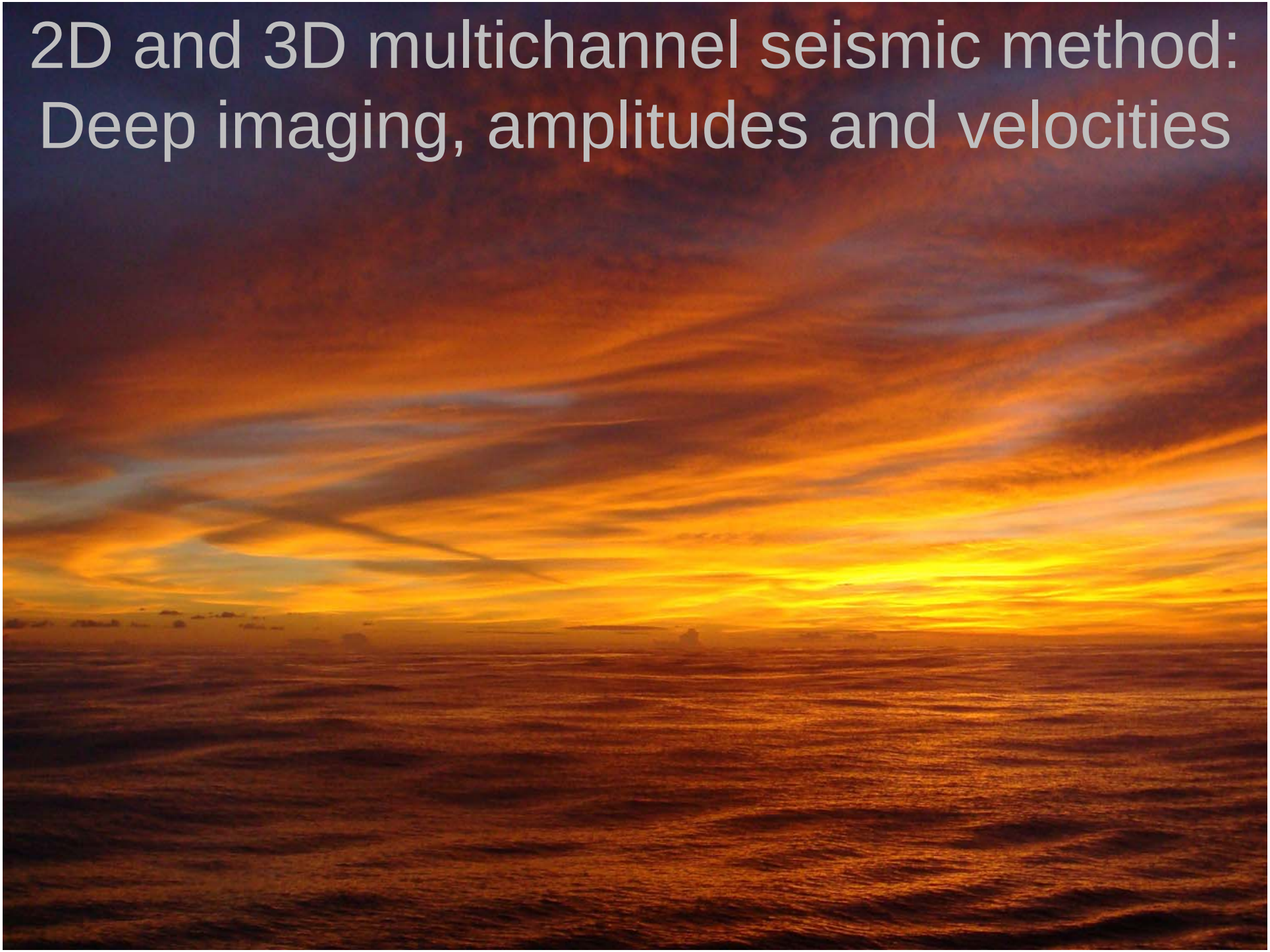
2D and 3D multichannel seismic method: Deep imaging, amplitudes and velocities

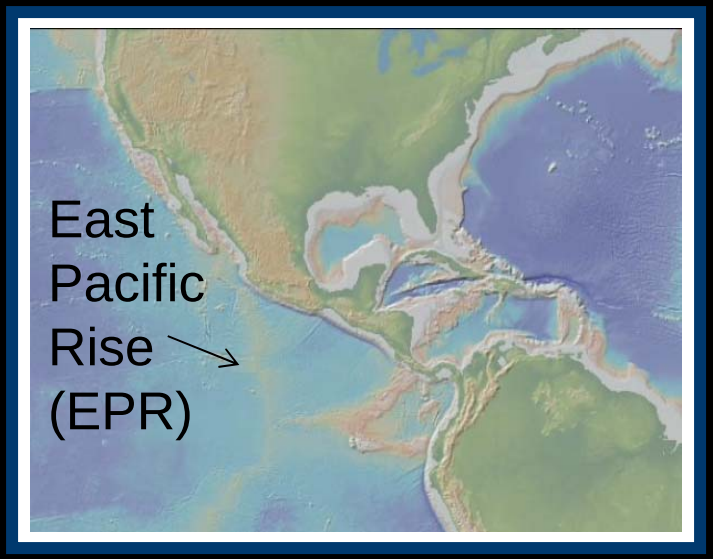


Mutter & Carton (2013); History of Moho reflection imaging across ocean basins since 1970s

