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Quantitative analysis of periglacial lake sediments from Schirmacher Oasis, East Antarctica: implications for Late Quaternary depositional environment.

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Schirmacher Oasis, central Dronning Maud Land (cDML), represents a unique Periglacial environment of East Antarctica bordering ice shelf in the north and East Antarctic Ice Sheet (EAIS) in the south. This Oasis has more than 100 fresh water lake reflecting very active hydro-dynamic system. The sediments carried by thick continental ice rest in these lakes and represent palaeoclimatic conditions of the region. Apart from typical glacial and glaciofluvial granulometric characters, the clay mineralogy of sediments also shows changing climatic conditions. Moreover, the lake sediments also indicate change in hydro-dynamic conditions in sediment transportation and deposition. The different physico-chemical properties of lake sediments, along with OSL dating, show 42 Ka age for the change of climate of Schirmacher Oasis from glacial to fluvioglacial.

The most common microtextures of quartz grains from lake sediments of Schirmacher Oasis are conchoidal fractures, straight and curved grooves and arcuate/straight steps, [1,2,3,4,5] which indicate basal transport of sediments in continental ice. Pre-weathered and weathered surface vary widely, possibly as a result of influences of climate change and reworking of sediments. Most of the quartz grains show good amount of abrasion features indicating the effects of cryostatic pressure of thick ice. The high frequency of precipitation coatings on some grains indicates complex weathering of the rocks prior to erosion, followed by glacial transport. Glacial grinding and fluvial influences are observed over quartz grains.

The quartz grains show wide variations in their surface textures when compared with depth and size. New growths, straight grooves and arcuate steps show positive correlation with depth in fine quartz grains (63 μm), indicating dominance of glacial action in the older sediments. Similar result has also been shown by medium quartz grains (250 μm). The role of glacial crushing and grinding is more pronounced on the coarser quartz grains (250 – 500 μm). The effect of fluvio-glacial system is evident with mix population of these surface textures, specially in the middle horizon lake sediments. This effect becomes more pronounced with increase in size. The younger quartz grains show dominance of fluvial effect in the lacustrine environment, specially in the coarser grains. Edge abrasion and surface abrasion also increases in older sediments as well as in coarser grains. Thus, the coarser quartz grains have preserved glacial action in better way than the finer grains.

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