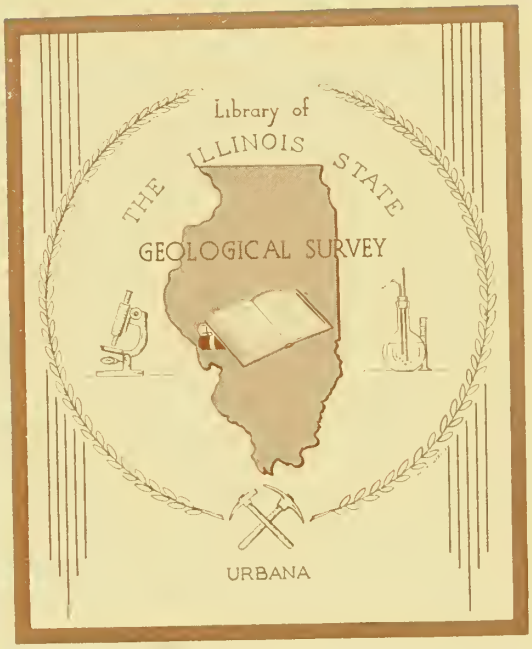

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ORIGIN OF ILLINOIS SAND AND GRAVEL DEPOSITS

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Introduction

Sand and gravel are important mineral resources and occur at many places in Illinois. Numerous questions have been asked from time to time by members of the industry producing these materials regarding how the various kinds of sand and gravel deposits have been formed. This is a complex story. To tell it simply and briefly requires the omission of many details regarding the manner in which many special types of deposits were formed. Nevertheless, certain broad features that pertain to the majority of deposits can be outlined. This is done below, with the aid of diagrammatic drawings, in the hope that it will explain some of the major ways in which the State's sand and gravel deposits originated.

The Formation of Illinois Sand and Gravel Deposits

The sand and gravel deposits of Illinois* are directly or indirectly related to glaciers. Glaciers extended southward from Canada into the State during each of four major intervals of glaciation. Most of the economically important deposits of sand and gravel were formed during the last two glaciations, the older of which is called the Illinoian and the younger the Wisconsin. Figure 1 shows the area covered by the Illinoian and Wisconsin glaciers. The glaciers may have been as much as several thousand feet thick.

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* Excluding certain deposits of sand and chert gravel in western and extreme southern Illinois.

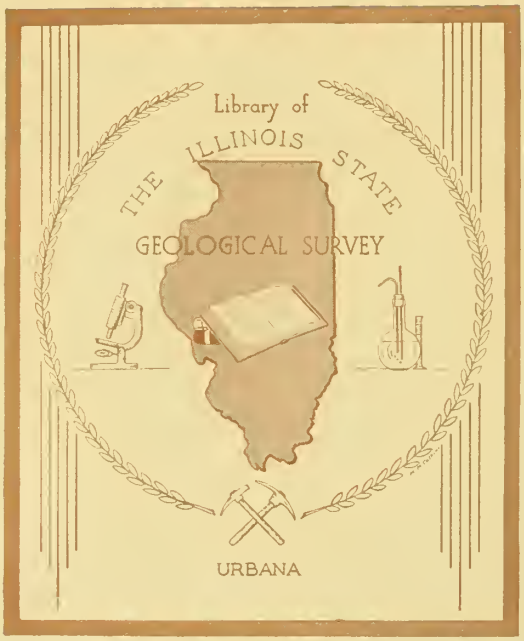
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Fig. 1. - Areas covered by Wisconsin and Illinoian glaciers. Areas marked "U" were not glaciated. Modified from maps by G. E. Ekblaw (Glacial geology of northeastern Illinois, 1957) and J. M. Weller (Geologic Map of Illinois, 1945).

The glaciers carried embedded in their ice enormous amounts of clay, silt, sand, and gravel they had picked up from the areas over which they passed. The formation of useful sand and gravel deposits involved a separation of the sand and gravel from this mixture of materials. The sorting of the glacial debris into deposits of materials of different sizes was accomplished by running water which came largely from the melting of the glacial ice.

The ice in a glacier flows continuously forward. The front of the glacier moves forward when the ice advances more rapidly than it melts. The front melts back, or retreats, when melting exceeds the rate of advance.

