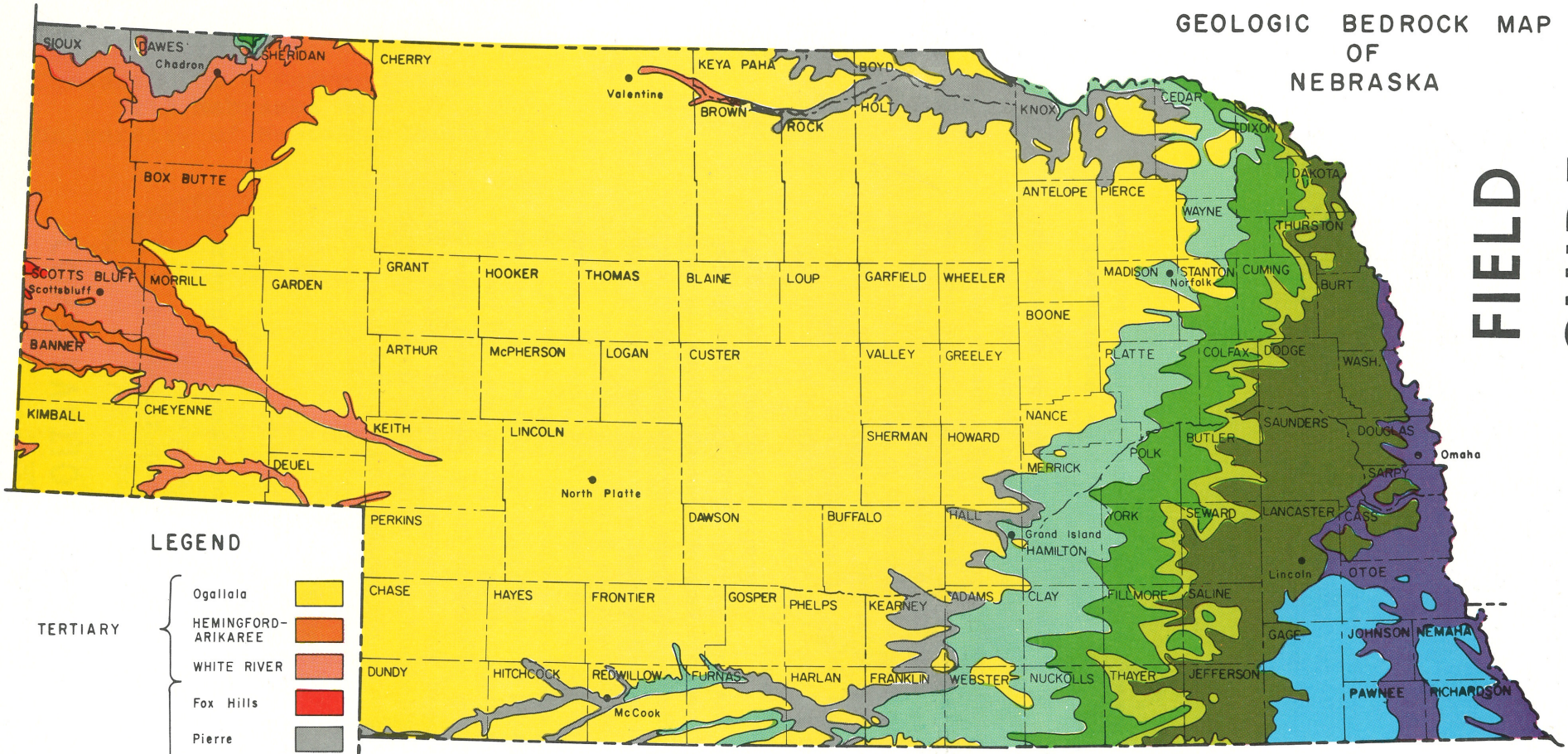
1977

Pawnee County, Table Rock Area

R. K. Pabian
University of Nebraska - Lincoln

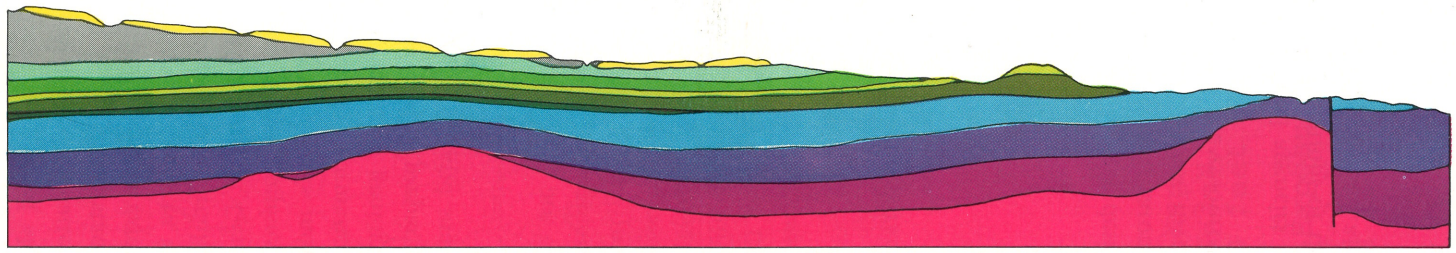
GEOLOGIC BEDROCK MAP OF NEBRASKA

FIELD GUIDE



LEGEND

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



Cross Section Along Southern Nebraska Border

20 0 20 40 60

Scale in Miles

University of Nebraska
Conservation & Survey Division
Nebraska Geological Survey
1969

