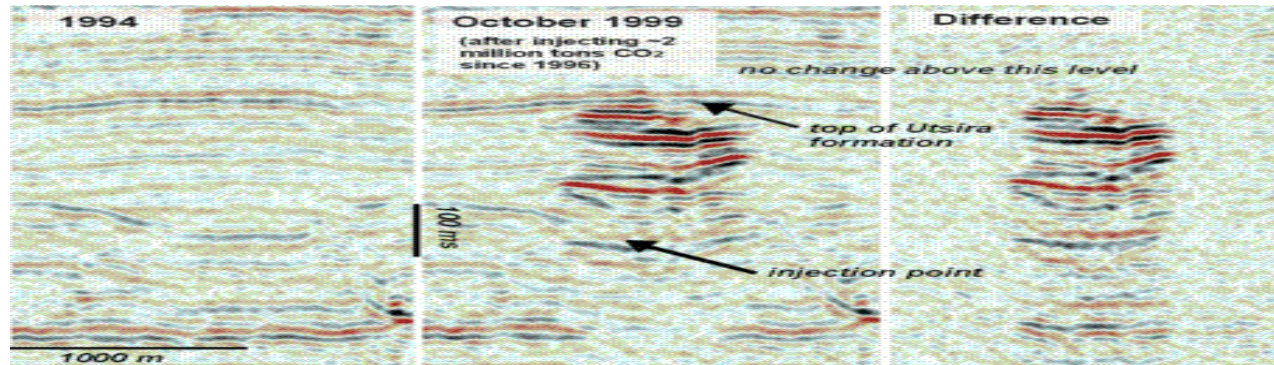


# Exploration

## Where to expect oil?

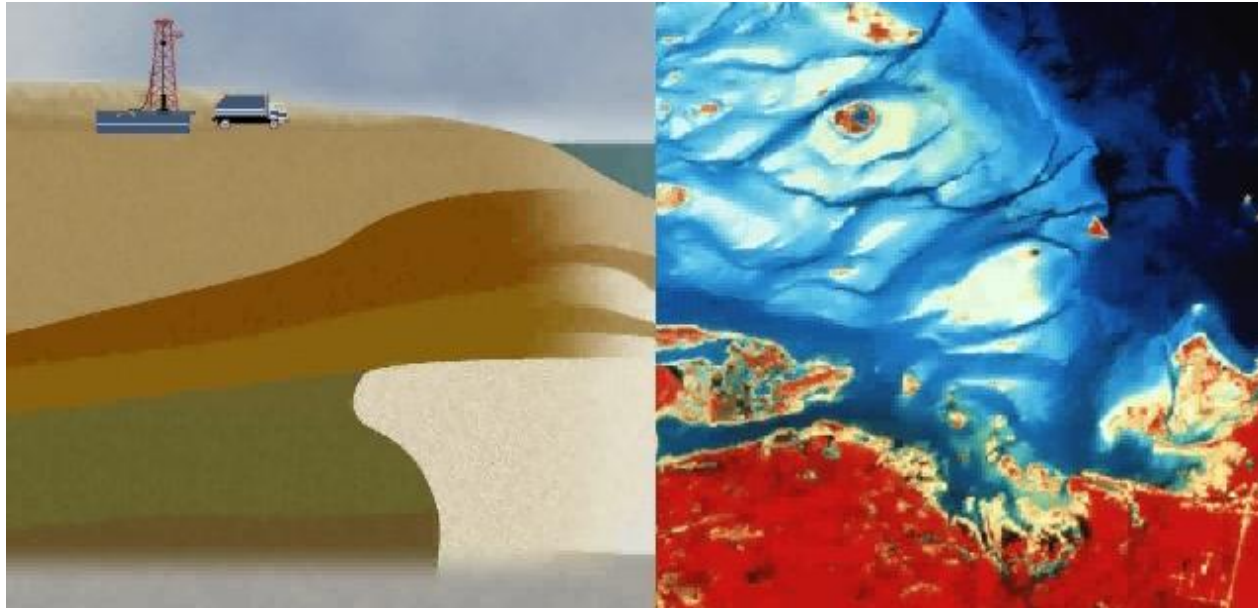


The first oil discoveries were by good luck. Or most often even by bad luck since usually people were digging for potable water wells when they discovered the unwanted oil floating on the water.

Naturally the first surge for oil was done in areas known for oily waters.

Early exploration involved the search for geographical structures like faults and unconformities as well as the use of skilled people who claimed to smell oil, the diviners also called diggers.

