Geologic Story of the Lower Wabash Valley with Emphasis on the New Harmony Area

By ROBERT H. SHAVER

DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY OCCASIONAL PAPER 27

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FRONTISPIECE

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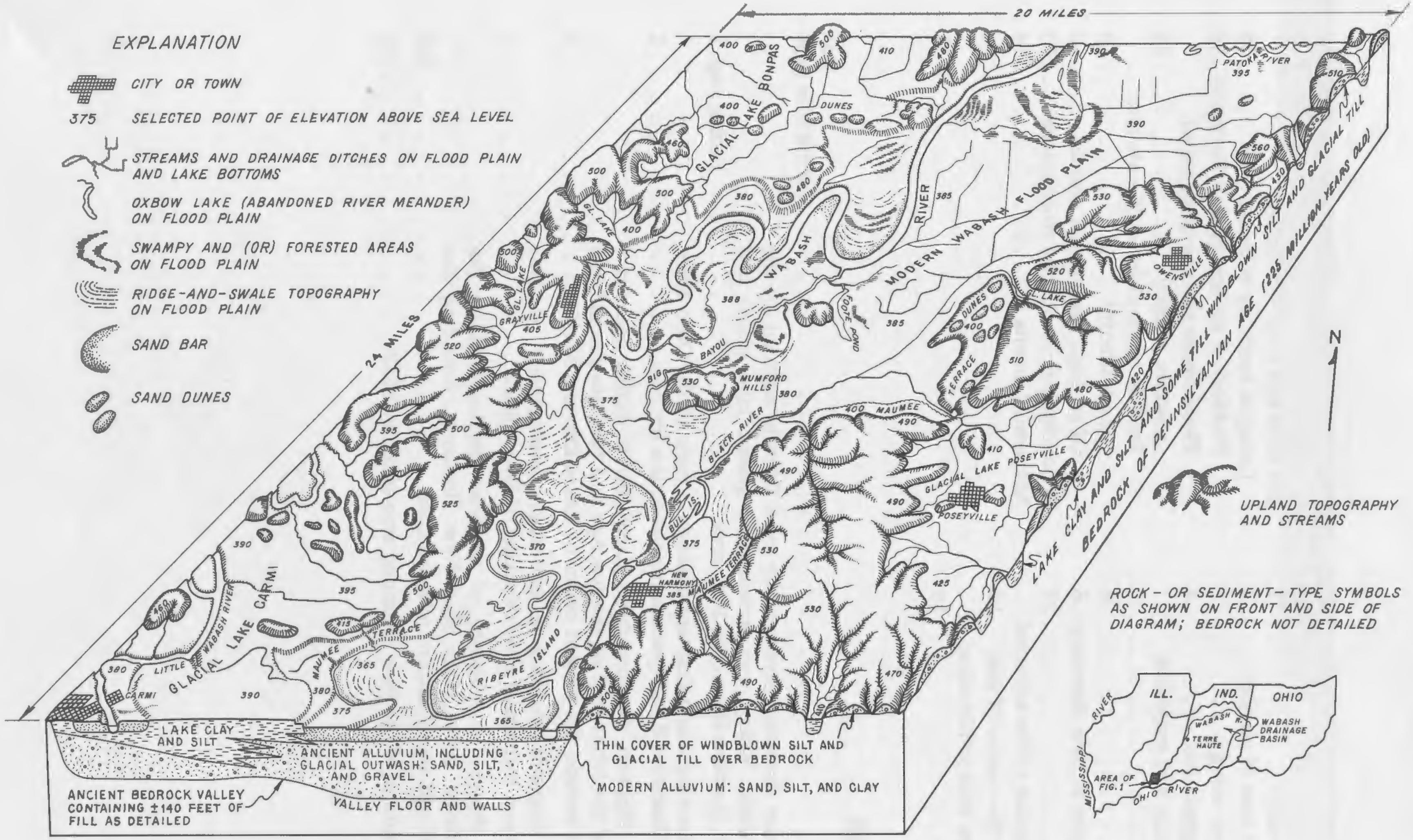

Figure 1. Block diagram showing physiography of a 24-mile segment of the lower Wabash Valley and surrounding glacial lake plains and uplands in the New Harmony, Ind., area. The two exposed sides of the block represent vertical cross sections of the geologic materials that underlie the surface along those edges to an average depth of about 300 feet (not to same scale as horizontal dimensions).

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Whence This Historic Valley?

The lower Wabash Valley—215 miles as the river flows from Terre Haute, Ind., to its meeting with the Ohio Valley; 3 to 12 miles across from bedrock wall to bedrock wall; as much as 150 feet from modern alluvial plain to ancient bedrock floor; conduit for 6 1/3 cubic miles of water each year by both gentle current and angry torrent; drainer of 33,000 square miles of basin; reservoir for 750 billion gallons of ground water within the alluvial fill at any given moment; storehouse of 18 cubic miles of sediment, some in active transit but much more waiting thousands of years between legs of its fitful journey to the sea—

Both host to and product of a restless wandering river that forever renews its flood plain, cutting into its alluvial bed on one side and backfilling on the other; host to a river that adds a new layer of silt annually to part of the 900 square miles of lower valley flood plain; a river that erosively impinges here and there against the bedrock-valley walls, thus moving them farther apart as though demanding even more room to accomplish its ultimate task; a river that leaves telltale marks of its patient sorting through the flood-plain sediments: cutoff meanders, silted-up channel scars and sloughs, crescentic ridge-and-swale topography, valley-marginal terraces, whose rising edges denote the farthest advances of the latest looping-river bends to migrate gradually by those parts of the valley—

A 500,000-acre breadbasket to a nation; direct provider of such basic resources as sand, gravel, and water; secreter and protector, it would seem, of the rich coal and oil fields that extend far below the bedrock floor.

