Facies Analysis, Depositional Environments and Diagenesis of the Sarvak Formation in Azadegan Oil Field

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Abstract

The Sarvak Formation (Albian-Turonian) was measured 822 m in type section and mainly consists of carbonate rocks. This Formation forms the important hydrocarbon reservoir in southwest of Iran. In this research the Sarvak Formation with Cenomanian age has been investigated in some wells in Azadegan oil field in the north of the Dezful Embayment in south west Iran. This research has been focused on facies analysis, depositional environments and diagenetic processes in the Sarvak Formation. The thickness of the Sarvak Formation is varied from 608 to 637.5 meters in Azadegan wells. In these wells the Sarvak Formation is overlain by the Ilam Formation uncomfortably. It is underlain the Kazhdumi Formation with conformable contact. Based on detail sedimentological analysis over the Sarvak formation four facies associations including tidal flat, lagoon, barrier and open marine have been recognized. The detailed microfacies analysis and sedimentological criteria suggest the Sarvak was deposited in rimmed shelf carbonate setting. The most important diagenetic processes include dolomitization, calcitization, cementation, pyritization, micritization, neomorphism, compaction, dissolution and bioturbation influenced Sarvak. From the petrophysical point of view, the porosity is the most important diagenetic process in the Sarvak Formation and fracture, vuggy and moldic types are dominant porosity types in this Formation.

Keywords: Azadegan field; Sarvak Formation; Cenomanian; Facies; Rimmed shelf

1. Introduction

The Azadegan oil field is located in Khuzestan province in southwest of Iran. This structure is near the boundary between Iran and Iraq and it is 60 km far from Abadan city. The Azadegan structure was explored by geophysical operations in Abadan plain. The Sarvak Formation with Cenomanian in age forms main reservoir unit in this structure. This formation is a part of Bangestan group includes Kazhdumi, Sarvak, Surgah and Ilam Formation (James and Wynd 1965). The lower boundary of Sarvak Formation is conformable with Kazhdumi Formation. The upper contact with Ilam Formation is recognized by a discontinuity surface. In Dezful embayment and a part of Abadan plain an argillaceous unit (Laffan or Surgah Formations) separate carbonates of Sarvak from Ilam Formation. The microfacies and depositional environment of Sarvak Formation have been studied by different authors (Farzdi, 1371;
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Keyvani, 1372; Jalilian, 1375; Lasemi and Jalilian, 1376; Teymorian, 1383; Ale-Ali, 1386). In this study, microfacies analysis, depositional setting and diagenetic processes of Sarvak Formation in the wells A, B, C of Azadegan oil field have been investigated.

2. Methods of study
Totally about 380 thin sections have been adopted from the cored interval. Sampling had been taken systematic and very dense (one sample in each 30 cm.). Thin sections were treated with Alizarin Red-S following Diesone (1966) for discrimination of calcite from dolomite. Classification of carbonate rocks has been carried out based on Dunham (1962) classification and recognition of facies belts and sedimentary profile are based on Lasemy and Carrozi (1981) and Carrozi (1989).

3. Microfacies
The microfacies analysis of cutting samples of whole the wells in Azadegan oil field is caused to recognize 4 facies belts (depositional environments) including tidal flat, lagoon, bar and open marine. Tidal flat facies zone (A) consist of Fenestral mudstone (A1), Fenestral bioclast benthic foraminifera wackestone. Lagoon facies zone (B) consist of bioclast mudstone/wackestone (B1), Benthic foram wackestone/ Packstone (B2), Bioclast intraclast peloid packstone (B3), Orbitolin bioclast packstone/ Grainstone (B4), Intraclast orbitolin benthic foram grainstone (B5). Bar facies zone (C) consist of Rudist boundestone (C1), Peloid grainstone (C2) and open marin facies zone (D) consist of bioclast plagic foram mudstone/ wackestone (D1), Plagic foram wackestone/ packstone (D2), Intraclast bioclast packstone.

A: This facies zone is generally formed from lime mud with rare benthic forams and Gastropod with fenestral fabric which are associated with early fine dolomite. Presence of dolomites indicate internal part of a tidal flat setting (Shinn, 1983). B: This facies zone is mainly consist of various frequent benthic forams which suggest a lagoon environment in adjacent to tidal flat (Lakhdar, 2006). The skeletal allochems are abundant with high diversity and their association with pelloids indicate a shallow bathy with proper saline condition and water circulation which provide a nutrient condition (Bachmann, Harsch 2006). Low diversity of found and increasing of lime mud in some facies suggest a low energy restricted lagoon (Messe, 2003; Sandulli, 2004). C: This facies zone is characterized with abundant Rudist. In this facies zone Echinoid, Peloid and Intraclast have been observed. This assemblage found in part with Rudist abundant indicate a very high energy condition in barrier setting (Flugel, 1982; Ross and Skelton, 1993; Wilson, 1975). D: This facies zone is characterized with pelagic forams such as Hedbergella, Oligosteginid, Echinoid fragments and sponge spicules. Which indicate deep open marine setting (Simo and Lehmann, 2000). High frequency of Oligosteginid and Hedbergella suggest a very good nutrient condition in the presence of the sparse lime mud in matrix represent low energy environment in this facies zone (Adachi, 2004; Premoli-Silva and Sliter, 1994; Brasier, 1995; Luciani and Cobianchi, 1999; Birkeland, 1987). The specific faunal assemblage in this facies zone can survive in normal saline open marine condition (Heckel, 1972; Sanders and Hofling, 2000; Flugel, 2004). In summarized, presence of high amount of lime mud suggest a calm realm with no agitation.

4. Depositional Model
According to the results of Sedimentological studies of the Sarvak Formation in Azadegan field and comparison to previous studies and regarding to Walter's law, it seems that the Sarvak Formation has been deposited in a rimmed shelf carbonate platform.
5. Diagenesis and its Effect on Reservoir Characterization

Different diagenetic processes affected the studied interval, including compaction, dissolution, calcitization, cementation, neomorphism, bioturbation, dolomitization, and fracturing. Among all, dissolution and fracturing are the most important factors which cause to develop porosity and have a positive effect on reservoir quality.

6. Conclusion

1. Four facies belts including tidal flat, lagoon, bar, and open marine have been recognized.
2. Based on recognized facies association of Sarvak and with comparison of them to modern environments, a rimmed shelf carbonate platform setting for deposition of the Sarvak in the studied area has been suggested.
3. The compaction, dissolution, calcitization, cementation, neomorphism, bioturbation, dolomitization, and fracturing are all main recognized diagenetic processes in Sarvak.

References