## Satellite survey

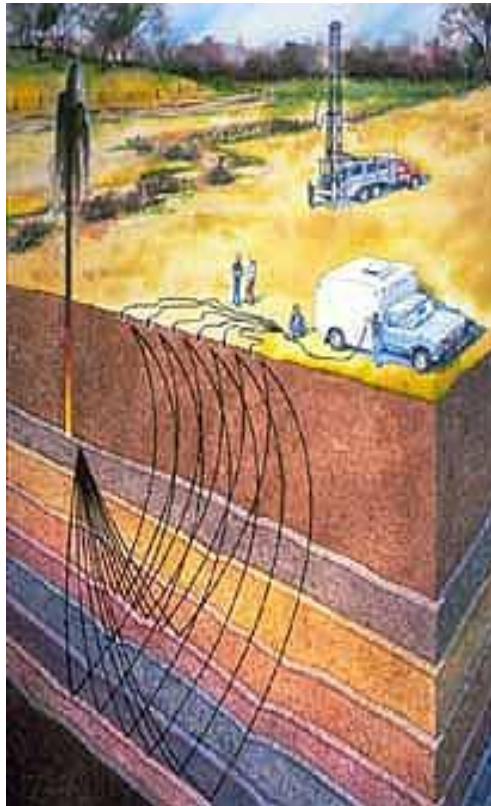


With modern satellite technology prehistoric river deltas, forests and swamps are identified.

The surface structure allows to extrapolate the subsurface structure in the search for oil traps.

However, only seismic surveys allow a real “look” into the subsurface structure.

# Seismic

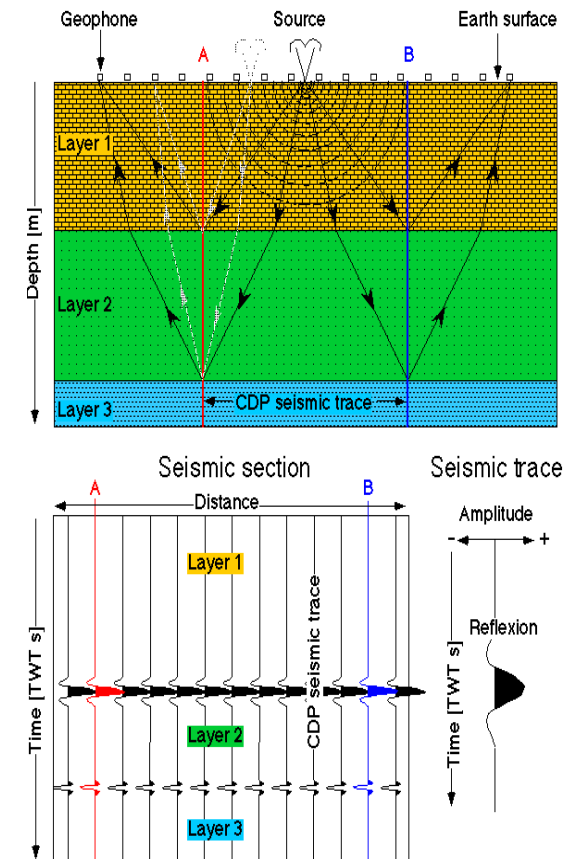


A seismic survey collects data from subsurface structures and layers.

Acoustic signals, caused e.g. by an explosion, are reflected by each layer having a change of density or formation fracture.

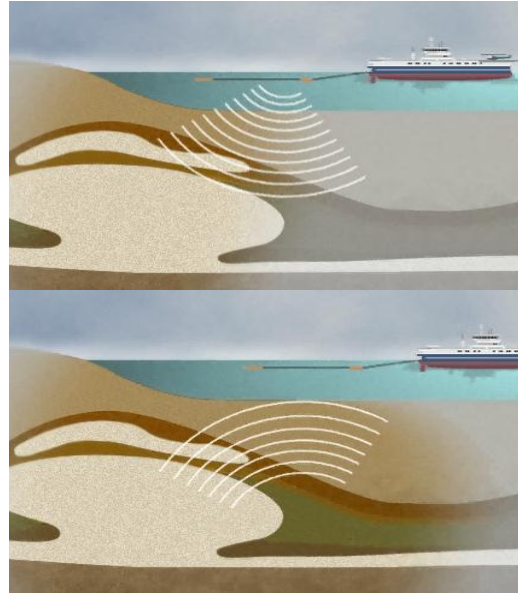
The first signal arriving at a geophone is the direct reflection of such a layer.

In reality many signals arrive at the same time at a geophone and huge computer power is required to filter out all multiple reflections and noise signals.



At each reflection the signal strength is reduced by a factor 10!

