G100 Field Trip: Bedrock and Surficial Geology of Fort Wayne and Northeast Indiana
by James O. Farlow

1. Leave IPFW Kettler parking lot, and go out the north exit of the campus. The IPFW campus is site D on the reference map.

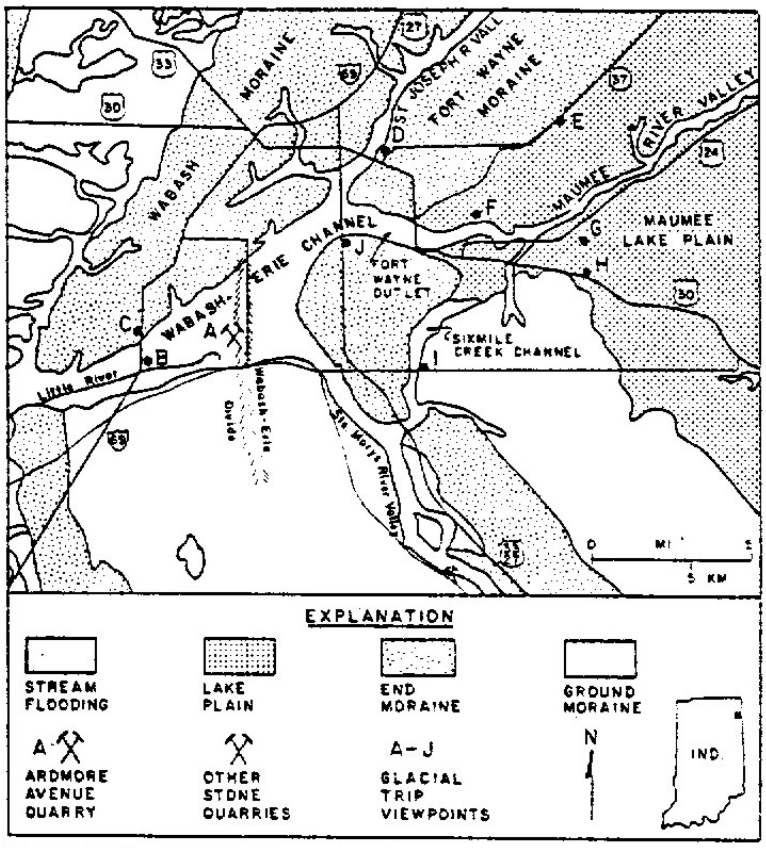

Figure 1. Geomorphic map of the Fort Wayne area, Allen County, Indiana, showing distribution of Pleistocene glacial landforms, location of rock quarries, and viewpoints for Pleistocene geomorphic features. Modified from Bleuer and Moore (1978).

Reference map for the Pleistocene portion of the field trip. Taken from Sunderman (1987)

Note the eolian dunes on the left that we visited during class. Recall that these dunes formed during the late Pleistocene (the very end of the Cenozoic Era) from glacial outwash that was blown downwind, out of the St. Joseph River valley. We will see other examples of wind-blown dunes later in the day.

The dune field is actually a small-scale feature that sits atop a much larger feature, the Fort Wayne Moraine. The Fort Wayne Moraine, like the Wabash Moraine a bit farther west, is a few miles wide. Its width is much greater than its height, and so it is not readily recognizable when one drives across it.

The Wabash and Fort Wayne Moraines are the youngest of a series of end moraines that formed as a continental glacier (more exactly, the Huron-Erie Lobe of the Wisconsinan glacier, the last continental glacier to cover North America) retreated from northeastern Indiana. As one travels southwest from the Fort Wayne area, the Salamonie, Mississinewa, and the Union City Moraines are encountered, in that order. Each of these end moraines formed when the balance between glacier growth (due to snowfall in the glacier s source area) and decay (due to melting at the glacier s front end) was such that the front end of the glacier remained in roughly the same place for a protracted period of time. The Union City Moraine is the oldest, and the Fort Wayne Moraine the youngest, of these features. During times when melting of the front of the glacier was faster than the addition of new ice from behind, an end moraine was abandoned, and lower, flatter ground moraine material was deposited as the ice melted back, until the glacier s growth and decay once again came into rough balance, and a new end moraine was formed. Thus the retreat of the glacier was not a steady process, but something that happened in distinct pulses, punctuated by long periods when the front of the glacier stood more or less still.

