# Integrated stratigraphy of the Bathonian-Callovian in Arabia and the first report on calcareous nannofossils and dinoflagellate cysts: Age constraints on the Tuwaiq sequence in the Riyadh area (Saudi Arabia)

Jihede Haj Messaoud*[1], Sayed Hassan Alsaihati*[1], Philippe Razin*[2], and Frans Van Buchem*[1]

[1]King Abdullah University of Science and Technology – Saudi Arabia
[2]Institut Polytechnique de Bordeaux – ENSEGID – France

**Abstract**

The Callovian Tuwaiq Mountain Formation (TMF) represents a large (> 1000 km) shallow marine, tropical mixed carbonate-siliciclastic platform system hosting the main source rock and reservoirs in Saudi Arabia. Petroleum exploration of this interval relies on a detailed sequence stratigraphic scheme that predicts the extent of the physical parameters of the target reservoirs. Several age dating issues hampered the improvement of the current sequence stratigraphic framework established by the BRGM since the 80s: (1) the position of the middle-upper Callovian MFS, (2) the position and duration of the middle-upper Bathonian / lower Callovian and the late Callovian / early Oxfordian hiatuses, (3) the age of the Wadi ad Dawasir delta in the South, (4) the spatial/temporal relationship of the siliciclastic influx of Wadi ad Dawasir delta with the carbonate units of the TMF. These issues will be addressed through an integrated stratigraphy approach (ammonites, calcareous nannofossil, dinoflagellate cysts, benthic/ planktonic foraminifera, carbon-isotope stratigraphy, cyclostratigraphy...) to refine the age uncertainties for the Late Dogger. We report the first record of Bathonian–Callovian calcareous nannofossils of a marine sedimentary sequence based on the identification of thirteen species to produce a synthetic stratigraphic chart. The nannofossils species richness is low in the lower part of the section and the record of *Carinolithus magharensis* (syn. *Hexalithus magharensis*) allows the approximation of the NJT11 Zone (early Bathonian) in the Riyadh limestone member. Calcareous mudstones/packstones of the transgressive Callovian reef sequences (Attash member) has higher species richness dominated by genera *Watznaueria.* The paucity of the assemblages, the prevalence of coccospheres, and the relatively high organic contents in the Hiysan member are characteristics of a restricted interior basin that had little communication with the open ocean. This member is dominated by genera of *Cyclagelosphaera* and *Watznaueria.* The last occurrence of *Cyclagelosphaera wiedmannii* (NJT 12) and the first occurrence of *Stephanolithion bigotii subsp. Bigotii* (b*ase of NJ13)* provides detailed biostratigraphy for the TMF. The prominent abundance of *Zeugrhabdotus erectus* in the upper TMF record enhanced surface-water productivity which may have been one of the factors behind the formation of the Jurassic organic-rich deposits in Saudi Arabia.

*Speaker

**Keywords:** Dinoflagellate cyst, Calcareous Nannofossils, Bathonian, Callovian, Saudi Arabia, Cyclostratigraphy, Sequence stratigraphy