6 Traps and seals

As discussed in previous chapters, a trap is one of the five essential requisites for commercial accumulation of hydrocarbons.

A trap can be defined as the place where oil and gas are barred from further movement. Actually, explorationists and geophysicists search for hydrocarbon traps. Only after drilling and testing it could be known whether the trap contains oil or gas. Thus, it is more accurate to say that they search for potential traps. Accordingly, the word trap is still a trap whether it is barren or productive.

6.1 Nomenclature of a trap

Fig. 6.1 shows an anticlinal trap with its different parameters.

The highest point of the trap is the crest, or culmination. The lowest point at which hydrocarbons may be contained in the trap is the spill point; this lies on a horizontal contour, the spill plane. The vertical distance from the crest to the spill plane is the closure of the trap.

A trap may or may not be full to the spill plane, a point of both local and regional significance.

In areas of monoclinal dip the closure of a trap may not be the same as its structural relief (Fig. 6.2). This situation is particularly important in hydrodynamic traps.
Fig. 6.2: Cross-section through a trap illustrating the difference between closure and structural relief.

The zone immediately beneath the petroleum is referred to as the bottom water, and the zone of the reservoir laterally adjacent to the trap as the edge zone or edge water (Fig. 6.1).

Within the trap the productive reservoir is termed the pay. The vertical distance from the top of the reservoir to the petroleum/water contact is termed gross pay. This thickness may vary from only 1 or 2 meters in some cases (Texas for example) to hundred meters in others (Middle East for example). But not all parts of the gross pay produce hydrocarbons, only the net pay. The net pay can be defined as the cumulative vertical thickness of a reservoir from which petroleum may be produced.

Within the geographic limits of an oil or gas field there may be one or more pools, each with its own fluid contact. Each individual pool may contain one or more pay zones (Fig. 6.3).
Fig. 6.3: Cross-section through a field illustrating various geological terms. This field contains two pools, that is, two separate accumulations with different oil/water contacts. In the upper pool the net pay is much less than the gross pay because of nonproductive shale layers. In the lower pool the net pay equals the gross pay.

6.2 Distribution of petroleum within a trap

A trap may contain oil, gas, or both. The oil/water contact (also called OWC) is the deepest level of producible oil. The same is applied on the gas/oil contact (GOC) or gas/water contact (GWC), as the case may be, is the lower limit of producible gas. These surfaces are important for calculation of the reserve of the field which is the task of well logging and testing.

Oil occurs below gas in some traps due to its higher density than gas. Besides this gravity separation between gas, and oil, a slight chemical variation exists. Boundaries between gas, oil and water could be sharp or transitional. Abrupt fluid contacts indicate a permeable reservoir, whereas gradational ones indicate a low permeability with a high capillary pressure.

6.2.1 Tar mats
Some oil fields have a layer of heavy oil, called a tar mat, immediately above the bottom water, as for example in the Sarir field of Libya. Tar mats are very important to identify and understand because they impede the flow of water into a reservoir when the petroleum is produced.

Many mechanisms are proposed for formation of tar mats. They could be formed in the most porous and permeable parts of the reservoir. Or they could be formed by bacterial degradation of oil long after petroleum migration has ceased. The bacteria were brought into contact with petroleum accumulation by connate water flowing beneath the petroleum/water contact. Finally, tar mats could originate by the thermal degradation of oil causing the precipitation of asphaltenes, or by the increased gas solution in the oil column.

### 6.2.2 Tilted fluid contacts

Generally fluid contacts in a trap are planar (horizontal) but not always. The early recognition of tilted fluid contacts is essential for the correct evaluation of reservoirs, and for the efficient production of the field.

Tilted fluid contacts are caused by several processes. They may occur where a hydrodynamic flow of bottom waters leads to a displacement of the hydrocarbons from a crestal to a flank position (Fig. 6.4).

![Diagram](image)

**Fig. 6.4:** Cross-cutting through a trap showing tilted oil/water contact due to hydrodynamic flow.

Another cause to tilted fluid contacts is cementation of reservoir below the oil/water contact (seat seal) followed by tilting of the trap but the OWC cannot adjust because of the seat seal (Fig. 6.5).
6.3 Seals and cap rocks
Any trap should be overlain by an effective seal. Any type of rock that is impermeable could act as a seal. Seals could be porous, thus petroleum saturated, but they must not permit the vertical migration of petroleum from the trap. Shales are the most common type of seals followed by evaporites. Although shales are porous, their fine grain size gives rise to very high capillary forces that prevent fluid movement.

