

## The Middle East Late Aptian Tectonic Event: a debate

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The Lower Cretaceous Aptian Shu'aiba Formation (Thamama Group) constitutes one of the most prolific reservoirs in the Middle East. The upper boundary of this formation consists of a widely-recognized regional unconformity that separates the Thamama Group from the overlying Wasia Group. The unconformity corresponds to a late Aptian hiatus of non-deposition. Two papers (Montenat and Barrier, 2002; Montenat et al., 2003), based on studies of the Al-Huqf outcrops in Oman, published for the first time evidence that this unconformity was accompanied by faulting.

Bertotti et al. (2004) and Immenhauser et al. (2004) have used the interpreted late Aptian tectonic event to map the regional distribution of fractures in surface and subsurface strata that are hydrocarbon-bearing reservoirs in Oman. In a recent issue of GeoArabia, Fournier et al. (2005) questioned the interpretation of both the age and structural style of the tectonic event postulated by Montenat and coauthors. This debate continues here with the below comments and a reply by Montenat et al.

*Why is this debate important?* Episodes of faulting and associated fracturing that occur shortly after deposition (and potentially incorporating at least partially unconsolidated sediments), greatly affect early fluid movements by, for example, allowing meteoric water infiltration and circulation, or compaction water expulsion. These phenomena, in turn, affect the early diagenesis and porosity development of the future reservoir rock. All subsequent fluid movements (e.g. during hydrocarbon migration or related to hydrocarbon production), will also be affected by these early reservoir heterogeneities. The creation of structural heterogeneities at such an early burial stage, is often accompanied by pronounced host-rock alteration, which leads to porosity and permeability heterogeneities governing today's reservoir behavior.

The nature of the late Aptian hiatus and its possible structural significance represents an important geoscientific debate that is welcomed by GeoArabia. The debate, so far, involves many leading geologists including: Pascal Barrier (Albert-de-Lapparent Institute), Jean-Paul Breton, Yves-Michel Le Nindre and Denis Vaslet (BRGM), Olivier Fabbri (University of Franche-Comte, Besancon), Marc Fournier (Marie Curie University), Christian Montenat (French National Centre of Scientific Research), Phillippe Razin (University of Bordeaux), and Henri Soudet (Total).

The debate has direct implications for the reservoir management of fields that produce from the Shu'aiba and underlying Kharaiib reservoirs. Moreover, an important source rock that was deposited during the late Aptian time (Bab Member of the Shu'aiba Formation) in the United Arab Emirates may have also been affected by this tectonic event. Therefore the Middle East petroleum industry stands to gain from understanding the outcome of this debate. And they can greatly assist in resolving it by adding substantive local and regional subsurface data (particularly seismic lines) to accompany the surface studies. The integration of subsurface data into a regional synthesis can lead to a rapid convergence upon the correct interpretation.

Furthermore, industry geoscientists can benefit by actively participating in the scientific process of developing alternative and rigorous hypothesis, and then critically choosing between them in the light of data. They can benefit by understanding which data is not conclusive and how to focus on collecting and documenting new and decisive data.

Presently many interpretations in the Middle East petroleum industry are not published, or if published they tend to show insufficient data. Data is sometimes rendered much less meaningful when its location or orientation is intentionally masked, or only a single (and possibly unrepresentative or inconclusive) example is shown. In many cases the interpretations are only briefly presented at conferences but not documented in writing for posterity. This makes the critical review of the interpretations and conclusions impossible. It not only makes the scientific standard of the debate anecdotal at best, but also deprives present and future geoscientists from gaining new insights and building robust and advanced scientific models.