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Bimodal Plio-Quaternary glacial erosion of fjords and low-relief surfaces in Scandinavia

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Glacial landscapes are characterized by dramatic local relief, but they also commonly exhibit high-elevation, low-relief surfaces. These surfaces have been attributed to glacial headward erosion and periglacial processes in Alpine settings. However, the timing and processes responsible for their formation in northern high-latitude regions remain elusive. Here, we infer the topographic evolution of western Scandinavia during the Plio-Quaternary glaciations (0-2.8 Ma) by linking onshore erosion to offshore sedimentation. We estimate the rate of fjord erosion from geophysical relief and compare that with the erosion reflected by offshore sedimentation. We find that the sediments generated by fjord erosion (65-100 103 km3) over the entire western Scandinavia during the Plio-Quaternary glaciations accounts for only 35–55% of the equivalent bedrock erosion deduced from total sediment volume deposited off the coast of Norway. This large mismatch implies that during this period, significant erosion (300-400 m) must have also taken place away from the fjords at high elevation and thus indicates a bimodal distribution of glacial erosion. Furthermore, comparing the distribution of the high-elevation, low-relief surfaces with estimates of the long-term glacier equilibrium line altitude supports the idea that effective erosion in extensively glaciated areas limits topographic height, a process known as the glacial buzzsaw. We therefore conclude that glacial and periglacial processes have a substantial impact on the formation of low-relief surfaces observed in glaciated mountain belts and high-latitude continental margins.