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Abstract

Hydrocarbon traps from when reservoirs receive a charge from hydrocarbons migrating from a source rock at a time when effective seals and trap geometries are in place. Exploration that focuses on traps along a migration route is termed conventional exploration. Conventional exploration deals with understanding secondary migration. In the last 20 years, there has been an increasing focus on unconventional exploration, which focuses on the hydrocarbons remaining in the source. Here we will focus on the traps, its types and the causes that formed these traps.

The earliest concept of a trap was made by William Logan in 1844 when he noted the occurrence of oil on anticlines. I.C. White took Logan's anticlinal trap concept and applied it to search for oil and gas in 1855. Since then, models and applications of trap concepts have evolved as new trap types have been discovered.

Traps are usually classified according to the mechanism that produces the hydrocarbon accumulation. The two main groups of traps are those that are formed by structural deformation of rocks (structural traps), and those that are related to depositional or diagenetic features in the sedimentary sequence (stratigraphic traps) Many traps result from both of these factors (strati-structural or combination traps). A common example is stratigraphic pinch-out (e.g., a sandstone lens wedging into mudstone) that is combined with tectonic tilting (which allows hydrocarbons to pond in the updip part of the sandstone wedge). Other traps result mainly from fracturing (which creates the reservoir porosity) or hydrodynamic processes.

CHAPTER I

Introduction

The trap is the element that holds the oil and gas in place in a pool. Most geologists think of the trap as the shape of reservoir rock element that permits a petroleum pool to accumulate under-ground.

Rocks trap are formed from a wide variety of combinations of structural and stratigraphic features of the reservoir rocks. A trap generally consist of an impervious cover the roof rock overlying and sealing a porous and permeable rock that contain 3 the oil and gas . The upper boundary as viewed from below is concave; the top is generally arched, but it may form an angle or peak. In practice the term" trap" usually means any combination of rock structure and of permeable and impermeable rocks that will keep oil and gas from escaping , either vertically or laterally , because of differences in pressure or in specific gravity. Some petroleum reservoirs completely fill the trap, so that if any additional oil or gas were added it would spill out around the lower edge. Other reservoirs occupy merely a part of the apparent capacity of the trap.

The lower boundary of the reservoir is, either wholly or partly, the plane of contact of the oil and gas with the underlying body of water upon which the pool rests. It is known as oil- water contact or oil- water table. The water fills all of the pore space of the reservoir rock below the oil—water contact, and that portion of the reservoir pore space that is not filled with oil and gas. If the water is at rest, the contact plane is level or approximately level. But, if the water is in motion, because of a hydrodynamic fluid potential gradient parallel to the bedding and across the pool, the lower boundary of the reservoir may be an inclined plane, and the pool is said to have an inclined or titled oil-water table.

Occasionally the tilt of the oil-water table is enough to flush the oil and gas Out of a potential trap, in which case the trap is not effective, and there is neither reservoir nor poor

Hydrocarbons may be trapped in many different ways. Several schemes have been drawn up to attempt to classify traps (Hobson and Tirastoo, 1975). Two Major genetic groups of trap have been agreed upon: upon structure and stratigraphic. A third group, combination traps, is caused by a combination of processes. Agreement breaks down, however, when attempts are made to subdivide these groups. Table .1 presents a classification of hydrocarbon traps.

Structural traps are those traps whose geometry was formed by tectonic processes after the deposition of the beds involved. According to (Levorsen ,Al.,1966), a structural trap is" one whose upper boundary has been made concave, as viewed from below, by some local deformation, such as folding, or faulting or, both of the reservoir rock. The edges of a pool occurring in a structural trap are determined wholly, or in part, by the intersection of the underlying water table with the roof rock overlying the deformed reservoir rocks". Basically, therefore, structural traps are caused by folding and faulting.

A second group of traps is caused by diapirs, where salt or mud have moved upward and domed the overlying strata, causing many individual types of trap. Arguably, diapirie traps are a variety of structural traps, but since they are caused by local lithostatic movement, not regional tectonic forces, they should perhaps be differentiated.

Stratigraphic traps are those traps whose geometry is formed by changes in lithology. The lithological variations may be depositional (e.g., channels, reefs, and bars) or post depositional (e.g., truncation and diagentic changes).

Hydrodynamic traps occur where the downward movement of water prevents the upward movement of oil without normal structure or stratigraphic closure. Such traps are rare. The final group, combination traps, is formed by a combination of two or more of the previously defined genetic processes.

CHAPTER II

Structural traps

Structural traps are formed by a deformation in the rock layer that contains the hydrocarbons. Domes, anticlines, and folds are common structures. Fault-related features also may be classified as structural traps if Closure is present. Structural traps are the easiest to locate by surface and subsurface geological and geophysical studies. They are the most numerous among traps and have received a greater amount of attention in the search for oil than all other types of traps. An example of this kind of trap starts when salt is deposited by shallow. Seas, Later, a sinking seafloor deposits organic-rich shale over the salt, which is in turn covered with layers of sandstone and shale. Deeply buried salt tends to rise unevenly in swells or salt domes» and any Oil generated within the sediments is Trappe where the sandstones are pushed up over or adjacent to the salt.

2.1. Traps formed by compressive tectonic processes:

Compressive tectonic regimes commonly lead to the development of large scale constractional folds and thrust such contraction most common at convergent plate boundaries and transpressional strike-slip plate boundaries. Compressional folds from the trap geometries for large part of the world's most important petroleum provinces the Middle East.

2.2. Traps formed by extensional tectonic processes:

Traps formed by the extensional tectonics are very common in the rift basins. Structural features generated by the gravity effects will be examined in following section. Traps formed through tectonic extension are important in Gulf of Suez, the Haltenbanken area, offshore mid—Norway (Spender&Eldholm, 1993).

2.3. Traps formed by diapiric processes:

The specific gravity of salt is about 2.2gcm-3. In consequence, salt is buoyant relative to the most other sediment and sedimentary rocks. Over geologic timescales, salt is also able to deforms plastically. The onset of salt movement may be caused by a variety of initial condition. Clearly diapiric movement of both salt and mud can create anticlinal structures that could form petroleum traps (Gluyas and Swarbrik, 2004) However the opportunities for traps formation in association with the salt or mud movement are much more diverse than simple domal anticline formation (Fig.2).

2.4. Traps formed by compactional processes:

Differential compaction across basement highs, titled fault blocks, carbonate shelf rims, reef or isolated sand bodies in mud can lead to the development of relatively simple anticlinal traps.

2.5. Traps formed by gravity processes:

Traps formed by gravity driven processes are particularly important in large recent deltas. The gravity structures form independently of basement tectonics (either extension or compression). They owe their existence to shallow detachment along a low angle, basin ward-dipping plane. The drive mechanism is provided by the weight of sediment deposited by the delta shelf slop break or on the slop itself.

Many producing anticlines are faulted according to the stress patterns that formed them. Most anticlines are associated with some types of faulting in their Deformational histories, whether they are normal or thrust fault related faulted anticlines are usually asymmetrical .

Over thrust anticlines produce abundantly from fields in over thrust belt Provinces.

In some cases, producing beds in over thrust anticlines are thrust against source beds of different ages not normally associated with the reservoirs. Over thrust anticlines are normally asymmetrical and complexly faulted. Typical over thrust belts do not significantly involve crystalline basement rock in potentially productive structure. However compressive foreland blocks detach the crystalline basement and often thrust it over prospective sediment.

Faulting and tilting of crustal produces a variety of trapping mechanisms. A single fault can provide a seal to prevent petroleum migration. Multiply faulted blocks create traps which are often connected, but can conversely be entirely independent of each other. Petroleum production usually comes from the fault-sealed up thrown block. Enough petroleum comes from downthrown blocks to consider them important exploration objectives.

Simple fault traps involve up-dip Closure of a reservoir bed against a sealing fault. A plunging anticline faulted up-plunge is good example of a trap involving partial closure. Where a reservoir is multiply faulted, a complex fault trap occurs. Multiply faulted anticlines form complex fault traps.

