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New structural/tectonical model and its implication on hydrological thinking and groundwater management - the Lake Tiberias, Jordan Rift Valley

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Lake Tiberias is a fresh water lake located at the Kinneret basin which is approximately 30 km long and 10 km wide. It comprises a link in the chain of pull-apart basins that characterizes the structure of the conspicuous Jordan Rift Valley (JRV). The basin surface is about 200 m below mean sea level (msl) and basin-fill attains a thickness of up to 8 km. Until recently, studies focused mainly on the upper strata of basin fill. Consequently, a complete three dimensional geological model, including clear view of the tectonic framework at the Kinneret Basin was incomplete. This situation imposes great difficulty in understanding the local hydrological system and as consequence enforce constrains on groundwater management of the regional aquifers that flows towards the lake. A recently proposed structural/tectonical model (Inbar, 2012) enables revaluation of several geohydrological aspects at Sea of Galilee and its surroundings and a new hydrological model based on those findings aims to clarify those aspects with relation to groundwater management.

The deep-seated stratigraphical units were seismically studied at the Kinnarot Valley (southern part of Kinneret basin) where sufficient information is available (Inbar, 2012). This study shows the subsidence and northwestward tilting of the basin floor (pre-rift formations) and the flow of thick Late Miocene salt accumulation accordingly. Furthermore, shallower seismic data, collected at the lake itself, shows a suspected salt dome close to the western boundary fault of the basin (Resnikov et al., 2004). Salt flow is now suggested to be a substantial factor in the tectonic play.

At the lake surroundings there are several springs and boreholes where brine immerges from an estimated depth of about 2-3 kilometers. Significant differences in brine characteristics raised questions regarding the location of brine traps, flow mechanism and the mixture process between the fresh water and the brine. However, the effect of the juxtaposing salt rock to the hydrological system was overlooked. Recent study reported an anomaly in groundwater chemistry at the western shore, indicating a possible contribution of halite dissolution into the ascending brine (Möller et al., 2011). This correlates to the results of the salt tectonic model and the suspected salt diapir above mentioned. Moreover, Arbel-1 borehole (drilled at 2003 at the same area) showed rapid salinity increase during pumping. Today the well is shut off.

Based on the above findings, a numerical model is built. The studied profile crosses the rift from the Galilee at the west to the Golan and Ajlun at the east reaching a depth of 6 kilometers. The model indicates the possible brine flow paths across the rift and their interaction with fresh water aquifers and lake springs.

References

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