Physiography of St. Clair County, Illinois

John H. Sandy
Southern Illinois University Edwardsville

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PHYSIOGRAPHY OF ST. CLAIR COUNTY, ILLINOIS

by

John H. Sandy

B.A. Geography

St. Cloud State College

A Research Paper Submitted in Partial Fulfllment of the Requirements for the Master of Science Degree

Faculty of Earth Sciences
in the Graduate School
Southern Illinois University
Edwardsville Campus
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CHAPTER I

INTRODUCTION

Purpose

The objectives of this paper are twofold: (1) to investigate the evolution of the present landscape by inquiring into the major events of geologic history, and (2) to investigate the general configuration of the landscape and thereby establish the existence of more or less homogeneous landform regions.

(1) What are the characteristic topographic elements that give each landform region its individuality?

(4) What are the factors that account for the physiographic uniformity observed? This question is answered in a general way, throughout the paper.

Statement of Problems

Accomplishment of the objectives set forth requires that several problems be examined. These problems may be enumerated as follows:

(1) What are the geologic elements that have determined the development of the present landforms?

(2) In recognition of the areal variability of geologic phenomena, what distinctive areas
of homogeneous topography can be discerned? Do these areas exhibit sufficient uniformity of landforms to be classified as landform regions?

(3) What are the characteristic topographic elements that give each landform region its individuality?

(4) What are the factors that account for the physiographic variability observed? This question is answered, in a general way, throughout the paper.

**Methodology**

**General Method**

As a basis for dividing the county into landform regions, topographic maps at a scale of 1:24000 are analyzed to determine areas of uniform topographic expression, using local relief, slope, altitude, and type of landforms as criteria. Although the evaluation of these criteria is essentially subjective, the classification of physiographic regions is easily accomplished, for the topography in different areas of the county exhibits strong contrast.

Once the landform regions are delimited, a genetic-empirical-graphic approach is employed to describe the characteristic topographical elements in each region; the findings of geomorphology and topographic map analyses are used to
define those elements that give variability to the landscape.

A summary of the characteristics to be studied is as follows:

1. Drainage pattern
2. Valley development
3. Degree of dissection
4. Extent of interstream areas
5. Local relief
6. Mean slope
7. Nature of surface (rolling, flat, etc.)
8. Other notable characteristics

In explanation of the landforms, five factors that figure strongly in causing topographic contrast are examined. These factors include (1) character of the bedrock, (2) differences of glacial deposits, character and morphology, (3) degree of bedrock control of topography, (4) effect of valley aggradation, and (5) available relief. The importance of each factor or combination of factors, whichever the case may be, is determined by a careful study of geomorphic relationships, based on established geologic facts and field observations.

**Research Techniques**

In regard to research techniques, heavy reliance is placed on earlier investigations, map analyses, well logs, and field observations.

**Library research**

Preliminary research for this paper involved a
survey of relevant literature, mostly publications of the Illinois and United States Geological Surveys. General reference works including Principles of Geomorphology by W. D. Thornbury and The Encyclopedia of Geomorphology by Rhodes W. Fairbridge et al. are valuable aids in the descriptive aspect of this paper. For quantitative methods, this paper is dependent on material published in the American Journal of Science by C. K. Wentworth.

Map use and data collection

Local relief is calculated by measuring the difference between the highest and lowest points of elevation in a one-mile-square area. To collect this data, a procedure of systematic sampling is used. After dividing each region into one-mile-square areas, 10 percent of the areas are selected for measurement. In the case of very small regions, data is collected from at least two areas. A table of random numbers is used to ensure an unbiased sample.

Applying Wentworth's technique, mean slope is calculated as follows:

1. A north-south, east-west grid, containing three lines each way, is placed on the topographic map.
2. The number of contour crossings (tangency contacts are counted as one) for each line is counted.
(3) As a final step "average the results and divide the product of the contour crossings per mile and the contour interval in feet by the constant 3361 (5280 times mean value of sin $\theta$). The result will be the average slope, i.e., the tangent of the average angle of declivity."^1

For presentation purposes, this result is converted to degrees of slope.

Local relief is calculated by measuring the difference between the highest and lowest points of elevation in each of the one-mile-square areas under consideration.

Topographic maps are further used as a primary source of qualitative-descriptive data. In this case, information is collected by visual inspection and direct measurement.

Geologic maps. Geologic maps, prepared by the Illinois and United States Geologic Surveys, provide information on areal geology, geologic structure, and paleo-landscapes.

Well logs. In many cases the relationship between the bedrock topography and the overlying drift is difficult to determine from geologic map interpretation alone. In order to resolve this problem, numerous well logs are evaluated to determine thickness of surficial deposits. This procedure does not completely resolve the complexities involved, but it does make clear the relative influence of
each on the present topography.

Field observations. Field observations are an important part of this study for verification of physiographic relations, as shown on topographic and geologic maps. In addition, precise delineation of boundaries between the various regions is finalized by many checks in the field.

Related Studies

Much of the information contained in this paper is drawn from earlier studies, completed by the Illinois and United States Geologic Surveys. Four of these studies, which include all or parts of St. Clair County, are of particular significance, as they emphasize physiography. One of the earliest studies entitled Physiography of the St. Louis Area (1909) by N. M. Fenneman provides an excellent survey of the northwestern section of the county. A second study, Physiography of Eastern United States (1938), also by N. M. Fenneman, delimits the broad regional framework of which St. Clair County is a part. A paper, Physiographic Divisions of the Area Covered by the Illinois Drift Sheet in Southern Illinois (1929) by Paul MacClintock, is another important source, as it identifies the subtle differences in the topography of forty southern Illinois counties, including St. Clair County. Singularly the most important study, in regard to physiographic setting, is a paper entitled Physiographic Divisions of Illinois (1948) by
M. M. Leighton, et al. It represents a refinement of Fenneman's earlier classification, and is the basis for the present physiographic subdivisions of Illinois and St. Clair County. Other useful data is contained in two USGS geologic folios (Belleville-Breese, No. 195 and New Athens-Okawville, No. 213) which discuss the physiography of those areas of the county.

