Journal of Geography

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rjog20>

A Type Case in Diversion of Drainage

Frank Carney ^a

^a High School , Ithaca, N. Y.

Published online: 20 May 2008.

To cite this article: Frank Carney (1903) A Type Case in Diversion of Drainage, Journal of Geography, 2:3, 115-124, DOI: [10.1080/00221340308985931](https://doi.org/10.1080/00221340308985931)

To link to this article: <http://dx.doi.org/10.1080/00221340308985931>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is

expressly forbidden. Terms & Conditions of access and use can be found at
<http://www.tandfonline.com/page/terms-and-conditions>

The JOURNAL of GEOGRAPHY

VOL. II.

MARCH, 1903

No. 3

A TYPE CASE IN DIVERSION OF DRAINAGE*

BY FRANK CARNEY,
Of the High School, Ithaca, N. Y.

IN regions that have once been glaciated we find many interesting drainage problems. While the general topography of northern North America may have been but slightly altered by the ice invasion, the courses of many streams have suffered change. Particularly is this noticeable in present divide areas, and in sections where thick deposits of moraine have accumulated. When a mass of moraine was laid across the valley of even a well developed river, the waters were often obliged to seek another outlet. The position of the new outlet was determined largely by the relation of valleys already existing to a divide that yielded most readily to agents of erosion. The normal river piracy that may be observed in water-parting regions of unglaciated lands would be accentuated by an Ice Age; for ice erosion, and ice front drainage, would hasten the cutting down of narrow barriers remaining between the extreme tributaries of separate systems. The southern arms of the St. Lawrence basin have been shortened through the interference of glacial deposits and the northern tributaries of the Susquehanna and Ohio Rivers have encroached in New York and Pennsylvania on the Laurentian system, as is shown by several instances that have been investigated.†

In the glaciated states there is scarcely a county in which a stream has not undergone some abnormal alteration, though the change may be slight, such as the mere removal or addition of a few miles to the headwaters of the stream. A type case in such diversion of drainage is here

*This paper is work done under the direction of Professor R. S. Tarr, at Cornell University, as a partial requirement for the degree of Ph. D.

†Carll, Second Geological Survey—Penn., III., 1880, 330-366. Chamberlin and Leverett, *American Journal of Science*, Series III., XLVII., 1894, 247-283. Tarr, *The Physical Geography of New York State*, 167-172.

described for the purpose of suggesting to grammar and high school teachers the possibility of investigating similar cases in their own localities.

NORMAL RIVER DEVELOPMENT

For a better understanding of the phenomena to be considered, we will briefly review the development of a drainage system. Given a region in youth,* the rocks being of uniform texture, the first streams are simple, each having a single valley. Then lateral streams appear; the valley of the parent river grows longer and broader. The original lateral arms become the parent streams of secondary branches; ultimately a river system is produced. The valley of the parent stream is widest where it approaches the sea, or the body of water into which it empties; the original lateral streams widen as they approach the major streams; while the valley of each sub-arm is broadest at its point of union with a larger arm of the system. The eroded material is carried seaward. As down-cutting progresses, the slope of the stream bed decreases, and a part of its

FIG. 1. Looking east across the Valley which leads south past Blodgett Mills. At this point, some three miles east of Cortland, the Troughnioga turns southward. The stream is here running near the western wall of the valley. The width of the valley bottom and the rather gentle slope of the walls show maturity.

* Gannett, *Topographic Atlas of the U. S.*, Folio 1.

FIG. 2. Looking northward from Messengerville.

This picture was taken from a spur at the foot of which is the village; the wall directly east is cliff-like. Had the camera been near the axis of the valley, the two profiles in the distance would interlock. Opposite each of these spurs is a steep cliff.

load is deposited in the lower reaches of the river where aggrading or upbuilding commences. Such a condition is usually marked by a broad valley with a meandering stream. The water in every part of the system flows in the direction in which the valleys broaden.

Furthermore, note in particular two points always observed in normal drainage of regions with uniform texture of rocks: (1) the valleys narrow toward divide areas, (2) the water flows contrary to the direction in which the valleys narrow. In general, at every stream juncture the land surface has been cut into two unequal angles, the smaller of which points down stream; *i. e.*, the land surface of the drainage basin has been dissected into irregular blocks whose longer axes converge towards the original stream valley.

