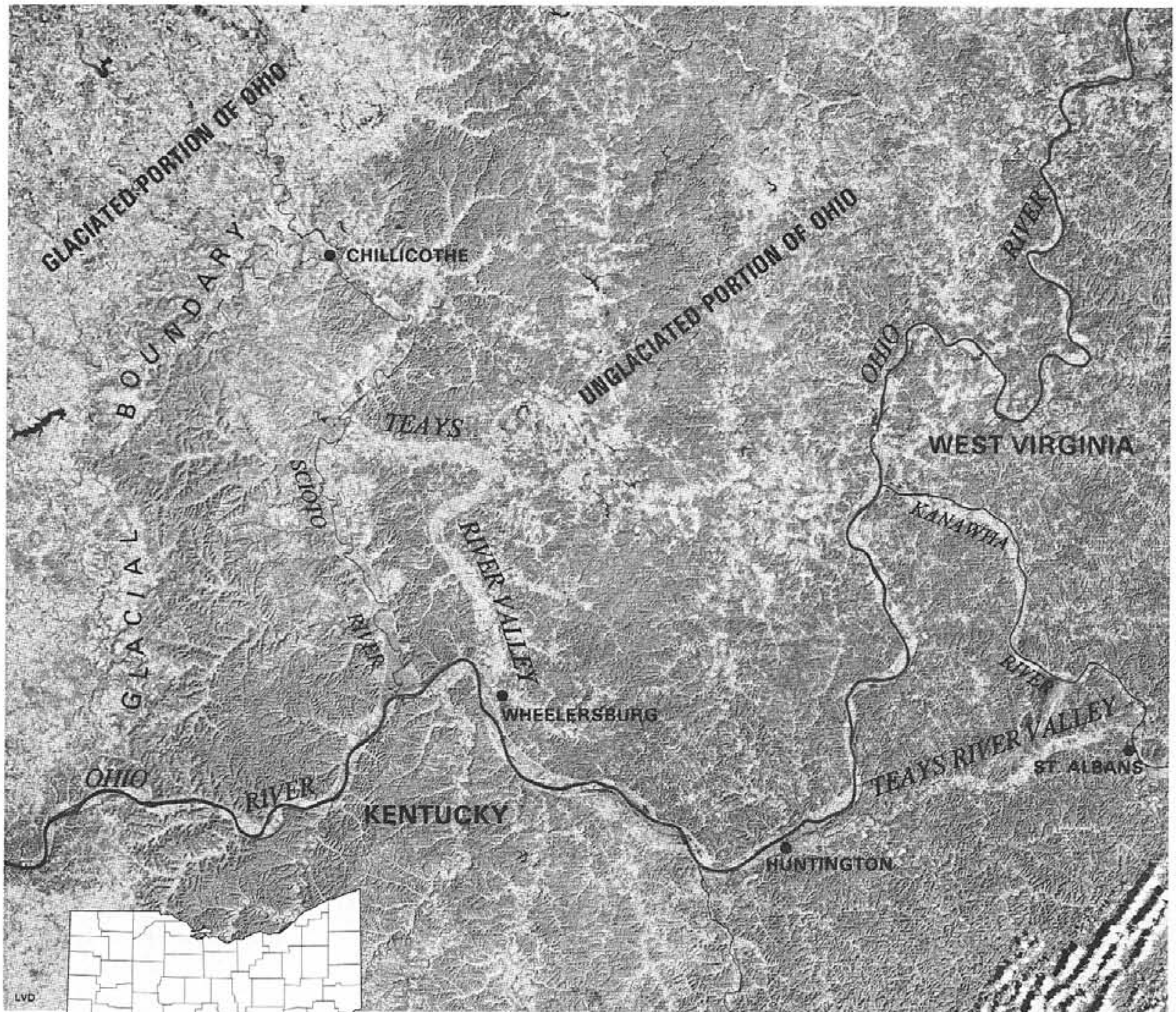
SUMMER 1987

Ohio Geology Newsletter

Division of Geological Survey

THE TEAYS RIVER

by Michael C. Hansen



Satellite image (ERTS) of southern Ohio and adjacent portions of Kentucky and West Virginia. Modern streams, including the Ohio, Scioto, and Kanawha Rivers, show as dark lines. The abandoned segments of the preglacial Teays River, from St. Albans to Huntington, West Virginia, and from Wheelersburg to Chillicothe, Ohio, are dramatically illustrated by the light-colored, broad valleys. The modern Ohio River follows the valley of the Teays from Huntington to Wheelersburg. The southern limit of the relatively recent Wisconsinan glacier is also readily visible.

continued on next page

ODNR
OHIO DEPARTMENT OF NATURAL RESOURCES

Richard F. Celeste, Governor • Joseph J. Sommer, Director

Chief's corner by Horace R. Collins

A geologically exciting project will be underway as you read this issue of *Ohio Geology*. The project is being carried out by the Consortium for Continental Reflection Profiling (COCORP) and will consist of a 220-mile-long east-west seismic traverse across Ohio, from the Indiana border to the West Virginia border. This project is in response to a proposal submitted to COCORP by the Division of Geological Survey in 1983.

