

Biostratigraphy of the Middle to Upper Jurassic, Onshore Kuwait: A Multidisciplinary Approach for a Higher Resolution Biostratigraphic Scheme

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ABSTRACT

An integrated, high sampled-resolution biostratigraphic study is undertaken for the Middle to Upper Jurassic Dhurma, Sargelu and Najmah formations. Age and palaeoenvironments have been determined using Tethyan nannofossils, benthic and planktic foraminifera (thin section) and palynomorphs from approximately 1500 samples from eighteen wells. Interbedded calcareous shales, organic-rich argillaceous mudstones, wackstones, packstones, grainstones and bituminous limestones characterize the succession. Early Bajocian NJT 10a nannofossils subzone is determined in the lower part of Dhurma Formation, correlated to the J20 Maximum Flooding Surface (MFS). An early Late Bajocian NJT 10b subzone is assigned to the uppermost Dhurma and Sargelu Dhurma Transition, where the J30 MFS is recognized. The presence of *C. dagestanica* in the overlying Sargelu Limestone indicates a Bathonian age, followed by a Callovian interval at the uppermost Sargelu and lower part of Najmah Formation, where *G. calloviensis* occurs. The determination of the NJT 12 Zone confirms this age assignment. Abundance of planktic foraminifera and *Bositra* spp. enables to identify the J40 MFS in this interval. The upper half of the Najmah Shale is Oxfordian based on *G. bathoniana* and *G. oxfordiana*, together with nannofossils that characterize the Zone NJT 13b, determining the J50 MFS. The FO of *Circulodinium* spp. at the top of the Najmah Shale is the basis for a Kimmeridgian age assignment, extended up to the Najmah Limestone. Unconformably overlying the Najmah Limestone an organic-rich unit identified as the non-evaporitic base of Gotnia or Jubaila Formation contains a Kimmeridgian - Tithonian nannoflora, associated to the NJT 14 or younger Zone, where the JM60 is proposed. The succession is characterized by middle neritic conditions during Early-Late Bajocian Dhurma and Sargelu-Dhurma Transition; middle - outer neritic in the Bathonian-Callovian interval (Sargelu Limestone and Lower Najmah Shale); middle to outer neritic from the Callovian to the Oxfordian interval (Najmah Shale), with prevailing inner neritic conditions for the Najmah Limestone. The strongest palaeogeographic differentiation occurs in the Callovian-Oxfordian interval, when probably global conditions such as elevated Oxygen Minimum Zone, coupled with topographic barriers that could have caused restrictions in water circulation, created anoxic conditions and organic-rich sedimentation such as that observed in the Najmah Formation.