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Holocene relative sea-level change on Alexander Island, Antarctic Peninsula from OSL dating of elevated lake deltas

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Onshore field data constraining the rate and spatial pattern of relative sea-level (RSL) change on the Antarctic Peninsula are relatively sparse; hence new data from key inland localities are needed to improve the predictive ability of isostasy-related models. We studied the geomorphology, sedimentology, geochemistry and optically-stimulated luminescence (OSL) geochronology of elevated deltas around two epishelf lakes, Ablation Lake and Moutonnée Lake, on the eastern coast of Alexander Island on the Antarctic Peninsula to better constrain the timing and spatial pattern of post Last Glacial Maximum (LGM) RSL change for this part of Antarctica. Ablation Lake and Moutonnée Lake are dammed by George VI Ice Shelf, but maintain a direct hydraulic connection to the sea; hence, their lake level is controlled by changes in RSL. There was insufficient quartz in samples from two elevated deltas in Moutonnée Lake for single aliquot regeneration OSL (SAR-OSL) dating, but the Ablation Lake elevated delta, at c. 14.4. m above present lake level, has an SAR-OSL age of 4.9±1.8 ka. Therefore, the Ablation Lake delta was formed by a previous sea level high-stand during the early-mid Holocene, and became isolated by a fall in relative sea level associated with a phase of ice unloading, which was likely completed by c. 3 ka. We compared the SAR-OSL age data from the Ablation Lake delta to five existing ice sheet/ isostatic rebound models for the Ablation Lake area from the LGM to present day. These were run without the Ablation lake delta included, and show that the required relative uplift of c. 14.4 m is plausible, mainly because previous possible scenarios for RSL change for this part of Alexander Island have a wide altitudinal range of as much as 90 m above present day sea level. The Ablation Lake delta RSL data point is, therefore, a valuable new chronological and vertical constraint on isostatic change for the southern part of Alexander Island because it implies relatively smaller ice masses than suggested by some models since the mid-Holocene. Moreover, field data of this type is important because it can reduce the number of possible model scenarios, and make future isostasy-related investigations more amenable to model interpretation.