COCORP is an organization of academic, industry, and government geoscientists interested in the fundamental characterization and geologic history of the earth's crust and upper mantle in the United States. The operating institution of this NSF-funded organization is Cornell University, Ithaca, New York.

Seismic reflection profiling propagates waves through the earth's crust by means of truck-mounted vibrators using the VIBROSEIS technique. Waves bounce off reflecting horizons in the crust and are recorded on an array of geophones. Computer processing of these data allows construction of a cross section or profile of the crust and analysis of geologic structures and major changes in rock types. Such information provides detailed insight into the complexities of the basement rocks that underlie the state.

The traverse will cross a zone of earthquake activity in western Ohio (western Ohio seismic zone), a postulated failed rift zone in west-central Ohio, and the area (more or less coinciding with the rift zone) thought to represent the Grenville front (see *Ohio Geology*, Summer 1984).

The COCORP traverse across Ohio offers an exciting opportunity to investigate both long-standing and recently discovered puzzles and perhaps discover entirely new aspects concerning the Precambrian basement rocks of Ohio. Future issues of *Ohio Geology* will provide updates on the COCORP traverse in Ohio.

COMMEMORATIVE MUGS

A limited supply of the popular coffee mugs given to the attendees of the Survey's Sesquicentennial Banquet in March is available for purchase. The mugs are beige porcelain with the Survey's Sesquicentennial logo and a portrait of W. W. Mather embossed in brown ink. Cost per mug is $3.00 over the counter and $5.00 shipped UPS. Both prices include tax and handling. Prepayment is required and checks must be made out to "Sesquicentennial Fund." Send mail orders to Sesquicentennial Fund, ODNR Division of Geological Survey, Fountain Square, Building B, Columbus, Ohio 43224.

OHIO GEOLOGY

A newsletter published quarterly by the Ohio Department of Natural Resources, Division of Geological Survey, Fountain Square, Columbus, Ohio 43224. Telephone (614) 265-6605.

Editor: Michael C. Hansen
Secretary: Donna M. Schrappe
Phototypist: Jean M. Lesher
Pasteup artist: Lisa Van Doren
Halftones: Robert L. Stewart and
Edward V. Kuehnle

News items, notices of meetings, etc. should be addressed to the attention of the editor. Change of address and new subscriptions should be addressed to the attention of the secretary.

