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Palaeoclimatic and morphodynamic implications from boulder dominated peri- and paraglacial landforms in two areas of South Norway

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Boulder-dominated landforms of periglacial, paraglacial and related origin constitute a valuable, but often unexplored source of palaeoclimatic and morphodynamic information. The timing of landform development initiation and its subsequent stabilization can be linked to past climatic conditions offering the potential to reconstruct cold climatic periods. In this study, Schmidt-hammer exposure-age dating (SHD) was applied to a variety of boulder-dominated landforms (e.g., sorted stripes and polygons, blockfield, paraglacial alluvial fan, rock-slope failure) in two different areas South Norway, Breheimen and Rondane. On the basis of old and young control points a regional SHD calibration curve was established and successively utilised for the calculation of surface exposure ages for individual landforms. The chronological investigation of development and stabilization of the respective landforms permitted an assessment of Holocene climate variability in different areas of South Norway and its impact on overall landform evolution. The obtained SHD ages range between 11.44 ± 1.22 to 3.45 ± 0.70 ka showing their relict character. There appear to be differences in the timing of stabilization of comparable landforms between the eastern and western part of South Norway within ca. 100 km. For instance, sorted ground structures show particular age differences and stabilized around 3 ka earlier in the eastern study area compared to the west. The sorted polygon ages in the west of 6.55 ± 0.68 and 4.76 ± 0.63 ka point to a stabilization around the Holocene Thermal Maximum (HTM; ~8.0–5.0 ka). In contrast, SHD ages from blockfields in both areas show rather young and comparable ages within the mid-Holocene, compared to former studies. Our obtained surface exposure ages from boulder-dominated landforms in two areas of South Norway give important insights into the local palaeoclimatic variability during the Holocene.