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Diamictites as a tectonofacies: Insights from a sub-surface database in the Grand Conglomerat Formation at Kamoa, Democratic Republic of Congo

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Thick diamictites are a distinctive component of Neoproterozoic basins world wide and are typically regarded as direct evidence for a severe pan-glacial climate state. Examination and detailed facies analysis of an extraordinary collection (about 300 km) of drill core through the Grand Conglomerat at Kamoa, Democratic Republic of Congo, provides clear evidence that diamictite deposition within the Kamoa Sub-basin was the product of ongoing active extensional tectonism rather than direct climatic forcing. The overall basin stratigraphy comprises three kilometres of genetically related sediment gravity flow facies, including some 1800 m of diamictites deposited as debris flows into deep water. A primary glacial origin for these diamictite facies is inconsistent with the very simple stacked geometry of the basin fill, and any ice, if present, was likely restricted to the hinterland. Instead, the primary controls on sedimentation were syndepositional faulting, rapid subsidence, and volcanism. Elevated basin margins generated large volumes of scarp-derived breccias and conglomerates that periodically collapsed into the basin centre where they incorporated and intermixed with basinal muds to form the characteristic matrix-supported texture of diamictite so often misinterpreted as glacial in origin. Intermediate stages of this mixing process are well-preserved within the Kamoa cores, ranging in scale from millimeter-thick laminae to chaotic ‘megabeds’ over 30 metres thick. Diamictites that form primarily as a consequence of sediment mixing could appropriately be called ‘mixtites’ as a parallel to the genetic term ’tillite’ for a glacial diamictite. Rapid subsidence during diamictite deposition is evident from interbedded deep-water facies, and is a crucial factor in generating the oversteepened conditions favourable for diamictite production, and in focussing and ponding enormous thicknesses of debris flow diamictite into confined depocentres. The evidence from Kamoa suggests that diamictites in active tectonic settings should be regarded as a ‘tectonofacies’ that lacks any direct climatostratigraphic significance. Though the Kamoa Sub-basin is a fairly simple rift basin, in a more complex extensional system, tectonofacies may be deposited diachronously over large distances as local subsidence rates vary, rendering them of limited value for correlation.