The Different Types of Seismic Waves
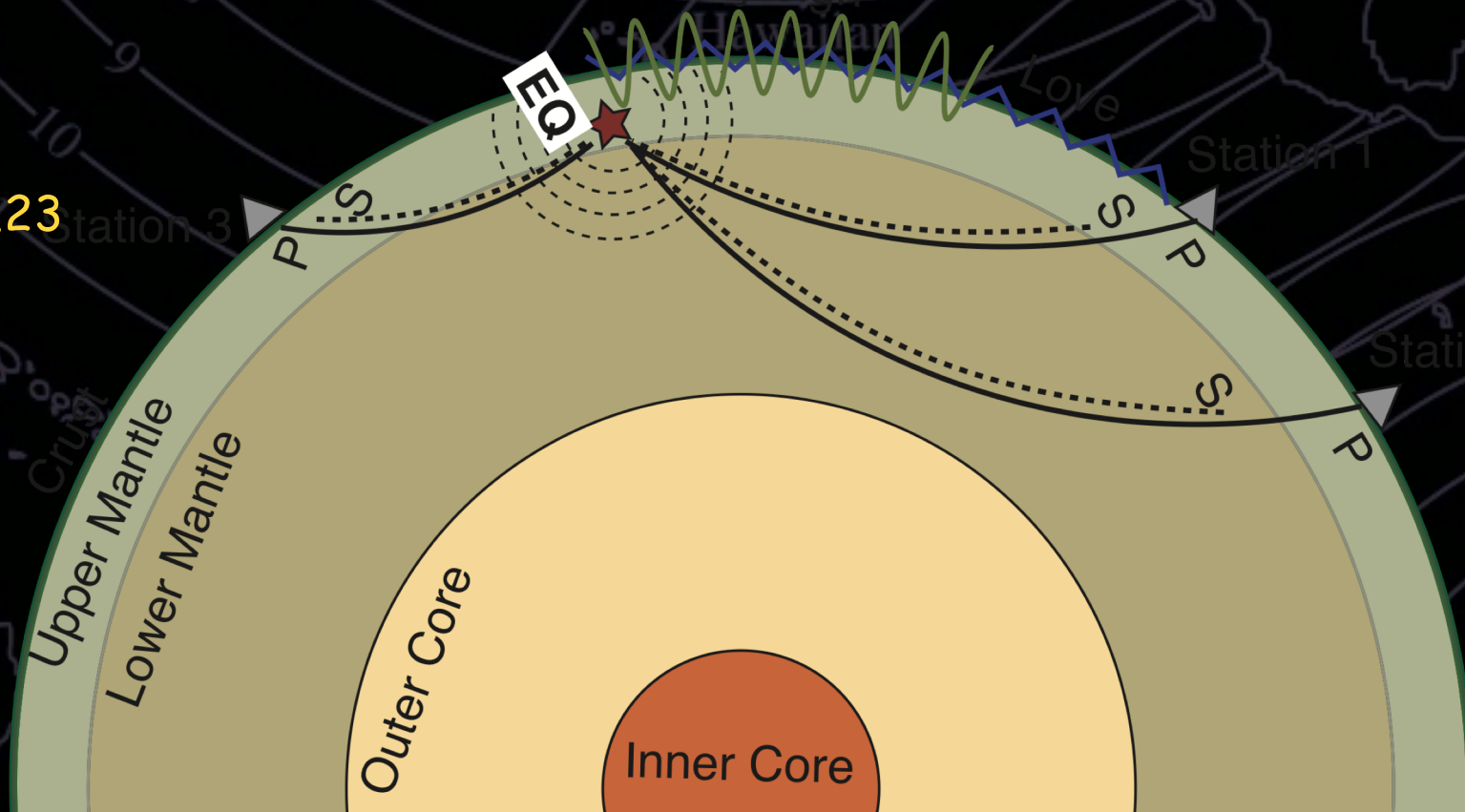
body waves: P and S Waves

