EXPLANATION

- Limestone
- Dolomite
- Calcareous sandstone with subordinate amounts of shale
- Calcareous siltstone with subordinate amounts of shale and limestone
- Shale with subordinate amounts of siltstone and limestone
- Sandstone with subordinate amounts of shale
- Rock sequence — Numbers indicate sequence; unit 1 is oldest

GLOSSARY

LIMESTONE — A rock composed chiefly of calcium carbonate ($CaCO_3$)

DOLOMITE — A rock composed chiefly of calcium magnesium carbonate [$CaMg(CO_3)_2$]

CALCAREOUS — A rock containing some calcium carbonate

SHALE — A rock composed of particles less than 0.002 millimeters in size

SILTSTONE — A rock composed of particles ranging in size from 0.002 to 0.05 millimeters

SANDSTONE — A rock composed of particles ranging in size from 0.05 to 2.0 millimeters

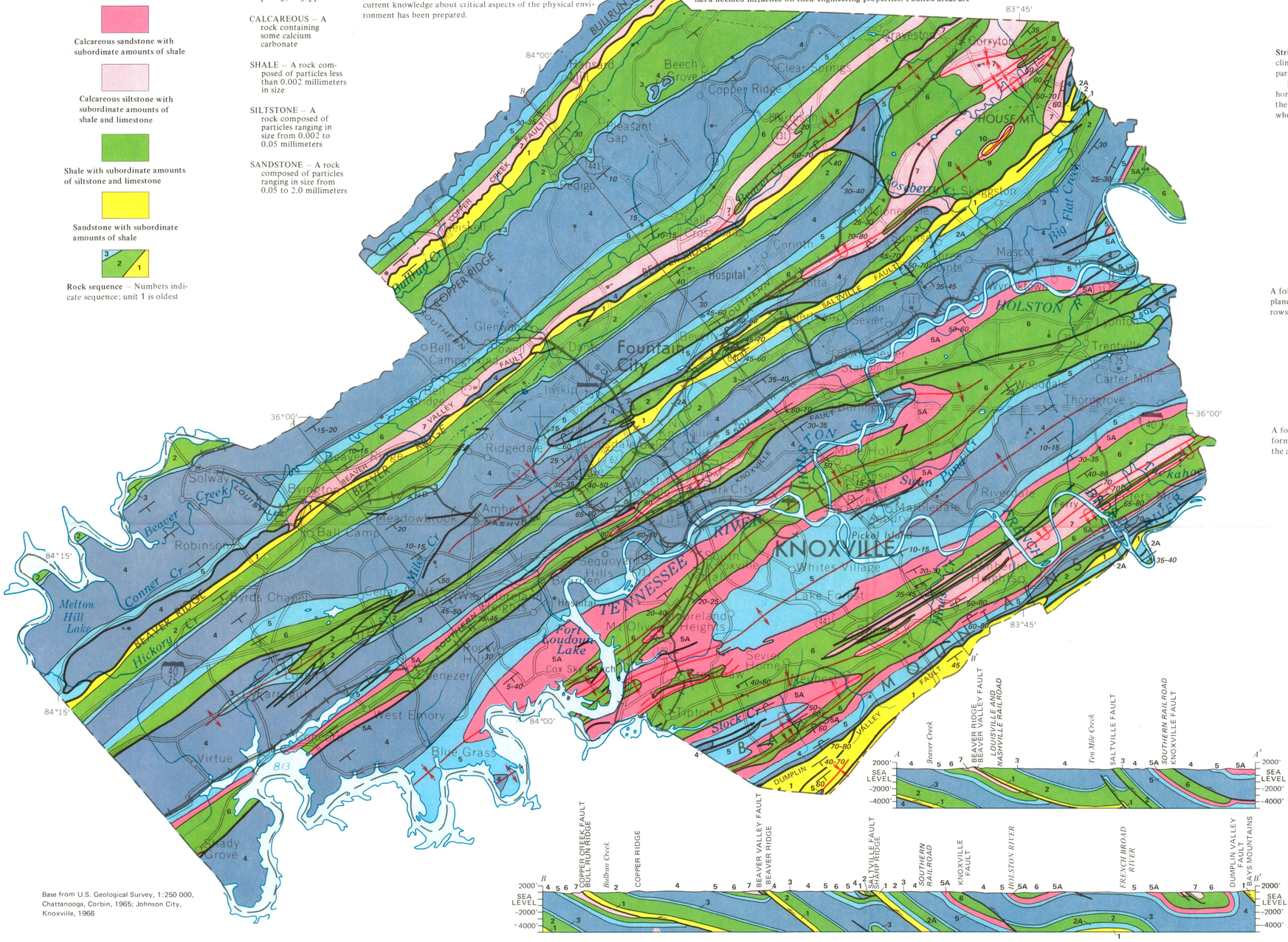
LAND RESOURCE ANALYSIS MAPS OF KNOX COUNTY