The lower Wabash Valley—complex physiographic wonder; capricious (or misunderstood?) phenomenon; tireless geologic agent; artery, resource, playground, and home for prehistoric and modern man alike—what are its origins, how does it gain its boundless energy, and of what legacy does its physiography speak?

The Bountiful Sun and Laws of Physics

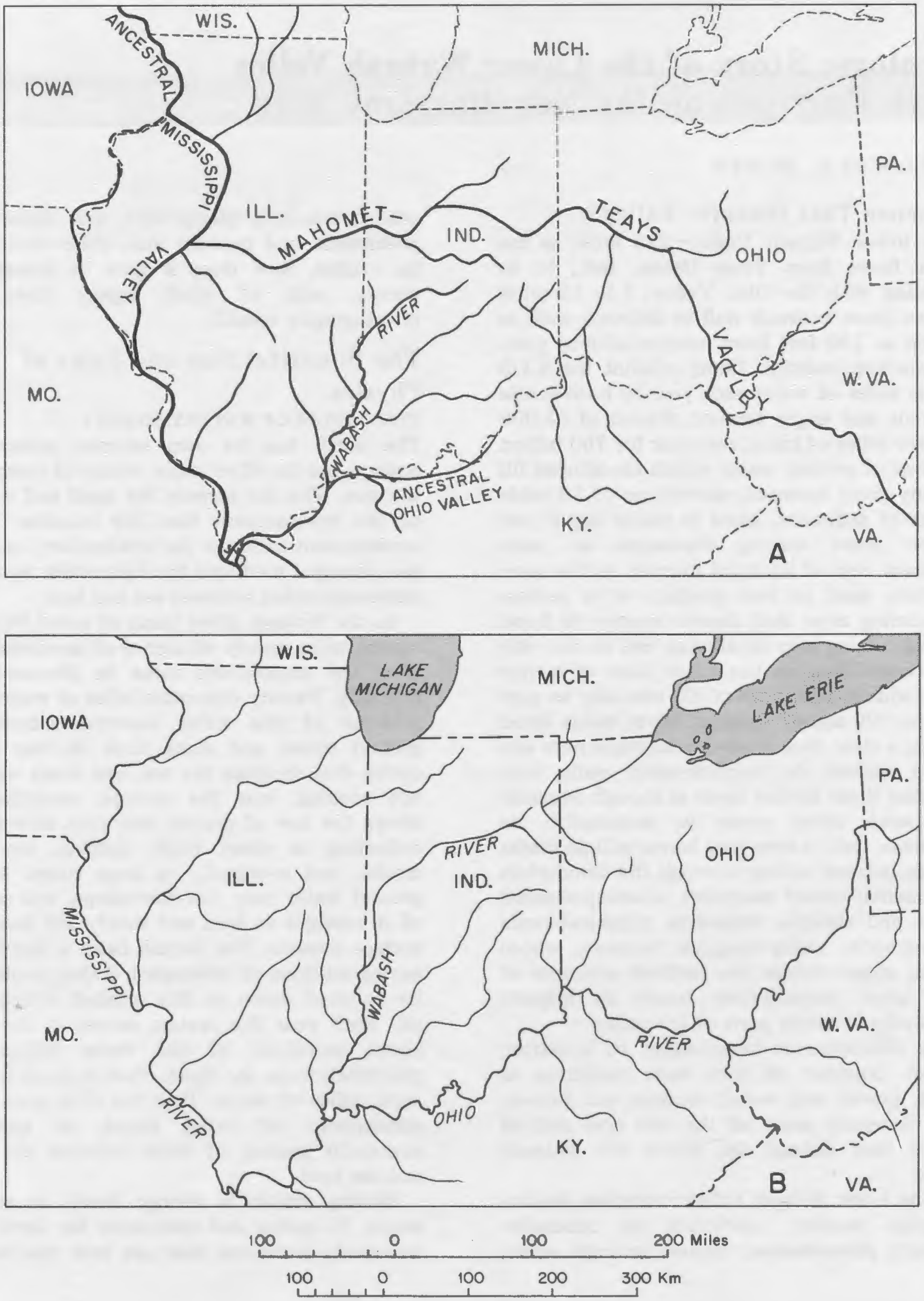
CUBIC MILES OF WATERY ENERGY

The earth has its own internal source of energy, but its other major source of energy is the sun. The sun powers life itself and much of the environment that life inhabits. This environment includes the atmosphere, one of the principal mediums through which water is endlessly cycled between sea and land.

In the Wabash River basin of some 33,000 square miles, nearly 40 inches of precipitation from the atmosphere must be disposed of annually. Twenty-one cubic miles of water!

Some of this water becomes stored as ground water, and some finds its way into cycles that shortcut the sea. But some water, not soaking into the ground, nevertheless obeys the law of gravity and runs downhill, collecting as sheet wash, rivulets, brooks, creeks, and eventually as large rivers. Even ground water may run downslope, and some of it emerges to feed and steady the flow of surface streams. The Wabash basin is like that, having millions of tributaries, if they could all be counted down to the smallest collecting rill. Each year this system moves to the sea about one-third of the water falling as precipitation in the basin. That is about 6 1/3 cubic miles of water. Thus the river joins the atmosphere to bring about an endless roundtrip journey of water between the sea and the land.

Moving water is energy itself, or so it seems. It erodes and sculptures the earth. It transports sediments that are both the waste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100 0 100 200 Miles
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products and tools of erosion. These processes are interrelated, of course, with certain aspects of the lower Wabash Valley (fig. 1) described above. The shape of the valley is a sculptural detail of the lands. Its partial fill of sediments is an erosive product and, simultaneously, an economic resource and agricultural base. The winding watery ribbon that is the Wabash River, along with the ground water that inhabits the alluvium, is the moderator of a dynamic geologic drama that is ever changing, sometimes unpredictable, and always to be respected.