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

THE UNIVERSITY OF NEBRASKA
CONSERVATION AND SURVEY DIVISION

GEOLOGICAL SURVEY
WATER SURVEY
SOIL SURVEY
INFORMATION SURVEY

PUBLISHED IN COOPERATION WITH:
NEBRASKA GEOLOGICAL SOCIETY
LINCOLN GEM & MINERAL CLUB

PREFACE

In recent years the earth sciences have become an important part of the curricula of many school systems. In the past, pupils were given only a smattering of geology, paleontology, mineralogy, etc. to help them better understand the world around them. Recent emphasis on the earth sciences has created a demand from teachers and students for geologic information in the area in which they live. In response to this demand in Nebraska, Educational Circular No. 1, "Record in Rock," and Educational Circular No. 2, "Minerals and Gemstones of Nebraska," were prepared. In addition to the educational emphasis on earth sciences, rock collecting has grown to be one of the nation's most popular hobbies. Many students and hobbyists are now requesting information on how to identify the various stratigraphic horizons (rock layers) and geologic features they encounter in the field. Thus, these field guides have been prepared to help the nonprofessional familiarize himself with the stratigraphy and some of the geologic phenomena of Nebraska.

The locations presented herein were chosen for several reasons. All are on public property so that viewing them is always possible. All are easily reached by car and are generally accessible even to the elderly or handicapped. All provide "typical" examples of either common Nebraska rocks, minerals, or fossils. In addition to the brief description of the stratigraphy and the rocks, minerals, and fossils found in the outcrops, a brief description of the land forms within view of the outcrop is given. It is hoped that this information will orient the student to the geology of Nebraska and help him to understand the processes responsible for the landscape about him.

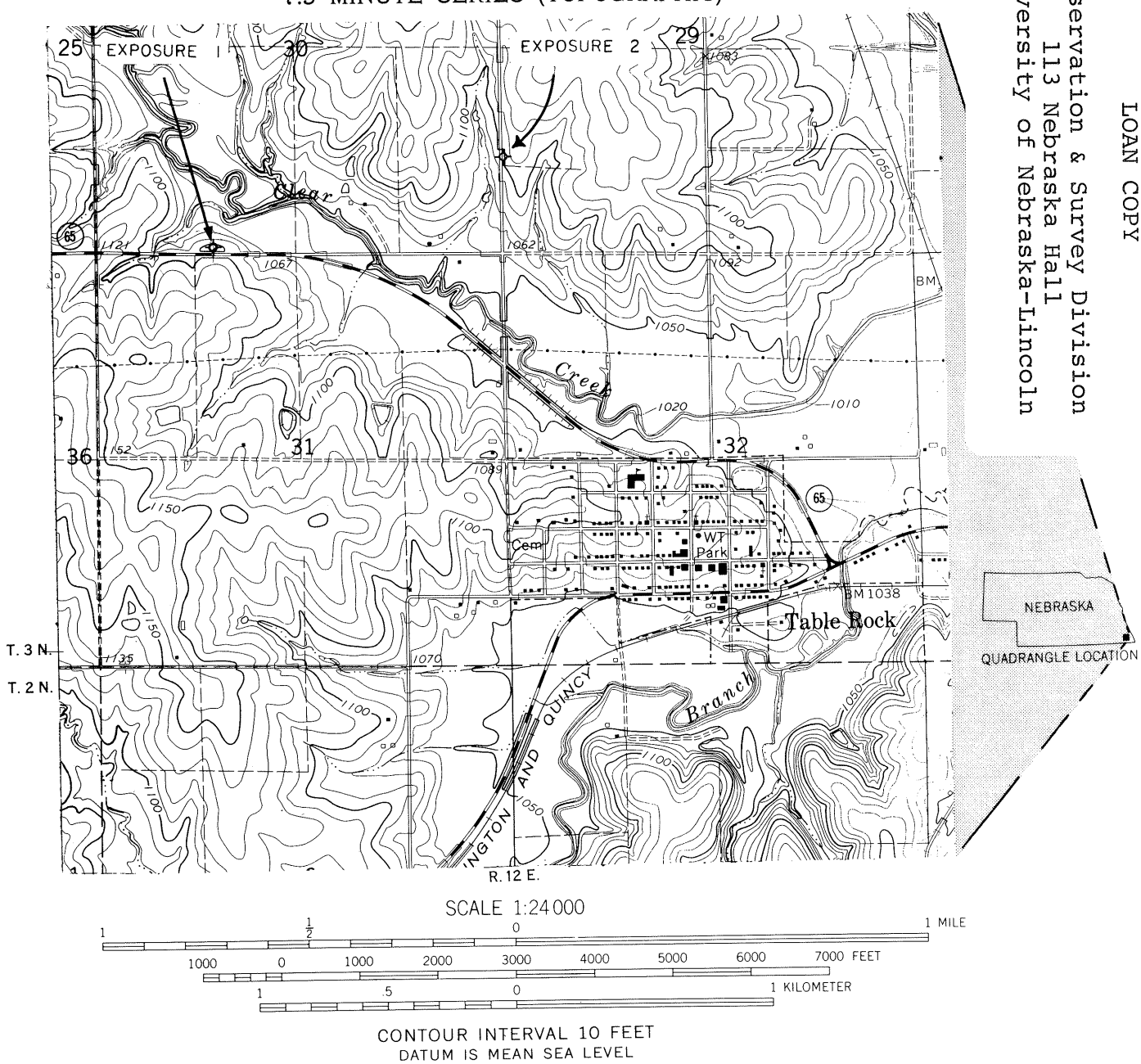
One safety note: when visiting these outcrops, be sure that your car is parked well off of the road—if your car is equipped with safety blinkers, use them.

