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Depositional Environment, Sequence Stratigraphy, Quality and Deployment of Reservoir Zones in the Kangan Formation in the Tabnak Anticline (Southern Zagros)

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INTRODUCTION

The hydrocarbon reservoirs of the studied field include Dalan and Kangan formations with the age of Permo-Trriasic and their equivalent, the Khuff Formation, on the Arabic plate, of the most important gas reservoirs in the Middle East as well as in the world [1]. Therefore, it is necessary to recognize the reservoir characteristics of these formations, especially Kangan Formation, and to provide a more complete view of the conditions of its depositional environment in this field, requires petrographic studies, sequence stratigraphy, and petrophysical studies. This study is very important for determining the quality and position of production zones in the reservoir sections of the Kangan Formation.

RESULTS AND DISCUSSION

DEPOSITIONAL ENVIRONMENT

Due to the importance of sedimentary facies in controlling reservoir properties, the thin sections obtained from the viewpoint of facies characteristics and depositional environment were investigated. According to this study, the major lithology of the Kangan Formation in this part of the well is mainly limestone and slightly dolomite. The limestones are mainly grainstone and dolomites in size of dolomicrosparite (medium crystalline). The result of this study led to the identification of seven microfacies belonging to four sections

of depositional environment of a homoclinal carbonate ramp including the tidal flat, Lagoon, shoal and open marine [Fig. 1].

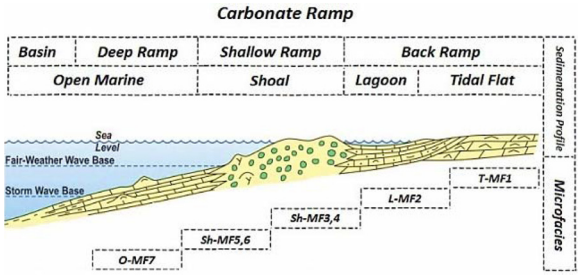

Figure 1: Depositional environments schematic profile of Kangan Formation with distribution and determination of microscopic facies position in its different sections in the study area.

RESERVOIR ZONATION

One of the main objectives of this research is to provide zonation based on reservoir properties for this formation in the studied area. Therefore, based on the combination of petrographic studies and well logging data in this study, the Kangan formation in this field is classified into three general zones, and the proposed zoning of this study is completely independent of other zonations that so far done. In this study, after illustrating and interpreting each of the logs (SGR, DT, RHOB and PHIE) according to the petrophysical properties and its adaptation to the total lithology of the well, reservoir zonation was performed and for the Kangan Formation, three zones Ka-A, Ka-B and Ka-C were defined. The B zone is the best reservoir horizon with the most hydrocarbon accumulation and zone A and C is the lowest horizon in terms of reservoir quality [Fig. 2]. It should be noted that the general purpose of presenting the zonation in this study was to have a closer look at the reservoir horizons of the Kangan Formation, especially in the field studied, and based on available data. Because the basis of zonation in past studies was based on lithological changes and depositional environments of Kangan Formation and is steadily extended for the whole of the formation. Therefore, in this study, by studying well data and integrating these data with petrography studies, we tried to provide

zonation but with the difference that Kangan Formation zones may be different in terms of reservoirs in wells of a field due to facies changes. Therefore, according to this study, it is suggested that the wells should be studied and investigated in order to identify reservoir horizons.

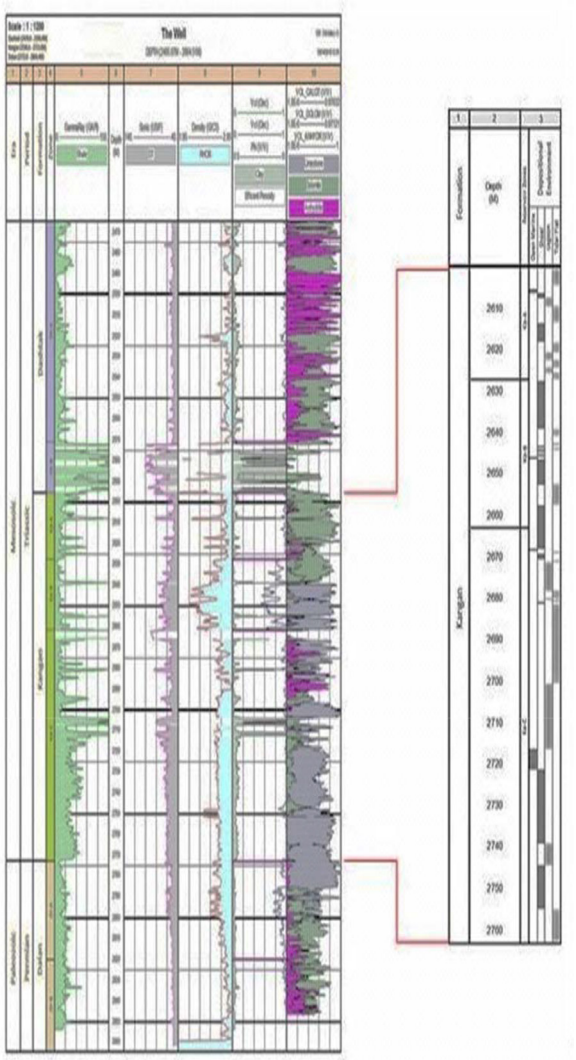

Figure 2: The lithological column, petrophysical logs, specified reservoir zones and their depositional environments based on available numerical data from the well.