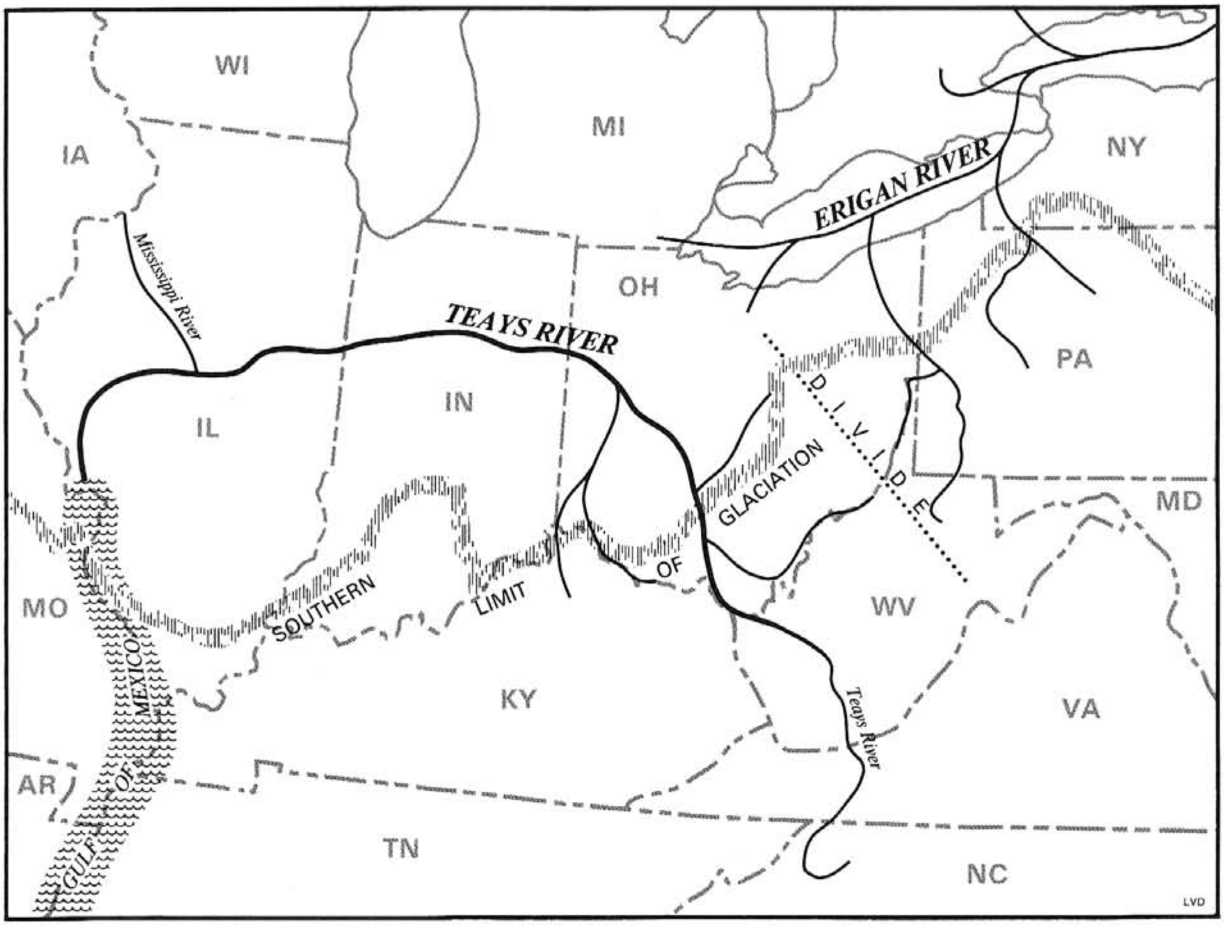
continued from page 1

You can't swim in it, fish in it, or boat in it, but the Teays River is the best known nonexistent river in the midwestern United States. A surprising number of Ohioans are familiar with the fact that the Teays was an ancient river that once flowed across Ohio. Indeed, there is even a school district in Pickaway County, Ohio, near where the Teays once passed, that is named "Teays Valley" in honor of this long-vanished watercourse.

Few people grasp, however, the full dimension of the Teays River and its tributaries, which are thought to have formed an 800-mile-long system that drained a vast area from headwaters in the Appalachian Mountains to the point of discharge in an embayment of the Gulf of Mexico in southwestern Illinois. It is also unclear to many that the Teays originated sometime during the Tertiary Period, more than 2 million years ago, and long predates the Ohio River, the Great Lakes, and other surface waters in Ohio and adjacent areas. That the Teays is long gone is well known, but the history of its demise from Pleistocene glaciers, as well as the complexity of drainage changes throughout the Ice Age, is a story that is commonly confused and still being unraveled by geologists.

The concept that much of the course of the Teays is buried beneath glacial debris—a buried valley—is familiar to many Ohioans; however, beyond this point, the understanding becomes muddled for most people. Ground water derived from the valley of the Teays and other buried valleys perhaps has contributed to the Styxian misconception that the Teays still lives as a flowing stream that has abandoned the sunlight for a subterranean course. Unfortunately, the notion of underground rivers is well ingrained in the minds of many people, with little distinction being made between genuine underground flowage in limestone caverns and a buried valley in which water is present only in the tiny pore spaces between sediment grains.

The history of the Teays River in its preglacial majesty and its destruction, with subsequent drainage modifications, by Pleistocene glaciers nearly 2 million years ago is a fascinating chapter in Ohio's geologic past. Perhaps no less interesting is the history of the discovery of the Teays and other preglacial drainage systems by several generations of geologists.



Course of the preglacial Teays River according to the classic interpretation. The entire extent of the Teays and its tributaries north of the glacial border is buried beneath glacial drift. Northern Ohio was drained by another preglacial stream, the Erigan River, which followed the axis of what is now Lake Erie, and flowed into the ancestral St. Lawrence River. None of the Great Lakes existed in Teays River time.

THE DISCOVERY OF PREGLACIAL DRAINAGE

Among the first geologists to seriously examine the state was Samuel P. Hildreth, a Marietta physician, who noted in 1836 and 1838 the presence of abandoned stream valleys in southeastern Ohio and the presence of unusual plants with southern affinities. Similar observations were made by later 19th-century Ohio geologists, but it was not until the advent of the glacial theory and the detailed demonstration of the effects of glaciation in Ohio and adjacent areas in the latter half of the 19th century that the complex story of the state's drainage history began to emerge.

William George Tight (1865-1910), professor of geology and botany at Denison University (1887-1901), Granville, and later president of the University of New Mexico (1901-1910), soon emerged as the leading student of drainage history and was the first to piece together the most important part of the puzzle. Although there were numerous other contemporaries who were important contributors, Tight was preeminent in both his original observations and in his ability to synthesize the contributions of other workers.

