Introduction to the seismic exploration method

- The main objective of this method is to map the structure of subsurface formations in order to infer the existence of possible petroleum traps.

- In addition, the method can be used to identify lithology (rock type), fluid content (oil, gas, or water), and fine structures (fractures).

- In this method, seismic energy is generated artificially at the near surface and the generated waves travel in the subsurface and get reflected off layer boundaries.

- The reflected waves are recorded at the surface and the traveltimes and amplitudes are analyzed to map the subsurface. (Figure: courtesy of www.geoph.com.cn)

- Almost all of petroleum exploration is done using the seismic method.

- Two variations of this method exist:
  
  - The 2-D method, which can be used to map structures along widely spaced traverses.
- Geometry (courtesy of www.fe.doe.gov).

- Result (courtesy of www-gpi.physik.uni-karlsruhe.de)

- The 3-D method, which can be used to accurately map subsurface structures in a three-dimensional sense.

- Geometry (courtesy of www.seismo.unr.edu)
- The majority (> 80%) of seismic exploration is done using the 3-D method.

- Compared to other exploration methods, the seismic method gives, by far, the best subsurface structural and lithological image.
In Saudi Arabia, most of the petroleum is produced from land-covered reservoirs (Ghawar, Shaybah, ... etc.); and hence, most of the exploration is done on land.

- Saudi fields (courtesy of www.aapg.org)

Therefore, more emphasis will be placed on land seismic methods.