

Paleoenvironments: Geosciences

Pleistocene Lakes along the Southwest Margin of the Laurentide Ice Sheet

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A series of Pleistocene lakes were formed by the Laurentide Ice Sheet (LIS) where it blocked parts of the upper Missouri River and Yellowstone River drainages in northern Montana. The general distribution and approximate size of these lakes has been known for some time (Alden 1932; Calhoun 1906; Colton et al. 1961; Flint et al. 1959; Montagne 1972). The presence of these lakes is potentially valuable in developing models concerned with the timing and extent of various lobes formed along the southwest margin of the LIS. Thus, the lakes were incorporated into summaries such as Lemke et al. (1966) and Clayton and Moran (1982). The ice margins in the glacial lake Great Falls region are related to the Shelby lobe and the Loma sublobe of the Havre lobe (Fullerton and Colton 1986). The timing of the advance and retreat of these glacial lobes is of some interest, since it may serve to test the proposal that there was a single advance of the southwestern margin of the LIS during the late Pleistocene (Jackson et al. 1999; Jackson et al. 1997; Young et al. 1994; Young et al. 1999).

Because glacial Lake Great Falls was created when the LIS blocked the Missouri River, examining stratigraphic sequences within this basin may help test models of the timing of the advance and retreat of the ice margin. For instance, glacial lake and till deposits near Belt have been mapped as Illinoian in age, implying a pre-late-Wisconsin advance of the LIS (Vuke et al. 1995). Detailed microstratigraphic studies in the area southeast of Great Falls, within the Missouri River Valley between Belt Creek and Widow's Coulee, demonstrate the presence of a local glacial-related sedimentary sequence. Cretaceous bedrock is overlain by sediments that can be correlated with the Pleistocene "Older Gravels" (Lemke and Maughn 1977). Typically these deposits are composed of rounded gravel, cobbles, and boulders with some thick lenses of well sorted sands. In exposures north of Belt Creek, the upper part is oxidized and the rocks are sometimes coated with clays and carbonate. These gravels seem to reflect deposition by the Pleistocene Missouri River.

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Near Belt Creek and Hower Coulee these gravels are overlain by a sequence of laminated clays and silts. In some exposures the laminated sediments are interrupted by beds of well-sorted sand. North of Belt Creek, in "Outhouse Coulee," this sequence is over 8 m thick and contains rhythmites consisting of fine silts and clay interpreted as varves, and several beds of cross-bedded sand. These deposits are thought to reflect sedimentation into glacial Lake Great Falls.

Directly overlying the laminated silts and clays is a diamicton. At the Outhouse Coulee exposure the deposit is composed of a matrix of silt and clay supporting gravels and boulders. At exposures west of Hower Coulee, the top part of what appears to be this same diamicton is weathered and oxidized. The diamicton is interpreted as till deposited from the southwestward advance of the Loma sublobe of the Havre lobe, perhaps of Illinoian age. The advance of this sublobe from the east could have blocked the Missouri River and caused the deposition of the underlying glacial lake sediments. The weathered zone at the top of the diamicton may be a paleosol formed during the interval after the retreat of the Illinoian margin of the Loma sublobe and prior to a late-Wisconsin southeastward advance of the Shelby lobe into the region.

Throughout the area the diamicton is overlain by a unit consisting of thick beds of sands, thinner beds of silts, and occasional lenses of gravels. These may partly be lithologic equivalents of the upper subunit of glacial Lake Great Falls (Lemke and Maughan 1977). The crossbedded sands are well sorted and contain abundant fragments of charcoal, while some of the more silty sediments contain molluscs. If these deposits represent a younger stage of glacial Lake Great Falls, they imply a later (post-Illinoian?) blockage of the Missouri River. This lake could be associated with a late-Wisconsin advance of the Shelby sublobe from the northwest. If so, the paleosol underlying these sediments (within the top of the diamicton) would potentially date to the Sangamon and early-middle Wisconsin. These sandier deposits may correlate with glacial lake sediments exposed at Holter Lake (Hill and Valppu 1997). The stratigraphy between Belt Creek and Widow's Coulee could be interpreted as potentially indicating both the Illinoian advance of the Loma sublobe as well as the late-Wisconsin advance of the Shelby lobe.

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