Seismic Reflection Data Processing Migration

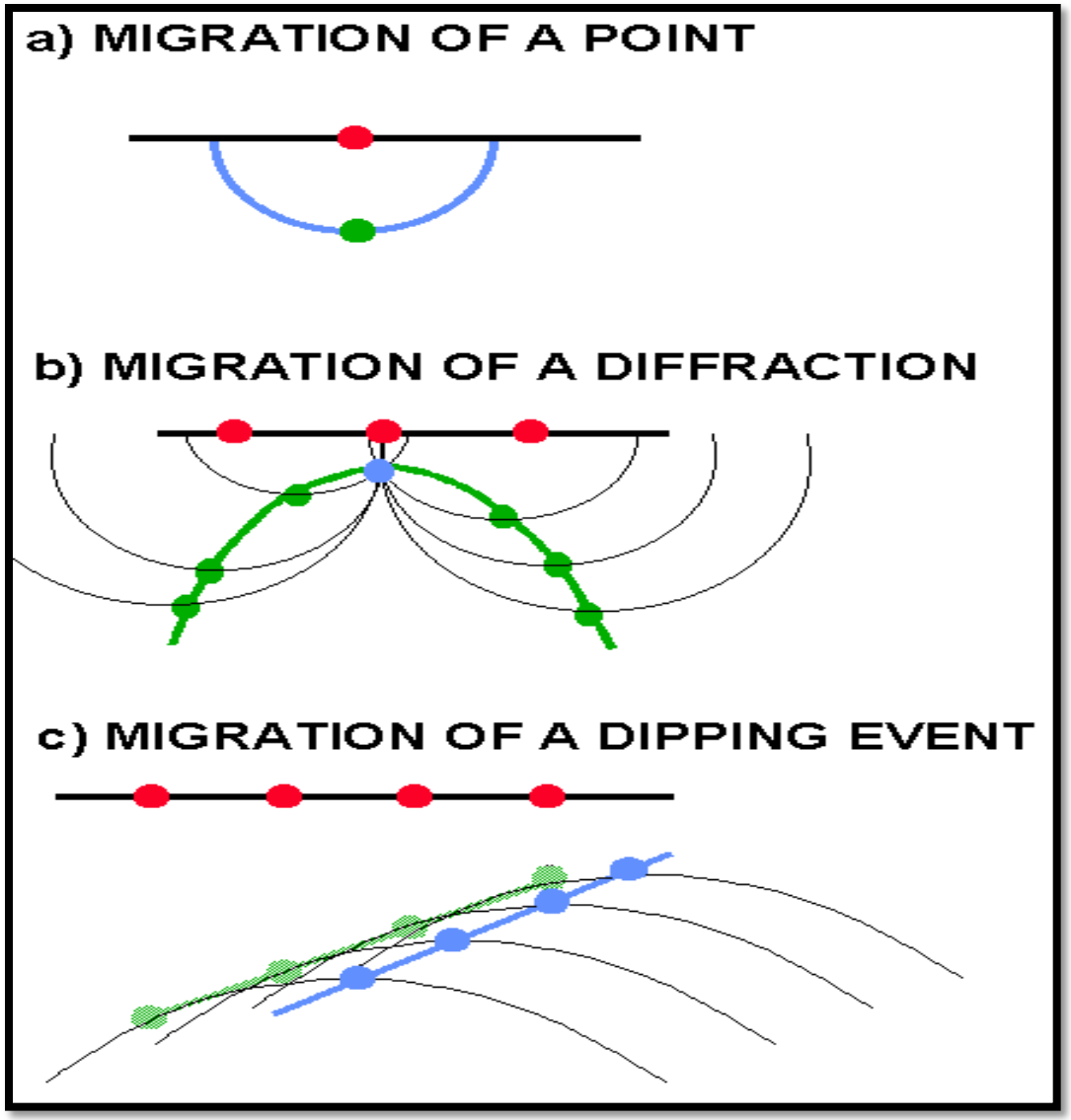
Emad A. Al-Heety
Department of Applied Geology
University of Anbar
Email: emadsalah@uoanbar.edu.iq

Migration

- Migration is a step in seismic processing in which reflections in seismic data are moved to their correct locations in the x-y-time space of seismic data, including two-way travel time and position relative to shot points.