Limitations

The classification of landforms as outlined in this paper is somewhat artificial, inasmuch as the designated landform regions are valid only in the context of the criteria by which they are defined. With the use of other criteria, it is probable that an entirely different classification could be devised. Moreover, because natural phenomena are, for the most part, gradational, the boundaries between the various regions are arbitrarily drawn.

A second limitation concerns the omission of man as a factor of geomorphic control. While acknowledging that human activities have clearly altered the surface configuration in some areas, especially where strip mining has scarred the land, the scope of this paper dictates consideration of only natural phenomena. Finally, it is not within the scope of this paper to propose new theories, regarding the genesis of the various landforms.
CHAPTER II

GENERAL GEOGRAPHY

Location

St. Clair County is located in southwestern Illinois. It is bounded on the north by Madison County, on the east by Clinton and Washington counties, on the south by Randolph and Monroe Counties, and on the west by the Mississippi River. It encompasses 640 square miles, nearly all of which is land surface. The city of Belleville, near the center of the county, has a location of 38°31' north latitude and 89°59' west longitude.

Regional Physiographic Relations

St. Clair County is recognized to lie within three physiographic divisions: the Springfield Plain, the Mount Vernon Hill Country, and the Salem Plateau (Figure 1). On a larger scale, the Springfield Plain and the Mount Vernon Hill Country are part of the Till Plains Section of the Central Lowland Province, and the Salem Plateau is part of the Ozark Plateaus Province.
Figure 1 Physiographic Divisions of Illinois.
(After Ekblaw et al., 1948)
Springfield Plain

The Springfield Plain encompasses an area in central and south-central Illinois, where the Illinoian drift forms a nearly level surface. With the exception of major valleys and uplands, the bedrock topography is buried beneath a moderately thick mantle of drift. Topographic evidence of glaciation is negligible, however, as morainic features are poorly developed. The only notable constructional features are found in the western part of the region, where two terminal moraines (deposits of the Jacksonville and Buffalo Hart Substages) and a belt of ridged drift break the monotony of the otherwise flat till plain.²

Post-glacial erosion of the drift surface has caused the development of a complete drainage system throughout the region. Major streams have low gradients, broad shallow valleys, and alluvial terraces, while secondary tributaries have wide, V-shaped valleys. Smaller streams exhibit low gradients and wide, shallow valleys.³

Mount Vernon Hill Country

The second division, the Mount Vernon Hill Country, lies south of the Springfield Plain and beyond the area of thick Illinoian drift. Because the drift is thin, the present surface is strongly influenced by the pre-glacial bedrock topography, which is in a mature stage of dissection. Wide alluvial valleys, limited uplands, low relief,
and moderate slopes are the characteristic topographic elements of this region. The drainage system is well developed.

Salem Plateau

Although most of the Salem Plateau is located in Missouri, two small segments can be found in Illinois. Both of these segments are developed on maturely dissected cuestas, which flank the Ozark dome. The segment to be discussed in this paper lies on the back slope of the Meramec-Osage cuesta.

Weather and Climate

Under the Köppen system of climatic classification, St. Clair County has a humid subtropical climate (Cfa). This climate is characterized by long, hot summers and brisk to cold winters. Daily temperatures in the summer average in the high 70's, whereas in winter temperatures average in the lower and middle 30's. Diurnal temperature fluctuations provide additional contrast, especially in autumn.

Rainfall is well distributed throughout the year. A summary of local climatic data collected at Scott AFB by the United States Weather Bureau is as follows:

Temperature

The monthly temperatures show a seasonal pattern, with winter and summer temperatures being relatively uniform
and spring and autumn temperatures being quite variable. In winter (December, January, and February) mean monthly temperatures depart a maximum of only 2.7° F. from the mean seasonal temperature of 35° F. Similarly, in the summer months (June, July, and August) mean monthly temperatures depart a maximum of only 1.8° F. from a mean seasonal temperature of 77.4° F.

The variability of spring (April, May, and June) temperatures is shown by a maximum mean monthly departure of 12.5° F. from the mean seasonal temperature of 54.7° F. During the autumn (September, October, and November), the contrast is even greater, as mean monthly temperatures depart a maximum of 13.6° F. from the mean seasonal temperature of 57.4° F.

As can be expected, daily temperatures show a similar pattern. The difference between mean daily maximums and mean daily minimums is low for the summer and winter months and high for the spring and autumn months.

Precipitation

As noted, precipitation is evenly distributed throughout the year, but more precipitation is received in the spring and summer months than in the autumn and winter months. Seasonal averages show 10.74 inches in spring, 11.13 inches in summer, 8.31 inches in autumn, and 6.50 inches in winter. January is the driest month with an average of 1.76 inches, while June is the wettest month.
with an average of 4.74 inches. The average annual precipitation is 36.68 inches. Most of this precipitation occurs as rain, but snow, which seldom remains on the ground for more than a few days, is common, averaging 15.4 inches per year.