There is much more to this business of streaming water and the physical laws of energy. Among the lower Wabash Valley processes, degradation (lowering or downcutting) and aggradation (building up), as well as lateral planation (lateral erosion and deposition), are yet to be explained—given the 6 1/3 watery cubic miles worth of energy annually to power such processes.

DEGRADATION AND AGGRADATION

The modern lower Wabash River flows almost entirely on alluvial fill. For most of its course, therefore, the river is several scores of feet above the ancient bedrock-valley floor (fig. 1). But in the New Harmony area the modern river flows at about an equal vertical distance below the top of the exposed part of the bedrock-valley walls. The valley trough, therefore, is about half filled with alluvial and other unconsolidated materials, most of which the modern river could never have touched. These observations lead to an inescapable conclusion: The lower valley has gone through a complex history of alternating degradation and aggradation. Natural physical laws explain this seemingly indecisive phenomenon. A delicate balance exists among the gradient of the river (presently about 1 foot per flood-plain mile in the New Harmony area), its discharge of water (a 46-year average of about 26,700 cubic feet per second at New Harmony), its velocity, its sediment load, and the friction to flow offered by the channel (including channel constrictions, turns, and obstructions).

An increase in discharge, for example, is generally accompanied by an increase in current velocity down a given gradient. The extra energy so gained is used in transporting greater amounts of sediment and in erosive downcutting. If increased discharge is a long-term event, general degradation of the channel floor and the flood plain itself may result. If decreased discharge is a long-term event, however, it is generally accompanied by a decrease in velocity and transporting power, so that aggradation (building up) of the flood plain results. As another example of the delicate balance among these factors, an increase in sediment load without a corresponding increase in discharge may overtax the ability of the river to transport, so that aggradation results.

Whatever the causes of imbalances, the resulting adjustments include lowered or raised gradients. The lowest level to which the gradient of the Wabash may extend is controlled by the level of the larger river (the Ohio) into which the Wabash flows; the ultimate control, however, is sea level.

THE IRRESISTIBLE ICE AGE AND RESPONSES OF THE VALLEY

What geologic history has caused degradation and aggradation to operate in fits and starts, as it were, in the lower Wabash Valley? The complete explanation is lost in geologic antiquity, but fragments of evidence dating from about a million years may be pieced together.

Prior to the beginning of the Ice Age, major drainage lines in the Indiana area of the Midwest (fig. 2*A*) differed considerably from those of today (fig. 2*B*). Part of the evidence consists of deeply buried (hundreds of feet) bedrock valleys in the upper Midwest—valleys that are filled brimful with glacial drift and that have little or no relationship with modern valleys.

Figure 2 (*on facing page*). Two maps showing major drainage changes in parts of the Ohio River and the Mississippi River systems related to the Ice Age. *A*, Preglacial, dating 1 million years or more ago; *B*, postglacial, dating from some thousands of years ago to the present.

Figure 3. Map of the Midwest showing three glacial fronts during successive periods of the latter half of the Ice Age and two late-glacial lakes extending beyond the present basins of Lakes Erie and Michigan.

The preglacial Wabash River was a shorter stream than is the modern river, but the lower parts of each of these rivers occupied(s) about the same geographic position. The preglacial Ohio River, however, was a lesser stream than was the preglacial Wabash (fig. 2*A*). The preglacial master stream flowing westward from the Appalachians was not the Ohio, but the river that occupied the so-called Mahomet-Teays Valley (fig. 2*A*), which now is completely buried and defunct in all but its upper reaches in the Virginias.

The instruments of this massive disruption of drainage were huge continental glaciers, which several times during the Ice Age invaded the central Midwest and which at least twice advanced to near or beyond the present course of the Ohio River (fig. 3). The New Harmony area (shown by fig. 1) was covered by glacial ice at least once. Each of many glacial advances was followed by a period of glacial retreat (deglaciation). We are privileged to live during the latest period of deglaciation.

Unlike the Mahomet-Teays Valley, the lower Wabash Valley was able to recover, in some measure, after each glacial episode. The river reestablished its position and began anew to regrade its valley in accord with its newly inherited conditions. Here, then, are explanations for the questions asked above on the origins of the valley, source of energy, and physiographic legacy: the extreme changes in discharge offered to the river between and during periods of glaciation and deglaciation, the changes in sediment loads (including huge loads derived from melting glacial ice), and the changes in sea level (base level of river systems) that were associated with alternate periods of glacial storage of water and glacial release of water. All these variables contributed to the seemingly erratic development of the valley.

The exact historical details of the lower Wabash Valley are lost in antiquity, because each glacial episode obliterated much of the record of the preceding episode. The events of the last 140,000 years, more or less, are clearest. The last deep excavation of the lower Wabash Valley (through the then-existing alluvial fill and into bedrock at least in part) probably followed the early glacial advances and preceded the last major glacial advance (fig. 3).

During and after the period of time about 20,000 years ago, when the snout of the last major glacier stood near its position of farthest advance in the Terre Haute and Indianapolis area, huge quantities of glacial-outwash sediments were released into the lower Wabash Valley. This caused the river to aggrade and fill the valley to about half full. In the New Harmony area, this fill was between 30 and 40 feet higher than the present flood-plain level.

