

# **OIL & GAS DEVELOPMENT COMPANY LIMITED**



**TENDER ENQUIRY NO. PROC-SERVICES/CB/EXPL-4979/2021**

**HIRING OF SERVICES FOR A GEOCHEMICAL EVALUATION  
OF THE PETROLEUM SYSTEMS OF KOHAT-POTWAR FOLD  
BELTS, UPPER INDUS BASIN, PAKISTAN**

## **Note:**

- Bid bond of **USD 20,000/- (US Dollar Twenty Thousand Only)** to be submitted with the technical bid.
- The master set of tender documents (services) uploaded on OGDCL website ([www.ogdcl.com](http://www.ogdcl.com)) is the integral part of this TOR.
- Following documents must be submitted with the bid:-
  - Bidding form, Integrity & Ethics undertaking, Affidavit, Data Summary Sheet, Declaration and Draft Contract. Please see master set of tender documents services for further detail.

**TERMS OF REFERENCE (TOR)**

**A GEOCHEMICAL EVALUATION OF THE PETROLEUM SYSTEMS  
OF  
KOHAT-POTWAR FOLD BELTS, UPPER INDUS BASIN,  
PAKISTAN**



**Oil & Gas Development Company Limited, Pakistan  
(OGDCL)**

## 1. Introduction

Oil & Gas Development Company Limited (OGDCL) is the national Oil & Gas Company of Pakistan and a prime body of the country's E&P sector. The Company intends to hire services of reputable firm to conduct a study on geochemical evaluation of the petroleum systems of Kohat-Potwar fold belts in Upper Indus Basin.

Kohat-Potwar Fold belt is a part of Indus Basin bounded by MBT in the north, Salt Range Thrust and Trans Indus Ranges in the south, Jehlum Fault and Kurram-Parachinar ranges in the east and west respectively (Fig-1).

The Kohat-Potwar Fold belts covering an area of approximately 42000 km<sup>2</sup> is prolific hydrocarbon province where exploration was started in 1866 with the drilling of Kundal-1 well. The first hydrocarbon discovery was made by Attock Petroleum Company at Khaur in 1914 from Tertiary aged reservoir. Since then more than 200 exploratory wells have been drilled which resulted 55+ hydrocarbon fields in the fold belt (Fig-2). Hydrocarbons are commonly being produced from stacked Cambrian to Eocene clastic and carbonate reservoirs (Fig-3).

This area comprises a sequence of Precambrian to Tertiary siliciclastics and carbonates that have been intensely deformed by thrusting and folding during the Himalayan orogeny. The area is still active tectonically which has an impact on reservoir compartmentalization and the distributions and orientations of permeable faults and fracture systems.

Though, accumulations of oil, gas condensate and gas are known to widespread across the area in stacked reservoirs, however the gaps of knowledge regarding petroleum systems of the region is a key constraint for the area to become a mature petroleum province.

## 2. Project Aims

The aim of this project is to establish the petroleum system (s) by integrating the oil, gas and source rocks geochemical data. Fixing the source rocks and to link those recognized source rocks to known hydrocarbon occurrences through the integration of the geological and geochemical evaluations by using top-down and bottom-up approaches.

## 3. Project Work Flow

The proposed project is structured in three stages/phases, with the results of each stage being used to focus the efforts of work to be performed in the next stage.

### 3.1 Phase-1

The first phase involves the integration and interpretation of all relevant legacy and published source rocks, oil & gas geochemical data. A top-down approach will be used to interpret the fluid properties and their distribution in the geological context. Following tasks will need to be performed during phase-1;

- a) **Data Extraction, Databasing and Quality Controlling:** It includes the evaluation and extraction of all available source rock (s) geochemical, biomarkers, isotopic, oil & gas compositional, and PVT data. All data will need to be placed in a proper integrated database and will be rigorously quality controlled (QC) before interpretation.
- b) **Synthesis and interpretation:** Geochemical data will need to be used to evaluate the occurrence and distribution of potential source rocks along with their characteristics in the area. Source rocks will be evaluated within a worldwide source rock database which classifies source rocks on the basis of depositional environment and nature of organic matter. Oil composition, biomarker and isotopic data will be used to assess oil

families, oil-oil and oil-source correlation, age, depositional environment, parent kerogen nature/organo-facies, maturity of oil, and possible effects of migration fractionation, mixing of oils in main reservoir formation, biodegradation, water washing etc. The oil and gas properties will need to be reviewed in the context of available source rock analysis to determine oil to source rock correlation.

