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Static 3d Modeling Of Hydrocarbonic Reservoir With The Help Of Rms Case Of Studies: The South East Anticline Of Khuzestan Iran

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ABSTRACT

The use of optimization from reservoirs of hydrocarbon in the world is considered as a serious aim, and the first step in this direction is reservoire description. Reservoire modeling performs to recognize more the geometry of oil traps and reservoire management. Generally, this technique is an essential part of oil industry in the fields of study and development processes. Softwares are planning for this aim, can do process of modeling using geostatistic technique, such as RMS. To provide the reservior 3D structural and petrophysical modeling using RMS software, petrophysical and UGC maps were used together. The results showed that the Mansuri is indicating elongate structure, symmetric form and its trend same as Zagros. After making the 3D griding and petrophysical modeling, distribution maps of petrophysical properties such as porosity, water saturation and N/G were constructed. These evidences suggeted that maximum porosity was detected in the eastern part of field, which is more than western part, and the zones 1,2 & 3 are showing the best reservior quality in view of petroleum potential. By comparing of the reservior zones, it is resulted that zone 2 is containig more initial oil (65.5%) ratio volume

KEYWORDS: 3D modeling, reservior modeling system, Mansuri field, petophysical evaluation logs, porosity.

1. INTRODUCTION

The management of the non-renewable hydrocarbon resources necessitates the optimizations for methods of exploitation, and the first step in this direction is reservoir description, which plays a major role in reservoir management (Nickravesh et al., 2007). Modern professional software makes it possible to model complex and irregular structures of geology in 3D by using geological maps and structural information in order to make an appropriate model (Kaufmman, 2008). It has been proved that modelling is an efficient way to evaluate oil reservoirs and encompasses myriads of reservoirdescription. Reservoir description includes describing the empty space and grain size, reservoir thickness, porosity and permeability of reservoir, recognizing faces, and sedimentary environment (Yeten and Gamruh, 2000). A static modelling contains two parts: 1- structural modelling which includes two models, stratigraphic and fault. 2- The model of reservoir features which includes faces model and petrophysical model. Structural reservoir's features, the relationship between different layers of reservoir, the reservoir shape, and etc. are examined in stratigraphic modelling, and features of the fault existing in reservoir and their influences on reservoir shape are studiedin fault modelling. Petrophysical features of reservoir such as porosity, permeability, and saturating water reservoirs are checked in petrophysical modelling RMS, a powerful software in reservoir modelling, contains a vast collection of mathematical and geostatistical functions and is able to calculate unknown values, levels, and volumes by using known parameters . Geostatistics examines those variables which have spatial structure such that the 3D image of reservoir makes it possible to control data qualities based on the spatial relationship between them. This study provides the 3D modelling of the Asmari reservoir in Mansuri field based on all structural and petrophysical information by using RMS**.**

Regional Geological Position

Dezful's embayment is one of the sub-zones of folded Zagros which is geologically important due to its huge oil fields (Figure 1). The Mansuri anticline is located in Khuzestan Province, 45 kilometer to southeast of Ahwaz city in south of Dezful's embayment, along fields of Ahwaz, Marun, and Abteymour and lies at longitude range from 48° 44' 6" to 48° 59' 41" and latitude range from 30° 46' 16" to 31° 4' 16" (Figure 2). This incline is in Asmari horizon at contact level between water and oil (2272 meters below the sea level), and it is 28 kilometers in length, 4 kilometers in width, and based on last reservoir closed curve (2400 meters below the sea level), it's closure is 256 meters. The Asmari reservoir of this field has been divided into 8 zones based on lithological and petrophysical features.lithologically, the zones 1, 6,

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and 8 have carbonate faces with between layers of red marl and shale, and the zones 2, 3, 4, 5, and 7 have sandstone faces together with between layers of red marl and shale