Knox County has a 1972 population in excess of 270,000. The Metropolitan Planning Commission (1968) projects an increase in population to approximately 360,000 by 1990. As the population grows and favorable areas like west Knox County approach their limit of development, more and more marginal land will be utilized. In order to utilize the existing land resources safely and efficiently, and in order to maintain a suitable environmental quality, knowledge concerning the physical environment and its limitations should be readily available to planners and decision makers. To provide some of these data, a series of maps, I–767, summarizing current knowledge about critical aspects of the physical environment has been prepared.

USE OF THE STRUCTURE MAP

Layers of sedimentary rocks form the bedrock underlying Knox County. The layers were originally deposited horizontally or nearly so, and have since been tilted (inclined), bent (folded), and broken (faulted). Subsequent wearing down (erosion) of the resulting complexly deformed rock layers to the present level of the earth's surface has formed the pattern of rock units shown on the structure map. The attitude and configuration of the rock layers and the faults that break them are shown on the map by special symbols explained in the diagrams and text.

The fact that the rocks are tilted and faulted throughout Knox County has a decided influence on their engineering properties. Faulted areas are generally zones of weakness along which weathering can penetrate to great depths. Consequently, foundation excavation in faulted areas needs to be carefully evaluated. Similarly, caution must be used in excavating areas of tilted rocks because, by removing support from the toe (or base) of these beds, the potential for landslides may be greatly increased. For these and many other reasons, a knowledge of the structural geology can and should influence an engineer in designing any building or other structure that is involved in any way with the bedrock or its overlying soil mantle in Knox County.



Base from U.S. Geological Survey, 1:250 000, Chattanooga, Corbin, 1965; Johnson City, Knoxville, 1966

SCALE 1:125 000

5 4 3 2 1 0 5 10 15 KILOMETERS

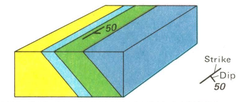
5 4 3 2 1 0 5 MILES

SOURCES OF DATA

Cattermole, J.M., 1955, Geology of the Shooks Gap quadrangle, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–76.
____1958, Geology of the Knoxville quadrangle, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–115.
____1960, Geology of the Rearden quadrangle, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–126.
____1962, Geology of the Maryville quadrangle, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–163.
____1966a, Geologic map of the Fountain City quadrangle, Knox County, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–513.
____1966b, Geologic map of the John Sevier quadrangle, Knox County, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–514.
Dale, T.N., 1924, Constitution and adaptation of the Holston marble of east Tennessee: Tennessee Div. Geology Bull. 28, pt. 2, p. 87–160.
Hardeman, W.D., and others, comps. and eds., 1966, Geologic map of Tennessee: Nashville, Tennessee Div. Geology, 4 sheets, scale 1:250,000.
Harris, L.D., 1972, Distribution of sedimentary rocks in Knox County, Tennessee: U.S. Geol. Survey Misc. Geol. Inv. Map I–767 C.
Neuman, R.B., 1960, Geology of the Wildwood quadrangle, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–130.
Rodgers, John, 1953, Geologic map of East Tennessee with explanatory text: Tennessee Div. Geology Bull. 58, pt. 2, 168 p.
Swingle, C.D., Harper, D.D., Palmer, R.A., Milici, R.C., 1967, Geologic map of the Boyds Creek quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 156–NW.
Swingle, C.D., Palmer, R.A., Skinner, R.B., Hawkins, J.O., McReynolds, J.L., Jr., 1967, Geologic map of the Luttrell quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 155–NW.

Contact — The boundary between layers of different kinds of rock

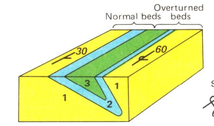
Fault — A break in the rocks along which movement has occurred. Shown as a heavy line in sections and on map



STRIKE AND DIP OF SEDIMENTARY LAYERS

Strike is the direction of a line formed by the intersection of an inclined sedimentary layer with a horizontal surface, shown by a bar parallel to the direction of the line.

Dip is the angle at which a sedimentary layer is inclined from a horizontal surface, shown by a tick on the strike bar pointing in the direction of dip. Angle of dip, in degrees, is shown numerically where measured; a range of dip values indicates local variations.

