GLACIAL AND INTERGLACIAL SEDIMENTARY RECORD IN CROSS-SHELF VALLEY: EVIDENCE FOR PERMO-CARBONIFEROUS ICE-MARGIN FLUCTUATIONS (DWYKA GROUP, SOUTH-EASTERN SOUTH AFRICA)

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The Gondwana-wide Permo-carboniferous glaciogenic deposits, known as the Dwyka Group in South Africa, form the basal succession of the classic Karoo Supergroup. In south-eastern South Africa, these deposits are commonly viewed as bearing the record of a single deglacial event. Conversely, its western equivalent (Namibia and western South Africa) is assumed to record four stages of growth and decay of ice masses separated by intermittent interstadials. The present work reveals, however, that at least three icemargin fluctuation sequences, formed by both glacial and non-glacial facies, form the infill of 100 m deep, 1-3 km wide U-shaped cross-shelf paleo-valleys carved into the bedrock. These valleys possibly represent paleo-fjords as observed elsewhere in Southern Gondwana but not recognized as such in this part of the Karoo Basin so far.

In the studied area (KwaZulu-Natal province), three superimposed units displaying both glacial and non-glacial signatures compose the Dwyka Group. The up to 70 m thick lower unit consists of massive diamictite bearing abundant up to boulder-sized lonestones. This lower unit wedges out and onlaps on valley flanks while its top is characterized by glacial striae and grooves. Above, the 50 m thick coarsening-upward sequence forms the second unit which also consists in massive lonestone-bearing diamictite interstratified by normally-graded sandstone beds devoid of lonestones. These facies grade upward into a 10 m thick trough and sigmoidal cross bedded conglomeratic sandstones that is locally highly disturbed by subglacial deformation. The third unit formed by a massive diamictite bearing carbonaceous concretions and rare pebblesized lonestones is topped by discontinuous patches of highly glacially-deformed conglomeratic sandstones. Black shales of the Ecca Group, usually interpreted as postglacial deposits, directly rest on this ultimate glacial surface.

Although diamictite intervals likely result from deposition in a glaciomarine environment by important rain-out beneath or immediately in front of a floating ice shelf, cross bedded and normally-graded sandstone horizons, respectively interpreted as fluvioglacial and subaqueous sediment density flows deposits, indicate local ice-free conditions. The vertical superimposition of these facies are then strong indicator of ice margin fluctuations throughout the study area. In such a context, the glacial maximum is likely marked by the basal erosion surface that carved valleys into the bedrock while the glacial surface recorded on top of the first unit is suspected to represent a temporary stillstand marked into an ice margin retreat. Deformed sandstones on top of both the second and third units thus represent fluvioglacial deposits emplaced during ice free conditions in a context of relative sea level fall forced by the glacio-isostatic rebound and deformed by subsequent ice margin advance. Conversely, marine and glaciomarine deposits resting on top of these deformed beds are interpreted as being deposited by rapidly retreating ice margin in glacio-isostatic depressions.