

A bird's eye view of a 443 million year old ice sheet: using aerial imagery to characterise deep time glacial landscapes

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A series of spectacular soft-sediment grooved pavements are exposed at Pakhuis Pass in the Western Cape Province, South Africa. These features record the processes of soft-bed deformation beneath a Late Ordovician (ca. 443 Ma) ice sheet. Until now, detailed understanding of these features has progressed little since their original documentation by Rust (1967), other than being used as prima facie evidence for the passage of past ice masses over Gondwana. Using aerial imagery acquired using a DJI Mavic Pro Unmanned Aerial Vehicle (UAV), we document the heterogeneity of three selected pavements in the Northern and Western Cape Provinces. Developing digital elevation models from the data allows the recognition of glacial lineations in otherwise comparatively flat and featureless bedrock surfaces, and allows flow pathways to be mapped. At Pakhuis Pass (Late Ordovician). We map ridges and grooves of up to 50 cm amplitude, and demonstrate bifurcation of these at the decametre scale. Unusual transverse structures with a sinuous to curvilinear geometry are ubiquitous, and testify to processes of deformation orthogonal to the main ice flow direction. It is tentatively suggested that the assemblage of structures record the partial coupling of an ice sheet to its bed, and speculated that collectively the soft-sediment grooved pavements may record the passage of an ice stream over the Pakhuis Pass area.