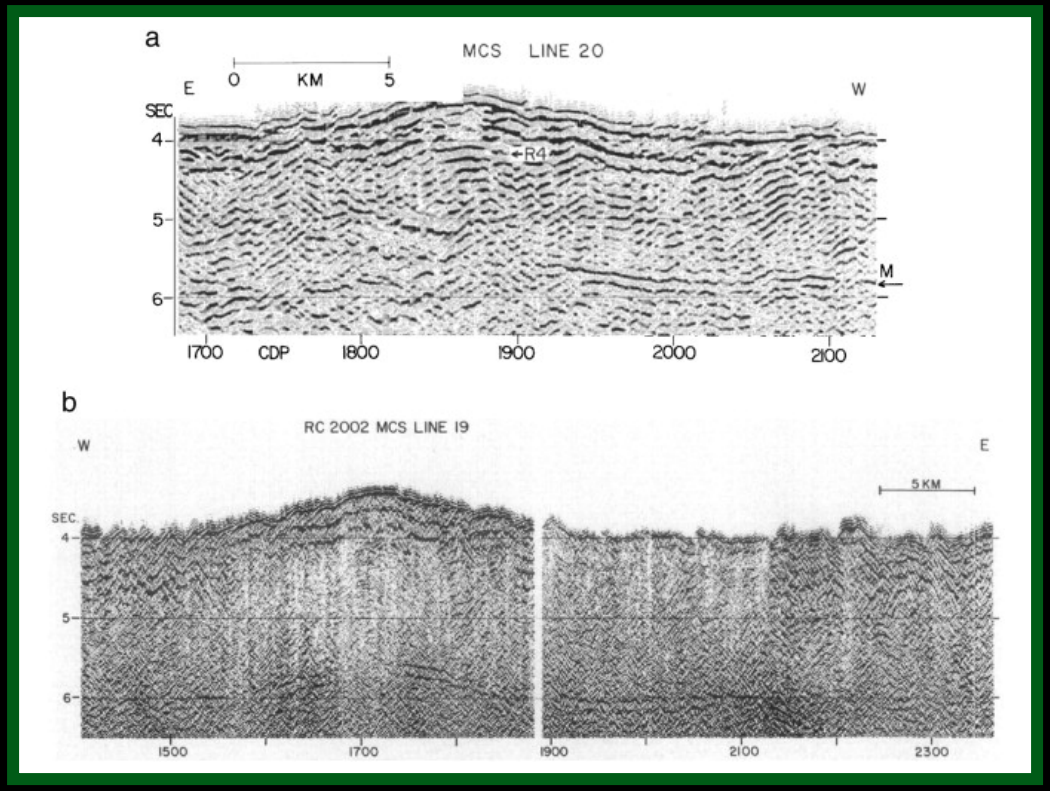
Early 2D imaging of reflection Moho; East Pacific Rise from R/V *Conrad*

