

Dry Holes Analysis Leads To Exploration: Assessment Steps to Determine the Major Reason of Failure in Prospects

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Abstract

The search for hydrocarbons in wildcat and developed zones needs a comprehensive evaluation of petroleum system elements to reduce the risk in this big investment. The dry wells (wells could not produce hydrocarbons) either exploratory or development is a common phenomenon across the worldwide sedimentary basins for hydrocarbon exploration. The investigation techniques that change failure to success for well and block is another step of research in the heading of “DRY HOLE ANALYSIS (DHA)”.

This analysis can lead to success in the dry well or dry blocks if thoroughly examine the petroleum system on the basis of available data. The exploration is a risky business, and dry holes are unavoidable and cannot reduced to zero in oil industry, especially in frontier and un-explored basins and plays. Technically evaluated dry hole give a way of thinking to exploration methodology, to hit the target in drilled wells and also for future wells success.

Here we applied the methodology to check the petroleum system elements in 08 drilled, dry wells of Indus Basin, Pakistan (Figure 1).

A brief methodology to determine the key failure reason for individual segments in conventional petroleum prospects and illustrate its use with examples from the Indus Basin, Pakistan. We hope that this methodology, or its customized versions, is the best practice in post drill analysis across the exploration industry.

Method / Workflow

Basically, a dry well analysis is carried out in order to find out as to why there is no producible hydrocarbon in a well despite the existence of favorable geological factors and convincing hydrocarbon petroleum system existence in the area. Subsequently, result of the dry hole can then be used to determine strategy for the next exploration/appraisal well planning and field development.

This paper describes methods, case studies and implication of a well dry hole analysis. Dry hole analysis procedures applied in this study consist of 08 wells and the some of the steps were utilized out of the following to find out the reason of failure of drilled wells.

CASE STUDY

In this context, we will discuss case of our success story of field located in the Lower Indus Platform Basin, Pakistan. The exploration lease is located in the highly prospective area with ~1500 sq. km area. Within this acreage, acquired seismic data from mid-eighties to 2010 and drilled 8 wells on different structural leads in a period of 16 years and all efforts went unsuccessful. Later on a rigorous DHA has been carried out with following steps are necessary for dry hole analysis

Source Analysis

Reservoir Analysis

- i. Sequence stratigraphic Correlation (DST Points Validity).
- ii. Lithology Correlation,
- iii. Facies Analysis (Sand/Shale Ratio: Sand Quality (Percentage)).

Cap/Seal Analysis

Trap/Structure Analysis

Interpretation of seismic data to find out

- i. Is the well properly on structural apex.
- ii. Is it valid structural closure

METHODOLOGY

Stratigraphic interpretations, re-visit of petrophysical data and master/mud/composite logs for identification of reservoirs and seals, geochemical interpretation to confirm the quality and maturation of source horizons and re-interpretation of Seismic data.

Results of Data Reinterpretation:

Well-1

Geochemical investigations show that penetrated source horizons in have negligible HC generation potential, good reservoir horizons are present in the targeted sandstone reservoir and RFT results shows that the reservoir is water wet. Revisit seismic data shown that the well was offset from the shallowest point of the structure.

Well-2

Geochemical investigations show that shale horizons penetrated by this well have negligible HC generation potential, good reservoir horizons are present in targeted sands and RFT results shows that the formation is water wet. Revisit of seismic shown that the well was offset from the shallowest point of the structure.

Well-3

Geochemical investigations show that the source rock penetrated has moderate HC generation potential, good reservoir horizons are present in the targeted sands and RFT

results in two sand intervals show that the formation is water wet. Revisit of seismic shown that the well was offset from the structure and drilled on the margin of easterly dipping fault.

Well-4

Geochemical investigations show that potential source rock have good HC generation potential, good reservoir horizons are present in the targeted sands, RFT results shows water gradient. Seismic interpretation revised shown that the well was offset from the shallowest point of the structure.

Well-5

Geochemical investigations show that potential source shale have good HC generation potential, good reservoir horizons are present in the targeted sands, RFT results shows that the formation is water wet. Revisit of seismic shown that the well was offset from the shallowest point of the structure.

Well-6

Geochemical investigations show that source rocks have good HC generation potential, good reservoir horizons are present in targeted sands, MTD results shows that the formation is water wet. Seismic revisit shown that there was issue in structural closure at drilled location.

Well-7

Geochemical data interpretation shows good potential for source rocks, poor quality reservoirs are identified in the targeted sands and MDT results shows that the formation is water wet. Revisit of seismic shown that the well was also offset from the shallowest point of the structure.