Sub thrust traps occur in over thrust belt where the deformed reservoir forms a trap below a thrust fault. Some sub thrust traps are complexly faulted, and others are quite simple and relatively un-deformed.

Salt structure formation can produce several different types of traps described by varying deformational intensities. Most salt structures are faulted in response to the degree of deformation. Traps related to salt deformation do not usually produce from the salt itself. They produce from beds deformed by the salt tectonic instead.

Salt dome traps are important in several areas of the world. The traps of many types have produced hydrocarbons from Tertiary sediment deformed by salt dome activity (Link, p.k., 1987).

2.6. Models of structural traps:

2.6. 1. Crests 0f titled blocks (Fig. 3a)

These are the most common traps in the gulf and they definitely contain the largest known oil accumulations. Reservoirs are located either in the pre-rift series (Nubia, Cretaceous, and Eocene) or in the Lower Miocene (Nukhul, Rudeis).The seals are the Globigerina marls or the evaporites.

Importance of secondary crests: the culmination of titled blocks is in fact very often eroded, frequently down —to-the basement, whilst secondary, more deeply buried crest, located on the homocline flank, generally have had their reservoir preserved from erosion and the likelihood of finding a sealed trap could be higher (Fig.3b)

To this kind of structural trap related to the crest of titled blocks, should be added horst-like features corresponding to crests of block limited on their titled flank (homocline flank) by synthetic faults (F ig.3c'). (EGPC&Beicip, 1988).

2.6. 2. Down -faulted wedges (Fig.4b)

These are down —faulted compartments bounding major longitudinal faults. Trapping possibilities in the pre-rift or lower Miocene series are controlled by the dip of the strata; should the dips be opposite to the fault, the down –faulted block may be a good trap. Conversely, if the dip of the strata and the fault are in same direction, the sealing properties of the fault will determine the trap. 1n general, this sealing quality is poor because of the nearly continuous activity of the clysmic fault form the beginning of the Miocene to the present time. The structural complexity of these traps is due to dip—slip gliding along the fault scarp. These subtle trapping mechanisms are exemplified in the surface geology although no oil pools have been reported producing from them in the Gulf. However, their exploration is difficult due to the quality of seismic at depth.

2.6.3. Hanging wall of synthetic faults (Fig.4c)

This is another possible model of structural trap present the Gulf but where no hydrocarbon accumulations have yet been discovered. This kind 0f trap forms in down- faulted compartment along the homocline flank of titled blocks .The trapping mechanism is a function of the throw of the normal synthetic fault; it has to be sufficient to completely offset reservoirs across the fault located in favourable position relative to hydrocarbon migration from the deepest part of the half-grabens . Such traps cold contain huge accumulations and should be a target in future rounds of exploration.

2.6. 4. Draping over- fault boundaries (Fig.53)

Such features, created by the differential sediment compaction over the crests of blocks are common in the syn- rift formations; flanks are steeper at depth and the structure usually dies out in the younger sediments. Symmetrical anticlines are less common than asymmetrical ones overlying a faulted high with hinge- line or associated flexure. Several examples of such traps can be documented (e.g. Belayim fields).

2.6.5. Twist zones (Fig. 5b)

The twist zones are defined as flat lying areas (saddles) between two graben or two horst feature. They are not properly structural traps but could have trapping possibilities when combined with stratigraphic pinch outs or transverse faults. Such subtle traps have to be carefully explored in the Zaffarana-Abu Zenima area in South Ramadan area (for example the South Ramadan field).

2.6.6. Roll-over folds (fig. 5c)

These traps are created by dip—slip of the hanging wall of major clysmic faults along the fault scrap. Numerous examples can be recognized in the Gulf of Suez, but they are generally deep prospects, and Miocene reservoirs are unlikely to be present. This kind of structure should not be confused with the rollover folds related to evaporites disharmonies (EGPC, 1996).

2.7. Hydrodynamic Traps

In these traps hydrodynamic movement of water is essential to prevent the upward movement of oil or gas. The concept was first formulated by (Hubbert,M.K.,l953) and embellished by (Leversen ,A.I.,1966).The basic argument is that oil or gas will generally move upward along permeable carrier beds to the earth‘s surface except where they encounter a permeability barrier, structural or stratigraphic, beneath which they may be tapped.

Where water is moving hydro dynamically down permeable beds, it may encounter upward-moving oil. When the hydrodynamic force of the water is greater than the force due to the buoyancy of the oil droplets, the oil will be restrained from upward movement and will trapped within the bed without any permeability barrier.

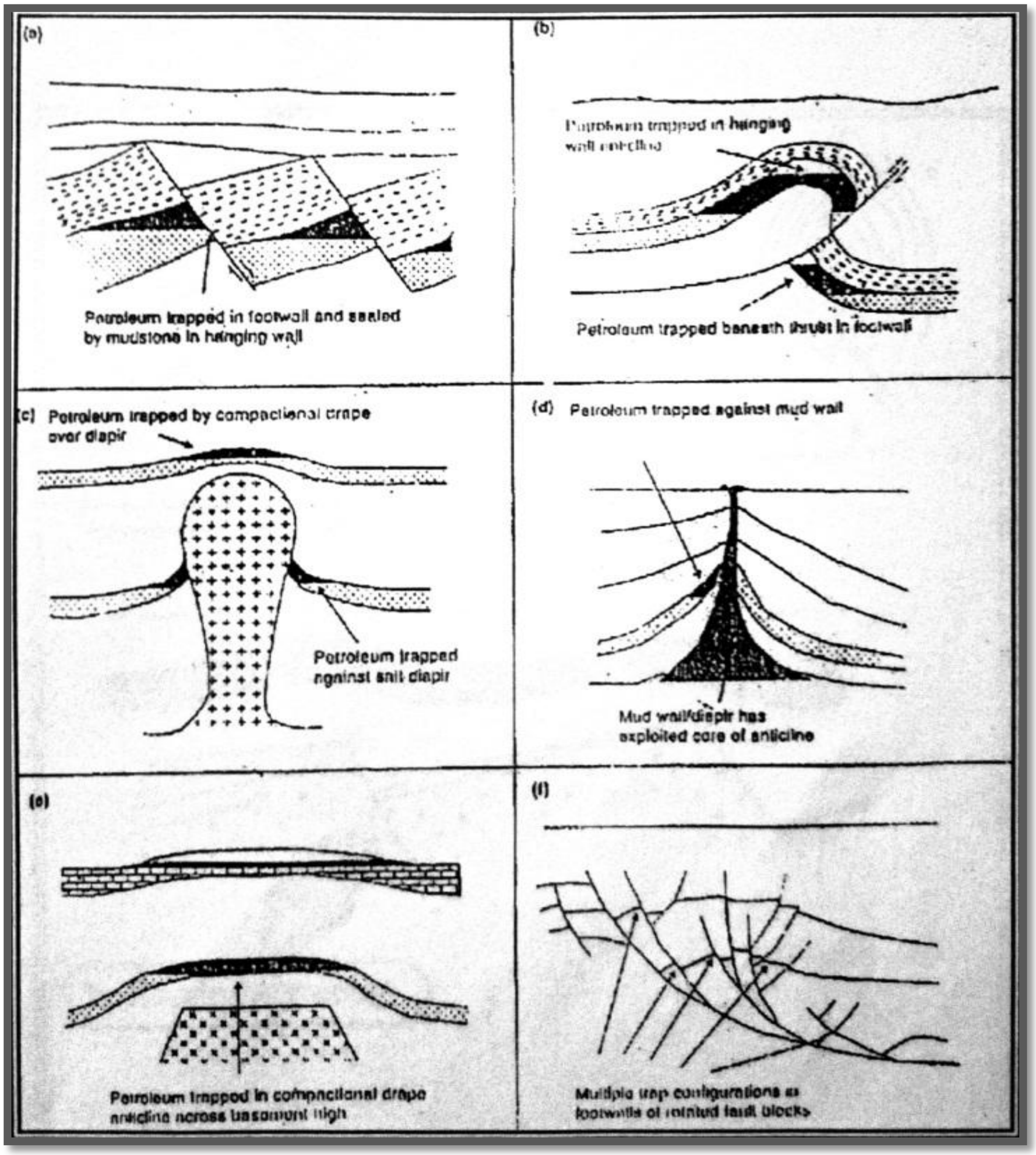


Fig (2) Structural traps. (a) Titled fault blocks in an extensional region. (b) A rollover anticline on a thrust. (c) The lateral seal of a trap against a salt diaper and a compositional drape trap over the diaper crest. (d) A trap associated with diaperic mudstone, with a lateral seal against the mud-wall. (e) A compactional drape over a basement block commonly creates enormous low relief traps. (f) Gravity generated trapping commonly occurs in deltaic sequences.