Tributaries to the lower Wabash were dammed by the glut of glacial outwash building up in the main valley, and large lakes formed in these tributary valleys from their mouths to their headwater areas. These glacial lakes were since drained by lowering of the Wabash River gradient and by partial removal of the dam of glacial outwash. Testimony of their former existence, however, is still preserved in the form of now-dry and rather flat lake bottoms obviously perched at levels above the modern Wabash flood plain but below the bordering bedrock upland (fig. 1).[1]

As noted above in connection with draining of the glacial lakes, the newer Wabash River eventually was able to lower its gradient and flood plain, maintaining a balance between discharge and sediment load during the latest glacial aftermath. The postglacial river attended its task so vigorously in the New Harmony area as to remove from the main valley all traces of the high glacial-outwash level that once dammed the tributary valleys and created the glacial lakes.

Much of this great work of degradation was accomplished when the retreating lobes of the last glacier still occupied the greater area of the Great Lakes (fig. 3) and blocked the present St. Lawrence River outlet of the Great Lakes to the Atlantic Ocean. Ancestral Lake Erie (called glacial Lake Maumee) found a southwestern outlet for its overflowing

[1]Many visitors to the New Harmony area will have driven across one or more of these flat lake plains, especially of glacial Lakes Poseyville and Carmi. Another large lake shown in figure 1 is glacial Lake Bonpas, and many other lake remnants are shown in the Grayville and Owensville areas.

glacial meltwaters, the Wabash River (fig. 3). The upper Wabash received this overflow via a now mostly abandoned sluiceway that ran through the present site of Fort Wayne. The Wabash thus inherited torrents of relatively clear waters in comparison with the sediment-choked waters of the preceding period. This flood of perhaps a few thousand years' duration stripped the evidence of the former high glacial-outwash level from the lower valley. Simultaneously, it created its own valley-plain level called the Maumee level.

When the St. Lawrence outlet finally became free of ice, the Wabash River lost the Lake Maumee (Lake Erie) overflow (fig. 2*B*). Once again the river was forced to begin a new cycle of valley renovation based on the new conditions of discharge and sediment load. The modern flood plain is the result, which in the New Harmony area has developed 10 to 15 feet below the Maumee level. In some places, however, the Maumee level is still preserved as a terrace. (The larger remnants of the Maumee level are depicted in the block diagram of figure 1.) New Harmony is built on one segment of the Maumee Terrace and thus has been relatively free from the annual floods that inundate nearby agricultural lands. (As depicted by figure 1, the relationships among the two late-glacial levels and the modern level described above may be seen in the western flood-plain and glacial-lake areas southwest of New Harmony and northeast of Carmi, Ill.)

LATERAL PLANATION

So far the discussion of aggradation and degradation and of the repeated filling and excavation of the lower Wabash Valley has neglected an important process in the regime of the river, the process of meander development and lateral planation. Wide looping bends, called meanders, develop in the course of a maturing river as a part of the process of flood-plain formation. That is, lateral planation, consisting of both lateral erosion and backfilling, is necessary to account for such meanders as those of the New Harmony area (fig. 1) and for the flood plain itself.

No natural stream is entirely straight. This is true for a new stream that has formed on a deglaciated surface, as one example, and it is true of any existing stream, whatever its stage of development. Moving water has momentum, so that even a stream that is doing little downcutting may accomplish lateral erosion wherever its main current is directed against one bank or the other. The force of the water against the bank is erosive in itself, and it is abetted by the abrasive action of suspended sediment. Once lateral erosion of the streambank occurs, it accentuates whatever crookedness already existed in the channel.

A more or less regularly alternating impingement of the main current on one bank and then on the other is the further result (fig. 4). So-called cutbanks develop at these places. On the opposite banks, slack currents, or even eddying back currents, cause deposition of silt, sand, or gravel in the form of so-called bars that are the youngest areas of flood plains. Meander loops tend to widen and to migrate down valley, but some migrate across valley and even up valley. Many successive meanders move laterally into one another, causing a cutoff and abandonment of one meander or another. The abandoned meander, having little or no current during most of the year, becomes a lake—called an oxbow lake. Most such oxbow lakes are short lived, rapidly filling up with silt and organic muck. In time, even these scars on the flood plain become healed.

Thus it is that most flood plains form, flood plains that also are the product of deposition of sediment generally over their surfaces during floods. And the lower Wabash Valley is a classic one for demonstration of flood-plain features and how flood plains are formed.

THE FLOOD-PLAIN REGIME AT NEW HARMONY

The New Harmony valley stretch is replete with examples of characteristic flood-plain features. The town itself is built on a terrace remnant of a former flood plain (Maumee) that has been all but destroyed by the lateral planation of meanders during the modern cycle of the river. A further drama is unfolding now in the few river miles above New Harmony (fig. 5*A*, *B*).

