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RECENT VERTICAL MOVEMENT OF THE LAND SURFACE IN THE LAKE COUNTY UPLIFT AND REELFOOT LAKE BASIN AREAS, TENNESSEE, MISSOURI AND KENTUCKY

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ABSTRACT

Tiptonville Dome, an established tectonic uplift, is one in a 20 mile series of en echelon topographic highs, most or all of which are uplifts. These features are too high to have been flooded during the largest historic floods. During these floods they were temporary islands. From Lewis Prairie, at New Madrid in Missouri, five such topographically high areas extend southward across the Mississippi River to Ridgely, Tennessee. Although separated now due to modern river erosion, they were nearly continuous in 1811. Contour trends reveal a squarish topographic bulge west of the "flood islands," the western corner of which is near Portageville, Missouri. It may have been uplifted with, but less than, the "flood islands." This bulge and the topographic highs comprise the Lake County Uplift.

Vertical movement is interpreted from variations in elevation of the alluvial plain surface and old soils. Individual features, datums, and vertical movement estimated are as follows:

TOPOGRAPHIC FEATURE	DATUM OF A LARGE FLOOD	DATUM OF REELFOOT LAKE
Ridgely Ridge	Up 5-15 feet	Up 20-25 feet
Tiptonville Dome	Up 10-20 feet	Up 35-40 feet
Bessie & Washpan Ridges	Up 0-10 feet	Up 15-20 feet
Lewis Prairie	Up 5 feet	Up 5 feet
Reelfoot Lake Basin	------	------
Portageville Bulge	------	Up 0- 5 feet

Ridgely Ridge and Tiptonville Dome in Tennessee correlate with positive gravity anomalies, and small earthquakes are concentrated beneath or near them. Thus these topographic features may be surface manifestations of deep-seated tectonic movements that continue today.

INTRODUCTION

Stratigraphically defined structural datum planes, from which historic and late pre-historic vertical movements of tectonic origin can be measured, are obscure or very irregular in the New Madrid earthquake region of southeast Missouri and northwest Tennessee. Unconformities such as that at the base of the high level continental deposits of Pleistocene and Pliocene(?) age and the base of the Mississippi River alluvium of Late Pleistocene and Recent age are irregular and hundreds of thousands or more years old. These provide poor data from which to recognize recent structural displacements. Possibly a more senitive datum is the relatively even Holocene surface of the Mississippi River alluvial plain. A coincidence between the shape of this surface, and several other mapped parameters including distribution of soils with a B-horizon. Bouguer gravity anomaly, and distribution of earthquakes will be shown.

Figure 1 shows the general location of the area referred to in this report. Figure 2 shows the same area as mapped by Fuller (1912, Plate 1).

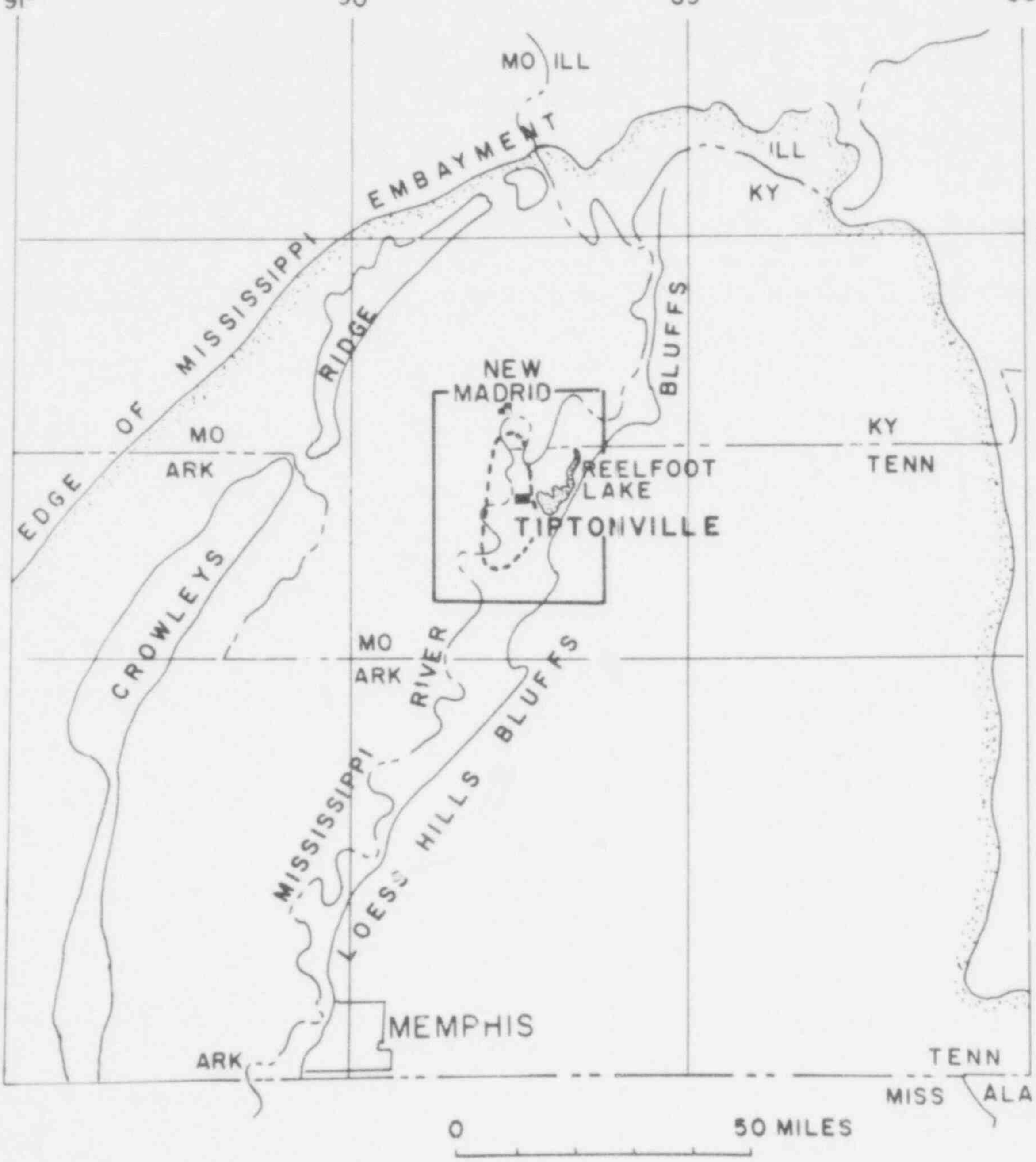

Figure 1- Map showing location of the study area within the Mississippi Embayment. The Tiptonville Dome limits of Fuller are shown by the dotted line around Tiptonville, Tennessee.