**Topography**

St. Clair County is characterized by low altitude, slight relief, and gentle slopes; nevertheless a wide variety of landforms make the topography quite diverse. Morainic hills, floodplains, drift plains, and karst features are only a part of the kaleidoscopic landscape. The contrast is heightened by the close proximity of the various landforms and by abrupt transition between them. A detailed description of the landforms is presented in Chapter V.

**Altitude**

Elevations throughout the county are low, ranging from 380 feet along the Kaskaskia Valley to over 700 feet near Rodemich in the southwestern part of the county (Figure 2). The highest elevations are found on the upland, which forms a broad plain, orientated north-south across the central part of the county. Sloping gently eastward, the upland plain decreases in elevation from 600 feet at French Village to 550 feet at O'Fallon, from over 690 feet on the bluffs near Dupo to 500 feet at a point south of Belleville, and from 623 feet at Bohleysville to 480 feet south of Freeburg.
A noticeable departure from this general trend is evident along the eastern portion of the upland, where a few morainic hills rise to over 650 feet in altitude. The lowest elevations can be found to the east and west of the upland in the Mississippi, Kaskaskia, and Silver Creek lowlands, where typical elevations are 405 feet, 385 feet, and 430 feet.
Relief

Local relief varies widely over the county, although it seldom exceeds 200 feet. The principal areas of strong local relief are located near the western and eastern margins of the upland, adjacent to the major lowlands. Here, the rather abrupt change in elevation has effected the deep incisement of valleys, as streams erode headward. Exemplifying this situation, the bluffs commonly have a local relief of over 150 feet. At the eastern margin of the upland, local relief is accentuated by morainic hills that rise over 100 feet above the upland surface. Another area of strong local relief, located in the southwestern part of the county, is attributable to numerous sinkholes and the Dupont fold, which forms a steep scarp. A local relief of 150 feet is ordinary for this region. In contrast to the above locations, the lowlands are essentially flat, without pronounced differences in elevation.

Accordingly, this section summarizes the geologic history of this area.

Pre-Cambrian

Because of the great age of the Precambrian rocks and because they are buried beneath more than 3,800 feet of Paleozoic rocks, little is known of their history. Limited
CHAPTER III

GEOLOGY

Geologic History

The configuration of the present landscape is chiefly the result of geologic processes that have operated over the last million years. The agents of erosion and deposition, of which wind, water, and ice are the most important, have transformed the ancient bedrock surface and shaped the present landforms. Nevertheless, the geologic events of the ancient past are not without significance, for they have provided the bedrock deposits and structural framework that have, in numerous ways, influenced more recent events. Accordingly, this section summarizes the geologic history of this area.

Pre-Cambrian

Because of the great age of the Precambrian rocks and because they are buried beneath more than 3,800 feet of Paleozoic rocks, little is known of their history. Limited
investigations indicate, however, that Precambrian time was marked by long periods of igneous activity, crustal movement, sedimentation, and erosion. The shales, on the other hand, represent fine-sized particles deposited in muddy, shallow seas.

Paleozoic Era

During the Paleozoic Era the area of St. Clair County, as well as much of Illinois, was intermittently submerged beneath epicontinental seas. Responding to continental tectonic activity and crustal movements in the nearby Ozark area, the seas alternately advanced and retreated over the area. This migration of the seas brought periods of marine deposition, followed by periods of erosion. These events are clearly recorded in some 3,800 feet of sedimentary rocks, mostly limestones, sandstones, and shales, which underlie the more recent Quaternary formations.

The earliest submergence is recorded in the late Cambrian rocks, which consist chiefly of sandstones and dolomites. During the Ordovician, Silurian, and Devonian periods the seas continued to advance and retreat, and to deposit additional layers of limestones and dolomites. Also, small amounts of shale and sandstone can be found in these early Paleozoic Systems.

Events of the Mississippian period are of particular significance, since rocks of this age form the bedrock surface of the western half of the "American Bottoms" and parts of the upland. At this time long periods of submergence permitted the accumulation of additional layers of
sediments, chiefly shales and thick beds of limestones. The pure limestones, which are commonly oolitic, indicate deposition in clear, shallow seas. The shales, on the other hand, represent fine-sized particles deposited in muddy, shallow seas.

The Pennsylvanian period is best known for its extensive coal deposits, which are found inter-bedded with limestones, sandstones, and shales of that age. Following periods of submergence, tropical conditions caused the formation of great beds of organic matter in extensive peat swamps. Intermittently, deposition of sediments buried the peat, resulting in compaction and the formation of coal.

Mesozoic and Tertiary

The time between the end of the Carboniferous period and the beginning of the Pleistocene represents a large unconformity, as the geologic record is either absent or indistinct. Uplift and deformation in post Pennsylvanian time caused the seas to withdraw for the final time, marking the end of deposition. Thus, throughout the Mesozoic and Tertiary, erosion acted continuously to reduce the land.

According to Horberg (1950) four distinct erosion cycles can be recognized in the bedrock surface of western Illinois. The earliest of these cycles, of late Tertiary time, is recorded in the Dodgeville peneplain of the Driftless area. Correlation with a similar surface (Buzzards
Point peneplain) in southern Illinois indicates that the Dodgeville peneplain may have extended southward across St. Clair County. Evidence for a second erosion cycle is more positive, as a well developed peneplain can be found in Calhoun County, some thirty-five miles to the northwest of St. Clair County. A third erosion cycle left an extensive truncated surface over much of central Illinois. A small segment of this surface, which is known as the central Illinois peneplain, occurs in the northern part of St. Clair County, where less resistant rocks of the Pennsylvanian Coal Measures have been truncated at an elevation of about 500 feet. A more recent erosion cycle is believed to have been initiated in late Pliocene time by widespread uplift. This surface, called the Havana strath, is recorded along the Kaskaskia bedrock valley at about 450 feet elevation. Subsequent uplift terminated this cycle before its completion, and caused further entrenchment of the ancient Kaskaskia River. Thus, the more recent erosion cycles are significant, inasmuch as they have shaped the general physiographic features of the county.

