Depositional Environment of the Asmari Reservoir Cap rock in Karanj Oil Field, SW Iran, Using Microscopic Studies and SEM Data

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Abstract

Gachsaran evaporative formation (Middle Miocene) divided to 7 members in Dezful Embayment lied on top of marine limestone of Asmari Formation (Oligo-Miocene). The cap rock (member 1 of Gachsaran Formation) doesn't have an outcrop in the surface, Therefore, The present paper is based on cuttings and thin sections gained from drilling process. Lithological variation of the Asmari reservoir cap rock in the Karanj oil field was investigated as important criteria of sedimentary environment determination. The results of microscopic and SEM studies indicated that the cap rock consisted of 7 key beds including A, B, C, D, E, F_1 and F_2 to depth. Evaluation of petrophysical studies showed that the cap rock consisted lithologically of anhydrite, salt, marl, limestone and bituminous shale. Therefore, it can be classified as salt-anhydrite and complete cap rock category. The main observed textures were nodular, spherolithic and lath in anhydrites and Hopper and Chevron in salts. Different criteria applied to deduce the depositional environment for the cap rock. These textures proposed a marginal Sabkha environment for upper parts of cap rock. Also presence of microbial-mat (stromatolites), pelloid and intraclast particles in middle parts of cap rock, offered an intertidal-lagoonal environment for it. In lower parts, benthic foraminifer's abundance such as milliolids and dendritina living in shallow-shelf marine, proposed marginal shallow marine. Thus, the environment of Gachsaran Formation tended to be shallower than the Asmari time.

Key words: *Caprock, Gachsaran formation, Karanj oil field, SEM studies, Sabkha environment.*

1. Introduction

With a view to regional-structural division of the Zagros, Karanj oil field located at Dezful Embayment, this area with extension of 60000 KM^2 have about 8% total hydrocarbone of the word [1]. Also this oil field geographically placed between Aghajary oil field in SW and Parsi oil field in NE, in the right side of Behbahan-Ramhormoz road with distance of 160 KM from Ahvaz city (figure 1) [2].

Gachsaran Formation in Zagros fold belt has important criteria to come into existence oil traps. This formation in the type section divided in to 7 members that are from Top to depth [3]:

7- It is including anhydrite, gray marl and lime stone.

6- It consisted of succession of anhydrite, red marl, lime stone and salt stone.

5- It is indicating of alternation between anhydrite, red and gray marls and tinny bedded lime stone.

4- It consisted of very thick salt layers intermittence with gray marl, anhydrite and lime stone seldom.
3- This member is showing anhydrite and very thick gray marl layers.
2- It composes of salt stone, anhydrite, gray marl and laminated lime stone.
1- It is containing 5 evaporative cycles as anhydrite, marl, lime stone and bituminous shale that averagely have about 40m thickness. This member identified as Asmari reservoir cap rock in SW Iran. The present paper, it an attempt using lithological and textural variation in the Karanj oil field cap rock to determine sedimentary environment.

2. Discussion

Member 2 Gachsaran Formation Base salt SEM pictures deliberation shown Hupper and Cheveron textures in the salts that can reveal sabkha environment for this part. Cap rock of the Karanj oil field using 400 thin section petrography information and scanning electron microscope studies of retail selection of drilling 30 wells were analyzed and 7 key bed, were determined. A sequence from top to bottom are: A, B, C, D, E, F_1& F_2. Except layer A, the other key beds with a limestone or shale started and finally the start of the next key bed is a layer of anhydrite. Each layer has a particular key lithology profile. Evidence of textures obtained from petrography review of the Karanj oil field cap rock is as follows (Figure 2):

A Key bed is white to gray anhydrite and sometimes clear crystals. Known as nugget sugar anhydrite by geology workers. Anhydrite textures are as spherolithic, nodule in fine grain back ground, sheet flow and sometimes porphiroblast. In some case with single crystals of dolomite and carbonate known as D, D2 and sometimes by match stick carbonate observed in this key bed.

B key bed consist of black to dark brown shale, often thin laminated state, bituminous particles, silt, sand, pyrite and sometimes anhydrite. This bitumen can solved in gas or chloroform solution and the solution is yellow to dark brown will be produced. Sometimes inside the bituminous shale anhydrite nodules can be observed that can be indicative for regional compression. Last anhydrite of this part known as fine crystal and spherolithic texture, contains formless and sheet carbonates.

