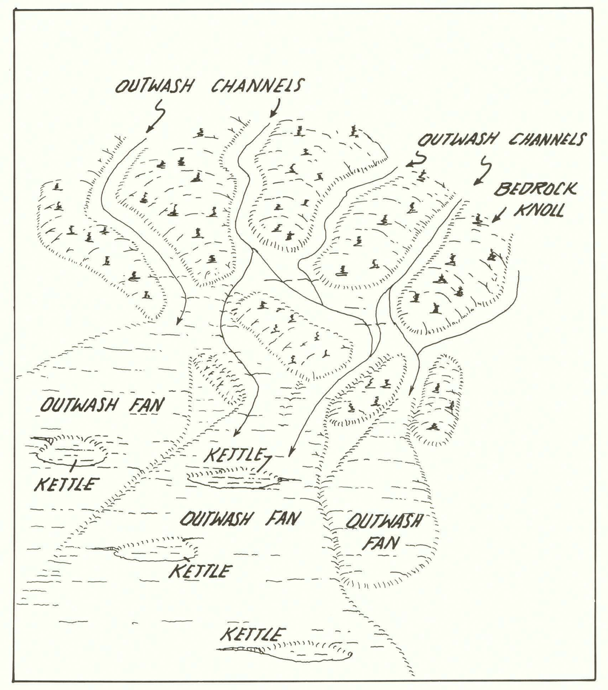


Figure 2. Outwash-channel deposit. Meltwater streams, emanating from a melting glacier (not shown), flow into pre-existing stream valleys and partly fill the valleys with unconsolidated sand and gravel (outwash). As these streams flow into a wide flat area their velocity drops and they deposit their sediment load to form outwash fans, which then coalesce to form a broad, almost featureless outwash plain.

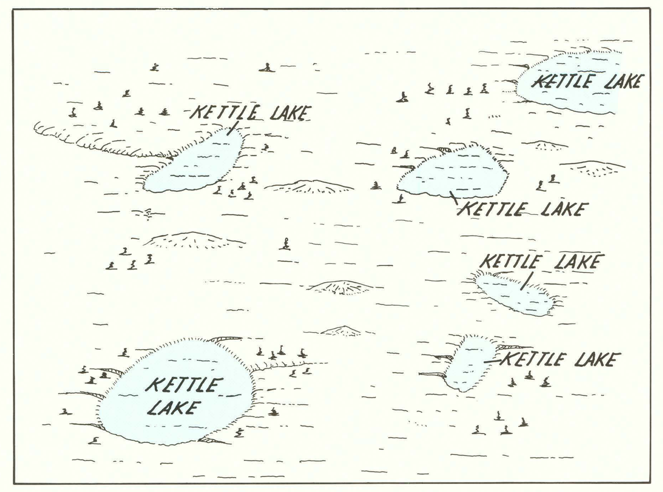


Figure 3. Outwash-plain deposit. An outwash plain is a low, broad, even-surfaced to faintly hummocky, almost featureless expanse of sand and gravel marked here and there by small kettles and kettle lakes. Commonly the plain forms as the result of the coalescence of several outwash fans.

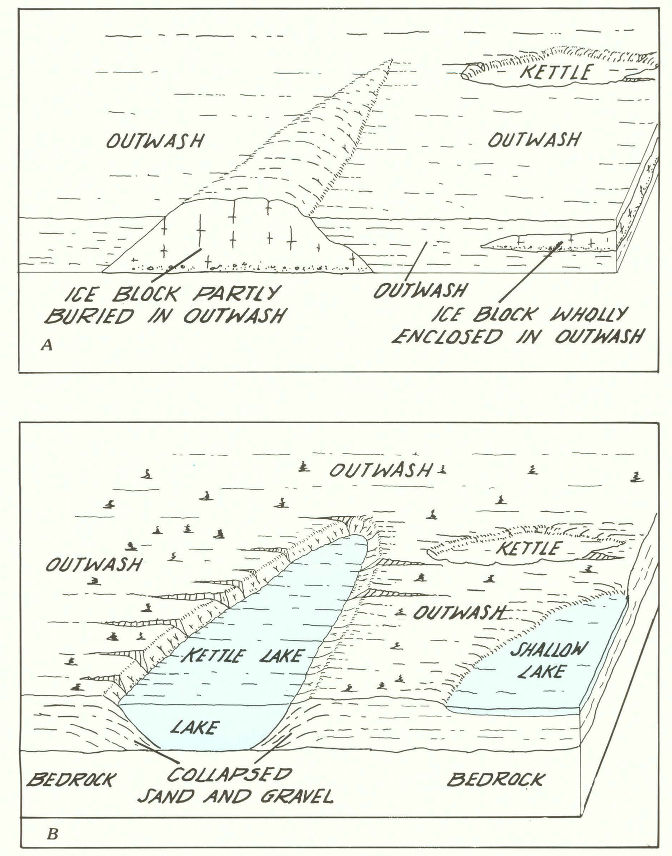


Figure 4. Kettles and kettle lakes. *A.* Kettles are undrained depressions some of which contain shallow bodies of water. Those containing water are referred to as kettle lakes; most of the large and small standing bodies of water in the Bigfork-Avon area are kettle lakes.