**Bedrock Topography**

As shown by the bedrock surface map (Figure 3), the shape of the land surface beneath the Quaternary deposits is relatively simple in outline. The outstanding physiographic features are a broad upland plain and two major bedrock valleys. Although essentially a horizontal surface,
The upland plain exhibits minor variations in elevation and slope. From the Madison-St. Clair County line south to Belleville, the surface is virtually level at an elevation of about 500 feet. In a direction southeast of Belleville it
slopes about five feet to the mile, until it reaches 450 feet in elevation at a point two miles south of Freeburg. Continuing southeast towards Lenzburg, the surface remains at 450 feet in elevation. A departure from the general pattern is shown by a comparatively sharp rise in elevation in an area southwest of Belleville. Here, the elevation increases to 600 feet.

West of the upland, in an area coincident with the present Mississippi floodplain, the preglacial Mississippi River has cut a major bedrock valley. The floor of the bedrock valley lies over 100 feet below the present valley surface, and some 300 feet below the upland. In regard to width, the valley has a transverse measurement of about nine miles at East St. Louis narrowing to four miles or less near Dupo. The valley wall along the bluffs is steep, whereas the valley bottom slopes gently towards the middle.

The second major bedrock valley, located east of the upland, represents the drainage channel of the ancient (and present) Kaskaskia River. Its bedrock floor lies more than 80 feet below the present valley bottom and 150 feet below the bedrock upland. The width of the inner channel averages two miles.

The Kaskaskia bedrock valley is joined from the north by two large tributary valleys, whose locations approximate the present Richland and Silver Creeks. The floor of the tributary bedrock valley beneath Silver Creek lies some 100 feet below the upland at a point near Scott
AFB. The second tributary bedrock valley attains its greatest depth beneath the lower course of Richland Creek, where the valley floor lies over 100 feet below the upland. Other smaller preglacial valleys join the Kaskaskia bedrock valley from the south, but are of less magnitude.

Bedrock Geology and Structure
The geologic map of Illinois shows that the bedrock of St. Clair County is Pennsylvanian and Mississippian in age. The Pennsylvanian strata, including the Bond, Modesto, Carbondale, Spoon, and Abbott formations, are the most important in terms of areal extent, for they occur over most of the county east of the bluffs. Defined lithologically, these units consist chiefly of limestones, sandstones, shales, and siltstones. In addition, coal is important in areas where the Carbondale formation outcrops.

The Mississippian strata, limited in their areal extent, form the bedrock surface of much of the "American Bottoms," the upland in the vicinity of Dupo, and localized areas in the south and southwestern parts of the county. Rocks of this age are included in the Chesterian and Valmeyeran series, and consist predominantly of limestones and dolomites, though small amounts of sandstone and shale are common.

Within the Valmeyeran series, the most important formation is the St. Louis limestone, for it gives rise to
the karst topography near Dupo. The remaining Valmeyeran rocks are of less consequence in terms of physiography, because they are deeply buried beneath alluvial sediments of the Mississippi Valley.

The structure of the bedrock is not complex; the formations are essentially horizontal, but for a gentle northeasterly dip and a few minor folds and faults. Most of these features are not expressed in the present surface configuration, however, since they are covered by drift. A notable exception is a prominent fold near Dupo in the southwestern part of the county (Figure 4). Here, bending of the sedimentary rocks has produced an asymmetrical anticline whose axis trends in a northwesterly direction. While the northeastern limb of the fold has a gentle dip of 4 to 5 degrees, the southwestern limb dips at 40 to 50 degrees. Topographically, this feature has produced an impressive monoclinal scarp, some 150 feet high.

An early geologic map of Illinois (1945) compiled by J. Marvin Weller shows a fault superimposed along the axis of the fold. But the most recent geologic map of Illinois (1967) does not indicate any major fault in this area. Although this study tends to confirm the map of 1967, further investigation is needed to determine whether faulting is associated with the scarp.
Figure 4 Diagrammatic cross section of Dupage monocline. This sketch is based on geologic map interpretation and field observations by Corr and Smith.
CHAPTER IV

GLACIATION AND ITS EFFECTS

To a large degree, the landforms of Illinois are a product of events that occurred during the Pleistocene epoch, when continental glaciers attained their fullest extent. After each maximum advance, the glacier melted back, leaving behind a thick mantle of glacial drift which acted to mask or bury the preglacial landscape. Beyond the margins of the retreating ice, deposition continued as pro-glacial streams carried vast quantities of fine sediment down major valleys. When wind velocities permitted, the fine sediment of these valley trains was deposited on nearby uplands as loess. The importance of all of these elements is vividly illustrated in St. Clair County, where at least two major glacial advances (Illinoian and Wisconsin) have played a role in shaping the landforms.

Pre-Illinoian Glaciation

Little is known about the pre-Illinoian glacial history of St. Clair County, since deposits of Nebraskan or...
Kansan age have not been positively identified. Yet, one can assume that till, outwash, and loess were deposited as these early glaciers retreated from Illinois.