The St. Joseph River here marks the boundary between the Fort Wayne and Wabash Moraines, and this position of the river tells us that it originated as a stream that carried meltwater from the margin of the continental glacier during the time that it deposited the Fort Wayne Moraine. The Ste. Marys River occupies a similar position with respect to the Fort Wayne Moraine, along the moraine s southern margin. Similarly, other ice marginal rivers (the Mississinewa, the Salamonie, the Wabash, and the White Rivers) formed along the edges of the other end moraines when they marked the front end of the glacier.

2. Turn left at the north campus exit, and then left again onto St. Joe Center Road.

After we cross the river, look ahead and notice the slight increase in elevation. As we drive along the road, we climb out of the St. Joseph River s present-day valley, and onto a stream terrace formed when the river was at a higher elevation with respect to the surrounding landscape. Put another way, the river has cut down into the land, and abandoned its former floodplain, since the Pleistocene.

Beyond the terrace we move onto the Wabash Moraine, the next end moraine older than the Fort Wayne Moraine.

3. Turn right onto Coldwater Road, and then take I-69, heading south. Take the U.S. 24 exit, heading west, all the way to Huntington.

As we travel west along 24, we are going through the valley of the Little Wabash River (often called simply the Little River). The river is aptly named; it is a tiny stream in

comparison with the size of the valley through which it moves. Notice the width of the valley from one side to another. We will have more to say about this one the way back.

4. At Huntington, take the bypass (right fork of U.S. 24) around the city. At the four-way stop just north of the Wabash River, turn right, staying on 24 and heading toward Wabash.

   Just south of the four-way stop is where the Little Wabash meets the main or historic fork of the Wabash, a stream whose headwaters developed along the margin of the Wabash Moraine, near Bluffton. At present the main fork of the Wabash is a more important source of stream discharge than the Little River. Later in the day we will see that the reverse may have been true at the end of the Pleistocene.

5. As we travel west along 24, notice the big ditch immediately to our left. This is a remnant of the old Wabash-Erie Canal; Fort Wayne was the summit city on this canal route. As we go further along 24, look for the occasional outcrops of rock. These are exposures of the Wabash Formation, a middle Paleozoic (Silurian Period) unit that we will examine more closely later today.

6. Stay close when we get to Wabash. We will head into town; I am looking for a railroad cut, and I may have to drive around a bit until I find it.

   The Wabash Railroad cut is one of the most famous rock exposures in the Midwest. It cuts right through a reef developed in the Wabash Formation. As we walk along the railroad cut, note reef flank beds dipping to either side away from the featureless reef core. This reef is one of many that developed in northern Indiana in shallow, warm seas more than 400 million years ago. At that time the ancestral North American continent sat right on the equator; northern Indiana was a tropic marine paradise possibly something like the modern Bahamas! Preservation of the fossils of organisms that built this and other reefs in northern Indiana is usually pretty poor, due to the conversion of the original limestone of the reef rock to dolomite.

7. Return east on U.S. 24. At Lagro we will turn south for a brief stop at Hanging Rock preserve.

   Hanging Rock is a klint (plural, klintar), a bit of Wabash Formation reef rock that was uncovered by the erosive force of the Wabash River during the Pleistocene, when the river s discharge (derived from glacial meltwaters) was probably considerably greater than at present. Hanging Rock represents material from the core of the ancient reef.

8. Return to 24, and continue eastward. At the four-way stop just west of Huntington, turn right and cross the Wabash River on combined U.S. 37/State Road 9. Immediately after crossing the river we will turn left onto a little dirt road.

   We are now standing on the surface of another Silurian reef in the Wabash Formation; fossils of the reef-builders (corals and stromatoporoids [extinct sponges or sponge-like animals]) can be found. As one walks downhill toward the south, one leaves the reef behind for fine-grained, interreef sedimentary rocks. Diligent searching of these interreef rocks may turn up fossils of crinoids or even trilobites.

9. Head north on 24 around Huntington. Stay close behind me, because we are going to stop at a rock quarry to look at more reef exposures of the Wabash Formation. With luck you may be able to collect reasonably good fossils of marine animals that lived on and around the reef.

10. Continue east on 24. Note once again the puny size of the Little River, compared with the valley through which it flows. Just before we get to I-69, turn right (south) onto Ellison Road. We will stop briefly along the road to look at the landscape around us (between spots B and C on the reference map).