Tight's studies culminated with his 1903 U.S. Geological Survey Professional Paper, *Drainage modifications in southeastern Ohio and adjacent parts of West Virginia and Kentucky*. In this work, Tight demonstrated the former existence of a mighty preglacial river that had its origins in the Appalachian uplands of North Carolina and Virginia. Tight traced

William George Tight (1865-1910), Denison University geology professor and leading student of the Teays River.

the course of the stream across West Virginia into southern Ohio and northward to Chillicothe, where the valley disappeared beneath the glacial drift. Tight actually applied two names to this river—the Chillicothe River for the lower portion and the Teays River for the main axial stream in its upper portions in West Virginia. The name "Teays," derived from a village in an abandoned valley segment in West Virginia, has been applied to the entire master stream including its westward extensions into neighboring states.

Tight's work delineated a major river that, for much of the Tertiary Period, flowed northward into Ohio until it was destroyed by early Pleistocene glaciers, with the eventual result that a new drainage system, the Ohio River, was created. The once-mighty Teays was forever abandoned, its former course marked by broad valleys in which only tiny streams flow today.

A glance at modern satellite imagery or even topographic maps of southern Ohio and adjacent parts of West Virginia and Kentucky clearly shows the course of the former Teays River in this region, but Tight did not have the benefit of such tools. Most of the first topographic maps (15-minute quadrangle maps) of the region were published in the period between 1898 and 1911 and were not available to Tight at the time of his research. Indeed, he bemoaned the fact that existing maps were inadequate and that benchmarks from which elevations could be determined were not always available in a particular area.

Although as early as 1894 Tight speculated on the northward course of the Teays River across an area mantled by thick glacial drift, precise tracing of the buried river course was impossible because of inadequate numbers of records from water and oil and gas wells. Tight's entry into university administration, far from Ohio, and his premature death precluded further work by him on this subject.

Karl Ver Steeg, professor of geology at the College of Wooster, began publishing on drainage changes in Ohio in 1930 and by 1936 had outlined the northwestward course of the Teays beneath the glacial drift from Chillicothe to the Ohio-Indiana border. Ver Steeg used logs from water and oil and gas wells to determine elevations of the bedrock surface beneath the drift and was thus able, through this first extensive map of the bedrock surface (also known as a top-of-rock map or bedrock-topography map) to delineate the course of buried valleys. The classic interpretation of the course of the Teays River in Ohio reached its essentially modern interpretation in the 1943 Division of Geological Survey Bulletin *Geology of water in Ohio* by Wilber Stout, Karl Ver Steeg, and George F. Lamb. This bulletin presented the first statewide bedrock-topography map, detailed tracing of the Teays and its tributaries and other preglacial drainage systems in Ohio, and interpretations of later drainage modifications due to additional glaciations.

By the 1940's, geologists in Indiana and Illinois had delineated the channel of a westward-flowing stream beneath the extensive glacial drift covering much of each of these states. This presumed preglacial stream was named the Mahomet River, after a community in Illinois. Researchers soon began to embrace the concept of the Teays as an 800-mile-long drainage system that stretched from the Appalachians westward across Ohio, Indiana, and Illinois.

THE CLASSIC TEAYS

The classic concept of the Teays that had developed during the first half of the 20th century was of a stream that originated during the Tertiary Period, more than 2 million years ago, with headwaters in western North Carolina, near Blowing Rock. The course of this stream is marked across Virginia and West Virginia by the modern New River (a misnomer as it is actually very old) and the Kanawha River. Near St. Albans, West Virginia, the modern Kanawha River continues northward to its junction with the modern Ohio River, whereas the Teays swung westward from St. Albans. The northward course of the Kanawha River was established after abandonment of the Teays system.

Eastward view across an abandoned segment of the preglacial Teays River valley near Wheelersburg, Scioto County. The valley is about 1.5 miles wide at this point and 150 feet higher in elevation than the modern Ohio River. Photo by Wilber Stout.

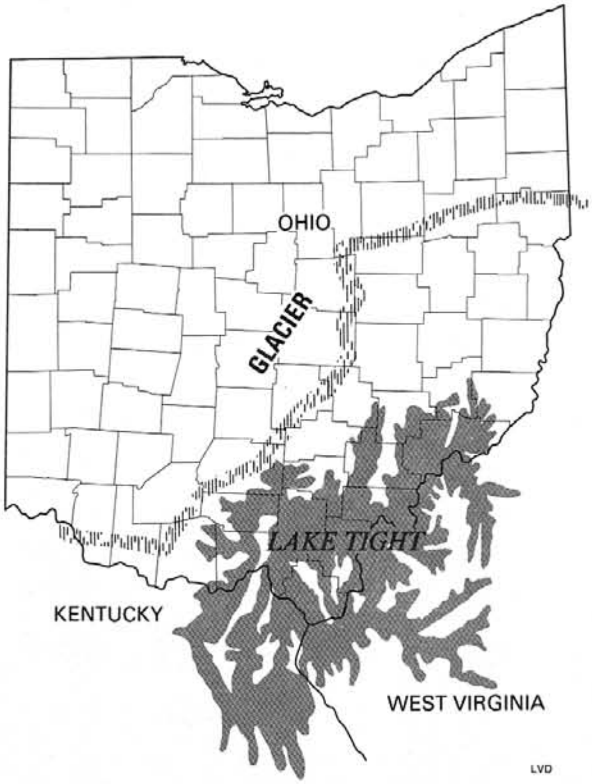
From St. Albans, the Teays flowed westward in a channel that is now abandoned by major modern streams to near Procterville, Ohio, where the valley of the Teays is now followed by the Ohio River to Wheelersburg. At Wheelersburg the Teays continued northward, although the modern Ohio swings westward. The Teays River continued northward, with some slight meanderings of the valley, across Scioto County, a small portion of Jackson County, and across Ross County. The now-abandoned valley from Wheelersburg to Chillicothe presents perhaps the most dramatic evidence, particularly on satellite imagery, of the existence and majesty of the Teays.