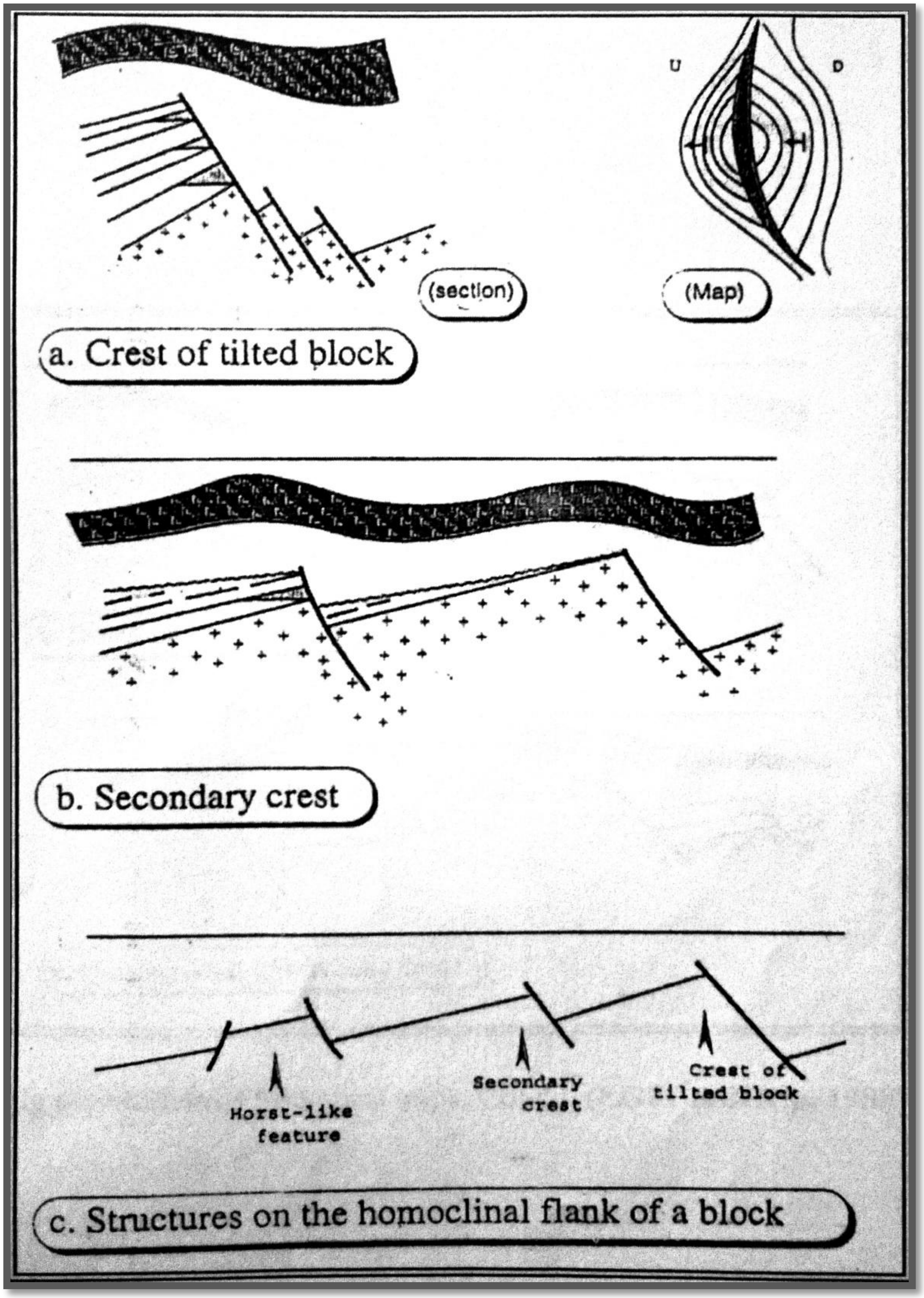


Fig (3) models of structural traps **(EGPC & BEICIP,1988)**

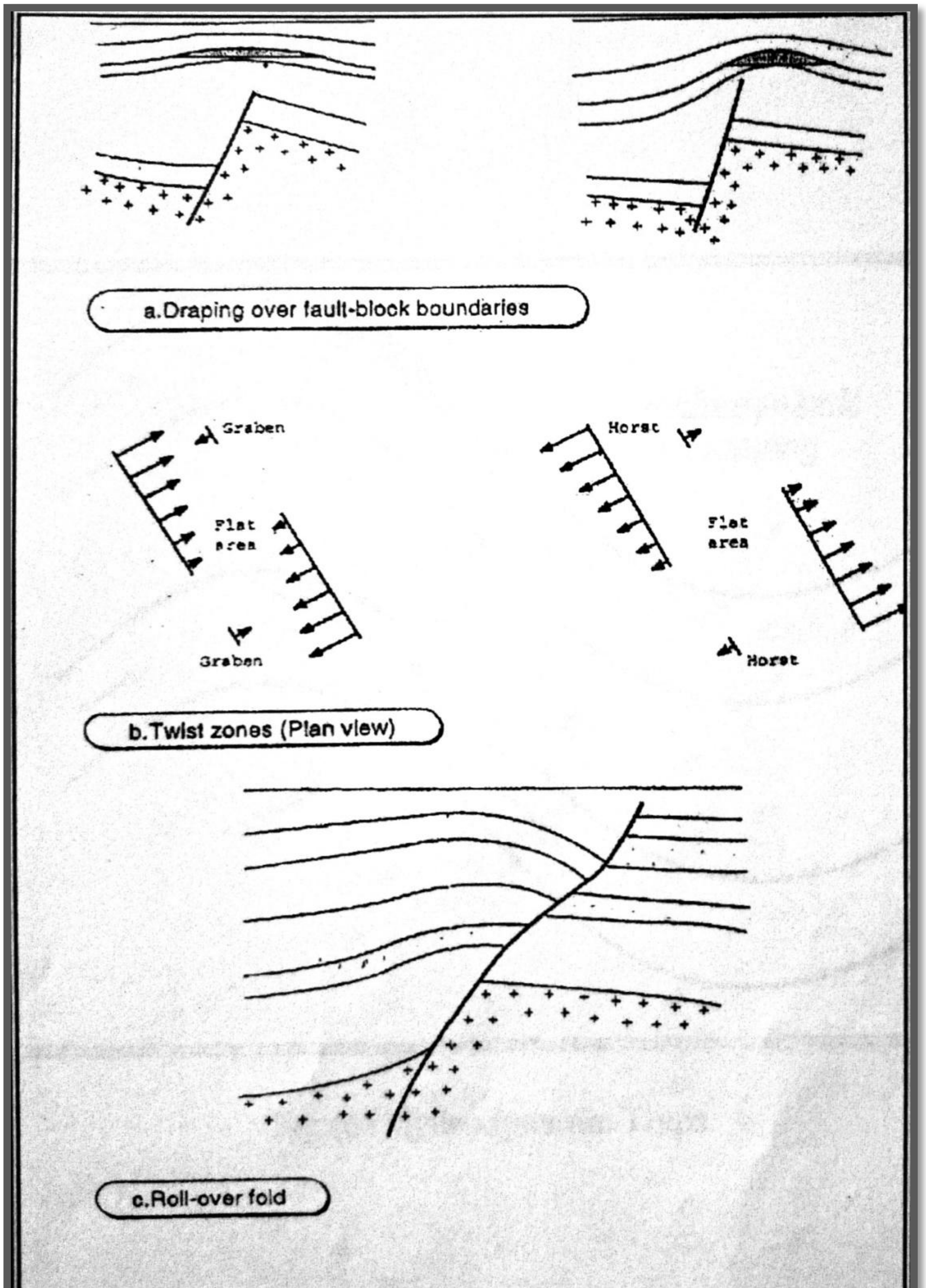


Fig (4) models of structural traps, cont'd **(EGPC & BEICIP, 1988)**

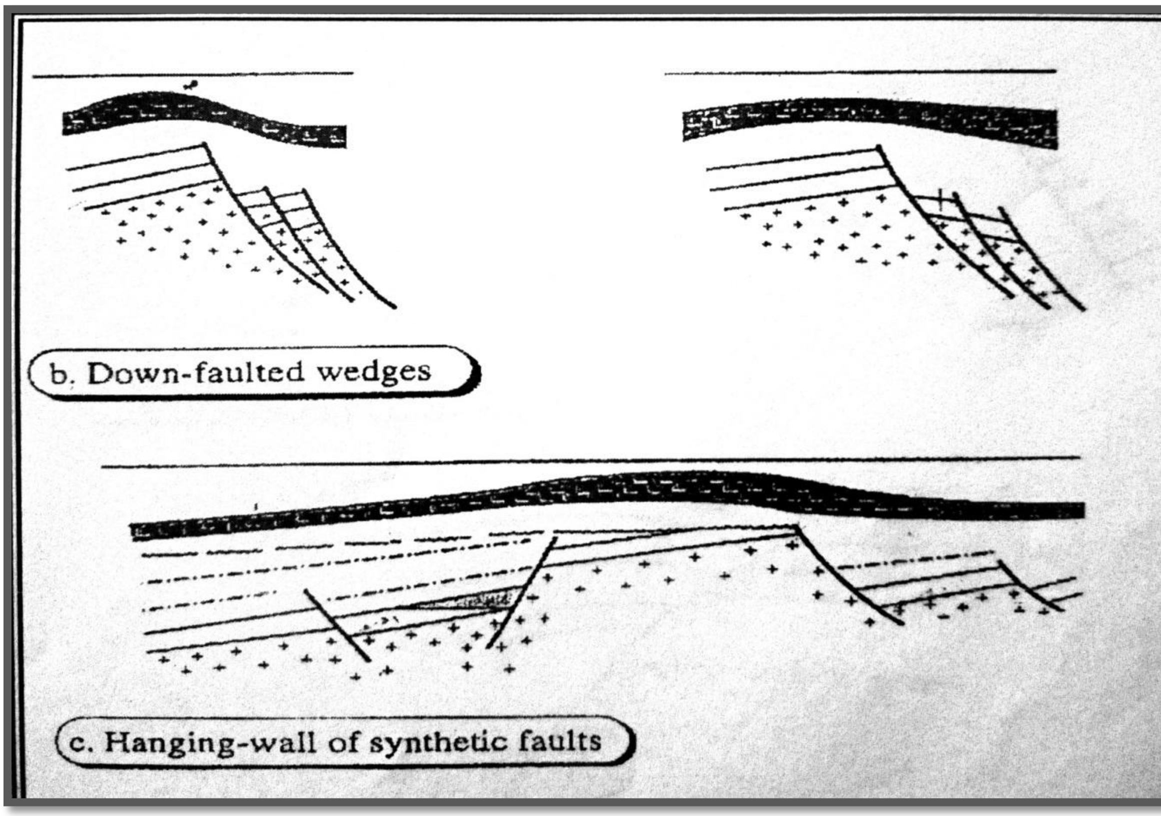


Fig (5) models of structural traps, cont'd **(EGPC & BEICIP, 1988)**

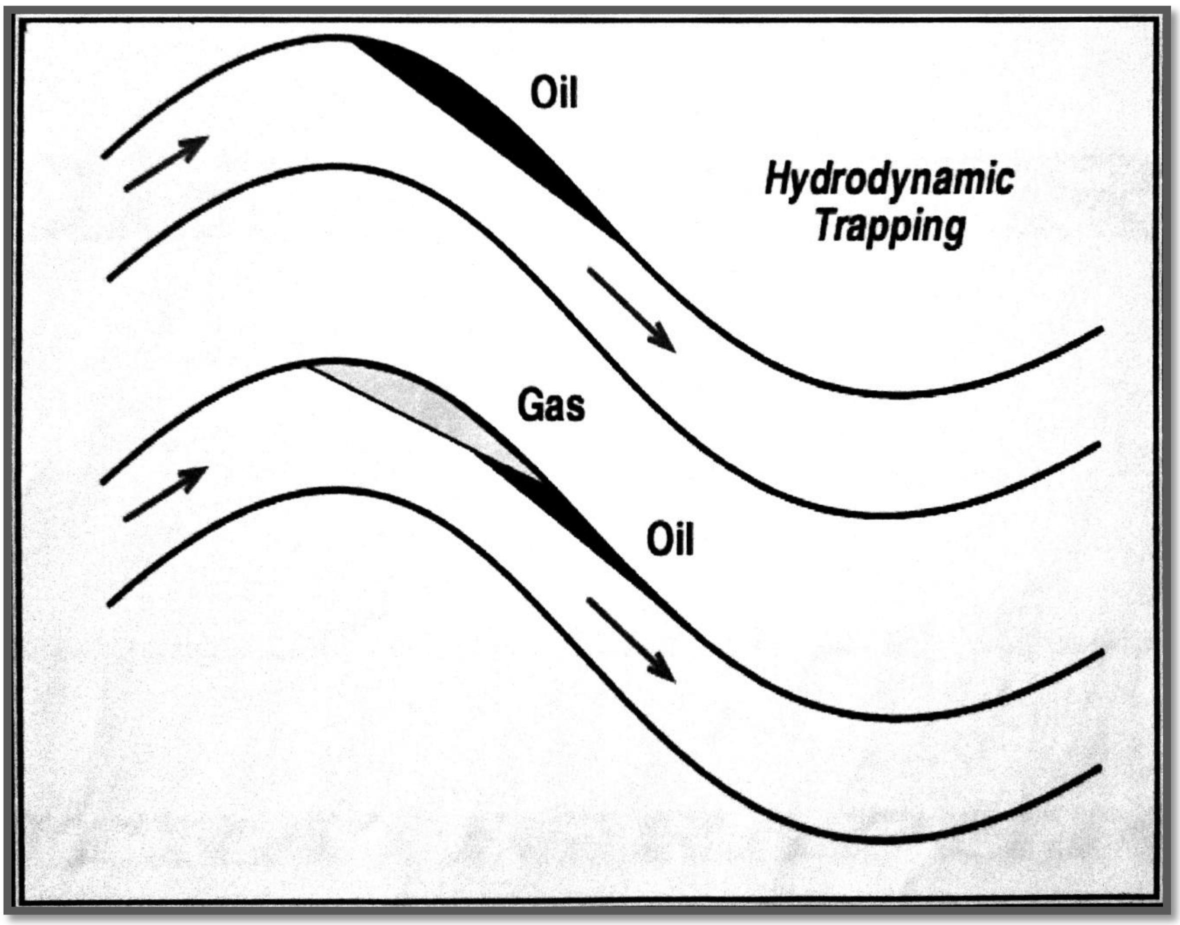


Fig (6) Hydrodynamic traps

CHAPTER III

Stratigraphic Traps

Stratigraphic traps are traps that result when the reservoir bed is sealed by other beds or by a change in porosity or permeability within the reservoir bed itself. There are many different kinds of stratigraphic traps. In one type, a tilted or inclined layer of petroleum—bearing rock is cutoff or truncated by an essentially horizontal, impermeable rock layer. Or sometimes a petroleum-bearing formation pinches out; that is, the formation is gradually cut off by an overlying layer. Another stratigraphic trap occurs when a porous and permeable reservoir bed is surrounded by impermeable rock. Still another type occurs when there is a change in porosity and permeability in the reservoir itself. The upper reaches of the reservoir may be impermeable and nonporous, while the lower part is permeable and porous and contains hydrocarbons.