**c) Data Gap Analysis:** The syntheses and interpretation will be followed by a data gap-analysis to identify the key missing/required data to fine-tune the interpretation and models.

**d) Presentation & Interim Report:**

The adopted workflows and key findings of phase-1, along with the requirement of new analyses will be presented to OGDCL management through an online workshop. An interim report of phase-1 having the interpretation and illustrations, will need to be submitted.

### 3.2 Phase-2

Second stage of the study will involve geochemical analysis of rock, oil and gas samples, identified during the data gaps analysis. The most cost effective analytical programme will be formulated by the consultant for this phase.

**a)** The contractor will communicate number of oil, gas and rock samples by specifying the wells, reservoir and the source rocks along with the nature and type of analyses. Contractor will also provide the justification that how and why required analyses are important to accomplish the study. Final number of samples (oil, gas & rocks) and type of analyses will be decided by OGDCL with the consent of contractor.

**b)** Required samples will be collected by OGDCL following the SOPs as defined by the consultant/lab, and will be shipped to the consultant designated geochemical lab.

**c)** The consultant and OGDCL representative both will liaise with analytical geochemical services provider (laboratory), however it will be the sole responsibility of consultant to ensure the quality of the newly-produced geochemical data.

### 3.3 Phase-3

Third stage will involve to conclude the study along with basin and petroleum system modeling. Following tasks will need to be performed in this phase;

**a)** Integration of newly acquired data with phase-1 data, and to complete/fine tune the interpretation and models;

**b)** Basin and Petroleum System Modeling: After sound integration / interpretation and correlation of source rock(s) and oil(s) & gas data, and having confidence in the type of organo-facies present in source rock beds and the lateral and vertical distribution of source beds/organo-facies in the study area and in stratigraphy, 1-D or multi-layer map-based basin and petroleum system modeling will need to be carried out, to model the generation, migration and distribution of hydrocarbons in the area. Generated and expelled volume and nature of hydrocarbons (per square kilometer) will also need to be modeled. Number of 1-D modeling points/locations will be finalized with mutual consent of the consultant and OGDCL.

## 4. Data Sets

Following data are available and will be used to accomplish the phase-1 of the tendered study:

Nature of Data	Description
Source rock (s) Geochemical data	TOC & Rock Eval Data of 45 wells
Optical Analysis Data	VKA & VR Data of 10 wells

Biomarker Analysis Data	GC & GCMS Data of 20 wells
Outcrop's data	TOC, RE, and VKA & VR Data of 40 outcrop locations
Isotopic Data	Stable Carbon Isotope data of gases and EOM of 10 wells
Oil Analytical data	40 wells
PVT Data	60 wells
Hydrocarbon composition data	Gas Composition data of 100 wells
Well's data	Well Reports (50 wells)
Published data*	Source rock geochemical, oil & gas composition, biomarkers and Isotopic data in the published articles will be part of the data set
Supporting/other Data	<ul style="list-style-type: none"> <li>• Depositional Facies Maps</li> <li>• Interpreted seismic lines of the structures</li> <li>• Geothermal gradient map of the area</li> <li>• BHT &amp; DST temperatures of the wells</li> <li>• Geoseismic transects representing the structural geometry of the area</li> <li>• Published literature</li> </ul>

**Note:**

- All data is in soft form i.e. scanned, pdf etc.

**5. DURATION**

The total project duration is 8 (eight) months starting from the complete data handing over to the contractor and its acceptance by the contractor. Breakup of the duration is as under:

Phase-1	3 months (90 calendar days)
Phase-2&3	5 months (150 calendar days)

- The duration of samples collection and shipment for 2<sup>nd</sup> phase will be excluded from the above period.