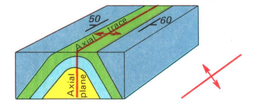


OVERTURNED SEDIMENTARY LAYERS

If the sedimentary layers have been tilted through more than 90°, the layers are said to be overturned and the symbol shown above is used to indicate the overturning. Where overturning exists, the oldest rock layer (**1**) lies above the younger rock layers (**2** and **3**).

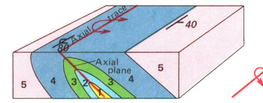
FOLDS

Folds are bends in rock layers. Each fold has an imaginary plane called the axial plane that divides the fold into nearly equal parts, or limbs. The intersection of this imaginary axial plane with the earth's surface forms a line, called the axial trace, which is shown on the map as a red line. The intersection of the axial plane of a fold with a bed forms another line which is called the axis of the fold. Special arrow symbols (explained below) are used on the axial trace line on the map to indicate the type of fold and the direction of dip of the limbs.



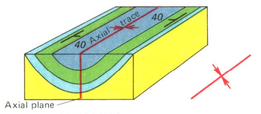
ANTICLINE

A fold in which the sedimentary layers dip away from the axial plane forming an archlike structure. In a simple anticline the arrows on the axial trace both point away from the line.



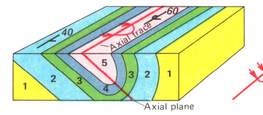
OVERTURNED ANTICLINE

An anticline in which the rock layers on one limb are overturned so that the layers on both limbs dip in the same direction. The arrows on this symbol point in the same direction (the dip direction of the limbs) and are joined by a loop at their tail ends.



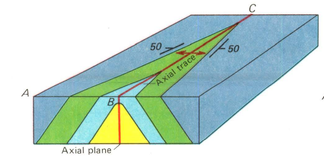
SYNCLINE

A fold in which the sedimentary layers dip toward the axial plane forming a troughlike structure. In a simple syncline the arrows on the axial trace both point toward the line.



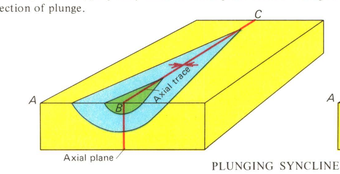
OVERTURNED SYNCLINE

A syncline in which the rock layers on one limb are overturned so that the layers on both limbs dip in the same direction. The arrows on this symbol point in the same direction (the dip direction of the limbs) and are joined by a loop at their head ends.



PLUNGING ANTICLINE

An anticline whose axis is tilted from the horizontal. A plunging anticline is easily recognized because sedimentary layers dipping away from the axial plane form a V-shaped pattern on the map that points in the direction of plunge.

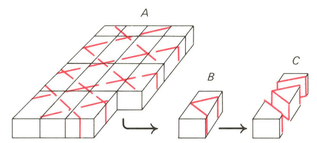


PLUNGING SYNCLINE

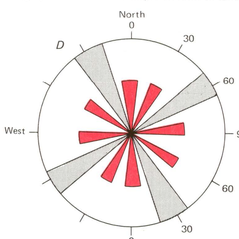
A syncline whose axis is tilted from the horizontal. A plunging syncline is easily recognized because sedimentary layers dipping toward the axial plane form a V-shaped pattern on the map with the open end of the V pointing in the direction of plunge.

JOINTS

Joints are fractures in rocks along which little or no movement has occurred. All rocks in Knox County contain abundant, closely spaced, joints (not shown on map), ranging from a few inches to several feet apart, that were probably developed during the period of mountain building discussed by Harris (1972). Two distinct joint types exist in Knox County. One (black in diagram *D*) is strongly developed and the other (red) is weakly developed. The strong joint system forms a characteristic bricklike pattern cut at an angle by the weaker (red) system. Rocks tend to weather most rapidly along joints, causing the layers to separate into rectangular blocks and angular pieces (diagrams *A* to *C*). Major creeks and rivers take advantage of the ease of weathering along joints and tend to parallel joint systems. Thus, the regular pattern of the Holston and French Broad Rivers is to a large extent a reflection of the joints in Knox County. Diagram *D*, which shows the direction of joints in the county was derived from a few measurements by Dale (1924) and from the drainage pattern of all the major streams in Knox County.



Joints in a sedimentary layer



Range in the direction of strike of strongly developed (black) and weakly developed (red) joints in Knox County

STRUCTURE MAP OF KNOX COUNTY, TENNESSEE

By
Leonard D. Harris

1972

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1972—G72425

For sale by U.S. Geological Survey, price 75 cents