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DRAINAGE EVOLUTION OF THE BUREAU CREEK BASIN CENTRAL-NORTHERN ILLINOIS

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Note—The evolution of the drainage patterns found today in the Bureau Creek Drainage System in North-Central Illinois is tied intimately to the movements of the last (Woodfordian) ice sheet which covered the region. Evidence is presented for an ice marginal origin of the major lines of drainage. Evidence also exists which leads to the inference that the courses of the upper reaches of South Branch Kishwaukee River and Indian Creek were once connected and drained south through the valley of Big Bureau Creek.

Bureau Creek rises in southeastern Lee County flows in a general southwesterly direction for about 50 miles and then turns to flow southeasterly for about 15 miles to the Illinois River (figure 1). The two principal tributaries, East Bureau Creek and West Bureau Creek flow in a generally southwestern direction and join the main stream 2.9 and 13.9 miles respectively above the State Highway 29 Bridge. The drainage area above that bridge is 481 square miles. The following table gives data on the principal tributaries:

Stream	Miles Above Hwy 29 Bridge	Drainage Area (Sq. Mi.)	Average Slope (Ft./Mi.)
Bureau Creek	0.0	481	7
E. Bureau Creek	2.9	114	15
Brush Creek	5.8	50	14
W. Bureau Creek	13.9	129	9.3
Big Bureau Creek Above Junction With W. Bureau Creek	13.9	193	7

River mileages are usually measured from the mouth of a stream. Bureau Creek, however, has no definite mouth. It enters the broad floodplain of the Illinois River near the State Highway 29 Bridge. Overflow channels and distributaries were established here after the level of the Illinois River reached its pre-regulation level during late Wisconsinan time. During periods of high flow from Bureau Creek and low flow from the Illinois River, the stream follows many different paths. Subsequent to settlement, some of this mouth area has been drained and leveed.

The basin of Bureau Creek lies just within the margin of the prominent

Bloomington End Morainic System. Beneath a cover of wind blown loess and except for a small area of the lower valley, the surficial deposits are drift left by the last great ice sheet which covered this part of Illinois. This ice sheet has been named the Woodfordian Glacier. The relationships of the three main branches of Bureau Creek to the end moraines built by the Woodfordian Ice and described by William and Frye (1970) can be seen on figure 1.

It may be readily seen that these end moraines roughly enclose a major portion of the area drained by the Bureau Creek System. It can also be seen that the trunk streams follow the general trend of the moraines.

Northeast of the Bureau Creek Basin is another area enclosed by the Woodfordian End Moraines. This area is drained by the upper portion of South Branch Kishwaukee River. The area between the headwaters of this stream and the headwaters of Big Bureau Creek is presently drained by the headwaters of Indian Creek. The alignment of these three is in the same general direction. Flemal (1970) described an episode of post-glacial stream piracy in this divided area in which the extreme headwaters of South Branch Kishwaukee were captured by Indian Creek. Before piracy, then, the drainage basins of South branch Kishwaukee and Big Bureau Creek probably were adjacent. The community of Paw Paw presently sits near the divide.

Some idea of the nature of this divide area can be gained through an observation of a portion of the Aurora sheet of the United States Geological Survey's 1:250,000 series. Even though the contour interval is 50 feet, there does appear to be some geomorphic connection between the basins of South Branch Kishwaukee River and the Bureau Creek System through the area occupied by Indian Creek and the Paw Paw Divide.

The deposits left by the Woodfordian Glacier in Illinois have been named the Wedron Formation (Frye, et al 1968). Eight divisions of this formation are presently recognized in the state (Willman and Frye 1970). Two members of the Wedron Formation form the surficial deposits in the area of interest—the Tiskilwa and Malden members. Figure 1 shows the relationship of the boundary between these two till sheets and the streams mentioned above.

The most striking difference between the Tiskilwa and Malden Tills is color. The Tiskilwa is generally pink. The younger Malden is yellow to tan-grey. The Tiskilwa is for the most part sandier than the Malden and there are subtle mineralogical differences between them (Piskin and Bergstrom, 1967).

The end moraines composed principally of Malden Till do not show the lobate character displayed by the end moraines composed primarily of Tiskilwa Till (the Bloomington System). The Tiskilwa lobes form the western rims of the Bureau Creek and South Branch Kishwaukee Basins. The reentrant between them is the present divide between the two basins.

The Bloomington (Tiskilwa) Moraines in this divide area appear to be coated with a thin layer of Malden Till (Willman and Frye 1970). The courses of the upper reaches of South Branch Kishwaukee and Indian Creek, and the main stem of Big Bureau Creek run generally parallel to the contact between the two till sheets.

The South Branch Kishwaukee Basin is a relatively flat area except for scattered areas of poorly drained shallow depressions. These appear as isolated patches of wetland in an otherwise cultivated landscape. Areas of slackwater deposits have been identified lapping onto the front of the Shabbona (Malden) End Moraine in

the southern part of the basin. This relationship is well represented on the map of Quaternary Deposits of Illinois (Linneback, 1979).