Shale may selectively trap oil, but permit the upward migration of gas constituting what is called gas chimneys that can be identified on seismic lines. This leakage of gas from traps can be explained by compressible Darcy flow of a free gas phase when the reservoir gas pressure exceeds the capillary pressure in the cap rock.

6.4 Classification of traps
Traps could be classified according to geometry of the trap and seal parameter. Two major genetic types of traps are present: structural and stratigraphic, and combination of both may constitute a third type. Tab. 6.1 presents a classification of hydrocarbon traps based on information cited above.

Tab. 6.1: Classification of hydrocarbon traps based on criteria cited in the text
Structural traps are those traps whose geometry was formed by tectonic processes after deposition of the beds involved. They are formed basically by folding and faulting. A special type of structural traps is the diapirc traps, where salt or mud have moved upward and domed the overlying strata, causing many individual types of traps.

Stratigraphic traps are those whose geometry is formed by changes in lithology.

6.5 Structural traps
Structural traps are caused by folding or faulting.

6.5.1 Anticlinal traps
Anticlinal, or fold, traps can be classified into compressional and compactional ones.

6.5.1.1 Compressional anticlines
Compressional anticlines are mainly found in or adjacent to subductive troughs (zones) where there is a net shortening of Earth’s crust. Thus field of such traps are found within and adjacent to many mountain ranges of the world.

One of the best known oil provinces with production from compressional anticlines occurs in Iran (Fig. 6.6).
Fig. 6.6: Map showing the location of the folded anticlinal traps of Iran. For cross-sections see Fig. 6.7.

Here in the foot-hills of the Zagros Mountains many such fields occur. Sixteen of these fields are in the “giant” category with huge reserves of oil and gas. The main producing horizon is the Asmari limestone (lower Miocene), a reservoir with extensive fracture porosity. The cap rock is provided by evaporites of the lower Fars Group (Miocene) with disharmonic folding. The traps lie southwest of the main Zagros Mountain thrust belt. Individual anticlines are up to 60 km in length and some 10 to 15 km wide (Fig. 6.7).
6.5.1.2 Compactional anticlines

These anticlinal traps form by crustal tension that causes a sedimentary basin to originate, the floor is commonly split into a mosaic of basement horsts and grabens. The initial phase of deposition in-fills this irregular topography. Throughout the history of the basin, the initial structural architecture usually persists, controlling subsequent sedimentation. Thus anticlines may occur in the sediment cover above deep-seated horsts (Fig. 6.8).
Fig. 6.8: Cross-section showing how basement block faulting causes anticlinal structures in sediments; closure decreases upward. These drape anticlines are formed by tension rather than compression.

Good examples of oil fields trapped in compactional traps occur in the North Sea, where Paleocene deep-sea sands are draped over Mesozoic horsts, such as the Forties fields (Fig. 6.9).
Fig. 6.9: Map (upper) and cross-section (lower) of the Forties field of the North Sea. This field is actually a compactional anticline draped over an old basement high.

6.5.2 Faults and fault-related traps
Faulting plays an indirect but essential role in the entrapment of many fields. Relatively few discovered fields are caused solely by faulting. Some faults act as a seal or barrier to fluid movement (hydrocarbons and water), others are permeable.

There are eight theoretical geometries for fault traps, assuming that the faults separate juxtaposed permeable sands or fractured limestone and impermeable shale (Fig. 6.10).

<table>
<thead>
<tr>
<th>Dip with fault</th>
<th>Dip against fault</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal fault</strong></td>
<td></td>
</tr>
<tr>
<td>Throw &gt; thickness</td>
<td>Throw &lt; thickness</td>
</tr>
<tr>
<td>Unlimited closure</td>
<td>No closure</td>
</tr>
<tr>
<td>Limited closure</td>
<td>Unlimited closure</td>
</tr>
<tr>
<td>Reversed fault</td>
<td></td>
</tr>
<tr>
<td>Throw &gt; thickness</td>
<td>Throw &lt; thickness</td>
</tr>
<tr>
<td>Unlimited closure</td>
<td>Limited closure</td>
</tr>
<tr>
<td>Limited closure</td>
<td>No closure</td>
</tr>
</tbody>
</table>

Assumptions: Shale against sand is sealing.
Sand against sand is not sealing.