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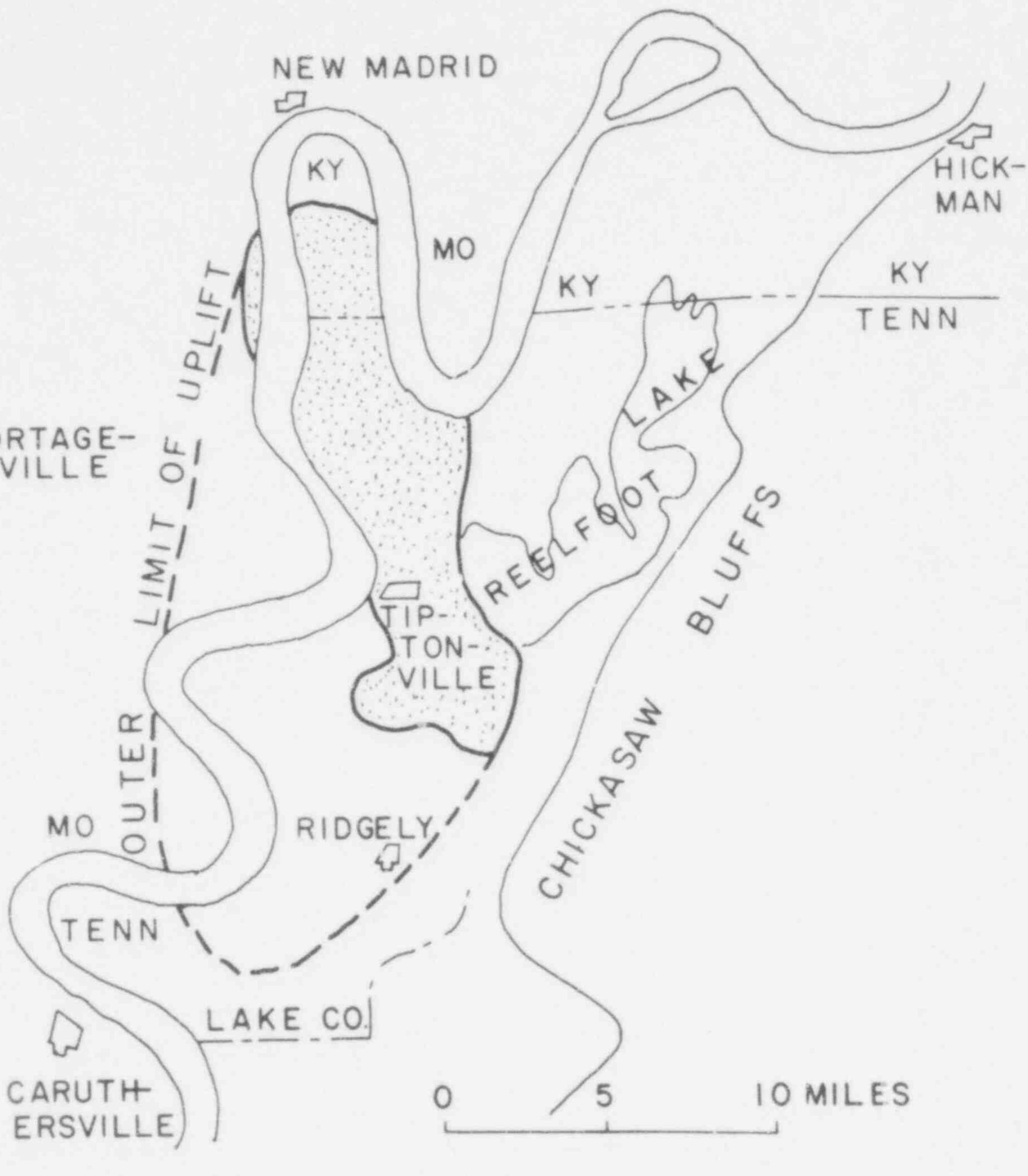

Figure 2- The study area showing the area of uplift and the area of "maximum" uplift (stippled) as mapped by Fuller (1912, redrawn from a part of his Plate 1). Compare this with Figure 3.

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PREVIOUS STUDIES

Background

Vertical movements have been inferred for portions of the region in the vicinity of Lake County, Tennessee, by Usher (1837), McGee (1892), Fuller (1912), and Fisk (1944). Fuller mapped the limits of uplift and an area of greater uplift of the Tiptonville Dome, which he named (Figure 3). Glenn (1933) suggested that the Reelfoot Lake sunken lands were the result of compaction during the earthquakes of 1811-12, rather than downfaulting, but Fisk (1944) asserted that a fault separates the Tiptonville Dome and Reelfoot Lake sunken land, and he supported this interpretation by drill records as well as river elevation data. Krinitzsky (1950), discussed criteria for recognizing faults; one of his criteria was irregularities that appear on profiles of the land surface. Later Saucier (1970) suggested a physiographic origin for the St. Francis sunk land. Past work leaves open the possibility of much vertical tectonic movement, but alternative explanations are offered. This present paper, though not concerned with faulting versus "bulging" uses lateral changes in the land surface elevation and gradients on maps to infer likely tectonic uplift and downsinking patterns.

Definition and Descriptions of Tiptonville Dome, Reelfoot Lake Basin, and Other Features

The Tiptonville Dome and Reelfoot Lake Basin were first described in the geological literature by Usher (1837) who had seen them several years before writing his report and had reproduced them from memory. He noted that the entire left (Tennessee) bank of the river was uplifted from New Madrid south to the mouth of the Obion River, or from about latitude 36°35' to latitude 36°. The uplift was said to be "only a few feet," but yet it obstructed the mouth of Reelfoot Creek and the Obion River. He also stated that "this obstruction formed several lakes along back of this . . . It is quite probable that the land there was depressed in some degree in order to form these lakes." Usher was explicit that the uplift is on the Tennessee side and said that on the Missouri side New Madrid sank. Lyell (1849) visited New Madrid in 1846 and described the occurrence of the 1811 ground movement (p. 174) as follows: ". . . the ground swelled up so the river flowed backward for a time, carrying several flatboats northward against the stream." Lyell presented a landslide explanation for sinking of the Missouri side at New Madrid which was, at the time of his visit, sliding into the river. The present city is on the riverbank yet nearly a mile north of its 1811 location. Lyell also presented evidence that the Missouri side had risen. Portage Bayou which used to make a connection by boat to a point on the Mississippi just south of

New Madrid nas been dry since the earthquake.

McGee (1892) described the uplift (which he called the Lake County uplift, a name this writer will adopt) and the Reelfoot lake Basin. He said (p. 411) that the uplift includes "all of Lake County, Tennessee, and a considerable area in Missouri, on the opposite side of the river. This area, some 20 miles in mean diameter, bulges upward in a low dome, 20 or 25 feet above the level of the alluvial plain." McGee explicitly stated that the uplift occurs on both sides of the Mississippi River, but presents no facts in support for uplift of the Missouri side, though Lyell did. McGee agreed with the view that the river ran backward (as eyewitnesses claimed, but were generally not believed) to fill Reelfoot Lake Basin as a result of the bulge damming up the low-gradient river. Because of the lack of sediment deltas where streams entered the lake in 1892, McGee reasoned that Reelfoot Lake Basin was filled suddenly with water. He emphasized the fact that, during floods on the Mississippi River, Reelfoot Lake level rose about 20 feet, so that the "Lake County uplift is transformed into a double island" (p. 412).

Fuller (1912, p. 63) first called this uplift the Tiptonville Dome and considered the feature to include areas on both sides of the Mississippi River (Figure 2). He used the description more or less as presented by Usher and McGee as summarized above. The dimensions of the Tiptonville Dome were given by Fuller (p. 63) as 15 miles long and 5 to 8 miles wide. The maximum uplift was recognized by him as being " . . . in a relatively narrow belt, extending from near the south side of the Mississippi at New Madrid a little east of south to a point 2 or 3 miles south of Reelfoot Lake. The uplift of this belt has been sufficient to raise the surface above the highest floods . . . The amount of uplift, judging from the fact that the land is only 10 to 15 feet above the high water mark, could not have been over 15 to 20 feet." Fuller also recognized that not all the uplift was necessarily due to the 1811 earthquake. As he points out: ". . . but if Little Prairie (Lewis Prairie on his map, a name this writer will use), on which New Madrid is situated, is a part of the dome, the uplift will have to be referred to an earlier date, as New Madrid Village previous to the shock was on high land, never covered by the floods. He mapped the dome as an egg-shaped feature. On his map (Plate 1) Fuller excludes New Madrid and the high ground about 4 miles to the south and west (Fig. 2).

