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The Qartaba Structure (Mount Lebanon): structural study and modeling

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The prominent Qartaba Anticline is located on the western side of the northern Mount Lebanon, one of the major physiographic elements in Lebanon. The studied part of this anticline ($\sim$20 km long, $\sim$5 km wide) represents a large-scale box-fold structure bounded by two SW- and NE-vergent monoclines. The aim of the structural study on the Qartaba Anticline was to get a better understanding on the poorly known mechanism and timing of folding of the structure. The main data elements used in this study included vintage geologic maps, very high-resolution satellite images, a satellite-based Digital Elevation Model and numerous field measurements taken during several field trips in the Mount Lebanon area.

The database was incorporated into an ArcGis platform in order to carry out quantitative remote sensing analysis to have a better three-dimensional understanding of the geometry of the Qartaba structure and to model it. Using the Three-Point-Method that was developed on a MatLab platform and adapted into an ArcGis toolbox, it was possible to determine dip and dip direction of the folded strata of the Qartaba Structure in order to build additional input data points besides the field observations. The results from the ArcGis Model show that the eastern and western flanks of the anticline represent oppositely verging monoclines with average dip values increasing from about 15° at the outer limits of the structure to 30° closer to the center area and reaching values up to almost 90° at the steepest part of the eastern flank. The strata become more or less horizontal on the top of the structure, just a few hundred meters away from the limbs of the anticline. Therefore, the whole structure resembles a large scale box-fold.

The structural model of the Qartaba Anticline presents new constraints on the timing and the mechanism of deformation of the structure. This new model has important implications for the tectonic evolution of Lebanon, for example, the footprint of the Syrian Arc deformations on a more regional scale. The study also suggests how remote sensing methods can be very effective to support structural analyses done in analogue geologic settings.