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Record of micro-scale frost weathering in the contemporary active-layer deposits – a case study of Kaffiøyra Plain, NW Spitsbergen

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Frost weathering affects rocks and/or sediments not only in the areas underlain by permafrost, but wherever cyclic temperature changes around 0°C are recorded. One of the main parameters influencing the intensity of frost weathering, both in the macro- and micro-scale, is the number of freeze-thaw cycles (FT). It depends on e.g. profile depth, lithology, land cover and especially, on climatic conditions (e.g. Matsuoka, 2001; French, 2007). Nowadays, global climate changes lead to the gradual increase in the number of FT and thickening of active layer. This is especially common in high latitude areas.

Spitsbergen is a proper example of an area where prevalent frost weathering is coupled with significant climate changes. The subject of the research is micro-scale frost weathering of sand-sized quartz grains, collected from the active-layer deposits of the Kaffiøyra Plain. Kaffiøyra is a coastal plain located in northwestern Spitsbergen (Oscar II Land), the largest island of the Svalbard archipelago. The thickness of the active layer recorded on the Kaffiøyra Plain varies both in space and time, with the maximum values observed in the summer season. However, its increasing in recent years has already be proven. Five profiles of sediments of different origins were analyzed with regard to their lithological variability. These included: moraine (from Little Ice Age - LIA), lake sediments and raised marine terraces. The analysis of the surface micro-relief of the sand-fraction quartz grains was performed using a scanning electron microscope (SEM). Additionally, grain-size distribution of samples, their pH, $CaCO_3$ content and conductivity were analyzed to specify the intensity of frost weathering. It was proven that the most intense weathering takes place in the upper- and bottom parts of the active layer. In the first case, it could be the result of a great number of FT affecting the sediments, while in the latter, it was supported by the content of water, which accumulate on the upper part of permafrost. Moreover, paleobottom of ancient active layer was recorded within the contemporary active layer deposits at a depth shallower than its current position. Quartz grains from this paleobottom shows a clear increase in the number of microtextures resulting from frost weathering. Furthermore, there is a clear dependence of the intensity of frost weathering on the lithology of sediments, and the finer the sediment, the more intense the weathering. Regardless of the lithology, profile depth and pH, the frost weathering remains at its initial stage, that is emphasized by the dominance of frost-induced microtextures, such as small- and large-sized conchoidal fractures. Frost microtextures indicating a more advanced weathering process, i.e. small- and large-sized breakage blocks, are of a minor nature. The only exception is the bottom part of the active layer, where the greater number of frost microtextures, including large-

sized breakage blocks, is recorded each time.

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