Migration

- Migration improves seismic interpretation and mapping because the locations of geological structures, especially faults, are more accurate in migrated seismic data.


a) MIGRATION OF A POINT
b) MIGRATION OF A DIFFRACTION
c) MIGRATION OF A DIPPING EVENT

Migration

- **Migration deals with**
- Dipping interfaces
- Curved interfaces
- Diffractions
- Reflections from the 3rd dimension

Migration

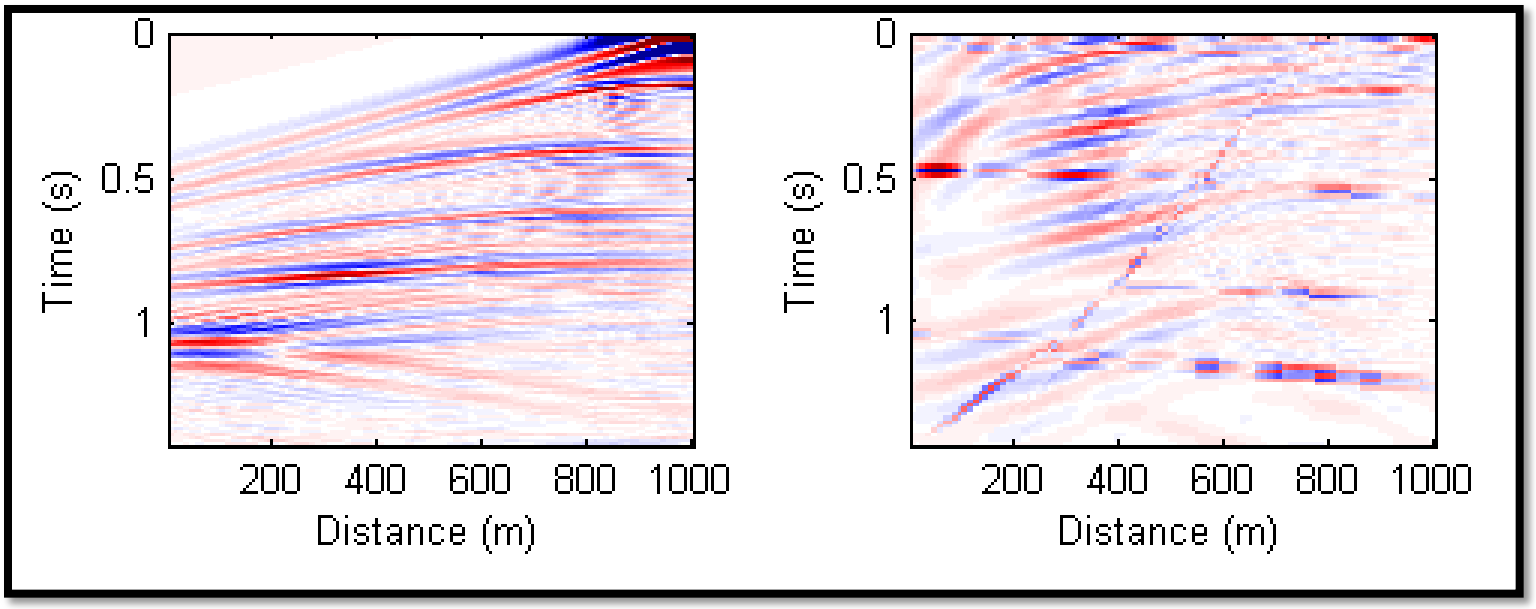
- **There are numerous methods of migration:**
  - dip moveout (DMO)
  - frequency domain
  - ray-trace and wave-equation migration

Time Migration

- Restore the geometrical relationships between seismic events on the time section.
- Time migration has the effect of moving dipping events on a surface seismic line from apparent locations to their true locations in time.

Time Migration

- The resulting image is shown in terms of travel time rather than depth , and must then be converted to depth with an accurate velocity model to be compared to well logs.

