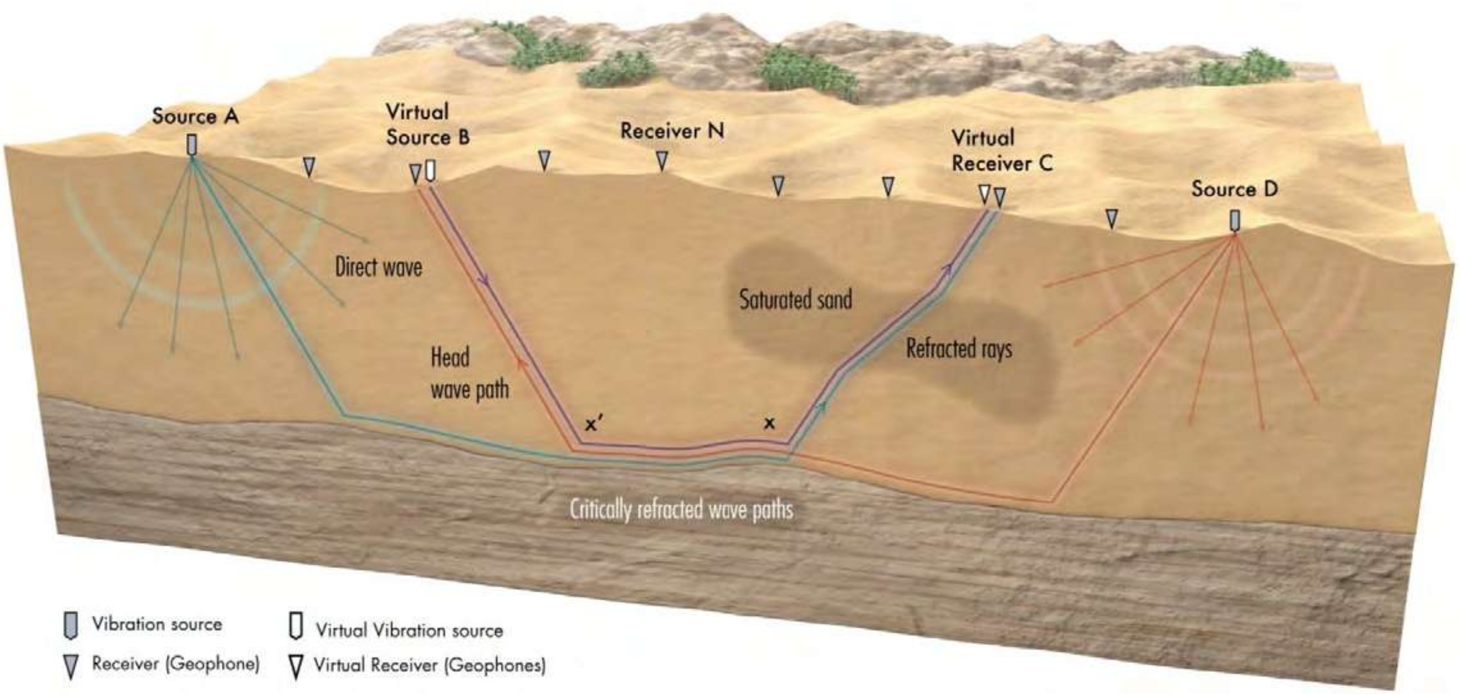
Seismic Imaging Techniques

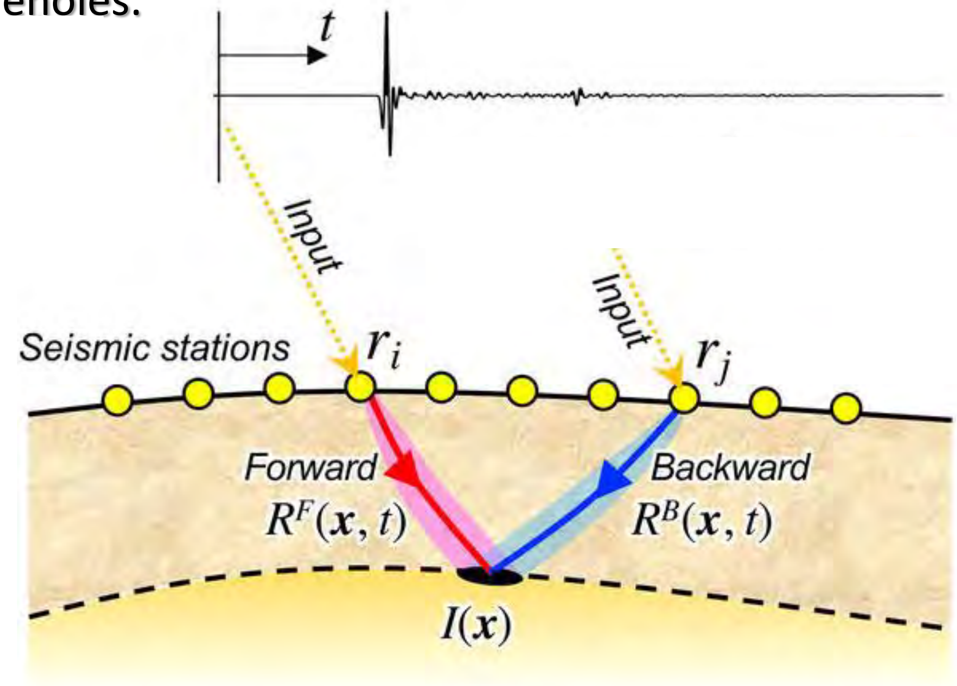
Seismic imaging techniques are used in geophysics to create detailed images of subsurface structures and formations. These techniques rely on the principles of seismic waves, which are generated by energy sources and recorded by sensors called geophones or hydrophones. The recorded data is then processed and analyzed to construct a subsurface model.



