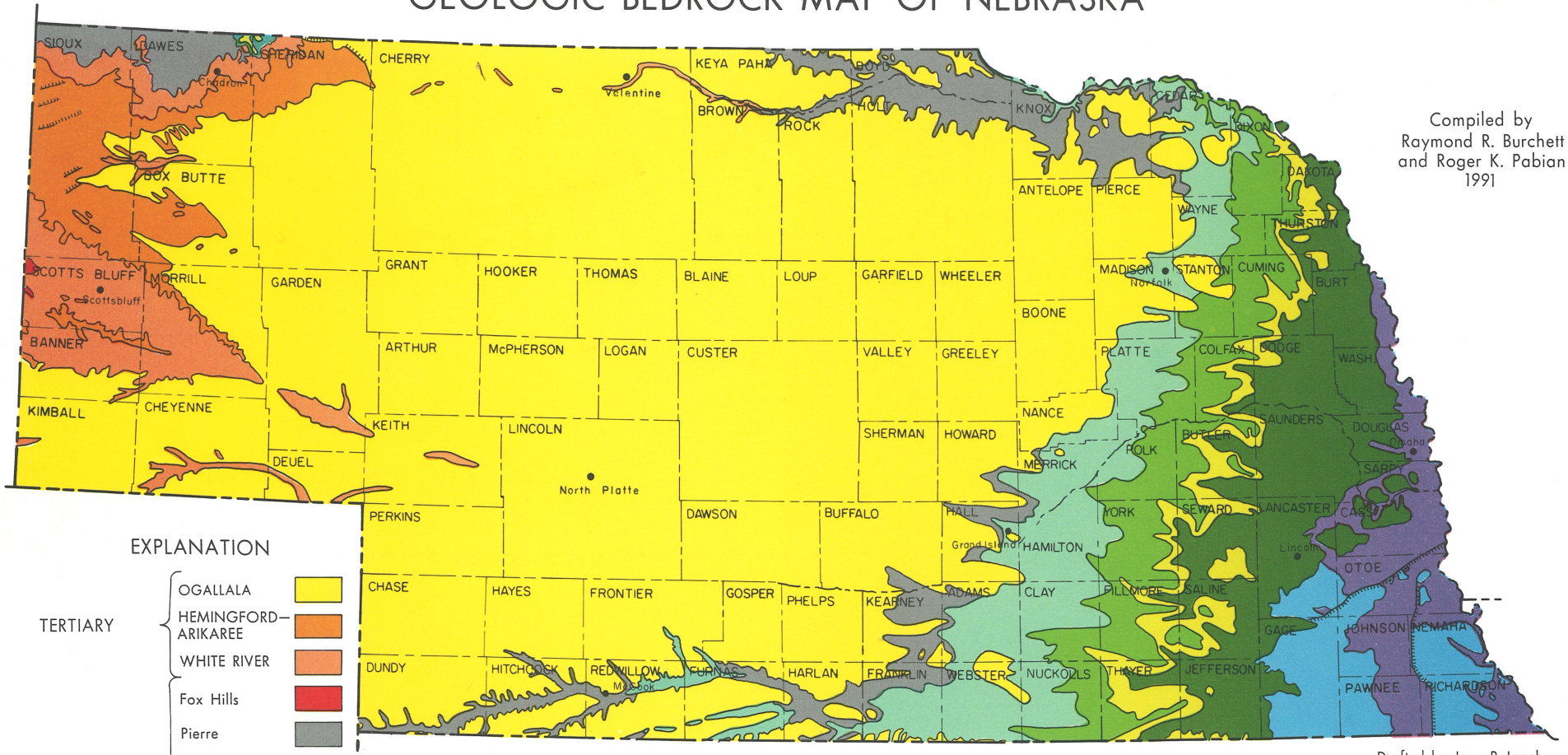


Principal structural features in Nebraska.