C key bed indicate cream to gray crystalline limestone with anhydrite nodules as spaces filling. Thinly laminated lime stone as seen in the Core [5]. Often as mudstone to wackestone; silty, sandy, anhydritic, celectitic and marl with chilostomellid and sometimes lamelibranch and gastropods are presented. In this key bed evidence of pelloid and interaclast particles, also fossils that have been filled with anhydrite were visible.

D key bed marks with gray to light brown limestone as small to medium crystals. There are lithologycal change from mudstone to the Wackestone with silt particles, quartzic mudstone, sometimes sand particles of different fossils, which often is enough to identify chilostomellid. Also in this layer was seen stromatollite fossil that can be helpful to diagnose cap rock sedimentary environment**.**

E key bed is Brown limestone, fine grained and re-crystallized, the marl nodules filled with anhydrite. sand with angular and semi-angular grains of quartz and usually without fossils. Since deeper environmental of this layer, diagnosis in this field is especially important because it proved that after this bed there is no layer of salt and casing work in this field within end anhydrite of this layer is done.

F_1 key bed composed of limestone beige brown willing to relatively hard and sometimes soft and easily be mistake with limy anhydrite. Medium to large grain size, re-crystallized, contains silt and small anhydrite nodules.

F_2 key bed is the lowest layer of cap rocks and marked by limestone. Light brown to buff, re-crystallized, very anhydritic, relatively hard, with medium to large grain size and abundant fossils such as: chilostomellids, rotalids, Dendritina. sp and miliollid's.

Attention to the definition provided for the Sabkha cycle ([6], [7], [8] and [9]), the sedimentary cycle layers of A and B plus member 2 of the Gachsaran Formation beginning salt, clearly showed the complete sequence of coastal Sabkha. Of fossil astronomy, bivalve debris, gastropods and micro fossils such as milliollidae, rotallia and dendritina lived in shallow near the beach to Lagoon environments [10]. Alga mat, interaclast particles, pellet and pelloid particles, shows coastal-between tidal sedimentary environment ([11], [12],[13] and [9]).

3. Conclusion

According to the lithology evidences found in the Karanj oil field cap rock, F and E key beds, shows the subtidal-Lagoon environment. C and D key beds in which have fossils such as stromatollits, pelloids and intraclasts particles, proposed intertidal environment for this part of cap rock. Further images from electron microscopes revealed Chevron and Hupper textures in the second section of the Gachsaran Formation salts which are indicating sabkha environment for this part. Therefore, considering the above descriptions, sedimentary environment of the Karanj oil field cap rock lagoon to coastal margins sabkha were diagnosed.

4. References

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5. figures

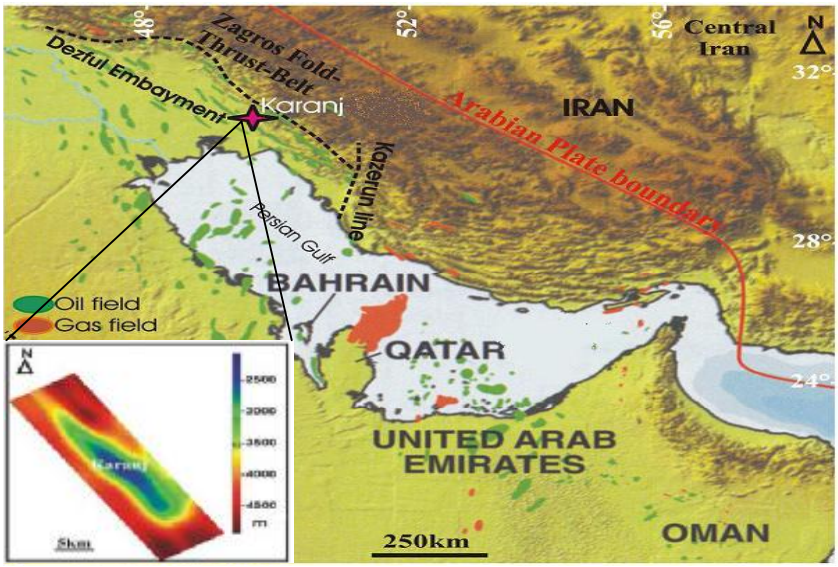

Figure 1: regional location and subsurface structural modified map of the Karanj anticline[4]