**6. DRAFT REPORT**

The consultant will submit a draft report to OGDCL for review, allowing reasonable time to complete the review. Final report should incorporate the inputs recommended by OGDCL as agreed by the consultant.

**7. DELIVERABLES**

Deliverables of the study includes;

- a) A thorough report (text and illustrations) integrating the results of the geochemical and modelling studies, identifying and characterizing the main petroleum systems of the region (05 hard copies + 01 CD having the same report in pdf format);

- b) A comprehensive petroleum and source rock geochemistry database encompassing carefully quality-controlled legacy and published data as well as data acquired for the purpose of the study, in a suitable format to load on OGDCL machines.
- c) Working data and software exported files of 1-D basin and petroleum system models (digital) in suitable format to load in modeling software.
- d) A CD containing all presentations

## 8. Participation of OGDCL Professionals

A team comprising 04 professionals will participate in this study for two weeks as counterparts to share the local knowledge and experience. During the participation, OGDCL professionals will review and discuss the major findings of the study with the consultant's team. Among them, one (01) professional will participate as a counterpart with lab during analysis of the samples. However, keeping in view the prevailing situation due to COVID-19, the discussion/participation may be virtual.

## 9. BID EVALUATION

All bids/proposals will be evaluated technically and financially. Technical proposal shall be reviewed first to determine its technical responsiveness and conformity with the requirement of TOR. After completion of technical evaluation, the financial proposal of only the technically responsive / qualified bidder(s) shall be opened and evaluated. The bids requiring substantial modifications to make it responsive shall be rejected out rightly.

### 9.1. Technical Evaluation

The technical evaluation shall be carried out according to bellow mentioned evaluation criterion. 100 credit points have been assigned for technical conformity of the bid, out of which the qualifying marks are 80% in each category. The bidders obtaining less than 80% points in each category will be declared non-responsive.

All bidders are requested to submit their bid considering the evaluation criteria. The technical evaluation will be based on the following criteria.

<b>Total Marks = 100</b>		
<b>S#</b>	<b>Description</b>	<b>Allocated marks/points</b>
<b>01</b>	<b>Number of Studies Conducted</b> Number of similar studies conducted/completed (including studies in hand) by the bidding firm / company during the last 05 years. Bidders are required to submit the title and duration of similar studies conducted during the last five years.	<b>Maximum Marks = 25</b> <b>1)</b> ≥ 20 Studies =25 <b>2)</b> Studies 15 to 20 =20 + one mark for each study above 15 studies <b>3)</b> Studies < 15 = 0
<b>02</b>	<b>Professional's experience</b> A team of highly experienced professionals in the field of geochemistry/petroleum system evaluation / petroleum and basin modeling will need to be required to conduct the study. Experience of each participating professional should not be less than 10 years. However, the experience of only team leader will be marked as	<b>Maximum Marks = 25</b> Team Leader: <b>1)</b> Experience ≥ 25 years =25 <b>2)</b> Experience 20 to 25 Years =20 + one mark for each year of experience above 20 years <b>3)</b> Experience < 20 years = 0