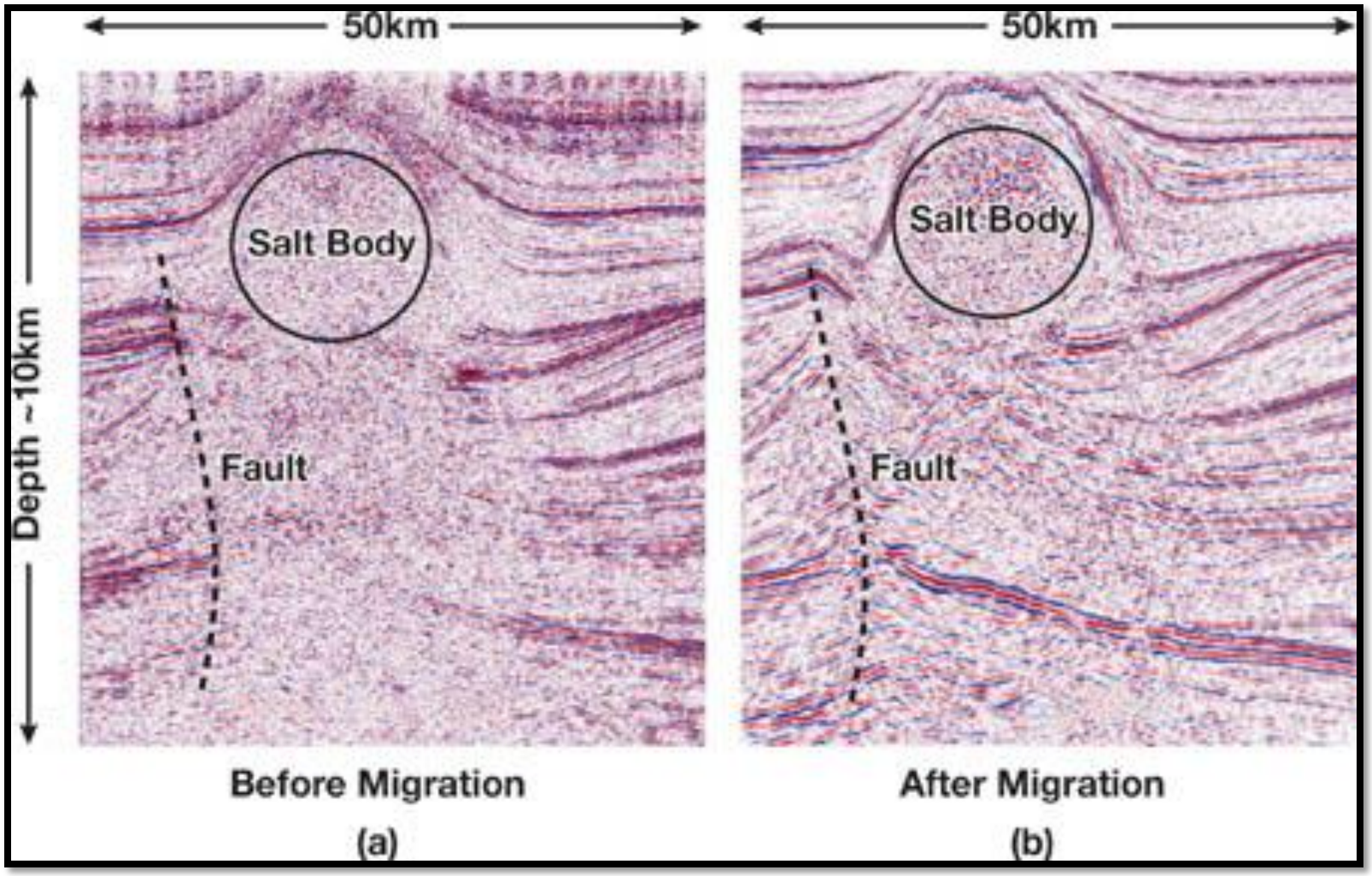


Immigrated image

Migrated image

Depth Migration

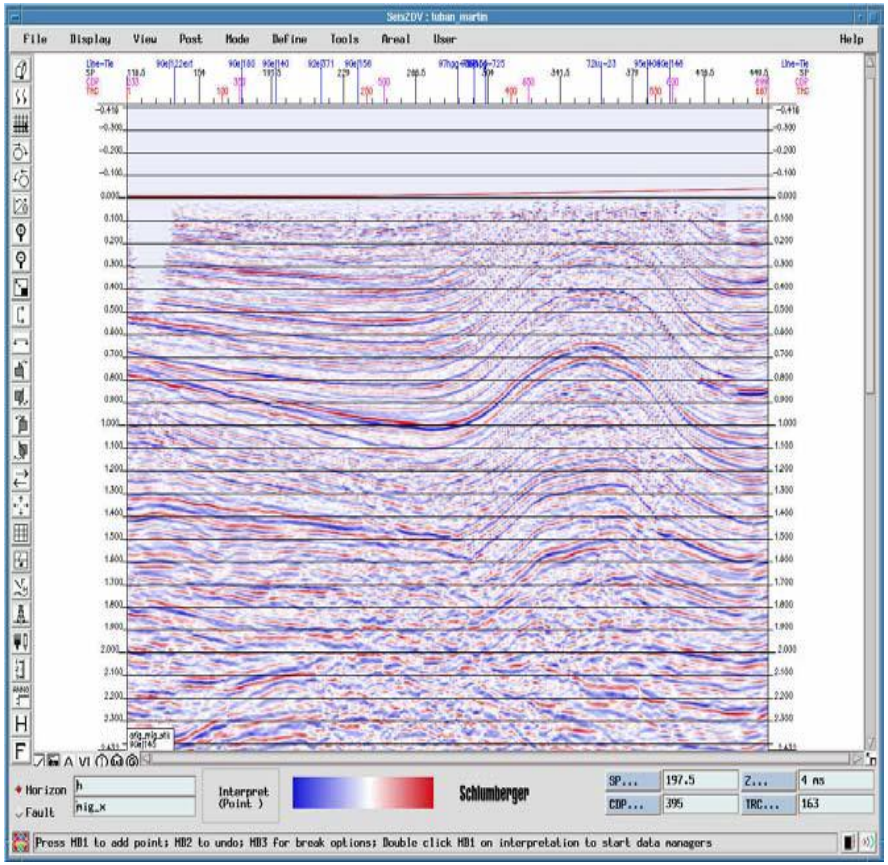
- A step in seismic processing in which reflections in seismic data are moved to their correct locations in space, including position relative to shot points, in areas where there are significant and rapid lateral or vertical changes in velocity that distort the time image.
- This requires an accurate knowledge of vertical and horizontal seismic velocity variations.


50km
50km
Depth ~10km
Salt Body
Fault
Salt Body
Fault
Before Migration
(a)
After Migration
(b)