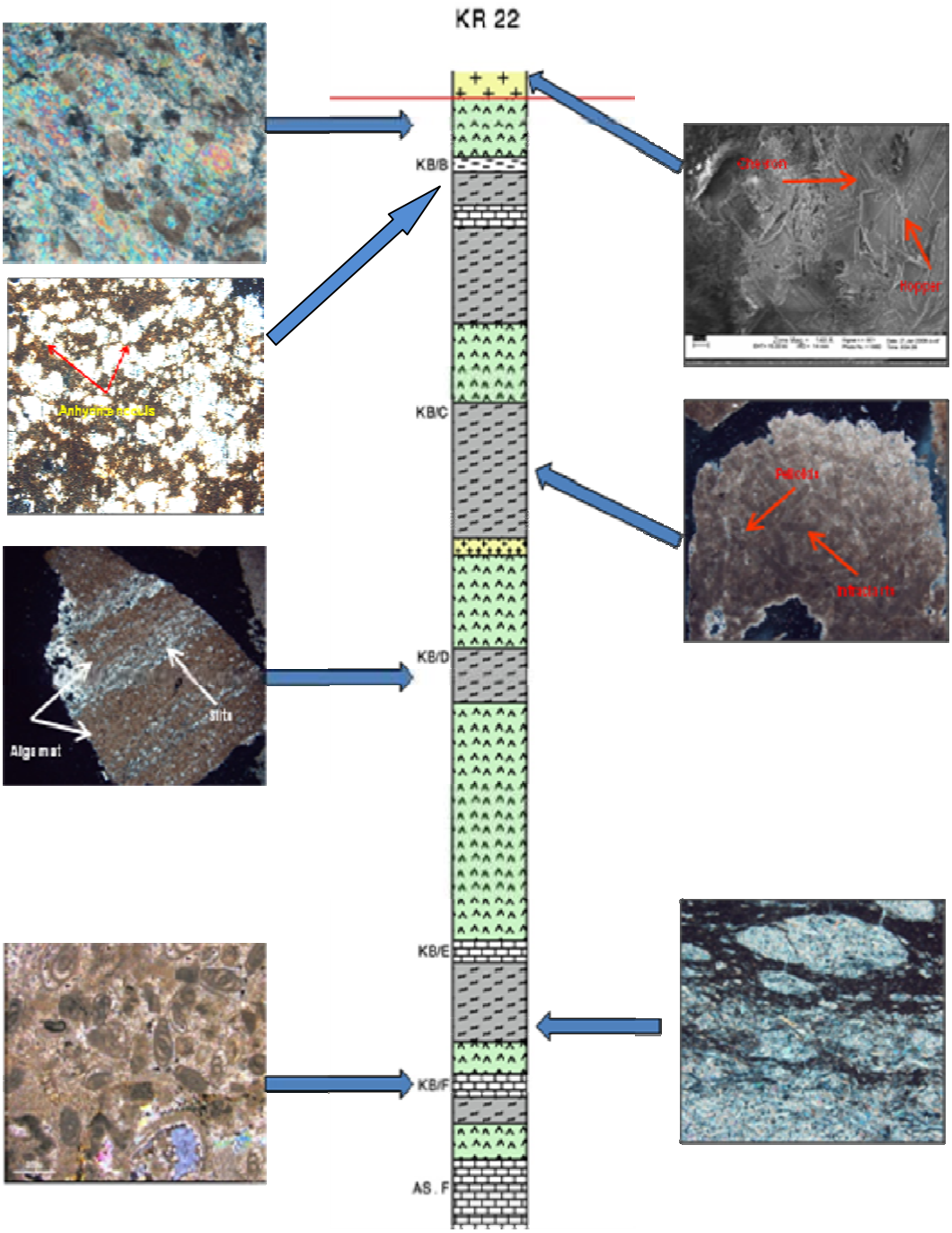

Figure 2: evidences for miscellaneous parts of cap rock addition to Gachsaran formation member 2 beginning salt.