	<p>per given criteria. Team Leader should have vast experience of conducting and monitoring petroleum system evaluation projects/studies on regional level.</p> <p>Bidders are required to provide the CVs of the professionals describing their experience along with their role in this study</p>	
<b>03</b>	<p><b>Technical Approach</b></p> <p>Describe and provide the detailed methodology and workflows to accomplish the study along with Software applications (i.e. databasing, interpretation, petroleum system modeling, analyses etc.)</p>	<p><b>Maximum Marks = 40</b></p> <p><b>1) Methodology and work flows</b> fully describing the given scope of work with latest concepts, applications, equipment / technology = <b>40 marks</b></p> <p><b>2) Methodology and work flows</b> not fully describing the given scope of work but covering more than 90% of the scope of work with latest concepts, applications and equipment/technology = <b>32 marks</b></p> <p><b>3) Methodology and work flows</b> not fully describing the given scope of work and without latest concepts, applications and equipment/technology = <b>0 marks</b></p>
<b>04</b>	<p><b>Geochemical/Analytical Lab</b></p> <p>The bidders have either their own laboratory for analytical geochemical services or to have collaboration with reputable laboratory providing all required geochemical/Analytical services.</p> <p>The laboratory should be well equipped with state of the art technology, using the latest techniques in analyses and following the analytical SOPs.</p> <p>Bidders are required to provide the proof of ownership/collaboration with analytical lab, and details on services of lab along with equipment /machines, and CVs of the analysts engaging for this study.</p>	<p><b>Maximum Marks = 10</b></p> <ul style="list-style-type: none"> <li>• Fulfilling all requirements as mentioned and providing required documents = 10</li> <li>• Bidders failed to provide the required documents = 0</li> </ul>

## 9.2. Financial Evaluation

Financial proposal of only technically responsive bidders shall be opened and evaluated.

### 9.3. Final Evaluation and Contract Award

For final bid evaluation, 80% weightage would be given to technical evaluation and 20% for financial evaluation. The Financially lowest bidder will secure maximum marks/points in financial evaluation and other would be ranked on sliding scale. The points obtained in technical evaluation and financial evaluation will then be combined, and the contract will be awarded to the bidder obtaining maximum points.

#### 9.3.1 Financial Bid Format

##### Phase-1

	<b>Work/Assignments</b>	<b>Charges</b> (US\$) Lump Sum charges
<b>A</b>	Data Extraction, databasing and Quality Controlling	
<b>B</b>	Data Synthesis, Interpretation, data gap analysis etc.	
<b>C</b>	Interim Report & Online Workshop	
	<b>Sub-Total (A+B+C)</b>	

##### Phase –II

	<b>Description of analysis</b>	<b>Number of samples</b> (vary up to )	<b>Rate per sample</b> (US\$)	<b>Sub-Total</b> (US\$)
	<b>Rock Samples</b> (cuttings, core, outcrop)			
<b>1</b>	Total Organic Carbon (TOC) Analysis including carbonate content	<b>200</b>		
<b>2</b>	Rock-Eval. /Hawk Pyrolysis	<b>150</b>		
<b>3</b>	Pyrolysis Gas Chromatographic (PYGC) Analyses	<b>150</b>		
<b>4</b>	Vitrinite Reflectance Analysis (Coal & carbonaceous samples)	<b>50</b>		
	<b>Rock's Extracts (EOM)</b>			
<b>5</b>	Soxhlet extraction of cuttings, core and outcrop samples	<b>50</b>		
<b>6</b>	High Resolution Gas Chromatography (HRGC) analyses	<b>50</b>		
<b>7</b>	Medium Performance Liquid Chromatography (MPLC) separation	<b>50</b>		
<b>8</b>	Saturate GCMS (biomarkers) Analyses	<b>50</b>		
<b>9</b>	Aromatic GCMS (biomarkers) analyses	<b>50</b>		
<b>10</b>	Saturates and Aromatics Carbon isotope analysis	<b>50</b>		
	<b>Oil Seep Samples</b>			
<b>11</b>	High Resolution Gas Chromatography (HRGC) analyses	<b>10</b>		
<b>12</b>	Medium Performance Liquid Chromatography (MPLC) separation	<b>10</b>		
<b>13</b>	Saturate GCMS (biomarkers) Analyses	<b>10</b>		
<b>14</b>	Aromatic GCMS (biomarkers) analyses	<b>10</b>		
<b>15</b>	Saturates and Aromatics Carbon isotope Analysis	<b>10</b>		



