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## The timing of deglaciation from mountain summits to cirques in Wales: $^{10}\text{Be}$ and $^{26}\text{Al}$ exposure dates from Cadair Idris

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Cosmogenic  $^{10}\text{Be}$  and  $^{26}\text{Al}$  exposure ages from 20 erratic samples collected from Cadair Idris (893 m), a mountain in southern Snowdonia, Wales, provide evidence for the timing of deglaciation from summits to cirques at the end of the Late Pleistocene. The summit of the mountain is characterised by intensely modified frost-shattered surfaces that have long been identified as representing a former nunatak. Numerous glacially-transported quartz boulders on the highest ground indicate that ice overran the summit at some point in the Pleistocene. Two quartz boulders, one with preserved striations, sampled at c. 856 m near the summit of Cadair Idris yielded consistent  $^{10}\text{Be}$  and  $^{26}\text{Al}$  paired exposure ages of 75 ka to 60 ka (using a high-latitude sea level  $^{10}\text{Be}$  spallation production rate of 4.20 at/g/y, scaled by the Lal/Stone scheme). A glacially polished bedrock quartzite outcrop at 735 m gave an age of 17.5 ka. Immediately below this, cirque and down-valley recessional moraine ages, covering an elevation of 480 m to 350 m ranged from 10 to 15 ka respectively.

These results confirm that Cadair Idris was overridden by the Welsh Ice Cap during marine isotope stage (MIS) 4, when ice was thicker than at the global last glacial maximum (LGM) in MIS 2. This is consistent with findings from northern Snowdonia. The highest Welsh summits, including Cadair Idris, emerged above a thinning Welsh Ice Cap (British Irish Ice Sheet) during the transition from MIS 4 to 3. The summit area above ~800 m then stood as nunataks above the LGM ice sheet surface in MIS 2. The Welsh Ice Cap then rapidly thinned over Cadair Idris at ~20-17 ka based on ages from high-level ice-moulded bedrock. This is supported by more new ages from high-level paired erratics and bedrock samples on several other mountains throughout Snowdonia, leading to a phase of alpine-style deglaciation. Valley glaciers initiated their retreat up-valley from ~17 to 14 ka after Heinrich Event 1. A later phase of glacier stabilisation or still stand formation produced classic cirque moraines near the rim of a present cirque lake basin (480 m elevation) yielding  $^{10}\text{Be}$  ages of 13-10 ka during the Younger Dryas.