**Illinoian Glaciation**

The only confirmed glacial advance into St. Clair County occurred during the Liman substage of the Illinoian glaciation, about 115,000 years ago. The mineralogical composition of tills of Liman age indicates that two glacial lobes entered this area. One lobe moved into western and central Illinois from the basin of Lake Michigan and a second lobe (Saginaw Lobe) moved into southern and east-central Illinois from the northeast, the two lobes being separated by an interlobate area of ridged drift. At its maximum advance, the glacier extended across the "American Bottoms" to St. Louis and as far south as Carbondale. With warming climatic conditions, the Illinoian glacier retreated a short distance, became stagnant, and melted down in place. The glacial history is recorded in an assortment of glacial deposits, which mantle the entire county.

**Glacial Deposits**

The glacial deposits of Illinoian age in St. Clair County vary considerably in their character, thickness, and distribution. In regard to character, two principal types of deposits can be identified, till and fluvioglacial...
deposits. The till, representing deposits laid down directly by the ice, consists of unsorted rock materials ranging in size from clay to large boulders, whereas the fluvioglacial deposits are stratified materials, deposited by meltwater flowing within the ice or issuing from its margin. In some cases, the meltwater materials have settled out in lakes to become glaciolacustrine deposits.

The thickness and distribution of these deposits, hereafter referred to as drift, varies according to the mode of deposition, differences in the bedrock topography, and the degree of removal by post-glacial erosion (Figure 5). In general, the drift reaches its greatest thickness in preglacial lowlands and valleys, and in areas where the ice formed constructional features. To illustrate, the drift acquires a thickness of over 100 feet in the Silver Creek and Kaskaskia bedrock valleys, in the eastern part of the county. And west of Silver Creek, the drift has also accumulated to a thickness of over 100 feet in some constructional features, believed to be crevasse fillings.

The drift thickness is 50 feet or less over most of the upland, however. In T. 1 S., R. 8 W., 59 percent of the well logs examined (a total of 67) show a drift thickness of 35 feet or less. The loess amounts to about twelve feet of the total drift thickness in this section. For many areas in the southern part of the county, thin drift is indicated by bedrock exposures high on valley walls.
Figure 5 For this map, drift refers to both Pleistocene and recent deposits. The dark areas show bedrock exposures. (After Bergstrom and Piskin, 1967)

Locally, streams have completely removed the drift, and exhumed the bedrock surface. In studying the accompanying drift thickness map, it is important to note that materials of Wisconsin age and recent alluviation are a part of the

Thickness of Drift

Scale
0 - 5 miles
total drift thickness.

**Wisconsin Glaciation**

During the Wisconsin glaciation (about 70,000 to 5,000 years before the present), the ice sheet did not advance as far south as St. Clair County. Nevertheless, surficial deposits in the form of outwash and loess record its advance into northeastern Illinois. Outwash from the melting ice overloaded the ancient Mississippi and Kaskaskia Rivers, whereupon their channels were aggraded. At the same time, action of the wind removed much of the fine sediment from the valley bottoms and deposited it on the upland as loess. Age determinations of the loess indicate that these events were episodic, occurring chiefly during the Altonian and Woodfordian substages, when the ice advanced into central Illinois. The extent of loess accumulation merits a discussion of its distribution.

**Distribution of Loess**

Detailed information on the thickness and distribution of loess is unavailable, still a reasonably accurate picture can be abstracted from a generalized map of loessial deposits in Illinois, prepared by G. H. Smith (Figure 6). A brief inspection of the map shows that the loess thickness varies with distance from the bluffs, where it reaches a maximum thickness of more than 300 inches. East of the bluffs, the thickness decreases from 150 to 300 inches at
As evidence of its aeolian origin, the loess attains its greatest thickness westmost to the widest part of the Mississippi floodplain. Conversely, as the floodplain narrows eastward, the thickness of the loess on the upland decreases. On the map, loess thickness also reflects depositional conditions and

Figure 6  The thickness and distribution of loess is shown on this map. The Mississippi and Kaskaskia floodplains are, for the most part, covered with reworked loess. (After Smith, 1942)

Belleville to about 100 to 150 inches at Mascoutah. And, in the southeastern part of the county, the loess thickness measures less than 75 inches.
As evidence of its aeolian origin, the loess attains its greatest thickness on the bluffs adjacent to the widest part of the Mississippi floodplain. Conversely, as the floodplain narrows south of Dupo, the thickness of the loess on the upland decreases. Although not shown on the map, loess thickness also varies locally, reflecting depositional conditions and post-glacial erosion.

**THE LANDFORMS**

The purpose of this chapter is to describe the landforms, show their distribution, and, in a general way, relate their development. To achieve this objective, the landforms are generalized into ten regions (Figure 7), based on the criteria set forth in Chapter I. A brief summary of each region is presented on page 60.

**Bluff Topography**

The bluffs, as described here, occupy the western margin of the upland, an area whose drainage flows west to the Mississippi Valley. Because of differences in topography, the bluffs can be divided into two sections—a northern section and a southern section. The northern section, mainly conditioned by thick loess, is characterized by steep slopes, and steep slopes. The major valleys extend, in a dendritic pattern, as much as 3-1/2 miles back into the upland, and because of the sharp break in elevation between the upland and the Mississippi
CHAPTER V

THE LANDFORMS

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Valley, have steep gradients. As a result, valley dimensions rapidly decrease upstream. For example, Schoenberger Valley has a width of 1,000 feet and a depth of 160 feet at the bluff line, while at a point three miles upstream, the corresponding figures are 200 feet and 80 feet. Similarly, the tributary valleys are deeply incised, though V-shaped. Both the master and tributary valleys have steep sides.
Figure 8 Representative terrain of Bluff Region—northern section. (USGS 7 1/2' topographic map, French Village, Ill.)
In addition to the larger valleys, numerous ravines head at the bluff line and extend from a few hundred to a few thousand feet back into the upland. The ravines, sharply incised in the face of the bluff, are V-shaped.

