GLACIAL LAKE MERRIMAC

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Named for a town at the crossing of Wisconsin River by the Elroy division of the Chicago and Northwestern Railway, Lake Merrimac came into existence in this part of the Wisconsin valley when the Green Bay lobe began to retreat from its terminal (Johnstown) moraine. The moraine and its outwash, blocking the valley, served as an effective dam, and the lake lengthened northeastward as the retreat continued. Its level appears to have stood at 850 to 860 A.T. during this time.

Overlooking the lake on the north was the southern of the two Baraboo Ranges which, 18 miles northeast of the drift dam, terminates abruptly where joined by the converging North Range. Here the upland surface drops off from 1200 to altitudes below that of the lake. Had there been no drainage into Lake Merrimac other than that of the adjacent retreating glacial front, and had no lowering from outlet erosion occurred, the lake would have continued to lengthen and expand as the glacier retreated north and east of this end of the Ranges and would have flooded the low country about Portage and north down the Fox River valley. Indeed, the upper Wisconsin River would today be a part of the St. Lawrence drainage system.

The possibility of such continued enlargement, however, was denied because that same ice front had been confining a higher and far larger lake on the north side of the Ranges, which abruptly began discharging southward into Lake Merrimac when the eastern end of the Ranges was freed by the retreating ice front.

Lake Wisconsin, largest of all such water bodies within the state, was formed when the advancing Green Bay lobe closed the Devils Lake gap in the South Range. Glacial ice and glacially ponded water then largely replaced the former free drainage of the upper Wisconsin River through this gap. This large lake found an outlet down Black River to the Mississippi north of LaCrosse. Because the ice built a bulky moraine (Johnstown) in two places across the Devils Lake gap, effectively blocking it against re-use by Wisconsin River after retreat from this position, Lake Wisconsin continued to exist and was enlarged eastward as the ice edge shrank back, until the abrupt east-pointing prow where the Ranges join and terminate was ice-free.

With lower surfaces thus exposed the glacial damming of Lake Wisconsin came to an end. The level of the new outlet around the east end of the upland was about 120 feet lower than that leading to Black River. The first 80 feet of this marked drop in level involved the entire lake. There then emerged a high place in the lake bottom, a group of submerged hills of sandstone in the region of The Dells, 20 miles northwest of the new outlet. They became a far more durable dam than glacial deposits could be and held back a large portion of the lake from further abrupt lowering. The

