Sedimentological and paleomagnetic study of glacial Lake Missoula lacustrine and flood sediment

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During the Fraser Glaciation (marine oxygen isotope stage 2), floods from ice-dammed glacial Lake Missoula affected large parts of Washington and Oregon. Flood deposits are interbedded with glaciolacustrine sediment in glacial Lake Columbia, Washington, and occur as thick slackwater sediments in southern Washington and in the Willamette Valley, Oregon. This thesis examines some of the issues surrounding this flooding, such as how many times glacial Lake Missoula emptied, whether glacial Lake Missoula is the only source of the floods, and the timing of these events. The sedimentology and stratigraphy of a new section of rhythmically stratified glaciolacustrine sediment in the glacial Lake Missoula basin confirms that the ice dam failed at least a few dozen times, exposing the lake bottom. Current indicators and clast lithologies of flood sediments in glacial Lake Columbia indicate that glacial Lake Missoula was the source of these flood beds. Additionally, rock magnetic studies identify hematite in fine-grained flood sediment that settled out of the water after the high-energy floodwaters had passed. The source of the hematite is the Belt-Purcell Supergroup in Montana, which supplied sediment to glacial Lake Missoula. Optical ages, a radiocarbon age, and paleomagnetic secular variation records help to constrain the timing of glacial Lake Missoula flooding. Optical dating was successful on three samples of fluvial sand deposited during initial filling of glacial Lake Missoula and on loess deposited above Mount St. Helens set tephra, which is a time-stratigraphic marker found in glacial Lake Missoula flood deposits. One sample of fossil plant detritus was found below at least 37 flood beds in glacial Lake Columbia. Lastly, four paleomagnetic secular variation records constrain the timing of glaciolacustrine units in glacial Lake Missoula and flood beds in glacial Lake Columbia and the Willamette Valley. All glacial Lake Missoula units and flood units studied in this thesis date to the later part of the Fraser Glaciation, between ~14.2 and 11.6 $^{14}$C ka BP.