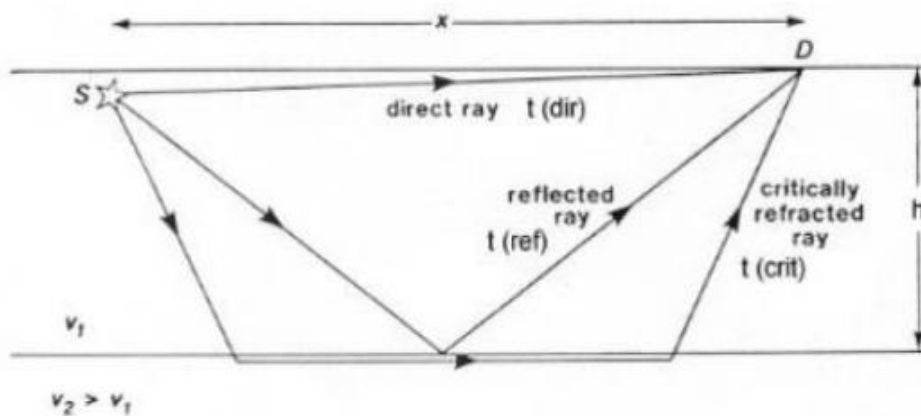


## Seismic exploration :

The basic techniques of seismic exploration consists of generation seismic waves and measuring the time required for the waves to travel from the sources to a series of geophones. The principal paths generated from the source point to receiving point are :

- 1) Direct path
- 2) Reflected path
- 3) Refracted path.



for the refracted path the principal portion of the path is along the interface between two rock layers and hence is approximately horizontal ,while for the reflected paths , the wave travels downward initially and at some point is reflected back to the surface ,the overall path being

essentially vertical .for both types of path ,the travel times depend upon the physical properties of the rocks and attitudes of the beds the objective seismic exploration is

to deduce information about rocks ,especially about the attitudes of the beds , from the observed arrival times and from variations in amplitude and frequency , based on these principles.

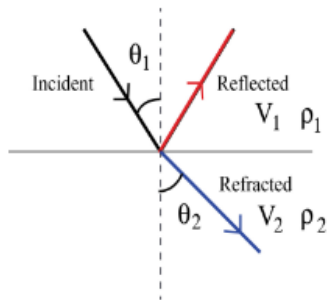
## The seismic method include two principle methods :

1-Seismic refraction method.

2-Seismic reflection method.

## Seismic refraction method:

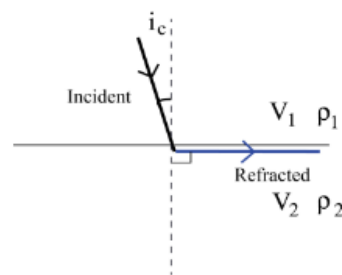
Seismic refraction employs waves that had passed down in to the earth had been critically refracted at interface ,that when the angle of incidence reaches a particular value, known as the critical angle, the angle of refraction becomes 90°. The refracted wave travels along the upper boundary of the lower medium, whose speed of propagation is greater than that of the overlying medium (i.e.  $V_2 > V_1$ )



Snell's Law  
angle

for general refraction  
refraction

$$\frac{\sin(\theta_1)}{v_1} = \frac{\sin(\theta_2)}{v_2}$$

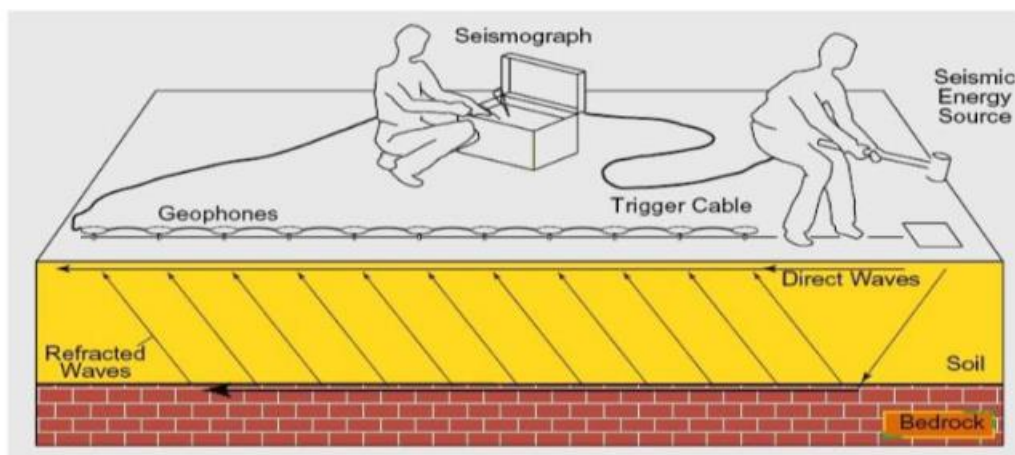


Special case of the critical

$$\sin i_c = v_1/v_2 \text{ for critical}$$

when  $i_r = 90^\circ$

The recording of the time of the first arrival by set of geophone distribution at the surface. The geophone near the generating source received the direct waves which move along the surface of the earth with velocity ( $V_0$ ) of the first layer. While the geophones far away from the source received the refracted wave which called also ( head wave) is arrive firstly because parts of its path travel with velocity of second layer so therefore it, arrive before the direct wave .



To form critical refraction for arrival wave inside the layer, there are three conditions:-

the wave propagated with different velocities in different geologic strata. the contrast between velocities is large.

the strata velocities increase with depth. Incidence of seismic wave on the boundary between strata in critical angle .

### **Applications of Seismic Refraction**

- Method Determining lateral extensions of layers.
- Mapping of sedimentary basins.
- Determining the physical properties of the bed rock.
- Detecting buried structures of small dimensions.
- Detecting salt domes

### **Reflection method:**

Seismic reflection is the most widely used geophysical technique. It can be used to derive important details about the geometry of structures and their physical properties. Major Fields of application of Seismic reflection include:

- hydrocarbon exploration.
- research into crustal structure with several kilometers of Depths of penetration.
- Engineering and environmental investigations.
- Mapping structural features such as shallow faults, buried valleys and Quaternary deposits.
- Hydrological studies of aquifers.