Figure 2: geological position of Mansuri oil field

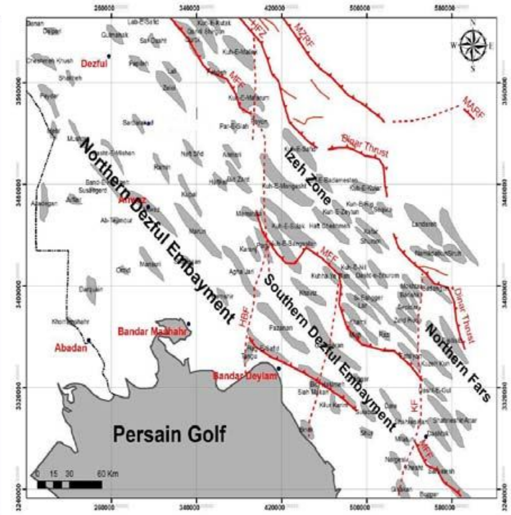

Figure 1: structural position of Mansuri oil field

DISCUSSION

In this study, the modeling of Asmari reservoir of Mansuri Field has been done with the aim of understanding the geometry of Asmari reservoir's structures and distribution of petrophysical parameters based on information obtained from excavation of 79 wells by using RMS. The procedure of constructing structural modeling of this reservoir has been established by considering Asmari formations as the interpretation level and depth information into reservoir zones and the route of wells' drilling. At the beginning, the depth contour map of Asmari formation with an appropriate format was used as input data for the software. In the next step, the between horizons and related thickness in the reservoir's structural model format was built (Figure 3). Eventually, the final assessment was carried out on the model built by some longitudinal and transverse sections (Figure 5). Then, the reservoir's petrophysicalmodel which is the process of relating every cell in the volume well to a value for porosity, permeability, and water saturation based on the values of wells' segmentation was constructed, and that process has been done by following steps: 1- Gridding i.e. building a continuous digital model of a plane by using information of some limited point locating on that plane. 2- Segmenting wells 3- Statistical data processing including data transmission, procedure removal, and determining spatial structure for data. Finally, in the constructed model, reservoir's features were assessed.