Seismic Imaging Techniques

Seismic Reflection Imaging:

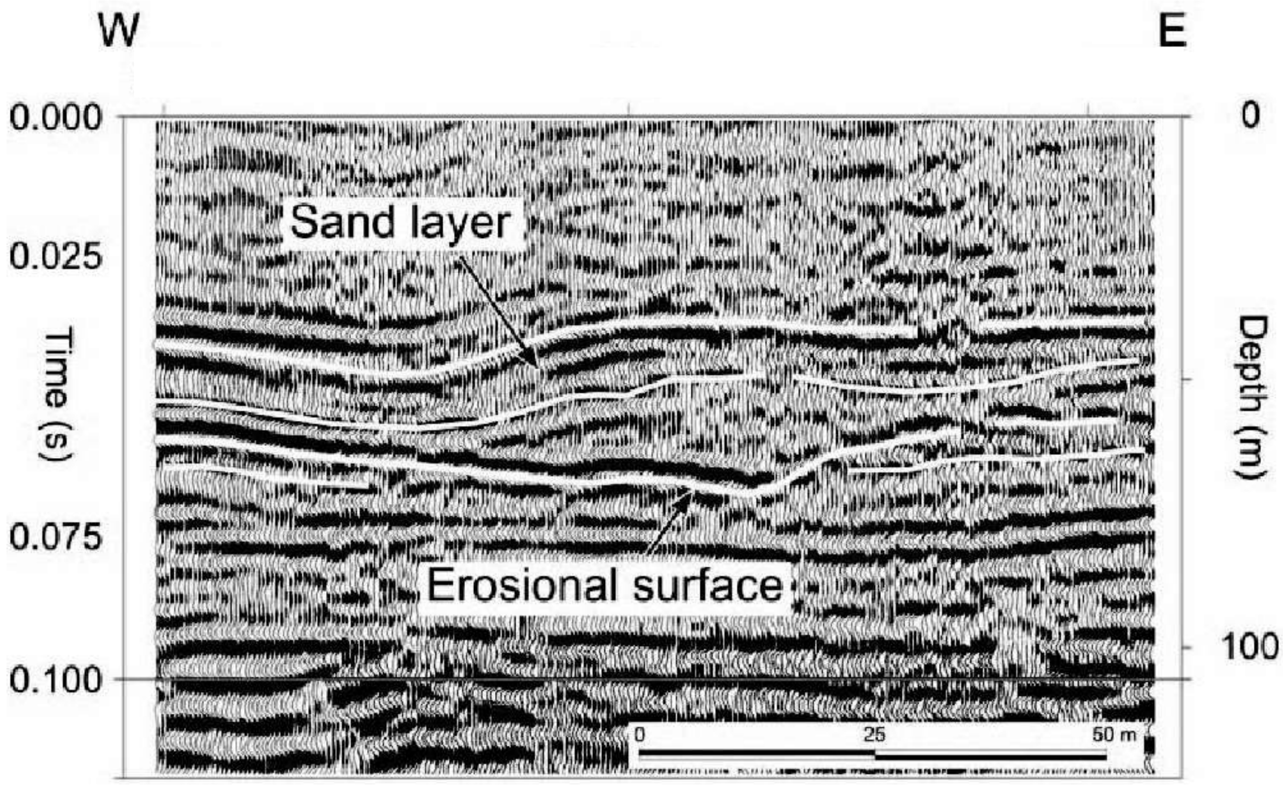
This technique is based on the principle of reflection of seismic waves at interfaces between different rock layers or formations. An energy source, such as a seismic vibrator or an explosive charge, is used to generate seismic waves, which propagate into the subsurface. The reflected waves are recorded by geophones or hydrophones placed at the surface or in boreholes.