The Conservation and Survey Division of the University is the agency designated by statute to investigate and interpret the geologically related natural resources of the state, to make available to the public the results of these investigations, and to assist in the development and conservation of these resources.

The Division is authorized to enter into agreements with federal agencies to engage in cooperative surveys and investigations in the state. Publications of the Division and the cooperating agencies are available from the Conservation and Survey Division, University of Nebraska, Lincoln 68508.

Publication and price lists are furnished upon request.

TABLE ROCK QUADRANGLE
NEBRASKA
7.5 MINUTE SERIES (TOPOGRAPHIC)



LOCATIONS AND ELEVATIONS OF EXPOSURES

Figure 1.

Exposure 1 is situated in the SW 1/4, SE 1/4, SW 1/4, sec. 30, T-3-N, R-12-E, Pawnee County, Nebraska. The elevation is 1,100 feet above sea level at the adjacent road grade.

Exposure 2 is situated in the NW 1/4, SW 1/4, SW 1/4, sec. 29, T-3-N, R-12-E, Pawnee County, Nebraska. The elevation is 1,100 feet above sea level at the adjacent road grade.

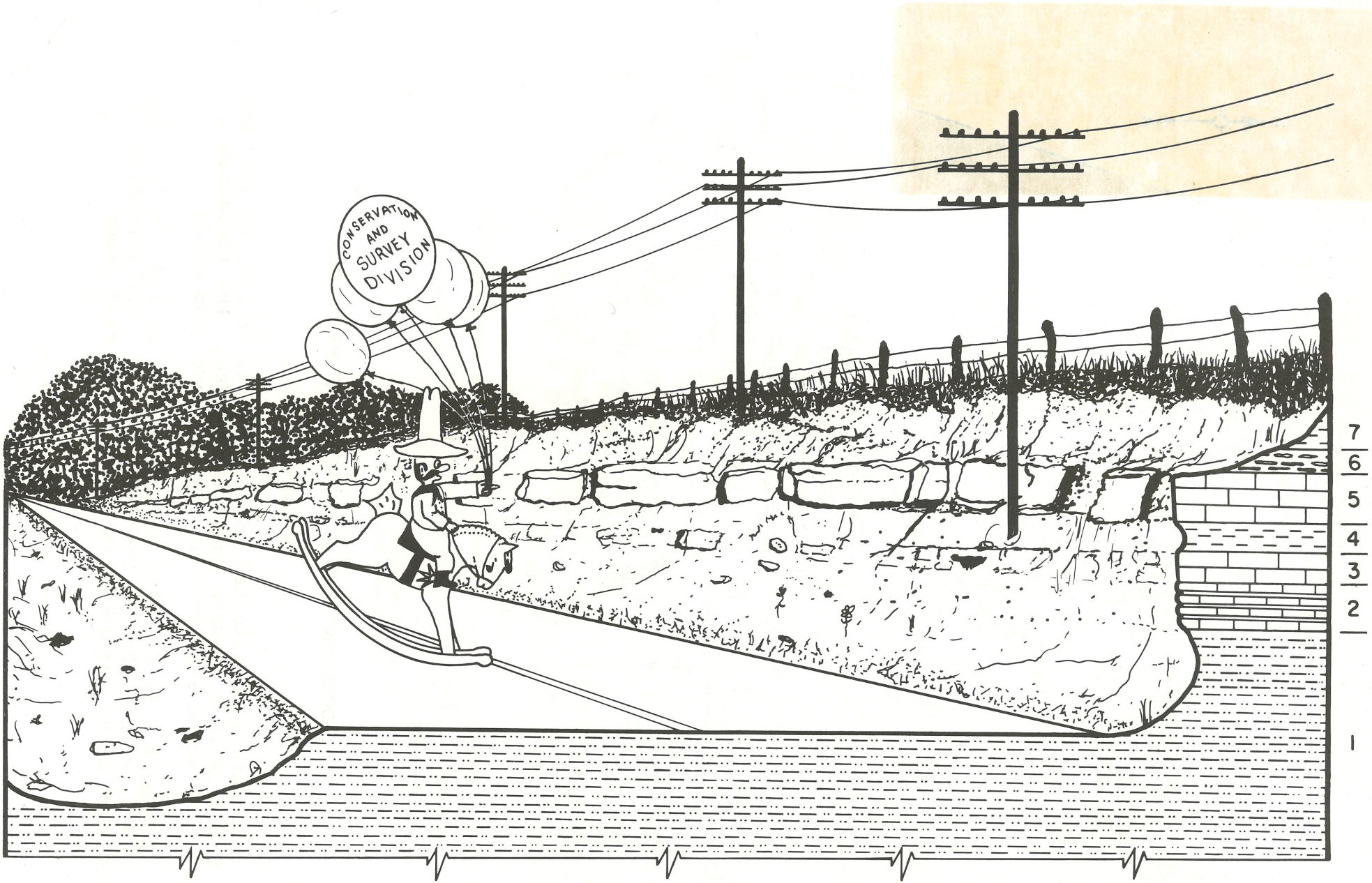


Figure 2

Exposure 1 near Table Rock on the north side of State Highway 65. Slumping may alter the appearance of the exposure.

EXPOSURES NEAR TABLE ROCK, NEBRASKA

The outcrops near Table Rock, Nebraska, have been the subject of study for many professional geologists since about 1900. These exposures are not too well known among fossil collectors, even though several exposures in the Table Rock area contain many fossils. These rock layers record the advance and retreat of a late Pennsylvanian age sea (see back cover). The abundant and diverse fossils of the Reading Limestone show that the Table Rock area was once covered by a warm shallow sea, teeming with life.