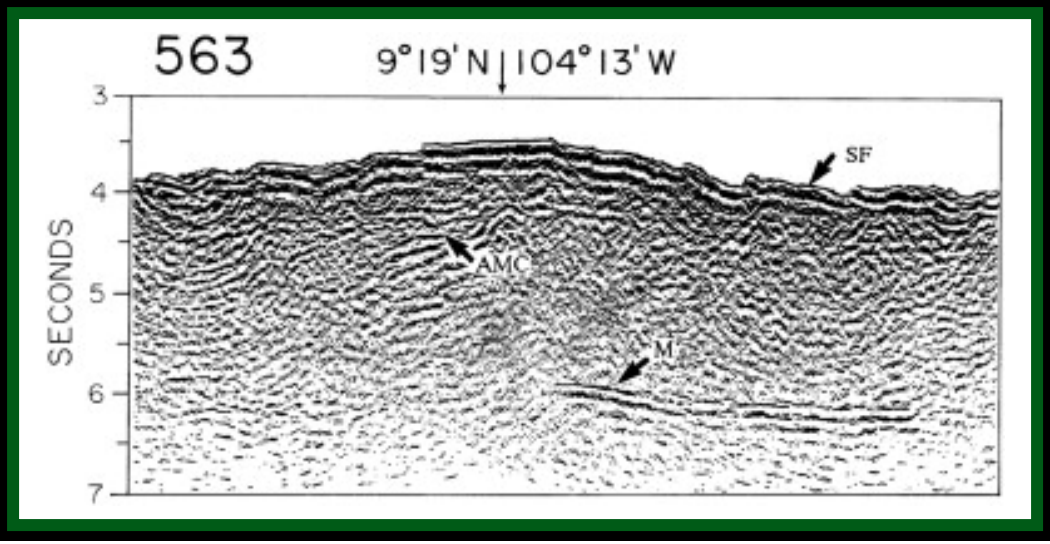
(a) Herron et al. (1980), 1976 survey

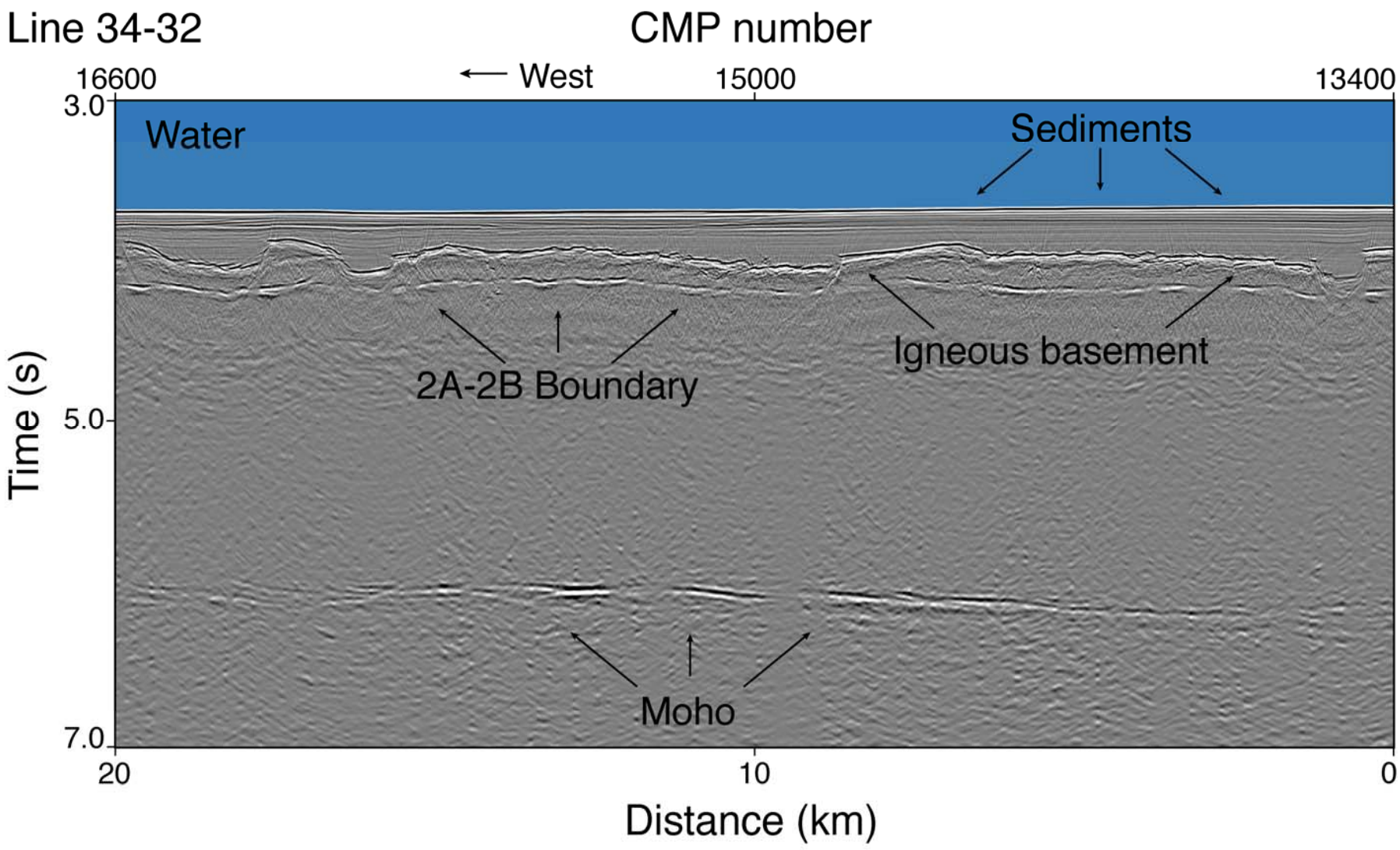
(b) Stoffa et al. (1980), 1976 survey



Barth & Mutter (1996), 1985 survey

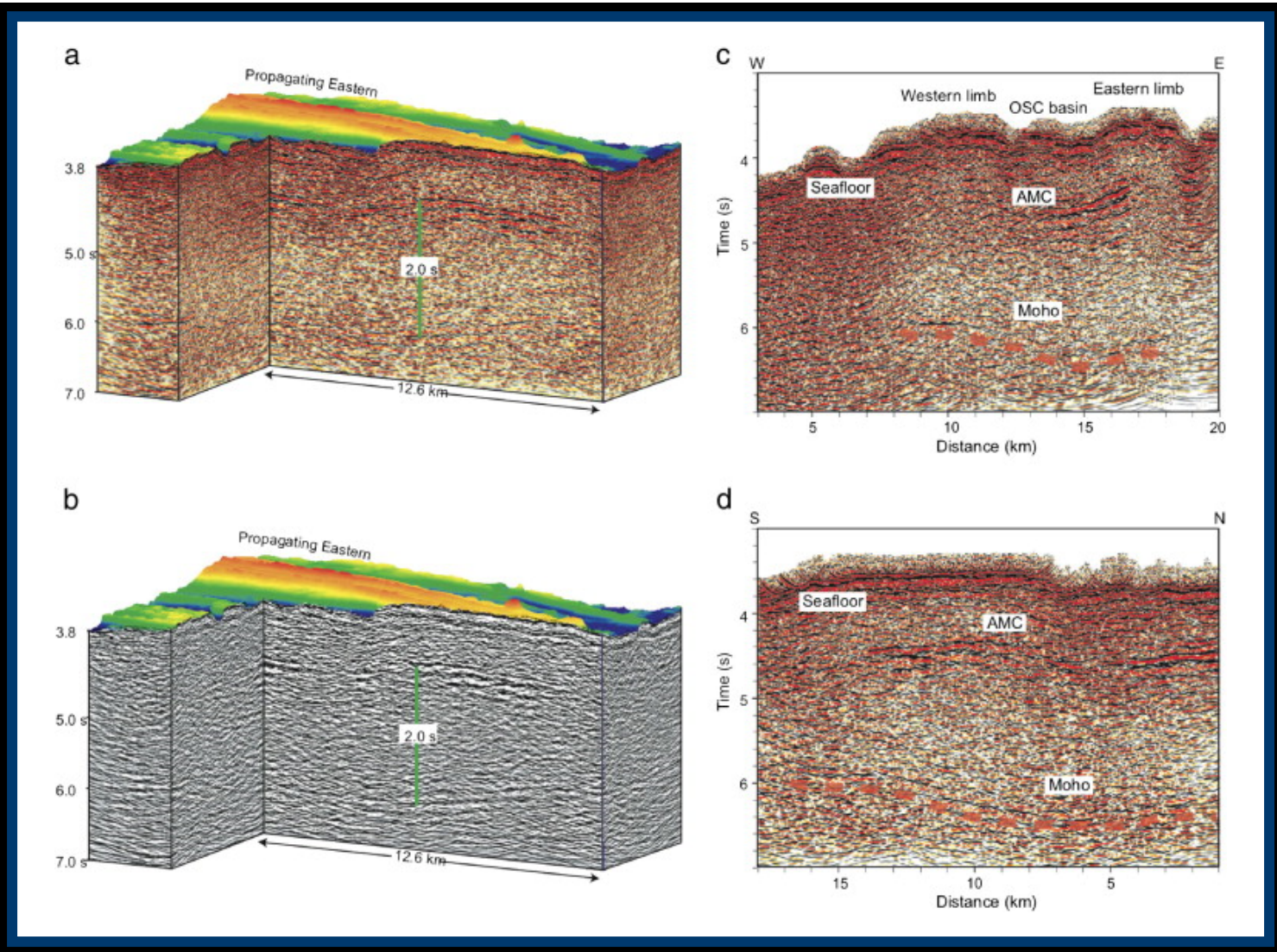






More recent 2D imaging of reflection Moho;