16	API & Elemental (S, V & N) Analysis	10			
	<b>Reservoired Oil Samples</b>				
17	High Resolution Gas Chromatography (HRGC) analyses	40			
18	Medium Performance Liquid Chromatography (MPLC) separation	40			
19	Saturate GCMS (biomarkers) Analyses	40			
20	Aromatic GCMS (biomarkers) analyses	40			
21	Saturates and Aromatics Carbon isotope Analysis	40			
22	API & Elemental (S, V & N) Analysis	40			
	<b>Gas Samples</b>				
23	Molecular composition of natural gas samples	30			
24	C and H isotopic composition of methane in natural gas samples	30			
25	C isotopic composition of C2 to C5 in natural gas samples	30			
26	Isotopic analysis of sulfur	10			
27	<b>Sub-Total (serial 1 to 26)</b>				

### **Phase-III**

	<b>Work/Assignments</b>	<b>Total Charges (US\$)</b>
<b>a</b>	Integration of lab data & finalizing the interpretation (% of analysis cost at serial #27, phase-II)*	
<b>b</b>	Final Report & Online Workshop	
<b>c</b>	1-D / Multi-Layer Basin and Petroleum System Modeling ( <b>05 locations</b> ) ( <b>US\$/location</b> )	
	<b>Sub-Total (a+b+c)</b>	

<p><b>Total cost of the project (US\$)= phase-1+phase-2+phase-3 inclusive of all applicable taxes, duties, levies etc. except Provincial Sales Tax/ Islamabad Capital Territory Tax on Services in Pakistan</b></p>	
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\* The bidders are required to quote percentage (%) of analysis cost for interpretation of analysis results for evaluation purpose, however, payment will be made as per quoted percentage on the actual analysis cost of the samples.

### **Note:**

- Financial evaluation will be carried out on lump sum cost of the project;
- Rates/cost must be inclusive of all applicable taxes, duties, levies etc. except PST/ICT taxes on services in Pakistan;
- Rates/cost must be inclusive of samples handling, preparation etc. charges;
- Number of samples, analyses and modeling points are not firm. Actual number of samples, analyses and modeling points will be finalized after Phase-1;

- The financial quotation of the study strictly be followed as per above mentioned format.

#### **10. Payment Schedule**

Payment shall be made against invoices for actual tests/ analyses/ work done, against verified invoices by OGDCL. Payment will be made in two stages:

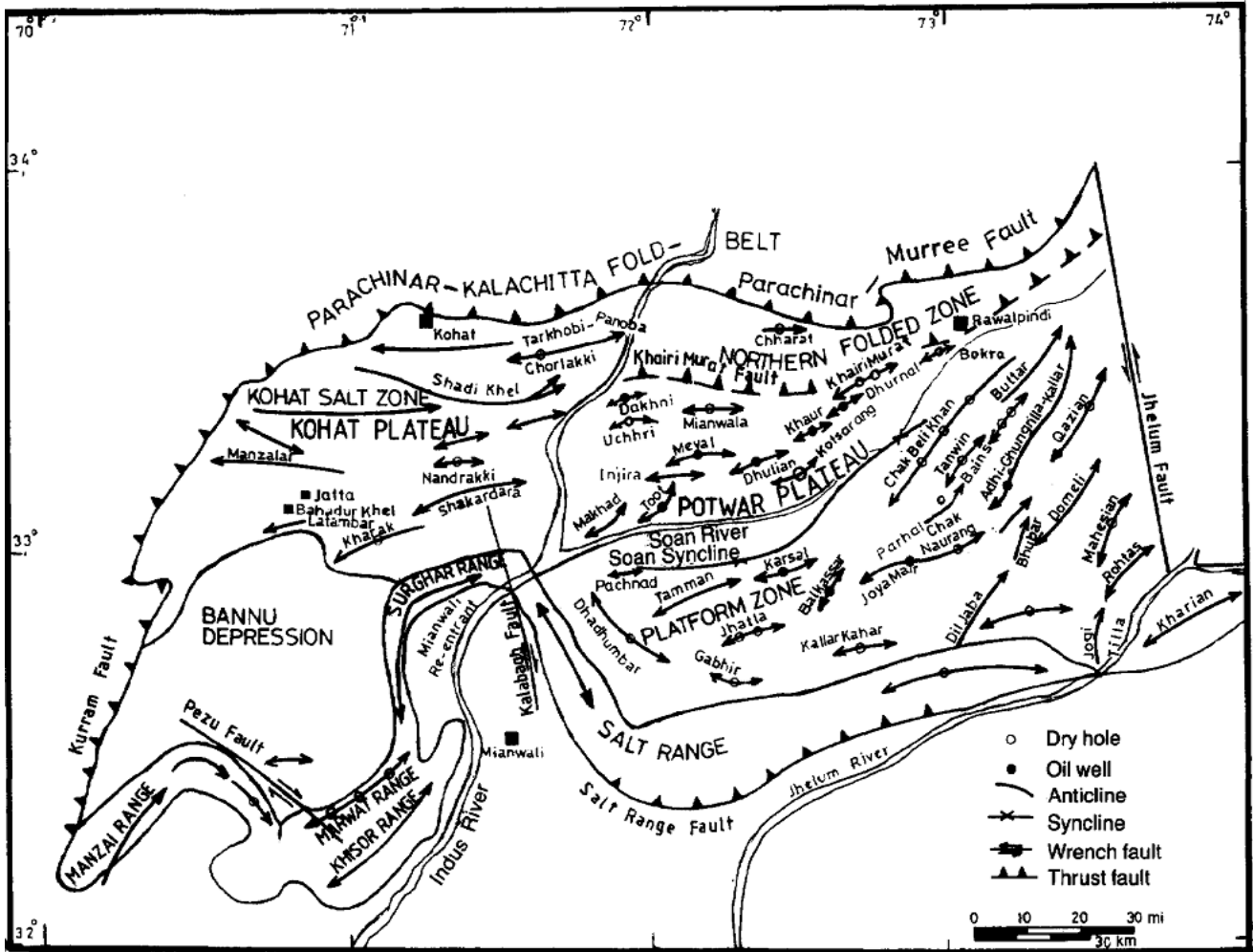
- i. 1<sup>ST</sup> payment will be made after completion of phase-1 and fulfilling the requirements as mentioned in this TOR;
- ii. The payment of phase-2&3 will be made after completion of the project in all aspects, acceptance of the report by OGDCL and fulfilling the requirements as mentioned in this TOR.

#### **11. Other Terms & Conditions**

- i. The bidder should submit the study program, shown in Gantt chart for time duration;
- ii. Consultant will provide (if required) the bottles/ampules/tubes for collection and shipment of oil and gas samples;
- iii. Collection, transportation of samples and supporting study material from Pakistan to consultant office (abroad) will be responsibility of OGDCL.
- iv. During the course of synthesis and interpretation phase, missing data or any data which will be required for interpretation will need to be timely notified.
- v. All data/reports/interpretations will remain the property of OGDCL. The consultant will treat all data and information supplied by OGDCL and those acquired by him during the implementation of the study with utmost confidentiality
- vi. Expenses (visa, air tickets, boarding & lodging) regarding the visit of OGDCL professionals to consultant's main project center will be borne by OGDCL;
- vii. Contractor shall provide office space, computers, internet facility and international telephone/fax facilities to the OGDCL visiting professionals;
- viii. OGDCL shall not be held liable for any expenses incurred with the preparation or submittal of the proposals or any subsequent discussion and / or negotiations.
- ix. OGDCL reserves the right to increase, decrease or omit any study/ task/ service/ number of samples related to above scope of work.