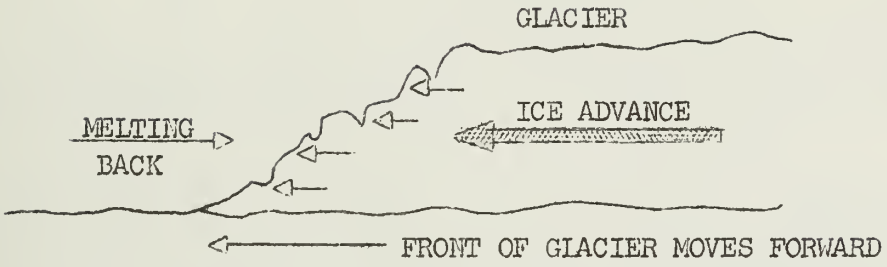

Fig. 2. - Diagrammatic cross section showing glacier moving forward faster than it melts. As a result the front of the glacier moves forward.

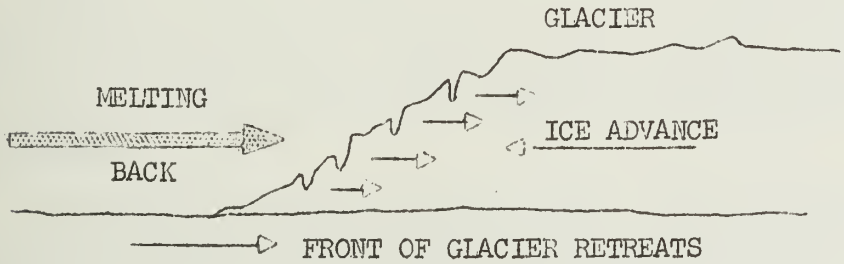

Fig. 3. - Diagrammatic cross section showing ice melting faster than glacier moves forward. As a result the front of the glacier moves back.

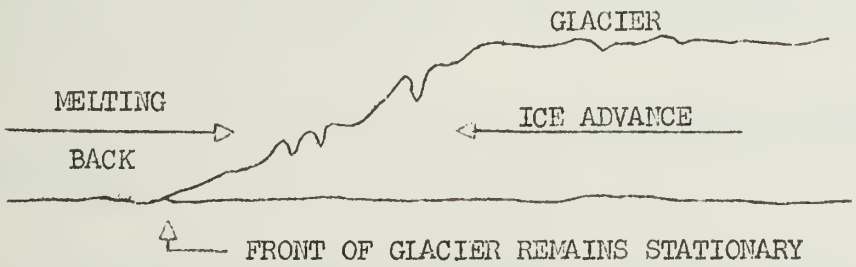

Fig. 4. - Diagrammatic cross section of stationary front resulting when glacier melts as fast as it moves forward.

Under some conditions, the ice movement stops and the ice melts, largely from the top down. The conditions under which a glacier's front advances, retreats, or remains stationary are shown in figures 2, 3, and 4.

When the advance and melting back of glacial ice are about equal (fig. 4), the front of the ice remains stationary or fluctuates within a narrow zone. The debris freed from the melting ice therefore piles up into a band of hills and ridges along the front of the ice (figs. 5 and 6). Such a band of hills and ridges is called an end moraine and may extend for long distances across country. Many end moraines are from one to several miles wide. Most hills of the moraine consist largely of pebbly, silty clay, called till, but some moraines are very gravelly. The gravel deposits of end moraines are commonly irregularly bedded and poorly sorted (fig. 7) and in many places contain boulders as well as beds, lenses, and balls of clay.

When the front of a glacier remains stationary, melt water from the ice may deposit aprons of sand and gravel, called outwash plains, in front of the glacier or its end moraine (figs. 8 and 9). The dimensions of outwash plains are often to be measured in miles. They are important commercial sources of gravel and sand in some parts of Illinois. Gravel deposits in outwash plains generally are regularly bedded (fig. 10) and commonly grade from gravel near the moraine to sand at greater distances.

In many situations much of the melt water with its load of rock debris was concentrated in valleys leading away from the front of the glacier. As this water moved down the valleys it sorted its load and dropped the coarser gravel and sand first, then the finer gravel and sand, then sand, then finally silt and clay (fig. 11). Such deposits are called valley trains and may be many miles in length.

As the rate of glacial melting varied, the coarseness of the materials deposited at a given place also varied. Nevertheless, the valley-train gravel deposits generally are regularly bedded (fig. 10) and better sorted than other deposits.