Juan de Fuca ridge flanks; 2002 R/V *Ewing*

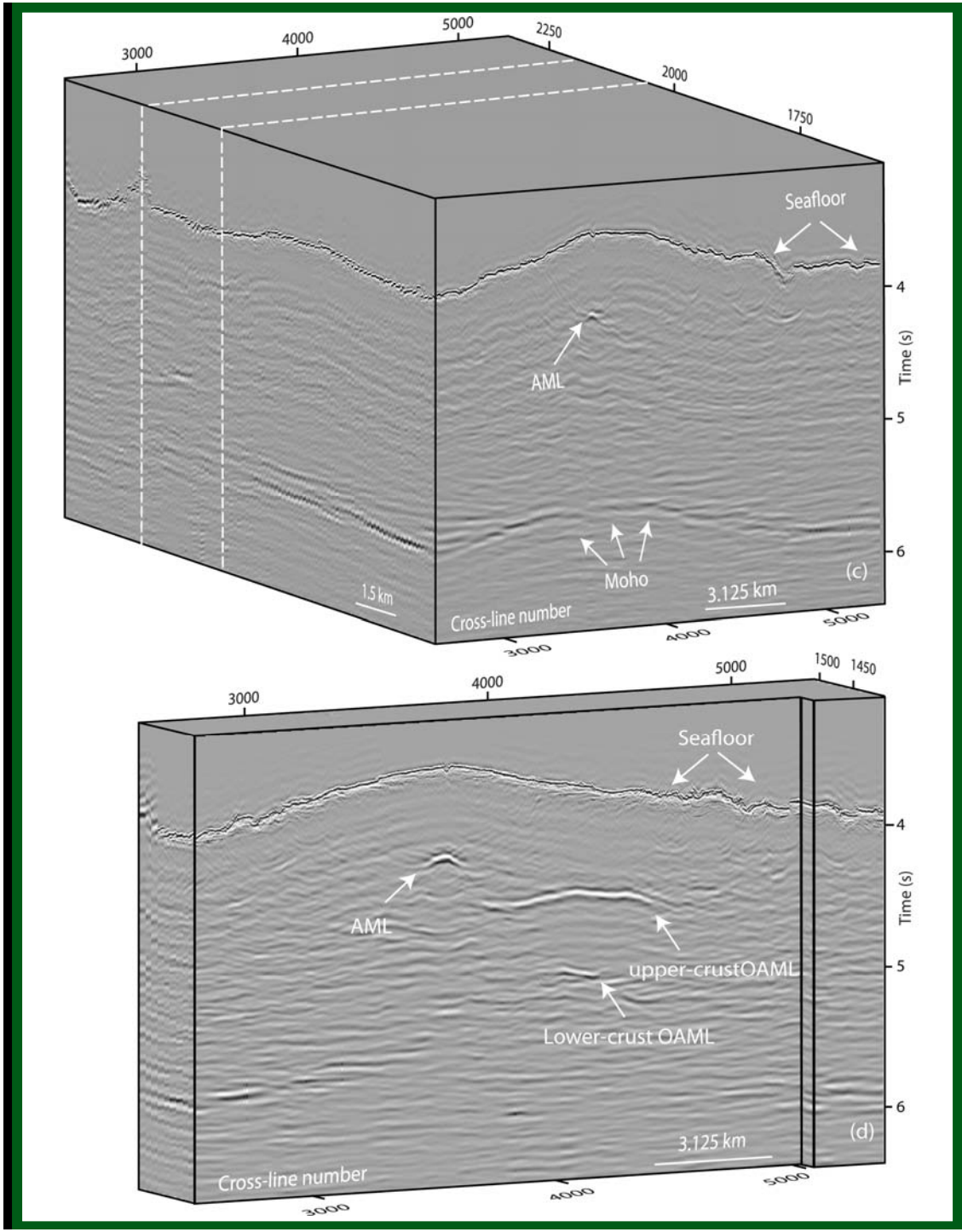


Early 3D imaging of reflection Moho; East Pacific Rise from R/V *Ewing*

Singh et al. (2006), 1997 survey

(a,b) Same view into 3D cube but with different color scales

