Interpretation of complex glacial geology from AEM data using a knowledge-driven cognitive approach

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Existing borehole data are seldom sufficient for detailed subsurface geological interpretation and 3D modelling due to geological complexity. If geology is not too complex and the amount of borehole data is high, experienced geologists may be able to construct coarse models based on boreholes and by using their geological expert knowledge. But very often supplementary data is needed, and this is one of the reasons for the growing use of geophysical methods like Airborne ElectroMagnetic methods (AEM).

New developments in AEM technology offer new opportunities for spatially dense subsurface mapping. The new AEM data enable high-quality mapping of detailed geology, providing new and improved geological knowledge and understanding of surveyed areas.

When AEM data is geologically interpreted, it is the measured electrical resistivity that is being used. The translation of resistivity into geology/lithology is a complicated task, but without this translation, lithological properties and the structural composition of the subsurface cannot be properly assessed. The translation can only be successfully done if a series of limiting issues about the methodology are carefully considered and implemented in the interpretation. An automated conversion/interpretation routine is therefore difficult to establish. In order to end up with the best interpretation that makes full use of the collected data and at the same time improves the geological understanding of the area, we recommend knowledge-driven cognitive interpretation approaches. Cognitive interpretation ensures a high degree of incorporated geological background knowledge such as the understanding of sedimentary processes, structural geology or sequence stratigraphy, but also that the limitations of the method mentioned above are taken into account.

We will present cases where AEM data combined with seismic and borehole data have been successfully interpreted, and we will show how they have brought new insight into local complex geology. We also show how they for some areas have been responsible for a complete change in the regional conceptual understanding of the geology.