Fuller also gave an estimate of the depression of the original land surface below the normal water level in Reelfoot Lake as: "2 to 10 feet, and possibly even more locally . . ." (p. 68). This present paper in large measure is a refinement of Fuller's work, extending the limits of, giving a more detailed shape to, and variation in the area of uplift.

Fuller is the only author to state a preference for the mode of origin of uplifts and sunken areas. He thought they most likely were superficial wrinkles of the Cretaceous and younger Mississippi Embayment fill as it moved laterally toward the Mississippi River and Gulf of Mexico during earthquakes, a conclusion not supported by the present study.

Glenn (1933) appears to use Fuller's smaller area of maximum uplift which is not covered by floodwaters as the Tiptonville Dome, rather than Fuller's larger area included in his egg-shaped dashed line limit. His description is as follows:

> "Tiptonville Dome. From Proctor City south to Tiptonville, the flood plain has been domed up by differential earth movements until its elevation is 300 to 320 feet above sea level. This domed area is not covered by flood waters."

Fisk (1944) more clearly defined the geographic units and placed the Tiptonville Dome south of New Madrid and on the Tennessee side of the Mississippi River, as he defines the Mississippi River to be the east boundary of the Little River Lowland south of New Madrid. On page 25 he says: "Tiptonville Dome, south of the Cairo Lowland, is an uplifted area which lies opposite the southern end of Sikeston Ridge, but is not a continuation of that feature." The reason that Fisk denied a common origin between the high ground on both sides of New Madrid is because Tiptonville Dome is underlain by more recent meander style alluvium whereas Sikeston Ridge is underlain by ancient braided alluvium.

Fisk stated further that the Reelfoot Lake Basin and Tiptonville Dome are separated by a fault and assigns estimates of "uplift" and downfaulting" as follows (p. 25): "Maximum uplift of the Tiptonville Dome amounts to 15 ft. judging from the displacement of stream profiles, and the Reelfoot Lake Basin is downfaulted by at least 25 ft.; hence the total displacement is as much as 40 ft." He also said of the faulting that the movement along the fault was probably slow and long continued, in accordance with Fuller's earlier conclusion for the uplift in general, so movement in 1811-12 on the fault was slight.

<u>The Present Writer's Use of Tiptonville Dome, Reelfoot Lake Basin, and Lake County Uplift</u>

It is clear from the literature review that the limits of uplift have been variously defined by McGee, Fuller, Glenn and Fisk. They are all essentially correct, but have used the same name, "Tiptonville Dome" in two ways. The present writer will use McGee's original name "Lake County" for the large uplift, and Fisk's and Glenn's later restricted definition of the area of greater uplift for the Tiptonville Dome. The basis for "Lake County uplift" is priority for McGee's earlier (1892) work; the basis for restricting the name "Tiptonville Dome" is consistency. Fuller's relationships are not contradicted. There is variation and uncertainty between previous workers as to whether topography resulted from erosive or tectonic processes. This writer chooses to define them as topographic features and then consider whether or not they are of tectonic origin. Tiptonville Dome is that area including the City of Tiptonville, that was not flooded in 1937; or, where protected by levees, would not have been flooded in the absence of levees. It is so mapped on Figure 3 and is only one in a series of areas of high ground. The collective name for all such features grouped into an inferred larger area of uplift is the "Lake County Uplift." Once the definition of the topographic features is made explicit, they have a useful meaning regardless of origin. Figure 3 is a map showing the various named features within the area of the Lake County Uplift and the Reelfoot Lake Basin.

The Reelfoot Lake Basin is defined as the present drainage basin of Running Reelfoot Bayou that once was occupied mainly by lakes and wetlands. Present Reelfoot Lake is only part of the basin. Before the 1811-12 earthquakes this area was in two separate stream drainage areas: the present Reelfoot Lake was drained by Reelfoot Creek which drained westward directly into the Mississippi River. The other is the southward flowing Obion

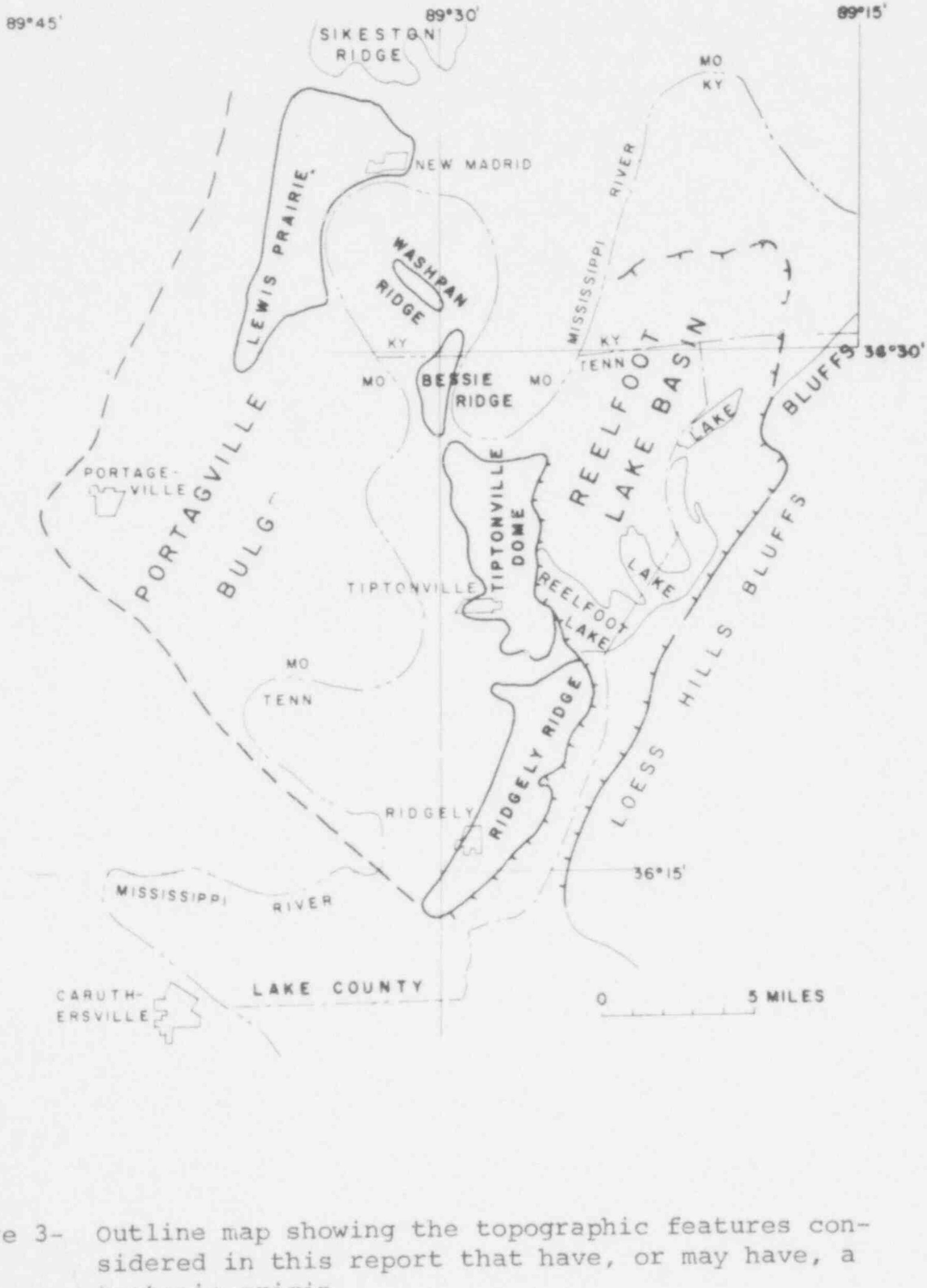

Figure 3- Outline map showing the topographic features considered in this report that have, or may have, a tectonic origin.