Since dissection is well advanced, the original upland is reduced to limited flat areas on the interfluves, which usually measure less than 600 feet across. A mean slope of 8.1 degrees and an average local relief of 132 feet are an indication of the hilly character of this section of the bluffs.

In contrast to the northern section, the southern section is chiefly conditioned by the bedrock surface, and in some areas, by glacial drift. Consequently, the topography differs in three important aspects: the valleys are more complex; the interfluves, although limited in area, are not as flat; and the surface is less rugged. The principal valleys are characteristically dendritic in pattern, but show very little similarity in size and shape. Partly eroded in drift and partly in bedrock, Prairie du Pont Valley changes in width from 1,000 feet along its lower course to 400 feet along its upper course. The valley walls, usually 50 to 60 feet high, are moderately steep with the exception of the right bank along the lower course. On the other hand, Hickman Valley has a width of 600 feet or less; yet, the valley sides, ranging from 60 to 110 feet in height, are higher and steeper than those of Prairie du Pont Valley.
Figure 9 Representative terrain of Bluff Region—southern section. (USGS 7 1/2' topographic map, French Village, Ill.)
Although hilly, the topography of the southern section is not as rough as the northern section. The local relief averages 91 feet. The mean slope at 5.6 degrees indicates relatively high dissection for this area.

**Upland Divide**

In this region, thick loess mantles the upland and forms an eastward sloping plain, which is slightly to moderately dissected. The drainage system, represented by the upper course of Richland Creek, is very complex in its development, as shown by the master valley with its extremely asymmetrical profile (a steep left bank and a gently sloping right bank) and its preponderance of right bank tributaries. In part, this situation is related to the locally steep eastward slope of the plain, as much as 50 feet to the mile at one point.

The western part of this region is coincident with the Mississippi-Kaskaskia drainage divide. Here, dissection is limited to a few headwater tributaries of streams that flow west to the Mississippi River and east to the Kaskaskia River.

Although not deeply incised, many valleys, including the master valley and several of its larger tributaries, are cut to bedrock. The headwater tributaries appear to be eroded in loess, however.

Because valley development and slope vary from area to area, the topography is not uniform. At the headwaters
Figure 10 Representative terrain of Upland Divide. (USGS 7 1/2' topographic map, O'Fallon, Ill.)
of Richland Creek and along the Mississippi-Kaskaskia drainage divide, the surface is flat to gently rolling. On the other hand, in areas of steep slope and maximum valley development, the surface is moderately rolling, as illustrated by the topography in the vicinity of Swansea. Overall, quantitative measurements show a mean slope of 2.0 degrees and an average local relief of 51 feet.

Millstadt Plain

In this region, the upland forms an extensive plain whose surface, in an early stage of dissection, gently slopes in an east-southeast direction. The plain is nearly flat, but for a few localized swells, which seldom rise more than a few feet above the general level of the surface. Hence, this region is distinguished by a well integrated system of valleys and broad interfluves (prairies).

The major valleys, dendritic in pattern, are incised some 50 feet, and have narrow, flat bottoms and moderately sloping walls. Typically, the valley bottoms are 400 feet wide, but in some places a width of 1,000 feet is attained. Variations in valley width appear to be related to the materials into which the valleys are cut. As illustrated by the West Fork of Richland Creek, the valley tends to narrow where cut into bedrock (sec. 6, T. 2 S., R. 8 W.) and widen where cut into drift (sec. 6, T. 2 S., R. 8 W.). The tributary valleys, incised some 30 to 40 feet, have narrow bottoms and gently sloping walls.
Figure 11 Representative terrain of Millstadt Plain. (USGS 7 1/2' topographic map, Millstadt, Ill.)
Although rolling near the major valleys, the topography can be best described as level. A mean slope of 3.3 degrees and an average local relief of 62 feet are, for the most part, related to valley development.

Over much of its extent, the plain closely corresponds to the bedrock surface, as the glacial drift is thin, less than 30 feet thick in most places. Accordingly, irregularities in the bedrock surface are reflected in the present surface. The increase in elevation at High Prairie, west of Smithton, indicates a rise in the bedrock surface, for example. Also, where cut into bedrock, the major valleys appear to follow preglacial drainage lines.

Freeburg Plain

This region is a nearly flat drift plain whose surface, locally interrupted by low morainic swells, is in an early stage of dissection. Yet, erosion has consumed much of the original surface and favored the development of a complete system of dendritic drainage. The master stream of the region (the lower course of Richland Creek) occupies a wide, flat-bottomed valley, which measures some 2,000 feet across. The valley walls, reduced by numerous tributaries and slope wash, are low and poorly defined. The tributary valleys are shallow, with narrow bottoms and gently sloping walls.

Inasmuch as most of the surface is dissected, the interstream areas are not extensive, typically less than
Figure 12 Representative terrain of Freeburg Plain.
(USGS 7 1/2' topographic map, Freeburg, Ill.)
2,000 feet wide. In the vicinity of Freeburg, however, the interstream areas form broad prairies.

With an average local relief of 51 feet and a mean slope of 1.9 degrees, the terrain is flat to gently rolling. Within this region, the valley floor of Richland Creek is probably the most extensive flat area, whereas the immediate, adjacent plain is the most rolling.

