Identification and Analysis of Fractures Exiting in one Well in SE Iran using by FMI Image Log

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Abstract:

Permeability is one of the most important factors in reservoir production which has a direct relation with fractures in carbonate reservoirs. Therefore determination of fracture density, strike and dip direction, the amount of the opening, their distance from each other being close or open and finally representing of suitable pattern of reservoir fracture, can help us know about production programming of the oilfield.

The main aim in this study is the determination of number and directions of fractures, their relative frequency in different zones, measurements of dip and strike of layering, local stress and recognition of other geological features available in drilled formation using by FMI log interpretation in a well of the lali oilfield, and also evaluate about the capability of this tool via correlation between archived data from FMI image log and core observation and thin section study data. In this study due to the lack of mud loss data as an indirect method diagnosis of deep reservoir fracture, FMI image log was used to identify small-scale fractures of the Asmari reservoir fractures type in this Oil-field. The result of this study are important in of operation acid Frac and geomechanics . the present study indicates that average slope of layering in Asmari reservoir based on 117 logs read from FMI, about 8◦ towards the N35W and S35W. Major fractures is open fractures with about about 78◦ towards the N35W and S35E and theirs strikes N55E-S55W along N55W-S55E. Minimal stress affected on the field is along the shear fractures (NE-SW) determined. On the other hand maximum stress is to consistent to the process of formation of the Zagros Mountains along the NW-SE trend. Hydraulic fractures (induced Fracture) created by increasing of the mud column pressure on the hole infact their forms in those location of maximum stresses in the hole and having NE-SE trend.

Introduction

The Asmari formation (Oligo-Miocen) is a main petroleum reservoir of Iran which is consisted of calcite and dolomite. Petroleum production potential of the Asmari reservoir is about 85% of the crude oil due to abnormal Vuggy prosity type resulted from Natural Fractures. Therfore the study of the fractures in the Asmari Reservoir is a serious subject up to now[1].Generally in the Fracture Reservoir, The Fractures controls the reservoir behavior[2].if the fractures are open,they can be the conduits to petroleum migration and so resulted to developed a highly production zone; with the permeability more than 10000 md[3,4]. core Analysis is also a common Method to identify the small-scale fractures of the well, but there is some limitations is the core procedure such as high expensive, unidirectional and low recovery coefficient in fractured zone, Thus this such cases to use Image Logs to study the subsurface Fractures[5]. Image log data complements core hole data and can reduce the amount of coring required by 75% resulting in significant savings to drilling programs in

terms of project cost and time[6]. It is cleared that fracture study and evaluation in any oilfield can be helpful in the complementary stage of the well ,the determination of perforating depth, field development, directional drilling well program, fluid injection zone and fracture modeling.

Geological position Area under study:

Lali oil-field is located in the region of northern Dezful at 112 km northeast of Ahwaz**(Figure 1)**.this anticline is an asymmetrical structure with NE-SW trend and southern flank dip is higer than northen flank, and its causes to change the axis to follow west trend in norther part and souther trend in the west.the Asmari reservoir is divided to 7 zones based on archived petrophysical data.

Methodology:

The lack of mud loss data, production rate and other indirect documents of the fracture presentation led to determine small scale fractures in the reservoir zones of the Asmari formations and fracture classification(open, closed, vuggy, induced and so) using FMI Image Log data. in the FMI Image Log , layer boundary maybe clear or disclear, Therefore dip value calculation from the first layer boundary is possible and classified in to:(1) High confidence bedding dip;(2) low confidence bedding dip. in the image, lines which intersect layer boundaries and indicating high resistivity are layers boundary. this line as also define the geometry shape and the thickness of the layers. the line simply present layer boundary which may be planar, concave ,convex ,wavy or irregular with load casts or erosion surface[7&8]. FMI Image Logs of the wells drilled with water-based mud are able to differentiate fracture types(open, closed, vuggy, induced and so).Therefore the tool programerized based on fractures resistivity. open fractures filled by mud are dark color but closed fractured filled by secondary materials are presenting light color.

Discussion:

Based on FMI Image Log as an power full tool to describe the subsurface fractures in the Asmari formation of the lali oil field, dip of bedding are varied from 30˚ NW to 60˚ NE**(figure-2)**. But dip average estimated 8˚based on 117 reading of the FMI Plots. In this well in The Asmari Reservoir as heterogonous reservoir revealed 98 open fractures (open and 58 sub-open fractures).their dips change from 54-86˚ with the azimuth of S30E and S35W and their strike N55W-S55E and N60E-S60W**(Figure-3)**. it is also observed 54 closed fractures with the dip of 62-84 toward N63W/S25E with the strike of N27E-S27W and N65E-S65W.With comparing of density and number of fractures, it is calculated that high density is in 1,2and7 zones since zone-1 contains 40 open fractures in the interval of 2074-2088 m; zone-2 having 17 open fractures and zone -7 has 29 fractures**(figure-4)**. FMI Image Log data revealed the fractures produced by borehole breakout the well ellipsoid in the less tension sides. In the well cross section the borehole breakout are indicating NE-SW trend, this fractures are indicated of less tension in to the wellbore. (induced fracture) which generated by mud pressure are observed in high tension over the well side with NW-SE trend. This trend can be some important during Acid Frac and Geomechanic stage.