Fig. 6.10: The eight theoretical configurations of petroleum traps associated with faulting. These configurations are drawn on the assumption that oil can move across, but not up, the fault plane when permeable sands are juxtaposed.

Six of these geometries may be valid traps provided that there is also closure in both directions parallel to the fault plane. Actually, pure fault traps are rare. However, Fig. 6.11 illustrates one example of a simple faulted trap.
6.6 Diapiric traps
Diapiric traps are produced by the upward movement of sediments that are less dense (such as salt or overpressured clays) than those overlying them, thus forming diverse hydrocarbon traps. They are not considered structural traps since tectonic forces are not required to initiate them, neither stratigraphic traps since they are not initiated by stratigraphic processes.

6.6.1 Salt domes
Salt has a density of about 2.03 g/cm$^3$. Recently deposited clay and sand have densities less that of salt. As the clay and sand are buried they become compacted losing porosity and gaining density. Ultimately, a burial depth is reached when sediments are denser than salt. That may occur between about 800 and 1200 m (Fig. 6.12).
Fig. 6.12: Density-depth curves for sand, clay and salt. The graph shows that salt is less dense than other sediments below about 800 m, and salt movement may therefore be anticipated once this burial depth has been reached.

When this point is reached, the salt will tend to flow up through the denser overburden. In some salt structures the overlying strata are only up-domed, whereas in others the salt actually intrudes its way upward giving rise to a piercement structures. In some instances the salt may actually reach the surface, forming solution sinks in humid climates and salt glaciers in arid climates such as Iran.

Salt movement, or halokinesis, plays an important role in the entrapment of oil and gas in the U.S. Gulf Coast, Iran, and the Arabian Gulf and the North Sea. Oil and gas may be trapped by salt movement in many ways (Fig. 6.13).
Fig. 6.13: Crustal cross-section illustrating the various types of traps that may be associated with salt movement; A: domal traps, B: and C: fault traps, D: pinchout traps, E: turtle-back or sedimentary anticline, and F: truncation trap.

In the simplest case, subcircular anticlines may trap hydrocarbon over the crest of a salt dome, like those in the fields offshore Norway and Denmark (Fig. 6.14).

Fig. 6.14: Seismic cross-section through the Cod field in the Norwegian sector of the North Sea. This structure is an example of a salt dome trap. Production comes from Paleocene deep-sea sands.

The crestal dome may be complicated by radial faults or a central graben. Around the flank of the dome, oil or gas may be trapped by faults, both sediment against sediment,
and sediment against salt, and by stratigraphic truncation and pinchout. Some salt domes are pear or mushroom shaped in cross-section, and petroleum is trapped beneath the peripheral overhang zone.

As the salt moves upward, a cap of diagenetically produced limestone, dolomite, and anhydrite often develops.

### 6.6.2 Mud diapirs
Overpressured shales have a higher porosity and therefore a lower density than the younger denser cover, thus they intrude them, like salt domes. Mud diapirs are known from the Mississippi, Niger and other recent deltas, and are less common from pre-Tertiary deltas (Fig. 6.15).

![Cross-section illustrating overpressured clay diapirs in a regressive deltaic sequence.](image)

Fig. 6.15: Cross-section illustrating overpressured clay diapirs in a regressive deltaic sequence.

Many of the mud diapirs have hydrocarbons trapped in analogous ways to those of salt domes.

### 6.7 Stratigraphic traps.
Stratigraphic traps have a specific geometry resulting from changes in lithology. These changes can be caused by the original deposition of the rock, as with a reef or a channel. Or the changes in lithology may be postdepositional, as with a truncation or diagenetic trap.
Another definition of a stratigraphic trap is: one in which the chief trap making element is some variation in the stratigraphy, or lithology, or both, of the reservoir rock, such as facies changes, variable local porosity and permeability, or an up-structure termination of a reservoir rock, irrespective of the cause.

Tab. 6.1 shows a classification of stratigraphic traps.

Tab. 6.1: Classification of stratigraphic traps.