There are two main groups of the stratigraphic traps:

Primary stratigraphic trapsresult from variations in facies that developed during sedimentation. These include features such as lenses, pinch-outs, and appropriate facies changes.

Secondary stratigraphic trapsresult from variations that developed after sedimentation, mainly because of diagenesis. These include variations due to porosity enhancement by dissolution or loss by cementation.

Sand Body traps. Inasmuch as there are numerous types of finite sand bodies, many different trap types are possible. Some trap types are modifications of each other because of changes in depositional environments .However; there are several well-defined types of sand bodies that form traps in many places. Channel sands form traps enclosed in shale in many locations in the mid-continent and rocky Mountain.

These deposits have limited lateral extent but may persist linearly for several miles of production. Delta reservoir traps consist mainly of channels enclosed by floodplain and swamp deposits. Traps of this type are well -developed in the Gulf coast. Delta deposits are common on divergent continental margins where rapid sediment progradation occurs.

Beach or barrier bar trap are relatively narrow linear deposits that become traps when enclosed by shale. These occur in the geologic column of the gulf coast where they are being formed under present condition as well. Changes in porosity and permeability can be caused by variety of depositional and diagenetic factors. Sand stone loses its permeability as it grades laterally into shale. Finely crystalline limestone becomes significantly more permeable when dolomized.

A trap often develops where sand loses permeability or pinches out entirely whether by non- depositional or erosion. Traps in dolomite are often sealed by Up-dip contact with impermeable limestone. Wherever the permeability of reservoir rock of any lithology becomes reduced up dip, the possibility of trap is manifest. This can occur as a result of changes in facies, erosion, or non - deposition.

3.1. Traps formed by depositional pinchout

From the trap to the bottom of a system tract, each depositional environment is capable of producing a juxtaposition of permeable and impermeable sediments which might one day form a stratigraphic trap for petroleum. In practice, the reservoir geometry becomes the trap geometry. Examples include aeolian dunes encased in lacustrine mudstone, sand- filled fluvial channels cut into mud rich over bank deposits, shallow marine bar sandstones surrounded by marine shales, carbonate reefs isolated by inclosing marls, and Submarine-fan sands trapped within the domain of pelagic mud (Fjg.7).

3.2. Traps formed by unconformities

Attenuation of the up dip portions of potential reservoir interval by an unconformity can create truly massive traps with enormous petroleum catchments areas. Most of the unconformity traps described above depends on a combination of trapping mechanisms, which rely in large part on a planar or gently folded unconformity. Unconformities do of course in a variety of the shapes (fig8, 9).

3.3. Traps formed by digenetic processes:-

Mineral precipitation tends to reduce reservoir quality. In exceptional circumstances, porosity impairment may be so severe that it is destroyed completely. Such tight rocks act as seals and trap petroleum. Mineral cements are known to form top, lateral, and even bottom seals to reservoirs. Examples in carbonate systems are more numerous than those in elastic systems.

3.4. Models of stratigraphic traps :-(fig.10)

3.4. 1. Truncation below unconformity:-

Numerous examples of truncation traps are recognized in the Gulf, in pre- rift strata (Nubia sandstone, cretaceous, or Eocene limestones cut by the basal rift unconformity) or Miocene sediment (Rudeis sandstones cut by intra-Miocene unconformities). Examples are shown in the RasGhan'b and July Fields.

3.4. 2. On-lap pinch-out

This mainly occurs where the Nukhul sandstones are overlain by the transgressive Globigerina shales, on the flanks of titled blocks. Examples are Abu Rudies, Ekma, and Ras Bakr. 1 ‘

3.4.3. Up-dip pinch-out of sand lenses:-

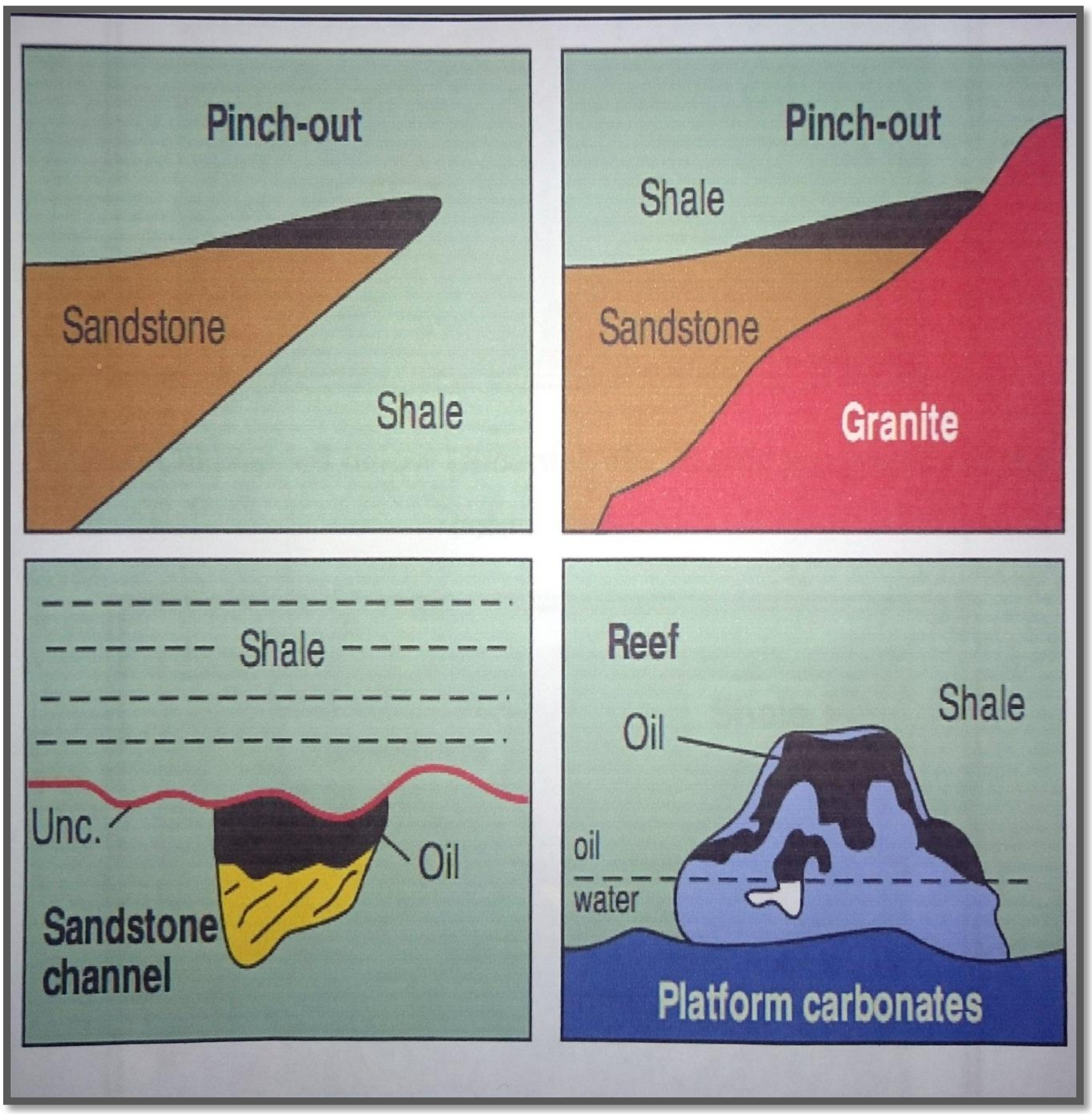
They are common in the sand bodies developed mainly in the lower Miocene Kareem and Rudies formation (Umm El Yusr and El Ayun fields for example). It is noteworthy that such sand bodies are generally developed at their best on the flanks rather than the crests of blocks.

