Ventifacts and wind deflation surfaces in context with glaciofluvial sediment successions in southern Sweden

Per Möller[a], Helena Alexanderson[a], Zoran Peric[a] and Mayank Jain[b]

[a]Department of Geology, Lund University, Lund, Sweden, per.moller@geol.lu.se; helena.alexanderson@geol.lu.se; zoran.peric@geol.lu.se. [b]Department of Physics, Technical University of Denmark, DTU Risø campus, Roskilde, Denmark, maja@dtu.dk.

Recent suggestions propose that the glacial landscape of southern Sweden is a relict landscape from the Saalian glaciation (>130 ka) (Lagerbäck, 2018). The primary argument supporting this viewpoint is the claimed observation that the majority of glaciofluvial deposits in this region exhibits a covering till bed, often accompanied by wind-abraded clasts (ventifacts) at the contact between glaciofluvial sediment and till. It has been further posited that this wind abrasion event dates back to the Early Weichselian, preceding the last glaciation, and occurred during periglacial conditions of that period. If this were indeed the case, it would imply that generations of Quaternary geologists had overlooked or disregarded this relationship, necessitating a paradigm shift in our comprehension of the Quaternary geological history of the area.

To assess the validity of these claims, we conducted a comprehensive evaluation of purported stratigraphic conditions within 54 gravel quarries south of the Middle Swedish End Moraine Zone (MSEMZ). The presence of a covering bed of what can be sedimentologically interpreted as a glacially deposited diamict – a till – above glaciofluvial sediments was confirmed in only 22% of the gravel pits. These occurrences were primarily linked to locations in close proximity to well-known positions associated with ice-margin standstills or oscillations during the Late Weichselian. In all other quarries, where the presence of covering till could not be confirmed, ventifacts were found in various stratigraphic positions. These positions were contingent upon deglacial and post-deglacial environmental conditions and included ventifacts at the contact between glaciofluvial and overlying littoral sediment, ventifacts redeposited within littoral sediment, and ventifacts at the contact between glaciofluvial or littoral sediment and overlying aeolian sediment.

To ascertain the age of the ventifaction event(s), we conducted an extensive luminescence (OSL) dating program (n = 74) in 22 of the gravel pits that were more meticulously studied from a sedimentological perspective. Out findings indicate that wind abrasion in southern Sweden was not a single, simultaneous event but a process that occurred at varying times. It sometimes coincided closely with the local deglaciation and at other times or locations extended into the Early Holocene. Importantly, none of the identified ventifact surfaces predate the Last Glacial Maximum (LGM).

For west-coast sites, the evidence suggests wind abrasion occurring as early as between 17 and 16 ka ago during periglacial conditions. This is indicated by the presence of ice-wedge casts in delta topset surfaces. In upland sites, ventifact formation age presents two possibilities – either it occurred immediately after deglaciation or during the Younger Dryas period. All upland sites were deglaciated during the Bølling–Allerød interstadial complex (14.7–12.8 ka). Despite protective vegetation further away from the ice margin, areas close to the ice margin may have experienced a sufficiently harsh wind climate conducive to ventifact formation. Moreover, several sites suggest a period of intensive ventifact formation also took place during Younger Dryas, even extending to regions far south of the ice margin at the time. The formation of patterned ground, as evidenced by recorded ice wedge casts, implies a severe periglacial climate with reduced vegetation cover, resulting in sand drift and ventifact formation, with the former also leading to aeolian sediment deposition as the Early Holocene commenced.

References

Lagerbäck, R., 2018: Den senaste nedisningen i södra Sverige – och tiden dessförinnan. *SGU Rapporter och meddelanden 143*, 87 pp.