With the retreat of the glacier, rivers cut into and partly removed the valley-train deposits, as shown in figures 12 and 13. Remnants of the valley trains remain as terraces or high bottomlands above the level of present-day floods. At some places a later advance of the glacier built another valley-train deposit in the valley (fig. 14), and, when this was cut into by a later stream, remnants of the second deposit were left in the valley as lower sand and gravel terraces (fig. 15).

Valley-train deposits are one of the principal sources of sand and gravel in Illinois and are found along most of the rivers and many of their major tributaries.

Streams of melt water flowing on the ice or in channels in the ice deposited sand and gravel where they spilled from the margin of the ice or in crevasses in the ice. When the ice melted, such a deposit remained as a hill, called a kame (fig. 16). Kames are the source of comparatively small amounts of sand and gravel but are worked in many small pits. They are found commonly in association with end moraines. As a rule the material in kames is irregularly bedded (fig. 7).

Fig. 5. - Cross section of glacier with end moraine in front of it.

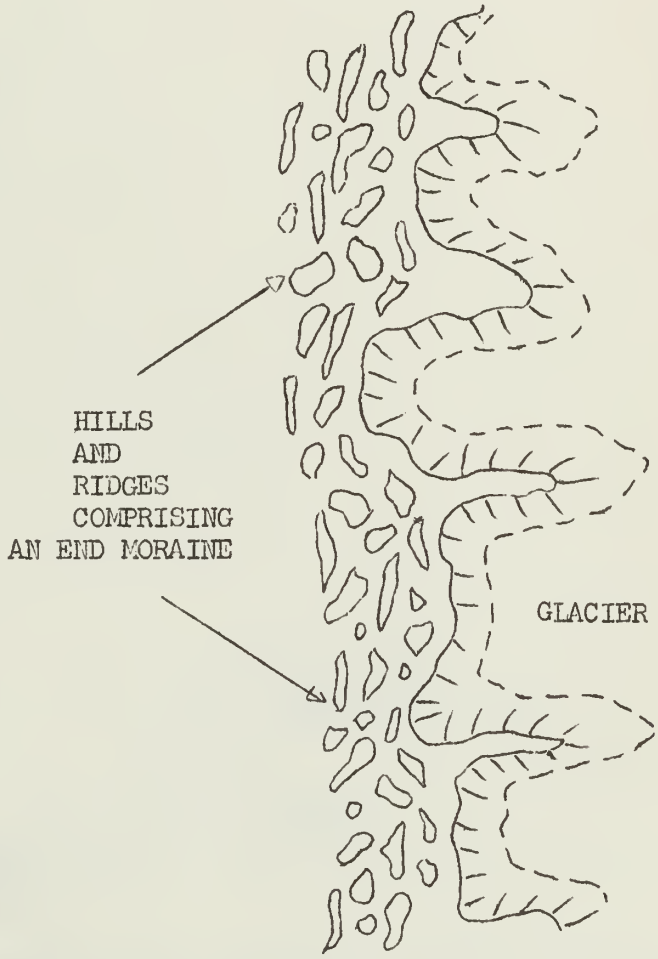

Fig. 6. - Bird's-eye view of a glacier and the hills and ridges comprising its end moraine. Some of the hills may contain sand and gravel.

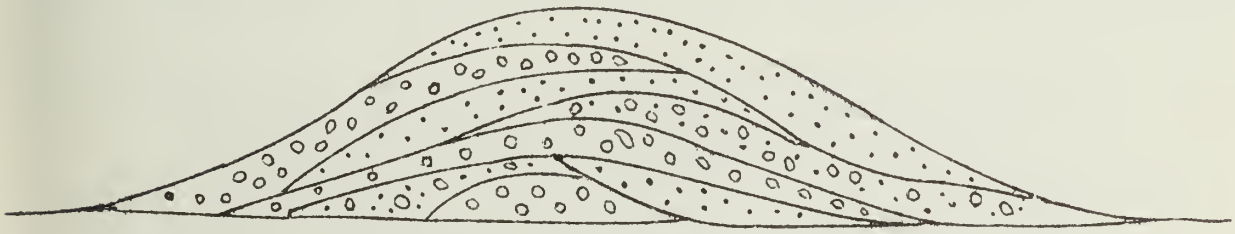

Fig. 7. - Irregularly bedded deposit of sand and gravel. This type of bedding is likely to be found in kames and eskers.