Registered irrigation wells in Nebraska (summer 1995)

GEOLOGIC BEDROCK MAP OF NEBRASKA



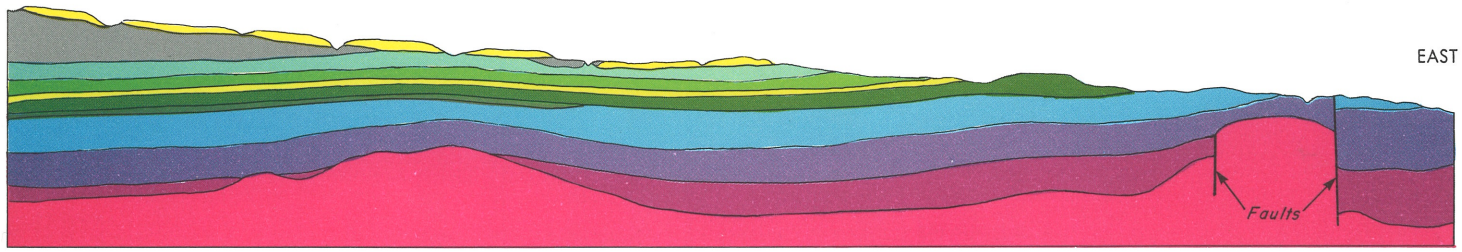
Compiled by
Raymond R. Burchett
and Roger K. Pabian
1991

Drafted by Jerry P. Leach

EXPLANATION

- TERTIARY
  - OGALLALA
  - HEMINGFORD—ARIKAREE
  - WHITE RIVER
- CRETACEOUS
  - Fox Hills
  - Pierre
  - Niobrara
  - Carlile
  - Greenhorn—Graneros
  - DAKOTA
- JURASSIC
- PERMIAN
- PENNSYLVANIAN
- MISSISSIPPIAN
  DEVONIAN
  SILURIAN
  ORDOVICIAN
  CAMBRIAN
- PRECAMBRIAN

Fault



GEOLOGIC CROSS SECTION ALONG SOUTHERN NEBRASKA BORDER

20 0 20 40 60
Scale in Miles

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NOTE: Unconsolidated sediments of Recent and Pleistocene age cover the bedrock throughout much of the State and are not shown.

GMC—2

AGE	GEOLOGIC TIME UNITS		ROCK TYPES	MINERAL RESOURCES AND PRODUCTS	TYPICAL FOSSILS
MILLIONS OF YEARS AGO					
1.6	CENOZOIC (RECENT LIFE)	QUATERNARY (Recent and Pleistocene)	Glacial till, silt, clay, sand, gravel, volcanic ash.	Agricultural soil, water, sand & gravel, volcanic ash.	MAMMALS
66		TERTIARY	Sandstone, siltstone, clay, gravel, marl, volcanic ash.	Agricultural soil, water, sand & gravel, volcanic ash, riprap & uranium.	MAMMOTH
138	MESOZOIC (MIDDLE LIFE)	CRETACEOUS	Chalk, chalky shale, dark shale, varicolored clay, sandstone, conglomerate	Water, oil & gas, cement, brick, agricultural lime, & other construction materials.	REPTILES
205		JURASSIC	Subsurface only. Sandstones and shales		DINOSAUR
240		TRIASSIC			PLESIOSAUR
290	PALEOZOIC (ANCIENT LIFE)	PERMIAN	Shale, limestone, dolomite, gypsum, anhydrite sandstone, siltstone, chert.	Water, agricultural lime, oil, road rock, riprap.	AMPHIBIANS
		PENNSYLVANIAN	Limestone, shale, sandstone, coal.	Oil, cement, brick, concrete aggregate, lightweight aggregate, road rock, agricultural lime, rip rap, water.	BRACHIOPOD
330		MISSISSIPPIAN	Subsurface only. Limestone, dolomite.	Oil, water.	FISH
360		DEVONIAN	Subsurface only. Dolomite, gray shale.		CORALS
410		SILURIAN	Subsurface only. Dolomite.		INVERTEBRATES
435		ORDOVICIAN	Subsurface only. Dolomite, sandstone, shale.		CRINOID
500		CAMBRIAN	Subsurface only. Dolomite, sandstone.		TRILOBITE
570	CRYPTOZOIC (HIDDEN LIFE)	PRECAMBRIAN	Subsurface only. Granite, other igneous rocks, and metamorphic rocks.		?
5,000 ?					