North of Chillicothe the valley of the Teays disappears beneath glacial drift. By means of water-well logs and other data the channel has been traced northwestward across Pickaway, Fayette, Madison, Clark, Champaign, Shelby, Auglaize, and Mercer Counties to the Ohio-Indiana border. At the Ohio-Indiana border the valley appears to be continuous with a valley that has been traced westward across Indiana and Illinois. In Ohio this valley is up to 2 miles wide and in some areas lies beneath more than 400 feet of glacial drift.

The valleys of the Teays and its many tributaries, some of which were impressive rivers themselves, can still be seen in unglaciated Ohio or traced as buried valleys in the glaciated portion of the state. The Teays drained nearly two-thirds of the state and constituted a major river system comparable in size to the modern Ohio River. The leisurely and idyllic life enjoyed by the Teays for so long during the Tertiary Period was to meet an abrupt end with the advent of glaciers during the succeeding Pleistocene Ice Age.

THE END OF THE TEAYS AND LAKE TIGHT

The Nebraskan glacier is thought to be the earliest of at least four major Pleistocene glaciers and is commonly thought



*Glacial Lake Tight as it may have appeared at some phase in its nearly 7,000-year history. The glacier is shown at maximum known extent of glaciation in Ohio, although it is likely that the early Pleistocene glacier that dammed the Teays River to create Lake Tight was not this extensive at any one time. Ridge tops above 900 feet formed islands in the lake and the Minford clay accumulated to a thickness of at least 80 feet in some of the submerged valleys. Extent of Lake Tight is greatly generalized from a map by J. N. Wolfe, 1942 (*Ohio Journal of Science*, v. 42, p. 2-12).*

to have been the executioner of the Teays River. Direct evidence of this early glaciation in Ohio is lacking, apparently because such deposits were removed by the erosive forces of running water and later glaciations.

Direct evidence of the demise of the Teays is preserved in a large area of southern Ohio that was occupied by the Teays and its tributaries. This evidence consists of thick deposits of laminated clay, known as the Minford clay, that accumulated in extensive lakes created when the north-flowing Teays was dammed by this early glacier. The exact time of the damming cannot be accurately determined with currently available methods, but studies of the magnetic polarity of the Minford clay indicates that it was deposited during a period of reversed magnetic polarity of the earth known as the Matuyama Reversed Epoch. The earth returned to normal magnetic polarity about 690,000 years ago, so the damming of the Teays by glacial ice, and the consequent accumulation of the Minford clay in the ponded waters, must have occurred between 2 million and 690,000 years ago.

The lake created by the damming of the Teays must have been an impressive sight, as the waters rose to elevations of nearly 900 feet, creating an intricate pattern of long finger lakes in tributary valleys and with numerous ridgetops poking above the waters as islands. This lake, named Lake Tight in honor of the work of W. G. Tight, is estimated to have covered an area of nearly 7,000 square miles (modern Lake Erie has an area of 5,002 square miles) in southern Ohio and

Thick deposit of Minford clay that accumulated in the waters of Lake Tight when the Teays River was dammed by an early Pleistocene glacier. This deposit was exposed along the Chesapeake and Ohio railroad in Harrison Township, Scioto County. The vertical grooves in the clay are from excavating equipment. Photo by Jesse E. Hyde, 1916.

parts of West Virginia and Kentucky. Lake Tight must have existed for some time because the sediments (Minford clay) that accumulated in its depths are up to 80 feet thick in southern Ohio and more than 260 feet thick in the lower reaches of the Ohio portion of the Teays valley in Madison County. The Minford clay exhibits rhythmic bedding that has been interpreted as seasonal layering. Counting of these sediment couplets suggests that Lake Tight existed for at least 6,500 years.

Eventually the waters of Lake Tight rose to an elevation sufficient to breach drainage divides and create new drainage channels, which in some cases were opposite in direction to the original Teays drainage. These new drainage channels cut below the elevation of the Teays, forming a new drainage system known as Deep Stage. This event marked the beginning of the modern Ohio River drainage system, although it would require many further modifications from the Kansan, Illinoian, and Wisconsinan glaciers to finally shape the present course of the Ohio River.