HOW TO FIND THE EXPOSURES
Figure 1

Use a Nebraska highway map to proceed from your starting point to Table Rock, Nebraska. Find the City Park and water tower--proceed north for two blocks to the intersection with State Highway 65--turn left (west) and go 1.3 miles--the outcrop is on the right (north) side of the road. To locate exposure 2, proceed east from exposure 1 for 0.2 miles to the junction with the county road--continue eastward following the county road for another 0.5 mile to the intersection--turn left (north) and proceed 0.2 miles--the outcrop is in the ditch on the right (east) side of the road.

STRATIGRAPHIC SECTION AT EXPOSURE 1
Figure 2

PLEISTOCENE LOESS AND GLACIAL TILL AT TOP OF EXPOSURE

PENNSYLVANIAN SYSTEM: VIRGIL SERIES: WABAUNSEE GROUP

EMPORIA FORMATION

HARVEYVILLE SHALE MEMBER

Horizon 7. Shale, about 3.5 feet, light-gray, weathers tan, with tiny fossils composed of limonite in lower portion.

Horizon 6. Shale, about 1.3 feet, light-gray, weathers tan, with abundant brachiopod, crinoid, and ectoproct fossils.

READING LIMESTONE MEMBER

Horizon 5. Limestone, about 2.0 feet, hard, crystalline, dark-tan, with brachiopod and crinoid fragments.

Horizon 4. Shale, about 1.0 feet, light-gray.

Horizon 3. Limestone, about 1.3 feet, medium-gray, weathers tan.

Horizon 2. Limestone, about 1.5 feet, medium-gray to dark-gray, silty, with shale seams.

AUBURN FORMATION

Horizon 1. Shale, light greenish-gray, calcareous at top. Not measured. Usually only in lower part of exposure.