(c,d) Cross-axis and along-axis sections from 3D cube, respectively



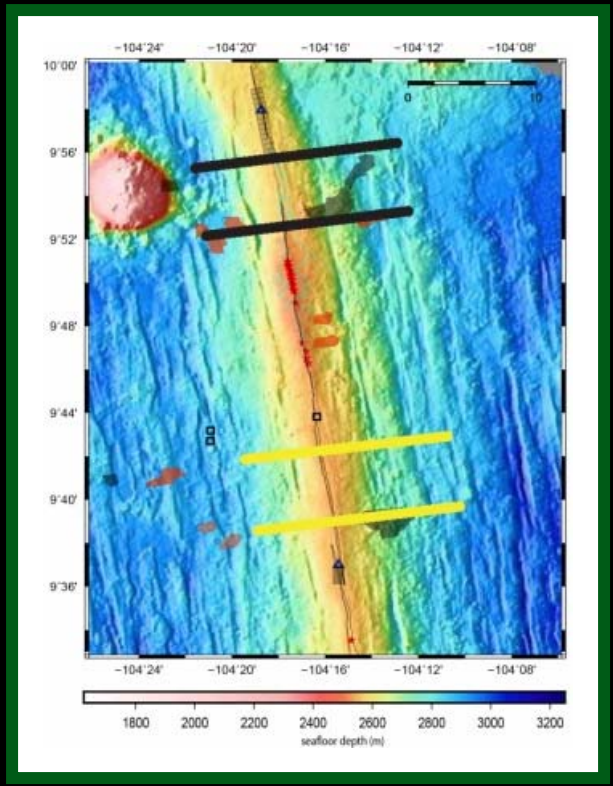
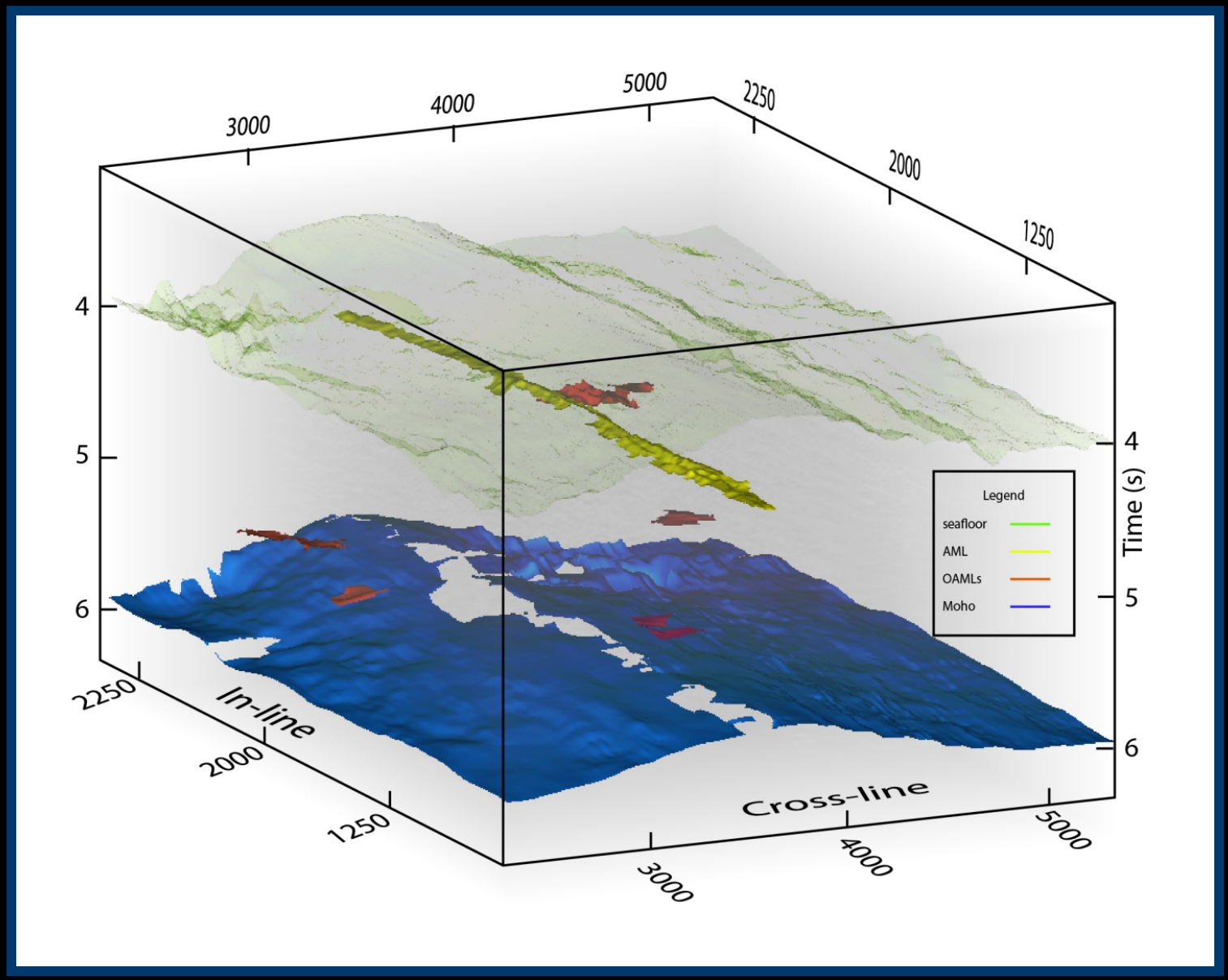
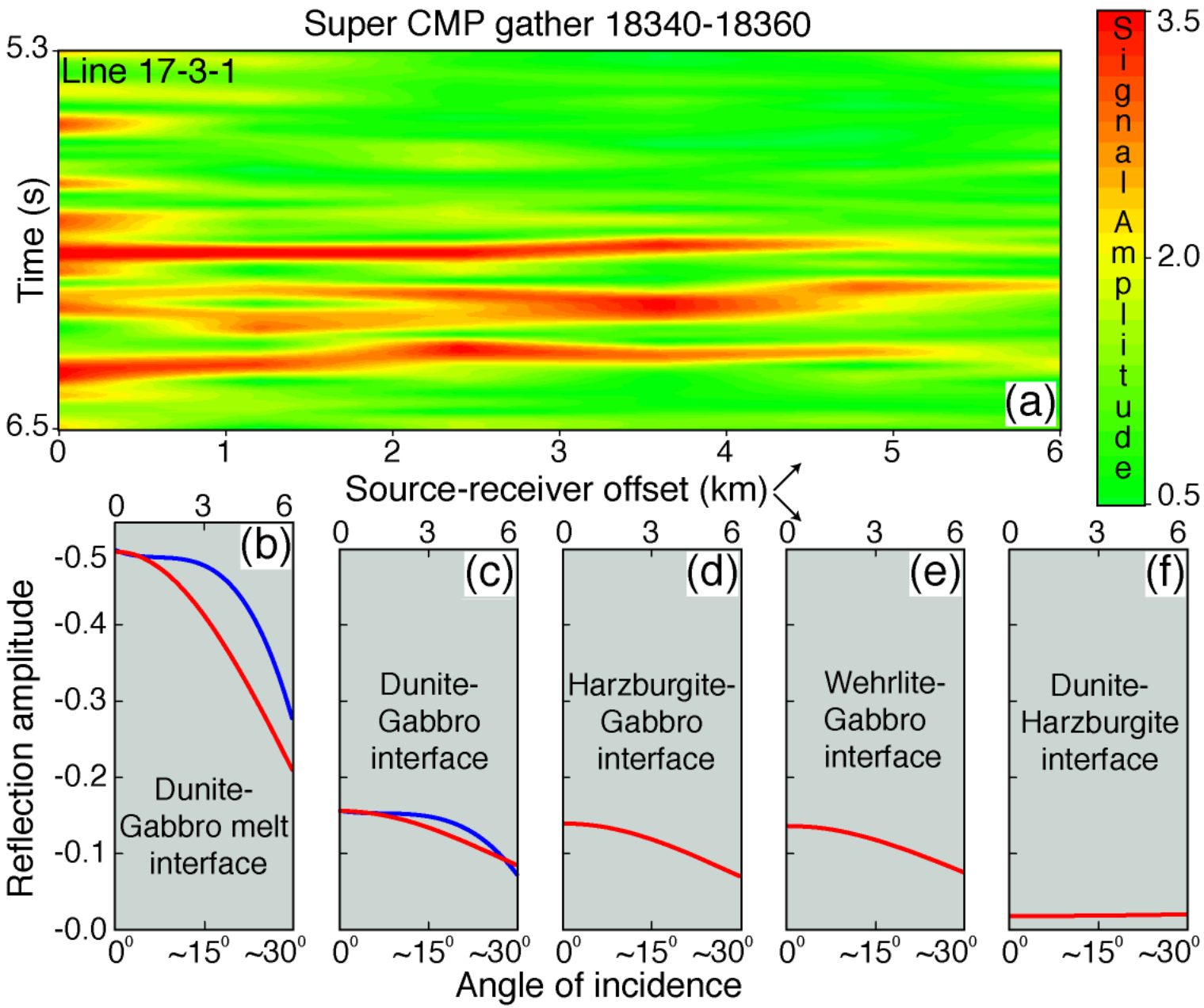