THE NOT-SO-CLASSIC TEAYS— OTHER IDEAS AND FUTURE RESEARCH

This neatly packaged concept of preglacial drainage and subsequent modification by glaciation has been pieced together over a long period of time by a large number of investigators and has captured the public imagination. But is this, in part, a story that would more appropriately begin with "Once upon a time"? Certainly, most of the story is accurate and is widely accepted by geologists because the principal facts cannot reasonably be interpreted in any other way. But there have been some interesting alternatives proposed for parts of the story.

George N. Coffey, a soils scientist trained in geology, authored two papers (1958, 1961) in the *Ohio Journal of Science;* the latter was published when he was 90 years old and proposed that the classic path of the lower portion of the Teays in preglacial times—across western Ohio, Indiana, and Illinois—was in error. On the basis of the position of bedrock drainage divides, Coffey suggested that the ancestral Teays River continued northward from central Ohio to the Erie basin, following the outcrop of soft, easily eroded shale of Devonian age. Coffey explained that the deep, buried valley that extends westward across Ohio, Indiana, and Illinois, the traditionally accepted valley of the Teays, was created by an early Pleistocene glacier that destroyed the lower portion of the Teays drainage and created a major westward-flowing ice-front river. He named this later stream system the Mahomet-Teays River, as it now connected the upper portion of the Teays system with the Mahomet River valley in Illinois.

More recently, Henry Gray of the Indiana Geological Survey, at a 1983 Geological Society of America symposium on the Teays, supported the idea that the deep, buried valley in western Ohio, Indiana, and Illinois was not created by the preglacial Teays River. Gray, like Coffey, suspects that this valley was formed along the ice front of an early Pleistocene glacier. Gray cited evidence for this hypothesis which includes observations that this buried valley is youthful in development rather than mature as would be expected from a long-existing preglacial river. Gray indicated that this evidence for a youthful valley includes a straight gorge that crosses three areas of elevated bedrock, the depth of the gorge across a broad plateau of limestone, relatively shallow development of karst features, and the fact that most of the tributaries to this valley do not join at grade, which would be expected with a mature stream.

The interpretations of Coffey and Gray are provocative and perhaps plausible—except that no deep, buried valley has been located that runs from Chillicothe northward to the Lake Erie basin. Coffey suggested that a broad, shallow valley across Wyandot, Seneca, Sandusky, and Ottawa Counties, as depicted on maps of the bedrock surface of Ohio by Cummins (1959) and Stout, Ver Steeg, and Lamb (1943), delineates the former course of the preglacial Teays River into the Erie basin.

Most geologists have remained unconvinced that this shallow valley represents the course of the preglacial Teays and support the classic interpretation that this river did indeed flow across western Ohio into Indiana and Illinois. Although this deep, buried valley does not perfectly fit the model of a mature stream as would be predicted from studies of the exposed portions of the Teays valley in southern Ohio, it still appears to be the hypothesis that best fits the available geologic data. Scientific hypotheses are formulated, or refuted, on the basis of available data. As new data accumulate, however, classic hypotheses sometimes require reevaluation.

The Division of Geological Survey is in the process of providing new data which, among many uses, may have important bearing on the questions concerning the Teays and other preglacial drainage systems in Ohio. These new data will be in the form of top-of-rock maps for all of the glaciated counties in the state. Such maps are contour maps, similar to the familiar topographic maps, except that they show the contours on the bedrock surface as if all of the overlying glacial sediments had been removed.

Top-of-rock maps are compiled primarily from the logs of water wells that reach the bedrock surface. For many counties in the state several thousands of such wells are available as data points. When mapping is completed for all glaciated counties we should have a more complete picture of the buried topography—and perhaps preglacial drainage patterns—in Ohio.

Inevitably, some portions of counties that are critical to the questions concerning the Teays will not have an adequate distribution of water wells to completely solve the puzzle. Nevertheless, we may move several steps closer to deciphering the intricacies of an ancient drainage pattern that has undergone a complex series of modifications through several episodes of glaciation, ponding, and cutting of new drainage outlets. These factors have obscured or removed portions of the evidence and added considerably to the number of pieces of this puzzle.

There is a tendency to view the bedrock surface beneath glacial sediments in Ohio as having been formed at the same time and suddenly encapsulated in till, preserving the surface exactly as it was at the onset of glaciation. In reality, of course, this bedrock surface is a "crazy quilt" of erosion surfaces of different ages—some of them preglacial, some of them sculpted by various glacial advances and by streams draining the meltwaters from each of these glaciers, and some of them carved by modern streams. The task of the geologist in dealing with this problem can be compared to reconstructing several different puzzles from a variety of puzzle parts that are all mixed together in the same box. The task is further complicated by the fact that numerous pieces of the puzzle are missing. Fortunately, new pieces of the puzzle are discovered from time to time and eventually the true picture may emerge.