<table>
<thead>
<tr>
<th>I. Unassociated with unconformities</th>
<th>Depositional</th>
<th>Diagenetic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pinchouts</td>
<td>Porosity and/or permeability transition</td>
</tr>
<tr>
<td></td>
<td>Channels</td>
<td>On lap</td>
</tr>
<tr>
<td></td>
<td>Bars</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reefs</td>
<td></td>
</tr>
<tr>
<td>II. Associated with unconformities</td>
<td>Supraunconformation</td>
<td>Strike valley</td>
</tr>
<tr>
<td></td>
<td>Subunconformation</td>
<td>Channel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Truncation</td>
</tr>
</tbody>
</table>

6.7.1 Stratigraphic traps unrelated to unconformities
Stratigraphic traps unrelated to unconformities can be due to deposition or to diagenesis. The depositional traps (the facies changes traps) include channels, bars, and reefs. Diagenetic traps are due to porosity and permeability changes caused by solution and cementation. Following is discussion of each.

6.7.1.1 Channel traps
A channel is an environment for the transportation of sand that could be filled either with sand or clay. In the latter case, the channel fill acts as a permeability barrier that might trap hydrocarbons in adjacent porous beds.

A good example of channel stratigraphic traps occurs in the Cretaceous South Glenrock oil field, Powder River Basin, Wyoming. The field contains oil trapped in a channel that has a width of 1500 m and a maximum depth of some 15 m. It has been mapped for a distance of more than 15 km and shows a meandering shape (Fig. 6. 16).
Fig. 6.16: Map and cross-section of the Cretaceous South Glenrock oil field, Powder River Basin, Wyoming. Note the small dimensions of the reservoir and that not all of the channels contain sand.

The channel is partly infilled by sand and partly clay plugged. This example illustrates that the reservoir has just a thickness of 15 m and a width of 1500 m making it a small host of oil accumulation, and only part of the channel is actually a reservoir (the other part is clay plugged).
6.7.1.2 Barrier bar traps

Marine barrier bar sands often make excellent reservoirs because of their clean, well sorted texture. Coalesced barrier sands may form blankets ands within which oil may be structurally trapped. Sometimes, however, isolated barrier bars may be totally enclosed in marine and lagoonal shales. These barrier bars may then form shoestring stratigraphic traps parallel to the paleoshoreline.

One example of barrier bar traps is the Bisti field in Cretaceous rocks of the San Juan Basin, New Mexico. Three stacked sand bars, with an aggregate thickness of only 15 m, occur totally enclosed in the marine Mancos shale. The field is of about 65 km long and 7 km wide. In some wells the three sands merge totally and can not be separated. SP logs show typical upward-coarsening bar sand motifs (patterns) in some of the wells (Fig. 6.17).
Fig. 6.17: Isopach map of typical log and cross-section of the Bisti field (Cretaceous) of the San Juan Basin, New Mexico. This field is a classic example of a barrier bar stratigraphic trap. Note the regressive upward-coarsening grain-size motif on the SP curve.

6.7.1.3 Pinchout traps
A regressive barrier bar deposits a sheet of sand. This sand may form a continuous reservoir, although in some instances shale permeability barriers may separate successive progradational events. Where these sheet sands pass up-dip into lagoonal or intertidal shales, they may give rise to pinchout, or feather edge, traps. For these traps to be valid,
they need also some closure in both directions along the paleostrick. This closure can be stratigraphic as shown in the example in Fig. 6.18 where the shoreline has an embayment, or structural, in which case the field should more properly be classified a combination trap, rather than a stratigraphic trap.

Fig. 6.18: Map and cross-section showing a stratigraphic pinchout trap. Note that this example is a pure stratigraphic trap because the embayment of the coast. Usually, some structural closure on top of the sand forms a combination trap.

6.7.1.4 Reefs
Reefs, or carbonate buildups are one of the most important types of stratigraphic traps. Reefs develop as domal (pinnacle) and elongate (barrier) structures. They grow a rigid rocky framework with high primary porosity, and they are frequently transgressed by marine shales, which may act as hydrocarbon source rocks.
Many reef fields occur in the Sirte basin of Libya. One group, the Intisar (formerly Idris) fields, consists of five pinnacle reefs located in a concession area of 1880 km$^2$. Each reef is only about 5 km in diameter, but up to 400 m thick; that is, the reefs build up in thickness from 0 to 400 m in a distance of about 2500 m. Of the five reefs located and tested, only tow ones were found to contain oil (Fig. 6.19).

Fig. 6.19: Isopach map of the Idris “A” reef, Sirte Basin, Libya.