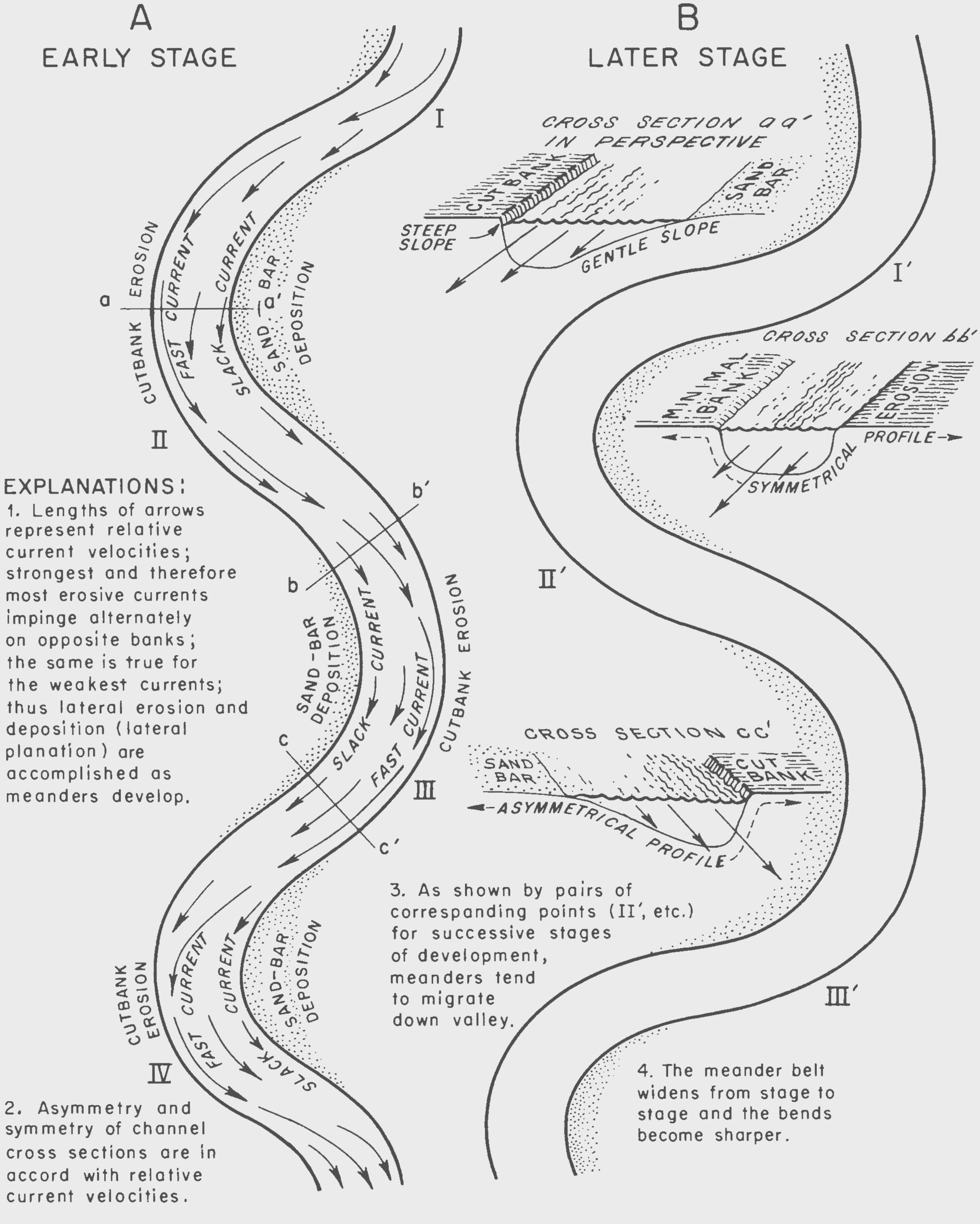

Figure 4. Schematic diagrams showing a two-stage development of river meanders and formation and reworking of flood plains.