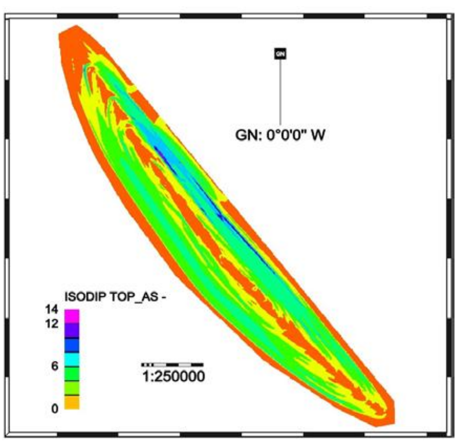

Figure 4: semi-slopped map for Asmari formation

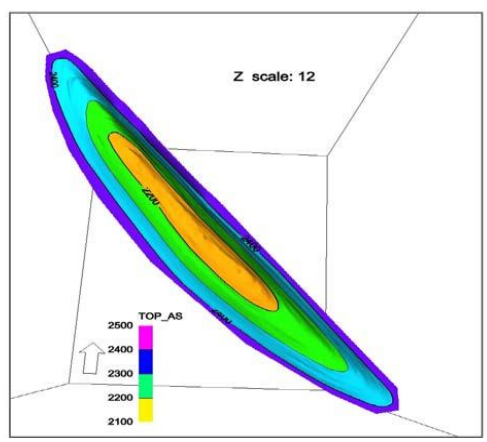

Figure 3: structural modelling of Mansuri field on the Asmari

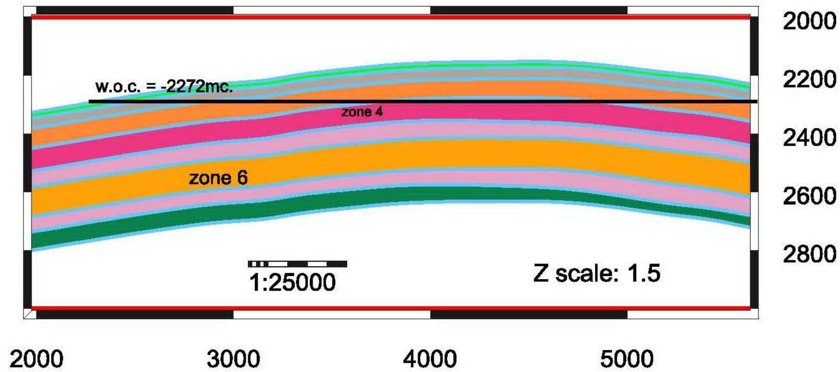

Figure 5: transverse section drawn on the Asmari horizon of Mansuri field

The procedure of producing structural modelling includes determining geological horizons and faults, and makes not only grid but also borders of petrophysical and facial models. Moreover, it is a basis for volume survey, designing new wells, and networks for reservoir's simulation (Holden et al., 2003). Based on provided structural modelling, the Mansuri anticline has elongate and symmetric form, and its trend is same as northwest-southeast (Zagros trend), and its axis is arc-shaped with tilt equals to 1-1.5 degree. The results of semi-slopped maps produced in Asmari horizon yielded that unlike most of the fields located in Dezful's embayment, northern slope of this anticline have more inclination (0-12 degree) in proportion to southern slope (0-8 degree) (Figure 4). The increase in slope and curvature of layered rocks causes anincrease in breakage density (Murray, 1968). Thus, in checking fractures of an anticline, the curvature of a structural axis is an important factor. The breakage density map, drawn by deriving semi-slopped maps by using the Asmari formation of this field, has shown that the proportion of breakage density at northern edge is more than southern edge which has less inclination (Figure 6). In petrophysical modelling, the information related to petrophysical data of reservoir is always considered as one of the most important informative resources for examining the performance of a reservoir, and obtained data is limited to the number of drilled wells into the reservoir.Obtaining new data is not feasible unless the data collected by means of estimation and simulation methods. One of the methods is utilizing geostatistical methods which nowadays are considered as a reliable method in developed countries . In this model, the distribution of petrophysical parameters (porosity and water saturation) is determinedThese models are separately created for every reservoir zones, and the zone maps 1 and 2 (Figures 7 and 8) and the zone maps 2 and 4 (Figures 9 and 10) have been optionally shown for porosity distribution and water saturation distribution respectively. Furthermore, the model of the net thickness to the gross thickness are separately created for every reservoir zone based on cut off and map zones 1 and 4 (Figures 11 and 12) has been optionally shown for the net thickness to the gross thickness (the more this value is closer to one, the more quality reservoir has). Finally, since volume factor of oil, fluid contact level, recovery factor, and the proportion of net thickness to the gross thickness was calculated based on structural and petrophysical modelling, the volume of oil (in every zone) was computed by knowing reservoir parameters and by using following formulas

Total volume of reservoir stone:	Bulk(m^3)=structure volume
Useful reservoir volume:	Vnet(m^3)=Bulk * NTG
Porosity reservoir volume:	Vpore(m^3)=Vnet * PHI
In situ oil volume:	HCPV(oil)=VPore * (1-Sw)

(The empty space saturated by hydrocarbour)

The volume of initial oil in storage tank condition: STOIIP=HCPV(oil)/Bo

Based on reservoir engineering condition, in this field, the contact level of oil and water is 2272 meters below the sea level, and the oil volume factor equals 1.22 of reservoir volume to the canonical volume, and recovery factor is 0.3. In addition, based on computed cutting limit for porosity and water saturation, the volume of in situ oil reservoir was computed, and consequently, the Asmari formation zone 2 is containing 65.5% of total volume of in situ oil.