3.4.4. Reefal buildups over block crests:-

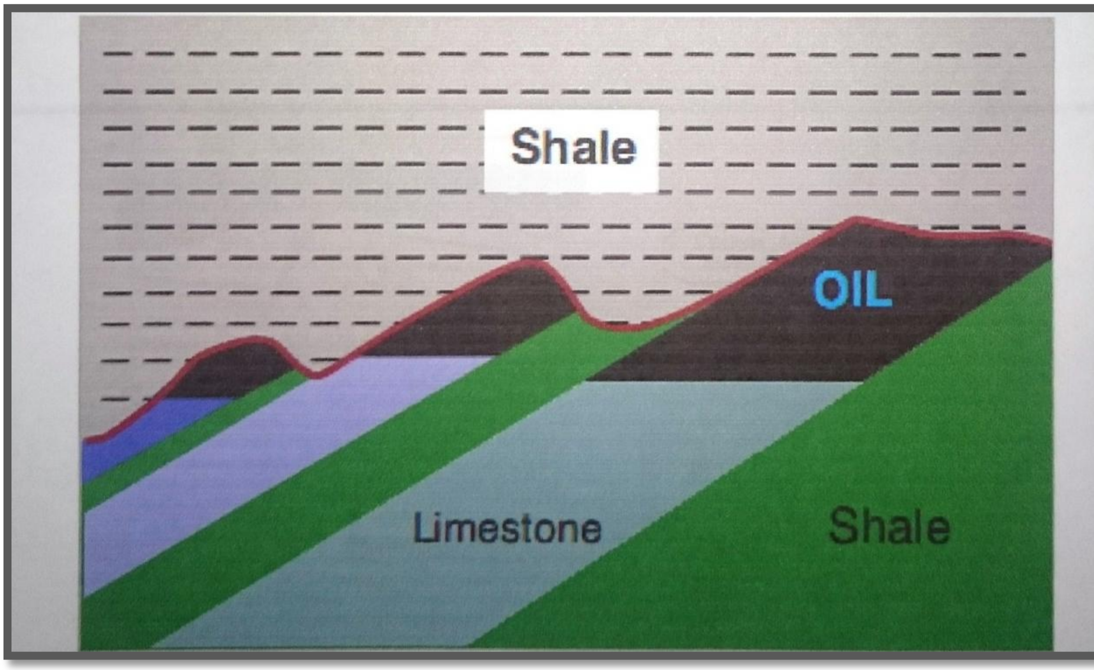
Carbonate reefs grew on the crests of some blocks that remained high during Miocene deposition. They generally have good petrophysical properties related to secondary diagenesis such as dolomitization, and fracturing. Examples are the Res Gharib, Gemsa and Ras Bakr fields.

3.4.5. Weathered and fractured basement:-

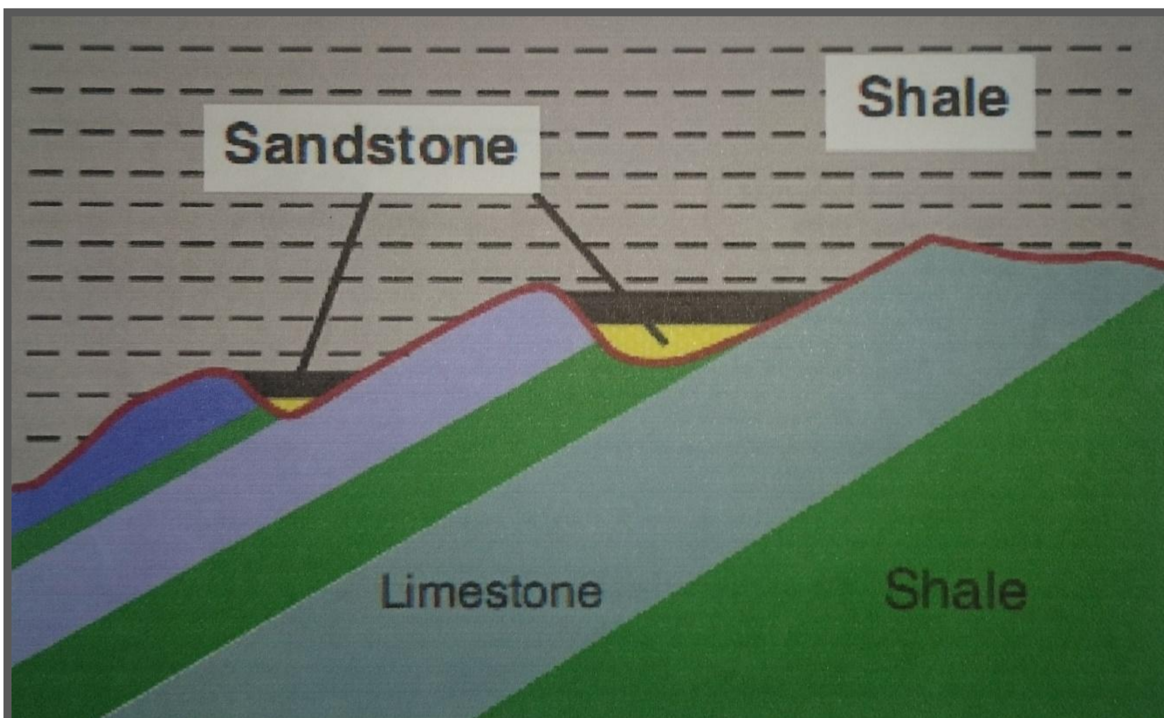
Some block crests were exposed to erosion during the first phases of rifting facilitating weathering and fracturing of the basement. These rocks may contain oil accumulations such as Shoab Ali, Zeit Bay and Hurghada fields.



Fig(7) Examples of stratigraphic traps



Fig(8) oil trapped below unconformity in pale geographic highs below shale.



Fig(9) oil trapped above unconformity in pale geographic lows formed by porous channels sand.

