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Erosion-tectonics feedbacks in shaping the landscape: an example from the Mekele Outlier (Tigray, Ethiopia)

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Abstract

An outlier consists of an area of younger rocks surrounded by older ones. Its formation is mainly related to the erosion of surrounding rocks which causes the interruption of the original continuity of the rocks. Because of its origin, an outlier is an important witness of the paleogeography of a region and, therefore, essential to understand its topographic and geological evolution. The Mekele Outlier (N Ethiopia) is characterized by poorly incised Mesozoic marine sediments and dolerites (~2000 m in elevation), surrounded by strongly eroded Precambrian and Paleozoic rocks and Tertiary volcanic deposits in a context of a mantle supported topography. In the past, studies about the Mekele outlier focused mainly in the mere description of the stratigraphic and tectonic settings without taking into account the feedback between surface and deep processes in shaping such peculiar feature. In this study we present the geological and geomorphometric analyses of the Mekele Outlier taking into account the general topographic features (slope map, swath profiles, local relief), the river network and the principal tectonic lineaments of the outlier. The results trace the evolution of the study area as related not only to the mere erosion of the surrounding rocks but to a complex interaction between surface and deep processes where the lithology played a crucial role.