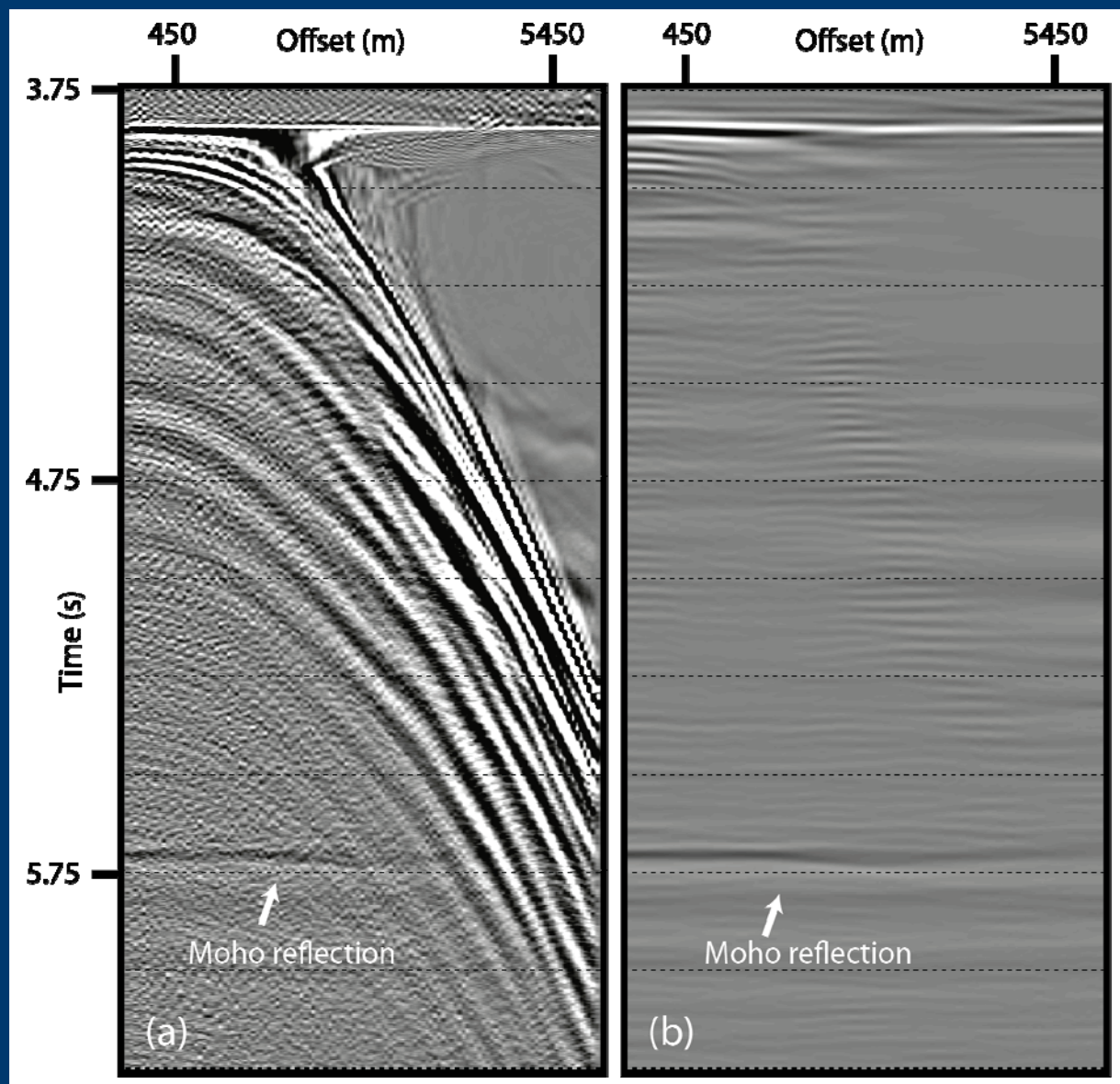
Image slices
from 3D prestack
migrated cube