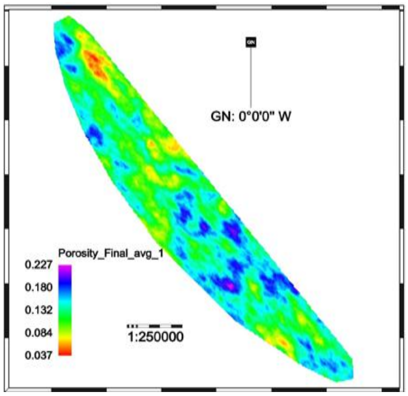

Figure 7: the normal distribution map for porosity zone of an Asmari

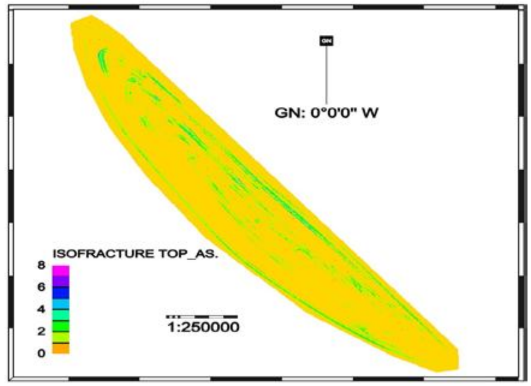

Figure 6: semi-breakage density map on the Asmari horizons

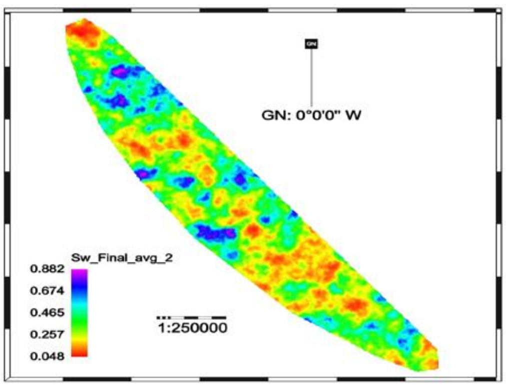

Figure 9: the normal distribution map for water saturation of zone 2 Asmari

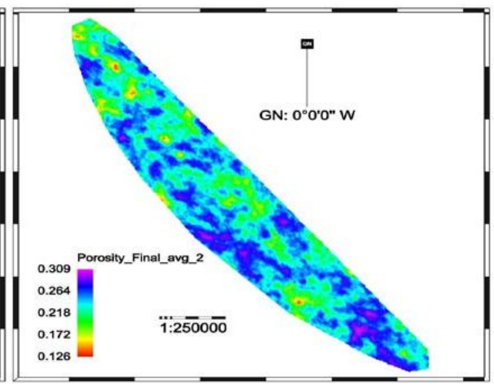

Figure 8: the normal distribution map for porosity zone 2 Asmari

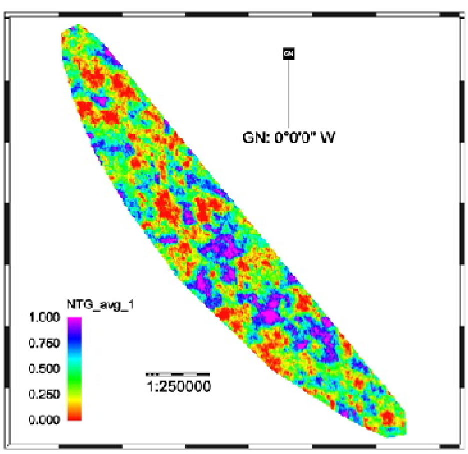

Figure 11: the normal distribution map for the net thickness over the entire zone 1

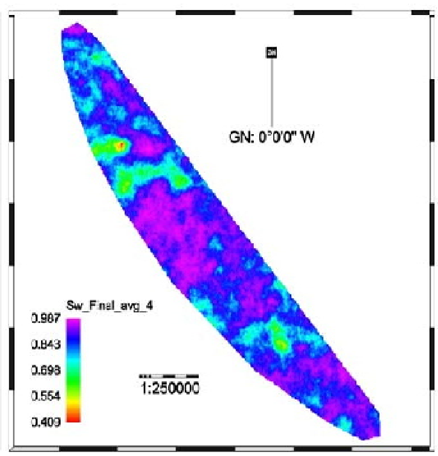

Figure 10: the normal distribution map for water saturation of zone 4 Asmari

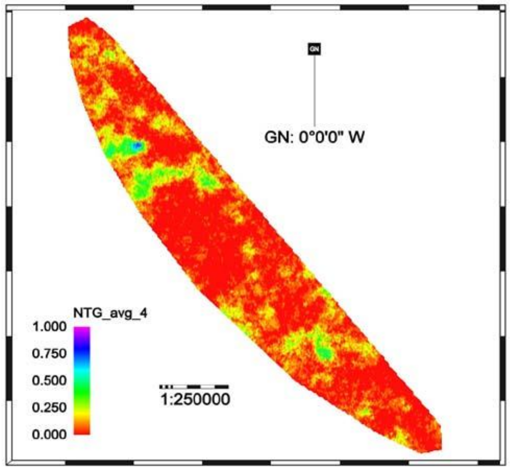

Figure 12: the normal distribution map for the net thickness over the entire zone 2

Acknowledgements.

- The Mansuri oil field has elongate anticline structure and similar to other fields located in southwest of Iran and in Dezful's embayment, its trend is northwest-southeast direction, but it has been less influenced by regional pressure forces.
- Based on information obtained by 79 existing well, the Asmari formation of this field is divided to 8 zones such that the zones 1, 2, and 3 are more important with regarding reservoir, while zones 4, 5, 6, 7, and 8 are not so important with respect to reservoir because of their high percentage of water saturation.
- Based on semi-slopped map produced for the Asmari formation, the inclination of northern slope is more than southern slope in this field such that in the northern edge, this inclination is between 0 to 12 degrees, and in the southern edge, it is between 0 to 8 degrees. The inclination of east and west angle tendency is approximately 1 to 1.5degree.

  -The map of breakage density shows that the breakage rate in this field is very small (features of low level fields). Therefore, the oil producing of this field is reservoir matrix system. Builtpetrophysical modelling in this field demonstrates that the maximum porosity rate and the minimum water saturation n the eastern partis better than the western part of this field. In other words, the reservoir quality in eastern part is higher than western part of the field. Moreover, in comparison of zones of this field, zone 2 is the most useful and productive zone in a way that based on calculated volume survey, 65.5% of in situ oil of Asmari field of this field exists in this zone.

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