Fig. 6.20 shows the “A” reef in cross-section, demonstrating how the reef began to form as a biostrome of algal-foraminiferal wackestone on a platform of tight non-reef limestone.
A reef (largely made of corals and encrusting algae) began to grow at one point on the biostrome. It first grew upward and then prograded over a coralline biomicrite, which had formed as a forereef talus of its own detritus. Now compare between the upper and lower halves of Fig. 6.20. There is little obvious correlation between facies and petrophysics. This is due to diagenesis, where secondary porosity has a distribution not related to primary porosity with which the sediment was deposited.

6.7.1.5 Diagenetic traps
As discussed above solution can generate secondary porosity, whereas cementation can destroy it. In some situations diagenesis can actually generate a hydrocarbon trap. Oil or gas moving up permeable carrier bed may reach a cemented zone, which inhibits further migration (Fig. 6.21A).
Fig. 6.21: Configuration of diagenetic traps caused by A) cementation, B) solution, and C) shallow-oil degradation.

On the other hand, oil may be trapped in zones where solution porosity has locally developed in a cemented rock (Fig. 21B). Secondary dolomitization can generate irregular diagenetic traps as the dolomite takes up less space than the original volume of limestone.

Also, as oil migrates to the surface, it may be degraded and oxidized by bacterial action if it reaches the shallow zone of meteoric water. This tarry residue acts as a seal inhibiting further up-dip oil migration (Fig. 6.21C).

However, traps that owe their origin purely to diagenesis are rare.

**6.7.2 Stratigraphic traps related to unconformities**

Unconformities facilitate the juxtaposition of porous reservoir and impermeable shales that may act as source and seal. Traps related to unconformities can be divided into those that occur above the unconformity and those that occur below it.
6.7.2.1 Supraunconformity traps
Stratigraphic traps that overlie unconformities include reefs and various types of terrigenous traps. These traps can be divided into three classes according to their geometry: sheet, channel, and strike valley. Shallow marine or fluvial sand may onlap a planar unconformity. A stratigraphic trap may occur where these sands are overlain by shale and where the subunconformity rocks are also impermeable. Fig. 6.22 shows an example of an onlap stratigraphic trap.

![Cross-section showing the occurrence of strike valley sands. Examples of oil trapped in these sands are known from the Cretaceous of New Mexico.](image)

When an unconformity is irregular, sand often infills valleys cut into the old land surface. This process gives rise to paleogeomorphic traps. The two main groups of paleogeomorphic traps are channel and strike valley. Rivers draining a land surface may incise valleys into the bedrock, and these valleys may then be infilled with alluvium (both porous sand and impermeable shale).

When alternating beds of hard and soft rocks are weathered and eroded, the soft strata form strike valleys between the resistant ridges of harder rocks. Fluvial and occasionally marine sands within the strike valleys may be blanketed by a transgressive marine shale. Oil and gas may be stratigraphically trapped in the strike valley sands (Fig. 6.22).

6.7.2.2 Subunconformity traps
Stratigraphic traps also occur beneath unconformities where porous permeable beds have been truncated and overlain by impermeable clay. As with pinchouts and onlaps, some closure is needed in both directions along the paleostrke. This closure may be structural or stratigraphic, but for many truncation traps it will be provided by the irregular topography of the unconformity (Fig. 6.23).
Fig. 6.23: Cross-section (upper) and map (below) illustrating the geometry of a truncation trap. The contours drawn on the unconformity surface of the map define a buried hill.

Most, if not all, truncation traps have had their reservoir quality enhanced by secondary porosity induced by weathering of limestone and also of sandstone.

As discussed earlier, a number of fields produce from basement rocks, where the reservoir is unconformably overlain by shales that act as source and seal. Production comes from the fractures and solution pores, where unstable minerals (generally mafics and occasionally feldspars) have weathered out. A notable example of this type of traps is the (المتيانة) Augila field of Libya, where one well produced 40,000 BOPD (barrels of oil per day) from granite. This remarkable stratigraphic trap also produces from sands and carbonates that onlap a granite hill (Fig. 6.24).
Fig. 6.24: Cross-section through the Augila field of Libya. This field is a complex trap that produces partly from sands and reefal limestone and partly from fractured and weathered granite.