Picked seafloor, AML, OAMLs and Moho surfaces



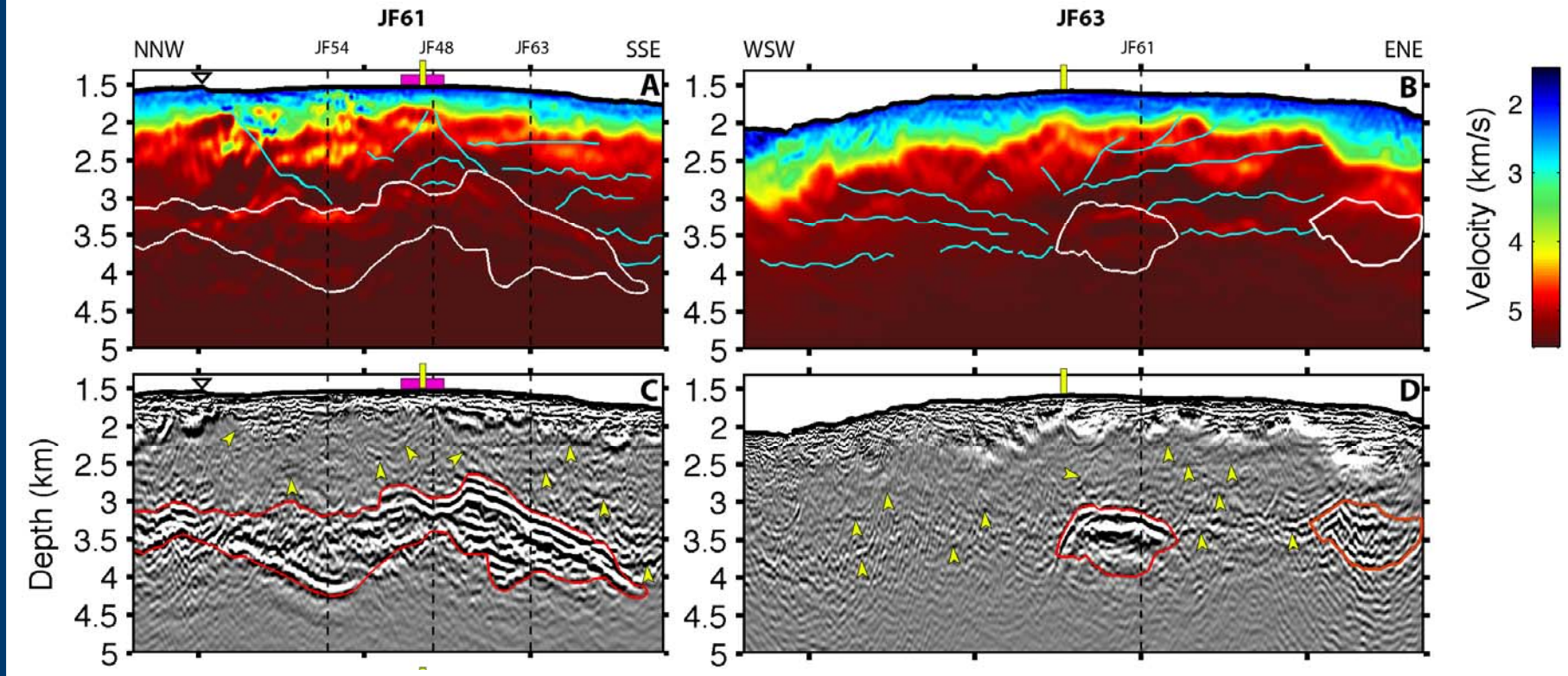

Super CMP gather 18340-18360
Line 17-3-1
5.3
6.5
Time (s)
0
1
2
3
4
5
6
(a)
Source-receiver offset (km)
Signal Amplitude
3.5
2.0
0.5
(b)
(c)
(d)
(e)
(f)
Reflection amplitude
-0.5
-0.4
-0.3
-0.2
-0.1
-0.0
Dunite-Gabbro melt interface
Dunite-Gabbro interface
Harzburgite-Gabbro interface
Wehrlite-Gabbro interface
Dunite-Harzburgite interface
0°
~15°
~30°
Angle of incidence