**Mascoutah Plain**

The topography of a large area in the eastern part of the county is that of a flat drift plain, which for the most part, is uneroded. The average local relief is low, measuring only 22 feet. The mean slope, more related to the general slope of the surface than valley development, is 0.6 degrees.

The valleys are inconspicuous, for they are widely spaced and poorly differentiated from the general level of the surface. In cross section, they seldom exceed a width of 600 feet and a depth of 20 feet. Many valleys, occupied by intermittent streams, are merely represented by shallow swales. The principal valley of the region, occupied by the lower course of Silver Creek, is somewhat of an exception, however, in that it has a wide floodplain, which commonly measures one mile across. Yet, the valley bottom lies only a few feet below the level of the adjacent plain.

Although interrupted by a few low morainic swells and an occasional hill or ridge, the interstream areas have
Figure 13 Representative terrain of Mascoutah Plain. (USGS 7 1/2' topographic map, Lebanon, Ill.)
a flattish appearance, similar to the original drift surface.

Shiloh Ridged Drift

The upland drift plain in this region is mantled with moderately thick loess, and forms a flat to irregular surface that slopes east to the Silver Creek lowland. The plain is quite diverse in its topography, however, as the surface is interrupted by well developed morainic features and a complex network of valleys.

Referred to as ridged drift, the morainic features consist of hills and ridges of varying size and morphology. The hills are usually small and elliptical, while the ridges, orientated in a general northeasterly direction, are larger and elongate. Occasionally, the ridges are massive, without describable shape. Representative features are a hill east of O'Fallon that has a diameter of about 1,000 feet and a height of 30 feet and a ridge north of Scott AFB that measures 5,000 feet in length, 2,400 feet in width and 70 feet in height. Two well known ridges, Shiloh Hill and Turkey Hill, are illustrative of the massive type of ridge. Shiloh Hill, spread over an area of more than five square miles, is an irregular shaped mass that rises more than 120 feet above the adjacent plain. The only semblance of definable form is a narrow spur that projects in a direction west-southwest from the center of the mass. Turkey Hill is even more impressive, as it covers some six square miles and rises over 130 feet above the adjacent upland. Like Shiloh
Figure 14 Representative terrain of Shiloh Ridged Drift (USGS 7 1/2' topographic maps, Collinsville and O'Fallon, Ill.)
Hill, Turkey Hill is essentially formless, but for two ill-defined limbs, projecting west and southwest from the central mass.

Although the genesis of these features is quite controversial, recent investigations tend to indicate that both the hills and the ridges represent glaciofluvial deposits, known in glacial terminology as moulin kames and crevasse fillings. Moreover, the location of many of these features on preglacial divides suggests some degree of bedrock control.

Because of the irregular nature of the surface, this region exhibits a very complex drainage pattern. For example, in its ground plan, the valley of Ogles Creek has a parabolic shape. Furthermore, most of the tributary streams enter the valley along its left bank, at right angles. Another valley, occupied by Engle Creek, is equally as complex, with a bifurcated channel. For both of these valleys, the headwater tributaries often have a peculiar fishhook pattern. At least in one case, at the headwaters of Ogles Creek, this phenomenon appears to be the result of stream piracy. Still other valleys, more accurately described as ravines, form a radial pattern as they diverge from ridges such as Shiloh Hill and Turkey Hill.

The major valleys, cut to bedrock, are as much as 80 feet deep, and have narrow bottoms and moderately steep walls. On the other hand, the smaller valleys, eroded in drift, have restricted bottoms and gently sloping walls. The ravines are deeply incised and V-shaped.
Because of the morainic features and the advanced stage of dissection, the region is rolling to hilly in its topography, though limited flat areas can be found in the interfluves. Quantitative measurements show an average local relief of 85 feet and a mean slope of 2.9 degrees.

**Lebanon Ridged Drift**

In this region, post-glacial erosion has not significantly modified a strongly developed morainic landscape. Thus the topography is distinguished by a multitude of hills and ridges (moulin kames and crevasse deposits), which are fresh in appearance. Drainage development is limited to a poorly integrated system of shallow valleys. With an average local relief of 110 feet and mean slope of 2.6 degrees, the region has a rolling to hilly surface configuration.

**Karst Topography**

The most prominent topographic form of this landform class is the sinkhole, a depression of variable size and morphology. The typical sinkhole is funnel-shaped, and measures 10 to 20 feet in depth and 100 to 200 feet in diameter at ground level. Although not as numerous, a few sinkholes are considerably larger, as much as 40 feet in depth and 1,000 feet in diameter. In many cases, these larger features contain two or more smaller sinkholes, which are separated from each other by narrow divides.
Figure 15 Representative terrain of Lebanon Ridged Drift. (USGS 7 1/2' topographic map, St. Jacob, Ill.)
Figure 16 Representative terrain of Karst Region. (USGS 7 1/2' topographic map, Columbia, Ill.)
Still other sinkholes are trench-like in form, measuring about 3,000 feet in length and 1,000 feet in width.

The sinkholes have developed in response to solution of the bedrock, the St. Louis limestone. This formation, some 300 feet thick, is especially well suited to karst formation, since it is thinly bedded, highly jointed, and massive in structure. The surface water, containing concentrated carbon dioxide, readily dissolves the limestone as it enters the rocks and moves vertically along joints and horizontally along bedding planes. A low water table and an adequate supply of rainfall (36 inches annually) are other conditions that have caused karst development in this area.