SEQUENCE STRATIGRAPHY

In general, one of the most important applications of sequence stratigraphy is the separation of the reservoir and non-reservoir units and their adaptation to hydrocarbon formation sequence units. Considering that the selection of the model has a great influence on the result obtained, the best model for conducting this type of study is necessary [2]. In sequence stratigraphy, when well log data is available, it can be determined by using the gamma-ray log process with highstand system tract [3]. One of the objectives of this study is to establish a link between the sequences and the reservoir horizons studied. In this study, according to the microfacies studies and the reconstruction of its depositional environments, and the analysis of the gamma-ray log, two third-order sediment sequences (in the third-generation cycles, the sea level changes are global and dependent on local variation not detected) in the sedimentary system, all of which have been sedimentation in a carbonate ramp. The system tracts in the gamma log are characterized by decreasing and incremental patterns. As the process of decreasing the gamma log, representing the transgressive system tract and increasing the trend of the gamma log, regressive system tract [4-5]. Also, according to microscopic samples and stratigraphic column of Kangan Formation in the study area, the generally recognized sequences from the lower formation (the boundary with the Dalan Formation), up (boundary with the Aghar shale member of Dashtak Formation), respectively, Sq-I, Sq-II and Sq-III [Fig. 3], the depth of each sequence is related to the same well depth.

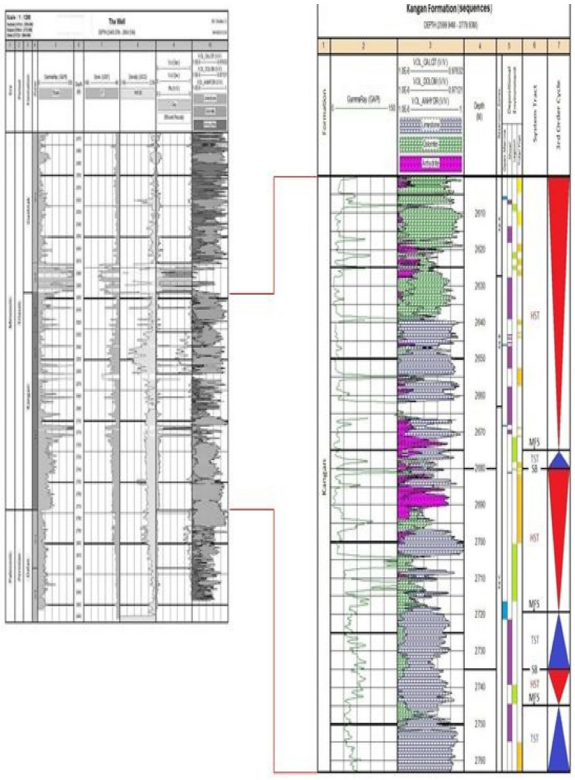

Figure 3: Depositional environment of system tracts and correlation of sedimentary sequences of Kangan Formation with its reservoir horizons in studied field.

CONCLUSIONS

Considering the study of thin sections of Kangan Formation in the study area, in the framework of four facies belt recognized including tidal flat, lagoon, shoal and open marine. According to the succession of facies, the sedimentary model of this formation is related to a large carbonate platform of the homoclinal ramp type.

According to previous studies, in general, for the Kangan Formation, four main zones were determined based on lithological and depositional environments, but in addition to the petrography of the formation, in this study, by studying the well data and combining the results with lithological studies and the depositional environment, a new zonation based on three general zones Ka-A, Ka-B, Ka-C was presented.

The three zones identified in this study have reservoir properties, but in general, the Ka-B

zone has a higher quality than the Ka-A and Ka-C zones in terms of reservoir, and in relative terms consider the best reservoir zone in the entire well, also, the reservoir parameters of the two zones A and C are slightly similar, and the only difference is the lithology of the dominant ones.

Investigations on the depositional environment of the microfacies and the fluctuations of gamma rays, two third order sediment sequences (Sq-I, Sq-II and Sq-III) to the Early Triassic with second-order boundary (SB -II). It is recognized that most of the sequences belong to the highstand system tract.

Comparison of reservoir horizons and the system tracts identified indicate that the transgressive system tract, except in the Sq-III sequence, has good reservoir quality, but its extension is low in this part of the Kangan Formation in comparison with the highstand system tract. The best part of the sediment sequences determined in terms of reservoir quality is part of the highstand system tract of the Sq-III sequence, which has the best horizons in terms of the reservoir.

The data obtained from petrography and depositional environment are complementary to petrophysical data, therefore, for a precise sequence stratigraphy and zonation, there should be a combination and interpretation of qualitative and quantitative studies that the appropriateness of these two types of studies suggests the accuracy and the correctness of the research is done.

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