River tributary, now called Running Reelfoot Bayou, which still follows approximately its original course downstream from Reelfoot Lake. A chain of lakes about 20 miles long existed here until after 1869 (Usher, 1837 map, and Glenn, 1869 base map in his 1933 report). South of Reelfoot Lake only Lake Isom remains of this old chain. Reelfoot and Isom lakes both could drain if not protected.

PRESENT STUDY

The present investigation has the benefit of new data as well as information presented in previous publications. The new data consist chiefly of (1) recent detailed 7½ minute maps which provide a better rendition of topography; (2) soil surveys (Brown and others, 1965, 1969, and 1973) permit an interpretation of the origin of surface deposit in terms of relative age (younger versus older, but dates unspecified); and (3) gravity surveys (including that of the writer as part of Hildenbrand and others, 1977), which provide clues to uplifts and (4) relatively accurate location of earthquake epicenters (Stauder and others, 1976-77) which permit comparison of topography and soil with gravity and earthquakes.

ACKNOWLEDGMENTS

This project was mainly made possible by a grant from the U. S. Nuclear Regulatory Commission -(NRC 04-76-299)-to Vanderbilt University as part of the New Madrid Study Group.[1] U. S. Geological Survey Regional Geophysics Branch furnished support for part of the gravity survey (Grant No. 14-08-001-G-270). Geologic Services Branch of Tennessee Valley Authority and the Tennessee Division of Geology loaned gravity meters. A computer-drawn gravity map was made by TVA.

Much assistance in compiling flood and soil map was rendered by Phill Steidl, graduate student and Vicki Castro, undergraduate student at Vanderbilt University. T. M. Haselton, graduate student, and Parrish Erwin, undergraduate student participated in the gravity survey. Peggy 'renne, of the Geology Department at Vanderbilt, compiled earthquake epicenters on a base map. The manuscript was much improved by criticism and discussion with Stuart W. Maher, E. T. Luther, T. C. Buschbach, J. M. Kellberg, and David Russ.

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[1] The New Madrid Study Group is a confederation of geological surveys and universities working together on the geology and geophysics of the region with a focus on earthquakes and their effects. It is mainly funded by the U.S. Nuclear Regulatory Commission, and its co-ordinator is Dr. T. C. Buschbach of the Illinois Geological Survey, and St. Louis University.

FLOOD MAPS

The Tiptonville Dome,[1] a topographic high, was recognized by earlier workers because it has been above the greatest floods e.g. Mississippi River Commission, 1887, 1939.

The "shorelines" and altitude of islands above the 1937 flood serves to illustrate (Figure 4) the relationship of Tiptonville Dome to the other topographic high areas. Ridgely Ridge is a southward continuation, but it is offset about 3 miles to the east. This map also shows that the highest part of Ridgely Ridge, about a mile northwest of Ridgely, is nearly as prominent a high as Tiptonville Dome. Tiptonville Dome is offset to the east relative to more northern features; the west edge of Lewis Prairie is 5 miles or so out of line with the west edge of Tiptonville Dome. Tiptonville Dome is an uplift; it will be shown that Ridgely Ridge is also an uplift, and if Lewis Prairie is too, then Tiptonville Dome is the middle member of a series of five en-echelon uplifts.

The southernmost and longest uplift is Ridgely Ridge; next the Tiptonville Dome, then the smaller Bessie and Washpan Ridges, and on the north Lewis Prairie, which is narrowly separated from Sikeston Ridge. These were likely once all closely connected, as Tiptonville Dome and Ridgely Ridge now are; big gaps were eroded after 1811 by the Mississippi River as will be shown later.

[1]"Dome" in geology ordinarily signifies a structural uplift. Although the present writer defines it as a high topographic elevation, the name is retained because of long usage. If all the authors including the present one are correct, it is also an uplift.

Figure 4- Tiptonville Dome as part of a series of topographic highs, which are drawn as islands during a flood like that of 1937 to an elevation of about 298 at mile 900.

UPLIFT OF TIPTONVILLE Dome, RIDGELY RIDGE, AND BESSIE RIDGE AS JUDGED FROM SOIL MAPS AND TOPOGRAPHY

Areas underlain by soil with a B-horizon probably stopped receiving sediment before areas underlain by soils lacking a B-horizon. Figure 5 delineates areas with soils having a B-horizon and Figure 6 shows the surface elevation of these soils. See Table 1 for a list of soils with "B" horizons. Both high and low ground have soils with and without B-horizons. Where soils lacking B-horizons occur on high ground, it is possible that sediment at the land surface was deposited on lower ground a relatively short time ago[1] and since uplifted.

In the Reelfoot Lake Basin, soils with B-horizons occur on low ridges nearly at lake level (elevation 283 feet). Between Reelfoot Lake Basin and the Tiptonville Dome, the elevation of these soils is from about 315 feet on the dome to 280 feet (or lower if any of the soils lie buried beneath lake mud) in the basin -- a difference of 35 feet (or more). If as a basis for calculation, this surface can be considered to once have been nearly flat, the present 35 foot (or greater) difference is consistent with Fisk's (1944) estimate from drill data of 40 feet of vertical fault offset between these two areas.

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[1]In the (June 1977) USGS-Vanderbilt trench on the Tiptonville Dome, two samples of gastropod shells from about 8 feet below the land surface on the Tiptonville Dome gave radiocarbon dates of about 1200 to 1600 years b.p. If these dates are correct the uplift has been at least 20 feet or so in about 1400 years.

Figure 5- Soil Map showing areas underlain by older soils, as judged from their having a B horizon. These older soils probably differ from each other in age by many hundreds or thousands of years, but they are likely to be collectively older than the other soils on the alluvial plain without "B" horizons. For a list of the soils having "B" horizons see Table 1.