Seismic Imaging Techniques

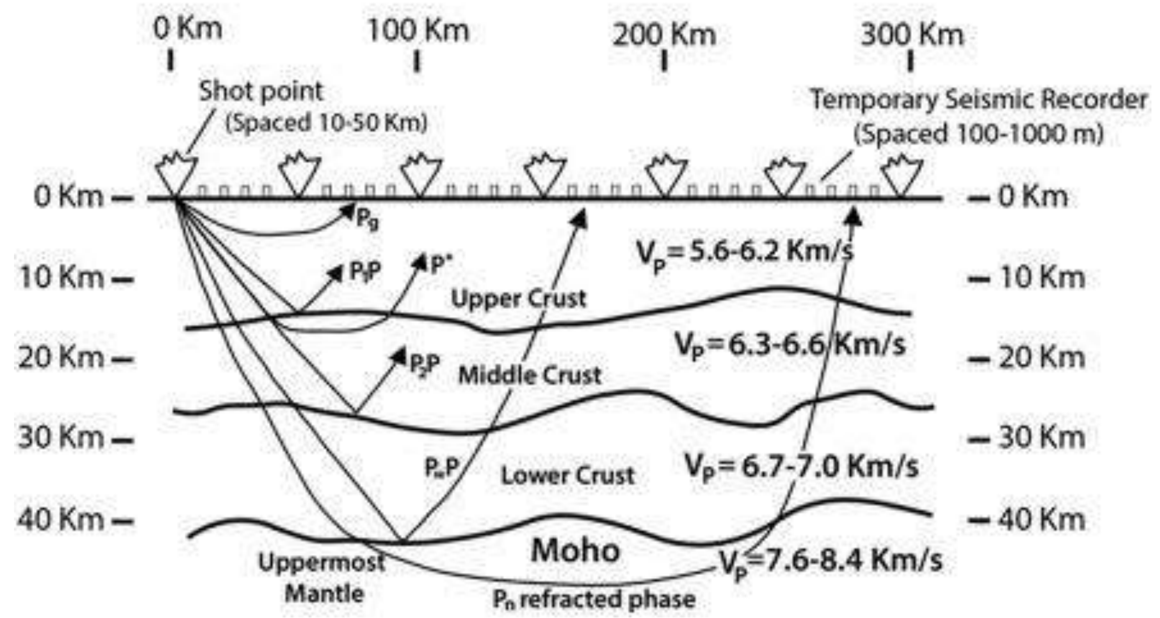
Seismic Reflection Imaging:

By analyzing the recorded data, it is possible to image and characterize subsurface structures, such as sedimentary layers, faults, and reservoirs.



Seismic Refraction Imaging:

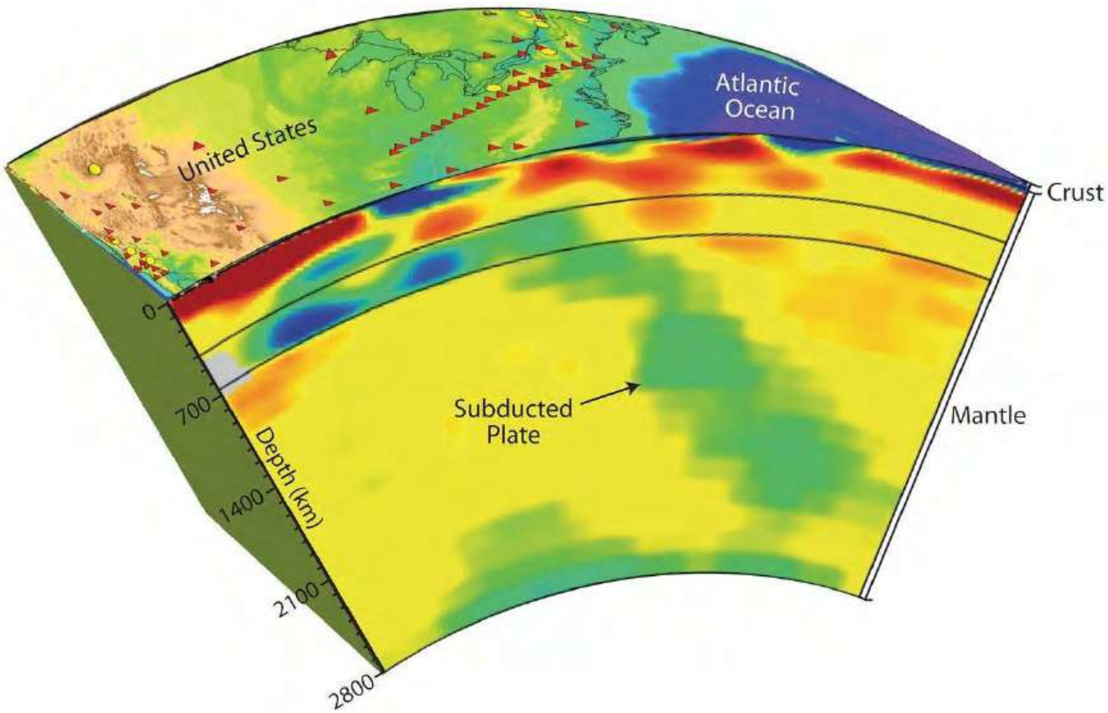
In this technique, seismic waves are refracted as they pass through layers with different seismic velocities. By measuring the travel times of the refracted waves, the subsurface velocity distribution can be determined. This information is useful for mapping the depth and geometry of subsurface layers and identifying geological features like bedrock depth and the presence of subsurface anomalies.



Seismic Imaging Techniques

Seismic Tomographic Imaging:

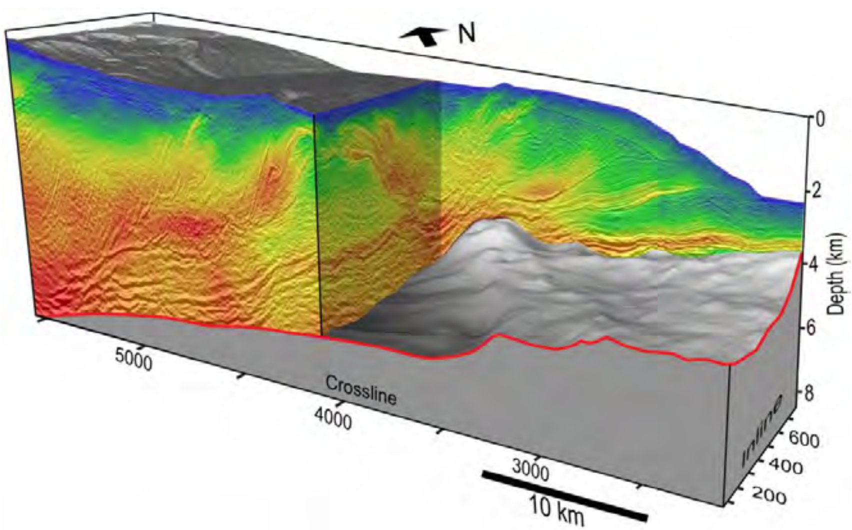
Seismic tomographic techniques involve measuring the travel times of seismic waves at various receiver locations and using this information to create a velocity model of the subsurface. Seismic Tomographic imaging is widely used in applications such as earthquake studies, reservoir monitoring, and imaging of subsurface structures.

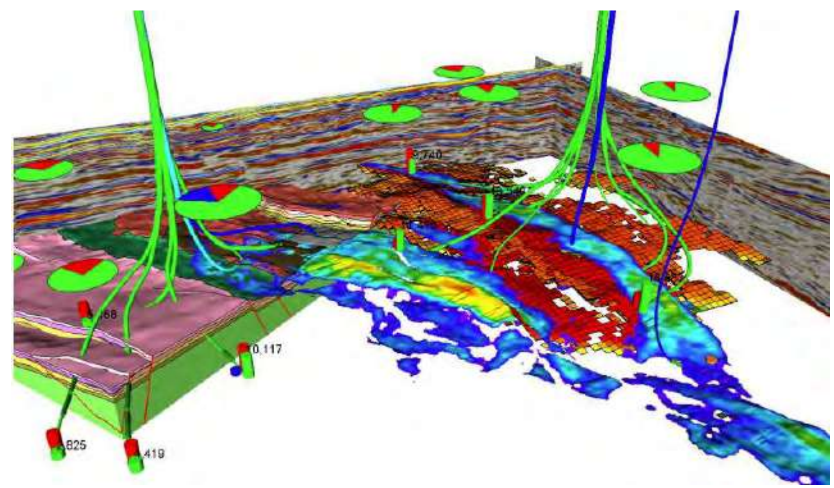


Seismic Imaging Techniques

3D and 4D Seismic Imaging:

3D seismic imaging provides a detailed representation of subsurface structures in three dimensions, allowing for more accurate reservoir characterization and imaging of complex geological features. 4D seismic imaging is used to monitor changes in subsurface structures over time, such as fluid movement in reservoirs or the effects of production activities.

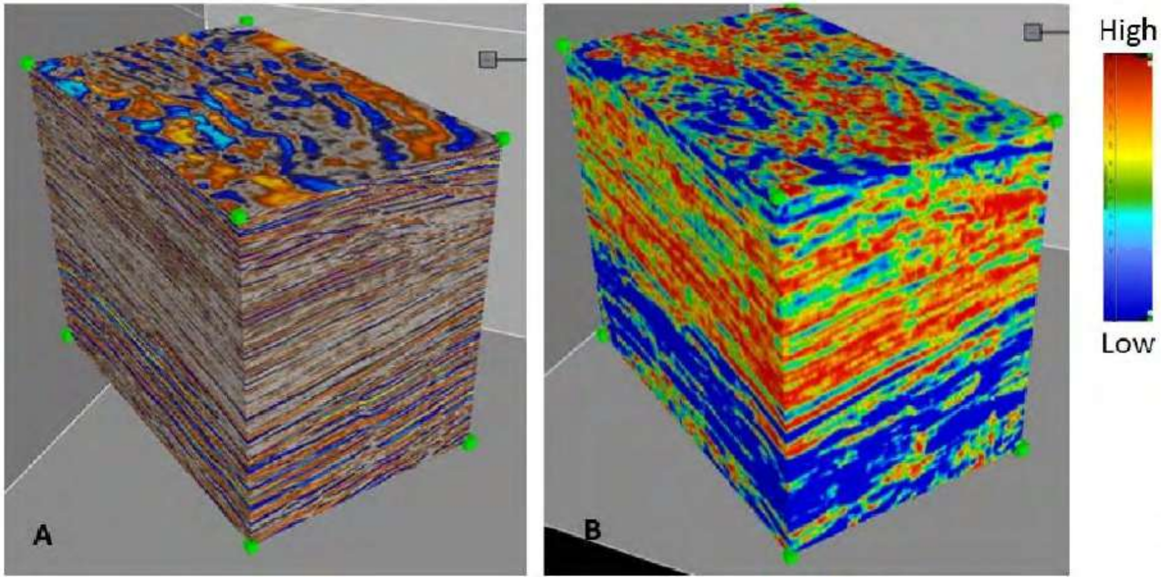




Seismic Imaging Techniques

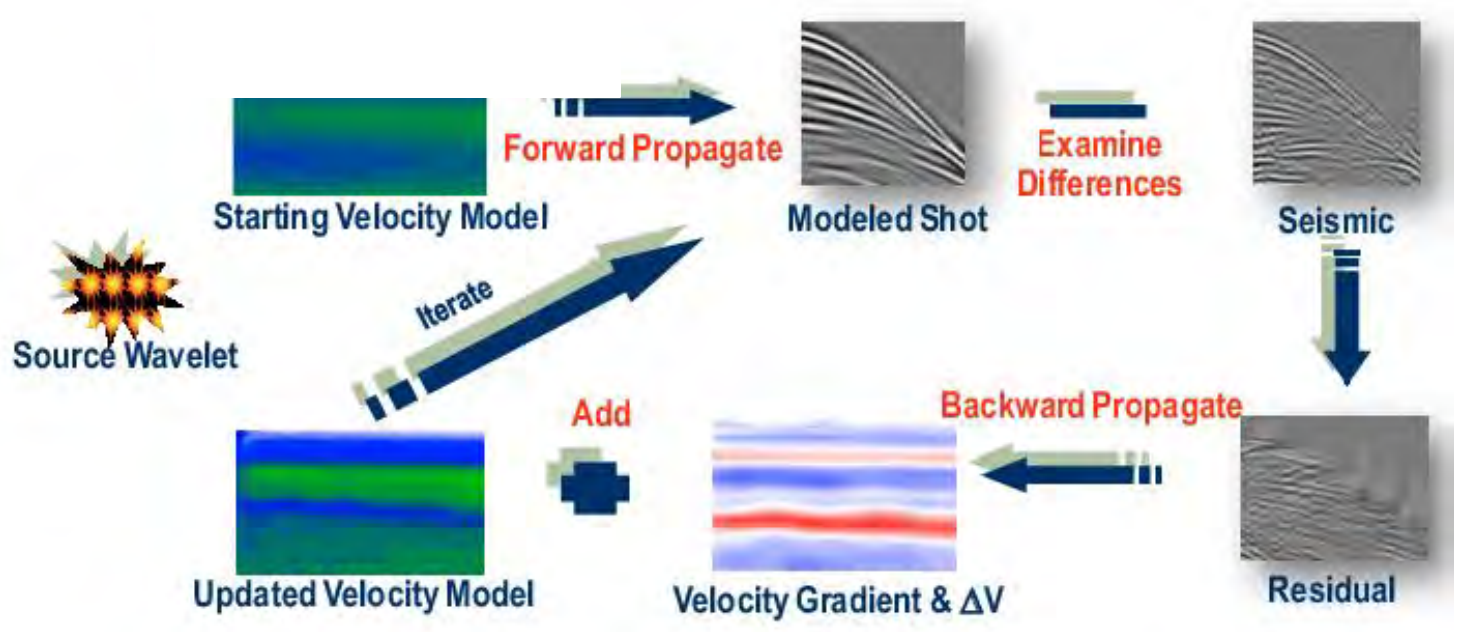
Seismic Attribute Analysis:

Seismic attributes are properties derived from seismic data that provide additional information about subsurface characteristics. These attributes