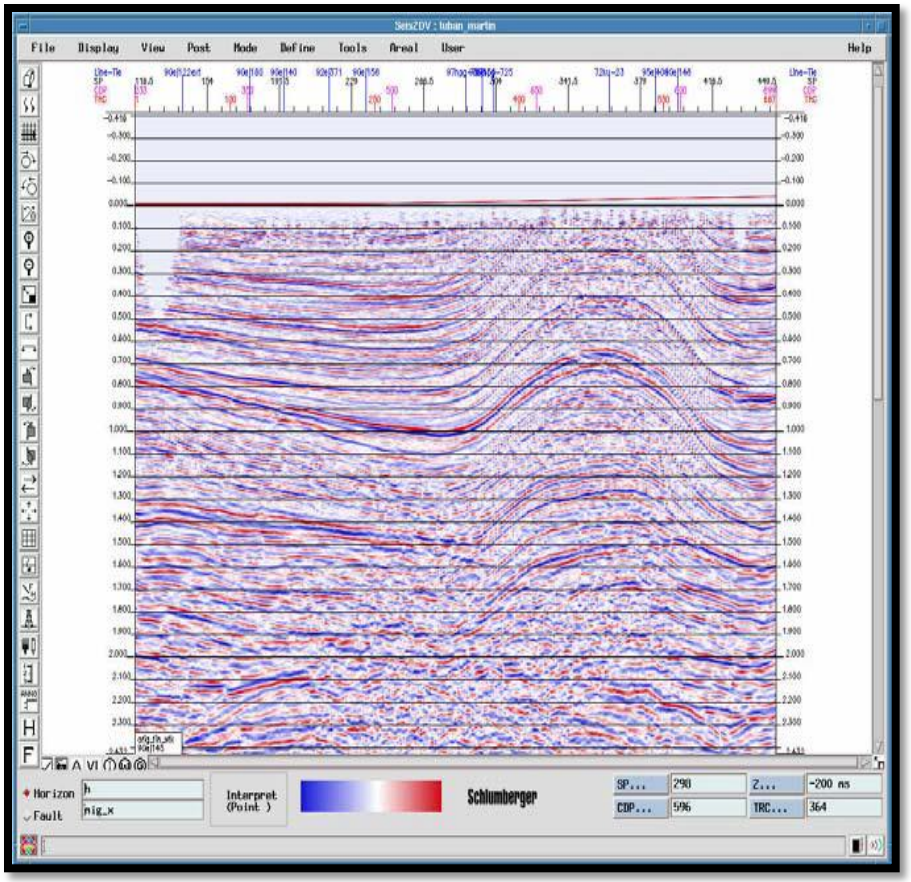
Migration Procedure

- For a zero offset seismic section (i.e. stacked data):

Diffraction hyperbolae are identified by scanning adjacent traces and collapsed back to the point of origin.