In the southwestern part of this region, a structural monocline, described in Chapter III, forms a steep scarp, which is orientated in a northwesterly direction. The surface of the scarp, rising some 150 feet, is partly subdued by erosion, as evidenced by deep ravines that extend as much as 7,000 feet into the upland. Likewise, at the base of the scarp, streams have cut deep ravines.

Because the drainage is largely subterranean, streams and valleys are not conspicuous in this region. Yet, surface water is present in several sinkholes that have become clogged by the overlying surficial deposits.

The topography, as shown by a mean slope of 6.2 degrees and an average local relief of 148 feet, is hilly.
Lenzburg Hills

The topography in the southeastern part of the county, south of the Kaskaskia River, is largely conditioned by the bedrock surface, for the glacial drift is thin. General rises in the bedrock surface are reflected in the present landscape. Many constructional features are present in this region, however. In the vicinity of Marissa, a few hills appear to consist entirely of drift, inasmuch as they rise above the general level of the surrounding plain.

The most outstanding aspect of the terrain is a strip of hills that form a continuous ridge, extending from a point east of New Athens through Marissa. The ridge, somewhat irregular in outline, rises as much as 100 feet above the valley of Mud Creek, immediately to the northeast. On the southwest side, the break in elevation is more gradual, however, for the ridge grades into a moderately sloping plain.

The streams diverge in a radial pattern from the summit or flanks of the ridge, and flow northeast to Mud Creek, north and west to the Kaskaskia River, and south to Doza Creek. The streams that flow to the north and the northeast have short courses and steep gradients, but are not deeply incised. Streams that flow to the south and west are fewer in number, flow across an irregular plain,
Figure 17 Representative terrain of Lenzburg Hills. (USGS 7 1/2' topographic map, New Athens, Ill.)
and have cut shallow valleys. In agreement with the general configuration of the surface, interstream areas are very irregular in size and shape.

Quantitative measurements show an average local relief of 49 feet and a mean slope of 2.0 degrees. In general, the topography is gently rolling to hilly.

Aggraded Lowlands

In the western and southeastern parts of the county aggradation of the ancient Mississippi and Kaskaskia bedrock valleys has produced extensive flat plains whose surfaces, in recent geologic time, have been transformed into a variety of landforms by fluvial erosion and deposition in a floodplain environment. The principal landforms thus formed include oxbow lakes, swamps, and depressions, representing abandoned channels; arcuate ridges and swales, formed by lateral accretion or cut and fill during former channel migrations; natural levees, formed by deposition parallel to the river channel; and terraces (Kaskaskia Lowland only), representing former levels of valley fill.

The landforms of the Mississippi Lowland are strongly developed, and can be easily located on 7-1/2 minute topographic maps. The ridge and swale topography is especially prominent near the cities of Cahokia, Centerville, and Brooklyn. Whereas the ridges rise a few feet above the general level of the floodplain, the swales form depressions, which are usually swampy. One ridge northeast
Figure 18 Representative terrain of Aggraded Lowlands—Mississippi Valley. (USGS 7 1/2' topographic map, Cahokia, Ill.)
of Bi-State Parks Airport is outstanding for its size, as it measures over 9,000 feet in length. A feature near Fairmont City represents a remnant of former natural levee. At 15 feet above adjacent areas, it measurably increases the relief of the floodplain. Still another feature, a swampy lowland west of Fairmont City, is an excellent example of an abandoned meander. It is noteworthy that the floodplain at the eastern margin of the lowland, from Edgemont north to Collinsville, is obscured by a broad apron of alluvium, deposited by tributary streams that discharge from the upland.

The landforms of the Kaskaskia Lowland are equally as diverse, though of a lesser scale. Here, a complex system of terraces adds to the vertical dimension of the surface. The terraces lie above the level of the present floodplain, which stands at about 380 feet, and occur on both sides of the valley. Shaw (1921) has recognized two distinct terraces, an upper terrace at about 420 feet elevation and a lower terrace, which is actually compound, at 390, 400, and 410 feet elevation. Remnants of the lower terrace can be found on the present floodplain. Both terraces have a down-valley slope, and show evidence of slight dissection.

On the first bottom or present floodplain, abandoned meanders, which occur as oxbow lakes and swamps, are the most common topographic form. Many of these features are located near the present channel of the Kaskaskia
FIGURE 19 Representative terrain of Aggraded Lowlands—Kaskaskia Valley. (USGS 1/2' topographic map, New Athens, East, Ill.)
River, indicating recent formation.

From the above discussion, it can be concluded that the apparent flatness of the Aggraded Lowland areas is an illusion. In terms of microrelief features, the topography is actually highly irregular: quantitative measurements show an average local relief of 13 feet and a mean slope of 0.7 degrees.
The physical landscape of St. Clair County is the product of a long, complicated geologic history. Nevertheless, from a physiographic viewpoint, only the more recent events are important. Whereas the general physiographic features and the bedrock topography can be attributed to Tertiary erosion cycles, the present landforms, although evidencing bedrock control in some areas, are chiefly conditioned by thick Pleistocene deposits (glacial till, outwash, and loess). In recent geologic time, the glacial deposits have undergone varying degrees of modification by fluvial processes.

Inasmuch as these geologic elements do not occur uniformly across the county, rather distinctive topographies or natural geomorphic units have developed on a regional basis. This study recognizes ten such regions, each containing a characteristic assemblage of landforms. A summary of selected terrain characteristics for each region is given in Table 1.
<table>
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<tr>
<th>Landform Region</th>
<th>Average Local Relief</th>
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<th>Nature of Surface Dissection</th>
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3. Ibid., p. 27.

4. Ibid., p. 27.

5. Ibid., p. 30.


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