surface waves: Rayleigh and Love waves

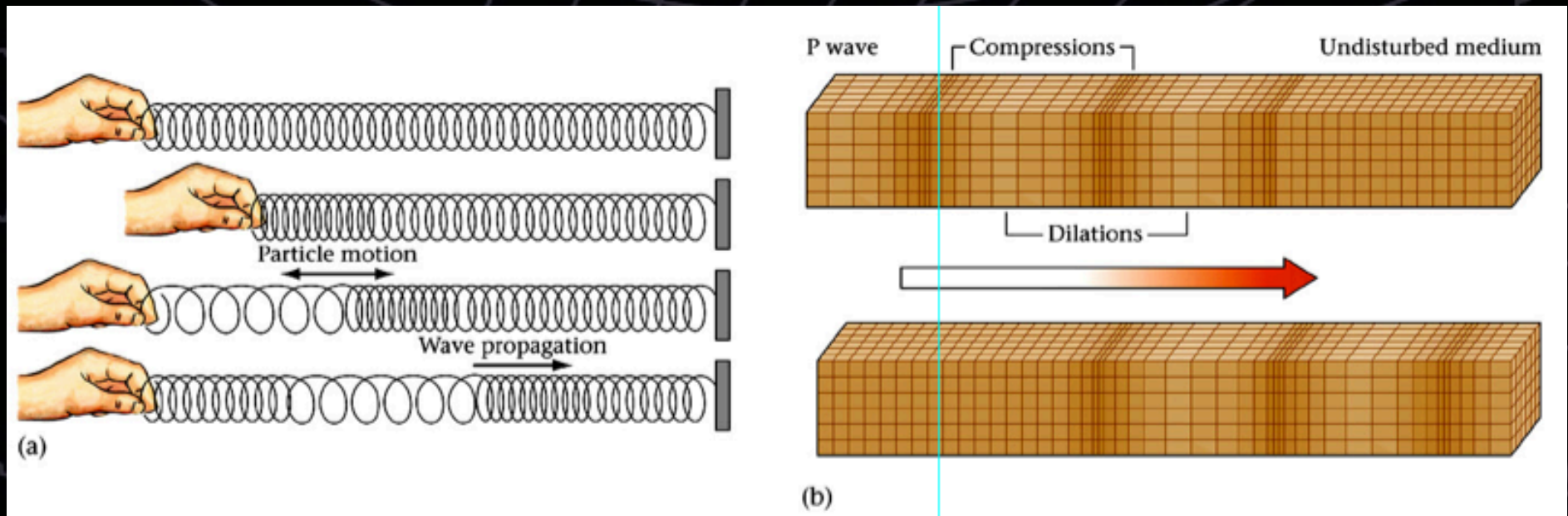Fig. 5.23

EQ

Crust
Upper Mantle
Lower Mantle
Outer Core
Inner Core

P
S
S
P
S
P

The Different Types of Seismic Waves

P Waves

- primary waves/arrive first at a station
- compressional
- particle motion in propagation direction
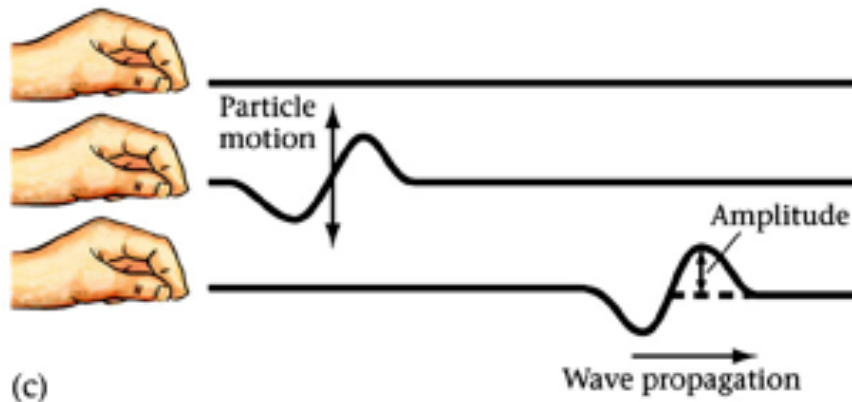- like sound waves

