

THE PROSPECTS OF PETROLEUM OCCURRENCE IN

WEST PAKISTAN

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The geographical location of West Pakistan on the East of the oil rich country "Iran" has often led people to assume that large potential petroleum fields might also exist in West Pakistan. Besides this the often occurring oil seepages at various places in West Pakistan have further encouraged the people to think that oil was definitely present in the depths of the West Pakistan.

Since the inception of Pakistan a number of holes had been drilled, & most of the time this met with failure. Either non-commercial deposits of dry gas were discovered or scanty oil traces and sometimes nothing but just super heated rotten sulphurated water. One can imagine that what these failures mean to the exploring companies and the Government who shares some of the expenses. Ignoring the fact that huge finances and precious time were expended people assumed arbitrarily that large oil discoveries were deliberately avoided by the western oil companies. However with the exception of illiterate and few ignorant people few gave much consideration to this foolish speculation. In my opinion no firm is foolish enough to waste the huge finances and precious time only to announce that no oil was found. If it were the motives of the western oil companies, they may have never entered the contract. This should be kept in mind that when an oil company intends to explore for oil in virgin areas it has to go through a number of Preliminaries of which following are the major ones.-

1. Negotiations of leases and contracts.
2. All the sorts of Geological Surveys.
3. Construction of a road connectin the area with the nearest city & Railway head.
4. Transportation of heavy equipment.
5. Arrangements for water supplies.
6. Construction of an Air Strip and a Heli-Port.
7. Provision for workshop to maintain transport vicles.
8. Arrangements for the generation of electric power.
9. Provision for scientific laboratories in the field.
10. Provision for camp accomodation.

All these things are not accomplished with the help of an "Alladin Lamp". Instead great efforts and large finances are put together to bring this to accomplishment. Moreover, this venture at a far flung place provides a chance to the population of that area to earn money, which otherwise is not possible in normal circumstances.

In short the actual oil drilling is preceded by the establishment of a minature industrial twon. This brings prosperity to the people of the area as long as it remains in operation.

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I think the readers may have now visualised that the expenditures on such ventures are not small. And no company will be so foolish as to waste its finances and time for nothing. To summarise the companies the CoS which have so far operated and are operating in West Pakistan have been sincere for discovering oil. The writer is himself a testimony to this fact.

Now when it is clear that the oil companies were sincere in their efforts to find oil fields in West Pakistan why they failed inspite of these sincere efforts to discover oil. It is an irony of fate that most of these sincere efforts went to waste and caused great financial depressions to the operating oil companies. Only a few new oil producing areas have been discovered till now, but it is another fact that these are situated in an area which is already known to be oil producing i.e. The Potwar Plateau area.

For a layman it is off-course difficult to discover or understand the causes of these failures. And they stick to their same foolish conception. In my opinion it is not their fault but the fault of the people who didnot tell them the facts. I mean the scientists associated with the oil exploration-- "The Geologists".

As I have already pointed out that Neighbour-Hood of Iran and West Pakistan gives an idea to people that oil can be found in West Pakistan. I will try to explain that why inspite of their neighbourly situation oil is found in Iran and not so far in WEST PAKISTAN.

It is a fact that other neighbours of Iran are also oil rich, but it is another fact that Iran and these areas were one geological entity in the geological past or to speak more simply their Geological Chronology has been more or less same.

In most of the Middle eastern countries oil is known to occur in upper Mesozoic and Tertiary rocks. It is mostly the older Tertiaries which are the oil producing horizon both in Middle East countries and also in a few areas of West Pakistan, i.e. Potwar Plateau.

In these countries the Tertiary sequences are fully developed. That is the Tertiary formations and as well as the Mesozoic occur in considerable thicknesses. This means that these areas have remained under waters for a long time. This fact is of considerable importance because the sedimentary rocks are deposited on the ancient sea floor in the river channels and also on the land surfaces. But it is only in the rocks deposited at the sea floor, in which oil occurs. The organic material dumped alongwith the sediments in form of muds or slimes gets converted into the oil when the water recedes and sediments are laid bare. On converting into oil it travels upward due to low gravity and gets accumulated in pore space of pervious formations. Later on it migrates into the structural traps. This is known as Primary and Secondary migration of oil respectively. It is only in the marine rocks where the oil originates.

Thus it is clear that the Mesozoic and Tertiaries have been the times of the maximum development of both the animal and plant life, the chief source for oil formation. It means that bulk of organic material was dumped in the basin where oil generated later on.

As compared this to the West Pakistan region, the Mesozoics are not so fully developed. In West Pakistan, no doubt we get developments of Triassic, Jurassic and Cretaceous, but on a smaller scale. Moreover these formations are laid bare by the Geological forces. The Tertiaries are also developed in parts of West Pakistan, but they are also considerably small in magnitude as compared to the development of the same age formations in Middle Eastern countries. From these facts we conclude one thing that the part of the landmass now forming West Pakistan has remained under sea water for a shorter period as compared to its neighbour country Iran.