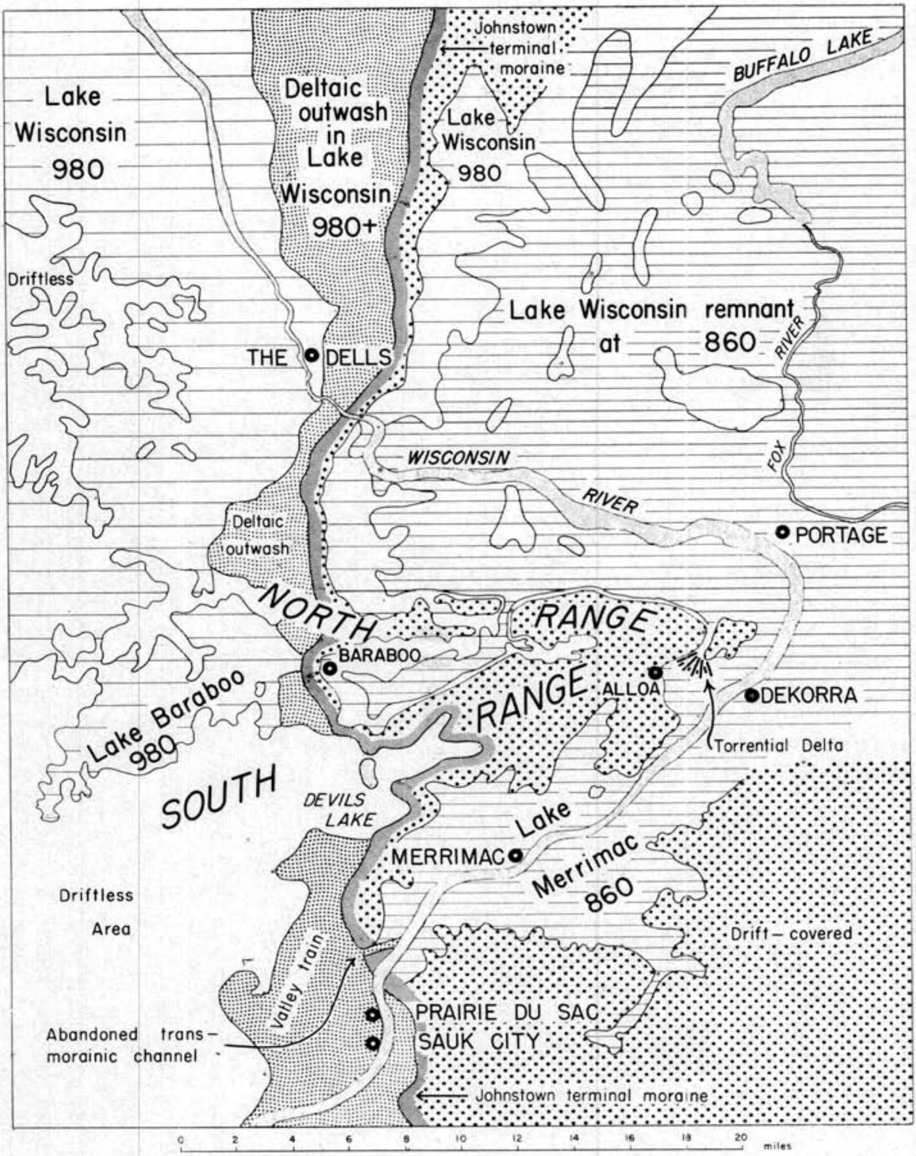

FIG. 1.—Glacial Lake Merrimac

postglacial Wisconsin River is still at work incising this barrier on which it found itself superposed.

The southern and southeastern part of the dismembered lake, however, continued to lower rapidly as obstructing drift deposits were eroded by the new outlet. The details of lowering involved the existence of Lake Merrimac, into which the discharge poured at the time the glacial dam failed, the building of a torrential delta at the head of that lake by the rapid lowering of Lake Wisconsin, followed immediately by the trenching of this delta as Lake Merrimac's own outlet near Prairie du Sac was rapidly deepened and its level lowered by the greatly increased volume of its discharge.

The details are as follows: When retreat south of the Ranges began, an extensive valley train heading at the terminal moraine reached down the Wisconsin valley across the Driftless Area. Where it rested against the outer face of the Johnstown moraine its altitude ranged between 860 and 880 feet A.T., and its gradient thence down-valley was gentle. Rather than the moraine, this valley train was the effective dam for Lake Merrimac. Two channels were promptly cut into the moraine to the level of the outwash apron in front, one now deeply incised by later use and carrying Wisconsin River today, the other a narrow abandoned trench somewhat more than a mile long, exceeding 80 feet in depth and its floor 30 to 40 feet lower than the 850-860 level of the lake.

No shore lines of Lake Merrimac are known, and the only record of the lake's level is the torrential delta east of Alloa and just south of the east end of the Ranges. Its surface is somewhat undulatory, its southern or frontal slope is rudely parallel with the foresets revealed in excavations and its back slope is steep and irregular as befits an ice contact. An alluvial fan stands on the northern part of the delta top, sloping southward and truncated on the north by the same ice contact slope.

Topography alone would hardly establish the interpretation given this hill. There is no denying it, however, when the sections in the gravel pit on the south slope are examined. For 40 or more vertical feet, unbroken foresets of extraordinarily open-work coarse gravel dip southward. Except for one growing delta at the head of Franz Josef fiord, East Greenland, the writer has never seen a more bouldery delta deposit. Most of the boulders are crystallines up to 3, 4, and even 5 feet in maximum diameter. Most of them lie in a cobble gravel; a few are imbedded in pebble gravel. No foresets composed dominantly of boulders were seen, nor any foresets largely of sand. Subordinate to the crystallines are sandstone and dolomite boulders, and still less common but highly significant are widely distributed cobbles and boulders of a pink clayey till. The largest till boulder seen was 3 feet in diameter.