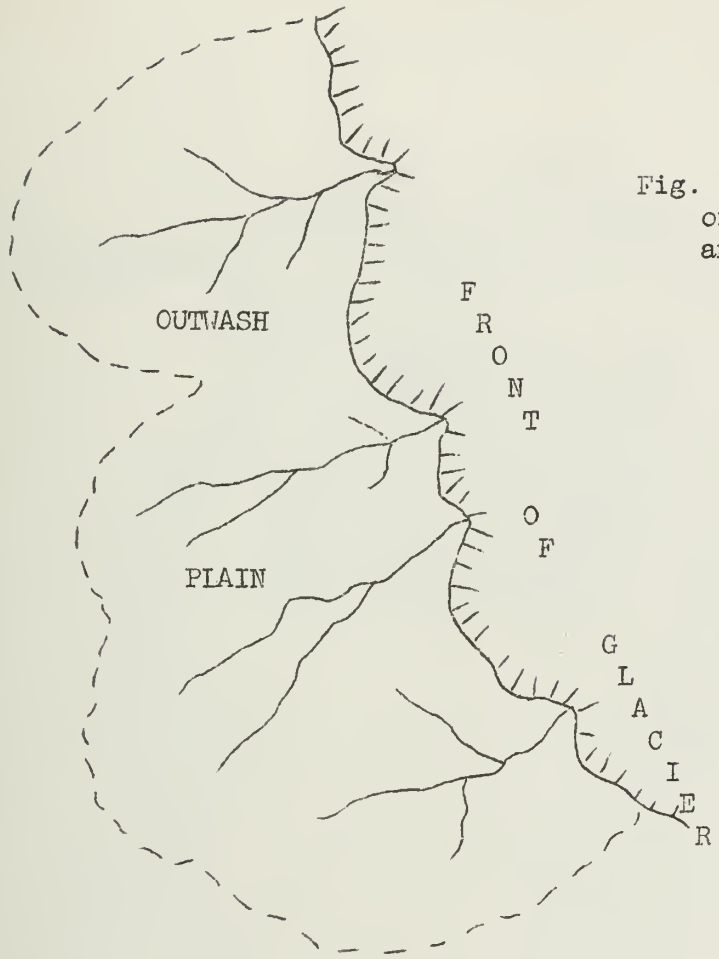

Fig. 8. - Bird's-eye view of the formation of an outwash plain.

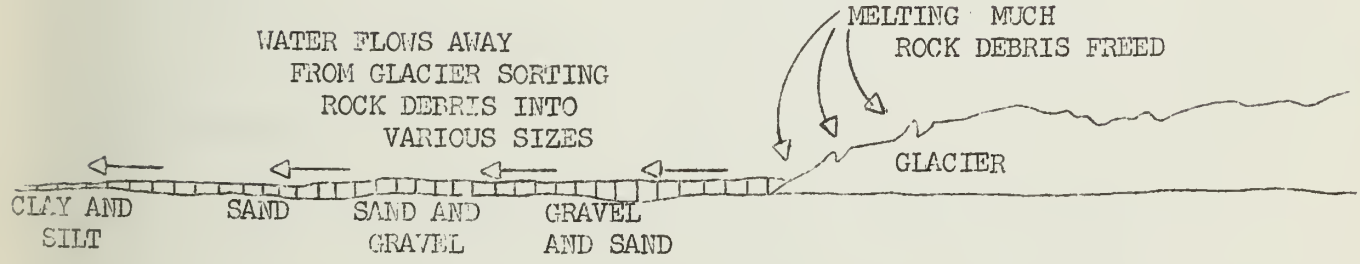

Fig. 9. - Formation of an outwash plain of sand and gravel in front of a glacier.