So this is one of the many reasons why oil is found in Iran and not in West Pakistan in the same quantity. I hope the readers will now be willing to get rid of the idea that if oil occurs in Iran it must also occur in West Pakistan.

Now, I come to other reasons and causes which explain the failures in the discovery of oil fields (new) in West Pakistan. The reasons are summarised as below.-

1. The Himalayan Orogeny.
2. The Igneous activity.
3. The erosion of mountain ranges and their deformation.
 - i. The escape of oil to the surface of the earth and its subsequent destruction.
 - ii. Migration of oil due to the incompetent traps.
4. Non application of other exploration methods based on theories other than Anticline theory.

Most of the causes mentioned above are more or less inter-connected with one-another and cannot be separated. One cause may be the after effect of the other.

I will try to explain each cause and try to make the reader to understand these as fully as possible.

The Himalayan Orogeny or the Alpine Mountain Building Movement occurred for the first time in Eocene at the beginning of Tertiary Era. Before this Movement the Tethys (The name of the ancient ocean which separated the earth into Northern and Southern hemispheres. It has now shrunk to a small size and is known as the Mediterranean Sea.) inundated the entire area which now forms the Himalayan Mountain Range and major parts of the rocky terrain of West Pakistan. The movement caused the retreat of the sea towards North-West and South-West. The area now forming the West Pakistan was the limits of the sea or the part of the continental shelf. Here the Tertiary rocks were deposited. These are mainly limestones which are highly fossiliferous. In former Sind and Baluchistan they attain a great thickness but are found to form the high ridges. This gives an idea about the severe movements they have undergone. They practically form all the high peaks in former provinces of Sind and Baluchistan.

This was a milder movement but continued ceaselessly with the result that the sea kept retreating towards Middle Eastern countries. From this it is perfectly clear that while areas in West Pakistan were gradually coming out of the sea and were being rendered incapable of receiving any sorts of sediments, Iran and other adjoining areas were still underwater and were receiving huge quantities of sediments presumably highly charged with organic

material. It was due to this accumulation of organic material that later on gave rise to oil.

As a result of this ceaseless uplift the areas now comprising West Pakistan, virtually came out of the Tety's Sea and during Oligocene Period most of the areas of West Pakistan remained out of the sea, consequently failing to record any Oligocene Rocks. Only limited exposures occur in former Sind. These Oligocenes of Sind were deposited in marine as well as estuarine conditions. On the contrary thick sedimentation occurred elsewhere, for instance in the Middle East. Oligocene formations have been found to be good oil producing horizon in most parts of the world.

In Miocene Period, the Himalayan Ranges saw one of the most violent mountain building cycle which is still going on, as evidenced by earthquakes. This was followed by the abundant igneous activity as occurred in Eocene Period.

These Mountain Buildings and the subsequent Igneous activity caused the extreme deformation of the earth crust and its metamorphism led to the complete obliteration and destruction of original structures. While old structures and patterns were destroyed, new ones were added in place of old ones.

Now it remains to be explained that what relationship this has got with the oil or petroleum occurrence in West Pakistan. I have somewhere mentioned in this article about the migration of oil and have also differentiated between the primary and secondary migration of oil. The Primary migration occurs during the consolidation, compaction and induration of sediments. While secondary migration occurs when the structural pattern is attained by the reservoir rocks. The oil gets itself accumulated when stable conditions are attained. The oil remains in this structure as long as the equilibrium is maintained and no further movements effecting the crust of the earth occur. During the early Tertiary Period Sedimentation occurred and rocks were formed on lithification of these sediments. During the first phase of Himalayan upheaval in Eocene Period must have migrated and accumulated at suitable places. But during the second phase of the Himalayan Orogeny in early Miocene must have migrated from the previous structures. This time the migration must have been a long distance one. The oil thus on migration must have accumulated in regions where ordinarily oil cannot be expected. Examples are met of occurrence of oil in highly fractured igneous and metamorphic rocks. Basically oil is explored on the basis of Anticlinal Theory. (Anticlines are the structures which result due to the arching up of sedimentary strata. Oil due to its light Sp. Gr. ascends up into apical regions and limbs of the anticlines, and stays there as long as an impervious rock layer prevents it from further movement.) The method of oil exploration based on the Anticlinal theory is comparatively easier and cheaper as compared to other ways of exploration. Thus it becomes clear that the oil no doubt occurs in the anticlines but not always. It may occur in surroundings and structure which are all together contrary to the normal occurrence of oil. To put short the oil migrated to long distances or must have destroyed during the Miocene mountain building movement. Most probably it may have escaped due to vertical migration and may have burned off. The igneous masses may have also added to this process of destruction.