Fig. 5.22

source: Marshak "The Earth"
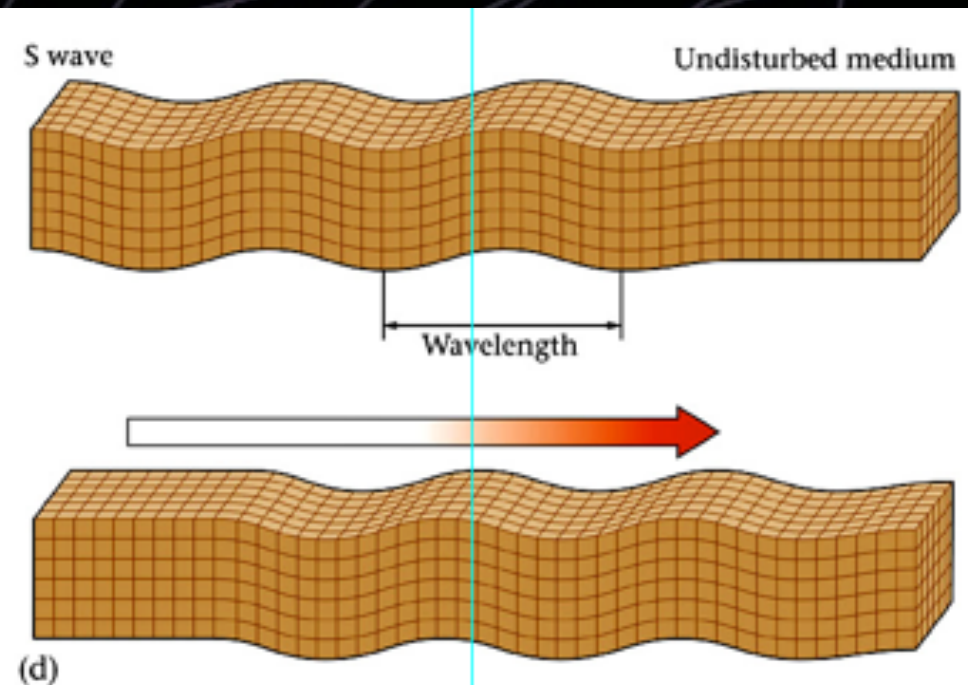
The Different Types of Seismic Waves