Well-8

Geochemical investigations show that shale horizons in potential source rocks have good HC generation potential, good reservoir horizons are present in sands of targeted reservoir. Revisit seismic shown that the no structural closure discernible on the seismic line.

IMPLICATION

In an exploration block, Lower Indus Platform Basin, a total of eight P&A wells as dry holes, were dry hole analysis. Based on G&G interpretations, well reports and E-logs re-evaluation. The dry hole analysis found out that in well-1 target sandstone reservoir ranges tight/low to excellent porosity and initially it was interpreted that it is not charged. DHA shows the reason is associated with trap definition. Well-2 was initially interpreted as reservoir was not charged. DHA shows the well located on the margin of easterly dipping fault. Similarly rest of the wells also show that they were lacking the trap or drilled on down dip of the structure, later on a new seismic data was acquired and interpreted to ascertain the structural closure. Finally the ninth well encountered the oil and gas accumulation.

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References

All references will be incorporated in full length paper and presentation

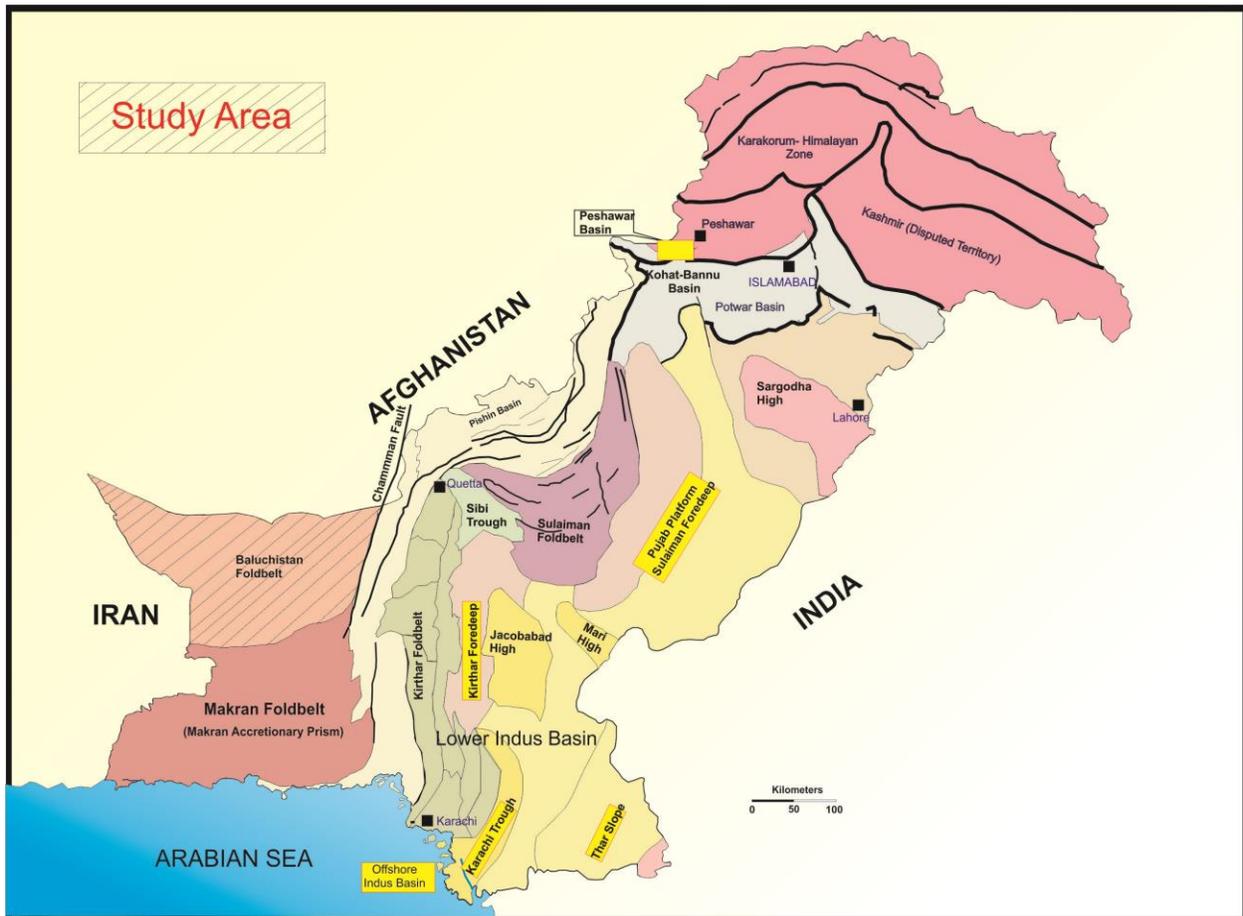


Figure . 1