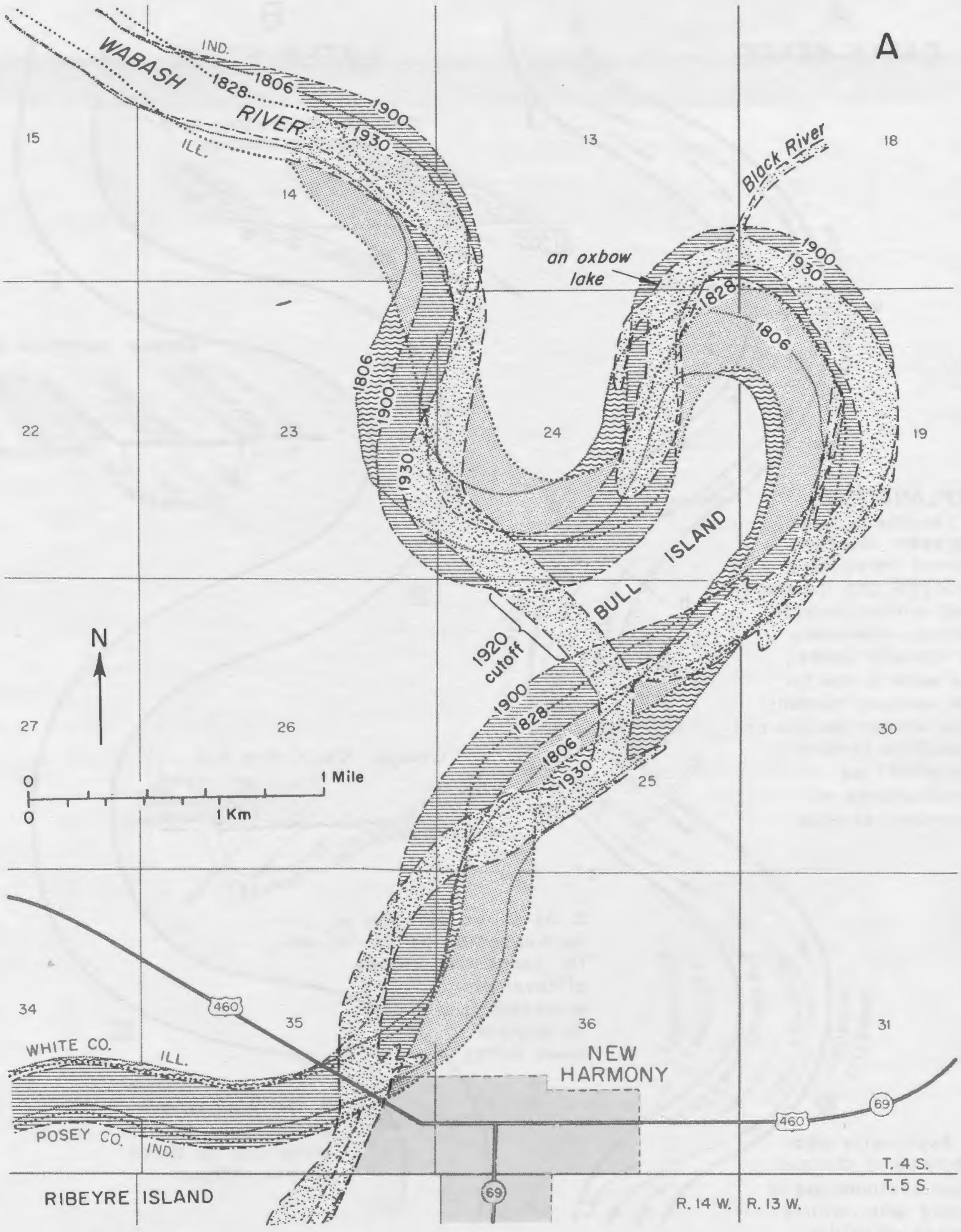

Figure 5. Two maps showing the history of meander development on the Wabash River flood plain near New Harmony, including the cutting off and abandonment of a meander. *A*, 1806 to 1930; *B*, 1930 to 1966 and to 1978 in part. Note from map *B* that the state boundary shifts gradually if the river shifts gradually but remains fixed in the sudden events of meander cutoffs.

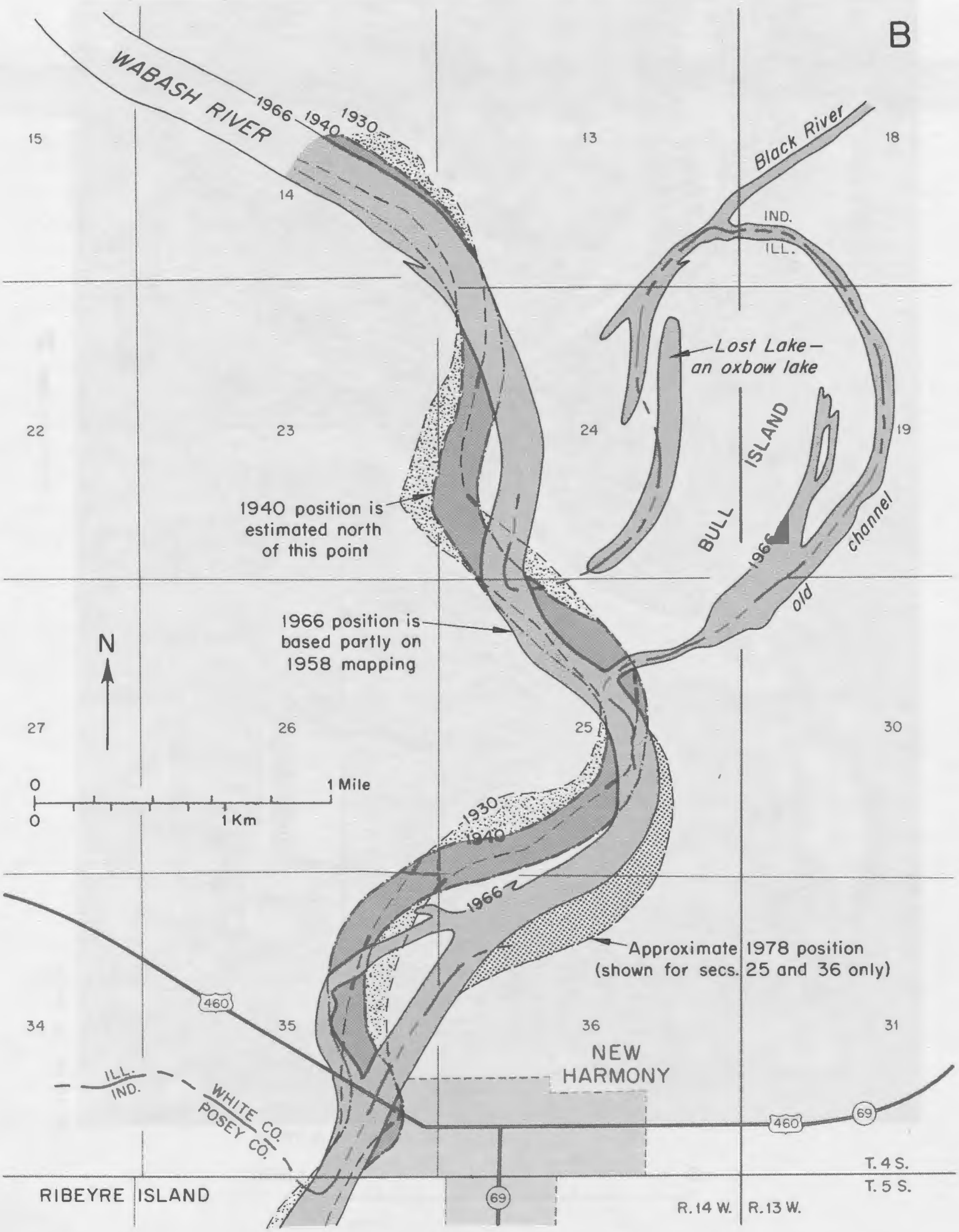

Figure 5—Continued


sand bar
24
19
flood plain
26
30
N
bar
RIVER
flood plain
approximate
1978 edge cutbank
Gresham
Creek
sand
36
31
Maumee Terrace
WABASH
NEW HARMONY
bedrock
valley
wall
T.
4
S.
T.
5
S.
R. 14 W.
R. 15 W.
0
1 Mile
0
1 Km

Two meanders in secs. 24 and 25 migrated toward one another during the 19th century but had a great intervening meander in parts of secs. 24, 13, 18, and 19 (in order of river flow). (See the 1806, 1828, and 1900 courses[2] shown in fig. 5*A*.) About 1920, however, the river took a shortcut. Obeying the laws of physics, it chose the shortest and steepest route between two points along its journey toward the sea. Probably during the period of one or a few overbank floods, it excavated the new cutoff channel shown in figure 5*A* and abandoned the great loop around the meander core now called Bull Island. Only the fact that Black River still uses this old meander loop in its journey to the Wabash accounts for as much water, partly in the form of oxbow lakes, as flows today through the abandoned meander (fig. 5*B*).

