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A NEW MAP OF THE CENTRAL BASIN OF TENNESSEE[1]

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Introduction

The Central Basin of Tennessee is an elliptical topographic depression in the southeast central portion of the Interior Low Plateau. Its long axis extends about 25 degrees east of north across the middle portion of the State, from near the Kentucky border on the north to the Alabama boundary on the south. This depression is approximately 120 miles long; the width varies greatly (see Fig. 1); at 36 degrees latitude it is 40 miles wide. Typically its altitude ranges from 500 to 700 feet; it is surrounded by the Highland Rim of approximately 1000 feet altitude.

The writer's interest in the vegetation of the area led to this attempt to define on a single basis the limits of the Basin, thus definitely separating it from the encircling Highland Rim.

Geological History

In the papers of Wilson and colleagues may be found the details of the deposition of the Ordovician limestone strata now exposed in the Basin. It has been shown (Wilson, 1935; Wilson and Spain, 1936) that the strata were deposited upon the slopes of a dome (the Nashville dome) which developed synchronously with mountain building activities in Appalachia. Vertical movements are believed to have occurred many times and the line of greatest uplift shifted east and west in accord with the intensity of stresses transmitted westward from Appalachia. Further, the dome is thought (Wilson, 1949; Wilson and Born, 1943) to have been connected to the Ozark dome before the latter sagged and was covered by sediments of the Mississippi.

Altitude fluctuation resulted in great variations in bed thickness over the area. Eight unconformities in the Ordovician system such as that between the Lebanon limestone and the Carters limestone are known. Some of these are nondepositional, and others are due to interformational erosion. In addition, minor faults and folds are to be found throughout the presently exposed strata.

The last series of upwarpings of the dome produced a swell which reached its highest altitude in south-central Rutherford County. The dip northwestward to Nashville is about 15 feet per mile; northwestward from Nashville, it is about 25 feet

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per mile. Wilson (1948) suggests that early in the last series of upwarpings – Miocene or early Pliocene – middle Tennessee had been reduced to a low-lying plain corresponding to the present level of the Highland Rim. By the close of the Pliocene the Cumberland River was meandering over resistant Mississippian deposits. Gravel terraces deposited at this time were largely eliminated when early Pleistocene rejuvenation resulted in renewed downcutting. Down and lateral cutting, especially of branch streams, resulted in formation of topography much as is today. According to Wilson (1948). "Topographically . . . the Nashville area [has] not been appreciably changed since the First Interglacial age, and the [Cumberland] river is now flowing on, or only slightly above, bed-rock in its channel cut into the flood plain alluvium". No attempt has been made to correlate terrace levels over the whole Basin area. However, the evidence summarized by Theis (1936) suggests the probability of contemporaneous terrace levels in the Elk, Duck, and the Cumberland River Basins.

General Character

The Basin is entirely surrounded by a broad to narrow area of relatively great relief: the dissected portion of the Highland Rim. The Basin itself is divided into a flattish inner portion, termed Central Plain by Galloway (1919) and Fenneman (1938), and an encircling outer part. It is drained to the north and west by branches of the Cumberland River, notably the Stones and Harpeth rivers, to the west by the Duck, and to the south by the Elk River and its tributaries. Certain streams, such as tributaries of the Duck, are located in gentle structural synclines (Theis, 1936).

The inner basin is a flat to gently rolling area of mild karst topography. While few cenotes are known in the region, sinkholes and underground drainage are conspicuous physical features. Cropping out in extensive areas, the Lebanon limestone weathers to platy rock fragments interspersed with soil material. Such land supports a thin vegetation cover, the cedar glades. The inner basin exists in three fairly well-defined segments: a narrow chain of hills across the extreme southern edge of Rutherford County divides the main body, centered in that county and Bedford and Marshall counties to the south, into two of the segments; while an outlier in the drainage areas of Barton and Spring creeks in central Wilson County forms the third.

The outer basin almost completely encircles the inner, being absent only in southeastern Rutherford County where slopes become abruptly sharp. In general, the main area of outer basin is featured by rolling topography, and sinkholes are less prominent. It is into this region that remnants of the dissected rim extend, mainly as fingers from the periphery. Some of the land

is the glade type, but many of the exposed strata weather into good agricultural soils, often high in phosphate.

The Elk River-Richland Creek drainage area may also be considered outer basin although this area is separated from the main body by typical, shale-capped hills of the dissected rim, connected by only two cols in south-central Marshall County.