Conclusions:

FMI Image Logs plots of the Asmari Reservoir revealed that dip and bedding boundary can be grouped as (1) High confidence bedding dip;(2) low confidence bedding dip mean is 8° toward N30W with the strike of N60E-S60W. All open fractures(98 numbers) are presenting variable dips between 54-86° with the azimuth of S30E and S35W and their strike N55W-S55E and N60E-S60W. closed fractures are indicating dips range 62-84 toward N63W/S25E with the strike of N27E-S27W and N65E-S65W.

Open fracture are mainly distribute in 1,2 and 7 zones (Because of the presence of the dense lithologies such as dolomite and calcite derived from conventional petrphysical logs likes PEF,NPHI,ROHB),since zone 1 contains 40 numbers, zone 2 has 17 and zone 7 has 29 numbers.

Reference:

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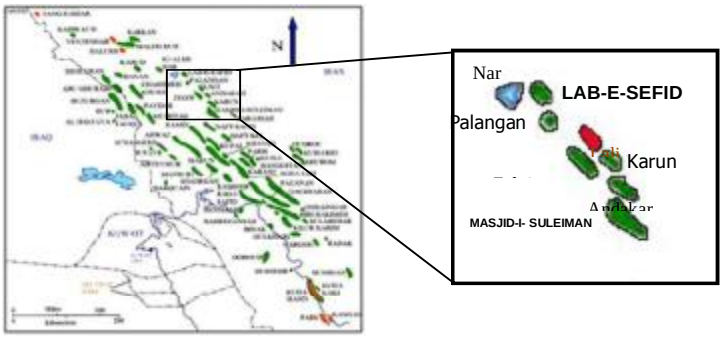
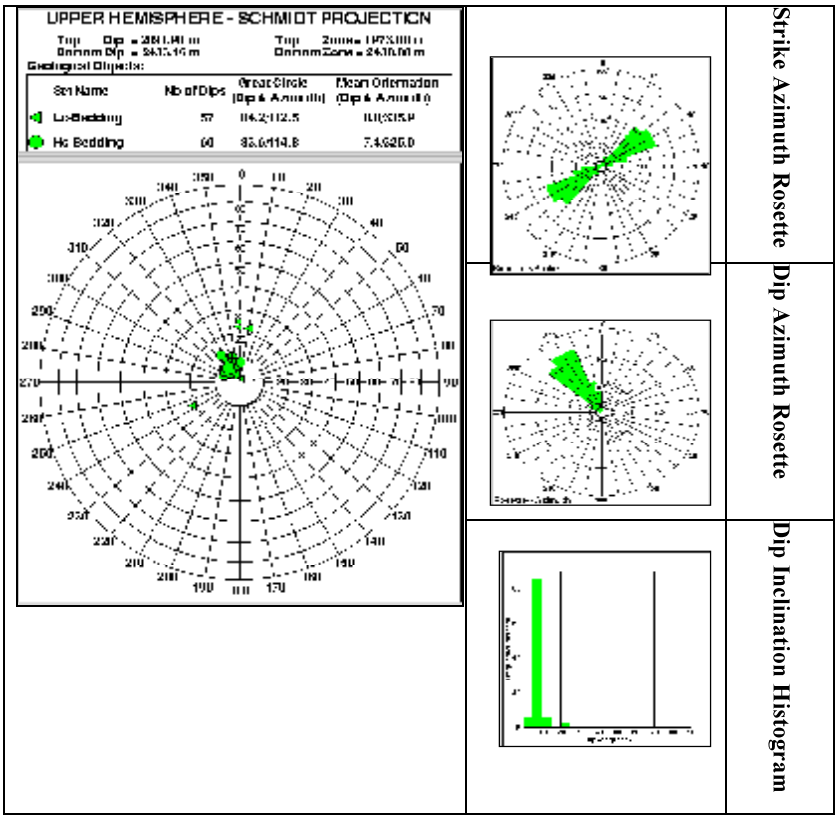
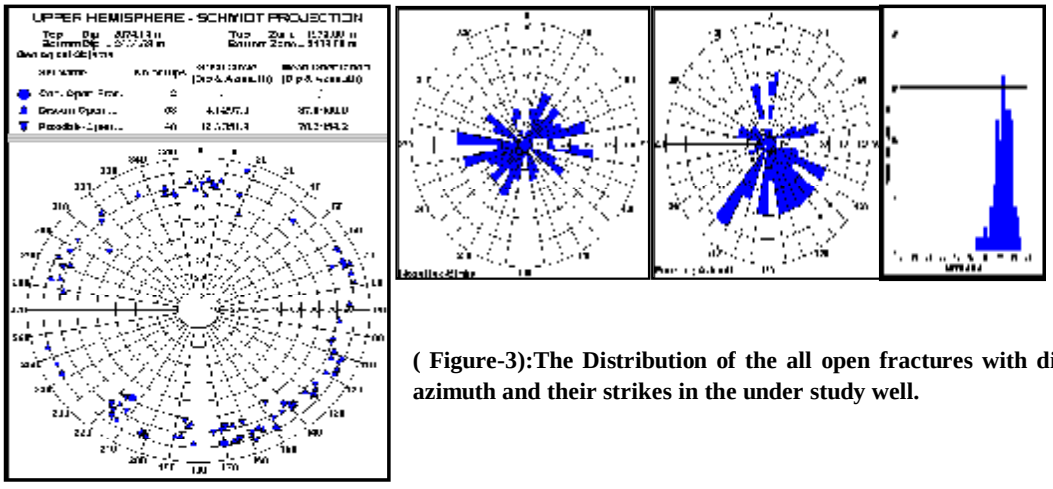


