Geophysical investigation of the subsurface structures of the mandawa basin, southeast coastal Tanzania

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The Mandawa Basin of southeast coastal Tanzania has been a focus of attention for geological, archaeological and economic reasons since the 1950's. The structural evolution of this area is poorly understood and relatively challenging because it involved a large number of different processes. During its evolution, processes of extension, uprift and salt tectonics have been affecting the basin. The result is the present day passive continental margin dominated by structural highs, platforms and structural lows (graben or half graben and locally the rim synclines). Although the regional structural trend has been well outlined, numerous problems have been encountered in understanding the structures and evolution of the basin and their relations to the basement through the sedimentary section and the surface expressions. In this thesis, I have developed a new understanding of the architectural setting (structural configuration) of the Mandawa Basin using an integrated geophysical approach along with structural field mapping and crustal lineaments extracted from SRTM1-DEM. The results from geophysical techniques have been obtained by combining gravity and magnetic potential field data with 2D reflection seismic data. Standard Euler deconvolution technique has been useful for the magnetic data to estimate the depths distribution to the basement which is equivalent to the thickness distribution of the sedimentary cover. The adopted integrated approach provides a better understanding of the structures and evolution of the Mandawa Basin. Four distinct structural trends have been distinguished: the dominant NNW-SSE, the less dominant N-S structural trend, and a set of two less dominant structural trends the NE and E-W structures. These structural sets are mainly basement inherited with minor variations in orientation in the sedimentary section. The most interesting observation is the presence of several structural traps ranging from the uplifted basement closure located at the center of the Mandawa graben, folds closure and faults within the sedimentary section. Subsurface gas chimneys have been revealed in the basin and are related to the basement closure. Surface oil seeps occur at the lineaments junctions, which imply the reactivation event. Moreover, the surface lithological boundaries of the sedimentary cover are fault controlled as observed on SRTM1-DEM lineaments. These lineaments also separate zones with different textures that imply different lithological units.