FURTHER READING

Coffey, G. N., 1961, Major preglacial, Nebraskan, and Kansan glacial advances in Ohio, Indiana, and Illinois: Ohio Journal of Science, v. 61, p. 295-313.

King, C. C., ed., 1983, Teays-age drainage effects on present distributional patterns of Ohio biota: Ohio Biological Survey Informative Circular No. 11, 14 p.

Stout, Wilber, Ver Steeg, Karl, and Lamb, G. F., 1943, Geology of water in Ohio: Ohio Division of Geological Survey Bulletin 44, 694 p.

Tight, W. G., 1903, Drainage modifications in southeastern Ohio and adjacent parts of West Virginia and Kentucky: U.S. Geological Survey Professional Paper 13, 111 p.

Ver Steeg, Karl, 1946, The Teays River: Ohio Journal of Science, v. 46, p. 297-307.

MINERAL INDUSTRY WORKSHOP A SUCCESS

Early this summer, while students were still getting used to summer vacation, 21 junior and senior high school teachers participated in the first Ohio Mineral Industry Workshop. This event was conducted by the Division of Geological Survey and the University of Akron on June 22-26 at ODNR headquarters in Columbus. Grants from the Ohio Aggregates Association, Ohio Coal and Energy Association, Ohio Mining and Reclamation Association, and Ohio Oil and Gas Association paid for field-trip costs and educational materials.

The purpose of the workshop was to familiarize participants with the economic geology of Ohio so that these teachers could more effectively communicate this information to their students. Participants listened to representatives from research, industry, and regulatory agencies present a variety of information on the economics, regulations, and geologic origin of the economic mineral resources in the state.

Three days of field trips gave the teachers a firsthand look at the operations of various mineral industries. The first field trip, which included an overnight stay at Burr Oak Lodge in Morgan County, visited the Waterloo Coal Company in Jackson County. Teachers viewed coal strip mining, reclamation activities, and limestone mining and were provided lunch by Waterloo Coal Company. Afternoon activities included a tour of the Southern Ohio Coal Company's coal-preparation plant in Meigs County. On the second day of the field trip the teachers toured Central Silica Company's sandstone quarry and glass-sand processing plant in Perry County and were provided lunch by the company. The group then journeyed to Flint Ridge State Memorial in Muskingum

County. This site is a monument to Ohio's earliest mineral industry, where Indians dug shallow pits in order to extract flint for projectile points and other tools. A stop at the operations of Bowerston Shale Company in Licking County concluded the day's events. Although oil and gas well sites were observed and discussed at numerous localities, heavy rains prohibited a scheduled stop at an active drilling rig.

The second field trip was confined to Franklin County. The teachers toured the sand and gravel and limestone operations of the American Aggregates Corporation, a concrete mixing plant of the Anderson Concrete Company, and the Franklin County landfill. Several reclaimed sand and gravel pits and limestone quarries were included in this field trip.

Written comments submitted by teachers indicated that the workshop was a success and included such notations as "useful; informative; unique field trips." Speakers and mineral industry officials were also favorably impressed with the success of the workshop. Such responses suggest that a similar event next year would be welcomed.

—René L. Fernandez
Regional Geology Section

1986 MINERAL INDUSTRIES REPORT

The Division of Geological Survey has released the *1986 Report on Ohio mineral industries,* compiled by Survey geologist and mineral statistician Sherry L. Weisgarber. The 1986 report provides production, sales, and employment statistics for all of Ohio's mineral industries, which include coal, limestone and dolomite, sand and gravel, sandstone and conglomerate, clay, shale, gypsum, salt, and peat. Statistics on mineral value and wages within each mineral-commodity group and directories of mineral producers in the state are included in the report. Production and mineral-value statistics for oil and gas also are included. A map of the locations of reporting producing coal mines and all industrial-mineral mines in 1986 accompanies the report.

The 1986 report has some significant changes from the 1985 report. The most significant change is the inclusion of the name of the president, owner, or manager of each company in the alphabetical directory of reporting producing coal-mine operators, the directory of reporting coal-washing plants and associated facilities, and the alphabetical directory of industrial-mineral mine operators. The alphabetical directory of industrial-mineral mine operators also now includes the production of each commodity, by mine, as well as sales. This year, table 9, *Dollar value of coal at mine, by county and mining method,* includes the totals of the tonnage sold and the value at mine, by county. The commodity summaries now give the number of companies which sold or produced each commodity along with the number of mining operations. The state commodity maps have been enlarged and symbols rather than patterns have been used to denote the tonnages sold from each county. One additional map, *Summary of new oil and gas well drilling in 1986,* has been included in this year's report. The commodity sales and value graphs have been reduced in size so they fit beside their respective state commodity maps. The *Numerical index of operators of mines shown on the 1986 mineral industries map of Ohio* this year includes the abbreviation of the county where the mine is located. The 1986 report commemorates the Division's Sesqui-

continued on next page

Michele L. Risser, 1952-1987

It is with deep regret that we report the death of former Division of Geological Survey geologist Michele L. Risser. Michele passed away on June 25, 1987, at the home of her parents in Pandora, Ohio. Her death followed a difficult 2½-month bout with cancer.