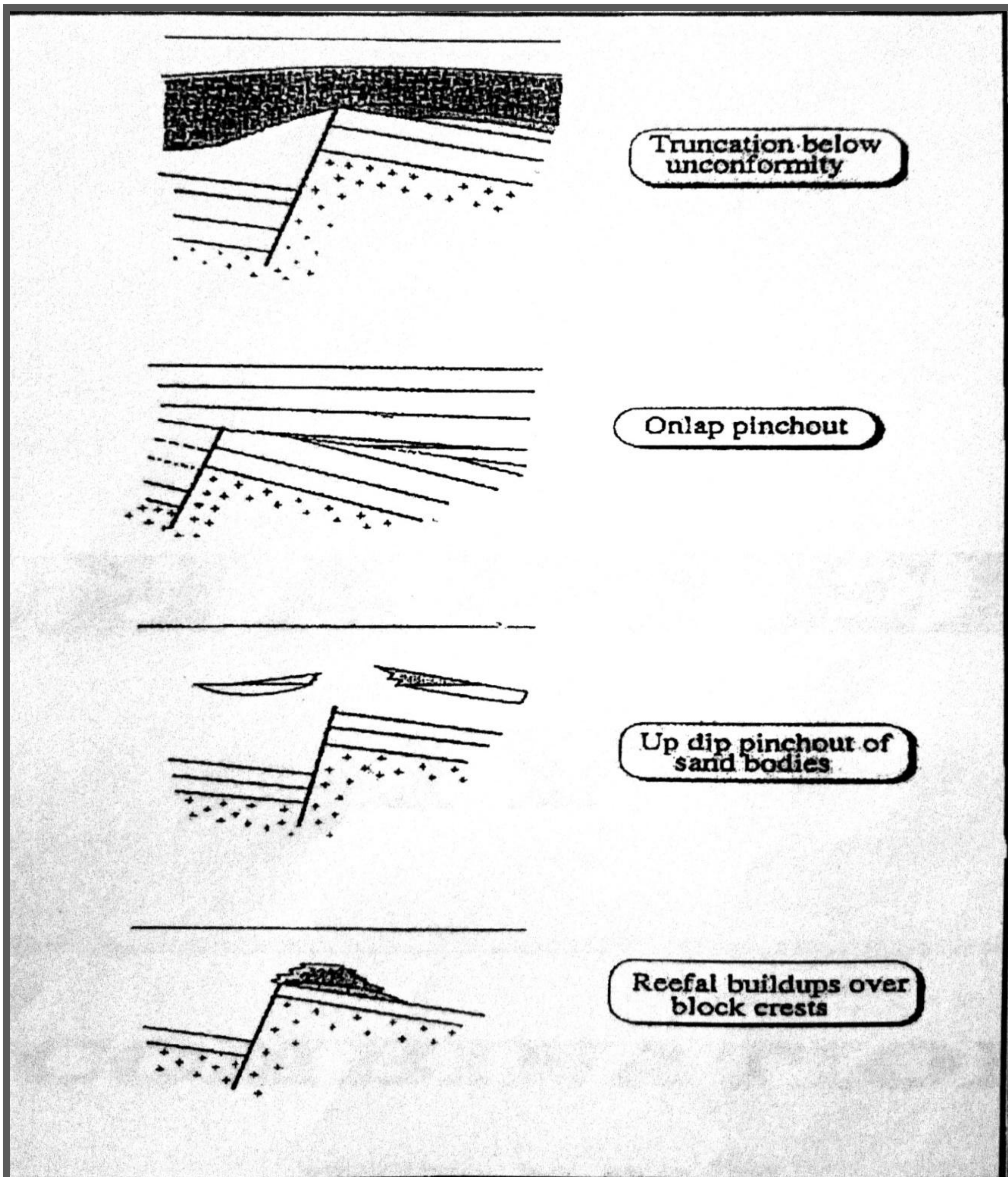


Fig (10) models of stratigraphic traps (EGPC, BEICIP, 1988)

CHAPTER IV

Combination Traps

These traps show the combined effect of structural and stratigraphical elements, neither element alone forms a trap but both are essential to it.

A combination trap generally has a two stage history:-

1-Stratigraphic element,often formed early and caused by edge permeability of the reservoir rock. The stratigraphic element may be lateral variation, truncation, weding out, unconformable overlap.

2-Structure element,nearly formed after and caused the deformation that completes the trap. The structure element may be any kind of folding &faulting (fig.11).

In this type of traps, the stratigraphic elements act before the structural elements. In some other cases the two are formed contemporaneously. In such cases the operating tectonic events may act as the controlling factor for each trap.

Traps are of the combined stratigraphic structural type, consisting mainly of , fault anticlinical features induced by generally vertical basement movement, due to periodic rejuvenation of these horst-type structures, unconformities and gaps, I on lapping wedges and erosional pinch-out are frequently associated with the culminating areas and form multiple stratigraphic traps.

The geometry of a channel deposit is linear. It can trap hydrocarbon laterally as it shales out into the associated floodplain. However, in the absence of a trapping mechanism the channel deposits can become a trap if faulted across its longitudinal dimension.

Folding a beach deposits will develop a trap in the same way as faulting achannel. The intrinsic limiting dimensions of beach provide trapping in one direction. Folding the beach sand provides trapping in another dimension and effectively closes the features.

Elimination of up-dip porosity by formation of asphalt where an oil bearing bed crops out can form an asphalt seal trap. Tilting of the oil bearing bed causes the oil to migrate up—dip to the outcrop where it is chemically altered to form the asphalt seal.

So far, the traps delineated by enough wells have found to be combination traps in which the stratigraphic element plays a major role. This is established by the lenticular nature of the sands &shales in many of the discoveries so far made, whether commercial or not yet proven commercial. At the same time, the finds are confined within structures which owe their presence to earth movement. For example, the Abu Madi field is a low relief dome, with faulting to form blocks.

Within one and the same structure, the stratigraphical trap- forming element is rather prominent.

The oil field of the Gulf of Suez generally exhibits a great variety of structural 'feature and structural—strati graphic traps. Purely stratigraphic or purely structural traps are nowhere the rule due to the close relationship between the structural evolution and deposition of sediments in the rift sub basins.(EGPC, 1996).

In the Northern Western desert there are many combination traps involving faulted unconformity surface which dissected the stratigraphic sequences. Also the structural traps are predominant in the North Western desert in the form of titled fault blocks. (Abd El Rehlm S.M., 1994).

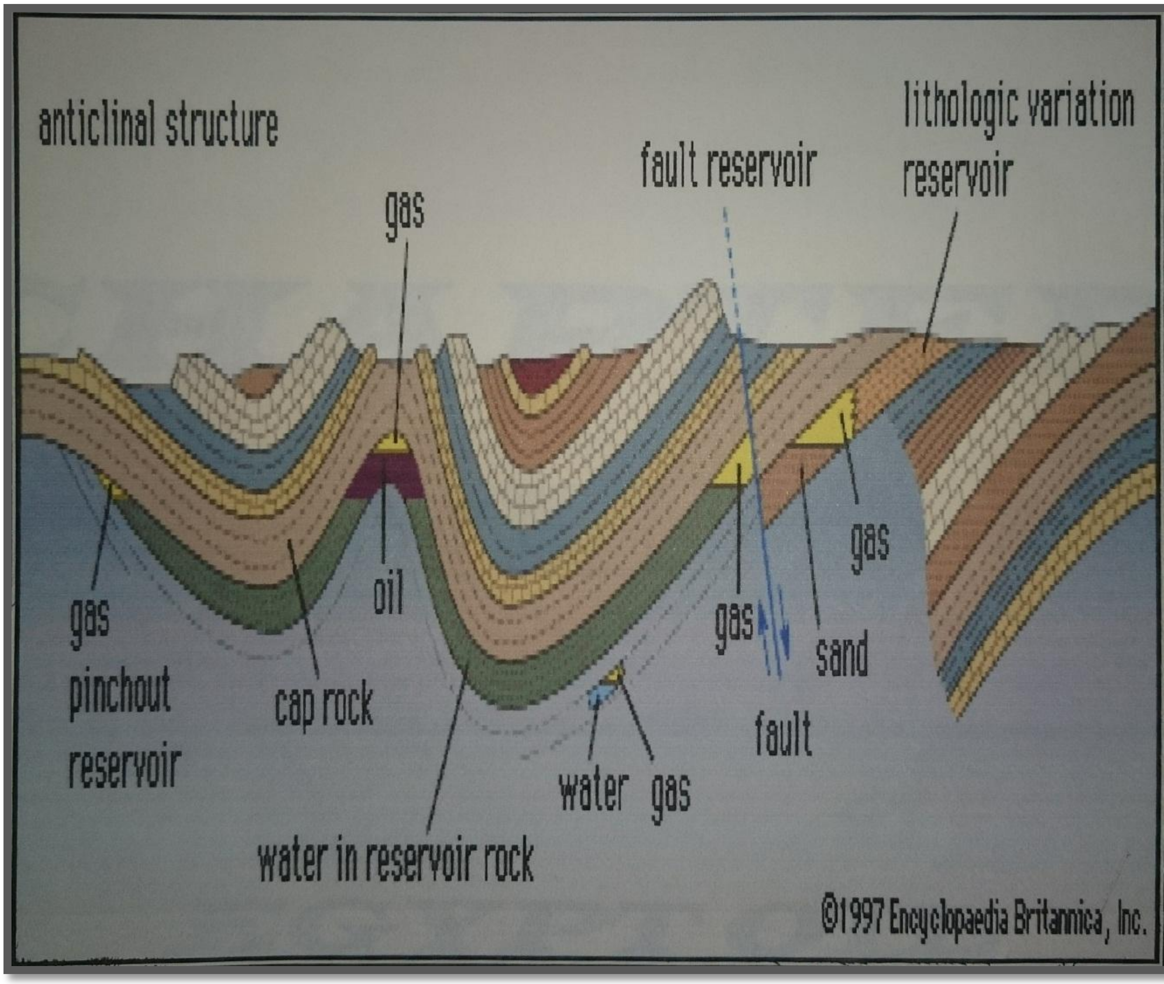


Fig (11) example of combination traps.