One dramatic event (the cutoff) set off another. In the early 1900's the river coursed southwestward through sec. 25, and the gentle meander in that section migrated westward—away from New Harmony—before the cutoff formed. After the cutoff was established, the river directed its energy southeastward and quickly reversed the direction of migration of the meander in sec. 25. By 1978 the meander had encroached southeastward well into sec. 36 (fig. 5*B*) and within a scant half mile of the northern boundary of the town. Its recent rate of approach appears to have been 50 or more feet per year.

The river thus reinvades flood plain where it has not been for perhaps a thousand years or more, destroying flood plain on one side and backfilling on the other to form new flood plain. Unless another event intervenes, the meander will encroach on the town itself, and eventually it will reach the valley walls just beyond, producing yet another scalloped etching in the bedrock wall.[3]

The lower valley in the New Harmony area (fig. 1) bears many other dramatic evidences of the ever-active regime of the river and of the never-finished history of the valley: other meanders and oxbow lakes; Ribeyre Island and its cutoff; the crescentic terrace fronts west of Ribeyre Island; bedrock hills (including Mumford Hills) surrounded by alluvium or glacial lake clays; the ridge-and-swale topography; wandering bayous; sand dunes concentrated in patches here and there; and crescentically striped, alternating light and dark soils characterizing the agricultural lands that constitute much of the older flood-plain surfaces (figs. 1 and 6).

[2]The 1806 course has been reconstructed from the first surveying records for this area that were made after the Northwest Territory had accrued to the United States and after the Congressional system of land survey had been established. Later courses have been reconstructed from old land plats and maps, from aerial photography, and by interpretation of modern topographic mapping. Not all the maps are necessarily accurate. One of them, unpublished but dating from the early period of the Robert Owen community at New Harmony, is on file in the Workingmen's Institute of New Harmony. The author is not recorded, nor is the date, which is thought to be about 1828.

[3]Examination of water-well records on file in the Indiana Division of Water, including one for the central part of New Harmony, reveals no bedrock at shallow depth below the alluvial surface, the presence of which would greatly slow the rate of migration of the meander.

Figure 6 (*on facing page*). Aerial photograph of the New Harmony area taken in 1953. Note that sandbars form on the inside (slack-water side) of meanders and that the outside (cutbank side) of the meander in sections 25 and 36 migrated as much as 775 feet southeastward during a 25-year period. Also note that the modern flood plain bears many scars of lateral planation by the river, including even the light and dark crescentic soil striping in croplands, while such scars have been obliterated from the older and higher flood-plain level now preserved in remnant form as the Maumee Terrace. This figure was made by superimposing section lines and labeling pertinent features on a part of U.S. Department of Agriculture aerial photograph QU-5M-159.

The River and Man

SIMULTANEOUS EMERGENCE OF THE ANCESTRAL WABASH RIVER AND THE SPECIES OF MAN

This account has set forth a geologic history for the lower Wabash Valley that claims the existence of the ancestral river during, if not before, the period of emergence of man as a separate species in another part of the world. Both primitive and modern man have found major rivers and their flood plains convenient places to live. They have depended on rivers for food and water and as arteries of travel and commerce.

Perhaps the very importance of rivers to man accounts for his willingness to suffer the disasters that rivers occasionally visit on him. These disasters include some that are triggered by man himself when he unknowingly or knowingly upsets the delicate balance between rivers and their valleys.

POWER OF THE RIVER VS. MAN IN HISTORICAL CONTEXT

Awesome forces have shaped the history and present physical circumstances of the lower Wabash Valley. Even modern man and all his technology would have been powerless to prevent the major changes that geologic processes have wrought in the valley. Further, these forces used such patience, as it were, in reshaping the valley as to dwarf the periods of time during which entire civilizations have come and gone while only a part of a major event in the history of the valley transpired.

LIVING IN HARMONY WITH THE RIVER

PROBLEM OF EROSION AT NEW HARMONY

Man has learned something about how to live in harmony with rivers. The followers of George Rapp had the foresight, for example, to construct the town of New Harmony on a terrace remnant of the ancient Maumee flood plain and thus to escape all but the highest floodwaters that came down the valley during more than a century and a half. But the very processes by which the higher ground of the terrace was created and then preserved as a flood-plain remnant are still at work, now threatening the very existence of the town. The critical period may be less than 50 years away. (See figs. 5 and 6.)

Ordinary levees built atop the flood plain and along the edge of the river north of the town would not avert impending disaster, nor would an ordinary type of flood wall built along the edge of the town. Man *has* learned this much about the habits of the river and its awesome power to undercut such structures if built squarely in front of the path of the main current and if not extended to below the bottom of the channel. Straightening the channel above New Harmony, however, and thus bypassing the threatening meander is one alternative within man's capability. In-place stabilization, or near stabilization, of the channel is another alternative to be considered.

Even so, he would be upsetting certain parts of the described balances in the regime of the river. He would have to consider the increased erosive energy, both lateral and vertical, that would be imparted to the river downstream from an artificial cutoff as well as the value and ownership of the land to be converted into the new channel segment. Aesthetics and environmental concerns would also have to be weighed in any alternative.