B. Each kettle or kettle lake represents a former block of ice, the remnant of a wasting valley glacier. Some of these ice blocks probably were exposed at the surface, others were buried in the outwash. When these ice blocks melted, the overlying sand and gravel subsided into the newly formed voids, and the undrained depressions that resulted—the kettles—mirror the shape and size of these former ice blocks.

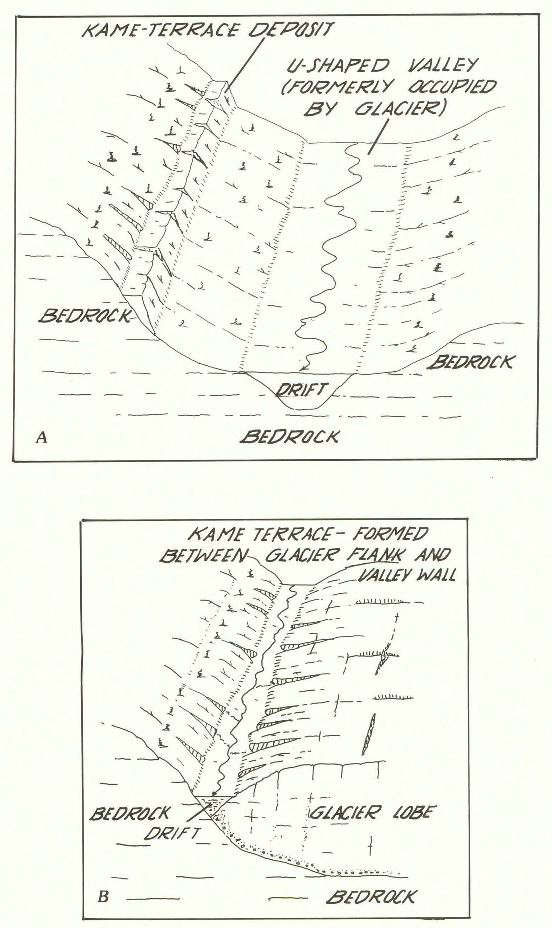


Figure 5. Kame-terrace deposit. *A.* A kame terrace is a glacially derived deposit of sand and gravel that clings to a valley side. In many glaciated terranes, these kame-terrace deposits are well above the valley floors. By contrast, in the Bigfork-Avon area the kame-terrace deposits are near and along the valley floor (see fig. 6).

B. A meltwater stream, confined between the glacier and the adjacent valley wall, deposits sand and gravel. Part of the deposit rests on ice and part on valley wall. Subsequently, when the glacier melts, that segment of the deposit that rested on the glacier collapses. The height of the kame-terrace deposit above the valley floor indicates the thickness of the glacier at the time the kame-terrace deposit was formed.

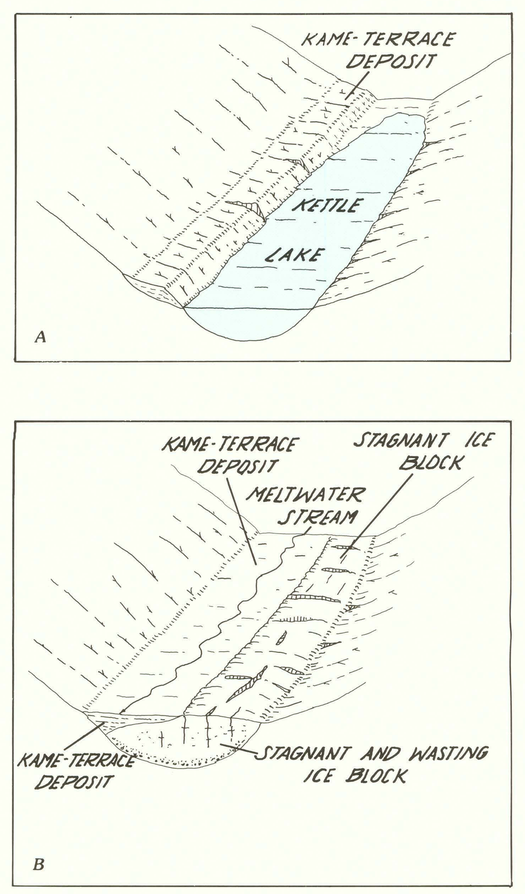


Figure 6. Kame-terrace deposit. *A.* In the Bigfork-Avon area the kame-terrace deposits are near and along the valley floor. Several are adjacent to kettle lakes.