can include amplitude, frequency, phase, and various other measures. By analyzing and interpreting seismic attributes, geophysicists can identify features such as faults, fractures, and hydrocarbon indicators, aiding in reservoir characterization and exploration efforts.



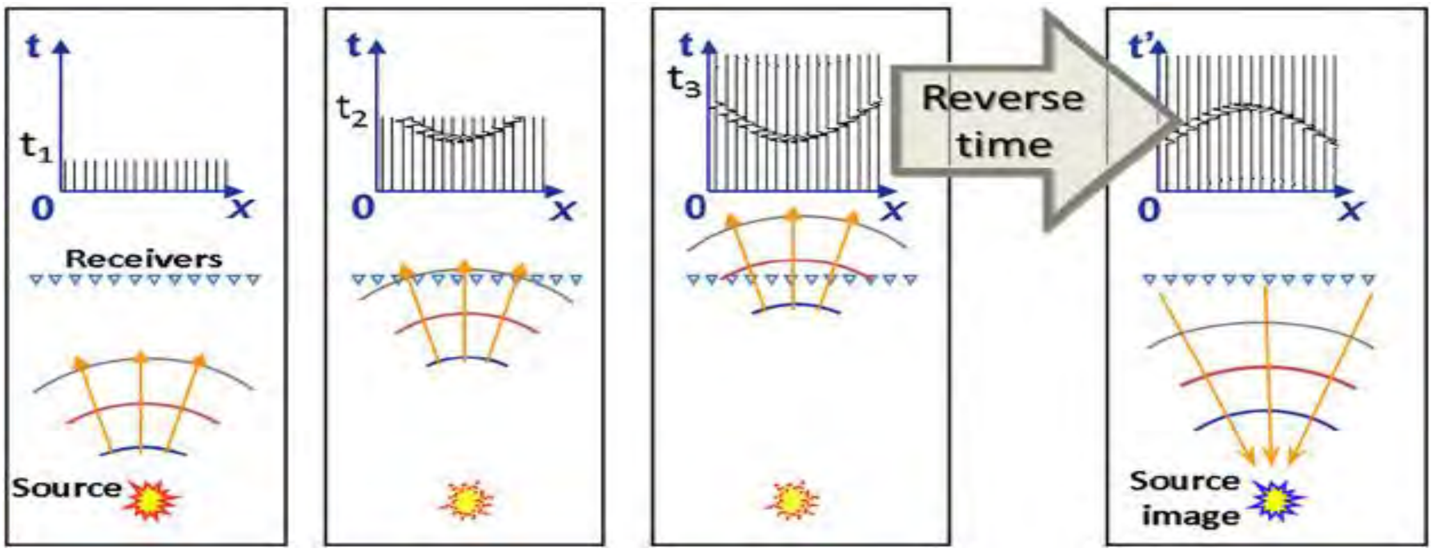
Full Waveform Inversion (FWI):

FWI is a computational method that aims to estimate subsurface properties by repetition by matching observed seismic data with modeled wavefields. It provides high-resolution images of subsurface velocity and density variations, allowing for detailed characterization of geological formations.