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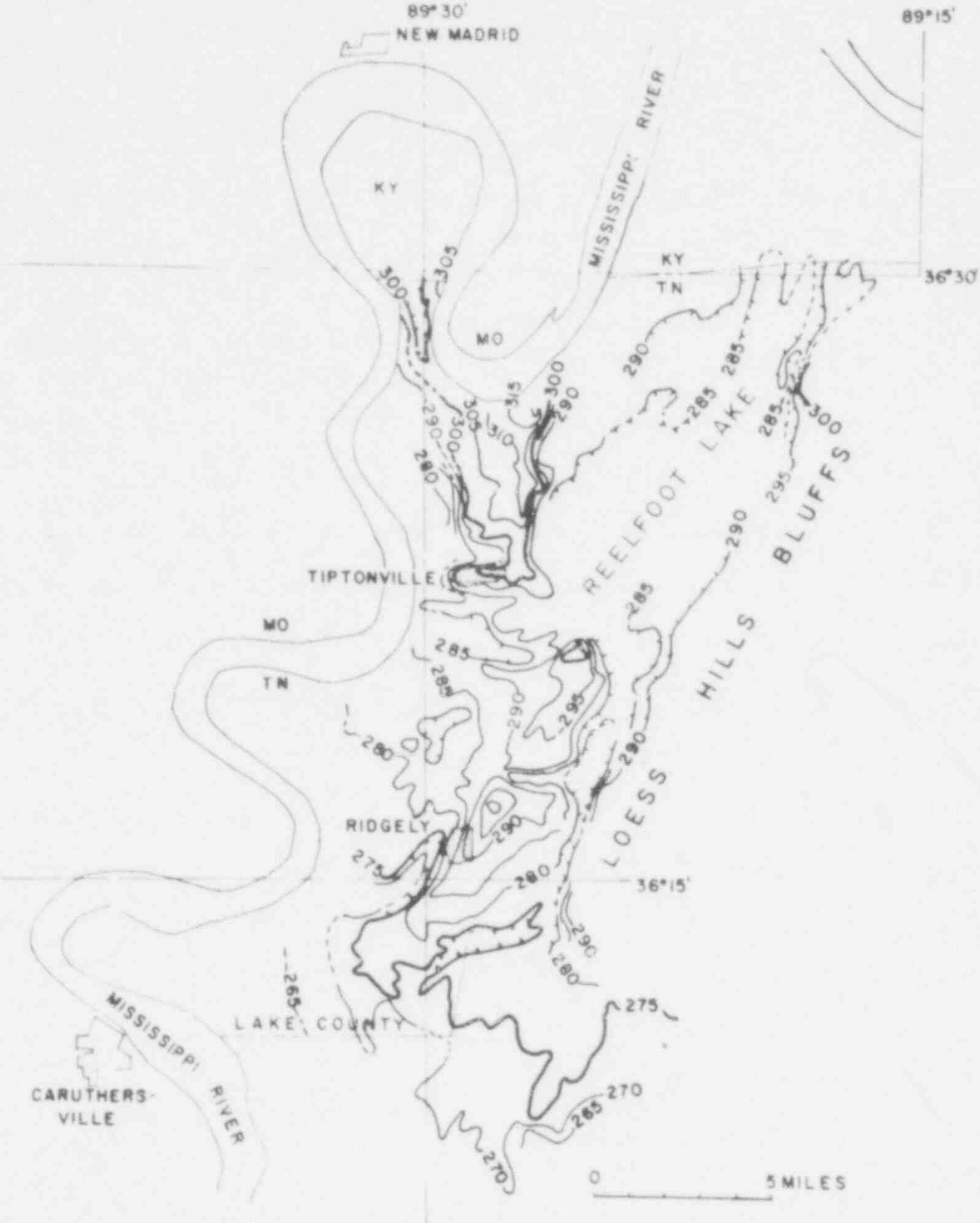

Figure 6- Elevation of the areas shown on Figure 5 to be underlain by older soils.

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TABLE 1

SOILS IN THE STUDY AREA THAT ARE DESCRIBED[1] AS HAVING A "B" HORIZON. THESE UNDERLIE THE STIPPLED AREA ON FIGURE 5 IN DYER, LAKE AND OBION COUNTIES, TENNESSEE

Series Name	Which County or Counties	Comment
Alligator[2]	Dyer County	Not mapped in Lake or Obion Cos.
Bosket[2]	Dyer County	Not mapped in Lake or Obion Cos.
Commerce	Obion County	In Lake and Dyer Cos. this soil is mapped, but is there described as having no "B" horizon
Dubbs[2]	Dyer County	Not mapped in Lake or Obion Cos.
Dundee[2]	Dyer Co.	Not mapped in Lake or Obion Cos.
Forestdale	Dyer and Obion Cos.	Not mapped in Lake County
Iberia	Lake and Obion Cos.	Not mapped in Dyer County
Reelfoot	Lake and Obion Cos.	Not mapped in Dyer County
Sharkey	Obion County	In Lake and Dyer Cos. this soil is mapped, but is there described as having no "B" horizon
Tiptonville	Lake and Obion Cos.	Not mapped in Dyer County
Worthen	Lake and Obion Cos.	Not mapped in Dyer County

[1] Brown and others, 1965, 1969, 1973.

[2] Dyer County was mapped and published first, so some soils mapped there are probably similar to those given other names later in Lake and Obion Counties.

TOPOGRAPHIC ENVELOPES

General

An envelope is a device useful to generalize topography and restore local eroded areas by graphically filling in depressions. Because relief is so low on most of the alluvial plain, envelopes, though they represent considerable straightening of contour lines, either touch or stay within a couple of feet of the land surface. Stearns (1967) used such envelopes to describe the dissected Western Highland Rim plateau surface in Tennessee and readers are referred to that paper for a detailed description of the method.

The use of envelopes is preferable to some averaging technique, precisely because envelopes emphasize high points. In this study the method served best to partially restore eroded topographic highs near the river. The shape of the land surface as generalized by envelopes will be examined for patterns of vertical movement.

Detailed Topographic Envelope (Figure 7)

Figure 7 is a contour map of an envelope closely approximating the topography. It touches the ground at points no more than 2000 feet apart, and generally closer than 2000 feet apart. The topographic highs already described are well displayed together with some curious trends west of the Mississippi River where the ground surface is nearly flat. The 280-foot contour line though having small deflections, makes a distinct "Z" with its base extending roughly from Portageville, Missouri southeastward; its diagonal runs north northeast from Portageville about 14 miles toward the west edge of Sikeston Ridge where it turns west parallel to the base. This trend appears to be anomalous, it would be expected that 5-foot contours would trend westward, as do the 50-foot contours on AMS 1:250,000 maps (e.g. on the Dyersburg 2 degree sheet, north of the area shown on Figure 2, the 300-foot line trends west 25 miles from East Prairie to Dexter). The feature defined by the "Z" contour configuration will be referred to below as the "Portageville Bulge."

Generalized Topographic Envelope (Figure 8)

Figure 8 is a more generalized topographic map. (The part of the map to the north and west, not on Figure 7, was made from 15-minute topographic maps rather than the 7 1/2-minute maps used for Figure 7.) This map is also an envelope, but is more generalized as it touches the ground at points spaced 1.5 miles

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Figure 7- Detailed Configuration of the alluvial plain of the Mississippi River in the Study Area (in the east part of the Eastern Lowlands). This is an envelope over the surface that touches every 2000 feet of closer. Arrows are put on the 280 foot contour line to show its "Z" shaped trend.

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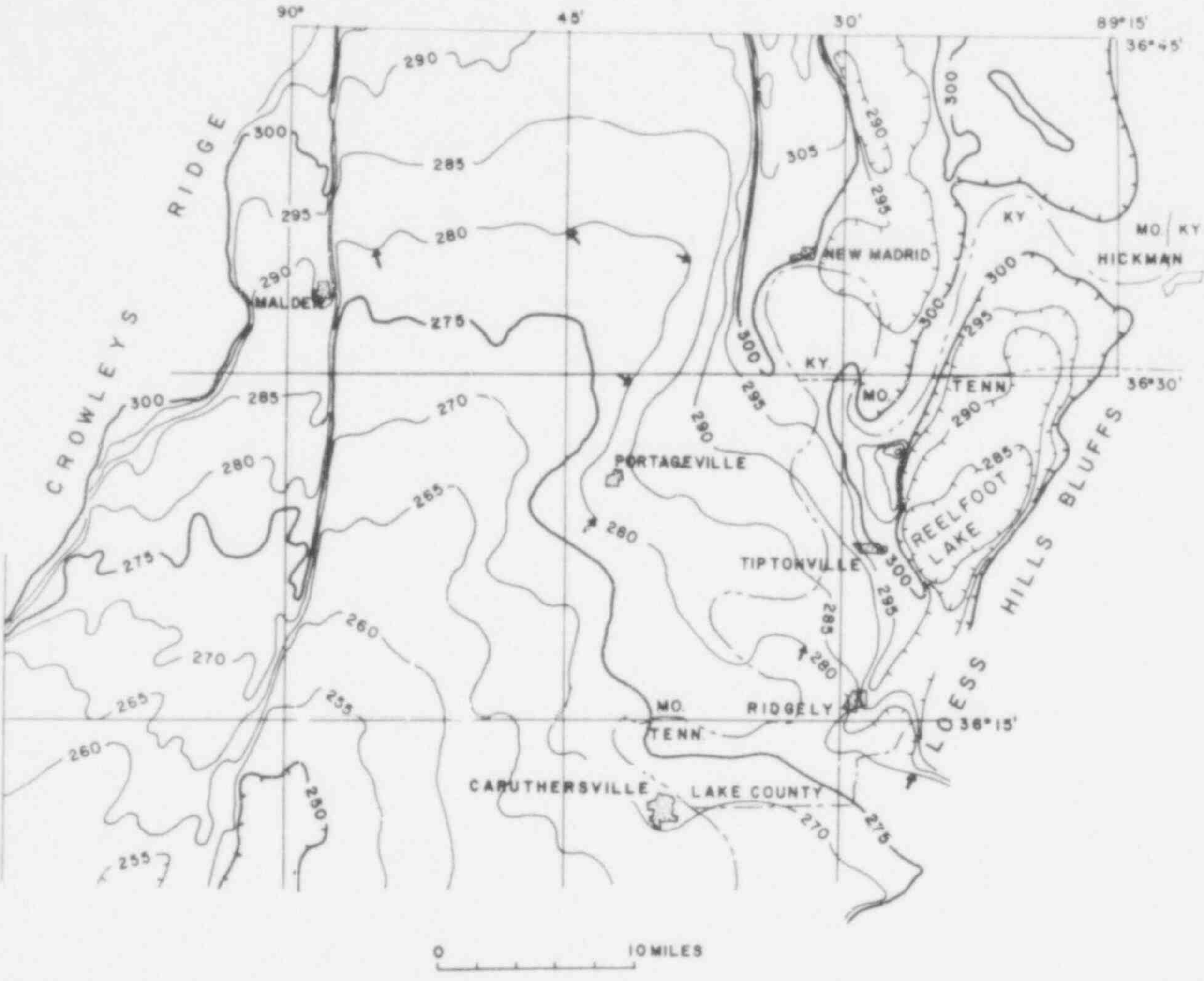

