Geomorphic and geologic evidence for a terminal Pleistocene megaflood in southwest British Columbia

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More than a decade ago, researchers hypothesized that a megaflood, possibly the result of the sudden draining of a large glacially dammed lake in central British Columbia, traveled hundreds of kilometers down the Fraser River to the Salish Sea. The principal evidence for the event was a pair of anomalous clayey silt beds found in ODP cores recovered from Saanich Inlet on Vancouver Island. The two beds contain pollen of Fraser Lowland provenance and were radiocarbon dated to ca. 12,000 years ago. Here we report direct geomorphic and stratigraphic evidence for the flood along its path in the Fraser River valley between Big Bar Ferry and the town of Hope, a distance of about 250 km. Airborne LiDAR surveys and fieldwork reveal a range of landforms and sediments that constrain the flood's extent and magnitude: 1) convex 'whaleback' bars littered with boulders up to many meters in length; 2) trains of very large boulders and blocks plucked from upstream bedrock outcrops and talus cones; 3) deposits of poorly sorted gravel with erosional bases and containing large outsized boulders and, at one site, rip-up clasts of till; and 4) gravel 'megaripples' with wavelengths of tens of meters and heights up to several meters. The extent of these features and deposits, at least as far north as Big Bar, suggests that glacial Lake Fraser was the source of the flood. Cross-valley profiles indicate peak flood water depths up to 300 m over valley widths ranging from 0.5 to 4 km. Flow was deepest just upstream of valley constrictions, likely due to hydraulic ponding, and shallowed within the constrictions where velocity and stream power increased. The floodwaters entrained and locally redeposited large volumes of the paraglacial valley fill that accumulated in the Fraser River valley during decay of the Cordilleran ice sheet. Much of the entrained sediment, however, was carried past Hope and deposited in arms of the proto-Salish Sea that extended eastward from what are now Vancouver and Bellingham at the close of the last glaciation. It is likely that these sediments are many tens of meters or more in thickness beneath Fraser River alluvium in the central and eastern Fraser Lowland. We await nine surface exposure ages (^{10}Be) from boulders transported by the megaflood to provide direct ages for the event.