The formation of Valle Härad

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Valle Härad is a well-known location in Sweden displaying ice-collapsed, 'kame-and-kettle' topography. It contains eight nature preserves and lies in the newly established Platåberg UNESCO Geopark. It has been studied for over 100 years, initially with papers by Henrik Munthe and Hans W:son Ahlmann in the early 1900's. Because it is close to the drainage site of the Baltic Ice Lake, its genesis has also at times been linked to that event. Despite its fame as a dead-ice locality, it has long been understood that non-collapsed, gently sloping outwash surfaces are present. With the advent of LiDAR elevation models, it has been possible to map the landforms more precisely, and we present a new map. In addition to collapse hummocks and outwash plains, there are numerous eskers, two-large esker nets, and at least one clear push moraine present. Maximum clast-size analysis of the outwash surfaces in Valle Härad reveal that they exhibit the same downstream fining of grain size measured on modern outwash plains, indicating that the outwash plains were formed at the retreating ice margin. The outwash plains, end moraines, esker nets and clast-size information allow for the lateral correlation of the push moraines of the Middle Swedish end moraine zone into Valle Härad. For example, the Eggby outwash surface is correlated to the initial Skånings Åsaka ice-margin position. And the Eahagen ridge (a push moraine composed of outwash) can be correlated to the second Skåins Åsaka ice-margin position. These results show that the surface topography of Valle Härad was developed sequentially and parallel with subaquatic, push-moraine formation further west. However, two major features remain difficult to explain. The first is the esker-covered steep slope at the north end of Valle Härad at Lerdala. The second is the genesis of the 30-60 m of sand and gravel that underlies the surface landforms. We offer two hypotheses for the origin of this older sediment. First, the older sediment was deposited during the Younger dryas sequentially from south to north as a series of ice-contact deltas with each delta overridden by subsequent ice-margin oscillations. Second, the older sediment may represent drainage sediment from the late Allerød drainage of the Baltic Ice Lake, as first suggedted by Björck and Digerfeldt (1984).

Reference

Björck, S., & Digerfeldt, G., 1984: Climatic changes at Pleistocene/Holocene boundary in the Middle Swedish endmoraine zone, mainly inferred from stratigraphic indications. In *Climatic Changes on a Yearly to Millennial Basis: Geological, Historical and Instrumental Records* (pp. 37-56). Dordrecht: Springer Netherlands.