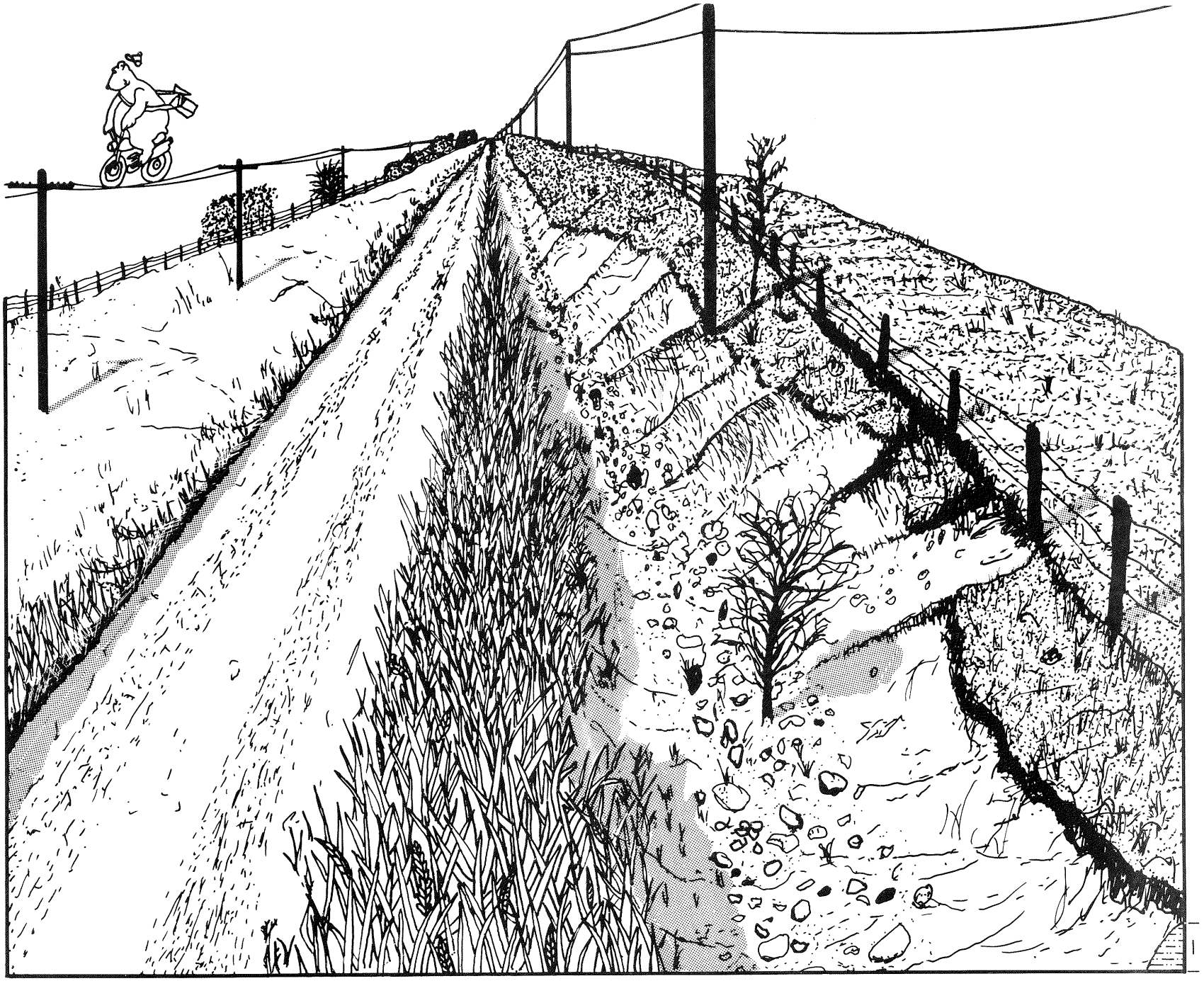


Figure 3

Exposure 2 near Table Rock on the east side of a county road. Slumping may alter the appearance of the exposure.

STRATIGRAPHIC SECTION AT EXPOSURE 2

Figure 3

PLEISTOCENE LOESS AND GLACIAL TILL AT TOP OF EXPOSURE

PENNSYLVANIAN SYSTEM: VIRGIL SERIES: WABAUNSEE GROUP

AUBURN FORMATION

Horizon 1. Shale, light-gray, weathers tan, with limonite concretions. This horizon is equivalent to horizon 1, exposure 1.

The geologic section here was not measured. The exposure, however, does provide the student with an excellent example of a thick glacial till overlying the weathered surface of an Upper Pennsylvanian shale. The student who is familiar with the geologic time column (back cover) will notice that rocks ranging in age from Permian through Pliocene are missing. Geologists call such a contact between the Pleistocene and Pennsylvanian unconformable because the contact is not parallel to the bedding planes and because some rock strata (Permian through Pliocene in this case) are missing. Compare this with the conformable contacts between the shales and limestones at exposure 1, which are approximately parallel to the bedding planes. Note that the glacial till contains a large variety of igneous and metamorphic rocks which originated on the Canadian Shield.