S Waves

- secondary waves/arrive second
- shear waves
- particle motion perpendicular to propagation direction
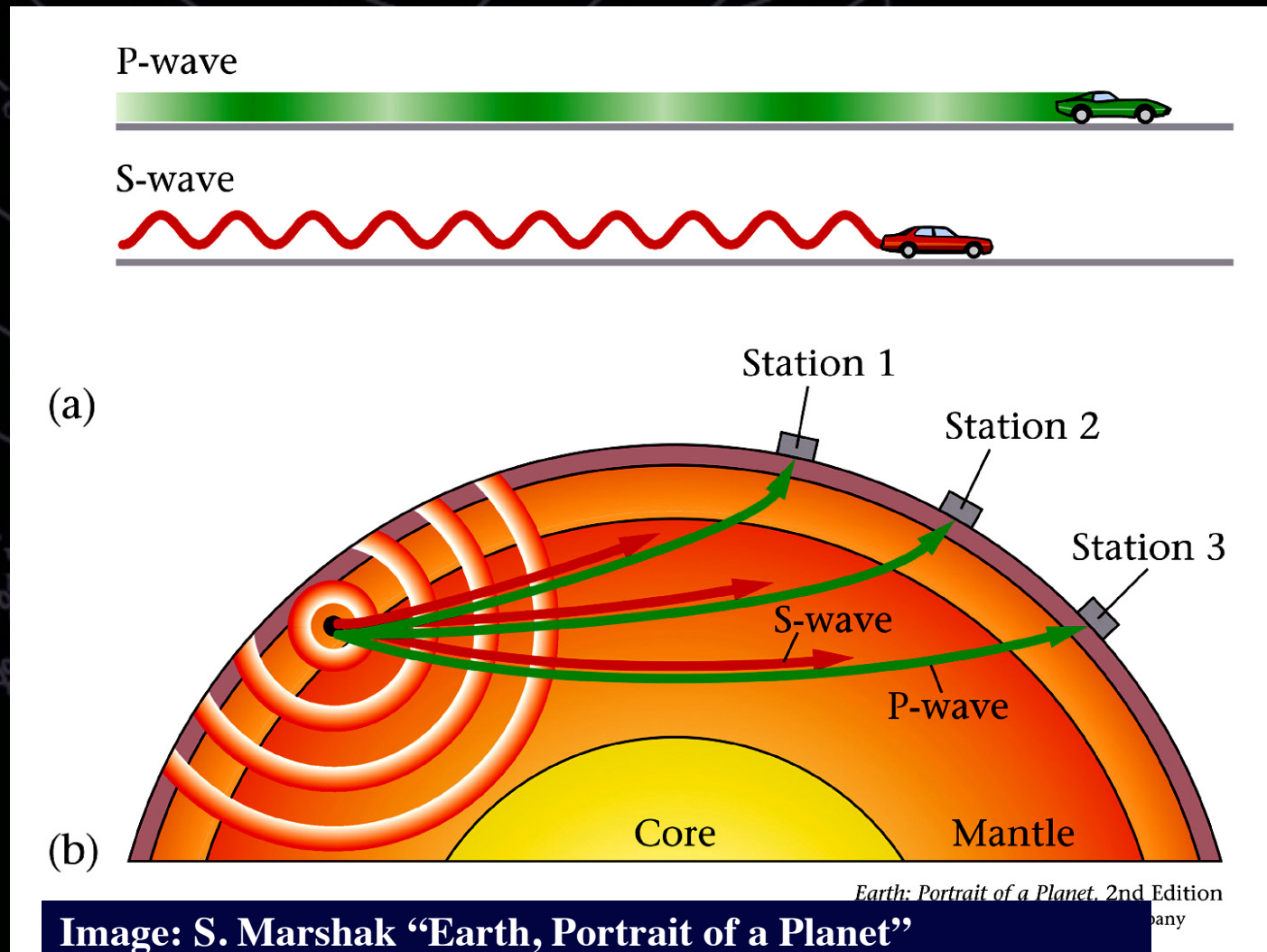- like waves on a rope

Fig. 5.24

source: Marshak "The Earth"

The Different Types of Seismic Waves

P and S Waves are body waves

P-wave

S-wave

(a)

Station 1
Station 2
Station 3

S-wave
P-wave

Core
Mantle

(b)

Earth: Portrait of a Planet, 2nd Edition
...pany

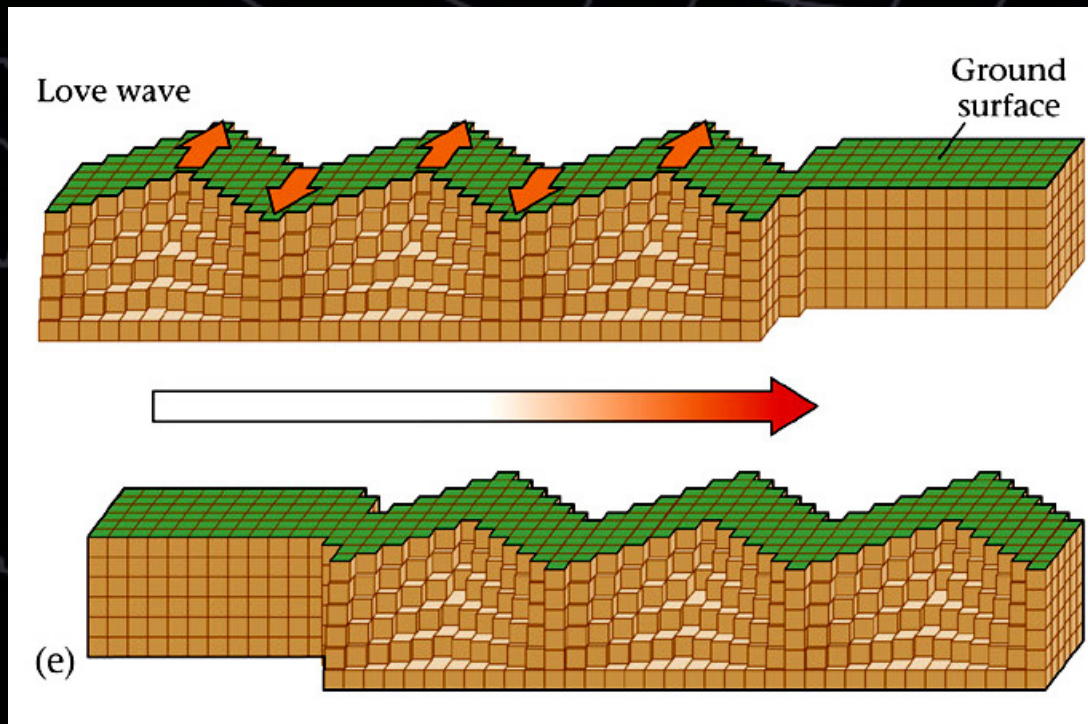**Image: S. Marshak "Earth, Portrait of a Planet"**