B. A stagnant, wasting ice block, remnant of a former valley glacier, partly fills a valley floor. A meltwater stream, heavily laden with sand and gravel, flows along one flank of the ice block and deposits some of its sand and gravel load partly on land and partly on the ice block to form a kame-terrace deposit. When the stagnant ice block melts, its former position is occupied by a kettle lake, and the sand and gravel, now unsupported, collapses to form a kame-terrace deposit adjacent to the kettle lake.

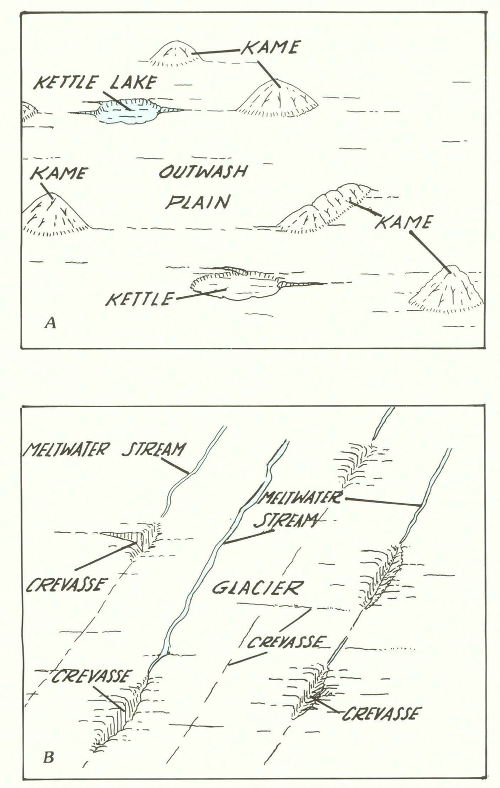
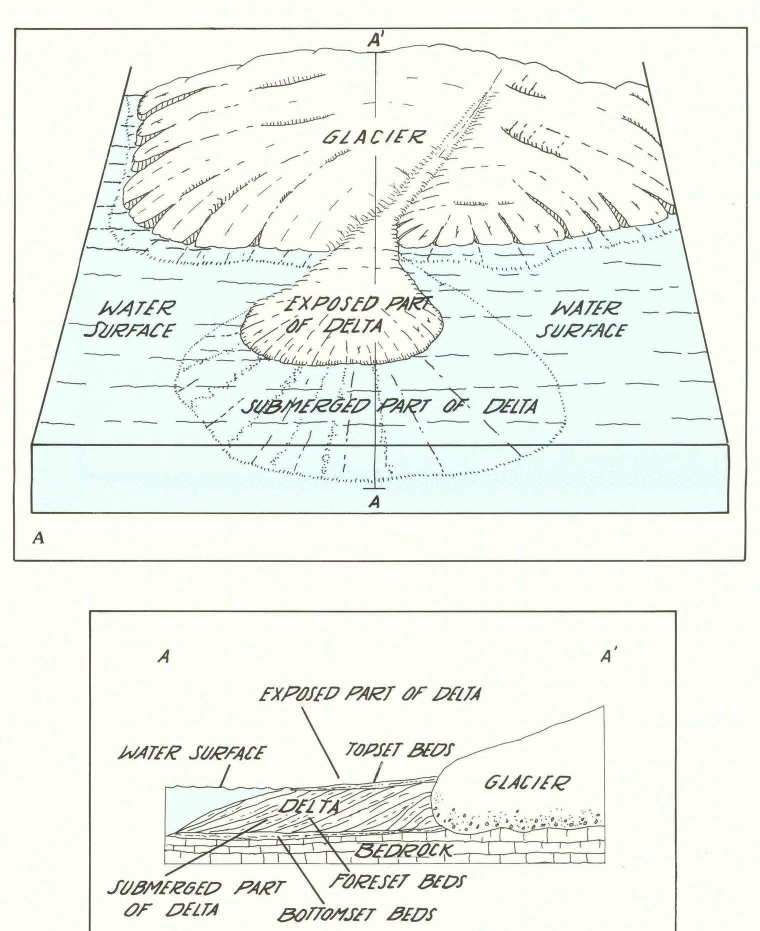


Figure 7. Kame deposit. *A.* A kame is a conical deposit of sand and gravel that generally appears as a small, discrete knoll. In a few localities several kames are clustered to form a kame field.