    When the Huron-Erie Lobe sat behind the Fort Wayne Moraine near the end of the Pleistocene, perhaps 15,000 years ago, meltwater from the glacier fed into the St. Joseph and Ste. Marys Rivers (ice-marginal streams). The two streams met at the western edge of the Fort Wayne Moraine, and their combined discharge created a much bigger stream that carved a valley known as the Wabash-Erie Channel (see reference map), also called the Sluiceway. This is the wide valley along U.S. 24 between Fort Wayne and Huntington, now occupied by the Little River. At the end of the most recent glacial episode this valley may have been filled with water. The river that flowed through the Wabash-Erie Channel was probably the main source of water for the Wabash River system (more important than the historic Wabash River that originates along the Wabash Moraine near Bluffton) in the late Pleistocene.

    The Sluiceway continued to carry water from the combined Ste. Marys and St. Joseph Rivers even after the glacier had melted back to the east of Fort Wayne. At that later time, roughly between 14,000 and 13,000 years ago, meltwater from the glacier was temporarily trapped between the ice front to the east and the Fort Wayne Moraine to the west, and formed a huge lake, the ancestor of modern Lake Erie. This prehistoric glacial lake is called Lake Maumee (see reference map). At some point after Lake Maumee formed, it became deep enough that its waters breached the Fort Wayne Moraine, cutting the Fort Wayne outlet across the moraine and once again flowing through the Wabash-Erie Channel into the Wabash River system.

Presumably it was flow through the Sluiceway that played the dominant role in putting enough discharge into the Wabash River to exhume klintar like Hanging Rock.

11. Continue along Ellison Road (eventually becomes Yohne Road) to Fox Island County Park (B on the reference map). Lunch and bathroom stop.

After lunch, take a short hike into the dune field of the park. The Fox Island sand dues, like those of the IPFW campus, are eolian features. The source of sand was outwash or other stream deposits of the Wabash-Erie Channel.

12. Turn left out of Fox Island onto Yohne Road. The headwaters of the Little River (here nothing more than a ditch) are to your right. When the road comes to a T, tum left onto Smith Road. Turn right on Smith Road and stop at the Ardmore Avenue Quarry (A on the reference map).

This stop is interesting for two reasons. First of all, this site is very close to the present-day continental divide between the Wabash-Ohio-Mississippi-Gulf of Mexico and the Maumee River-Lake Erie-Atlantic Ocean drainages; this continental divide was established when the Maumee River captured the St. Joseph and Ste. Marys Rivers. More about that later.

