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Late Pleistocene and Holocene environmental magnetic record of the northwestern Cordilleran Ice Sheet dynamics based on IODP Expedition 341 drill Site U1419 in the Gulf of Alaska

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International Ocean Drilling Program (IODP) Expedition 341 in the Gulf of Alaska drilled the continental slope at Site U1419 (684 m water depth) recovering an exceptionally expanded record containing information on the dynamics of the northwestern Cordilleran Ice Sheet's southern margin during the late Pleistocene and Holocene. The 112 m long splice from Site U1419 was sampled with u-channels, all of which were analyzed with a high-resolution CT scanner for the visualization of sedimentary structures and the estimation of density. The natural and laboratory induced magnetic remanences were studied using the stepwise AF demagnetization procedure and, along with magnetic susceptibility, provide information about the sediment's magnetic properties, including magnetic concentration, grain size, and mineralogy. IRM acquisition curves were obtained for nine discrete samples from selected intervals for additional information on the magnetic mineralogy of the sediment. Furthermore, hysteresis loops were obtained on 95 discrete samples to assess their magnetic domain state and coercivity.

Using a high-resolution radiocarbon age model derived from 72 dated levels of foraminifera (Mix et al., in prep), these magnetic parameters and environmental proxies provide insight into the sedimentary environments and glacial dynamics through the past ∼56 000 cal BP. Results indicate that early Marine Isotope Stage (MIS) 3 was characterized by alternating environmental conditions similar to those previously observed for the deglacial transition (Bølling-Allerød and Younger Dryas) where high productivity intervals characterized by very low magnetic concentration and high coercivity, alternate with periods of stronger glacial influence characterized by high magnetic concentration and low coercivity. The transition into glacial maximum conditions started at ∼ 43 000 cal BP (at a depth of 92.5 m CCSF-A) and lasted until approx. 18 200 cal BP (at a depth of 14.6 m CCSF-A). This interval, tentatively named the "Alaskan LGM", was characterized by average sedimentation rates of 258 cm/kyr, that at times exceeded 360 cm/kyr (Mix et al., in prep), and persistently high magnetic susceptibility indicating high input of terrigenous material and ice rafted debris (IRD). Larger amplitude variations in magnetic properties from ∼25 000 cal BP appear to reflect complex sediment transport dynamics at the ice front that could represent several advance and retreat phases of the ice sheet before sustained deglaciation around 16 500 cal BP.