DESCRIPTION OF FALL CREEK REGION

The map, page 113, is of a region drained at present by a tributary of the Susquehanna. The region is a part of the St. Lawrence-Susquehanna divide area, which has a general altitude of about 2,000 feet. The "Finger Lakes" lie to the west and northwest. The moraine of the "second glacial epoch"* stretches across the region under consideration. To the

*Chamberlin, U. S. G. S., Third Annual Report.

north are comparatively short streams draining into the Ontario basin; the area to the east is drained by the Chenango, another tributary of the Susquehanna. A sufficient number of contours are given on the map to show that the region is quite mature in its drainage development.* The question involved can be more easily understood by having at hand the following United States topographic sheets: Dryden, Moravia, Cortland, Harford, Pitcher and Cazenovia.

FIG. 3. *Kame Hills in the Moraine south of Cortland. These hills, rising 140 feet above the plain, are typical of the kame-moraine found throughout the Cortland-Freeville Valley.*

The Tioughnioga River has three arms which meet near Cortland. The valley of the West Branch, flowing southward past Homer, is broad and mature; the East Branch, coming from north of Deruyter, is also in a mature valley, which broadens continually as it flows southward past Truxton and East Homer; Trout Brook, rising east of Solon, flows nearly due west and meets the Tioughnioga in a broad overwash plain (see Figure 5) east of Cortland. A most obvious fact about these arms is that they all broaden towards Cortland, where the valley is over a mile wide. From Cortland the Tioughnioga flows in an eastern direction for about

* Gannett, *Topographic Atlas of the U. S.*, Folio 1.

three miles; then the stream turns southward (see Figure 1), passing Blodgett Mills and Marathon, and joining at Chenango Forks a tributary of the Susquehanna.

The Blodgett Mills Valley, at its junction with the east-west valley, is one-half mile wide; at Blodgett Mills the valley is one-quarter mile wide; it continues to narrow southward, having for some miles a width of from thirty to sixty rods. In this narrow section are perpendicular rock-walls produced by under-cutting of a meandering stream. In the vicinity of Messengerville the valley is more mature and commences to broaden again. (See Figure 2.) A study of the lateral streams of this valley shows (1) that for three miles south of Blodgett Mills they meet the parent valley, forming angles, the smaller of which point northward; (2) that for the next two miles or more there are no well formed lateral valleys; (3) that thence southward the side streams meet the main valley, forming angles, the smaller of which point to the south; (4) and that these lateral valleys now have streams which, before meeting the north-south valley, flow for some distance through rock walls, and have, in some instances, cascades, in others perpendicular falls, thus showing rejuvenation.

EXPLANATION

What probable explanation is there for the condition of affairs existing in the Blodgett Mills-Marathon Valley? Three sections of this valley are indicated on the map by A, B and C, respectively. B may have been a pre-glacial divide area; the stream in A then drained northward, as indicated by the angles of the lateral valleys, and was a tributary of the stream flowing westward from Solon; evidence of the same nature indicates that C drained southward by a stream passing Marathon, and belonging to the Appalachian drainage system. These two pre-glacial streams occupying valleys broadening in opposite directions belonged evidently to separate river basins. The narrow divide B was cut down; the drainage from the north then took its present course.

At Cortland the Tioughnioga receives from the south Otter Creek, which heads about two and one-fourth miles northeast of McLean; this creek, an insignificant stream, flows east of north in a valley one and one-fourth miles wide; its divide is in a moraine area dotted with kettle lakes. Flowing southwest from the same area is Beaver Brook, a branch joining Fall Creek south of McLean. Fall Creek rises some ten miles north of McLean; from McLean it flows in a general southwest direction, emptying into Cayuga Valley at Ithaca. Two branches, the Dryden and Groton

FIG. 4. *Eastern part of an Esker northeast of Freeville.*
The height of the esker is from 20 to 30 feet, while the slope of its sides is from 16° to 25°. The wooded area marks the location of a morainic kettle which is now nearly filled by the encroachment of vegetation.

arms, join Fall Creek Valley near Freeville, where the valley has a width of nearly two miles.

Thus it appears that the Tioughnioga, through its several branches, drains an area north and northeast of Cortland; that these branches flow in valleys one-half to one mile wide; that these valleys gradually broaden toward Cortland; and that they dissect the area into blocks, whose longer axes point in the direction of Freeville. But instead of flowing southwest from Cortland, the river turns eastward, then south, entering and flowing through a valley in the same direction in which the valley narrows. From a few miles north of Marathon the river continues southward in a valley which broadens in that direction.