The Different Types of Seismic Waves

Surface Waves: Love Waves

- arrive just after body waves
- combination of reflected S waves
- particle motion perpendicular to propagation
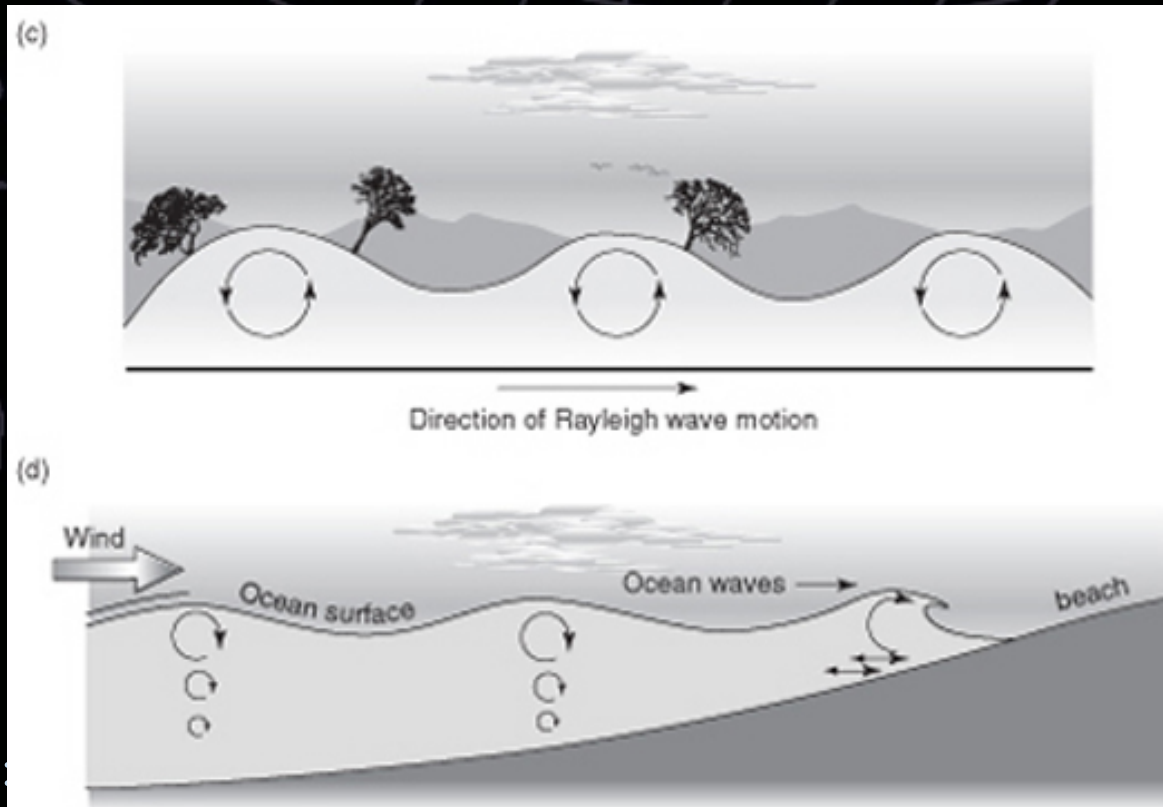- motion decreases exponentially with depth
- like spikes in a wheat field

