

Underexplored Opportunities in the Arabian Plate: Application of Global Analogues

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ABSTRACT

Historic exploration for petroleum on the Arabian Plate has rightly focussed on the abundance of four-way dip closure traps. However, once these usually easy-to-define structures have been drilled, exploration ceases to be quite so straightforward and new play concepts need to be considered. This is particularly true in geographically limited areas such as Kuwait, Qatar or Bahrain.

Fortunately, the stratigraphic complexity of the Arabian Plate and typical subtlety of the contained carbonate depositional systems provides explorationists with a host of concepts that can be considered whilst revising previously worked-over areas. Possibilities fall into two basic categories:

1. Second-testing of already tested four way dip closure structures in order to reassess those instead, as combination traps
2. Various categories of more purely stratigraphic pinchout trap which are time- and location- dependent

Second-testing existing structures

Second-testing is important because many very large structures are written off because it has been assumed that one well is sufficient to test the entire structure, when in fact it is much better to think of an anticline and its likely spill point(s) as a bulk rock volume within which there are reservoir 'sweet spots' that are highly productive. For example, if it had been the extremely disappointing NW end of the Kirkuk Structure which had been tested in 1927, it is quite possible that many more decades might have passed before the SE end and its prolific Oligocene reservoirs, were tested. There are many other examples of where known production is highly variable along-strike and these emphasise the importance of not just being dependent on one well for full appraisal; looking for such opportunities requires careful re-consideration of seismic facies as well as integration of regional facies data.

Exploring stratigraphic/diagenetic traps

Exploration for more purely stratigraphic traps depends on our application of sequence stratigraphic principles to basin dynamics. The Arabian Plate shows numerous examples, commonly around the margins of intrashelf basins, where reservoirs pinch out updip into tight lateral facies equivalents and offer the possibility of subtle but volumetrically large traps. Likely examples may be suggested for the margins of many of the Jurassic intrashelf basins, the Cretaceous Bab and Shilaif basins in the southern Gulf, and many as yet unnamed basins in both Iran and Iraq, of Triassic to Cretaceous age.

Additional possibilities lie in looking for lowstand wedges (containing either clastics or carbonates) within these intrashelf basins as well as within the Upper Cretaceous pull-apart basin systems of the northern and NE part of the plate (e.g. reservoirs in the Lofa Limestone or Emam Hassan limestones of Iran).

Another category of play consists of exploration for more traditional buildup stratigraphic trap plays, which may be expected locally within some of the larger intrashelf basins, and which are proven locally within the developing foreland basin geology along the Zagros margin. A sub-category here consists of carbonate platforms of Palaeogene age that seeded on end-Cretaceous inversion anticlinal highs, and which can be seen as field analogues (Jebels Sinjar and Bishri) but have not so far yielded subsurface production.

The final category of play concept is a diagenetic trap. Principally this consists of looking for hydrothermal dolomite traps analogous to the Trenton-Black Rock reservoirs of the US Palaeozoic, where dolomitised fault zones with enhanced porosity have lateral seals provided by the undolomitised tight host limestones. In these cases, quite commonly, it is not possible to map any structural closure whatsoever and the trap is entirely due to diagenesis.