



## **A multiphase model for a soft-sediment striated surface of subglacial origin**

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The aim of this paper is to showcase an ancient (Late Palaeozoic) striated surface in South Africa, and discuss its interpretation in the context of a soft-bedded ice sheet during the retreat phase. The quality of glacial geomorphic evidence, preserved in semiarid terrains of Africa, is extremely high, and allows special insight into aspects of an ancient glaciation that has gone to completion. The Dwyka Formation evidences multiple cycles of glacial advance and retreat which include a thick succession of diamictites and heterolithic strata. Painstaking work in the 1970s and 1980s produced regional palaeogeographic reconstructions, among which complex ice flows were identified. Trunk glaciers and / or ice streams appeared on a variety of palaeogeographic maps, many of which highlighted highly complex flow structures within the ice sheet. Nowhere are complex ice flow directions more apparent than in the Northern Cape Province, which exposes an outstanding soft-sediment striated surface at Oorlogskloof. Using a combination of field observations, aerial photograph interpretations, and new digital elevation models collected from an Unmanned Aerial Vehicle (UAV), we map the macrostructure of the surface. The inventory of structures, which include grain flow lobes at the flanks of flutes, suggests that the surface was largely generated at the ice-sediment interface, with local evidence for internal deformation and shearing of the sediment pile. Most importantly, the aerial images reveal two features that reveal a composite history to this pavement. Firstly, flutes and grooves to have high length to width ratios, potentially implying rapid ice flow. Secondly, the UAV images reveal a discontinuous network of bulbous ridges which traverse, fold and distort the striations and flutes. The latter features are interpreted to result from bulldozing beneath a floating ice mass. Collectively, therefore, the assemblage of structures may record two distinct phases in the construction of this spectacular pavement.