GEOLOGIC HISTORY

The Auburn Shale is largely a nonmarine unit that was rapidly deposited. An advance of the sea is shown by the presence of limestone and marine invertebrate fossils in the overlying Reading Member (exposure 1). Well preserved, marine invertebrate fossils in the lower part of the Harveyville Shale indicate that at least part of this unit is of marine origin. Observe that the fossils in horizon 7 (exposure 1) (Harveyville Shale) are very small and replaced by limonite, whereas the fossils in horizon 6 are large and replaced by calcium carbonate. Notice also that all the limonite fossils are mollusks (clams, snails, cephalopods), whereas the larger fossils include brachiopods, ectoprocts, and crinoids. After burial, the more soluble mollusk shells were dissolved, leaving a void called a mold. Groundwater carrying considerable amounts of dissolved iron later precipitated limonite in the mold, forming a type of fossil replacement called a cast. A similar occurrence of limonite fossils is pointed out in the Otoe County-Unadilla Field Guide.

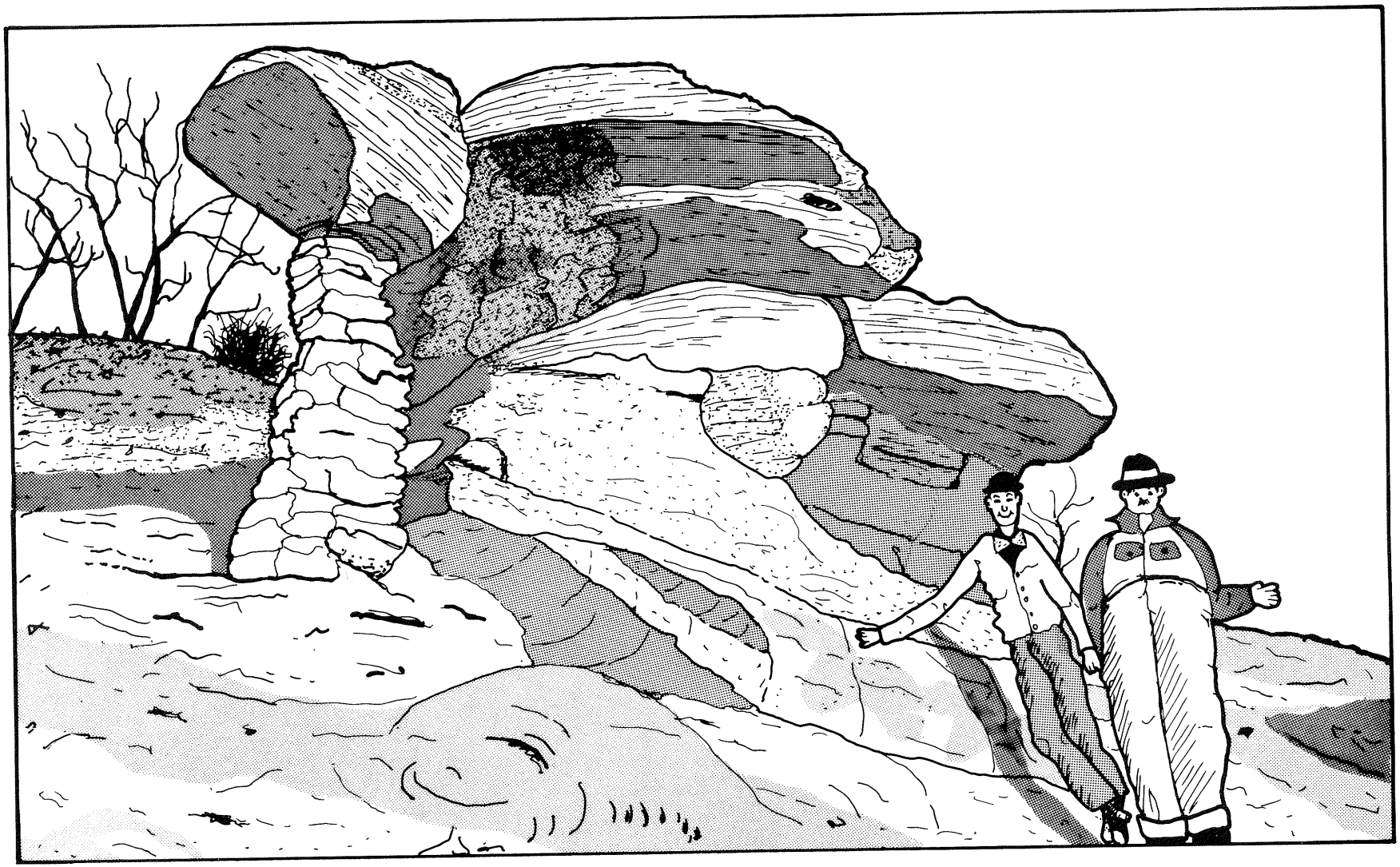


Figure 4

Turtle Rock, one of the many no-longer-existent "Table Rocks" from which the city of Table Rock derived its name. Drawing made from a Nebraska State Historical Society photograph.