Michele began her career with the Survey in 1974 following her graduation from Miami University with a BA degree in geology. Michele produced top-of-rock and drift-thickness maps for seven counties. In 1977, her duties expanded to include the mapping of sand and gravel resources and surficial materials. Michele authored sand and gravel reports for Ashtabula, Columbiana, and Medina Counties and a surficial materials map for Medina County. In 1982, Michele left the Survey to pursue a degree in nursing at the Mount Carmel Hospital School of Nursing in Columbus. She obtained a nursing degree in 1985. At the time of her death, Michele was employed as a registered nurse at Riverside Methodist Hospital in Columbus.

Michele is remembered by all who knew her as a sincere, dedicated employee and a friend to all. Her generosity, integrity, and courage in the face of personal adversity will not be forgotten.

—Dennis N. Hull
Head, Regional Geology Section

centennial Year with a special article on the history of the mineral industry in Ohio. Photographs of the mineral industry also are included throughout this year's report.

Single copies of the 1986 report and map are available from the Survey for $5.47, which includes tax and mailing. The map is available separately for $1.81, which includes tax and mailing. Add 50¢ per order if a rolled copy of the map is desired. Also available upon request are copies of the *Errata, revisions, and additions* for the *1985 Report on Ohio mineral industries.* A summary of the revised 1985 commodity information is given below. Please contact Sherry L. Weisgarber at 614-265-6588 for further information.

REVISED SUMMARY OF 1985 OHIO MINERAL STATISTICS

Numbers that are changes from those printed in the *1985 Report on Ohio mineral industries* are in *italics*

Commodity	Total production in 1985 (tons)	Total sales in 1985 (tons)	Value of tonnage sold (dollars)	Number of mines reporting sales	Average price/ton (dollars)
Coal	*34,751,772*	*35,401,510*	*$1,142,874,073*	*302*	*$32.28*
Limestone/dolomite	*31,851,345*	*38,417,138*	*132,455,046*	114[1]	*3.45*
Sand and gravel	*18,845,807*	*31,259,901*	*98,882,066*	255[1]	*3.16*
Salt	4,215,755	4,339,571	43,277,374	5	9.97
Sandstone/ conglomerate	1,273,697	2,073,784	25,017,916	27[1]	12.06
Clay	775,436	968,547	5,486,681	33[1]	5.68
Shale	1,035,288	1,328,580	1,778,252	25[1]	1.35
Gypsum	247,963	247,963	2,355,648	1	9.50
Peat	17,807	29,584	125,275	4	4.23

[1]Includes some mines which produced multiple commodities.

QUARTERLY MINERAL SALES, JANUARY—FEBRUARY—MARCH 1987

compiled by Sherry L. Weisgarber

Commodity	Tonnage sold this quarter[1]	Number of mines reporting sales[1]	Value of tonnage sold[1] (dollars)
Coal	8,197,651	219	252,546,091
Limestone/dolomite[2]	5,319,985	88[3]	21,069,278
Sand and gravel[2]	2,775,412	118[3]	8,457,383
Salt	904,592	5[4]	9,691,561
Sandstone/conglomerate[2]	399,603	21[3]	5,159,843
Clay[2]	143,044	20[3]	856,945
Shale[2]	257,455	14[3]	223,825
Gypsum[2]	64,898	1	616,531
Peat	1,549	2	21,325

[1]These figures are preliminary and subject to change.
[2]*Tonnage sold* and *Value of tonnage sold* include material used for captive purposes. *Number of mines reporting sales* includes mines producing material for captive use only.
[3]Includes some mines which are producing multiple commodities.
[4]Includes solution mining.

CAESAR CREEK FIELD TRIP

As part of the celebration of our Sesquicentennial Year, the Division of Geological Survey is sponsoring a fossil-collecting field trip to Caesar Creek State Park (Warren County) on Saturday, November 7, 1987. There is no fee, but **preregistration is required.** Details are provided on the insert in the newsletter.

Ohio Department of Natural Resources
Division of Geological Survey
Fountain Square, Building B
Columbus, Ohio 43224

OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF GEOLOGICAL SURVEY 1837-1987 150 YEARS OF SERVICE

Naturally OHIO the heart of it all!

BULK RATE
U.S. POSTAGE PAID
Columbus, OH
Permit No. 537

Total copies printed: 2,900
Unit cost: $.8103
Publication date: 10/87