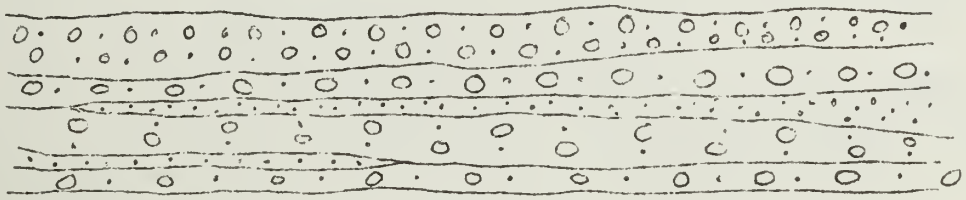

Fig. 10. Regularly bedded deposit of sand and gravel. This type of bedding is often found in valley-train and outwash deposits.

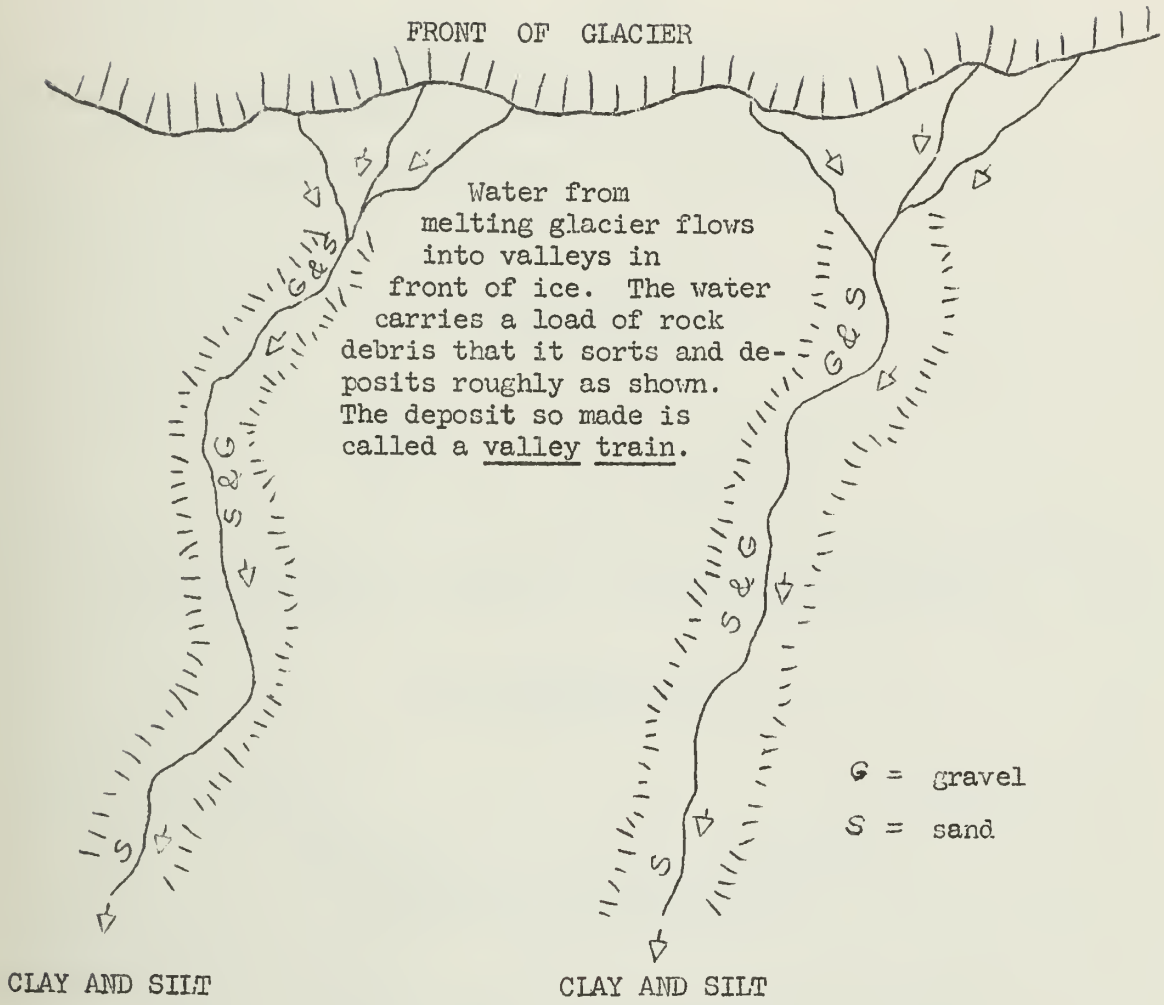

Fig. 11. - Bird's-eye view of glacier and valley trains.