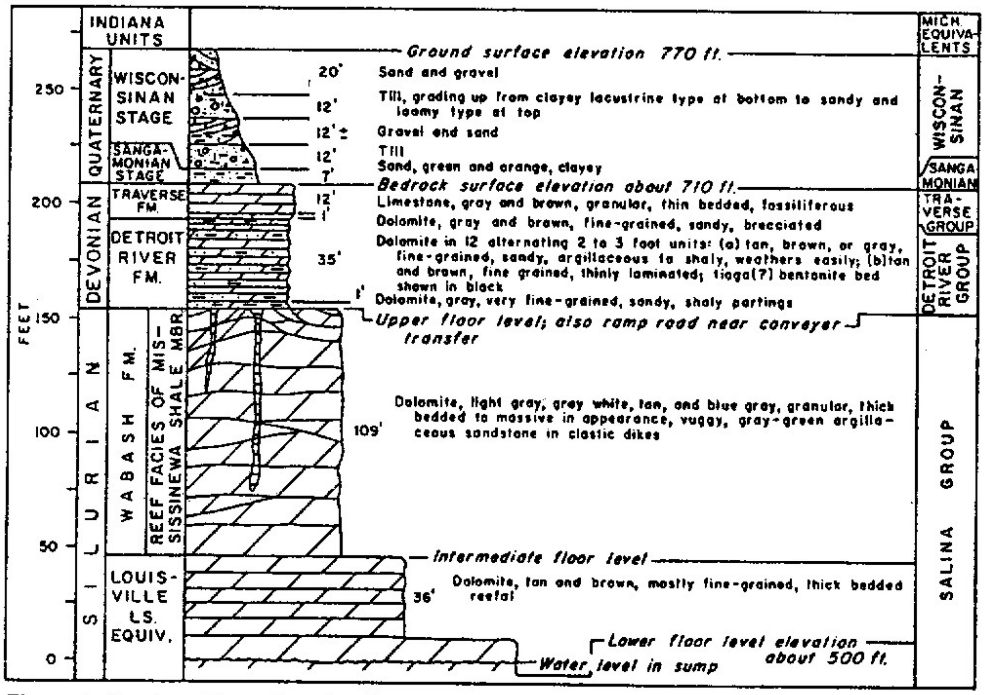

Figure 4. Stratigraphic section showing age, thickness, and characteristics of Paleozoic strata and Pleistocene materials exposed at various levels in the Ardmore Avenue Quarry. Modified from Shaver (1976).

The second reason for interest is the big hole in the ground in front of us (see stratigraphic section, taken from Sunderman [1987], reproduced above). We see in this quarry a good view of the bedrock geology of the Fort Wayne area. At the base of the quarry is the upper part of the northern Indiana equivalent of the Louisville Limestone, a dolomite of Silurian age. Above that is our old friend, the Wabash Formation, which here consists entirely of ancient reef rock. During the later part of the Silurian Period a huge barrier reef complex, the Fort Wayne Bank, surrounded what is today the lower part of the state of Michigan. Too bad we can t see the reef as it existed then Fort Wayne might have been one of the world s premier must-see places for SCUBA divers!

The top of the Wabash Formation is truncated by a major disconformity (for those familiar with such things, this unconformity marks the boundary between the Tippecanoe and Kaskaskia cratonic sequences). The rocks above the unconformity are of Middle Devonian age, and so the time gap represented by this erosion surface is about 15 million years. Karst topography is developed in the upper parts of the Wabash Formation rocks, probably due to chemical weathering of these rocks when they were exposed above sea level and the unconformity was eroded. There are also fractures in the Wabash Formation rocks that developed while they were exposed, fractures that became filled with sands when seas once again flooded the Fort Wayne area during the Middle Devonian.

The rocks immediately above the unconformity belong to the Detroit River Formation. Although deposited under marine conditions, the Detroit River has few fossils other than stromatolites, and may have been deposited under shallow, restricted, intertidal conditions. Within the Detroit River is a clay bed that may have originated as a volcanic ash, blown into Indiana from an eruption in the Appalachian region (perhaps associated with the Acadian Orogeny). This alter volcanic ash bed, called the Tioga Bentonite, is widely distributed in the eastern United States, and is particularly well known in central New York State.

Above the Detroit River Formation are Devonian limestones of the Traverse Formation. Unlike the Detroit River rocks, the Traverse is filled with fossils or corals and other marine animals, suggesting that this unit was deposited under normal, subtidal, shallow marine conditions.

Yes another unconformity this one of even greater temporal extent than the one between the Wabash and Detroit River Formations separates the Traverse Formation from overlying Pleistocene glacial tills, sands, and gravels. All of the late Paleozoic and Mesozoic time is missing from the stratigraphic record of the Fort Wayne area, along with nearly all of Cenozoic time. This means that the time gap represented by this upper unconformity represents some 375 million years! This in turn indicates that northern Indiana has been dry land, subject to erosion, since well before the time of the dinosaurs. In fact, there probably were dinosaurs living in Indiana throughout the Mesozoic Era, but the absence of Mesozoic rocks means that we will probably never know exactly what Hoosier dinosaurs were like.

13. For the rest of our trip we will be looking at features of the Pleistocene geology of the Fort Wayne area. Turn left out of the Ardmore Quarry parking lot, then left on Smith Road, and left again on Lower Hunting Road. Immediately after crossing Ste. Marys River, turn right at the T onto Tillman Road.

As noted before, the Ste. Marys River, like the St. Joseph River, developed as an ice-marginal stream along the edge of the Huron-Erie lobe of the Wisconsin glacier. After we cross the river we are once again on the Fort Wayne Moraine. In fact, as we travel along Tillman Road, you can see that we are climbing in elevation as we ascent the moraine.

14. Turn right on Hessen Cassel Road, and then immediately turn left into the parking lot of the Trier Ridge Community Church of God (I on the reference map).