Figure 8- Generalized configuration of the entire width of the Eastern Lowland. The alluvial plain of the Mississippi River. This map is an envelope on the surface that touches every mile and a half or closer. The spacing permits contour lines to "jump across" the Mississippi River. Arrows are put on the 280 foot contour line in the same position as those on Figure 7.

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apart or closer, generally closer. The features seen on Figure 7 are apparent here, too. The "Z" shape mentioned for the 280-contour line on Figure 7 occurs on Figure 8 for all contours from 275 to 290 feet. This pattern extends westward for 8 to 16 miles to the scarp at the edge of the Malden Plain. The set of east-west-trending contours just east of Malden scarp will be used as an arbitrary datum for comparison. This lower ground includes areas said by Fuller to have been "sunk," in 1811-12 but the sinking was disputed by Saucier (1970). Saucier's conclusion is arbitrarily accepted to permit a quantitative basis for comparison.

The eastern part of Missouri on Figure 8 displays a distinct rectangular southwestward-trending gentle "bulge" of the alluvial plain. Its west edge is shown by the diagonals of the "Z" contours bearing about south 40 degrees west from near Lilbourn (at the west edge of Sikeston Ridge) a distance of some 12 miles (as measured from the 280-foot contour line bend). This squarish bulge (Portageville Bulge) is believed by the writer (in accordance with the general conclusions of McGee and Fuller) to be the western and southern fringe of the Lake County Uplift, which is less uplifted (roughly 10 feet) compared with the land farther west below the Malden scarp.

MODERN EROSION OF THE TOPOGRAPHIC HIGHS

Fisk (1944, Plate 22) has presented historic river courses back to 1765 as well as more ancient ones. Using only the combined belt of the historic courses (Figure 9) we can see where the topographic highs could have been much eroded. Figure 10 shows that the north edge of Tiptonville Dome and east edge of Bessie Ridge could have been connected in 1765 with about 6 square miles of high ground that has since been eroded. The east side of Lewis Prairie has been eroded back two miles or so by the river since 1765, opening an original smaller gap to the present 2 miles between Washpan Ridge and Lewis Prairie.

Figure 10 suggests a probable chain of topographic highs from Sikeston Ridge in Missouri, 25 airline miles, to Ridgely in Tennessee with erosion partially restored so that gaps between them are a mile or less. This could have been the situation in 1812 immediately after the earthquake.

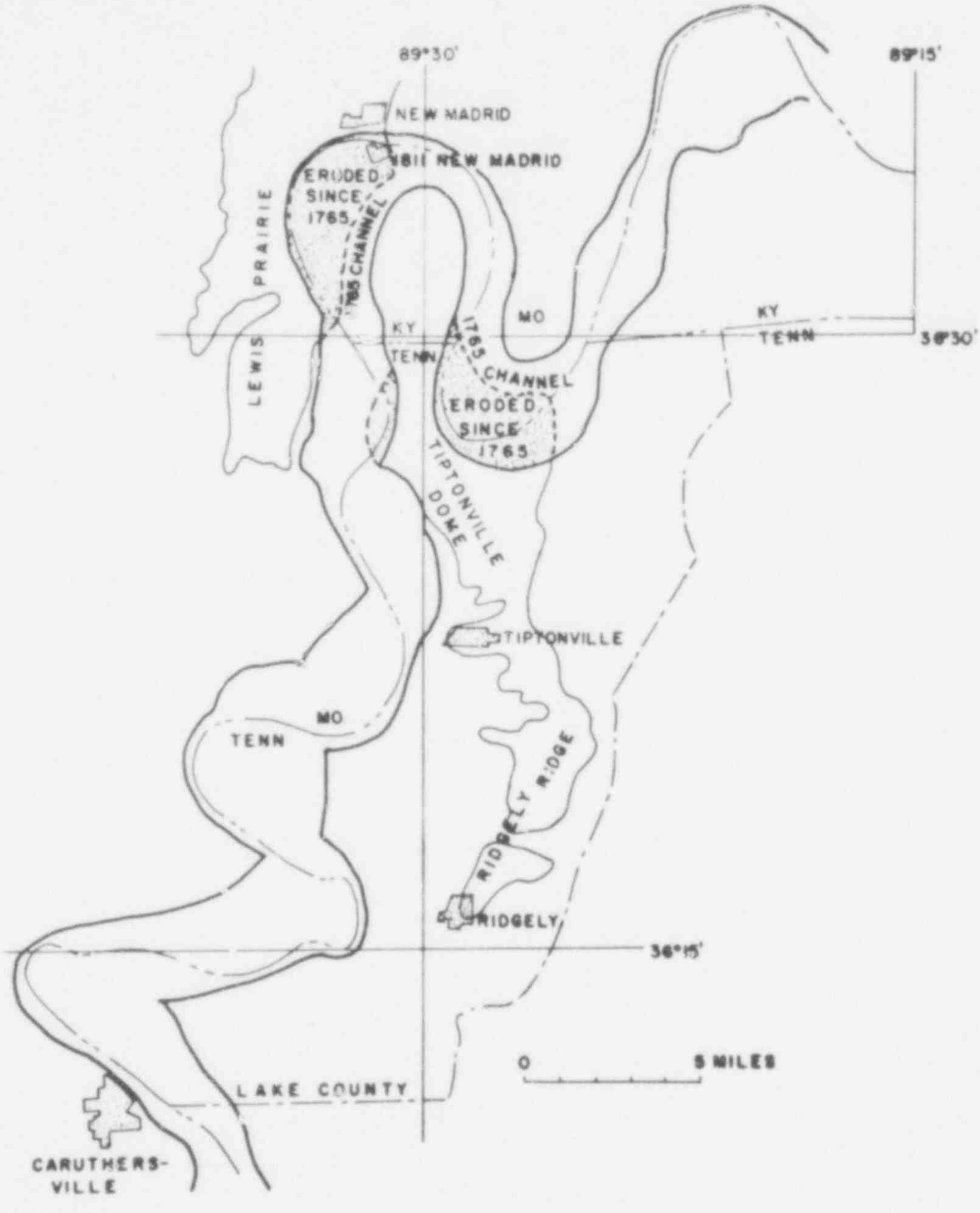

Figure 9- Area occupied by channels of the Mississippi River since 1765, and the areas where lateral erosion has likely destroyed part of the Tiptonville Dome and Lewis Prairie.