CHAPTER V

Barren traps:

In many areas, barren (water-filled) traps tend to be the rule rather than the exception. A number of possible explanations for barren traps are given here. It is assumed that the traps has been tested thoroughly that it is completely closed and of adequate porosity and permeability with eater filling the reservoir to the top.

1) No source material:

The absence of potential source material in the sedimentary section may be due to unfavorable climate, too rapid sedimentation, wrong depositional environments (which includes a topographically high position on the sea floor), or the destruction of once-present source material during the biochemical stage.

2) No generation of oil:

Because we don't know certainly the oil-producing process, we can only guess, what may be responsible for lack of transformation of organic solid into liquid or gaseous hydrocarbon. Suggested possibilities in this regard include absence of proper bacteria, absence of the necessary catalysts, inadequate time, and insufficient cover.

3) Oil failed to reach traps:

This may be due to down-dip impounding or to diversion. Damming could be caused by lenticular permeability or by faults. A large anticline lying along the migration pathway would prevent oil from reaching a smaller up-dip anticline until and unless it was filled to the spill point.

4) The oil has escaped:

Regional tilting may have caused the oil to spill out of the trap, after which renewed folding reproduced the trap. Fissures and faults may have allowed the hydrocarbon to escape upward to the surface, where they become dissipated. Renewed folding of the Kirkuk anticline in Iraq caused fracturing of over seals upward drainage of oil. Perhaps this type of escape has been more common in the past, because no rock is absolutely impervious a great enough apan of geologic time might permit the more volatile hydrocarbon, at least, to disperse through the confining rocks without the presence of any fracture system.

5) Oil destroyed:

Hydrocarbon in rock can be destroyed in at least three ways:

a) By relatively intense diastrophism.

b) By weathering

C) By the activity of hydrocarbon-consuming bacteria.

For the last two methods of destruction to become Operative, enough cover must be removed so that the oil accumulation lies within the zone of oxidation. It is also probable that the hydrocarbon accumulations have been destroyed (or at least expelled) by diastrophism where the sedimentary rocks show any degree of metamorphism.

6) Trap formed too late:

The timing of oil accumulation is of utmost importance. Obviously a trap is of no value if it does not come into existence until the hydrocarbons have Ceased movement through the rocks. In some areas the barren anticlines contain a greater thickness of the formations lying above the reservoir rocks than in adjacent productive anticlines.

It is also important to emphasize that structures that do not have any closure in the given stage geotectonic history will catch no oil.

CHAPTER VI

Summery and conclusion:

Hydrocarbon traps form where permeable reservoir rocks (carbonates, sandstones) are covered by rocks with low permeability (cap rocks) that are capable of preventing the hydrocarbons from further upward migration. Typical cap rocks are compacted shales, evaporates, and tightly cemented sandstones and carbonate rocks. Traps are usually classified according to the mechanism that produces the hydrocarbon accumulation. The two main groups of traps are those that are formed by structural deformation of rocks (stiuctural traps), and those that are related to depositional or diagenetic features in the sedimentary sequence (stratigraphic traps).

Many traps result from both of these factors (combination traps).Acommon example is stratigraphic pinch-out (e. g, a sandstone lens wedging into mudstone) that is combined with tectonic tilting (which allows hydrocarbons to pond in the up dip part of the sandstone wedge). Other traps result mainly from fracturing (which creates the reservoir porosity) or hydrodynamic processes there are many Classifications of hydrocarbon traps in use, but most have 90% in common.

Structure Traps: Structural traps are primarily the result of folding and (or) faulting, or both.

1-Anticlinal (fold) and dome trap:

Necessary conditions: An impervious cap rock and a porous reservoir rock; closure occurs in all directions to prevent leakage (four-way closure necessary for a dome)

a) Simple fold traps (anticlinal) with axial culmination (fold axis dipping m two or more directions). The simplest type of trap is formed when a Sandstone bed that is overlain by tight (Le. low permeability) shale is folded into an anticline .

b) Salt domes: Strata around the salt dome curve upward creating traps against the sealing salt layers.

2-Fault traps:

The fault plane must have a sealing effect so that it functions as a fluid migration barrier for reservoir rocks .There are several common types of fault trap.

a) Normal faults — commonly associated with graben (rift) structures.

c) Thrust faults — commonly associated with compressional tectonics

Stratigraphic Traps:

Stratigraphic traps are created by any variation in the stratigraphy that is independent of structural deformation, although many stratigraphic traps involve a tectonic component such as tilting of strata.

Two main groups can be recognized:

Primary stratigraphic trapsresult from variations in facies that developed during sedimentation. These include features such as lenses, pinch-outs, and appropriate facies changes.

Secondary stratigraphic traps result from variations that developed after sedimentation, mainly because of diagenesis. These include variations due to porosity enhancement by dissolution or loss by cementation.

Hydrodynamic Traps:

If pore water flow in a sedimentary basin is strong enough, the oil-water contact may deviate from the horizontal because of the hydrodynamic shear stress that is set up. In some cases, oil may accumulate without closure. Flow of fresh (meteoric) water down through oil-bearing rocks commonly results in biodegradation of the oil and formation of asphalt, which may then form a cap

Combination traps: These traps show the combined effect of .rock for oil structural and stratigraphic elements

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الملخص العربي

المصيده هي نسق هندسي للطبقات الرسوبيه يسمح للبترول او الغاز او كليهما بالتجمع فيه بكميات اقتصاديه ويحول دون هروبهما منها . ويتخذ هذا النسق النسق الطبقي الهندسي اشكالا عديده . لكن تظل السمه الرئيسيه للمصيده هو وجود صخر مسامي مغطي بصخور حابسه غير منفذه ويعد الماء عاملا اساسيا في توجيه البترول والغاز في المصيده في اغلب الحالات . مثلما يساعد في ازاحة البترول والغاز الي فتحات الابار في مرحلة الانتاج وهكذا تكون المصيده في بؤرة تبادل نشاط السوائل .

ومن افضل واحدث تصنيفات مصائد البترول ذات الجدوي الاقتصاديه هي اولا المصائد التركيبيه وتشمل مصائد الطي المدب ومصائد الصدوع وتعد مصائد الطي المحدب التضاغطيه اكثر المصائد شيوعا بفعل تغيرات تكتونيه او بنائيه .

وتقوم الصدوع بدور مباشر في تكوين المصائد عندما تؤدي الي تغير في ترتيب الطبقات وتعترض طبقه غير مساميه وغير منفذه هجرة البترول، كما يكون للصدع دور غير مباشر في اصطياد البترول بان يشترك في ذلك مع ظواهر تركيبيه اخري مث الطي او تغير النفاذيه .

وثانيا المصائد الاستراتيجرافيه التي تتكون نتيجة تغيرات جانبيه من حيث الساميه والنفاذيه في صخور المكمن او عدم استمراريتها، وفي هذا النوع يكزن تماس الصخور المختلفه حادا او تدريجيا او متوافقا ومن اهم المصائد الطبقيه تلك التي يحاط فيها صخر المكمن باخر غير منفذ مثل الطفل الصفائحي وبذلك يكون التغير في النفاذيه اساس تكوين المصيده.

ويوجد نوع اخر من مصائد البترول هي المصائد الهيدروديناميكيه وهي الاقل شيوعا حيث تقوم قوة الماء بدور اساسي في منع البترول من التحرك في اتجاه اعلي الميل في الطبقه الرسوبيه ،اذ يعترض الماء- التحرك هيدروديناميكيا في اتجاه اسفل الميل- السوائل البتروليه الصاعده لاعلي عندما تكون القوه الهيدروديناميكيه للماء اكبر اكبر من القوه الناتجه من قابلية طفو قطرات البترول في الماء (buoyancy) وبذلك يمنع البترول من التحرك لاعلي مايمكن من اصطياده ودون الحاجه الي وجود حاجز غير منفذ.

وثالثا مصائد البترول المركبه التي تتكون من عنصر طبقي نشأ عن وجود حافه فاصله بين طبقات منفذه واخري غير منفذه ، وعنصر تركيبي نتج عن حركات بنائيه للقشره الارضيه تسمي بالحركات التكتونيه .