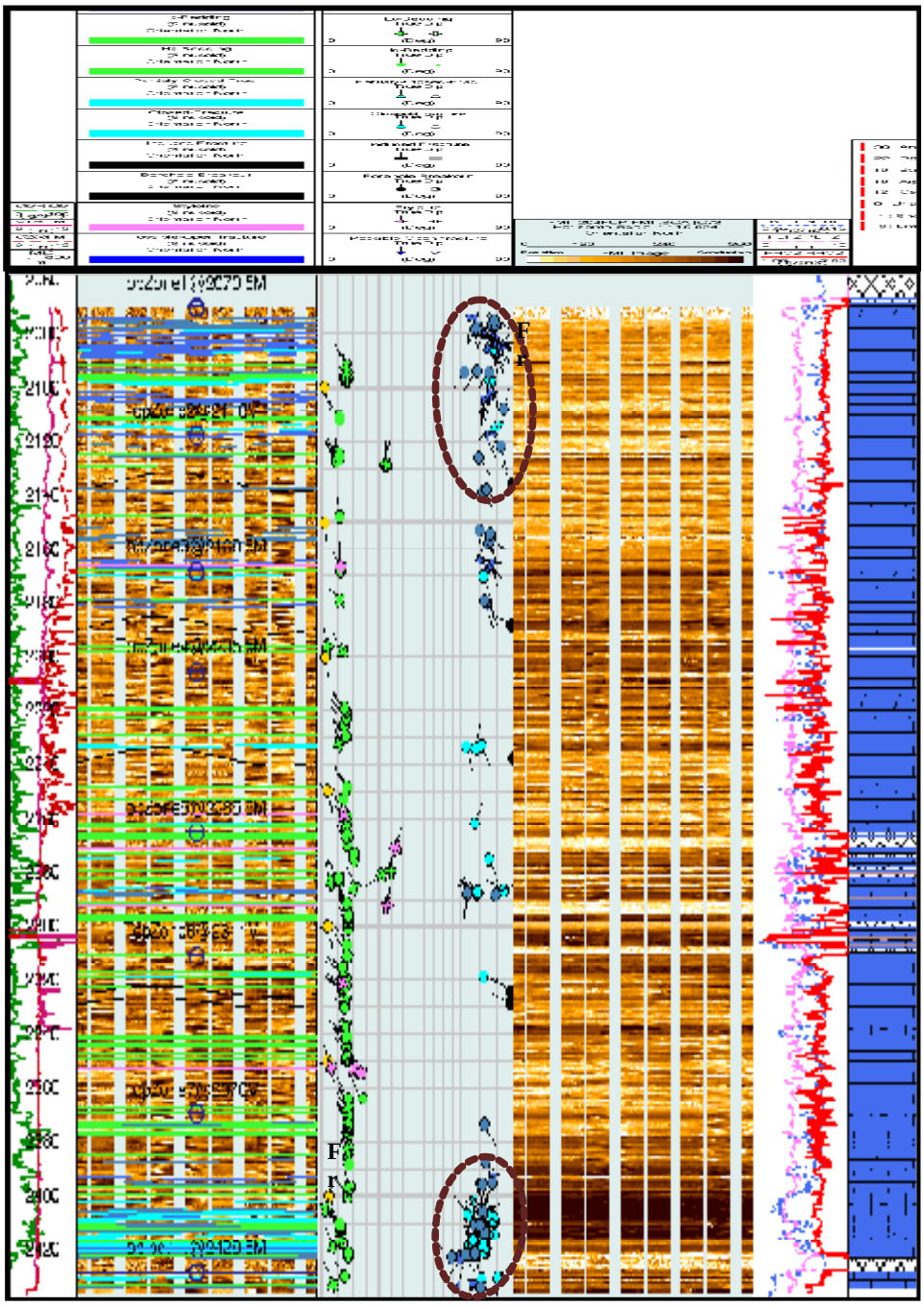
(Figure-1): The geological map of the lali oil field.



((Figure-2): structural dip average for all bedding in the under study well based on FMI.



(Figure-3):The Distribution of the all open fractures with dip, azimuth and their strikes in the under study well.



(Figure-4): the final schematic of all layers in the under study reservoir on the bases of caliper,GR,FMI,PEF,NPHI and,ROHB conventional logs .