## Published data\*

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4. Arif Nazir., 2013. Biomarkers and Pyrolysis Parameters to Investigate Hydrocarbon Generating Potential of Cretaceous Sequences, Indus Basin, Pakistan. PhD thesis, UET Lahore, Pakistan.
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8. Asif, M., Fazeelat, T., Jalees, M.I., 2014. Biomarker and stable carbon isotopic study of Eocene sediments of North-Western Potwar Basin, Pakistan. *Journal of Petroleum Science and Engineering* 122, 729-740.
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10. Fazeelat Tahira, 2006. Chemical composition and Geochemical Applications of Waxes Isolated from Pakistani Crude Oil. *Jour.Chem.Soc.Pak.* Vol. 26, No. 6, 187-190.
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13. Fazeelat, T., Jalees, M.I., Bianchi, T.S., 2010. Source Rock Potential of Eocene, Paleocene and Jurassic deposits in the subsurface of the Potwar basin, northern Pakistan. *Journal of Petroleum Geology* V.33, 87–96.
14. Raza, H.A., Alam, S, Khan. A., Iqbal, M., 1993. Source Rock Potential of Oil Shale Deposits in Kohat Basin, Pakistan. *Pakistan Journal of Hydrocarbon Research* V. 5, N 1&2, 1-14.
15. Yasin, G., Bhanger, M.I., Ansari, T.M., Naqvi, S.M.S.R., Ashraf, M., Ahmad, K., Talpur, F.N., 2013. Quality and Chemistry of Crude Oils. *JPT and Alternative Fuels*, V 4(3), 53-63.



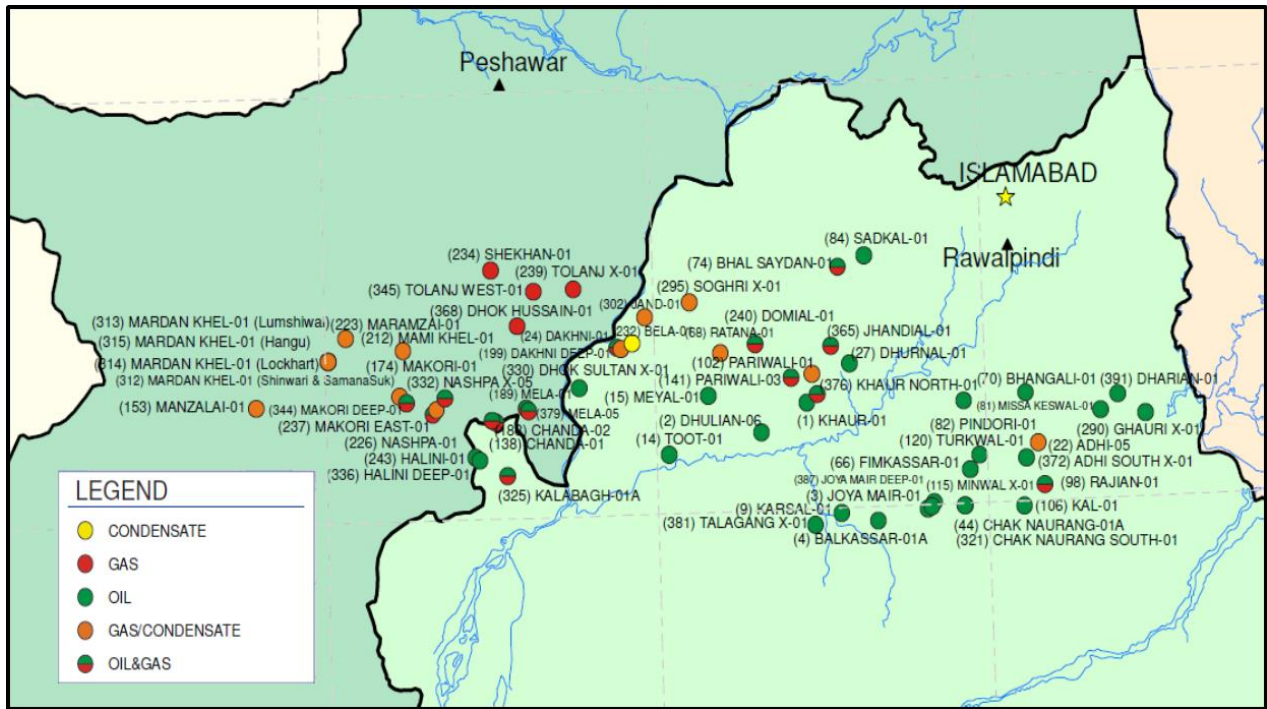


Figure-2: Showing the distribution of hydrocarbon fields and lateral variation of nature of hydrocarbons of Kohat-Potwar fold belts