3D prestack time migration



Common image gathers (CIGs) before (a) and after (b) LIFT filtering (Choo et al., 2004)

2D prestack depth migration



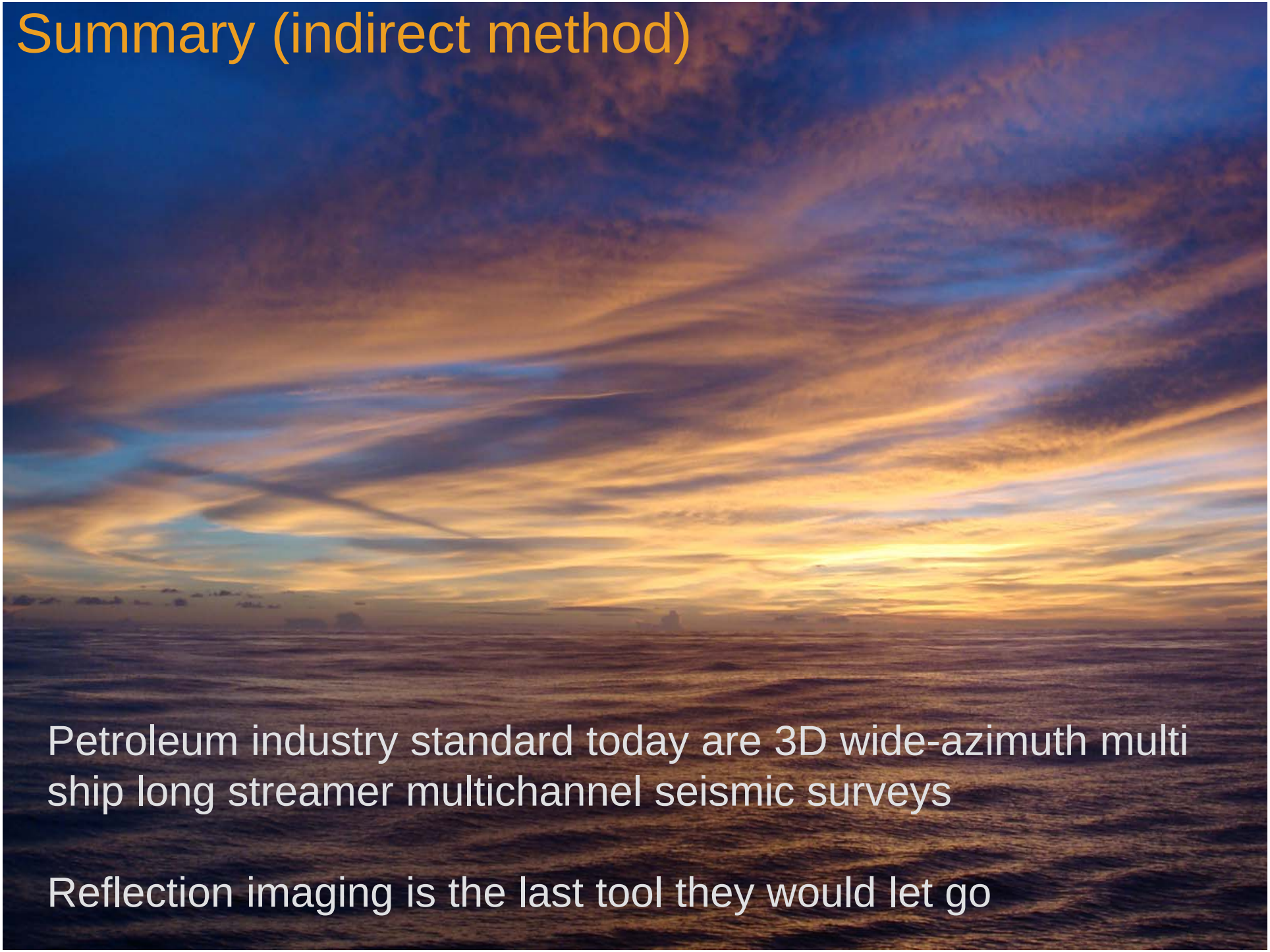
Summary (direct method)

2D/3D MCS data collection & processing to from reflection images of oceanic crust have greatly improved since the first 1976 EPR survey

- Powerful tuned source = increased vertical resolution
- Denser observation = increased lateral resolution
- Longer streamers = higher fold = higher signal2noise ratio
- Longer streamers = better velocity model = better imaging
- Longer streamers = seismic attributes = rock properties

-1976/1985 EPR 9^0&13^0N surveys: ~55%&30% Moho imaging
-1991 EPR 14^0S survey: ~30% Moho imaging
-2002 JDF survey: >60% Moho imaging
-2008 EPR 3D survey: ~89/92% Moho imaging

Summary (indirect method)



Petroleum industry standard today are 3D wide-azimuth multi ship long streamer multichannel seismic surveys

Reflection imaging is the last tool they would let go