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Non-cylindrical fold growth in the Zagros fold and thrust belt (Kurdistan, NE-Iraq)

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The Zagros mountains extends over 1800 km from Kurdistan in N-Iraq to the Strait of Hormuz in Iran and is one of the world most promising regions for the future hydrocarbon exploration. The Zagros Mountains started to form as a result of the collision between the Eurasian and Arabian Plates, whose convergence began in the Late Cretaceous as part of the Alpine–Himalayan orogenic system. Geodetic and seismological data document that both plates are still converging and that the fold and thrust belt of the Zagros is actively growing. Extensive hydrocarbon exploration mainly focuses on the antiforms of this fold and thrust belt and therefore the growth history of the folds is of great importance.

This work investigates by means of structural field work and quantitative geomorphological techniques the progressive fold growth of the Permam, Bana Bawi- and Safeen- Anticlines located in the NE of the city of Erbil in the Kurdistan region of Northern Iraq. This part of the Zagros fold and thrust belt belongs to the so-called Simply Folded Belt, which is dominated by gentle to open folding. Faults or fault related folds have only minor importance. The mechanical anisotropy of the formations consisting of a succession of relatively competent (massive dolomite and limestone) and incompetent (claystone and siltstone) sediments essentially controls the deformation pattern with open to gentle parallel folding of the competent layers and flexural flow folding of the incompetent layers. The characteristic wavelength of the fold trains is around 10 km. Due to faster erosion of the softer rock layers in the folded sequence, the more competent lithologies form sharp ridges with steeply sloping sides along the eroded flanks of the anticlines.

Using an ASTER digital elevation model in combination with geological field data we quantified 250 drainage basins along the different limbs of the subcylindrical Permam, Bana Bawi- and Safeen- Anticlines. Geomorphological indices of the drainage basins (spacing and elongation ratio, circularity index and shape factor) of different parts in the fore and back-limb of the anticlines demonstrate that the basins have a low maturity and that fold growth is still highly active. Most importantly, the results of this geomorphological investigations demonstrates that the subcylindrical folds have developed from several non-cylindrical embryonic folds, which have merged during progressive fold growth.