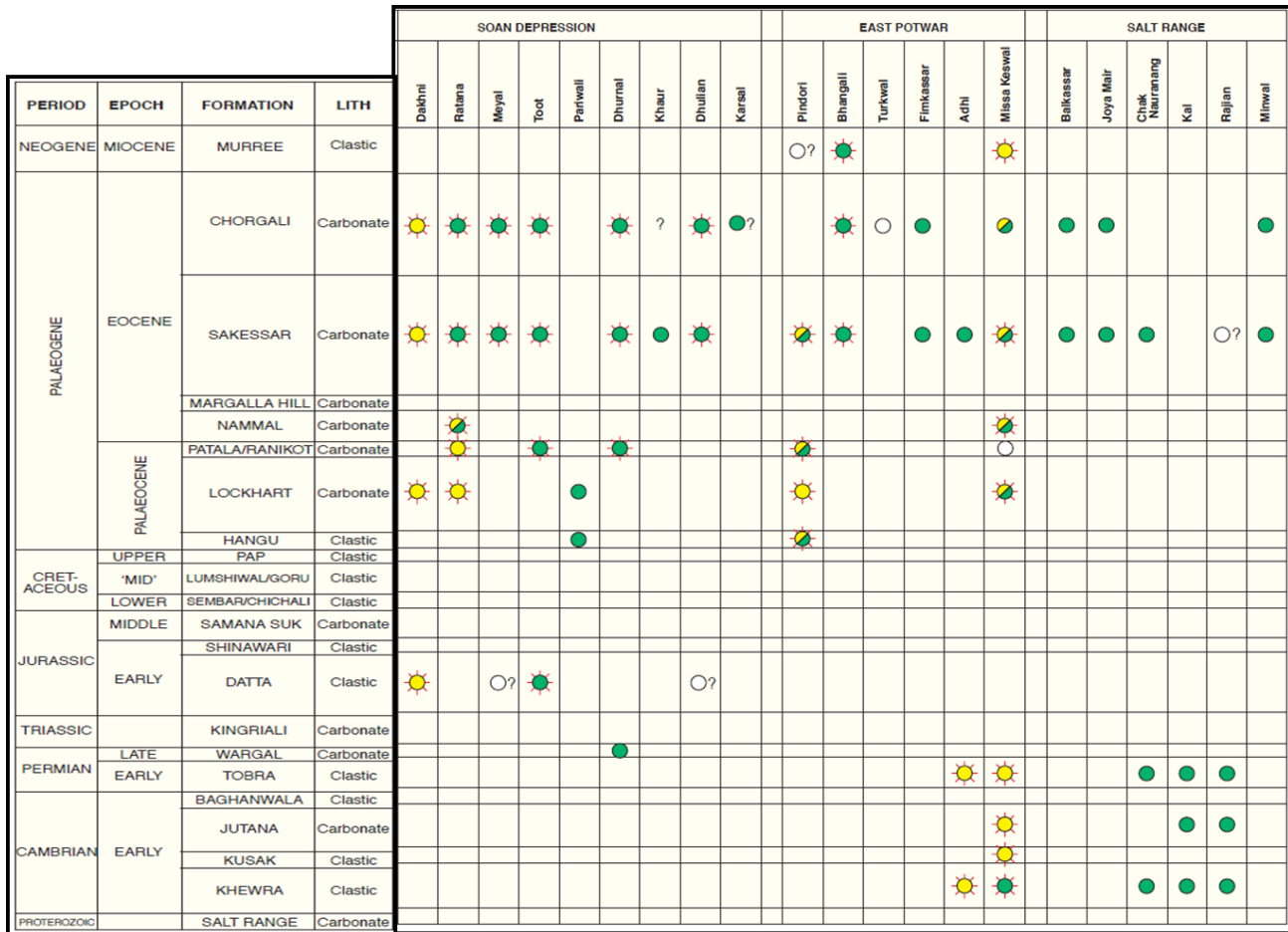


Figure-3: Showing the stacked reservoirs in hydrocarbon fields of Potwar Fold belt