Other Concepts of the Basin

Examination of any series of maps of the Central Basin will reveal that each author had a different concept of this physiographic unit. However, each is similar to the other in certain respects. The basis of the similarity apparently lies in the adoption of well-marked geological boundaries such as the Chattanooga shale (Safford, 1851), the bottom of the Mississippian system (Theis, 1936), or Fort Payne chert (Bassler, 1932) as a means of differentiating between Basin and Rim. The State geological map (Pond, 1933) beautifully illustrates this boundary as does that of Amick and Folmsbee (1940).

Other, more recent small-scale maps have generalized the ragged geological boundary of the escarpment. The degree of generalization has varied with the author; as a result, the Basin has been mapped conceptually with discordancies between results. Two versions are most common. The first, a liberal view, follows the geologic boundary through Moore, Lincoln, and Giles counties extending the Basin to, or almost to, the Alabama border. A more conservative treatment excludes the above counties, tracing the southern boundary through southern Bedford, Marshall, and Maury counties.

The most common practice among geologists is to interpret the Basin liberally (Safford, 1851, 1869; Safford and Killebrew, 1900; Fenneman, 1917; Nelson, 1921; Bassler, 1932; Theis, 1936; Wilson, 1949). They include the Elk River drainage in the Basin proper. On the other hand Fenneman (1946) and Piper (1932) interpret it conservatively. The discussion of Theis is pertinent here. His interpretation is based in the main on 1) topography — the Elk River area is rolling as is the outer basin — and 2) similar history — the same uplift resulted in downcutting of the Elk, Duck, and Cumberland river basins.

An early attempt to separate inner from outer basin was made by Killebrew and Safford (1874), who suggest "Take Murfreesboro as a point and with a radius of about ten miles describe a circle, the included area will be a basin within the Great Central Basin". Theis also attempts to distinguish southern outer from inner basins using the base of the Hermitage formation as a line. The results are rather good.

Inasmuch as the early interpretation of Tennessee soils was primarily on the basis of bedrock, it is not surprising to find

geological and soils maps agreeing closely. The early (Vanderford, 1896) soils map has been modified and sharpened into a more modern "soil association" treatment (Tennessee Dept. of Agric. Educ., 1956). Separable now are soil groups distinguishing rim, escarpment, outer, and inner basins. The latter two are separated on the basis of phosphate content of the parent material. A major change is a reinterpretation of the southern boundary of the basin; it now exemplifies the conservative view.

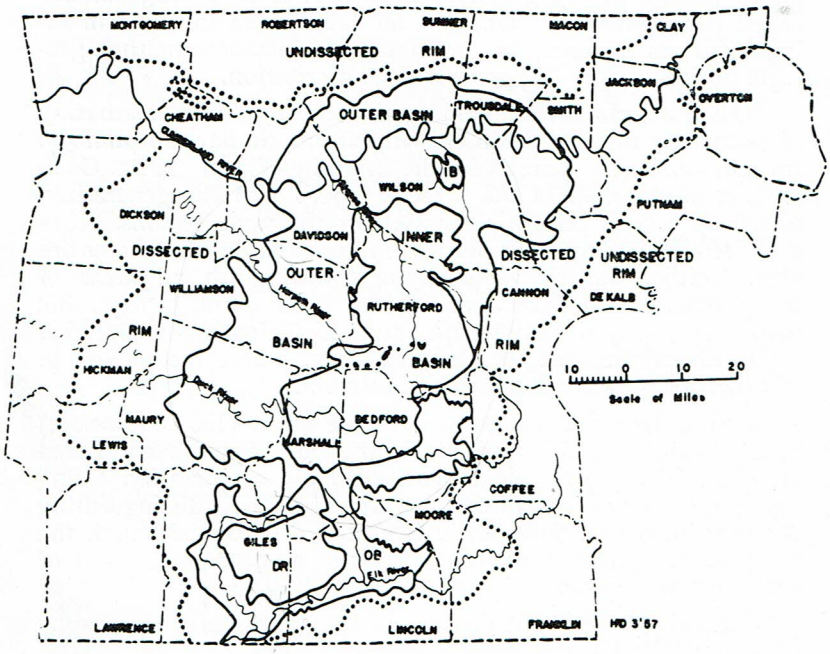

Figure 1. Map of the physiographic regions of the Central Basin area, of Tennessee. Separated are undissected rim, dissected rim, outer basin, and inner basin.

Consistent with this concept is the soil survey of Bedford County (Strickland, 1947). On the other hand, the Lincoln County report (Rudolph, 1946) takes the liberal stand.