Fig. 5.25

The Different Types of Seismic Waves

Surface Waves: Rayleigh Waves

- arrive last
- combination of reflected P and S waves
- retrograde elliptical particle motion
- motion decreases exponentially with depth
- like water waves

largest signal
most damaging wave

(c)

Direction of Rayleigh wave motion

(d)

Wind

Ocean surface

Ocean waves →

beach

retrograde R. waves

prograde water waves

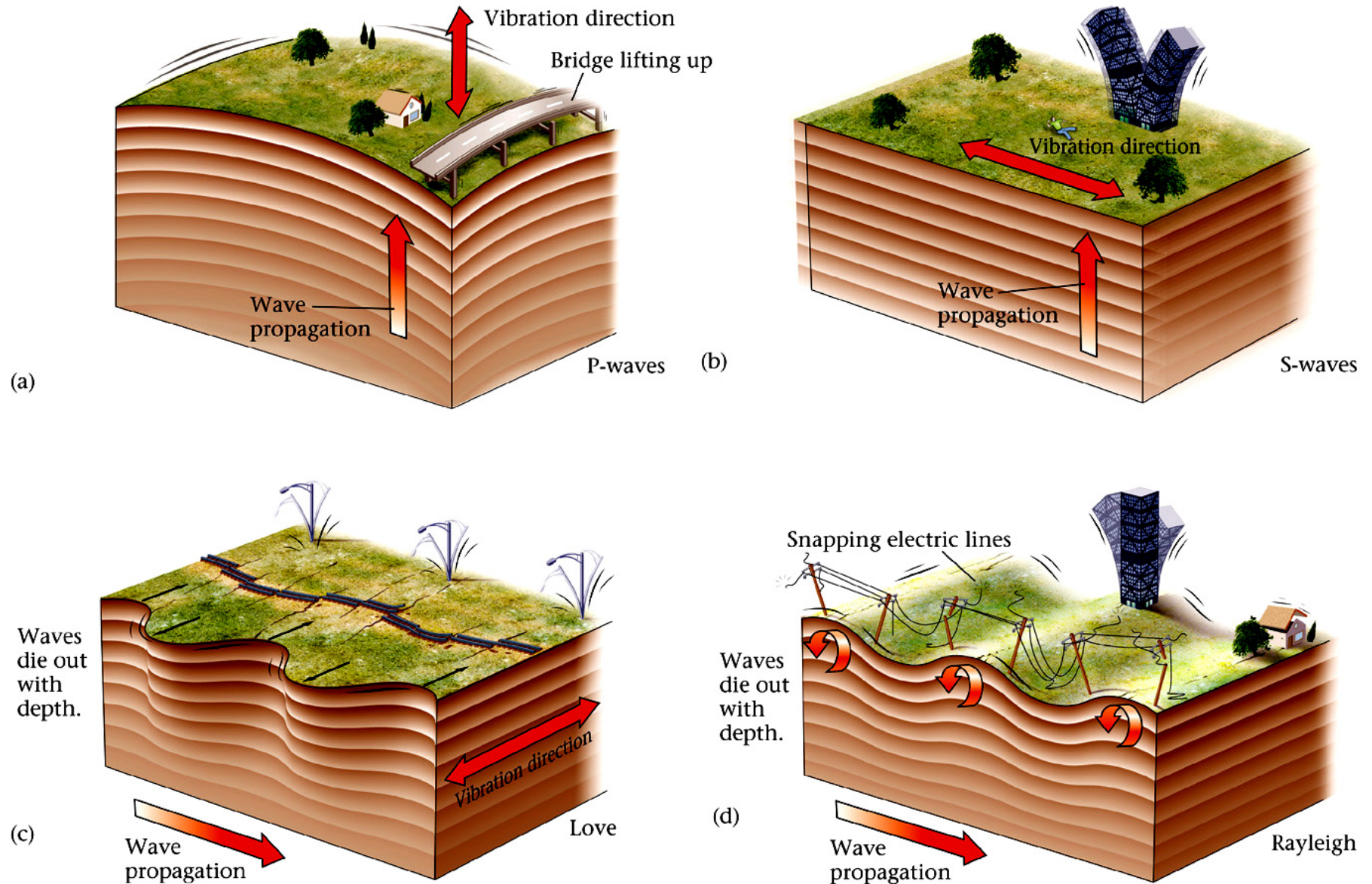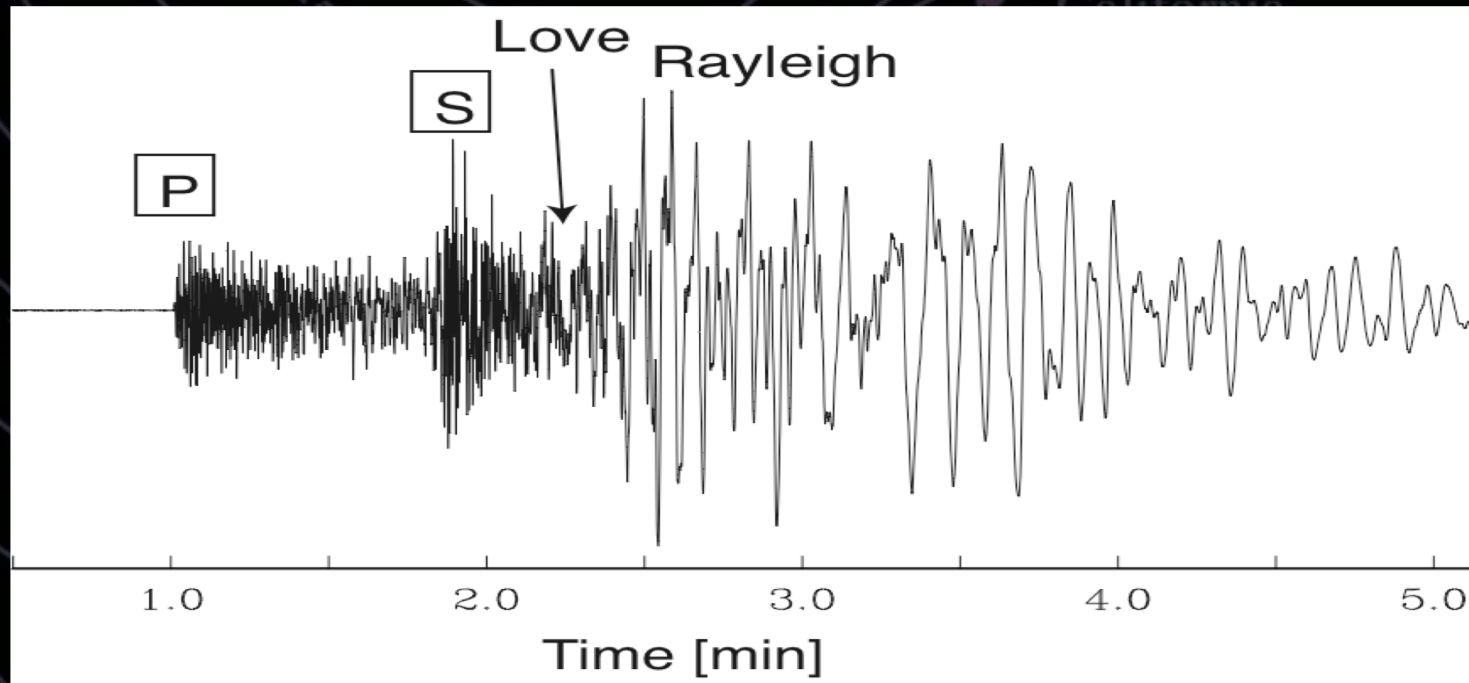Fig. 5.27 # The Different Types of Seismic Waves

