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The Stratigraphy of the Aquitanian-Burdigalian Asmari Formation of Lorestan Sub-Basin, Iran: an Inclusive Study

M. Lankarani (1), A. Amini (1), and R. Swennen (2)

(1) School of Geology, University College of Science, University of Tehran, Tehran, Iran (mlankarani@ut.ac.ir), (2) Department of Earth and Environmental Sciences, Geology, Katholieke Universiteit Leuven, Leuven, Belgium

The Asmari Formation is the most important hydrocarbon reservoir in the oilfields of the Zagros pro-foreland basin. The shallow carbonates of this formation have been producing oil for nearly one century. However, detailed stratigraphic aspects of this significant rock unit in some parts of the basin, especially Lorestan sub-basin, are poorly studied. So, because of the necessity, several outcrops of the Asmari Formation in this region were inclusively studied in the framework of this project.

The Lorestan sub-basin is a narrow, northwest–southeast trending intrashelf depression in the Zagros basin which is created during the Mesozoic. By the end of Mesozoic, continental collision between Iran and Arabian plates resulted in the formation of the Zagros fold–thrust belt and its associated pro-foreland basin, in which the Asmari Formation was deposited.

Detailed paleontological investigations done by this study (based on the distribution of the index fossils) showed that age range of the Asmari Formation in this region is Aquitanian-Burdigalian.

The main grain associations forming the facies of the formation were found rhodoliths, large benthic foraminifera (rotaliids), green algae, bivalves (mostly oysters), bryozoans, and echinoderms. The biotic associations suggest that carbonate sedimentation took place in tropical waters under oligotrophic conditions. This Aquitanian-Burdigalian carbonate deposits, which were deposited on an oligotrophic tropical carbonate ramp developed in a foredeep tectonic setting, have unconformable boundaries with the overlying and underlying formations.

Comprehensive sequence stratigraphic investigations proved that deposition of the Asmari Formation in the studied region has been generally coincident with a transgressive event during the time of global second order sea-level highstand. So, the whole Asmari rock unit in the Lorestan sub-basin comprises a supersequence formed as a result of the second-order eustatic sea-level changes. However, the lower order depositional sequences show little correlations with the global fluctuations in sea-level and are formed by local/regional tectonics of the pro-foreland basin.

Deposition of the Asmari marine carbonates in Lorestan indicates the flooding of this sub-basin by the lower Miocene. But this open marine environment quickly turned into a restricted marine environment in which the huge evaporite deposits of the Gachsaran Formation were formed in an arid climate.