Gravel and sand also accumulated in stream channels in or under the glacier. When the ice melted, the sand and gravel was left in a ridge, called an esker, commonly a few hundred feet wide and as much as several miles long. The materials in eskers usually are irregularly bedded (fig. 7). Eskers are among the less common sources of gravel in Illinois.

In a few places, streams from melting glacial ice built deltas of sand and gravel out into lakes. The waters of the lakes have long since drained away but the deltas remain and are a local source of gravel. These deltas are for the most part small but some have been worked as major sources of sand and gravel.

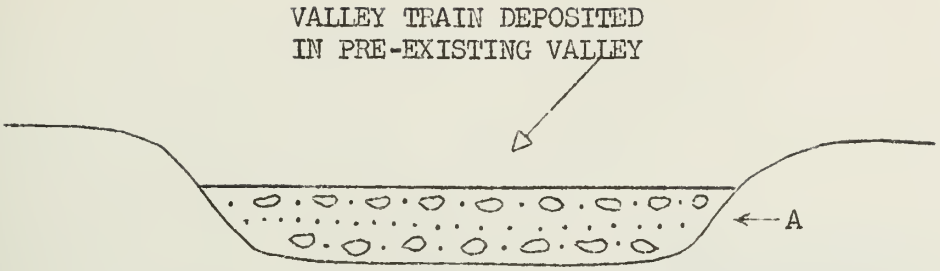

Fig. 12. - Cross section of valley train, A.

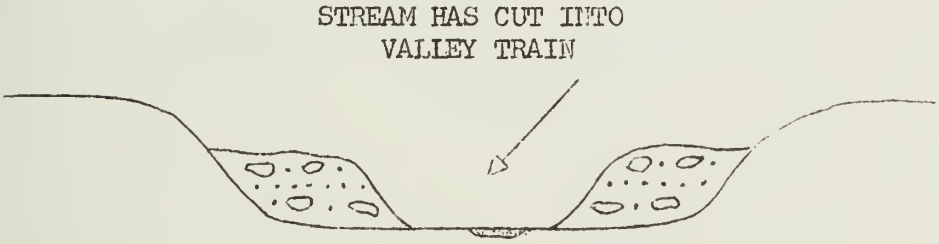

Fig. 13. - The valley train has been cut into and partly worn away by a later stream. Terraces of sand and gravel result.

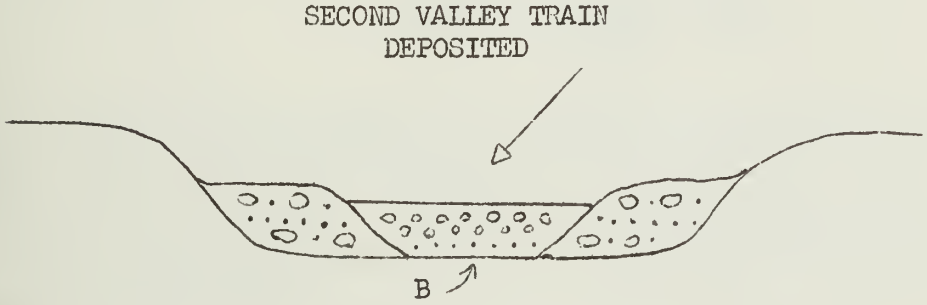

Fig. 14. - Another valley train (B) has been deposited.

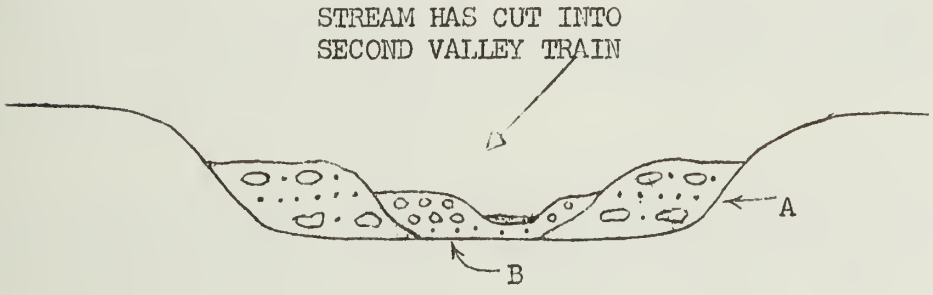

Fig. 15. - The second valley train has been partially eroded producing a second set of terraces.