Reverse Time Migration (RTM):

RTM is a imaging technique that precisely recreates subsurface images by numerically back-propagating seismic wavefields from receiver locations to the source locations. It is mainly effective in imaging complex subsurface structures, such as salt bodies, and provides improved imaging of reflectors.

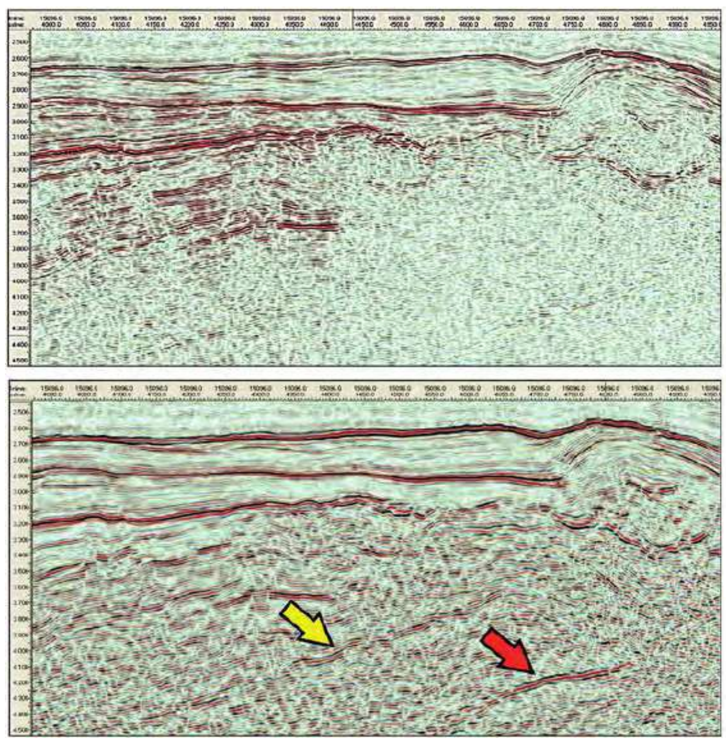


Prestack Depth Migration (PSDM):

PSDM is a technique that involves migrating seismic data to their true subsurface locations before stacking. It takes into account the variation in velocity and anisotropy across the subsurface, resulting in more accurate imaging of subsurface features and improved interpretation.

Before

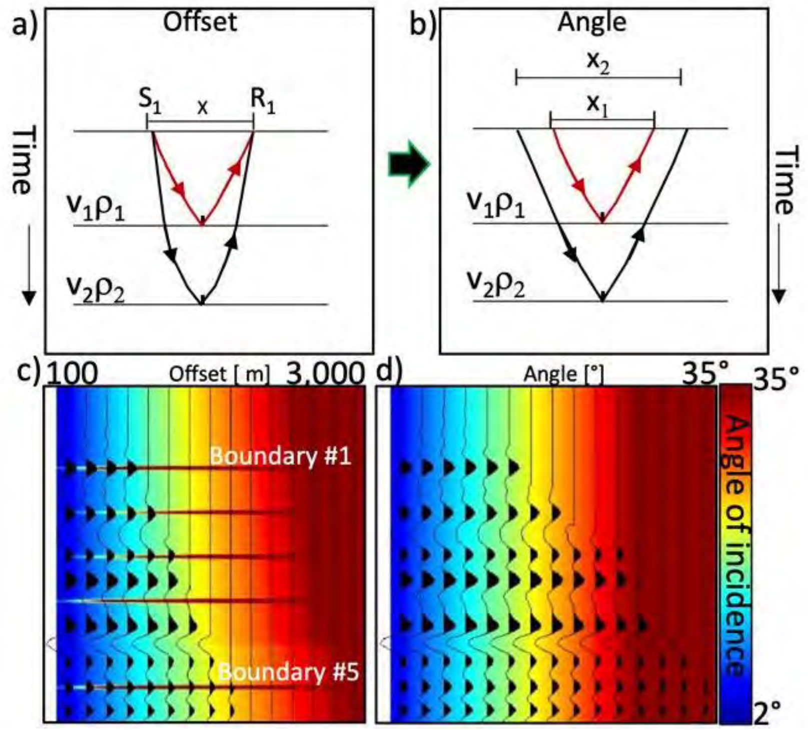
After



Seismic Imaging Techniques

Angle Domain Imaging:

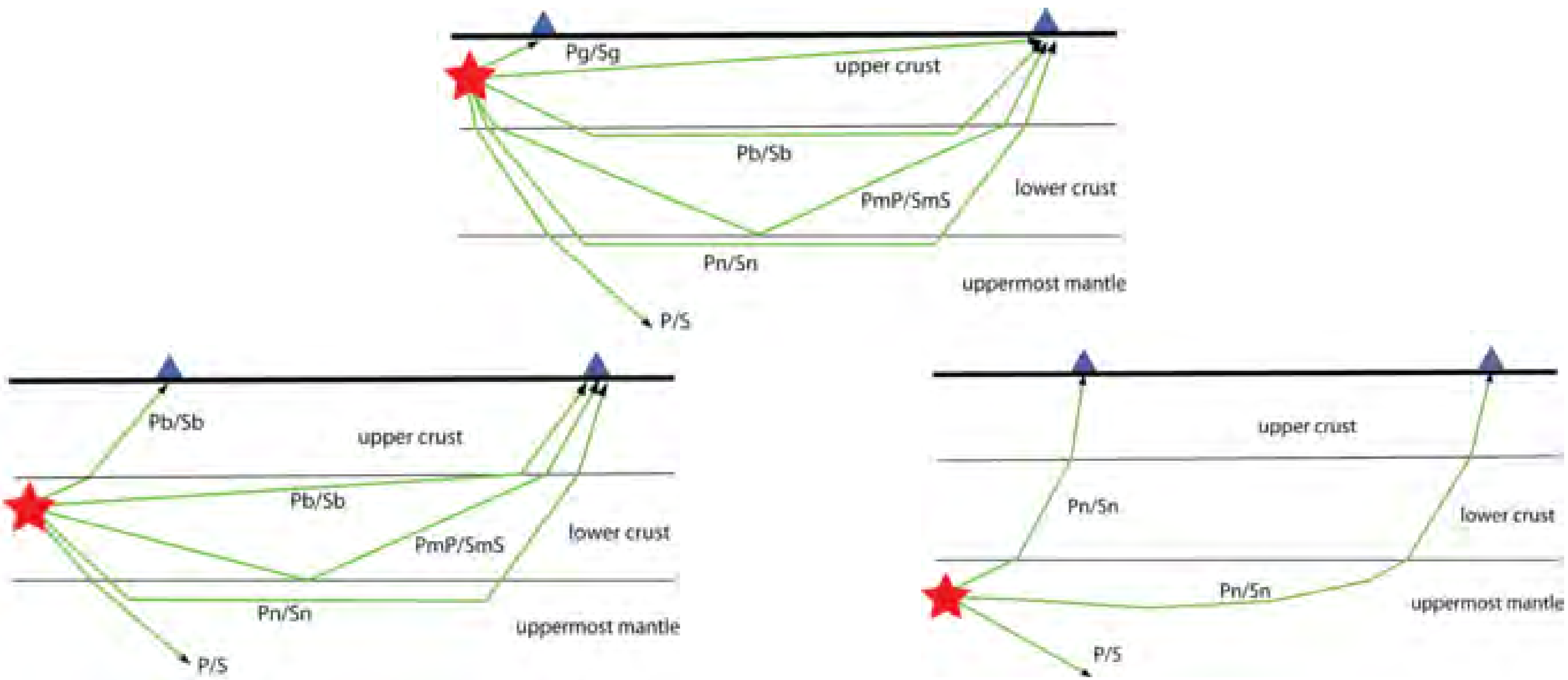
RTM is a imaging technique that precisely recreates subsurface images by numerically back-propagating seismic wavefields from receiver locations to the source locations. It is mainly effective in imaging complex subsurface structures, such as salt bodies, and provides improved imaging of reflectors.



Seismic Imaging Techniques

Multi-Component Seismic Imaging:

Multi-component seismic data, which includes both compressional (P-wave) and shear (S-wave) wave measurements, can be utilized to obtain more detailed information about subsurface properties. Techniques such as converted-wave imaging and elastic full-waveform inversion are used to process and interpret multi-component data.



Seismic Imaging Techniques