FLOOD LEVEES AND THE QUESTION OF A FUTURE PENALTY

During the past few decades levees have been constructed up and down the valley from New Harmony, and others are scheduled for construction. These levees are largely for protecting cropland and appurtenant structures from slack floodwaters. Short-term losses are thus averted. The prevention of slack-water flooding of agricultural land of nearly annual periodicity, however, transfers additional water downstream, where flood crests thus may be higher and erosion more severe. It also suspends a natural process that enhanced the flood plain as cropland in the first place.

That suspended process is periodic accretion of new, thin layers of sediment. Such sediment bears on fertility. It also builds up the flood plain, so that the flood plain (cropland) tends to become more immune to flooding. Further, flood-plain sediments are unconsolidated and water logged when deposited. Consolidation, dehydration, and loss of volume (causing lowering of the surface) follow deposition and hardly stop. However slowly these processes of compaction proceed, they apply not only to the latest layers deposited but also to *all* the earlier, underlying layers.

If no additional sediment layers are to accrete as the levee system becomes complete along the Wabash and other rivers, will not the process of healing of flood-plain scars (creation of new cropland) be slowed? And how much time will pass before parts of some large flood plains developed over thick alluvial fills subside enough to become too wet for farming? Or to become susceptible to depths of floodwaters never before seen by man in his borrowed valleys?

Five hundred years? A thousand years or more? No answer is set forth here except the claim that man hardly has had time to consider this question in the context of a geologic process, and he has not yet adequately searched his conscience as to what he owes future generations of man.

EROSION OF CROPLAND—ULTIMATE LOSS OR A TRADEOFF?

The rapidity of flood-plain erosion is mainly a function of flood stage and frequency, which in turn are affected by man's activities, such as deforestation of watersheds, structural alterations of flood plains, and changing agricultural practices. With perhaps some assistance by man, then, hundreds of acres of privately owned cropland have been lost since 1900 to erosion by the meanders immediately north of New Harmony, just as similar loss is occurring up and down the valley from New Harmony on either side of the river. But man must remember that the river is not actually causing a net loss in agricultural land, although it may have caused such loss during the short period of time in which agriculture has been carried on in the lower valley; the river creates new flood plain and potentially tillable land (in time) as rapidly as it destroys existing cropland (figs. 4-6).

It should now be clear that, depending on local laws, individual property owners and their heirs both lose and gain acreage as a result of riverine processes. Loss or gain to a given estate may be reversed during an owner's lifetime or during the lifetimes of one or more generations of descendants. It should further be clear that ordinary laws governing private ownership along a river are not necessarily in accord with the processes of the river and with man's concept of fairness among fellowmen. Certainly, considerations on how and whether to protect property, whether by levees, floodwalls, channel diversion, dam building, or other means, cannot be left as private matters. Indeed, society must first ask itself how it has affected and will continue to affect riverine processes, and then it must weigh benefits and costs of artificial alterations as a societal matter.

OF GEOLOGIC LESSONS AND MORALS

Man in his past attempts to control rivers has experimented (as later proved to be the case) in many ways, sometimes successfully and sometimes disastrously in reference to his short-term (so far) benefits. If his record should have been better and if it is to be improved, it could have been so, or it yet will be, through a better understanding of riverine processes and geologic histories of rivers. Man's most serious failure in this regard may be his reluctance or inability to weigh the time factor, both in the geologic sense applicable to fluvial processes and in the sense of what is owed to future generations of man, even to the civilization to inhabit such valleys as the lower Wabash a thousand years hence.

In Conclusion—About the Frontispiece

The frontispiece is reproduced through the courtesy of Historic New Harmony, Inc., from a painting by Karl Bodmer (c. 1832). It depicts Cutoff River as it once existed immediately south of New Harmony where the main Wabash River now flows across the northeast end of the great meander loop surrounding Ribeyre Island (fig. 1).

The haunting mood of this scene seems to recall the inspiration of another era, when the New Harmony community conducted innovative social, educational, and cultural experiments and eventually became a leading center for geologic science in particular. At the same time, the scene reminds us that the way of the Wabash River is restless and that change is the order of things. For the serenity of this forever-vanished scene belies the mood of the modern Wabash when it is at flood stage and rushes in swirling torrents over this very place that has been remade to suit the present fancy of the river.

Who now can fail to grasp the geologic essence of the lower Wabash River and its valley, an entity that is at once gentle and all powerful, patient and outrageously fitful, beneficial and dangerous, forgiving and revengeful, and stable and changing, ever changing?

Acknowledgments

This account has been prepared with particular reference to the educational interests of visitors to the historic New Harmony area of the lower Wabash Valley. The organizations known as the New Harmony Commission and as Historic New Harmony, Inc., provided special inspiration and assistance. Distribution of this report is made through the latter organization as well as through the Indiana Geological Survey.

I take full responsibility for the accuracy and aptness of all parts of this report as presented. By far the greater amount of collective knowledge, however, is owed to generations of geologists, engineers, and hydrologists that have been and are affiliated with especially the Indiana and Illinois Geological Surveys, the U.S. Geological Survey, Indiana University, the Indiana Division of Water, the Illinois State Water Survey, and the U.S. Army Corps of Engineers. Other valuable information, especially of documentary nature, was obtained from U.S. Geological Survey maps, U.S. Department of Agriculture aerial photographs, the Indiana State Library, the Workingmen's Institute of New Harmony, the USDA Soil Conservation Service office in Mt. Vernon, Ind., the Posey County, Ind., Recorder's office, the Wabash River Coordinating Committee's publications, and private citizens of New Harmony (including especially Don Blair).