

**Late Ordovician tillites in Southern Bolivia: How to describe, interpret and classify diamictite successions.**

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A new method of facies analysis for diamictite successions and its implementation on the Cancañiri Formation at the locality Sella in Bolivia is presented. These matrix-dominant diamictites controversially were interpreted either as glacial or non-glacial sediments. Classical methods led to an insufficient classification of the 180 m thick succession. Moreover previous investigations of diamictites do often not clearly distinguish between description, analysis, interpretation and genetical classification, which is necessary for accurate interpretative statements.

Lithofacies codes based on grain size nomenclature were developed that, in difference to the standard codes, are strictly descriptive, consistent with laboratory methods and that allow a detailed distinction and classification of diamictites and associated siliciclastics. Environmental interpretation based on multiple criteria is used to decide in which environment the sediments were deposited. Finally facies elements are classified genetically according to their depositional processes.

The Cancañiri diamictites of the Sella locality in the Eastern Cordillera could be proved to represent true tillites related to the Ashgillian glaciation. Additionally, facies elements originated from outwash and re sedimentation processes were recognized. Underlying Arenigian and early Ashgillian shelf sediments were eroded by glaciers coming from the Brazilian shield. Three advances of glacier ice occurred before Llandoveryan transgression started with the deposition of oolitic ironstones.

The presented method is an advance in diamictite analysis and helps to distinguish glacial from non-glacial diamictite successions both of which are abundant in South American palaeozoic basins. This question is crucial for the understanding of the significant climatic changes connected with the glaciations of Gondwana.