WHILE YOU ARE THERE

Table Rock derives its name from relief features no longer seen in the Nemaha River Valley in Pawnee County. These features were "tables" formed by hard sandstone ridges resting on soft shale bases. Since the shale eroded faster than the sandstone, the resulting feature was a table (see figure 4). These may be compared with the toadstools of Toadstool Park, Sioux County. Large pictures of the table rocks may be seen at the Pawnee County Historical Museum in Table Rock.

The Auburn Shale seen at exposures 1 and 2 can be traced, by way of outcrop study and drilling samples collected as part of the Conservation and Survey Division's test drilling programs, to outcrops near Unadilla. (See Otoe County-Unadilla Field Guide.) By comparing the rocks in test holes and sparse outcrops, geologists can determine the relationships between rock layers exposed in different areas and finally construct a complete stratigraphic column (see back cover). This column serves as a rock record of geologic history.

The topography in this area, consisting of rounded hills drained by a rather elaborate system of creeks and draws leading to broad valleys and flowing streams, is characteristic of the glaciated part of eastern Nebraska. However, the pre-Pleistocene topography was a series of eastwardly trending ridges and valleys eroded from the nearly flat-lying beds of Pennsylvanian age. These limestones and shales form the bedrock in the Table Rock area.

This older drainage system was largely obliterated by the great continental ice sheets. Large quantities of till (unsorted mixtures of clay, sand, gravel, and boulders) accumulated as ridges at the edge of the ice during pauses in advance. The sediment load of the ice was released as till to contribute to the filling of old valleys and the mantling of the land surface as the ice melted. Sand, gravel, and silty clay were also deposited by streams issuing from the melting glaciers. After the ice melted from the area many thousands of years ago, erosion re-exposed some of the bedrock and began developing the system of drainage you see today (figure 1). Some of the sand, silt, and clay washed from the uplands was redeposited to become a part of the fill in valleys such as Clear Creek. The wind has played a part in shaping the land that you now see. It eroded the land during periods of sparse vegetation and deposited silt blown from near and distant valley flats. Such deposits (loess) in the Table Rock area are generally thin, occurring mostly on the ridge tops. Most agriculturally important soils have developed in the last few thousands of years from the loess, stream deposits and till.

The Table Rock area is underlain by a relatively thin section of sedimentary rocks. Igneous and metamorphic rocks of Precambrian age (see back cover) are within 600 feet of the surface, the shallowest occurence in Nebraska. Uplift has created a buried feature known as the Nemaha granite ridge. This feature is illustrated on the cover near the right end of the cross section as a large uplift of the Precambrian (shown in red) immediately to the left of the Humboldt Fault (shown as a vertical black line).

SOME COMMON FOSSILS YOU MAY FIND
(Calcified Fossils)
(Figure 5)

A-B. ECTOPROCTS (Bryozoans) (A) Rhombopora, X2; (B) Fenestella, X3.

C-J. BRACHIOPODS (C) Reticulatia, X1; (D) Crurithyris, X5; (E) Neochonetes, X2; (F) Derbyia, X1; (G) Composita, X2; (H) Juresania, X2; (I) Hustedia, X5; (J) Punctospirifer,

K-L. TRILOBITE (K) Ditomopyge (cephalon), X4; (L) Ditomopyge (pygidium), X4.

M-N. CRINOIDS (M) Crinoid columnal, X3; (N) Dorsal cup, Delocrinus, X2.

O-P FISH TEETH (O) A ray, Cladodus, X2; (P) a shark, Petalodus, X2.