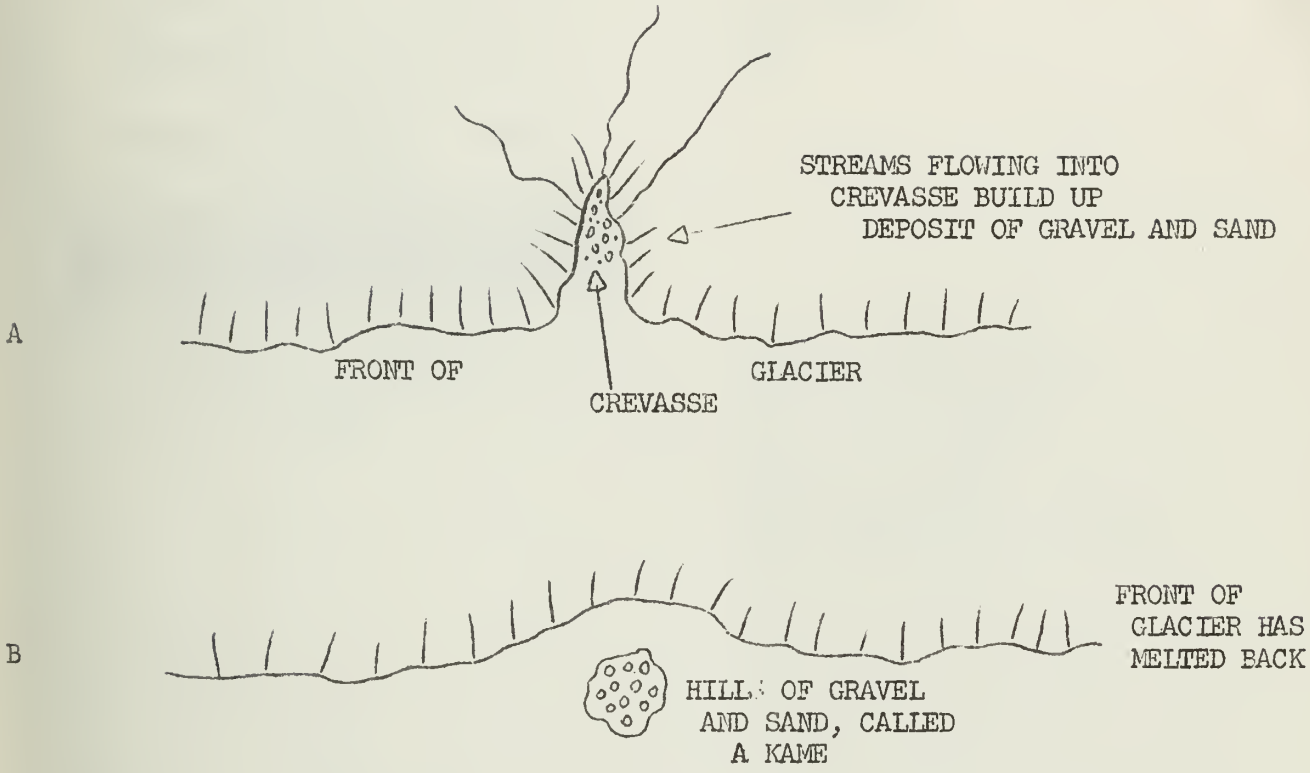

Fig. 16. - Front of glacier with a re-entrant or crevasse in its margin. Water from the melting ice at the surface of the glacier drains into the crevasse, carrying with it rock debris. The gravel and sand build up in the bottom of the crevasse. The clay and silt are carried away. When the front of the glacier retreats (B), the crevasse deposit is left as a rounded hill of sand and gravel, called a kame.

Modern streams cutting through the various types of glacial deposits commonly deposit some of the sand and gravel in or near their channels. Such deposits generally are comparatively small but some of them have been used as sources of sand and gravel. In favorable places the supply is renewed with each succeeding interval of high water.

Huge areas of sand, chiefly in sand dunes, occur in many places in Illinois, including the regions near Havana, Watseka, Kankakee, Prophetstown, Geneseo, Amboy, and Keithsburg. Most of these dunes have been blown by the wind from large areas of sand along the floodways of ancient glacial melt waters.