Recall that after the Huron-Erie glacial lobe melted eastward away from the Fort Wayne area, meltwaters from the glacier ponded between the ice front to the east and the Fort Wayne Moraine to the west to form Lake Maumee. Eventually the water of the lake became deep enough that it flowed across a low point in the moraine, and then eroded a gap at that spot in moraine to form the Fort Wayne Outlet. Excess water from Lake Maumee then drained through the Fort Wayne Outlet into the Wabash-Erie Channel, and then down the Wabash River proper.

However, the Fort Wayne Outlet was not the only spot at which Lake Maumee waters entered the prehistoric Wabash River drainage system. We are looking across the valley of Sixmile Creek, also known as Trier Ditch. This valley was a secondary outlet through which Lake Maumee waters crossed the Fort Wayne Moraine. Here they flowed through Sixmile Creek into the Ste. Marys River, which then met the St. Joseph River to feed into the Wabash-Erie Channel (the Sluiceway).

From the size of the valley, it is clear that a very large amount of sediment was eroded in the formation of this outlet from Lake Maumee-and this is though to have been a less important drainage of the lake than the Fort Wayne Outlet! One wonders if the outflow from Lake Maumee into the Ste. Marys River, and across the Fort Wayne Outlet into the Sluiceway, might at times have been catastrophic. Surf Lake Maumee!

15. Continue east on Tillman Road. As we head east, the Fort Wayne Moraine grades imperceptibly into ground moraine. Turn north on I-469, and then east on U.S. 30. Turn right on Doyle Road, and then make an immediate left onto a dead-end road. Follow this road to the cul-de-sac, turn around (we know what we are doing) and head back along the road until we come to a convenient parking spot along the road (H on the reference map).

We are looking north across the Lake Maumee plain. Roughly 14,000 years ago the scene in front of us would have been filled with water; we would be standing on the shore of the lake. Lake Maumee was a stage in the development of modern Lake Erie; because of their origin as glacial ice, its waters were probably not conducive to swimming (the Wabash Formation seas would have been more enjoyable in that regard). We are closed to the western edge of where the position of the opposite shore of the lake in our area. Farther east, in Ohio, the lake would have been so wide that one wouldn t have been able to see across it, any more than one can look from one shore to another across the widest park of Lake Erie today.

Lake Maumee is gone now, but its bed remains low and flat. Before extensive drainage ditches were dug into this plain for agricultural purposes, the old lake bed was a region of swampy forest, like the Black Swamp of historical times. Indeed, if the man-made drainage system were to be disrupted, the lake plain would probably once again become a huge wetland.

16. Head north on Doyle Road, across U.S. 30. We are now descending onto the prehistoric lake bed. Cross State Road 14 and two sets of railroad tracks. Turn left on Edgerton Road. We are still on the lake bed, but notice the house on a slight hill to our left. Turn right into a small cemetery, go to the far end, and park (G on the reference map).

Once again we are in dune sand, as we were at the north end of the IPFW campus and at Fox Island. Similarly, the house on the little hill across the road is built on dune sand. The sand dunes we see here, like those at IPFW and Fox Island, may well have an eolian origin, but the position of the dunes at the present stop, close to where Lake Maumee drained into the Fort Wayne Outlet, suggests the possibility that what we see here may have been underwater sand dunes, formed from sand piled up as water began to increase in speed as it moved into the Fort Wayne Outlet.

17. Backtrack along Edgerton Road, and turn left on Doyle Road. Note more sand dunes on our right. Turn right (east) onto U.S. 24, and then left onto Bruick Road. Cross the Maumee River.

As the continental glacier continued to melt back and retreat eastward toward the present position of Lake Erie, eventually drainage channels for Lake Maumee were developed in Ohio and Michigan that were lower in elevation than the Fort Wayne Outlet and Sixmile Creek, and the lake began to drain toward the north and the east. This was the beginning of the end of the prehistoric lake in the Fort Wayne area, although the lake survives in its modern incarnation as Lake Erie.

As lake levels fell and the prehistoric lake bed was exposed east of Fort Wayne, the Maumee River evolved to drain the watershed that developed on the east flank of the Fort Wayne Moraine. At that time, the site of Fort Wayne would have been the continental

divide between waters flowing eventually to the Gulf of Mexico and those eventually reaching the Atlantic Ocean. It seems a fair guess that in its early history the Maumee River was a much smaller stream than it is today, now that it receives the combined discharge of the St. Joseph and the Ste. Marys Rivers more of that later.