Q. GASTROPOD (Q) Straparollus cf. S. (Euomphalus), X2.

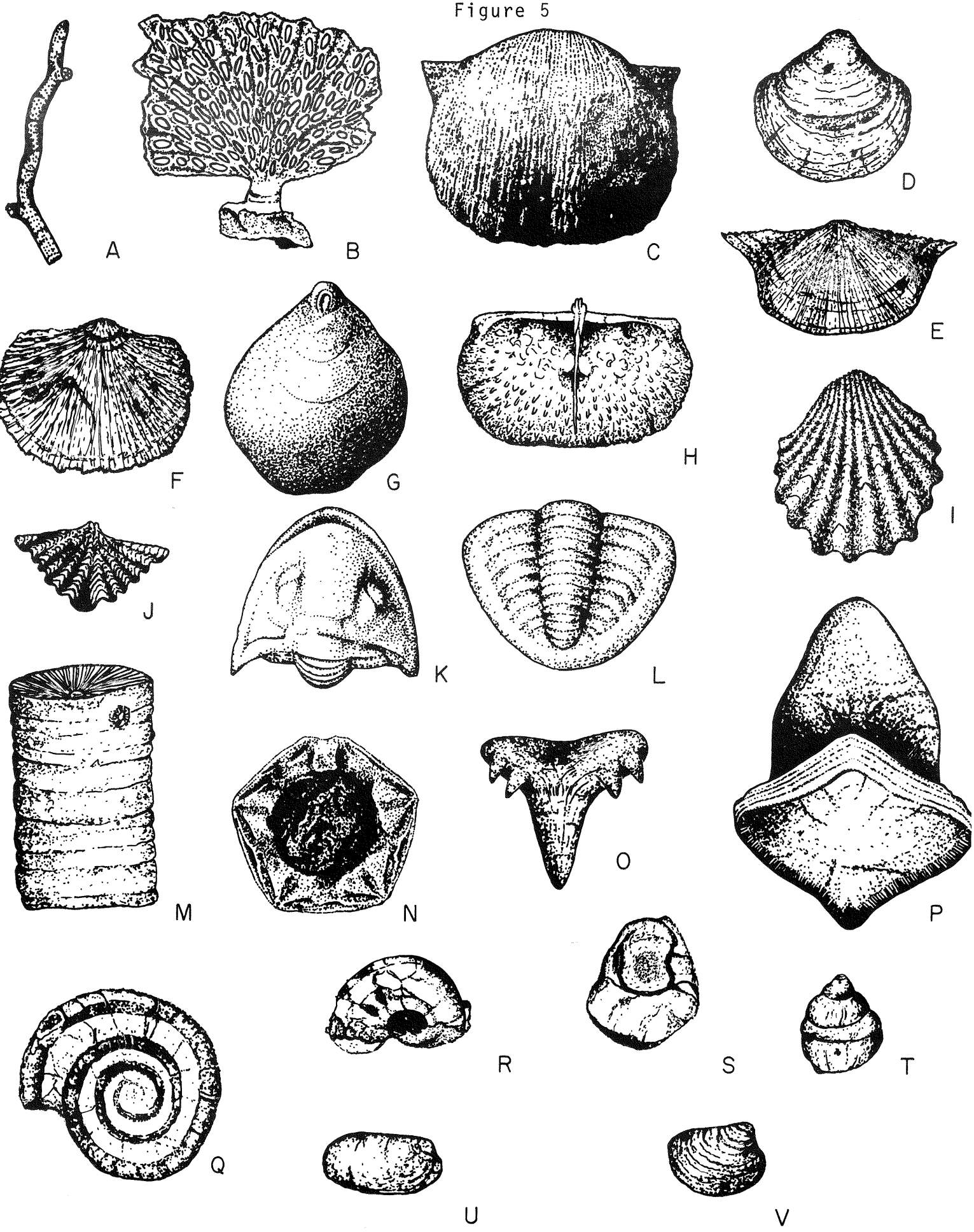
(Limonite Fossils)

R-S. NAUTILOID, Liroceras (R) Side view; (S) Front view, X5.

T. GASTROPOD (T) Araeonema, X5.

U-V. BIVALVES (U) Permophorus, X5; (V) Nucula, X5.

Figure 5



Some Additional Publications Available from the Conservation and Survey Division

RECORD IN ROCK, A Handbook of the Invertebrate Fossils of Nebraska: *Roger K. Pabian,* Educational Circular No. 1 (1970).

MINERALS AND GEMSTONES OF NEBRASKA, A Handbook for Students and Collectors: *Roger K. Pabian,* Educational Circular No. 2 (1971).

SOILS OF NEBRASKA: *J. A. Elder,* Resource Report No. 2 (1969).

DIRECTORY OF NEBRASKA QUARRIES, PITS, AND MINES:*R. R. Burchett,* Resource Report No. 5 (1971).

CENTENNIAL GUIDEBOOK TO THE GEOLOGY OF NEBRASKA: *R. R. Burchett and E. C. Reed* (1967).

GUIDEBOOK TO THE GEOLOGY ALONG THE MISSOURI RIVER BLUFFS OF SOUTHEASTERN NEBRASKA AND ADJACENT AREAS: *R. R. Burchett* (1970).

GUIDEBOOK TO THE GEOLOGY ALONG PORTIONS OF THE LOWER PLATTE RIVER VALLEY AND WEEPING WATER VALLEY OF EASTERN NEBRASKA: *R. R. Burchett* (1971).

THE GEOLOGICAL SECTION OF NEBRASKA: *G. E. Condra and E. C. Reed,* Nebraska Geological Survey Bulletin No. 14A (1943, revised 1959).

REVISION OF THE CLASSIFICATION OF THE PLEISTOCENE DEPOSITS OF NEBRASKA: *E. C. Reed and V. H. Dreeszen,* Nebraska Geological Survey Bulletin No. 23 (1965).

GEOLOGICAL MAP OF NEBRASKA: Compiled by *R. R. Burchett,* 1:1,000,000 Scale (1969).

TOPOGRAPHIC MAPS: Topographic Map Division, U.S. Geological Survey.

FG-6 $1.50

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