Earth: Portrait of a Planet, 2nd Edition
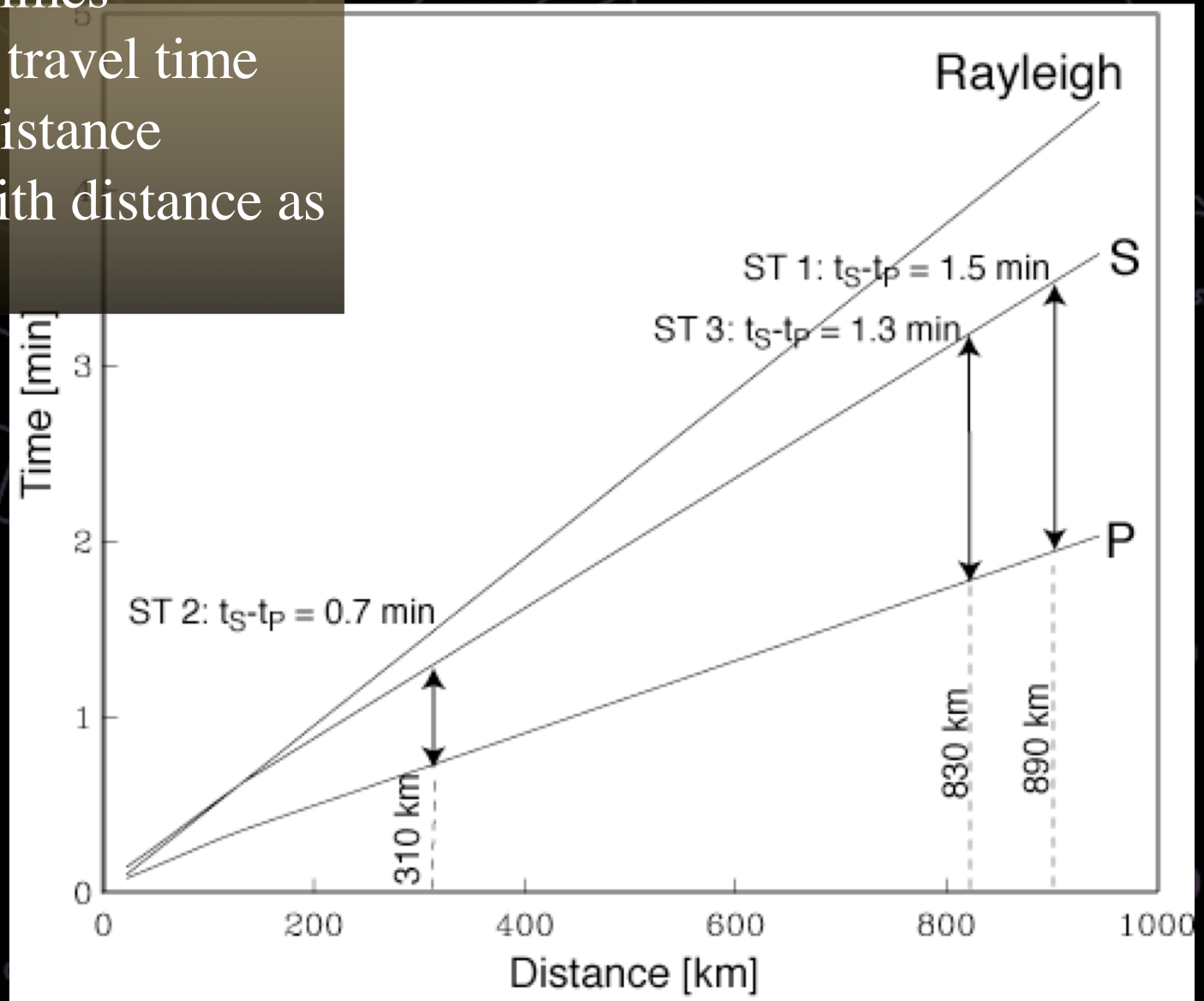Copyright (c) W.W. Norton & Company

FIGURE 10.27

The Phases in a Seismogram

1. P first, typically smallest signal
2. S, typically larger
3. Love
4. Rayleigh, longest/largest wavetrain, most damaging

Locating an Earthquake

1. measure S-P times
2. check against travel time graph to get distance
3. draw circle with distance as radius

Locating an Earthquake

4. repeat for at least 2 more stations
5. triangulation

- need 3 stations for epicenter
- need 4 stations for hypocenter

890 km

ST 1

ST 2

310 km

New Madrid
16 Dec 1811

ST 3

830 km