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Figure 10- The flood islands as they may have been in 1812 (restored for likely post-1765 lateral river erosion). Dashed lines show estimated extensions.

RELATION TO DEEPER STRUCTURE

Evidence from Gravity Anomaly Data

A gravity survey with about a 1-mile spacing of stations, and about 0.2 milligal or better accuracy has been made of the Tiptonville Dome, Ridgely Ridge, and Reelfoot Lake areas in Tennessee (Figure 11). Tiptonville Dome and Ridgely Ridge are on or near the crest of a north-trending elongated positive Bouguer gravity anomaly. The sources for such an anomaly are likely to occur only below the Cretaceous, at least 3000 feet deep and perhaps at earthquake focal depth. This relationship supports the conclusion that topographic features in Tennessee are deep seated structures. They are therefore not some discordant surface effect such as wrinkling during lateral shift of soft surficial deposits (as suggested by Fuller, 1912), or catastrophic local compaction of soft clays (as suggested by Glenn, 1933, for the Reelfoot Lake sunk area).

Evidence from Earthquake Epicenters

Comparison of earthquake epicenters (Figure 12) with the pattern of uplifts as proposed herein shows that the south end of Ridgely Ridge in Tennessee and Lewis Prairie Ridge in Missouri have many epicenters. This is a partial coincidence, because fewer earthquakes do occur on other similar features; for example only two occurred under the Tiptonville Dome, and only two have occurred near Washpan Ridge.

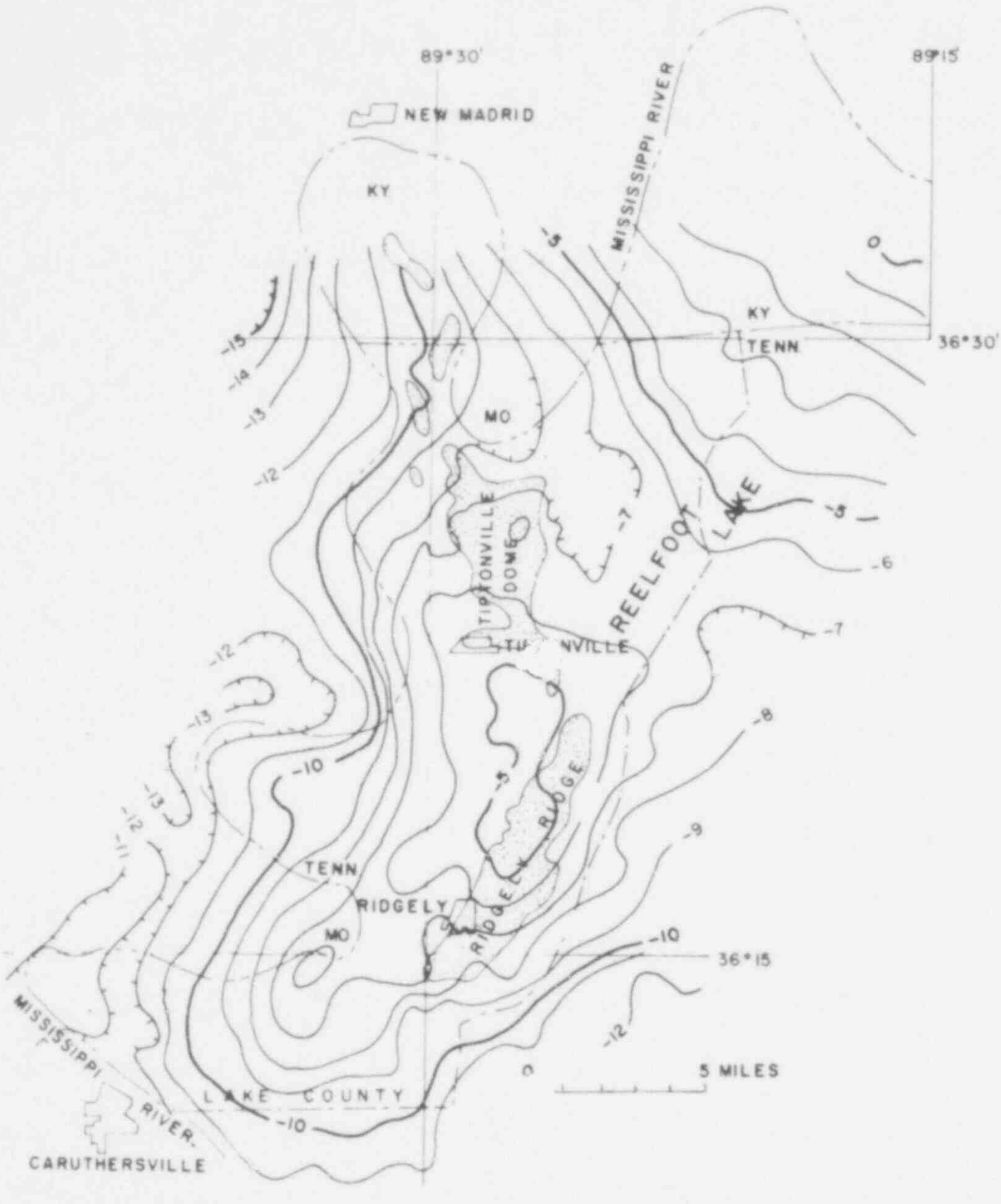

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Figure 11- Bouguer gravity anomaly map of the Tiptonville Dome, Ridgely Ridge and Reelfoot Lake area. Control (not shown) consists of about 800 observation points. The flood islands are shown by the stippled pattern.

