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New evidences on the specific character of the Late Ordovician striated surfaces and implication for ice-sheet dynamics

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Striated surfaces observed in the Late Ordovician glacial drift are generally considered as subglacial abrasion surfaces at the sole of a glacier overriding unlithified deformable sediments. This interpretation was supported by their stratigraphic occurrence at the upper part of glaciofluvial sandstones overlain by mudstones to sandy diamictites including evidences of glacial input. Furthermore, at a regional-scale, the striae orientations are consistent with larger-scale ice-flow indicators (e.g. glacial valleys, glaciotectonic thrust ridges, glacial fluting). However, field observations from Mauritania and Libya match this interpretation. The V-shaped transverse profile of the striations does not fit with an erosive in-ice clast-tool origin. The striated surfaces occur with their negative counterpart and similar orientation at different superposed horizons within the fluvial sandstones, suggesting internal shearing. These superposed striated surfaces are interpreted as concurrent intraformational decollement planes, within a subglacial brittle shear zone in unlithified sand beds. Non-deformed dewatering and liquefaction structures record the final evolution of the shear zone, leading to compaction, locking of the deformation and fossilisation of the shear zone.

Even if striated surfaces are not true glacial pavements, they can be used to confirm the existence of an overriding glacier, and to define its paleo-flow trend. The recognition of subglacial soft sediment deformation in Late Ordovician ice-sheet dynamics have inferences concerning the former ice-sheet characteristics such as its thermal regime, ice thickness and subsequent isostasic effect, terrestrial or marine setting, erosive and depositional behaviour. Accordingly, the new interpretation of the Late Ordovician striated surfaces offers new perspectives that will encourage a new approach of the glaciofluvial sandstones and associated structures in order to improve facies models capable to explain for instance the unusual low proportion of conglomerates or diamictites, which characterizes the Late Ordovician glacial drift in north Gondwana.