B. Meltwater streams, laden with sand and gravel, flow along the top of the ice more or less guided by existing crevasses. These streams make their way down through the crevasses and deposit their loads of sand and gravel at the base of the glacier. When the glacier melts, the unsupported sand and gravel collapses to form a conical mound.



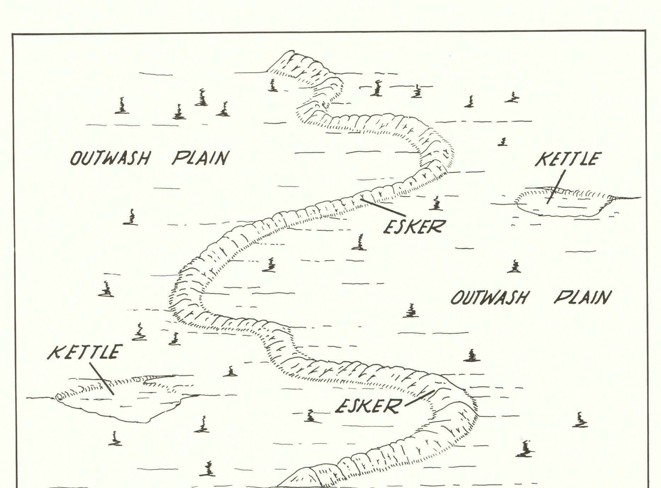


Figure 8. Esker deposit. An esker is a sinuous ridge of sand and gravel deposited by a subglacial meltwater stream. The stream, heavily laden with sand and gravel and under high velocity, flows through an ice tunnel at the base of a wasting glacier. Over time, as a result of decreased velocity, the stream gradually drops its load of sand and gravel; the sinuous trace of the esker reflects the course of the subglacial tunnel. As the glacier melts, the near-horizontal beds of sand and gravel collapse. The steep flanks of the esker reflect the angle of repose of these collapsed beds.

Figure 9. Deltaic deposit. *A.* A delta in glaciated terrane is formed when meltwater, derived from a wasting glacier and heavily charged with sand and gravel, empties into a body of water, commonly a glacial lake. As the meltwater stream flows into the lake, its velocity decreases sharply causing it to drop its load of sand and gravel. The resultant deposit, when viewed from the air, is triangular shaped, hence the name "delta."

B. Cross section of a delta showing the general attitude of the sand and gravel beds. The bottomset beds, first formed, are generally thin and are overlain by thick foreset beds—the major deposits of the meltwater stream. These foreset beds are overlain by a thin layer of topset beds, the final deposits formed during the development of a delta.

B, Percentage of sample that passed through a 75 mm (3 in.) sieve, but was retained on a 63 mm (2.5 in.) sieve.
D, Percentage of sample that passed through a 63 mm (2.5 in.) sieve, but was retained on a 50 mm (2 in.) sieve.
F, Percentage of sample that passed through a 50 mm (2 in.) sieve, but was retained on a 38 mm (1.5 in.) sieve.
H, Percentage of sample that passed through a 38 mm (1.5 in.) sieve, but was retained on a 25 mm (1.0 in.) sieve.
J, Percentage of sample that passed through a 25 mm (1.0 in.) sieve, but was retained on a 19 mm (0.75 in.) sieve.
L, Percentage of sample that passed through a 19 mm (0.75 in.) sieve, but was retained on a 13.2 mm (0.52 in.) sieve.
N, Percentage of sample that passed through a 13.2 mm (0.52 in.) sieve, but was retained on a 4.8 mm (0.19 in.) sieve.
P, Percentage of sample that passed through a 4.8 mm (0.19 in.) sieve, but was retained on a 2 mm (0.08 in.) sieve.
R, Percentage of sample that passed through a 2 mm (0.08 in.) sieve, but was retained on a 0.42 mm (0.02 in.) sieve.
T, Percentage of sample that passed through a 0.42 mm (0.02 in.) sieve, but was retained on a 0.15 mm (0.006 in.) sieve.
V, Percentage of sample that passed through a 0.15 mm (0.006 in.) sieve, but was retained on a 0,08 mm (0.003 in.) sieve.
W, Percentage of sample that passed through a 0.08 mm (0.003 in.) sieve.

Figure 10. Bar graphs showing results of sieve analyses. Also see table 1.

MAP SHOWING SAND AND GRAVEL DEPOSITS IN THE BIGFORK-AVON AREA, FLATHEAD, LAKE, LEWIS AND CLARK, MISSOULA, AND POWELL COUNTIES, MONTANA

By
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1995