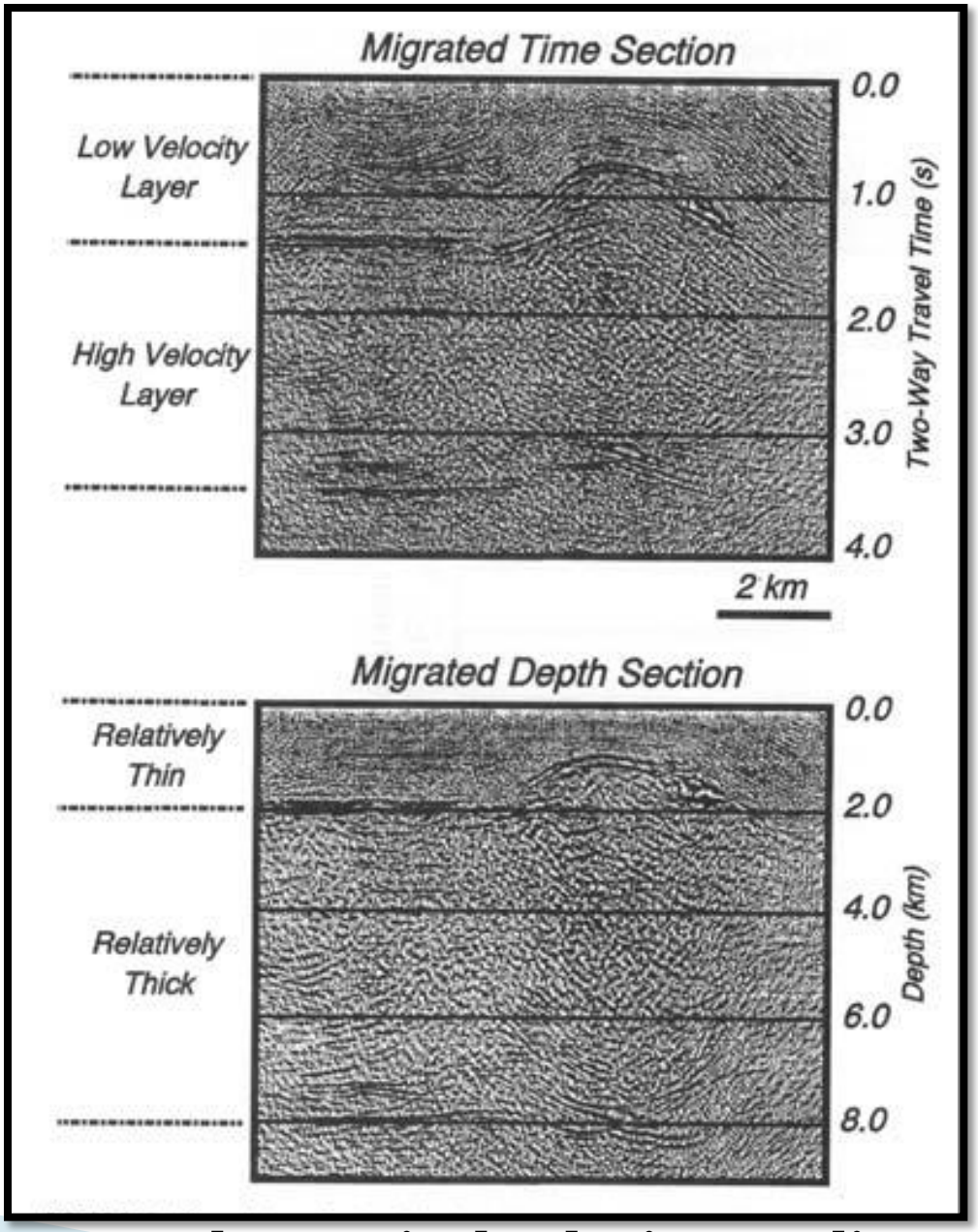
Stacked Section



Migrated Section

Velocity Distortions

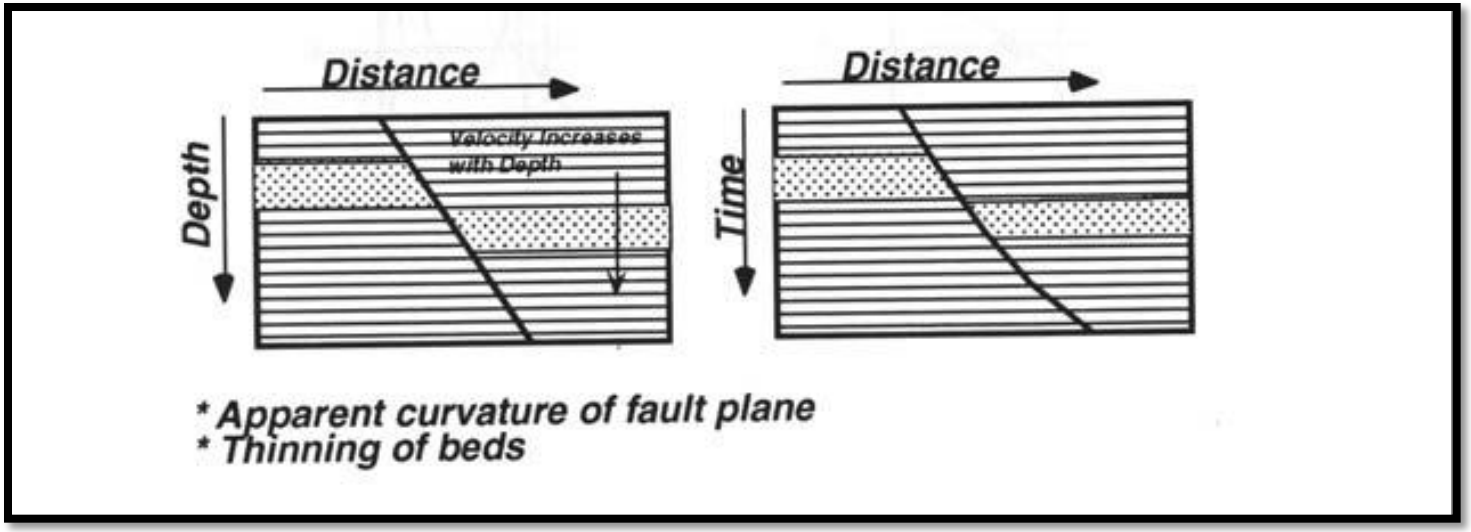
- Velocity relates the time section recorded to a depth section.
- Horizontal and vertical velocity variations distort the section.



Example: vertical velocity gradient

Fault Distortions

- Since velocities are variable with depth, distortion of fault planes and bed thickness due to velocity effects is a possible.



Textbook

Alsadi, H.N. (2017) Seismic Hydrocarbon Exploration: 2D and 3D Techniques. Springer International Publishing, Switzerland, 331p.