6.8 Hydrodynamic traps

The third group of traps, in addition to structural and stratigraphic traps, is the group of hydrodynamic traps. In these traps hydrodynamic movement of water is essential to prevent the upward movement of oil or gas. The basic idea is that oil or gas will generally move upward along permeable carrier beds to the earth’s surface except where they encounter an impermeable barrier, structural or stratigraphic, beneath which they may be trapped.

When water is moving hydrodynamically down permeable beds, it may encounter upward-moving oil. When the hydrodynamic force of the water is more than the force due to the buoyancy of the oil droplets, the oil will be restrained from upward movement.
and will be trapped within the beds without any permeability barrier. Actually this might occur if there is a local reversal of dip or facies change, or even a local fluctuation of in the potentiometric gradient (Fig. 6.25).

Fig. 6.26: Crustal cross-section showing a pure hydrodynamic trap. There is no vertical structural relief. Oil migrating upward is trapped in the monoclinen by the downward flow of water.

6.9 Combination traps
Many oil and gas traps are due to combination of two or more of structure, stratigraphic, and hydrodynamic forces. Such combination traps are mainly caused by combination of structural and stratigraphical processes.

On a small scale, oil may be trapped in shoestring sands (channels or bars) that cross-cut anticlines (Fig. 6.27).
Fig. 6.27: Combination channel rollover anticline trap. Contours are drawn on top of “G” sand.

Another example of combination traps is seen in Fig. 6.28.
Fig. 6.28: Map (upper) and cross-section (lower) of the Prudhoe field of Alaska.

Here, a series of Carboniferous, Permian, Triassic, Jurassic, and lower Cretaceous sediments were folded into a westerly plunging anticlinal nose. This structure was truncated progressively to the northeast and overlain by Cretaceous shales, which act as source and seal to the trap. Oil and gas were trapped in the older beds, which subcrop the unconformity. The main reservoir is provided by major faults on the northern and southwestern side of the structure (Fig. 6.28).

6.9.1 Astrobleme traps
A very rare type of combination traps is the astrobleme, or meteorite impact crater.
Numerous geologists have argued that ancient subcircular structures are of meteoric origin. In some cases petroleum is trapped within and adjacent to them. Notable examples include the Lyles Ranch field in South Texas, and the petrolierous Avak structure in Alaska. In these and other examples, organic-rich source rocks pre- or post-date the impact structure.

6.10 Traps: Conclusion
6.10.1 Timing of trap development relative to petroleum migration and reservoir deposition
The time of trap formation relative to petroleum migration is extremely important. If traps predate migration, they will be productive. If they postdate migration they will be barren.

Questions concerning a prospect should include these: Which horizons are known or presumed to be source rocks? Can time-burial depth curves be used to determine the time of petroleum generation? If the prospect is structural, did the fold or fault form before or after migration? In the case of truncation traps the source rock may underlie or overlie the unconformity? It is important to establish that a truncation trap was thoroughly sealed before petroleum generation began.

Postmigration structural movement may also be relevant. Faults can open to allow petroleum to undergo further migration. Structural closure may tighten. This tightening is not itself harmful, unless it is accompanied by crestal fractures, which increase the permeability of the seal. Uplift and erosion may breach the crests of traps. Regional tilting may trigger extensive secondary migration of petroleum because the spill points of traps may be altered.

6.10.2 Relative frequency of the different types of traps.
How can we arrange the various types of traps in some order of importance? This classification can be aided by global analysis of the trapping mechanism of known giant oil fields. The majority of giant oil fields are anticlines, followed, along way behind and in order of decreasing importance, by combination traps, reefs, pinchouts, truncations, salt domes, and faults (Fig. 6.29).
These data are applied on giant fields, which are defined as those with more than 500 million barrels of recoverable reserve. This is not applied on small fields having limited extent such as channel, bar, and reef reservoirs. Also these data pertain to oil fields not gas fields, although they would probably be similar.

Moreover, these figures reflect mankind’s ability to find anticlines easily. They may be mapped at the surface or detected seismically in the subsurface. The concept of anticlinal trap is a simple one to grasp for the managers, accountants, engineers, and farmers who may actually make the decision to drill, or not, based on geologist’s recommendation.

Stratigraphic traps, on the other hand, are harder to locate. Few can simply be picked off a brightly colored seismic section: most require an integration of seismic, log, and real rock data with sophisticated geological concepts. An explorationist would therefore find it harder to develop a stratigraphic trap prospect, and harder to explain it to the lay audience, which may hold the purse strings.