The State Planning Commission report (Whitlatch, 1948) also interprets the Basin liberally, as does Allred (1937) in a discussion of the state's agriculture.

Publications of the U. S. Forest Service (Wheeler, 1952; Sternitzke, 1955) include maps of major forest types of Tennessee. They recognize that the Giles-Lincoln-Moore county area con-

tains forest characteristic of both Rim and Basin. The latter report includes a state physiographic map after Allred (1937).

Quarterman (1950) in mapping cedar glade distribution found the less conservative concept of the Basin more useful. Braun (1950) follows Fenneman (1938) in this respect.

Method

Included in this report is the present writer's concept of the Basin (see Fig. 1) based on a compilation but with most emphasis placed on topography. Its purpose is to distinguish dissected rim from outer basin and the latter from inner basin using landform criteria. Except in certain instances neither geologic horizon nor soil type is used as a criterion.

It is recognized that landforms resulting from weathering of essentially uniform bedrock will exhibit similar morphology. Indeed, some are described for the Basin by Wilson (1949). Comparison of the map in the present report with the generalized soils map reveals certain likenesses for the same reasons. However, detailed county soils maps are not available over the entire area. Neither do the geologic maps distinguish all areas of sharp versus knob dissection. On the other hand, topographic maps, some only in manuscript form, are being made available for much of the area for the first time. These factors led to making the present interpretative attempt.

During the writer's field work in the Basin (1954 to present) he established a field concept of inner and outer basin, based on qualitative aspect phenomena difficult to quantify. Using topographic maps as a primary source of data in distinguishing between inner and outer basin is no less difficult, although the compiler has the advantage of "seeing" many square miles of landscape at a glance.

Generally, only the main area of flat to low hill topography is included in the inner basin. Some outer basin outliers persist, but the general aspect is that of little relief with slopes – mainly fingers from the outer basin – of about 2-5 per cent.

As has been shown, previous interpretations have included much of the escarpment in the Basin. Any method of separating knobby outer basin from the encircling rim must take into account the degree of slope, for if all dissected terrain is included the Basin might justifiably be continued west nearly to the Tennessee River.

In this paper the rounded, separated, gently to moderately sloping (10-15 per cent) hills of the outer basin are distinguished from those of the escarpment by increased degree of slope (20-35 per cent), narrow interfluves and flood plains (hills appear crowded), and the rather level-topped appearance of the hills in the escarpment area.

Discussion

The writer believes that the concept of the Central Basin as a physiographic entity is sharpened by the outermost boundary on the map (Fig. 1). This boundary, shown here in three sections, indicates where possible, the inner undissected edge of the Highland Rim separating it from its dissected portion. The boundary is entirely topographic. The eastern section is a continuation of a line extending north from Alabama; it continues northeast into northern Overton County where it is terminated by outliers of the Cumberland Plateau. The western section in its southern part follows a divide between tributaries of the Elk River northward, thence northwest to the vicinity of Hohenwald, Lewis County. Northward beyond this point this boundary is entirely arbitrary and is included only to meet the objective stated above. The northern section is well defined and exhibits an outlier in northern Cheatham County.

It will be noted that the outer basin exists in two sections. The southern of these along the Elk River drainage is topographically and geologically like the main outer basin but is separated from the main body by a narrow chain of shale-capped hills. The outer border of the main body of the outer basin is topographic on the south, west, and north. In most of Trousdale County and southwestern Wilson topographic maps are not available. The former boundary here is from Wilson (1940), the latter from Piper (1932). In eastern Bedford County the boundary has been modified from that by Strickland (1947).

The boundary of the inner basin is again topographic. That of the outlier in the vicinity of Lebanon, Wilson County, is interpreted primarily from the map of Wilson (1940).

The resulting map differs from others of the Basin in that all of the large area of dissected Highland Rim is excluded from the Basin proper. The boundary of the inner basin is depicted precisely for the first time. The present interpretation of the southern extension of the Basin is intermediate between the "liberal" and "conservative" treatments previously described.

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News of Tennessee Science

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by the U. S. Public Health Service to investigate means of altering the course of skin cancer in mice.

The U-T College of Medicine at Memphis has received a $1,000,000 research grant for a five-year study on the prevention of brain damage. The grant was made by the National Institute of Neurological Disease and Blindness of the U. S. Public Health Service, and funds for the study will be made available at the rate of $200,000 per year. Dr. James G. Hughes, professor of pediatrics, will be principal investigator and Dr. Phil C. Schreier, professor of obstetrics and gynecology, will be co-investigator.