Although all these boulders must have been rolled across the top of the delta to reach the foresets where they rest, there is no channel leading to this delta, no adequately extensive drift surface high enough to have carried a free-surface stream to the delta head. The ice contact slope, if correctly interpreted, records the debouching of the torrential stream directly from the retreating ice front.

The very brief episode of discharge was neither preceded nor followed by any noteworthy outwash deposition. It therefore appears to record unusual and short-lived conditions that developed just before the ice withdrew from contact with the Ranges. There is strong suggestion that the discharge initiated failure of the ice barrier between lakes Wisconsin and Merrimac, that the hydrostatic head of 120 feet caused a leakage under and through crevasses in the decaying glacial front. The till cobbles and boulders are difficult to explain unless they record quarrying beneath the ice and a very short transportation *upgrade* downstream.

Comparison with the Gregory Valley delta at the head of Franz Josef fiord is interesting although the argument derived is only by analogy. The observed boulders of this Greenland deposit lie on the delta top, extending to the very edge, and obviously indicating that others have gone over the edge to become a part of the foreset structure. Slabby boulders lie in imbricate positions despite their diameters of several feet, a relationship which the existing Gregory stream is wholly incompetent to produce.

These boulders were traced back to the fairly recent breaking of a glacial dam several miles up the Gregory Valley, behind which was impounded a lake*. Velocity for their transportation was provided by the valley's gradient instead of a hydrostatic head, and they were doubtless swept all along the lower valley by the brief torrent when the dam broke. The delta itself is a normal deposit and only the surface boulders are to be compared with those composing so much of the Alloa deposit.

Although no channel leads to the top of the Alloa delta, there is a glacial river channel trenched some 30 feet deep into its eastern part. This was noted by Thwaites,† who interpreted it as the initial outlet when "the ice margin cleared the east end of the Baraboo Bluffs" and "the level of waters impounded in front of the ice fell from about 980 . . . to about 840 feet." According to the present writer, it is the Alloa delta which records initial discharge, and the channel was made after the ice had been cleared away sufficiently to allow standing water at the subsiding Lake Wisconsin level to reach the ice-contact head of the delta. Thus, although the lower portion of dismembered Lake Wisconsin dropped 120 feet to Lake Merrimac's level during the growth of the Alloa delta, no debacle occurred during this failure of the ice barrier at the east end of the Ranges.

Excavation of the channel was completed while the retreating glacial front stood less than three miles to the east. At that distance, the drift surface beneath the glacier was close to 800 feet A. T., and when it became exposed, the channel was abandoned and lakes Merrimac and Wisconsin came to the same level, connected by a strait 4 to 5 miles south of Portage.

But Lake Merrimac was lowered about 30 feet during the channel's life, by reason of the great increase in its discharge volume across the moraine and outwash near Prairie du Sac. The time involved was only that required for about three miles of glacial retreat, a few centuries at the most. In the fact that the delta records none of this lowering, we find additional support for the concept that the extraordinary conditions (penetration of the glacial bar-

* Boyd, L. A. "The Fiord Region of East Greenland," Am. Geogr. Soc. Spec. Publ. No. 18, pp. 185-193.

† Thwaites, F. T. "Pleistocene of part of northeastern Wisconsin," Geol. Soc. America, Bull. Vol. 54, 1943, p. 120.

rier by water under high pressure) produced an extraordinary volume of discharge for an extraordinarily short time.

The two competing transmorainic channels near Prairie du Sac continued to be deepened after lakes Wisconsin and Merrimac became confluent, but the northern one was shortly abandoned and all subsequent drainage, including that from both Early and Late Oshkosh in Fox River drainage, has continued to deepen the winner in the contest, the present Wisconsin River route past Prairie du Sac and Sauk City. Lake Merrimac slowly dwindled to a series of extensive marshes which now are largely submerged beneath an artificial lake back of the power dam at the moraine transection north of Prairie du Sac.