18. Turn left at a very odd triangular intersection onto Stellhorn Road. As we approach Maysville Road, we climb out of the lake bed onto a sandy beach ridge. Turn left onto Maysville Road; we will be traveling more or less along the margin of old Lake Maumee as we head southwest along Maysville Road. Make another left to stay on Maysville Road at a Lutheran church with an odd, swiss-cheese-like steeple. Turn right onto North River Road, and immediately make a left turn into the GTE parking lot (F on the reference map).

    We are now looking across the Fort Wayne Outlet. Recall that this channel, along with Sixmile Creek, was one of the two gaps across the Fort Wayne Moraine through which excess water from Lake Maumee flowed into the Wabash-Erie Channel (Sluiceway), and from there into the main Wabash River system. As the continental glacier retreated farther and farther toward Ohio, Lake Maumee began to drain to the east, and the modern Maumee River developed, the Fort Wayne Outlet was temporarily abandoned. It remained a low-lying, probably marshy bit of terrain, and the stage was set for a dramatic change in the drainage system of the Fort Wayne area.

19. Continue west on North River Road, which becomes Lake Avenue as we enter the city. Eventually we are driving along on the Fort Wayne Outlet, but it is hard to tell where this happens because of all the urban development around us. Turn right into the parking lot of the apartment complex. Park and walk back onto the bridge.

    We are looking at the junction where the modern St. Joseph and Ste. Marys Rivers join to form the modern Maumee River; in the distance is the water treatment plant for the city of Fort Wayne.

    As the prehistoric Maumee River eroded backward into the Fort Wayne area, it eventually reached a point where it was separated from the St. Joseph/Ste. Marys River system only by the low-lying, swampy terrain of the Fort Wayne Outlet. This was a time when the location of present-day Fort Wayne was the continental divide between the Lake Erie and the Wabash River drainage systems, as described at earlier stops.

    We can only guess at what exactly happened next, but a reasonable hypothesis is that one year there was a flood that was much bigger than usual. The St. Joseph and Ste. Marys Rivers jumped their banks and flooded the marshy ground of the Fort Wayne Outlet. The discharge of this unusual flood was enough to cut across the outlet and come into contact with the headwaters of the Maumee River. Once this happened, the floodwaters rushed to the east into the Maumee River, and their erosive force was enough that the new channel

cut across the Fort Wayne Outlet into the Maumee River was at a lower elevation than that of the Sluiceway. This meant that when the floodwaters receded, the Sluiceway was permanently abandoned by the St. Joseph and Ste. Marys Rivers, whose discharge now served to convert the Maumee from a minor creek to a large river. Once again, river waters flowed through the Fort Wayne Outlet, but now they flowed eastward, toward Lake Erie, instead of westward, into the Sluiceway, the direction of flow when Lake Maumee s waters lapped against the eastern edge of the Fort Wayne Moraine.

There were several other interesting consequences of this act of stream piracy as well. Deprived of the discharge of the Ste. Marys and St. Joseph Rivers, the once-mighty fork of the Wabash that had occupied the Wabash-Erie Channel degenerated into the Little River of the present day. The southern fork of the Wabash River system (the one that originates near Bluffton) became the major branch of the historic Wabash River. The continental divide between the Erie and the Wabash drainage systems, previously located right on the site of present-day Fort Wayne, shifted several miles to the west, to its modern located in the vicinity of the Ardmore Quarry.

The creation of the modern St. Joseph/Ste. Marys/Maumee River system had a profound impact on human affairs as well. Both in prehistoric and much of historic times, river travel was the easiest way of getting from place to place in the American Midwest. As a result, artifacts of prehistoric (Middle-Lake Woodland Period) Native American cultures of the immediate Fort Wayne area show greater affinities to those of the Lake Erie region to the east than to those from sites a short distance to the west (beyond the continental divide) of Fort Wayne.

Control of the portage across the continental divide between the Erie and Wabash drainage systems had great commercial and strategic importance during historic times, which is why a series of Indian villages and (later) French, British, and American forts occupied the site of present-day Fort Wayne. This is also why Fort Wane became an important canal town. The events of the late Ice Age, and the early post-glacial interval that followed, had a major influence in determining why our city came to be situated where it is.

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