In the case of W. Pakistan the Mesozoics & Tertiaries have been

extremely folded & faulted & intruded with igneous masses. Most of the older formation along with younger are found exposed to surface, this clearly gives the idea of the severe tectonic forces which operated & destroyed all the structural traps etc: etc:

In West Pakistan most of the formation belonging to younger Mesozoics and Tertiarys are deeply eroded and resurrected by streams. At places the erosion has went so deep as to lay bare the oldest of formations. This erosion must have eroded away the structures suitable for oil pool and even may have eroded the oil pool itself. It is also possible that due to erosion the oil pool were laid bare as a result of which the lighter hydrocarbons burned off and residue was left behind which was also taken away by the eroding agents. It seems to be true in most of the Mountainous terrain of West Pakistan, with the exception of the Potwar Plateau, situated in the north of the range along.

It appears, as Salt Range along with the Kirana Hills acted as a stable block and checked the tectonic forces. The Eocene formation in the region were thus folded into a huge Synclorium fringed on the south-east by the Salt Range and Kirana Hills and on the north west by the pre-Cambrian Dogra slates and Granitoid gniesses. This Synclorium was subsequently burried under the Miocene, Pliocene and Plietocene deposits. Thus it escaped the same fate, which the other Tertiary formations suffered in other regions of West Pakistan. From this fact it seems most apparent that oil fields existed in West Pakistan before Miocene Period, but were destroyed by structural movements, and if they sustained this they were eroded away.

Now I will take the last point--"The Methods Of Exploration For Oil In West Pakistan".

Till present, exploration for oil has been done on the basis of the Anticlinal Theory. In West Pakistan all the producing oil fields are located in anticlines. The oil fields in Potwar Plateau are the best examples. The Eocenes at the basement of the Potwar Plateau have been folded into a huge synclorium-- comprising of a number of smaller anticlines. But there are instances of the occurrence of oil fields in structures other then the anticlines. For example in Stratigraphic traps formed by the various varieties of Unconformities or due to the facies changes like the Presence of Sandstone Lenses in limestones or shales, Organic Reefs, and the Combination Traps like Salt Domes.

These types of traps can be located by a thorough Geological study of the exposed areas and the compilation of Sub-Surface Geological maps on the bases of data and informations collected by the various Sub-Surface Geological Methods. The subsurface geolgical data so far collected during the drilling of so many dry holes can of immense help towards such a step.

Lastly a few words about the occurrence of oil in Potwar Area. It is already mentioned that the Eocene Rocks in the Potwar Region were folded into a large basin - a synclorium in general. This probably formed in the early Oligocene to Miocene period recieved tremendous deposits which were being constantly supplied to it by Denudation of rising Himalayas. The deposits subsequently covered and burried the

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the synclinerium formations and thus the Eocenes at the basement were saved from Erosion and the oil which generated in these formations or in older formations accumulated into scattered pools, mostly in the fractured limestones. (Dr. E. R. Gee is of firm opinion that it is the Laki Formation where oil has originated and accumulated.) It is mostly these limestones which are the producing horizon in the Potwar Plateau or the Attock Oil Fields.

From the above it is clear that only the Potwar Area is the place where we should look for oil in major quantity. Even the Russian Geologist who have entered the contract for oil exploration in Pakistan have paid much attention to this area. The first Oil and Gas Development Corporation's well was spudded in the Fathejang area. The results are still not known officially.

The other areas where the oil should be found are the off.shore areas of both East and West Pakistan. Serious attention should be paid to these areas in order to open new avenues for oil field discoveries. Other areas which are of importance are the Kohat and Bannu Basin areas. The suitable structures and conditions occur in these areas. The Tertiaries are also developed in greater magnitudes. While one moves from Kohat side towards Bannu Laki and Kirthar Formations, Murrees and Siwaliks are met in great thicknesses. Particularly the Bannu Basin is fully composed of Siwaliks. On either sides Eocene formations are also exposed. It is possible that here the conditions were simmilar to the conditions which Prevailed during the formation of Potwar Plateau, or the Bannu Basin area is the continuation of the Potwar Plateau.

Lastly a few very deep holes should be tried to examine the possibility of finding oil in older rocks other than Tertiaries. One such effort by Shell Oil Co, resulted in failure. They drilled for about 12,200 feet and reached the Jurassics (LIMESTONE) at Giandari near Kashmir. The surveys have revealed that highly Fractured limestone was present at such depth. No doubt they reached the highly fractured Lst., but instead of oil they only discovered superheated saline water ladden with sulphurated gas. However, a few more such holes will reveal whether oil occurs at greater depths in formations other than Tertiaries.

With this I conclude and hope that readers will not decieve themselves that large oil fields can be found in West Pakistan. The Geological facts are totally against this conception. This limits the occurrence of Petroleum in West Pakistan in a smaller area. To be more realistic I would say that out of hundred chances eighty are against the large scale discovery of oil in Pakistan, Particularly West Pakistan.

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