The valleys of the Bureau Creek System are floored by deposits of drift which are very thick—more than 200 feet in most places (Piskin and Bergstrom 1967). The trend of the system generally follows a deep buried bedrock valley system (Paw Paw and Princeton Bedrock Valleys, Horberg 1950), but the valleys of the streams in the Bureau Creek System themselves are established in glacial drift. Outcrops of bedrock in the basin are rare. The only area in which bedrock outcrops may be found is along the southern margin of the basin. Here, some of the northflowing tributaries of West Bureau and Big Bureau Creeks have cut completely through till and in places now flow directly on the bedrock. This is along the south bluff of the Ancient Mississippi (Princeton) buried bedrock valley.

A sequence of events which led to the establishment of the drainage patterns as they exist today might be inferred from all this evidence.

The episode of moraine building which took place when the margin of the Woodfordian Glacier stood at the present position of the Bloomington Morainic System was the initial event. As the ice pulsed back from this front, the courses of West Bureau and Big Bureau Creeks were established at the margin of the retreating glacier. The area between them today is a gently undulating ground moraine consisting mainly of Tiskilwa Till. It seems probable that the courses of East Bureau and Brush Creeks were also established in like manner at this time.

Although these latter two valleys are underlain by Malden Till, in places these deposits are thin and follow the contour of the buried Tiskilwa surface (William and Frye 1970). During the Bloomington retreat parts of the ice sheet became detached and slowly melted in the South Branch Kishwaukee basin resulting in the generally flat but irregular surface and isolated areas of interior drainage which are found there today. The stronger drainage patterns of the inter-morainal country did not have a chance to develope here. A comparison of the gradeints of South Branch Kishwaukee and Big Bureau Creek gives some hint of the different nature of the streams which were subsequently established in the two areas.

During the waning of the ice sheet that built the Bloomington System, drainage from the South Branch Kishwaukee Basin was probably through gaps in the surrounding end moraines at Kilbuck, Owens and Steward Creeks, the present northern gap in the Bloomington End Moraine and south through the valley of Big Bureau Creek. This was taking place perhaps 18,000 years ago.

The lower course of the Bureau Creek System was diverted to the southeast when it encountered the south bluff of the buried Princeton (Ancient Mississippi) Valley—the Pennsylvanian Escarpment.

The retreat of the Bloomington Glacier was probably significant. This is evidence by the difference in the nature of the Malden and Tiskilwa Till Sheets. Drainage relations in the area subsequently covered by the Malden ice can only be speculated. The nature of the Malden deposits would suggest a weak ice margin at its greatest extent.

Near the village of La Moille, Big Bureau Creek does not follow the expected inter-morainal course but instead flows westward through a gap in the end moraine. (A on figure 1.) Malden Till occurs in the valley of East Bureau Creek, and Big Bureau Creek is marginal to the Malden deposits up to the gap. This would suggest that the upper reaches of Big Bureau Creek may have discharged through the valley

of present East Bureau Creek below this point until it was forced into its present course by the advancing Malden ice.

At about the same time this was happening the Malden ice lapped onto the backside of the Bloomington System near the present town of Paw Paw. It thus separated the Bureau Creek and South Branch Kishwaukee Basins and by so doing cut of the headwaters of Big Bureau Creek.

Because the outlet had been cut off, water ponded in the southern part of the South Branch Kishwaukee Basin. Some of this discharged through gaps in the Bloomington System along Willow and Dry Run Creeks. Valley trains have been identified in both of these small valleys. The Malden Ice also drained through the present gap of South Branch Kishwaukee in the Paw Paw End Moraine. A valley train deposit is also found there today. Big Bureau Creek probably took some of the discharge from this ponded southern part of the basin until the water level receeded below the elevation of that outlet.

After the ice retreated from the malden maximum it was to invade the area no more. Man-made changes, including the construction of the Illinois and Mississippi (Hennepin) Canal through the lower valley; regulation of the Illinois River; and the development of tile drainage and agricultural ditching have had some effect on drainage relationships in the basin. However, the gross drainage patterns have remained the same since the retreat of the Woodfordian Glacier from the Malden margin. This was perhaps some 16,000 years ago.

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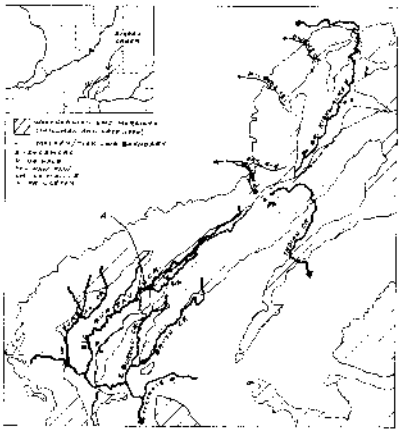

Figure 1