



## אלכסיס רוזנבאום

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### **The Late Miocene Bira and Gesher Formations: geochronology, depositional environments, and water sources**

#### **Abstract**

During the Late Miocene a sequence of carbonates, marls and evaporites that comprise the Bira and Gesher formations accumulated in continental water bodies in the Lower Galilee (LG) and the Jordan Valley (JV). The tectonic configuration of the area, the hydro-climate conditions and marine incursions, controlled the extension and development of the water bodies through time. The study covered the area between the western margins of the Yizre'el Valley and the central Jordan Valley. The aims of this study are: (1) establish a new chronostratigraphic framework for the Late Miocene formations in northern Israel; (2) reconstruct the depositional environments and paleogeography of the Bira and Gesher Fms; (3) identify the sources of waters that fed the water bodies; (4) evaluate the effects of the Messinian Salinity Crisis on the depositional environments.

$^{40}\text{Ar}/^{39}\text{Ar}$  plateau ages of basaltic and pyroclastic rocks yielded the following chronostratigraphy: The top of the Lower Basalt is overlain by the Umm Sabune Fm. deposited between ~12.2 and 10.2 Ma; the Bira Fm. between ~10.0 and ~ 7.0 Ma (Tortonian); and the Gesher Fm. between ~7 and 5.3 Ma (Messinian). The Bira Fm. in the LG comprises limestones, dolostones and marls, deposited in brackish water environments, whereas in the JV it comprised also gypsum and halite, deposited in saline environments.

Three sedimentary cycles are identified in the LG that reflect a continuous supply of fresh water with a few pronounced marine transgressions, which are apparently associated with precipitation of halite in the center of the JV. Similarly, the Gesher Fm. in the LG and the JV margins comprises limestones and dolostones and halites and marls in the center of the JV. The Gesher Fm. was deposited in partially connected water bodies of variable salinities and restricted connection to the open sea. Yet, a marine transgression was identified at the middle part of the Gesher Fm. The transition from the lower to the upper part of the Gesher Fm. indicates gradual drying of the water bodies, in step with the Messinian salinity crisis.  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios from the lower and middle part of Bira Fm. are similar to values of the Judean Group carbonates, indicating that the latter are the main source of freshwater to this Late Miocene water body. Upon the transition to the Gesher Fm. the ratios rise to higher values that may indicate stronger influence of marine waters. The marine impact on the Sr isotope composition of the late Bira and Gesher Fm. may be consistent with the occurrence of a thick halite sequence in the Zemah-1 borehole. The timing of the late Bira and Gesher transgressions are in accord with the recent ages of the Sedom Fm. salts suggesting a possible link between the northern and southern rift valley evaporites.