## Seismic survey offshore



Air guns powered by high compressed air are dragged behind a seismic ship and fired at regular intervals, 20 - 100 m. Behind the guns are km long floating lines of geophones every 5 - 20 m. Large areas are covered in a parallel and overlapping surveys.

## Seismic survey on land

Vibroseis job for  
OMV in Austrian  
Alps 1988

Oscillating steel  
cylinder of 1,000 kg



Vibrator truck

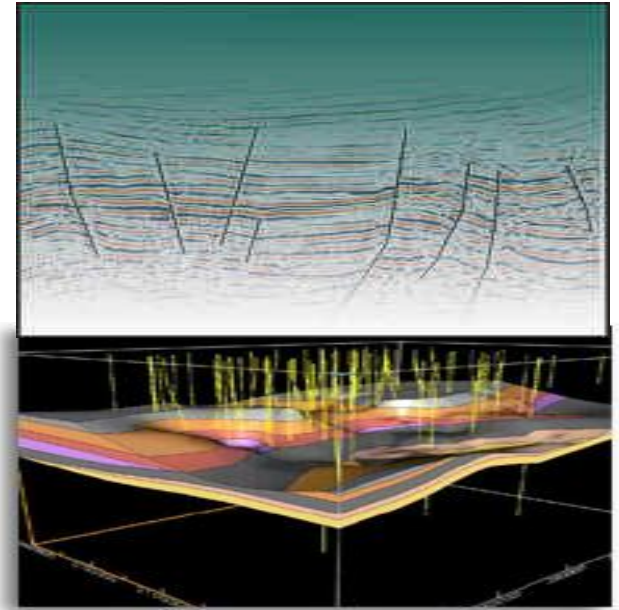
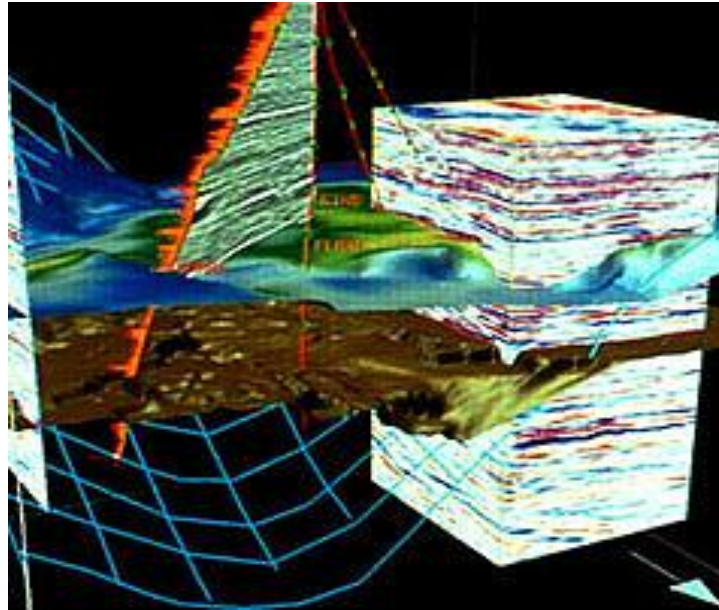
Vibration base plate,  
sweeping from 5 Hz to 95 Hz for  
a duration of 10 sec

Courtesy of OMV and RB

Onshore, small dynamite explosions or vibrator trucks are used as signal source. Although being without the poor signal transmitting media of water onshore seismic encounters the problem of non-uniform terrain, mountains, rivers, swamps and lakes.

The seismic crews are usually the first to explore literally on foot unknown wilderness, deserts and jungles.

## Seismic evaluation



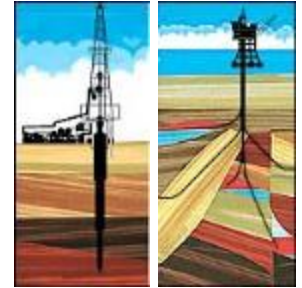
With the help of very powerful computers and highly sophisticated software the seismic surveys evaluate a three dimensional image of the subsurface conditions. Possible hydrocarbon traps can be identified and the relationship of shear and compressional waves received relate to the density of the formation and to the possible presence of oil and gas.

## Summery

Although nowadays the most sophisticated science and computer power is used to evaluate seismic surveys, one can only be certain whether or not there is a commercially usable petroleum reservoir after an exploration well has been drilled.

Since the drilling sites are getting more and more harsh and the reservoir depth deeper and deeper the costs involved are getting higher and higher.

However, besides all possible measures taken to select the right drilling site only about every 10th exploration well drilled finds the “black gold” to recover the investments of all 10 wells drilled.



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