We have, therefore, this abnormal condition of drainage: (1) a river for more than twenty miles meanders in a mature valley which attains a width of one and one-fourth miles, then for ten miles it flows through a narrow valley having a maximum width of one-fourth mile; (2) the United States topographic sheets show a mature valley of one and one-

fourth miles minimum width and ten miles long extending from Cortland to Freeville; the side walls of this valley have gentle slopes blending into the valleys coming together at Cortland. The valley from Cortland to Freeville continues with normal increase in width and gradient to Ithaca. The streams now flowing in the Cortland-Freeville Valley, aided by all the valley-making agents recognized, could not have produced the valley in its present condition; furthermore, the gently sloping side walls are continuous, evidently the product of a single river rising many miles to the north. But the valley is now drained in two directions: towards Cortland by Otter Creek, and to Ithaca by Fall Creek.

In the presence of these facts, one naturally inquires whether the drainage from Homer, Deruyter and Solon should not come normally by way of McLean and Freeville into Cayuga Valley? If the Blodgett Mills outlet for the drainage north and northeast of Cortland is abnormal, what has caused the diversion?

Early in this paper it is mentioned that the moraine of the "second glacial epoch" crosses the region we are studying. This moraine is extremely well developed between Freeville and Cortland. Just north

FIG. 5. *The Overwash Plain east of Cortland, looking a little north of west. The gently sloping side walls show the maturity of the valley. The dim sky line is the west wall of the Cortland-Freeville Valley. The meandering stream is Trout Brook, which joins the Tioughnioga one-half mile to the south.*

FIG. 6. *Kettle Lake in the Moraine of the Cortland-Freeville Valley.*

of Freeville is a marked kame area*; other kame areas of almost equal proportions are found on the west side of the valley south of McLean, and on the east side south of Cortland. (See Figure 3.) Two miles northeast of the first kame area is a beautiful esker. (See Figure 4.) The Cortland-Freeville Valley throughout its whole extent presents moraine topography; a tongue from the ice front persisted here long enough to plug the old valley quite full; it is not a case in which a dam has been built across the valley by a single crescentic moraine loop, marking the position maintained for some time by an ice tongue. Possibly a detailed study of this moraine accumulation will show a series of such loops blended and knit together by a variety of overwash and kame deposits. Well borings at Freeville have gone through 250 feet of glacial materials without reaching the rock floor of the valley; both here and at Cortland the streams from the ice front were so loaded by debris that the valley has been leveled up with overwash plains (see Figure 5), thus giving the valley an appearance of somewhat greater maturity than

* For a view of this, see Tarr, *The Physical Geography of New York State*, Fig. 68.

normally belongs to it. The depth of this drift filling can be ascertained only by borings; north of Freeville, no well deeper than seventy-five feet has been sunk. Between McLean and Cortland are many kettle lakes (see Figures 6 and 7); in some of the partially filled kettles, marl is found.*

It seems evident then that this valley was so blockaded by moraine and wash deposits that the normal drainage has suffered a reversal. Looking at a map made by assembling the contour sheets of the region, one is struck by the alignment of Fall Creek Valley with the valleys that come together at Cortland. One doubts whether Fall Creek, with its present length and volume, could, in any geological time, have carved the wide mature valley in which it flows; but by giving to this stream the drainage basin of the Tioughnioga, one can understand the maturity of the valley. In pre-glacial times, West Branch and Trout Brook were tributaries of Fall Creek, which had its headwaters north and east of Deruyter. A discussion of the further conditions which figured in the

FIG. 7. *Another Kettle Lake in the same locality as that of Figure 6. A railroad filling has divided this lake into two parts. In the foreground are many well rounded glacial pebbles.*

* Tarr, *The Physical Geography of New York State* 203.

establishment of the Blodgett Mills outlet for the drainage that once belonged to Fall Creek would lead this paper beyond its initial purpose, *i. e.*, of describing a type case in river diversion, which might be an incentive to the study and recording of similar instances.

THE CHINOOK WINDS*

BY ALVIN T. BURROWS,
Observer, Weather Bureau

ORIGIN of the Application of the Name "Chinook" to Winds.—At the present time there are three different winds called Chinooks. Each of them is essentially a warm wind, whose effect is most noticeable in winter. Under their influence snow is melted with astonishing rapidity and the weather soon becomes balmy and spring-like. The name "Chinook" is that of an Indian tribe which formerly lived near the mouth of the Columbia River. It was first applied to a warm southwest wind which blew from "over Chinook camp" to the trading post established by the Hudson Bay Fur Company, at Astoria, Oregon. The name soon came into general use in that locality, and as the adjacent country was settled the usage extended, so that now "Chinook" is applied not only to the warm, moist southwest winds along the Oregon and Washington coast, but to the warm, dry, descending winds east of the

*Reprinted by special permission from the Department of Agriculture Year Book, 1901.