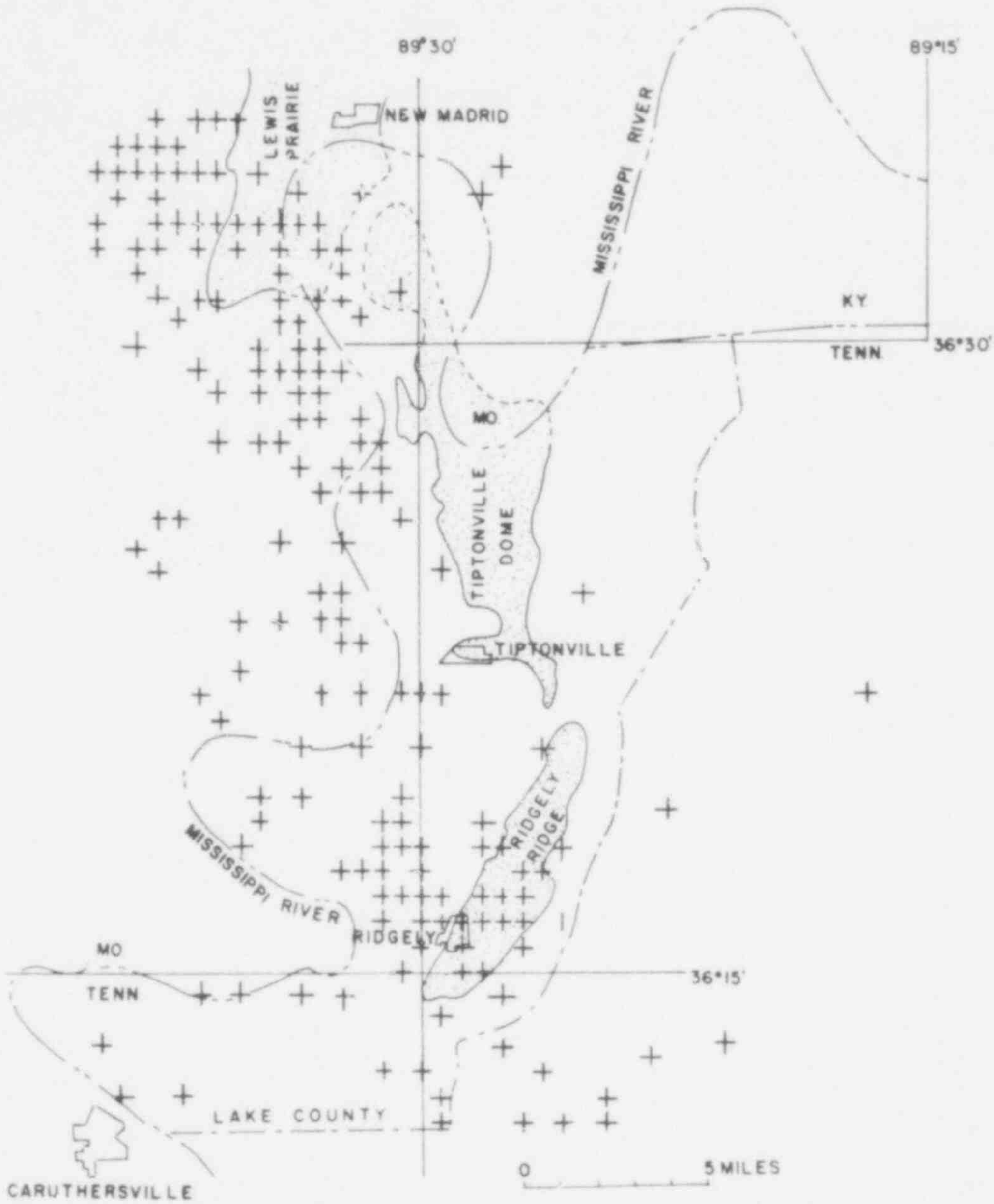

Figure 12- Earthquake epicenters in Lake County Tennessee, and vicinity June 30, 1974 to Jun. 30, 1977 (from Stauder and others Southeast Missouri Regional Seismic Network Quarterly Bulletins). Earthquakes south or west of Caruthersville or north of New Madrid are not shown. Flood islands are shown by the stippled pattern.

Earthquake locations suggest that the south edge of the uplift is a zone of recent movement. A line of earthquakes trending from near Dyersburg through Miston and northwestward across the Mississippi River toward Portageville is precisely on the trend of the 280-foot contour line (which topographically defines the trend of the south relatively straight edge of the Lake County Uplift. Continuous microearthquake activity suggests that uplift may occur gradually, and that only part of it may have been accomplished during major earthquakes.

CONCLUSIONS

Tiptonville Dome, a topographic high long recognized as a tectonic uplift, is seen to be part of a 20- to 25-mile long series of topographic highs. This series of topographic highs extends northward from Ridgely Ridge in southern Lake County, Tennessee, into Missouri at Lewis Prairie, a southwest tip of Sikeston Ridge. Though now separated by a gap of nearly 3 miles near New Madrid, in 1765 the topographic highs probably were nearly continuous, separated by gaps of only about a mile. Rectangular trends of contour lines in Missouri and southern Lake County, Tennessee define a squarish slightly high area, called the Portageville bulge. This feature could well be tectonic and raised with the ridges. The bulge, together with the ridges, are collectively classified as the Lake County Uplift of McGee (1892).

The ridges in Tennessee coincide with positive gravity anomalies. Thus, these topographic features in Tennessee are surface manifestations of deep seated tectonic movements. Because small earthquake epicenters are abundant on parts of the uplifts and in the vicinity of uplift boundaries, the uplift may be a continuous phenomenon, only part of which occurred during major earthquakes such as the 1811-12 series.

TABLE 2

FEATURE	HOW DEFINED AND MAPPED	LIKELY ORIGIN(S)	APPROX. VERTICAL MOVEMENT ESTIMATES		BASIS FOR ESTIMATE
RIDGELY RIDGE	Flood Island Topographic	Tectonic Uplift may be nearly original shape	UP 20-25 Ft. (6 to 8 m)*	from	Reelfoot Lake*
			UP 5-15 . (2 to 5 m)	from	Miss. River flood*
TIPTONVILLE DOME	Flood island Topographic	Tectonic Uplift now carved on N & W side by lateral river erosion	UP 15 Feet (5 m.)	from	Uplifted stream profiles (Fisk's (1944) estimate (relative to flood level)
			UP 35-40 Ft. (11 to 12 m)	from	Reelfoot Lake (elev. 283)
			UP 10-20 Ft. (3 to 6 m)	from	Miss. River flood
BESSIE RIDGE and WASHPAN RIDGE	A chain of flood islands Topographic	Tectonic Uplift maybe mostly destroyed by lateral erosion	UP 15-20 Ft. (5 to 6 m)	from	Reelfoot Lake
			UP 2-10 Ft. (1 to 3 m)	from	Miss. River flood
LEWIS PRAIRIE	A flood Island	Possibly a lesser tectonic uplift maybe 1/3 destroyed by lateral river erosion	UP 5 Ft. (2 m)	from	Reelfoot Lake
			UP 5 Ft. (2 m)	from	Miss. River flood
REELFOOT LAKE BASIN	Low wetland & adjacent low area Topographic	Tectonically sunk or left behind as adjacent land was uplifted farther. Maybe nearly original shape	DOWN 2 to 10 Ft. (1 to 3m)	below	present lake water level, Fuller's (1912) estimate
			DOWN 25 Ft. (8 m)		Offset from Drilling, Fisk's (1944) estimate. (rel. to flood & strata on Tiptonville Dome, see above)

TABLE 2 (Cont'd)

FEATURE	HOW DEFINED AND MAPPED	LIKELY ORIGIN(S)	APPROX. VERTICAL MOVEMENT ESTIMATES		BASIS FOR ESTIMATE
PORTAGEVILLE BULGE	Topographic squarish shape anomaly	Tectonic uplift & maybe partly a constructional feature deposited by Mississippi River Maybe nearly original shape	UP "only a few feet" in 1811-12 along river on Tennessee side, and enough to dry up Portage Bayou in Missouri	from from	Usher (1837) account Lyell (1846)
			UP 0-5 Ft. (0-2 m)	from	Reelfoot* Lake

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*Estimates of uplift relative to Reelfoot Lake are the preferred estimates. They come from comparing contours on Figure 8 with elevation 283, the spillway level of Reelfoot Lake. If it is desired to estimate uplift relative to the pre-1811 small slough at Reelfoot Lake, add 2-10 feet (1-3 m) to uplift estimates.

Uplift relative to a flood datum comes from contours on Figure 5.

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16. ABSTRACT (200 words or less) Tiptonville Dome, an established tectonic uplift, is one in a 20 mile series of en echelon topographic highs, most or all of which are uplifts. These features are too high to have been flooded during the largest historic floods. During these floods they were temporary islands. From Lewis prairie, at New Madrid in Missouri, five such topographically high areas extend southward across the Mississippi River to Ridgeley, Tennessee. Although separated now due to modern erosion, they were nearly continuous in 1811. Contour trends reveal q squarish topographic bulge west of the "flood islands", the western corner of which is near Portageville, Missouri. It may have been upliftedwith, but less than, the "flood islands." This bulge and the topographic highs comprise the Lake County Uplift.

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