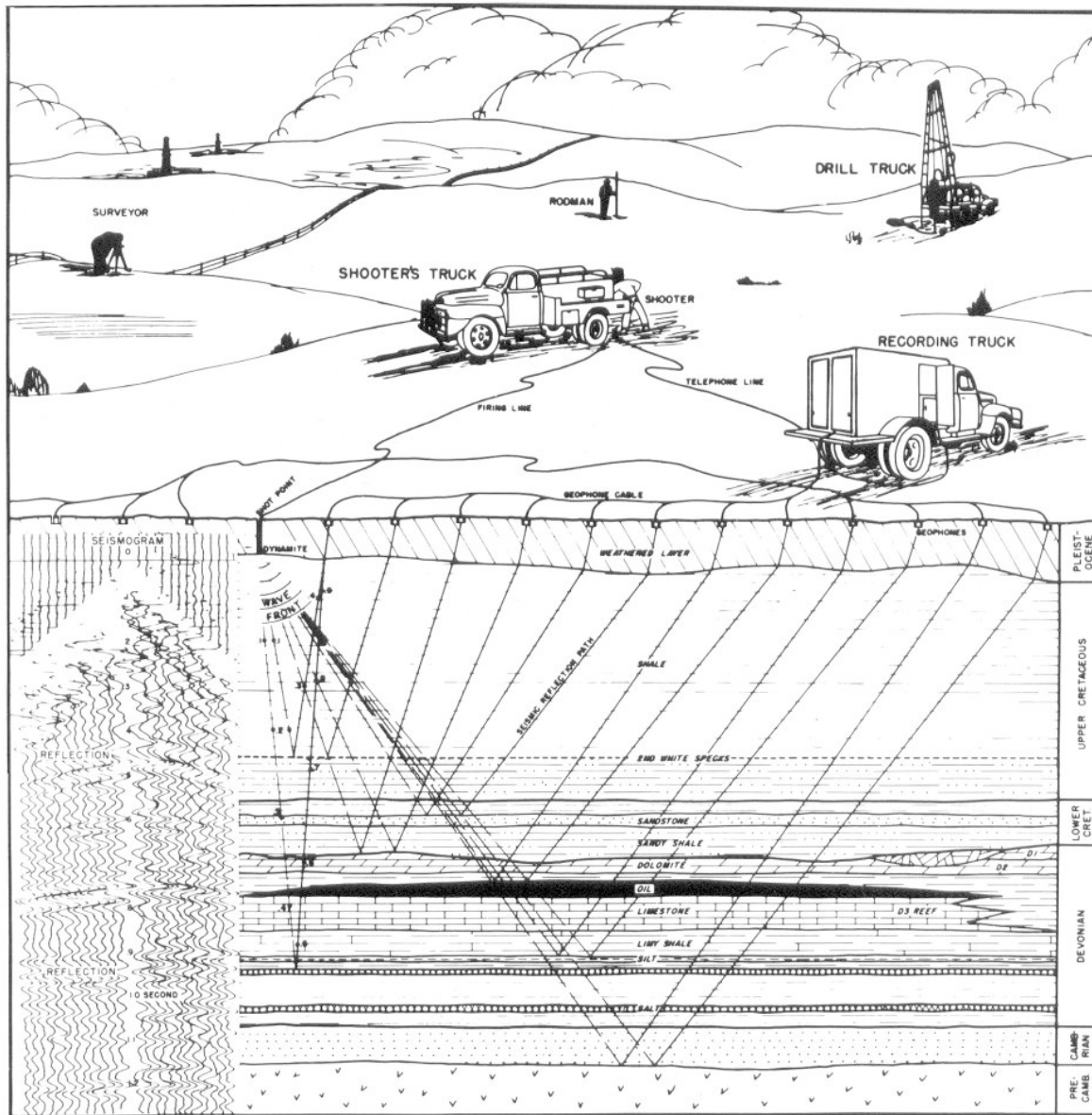# Just Enough Seismic . . .
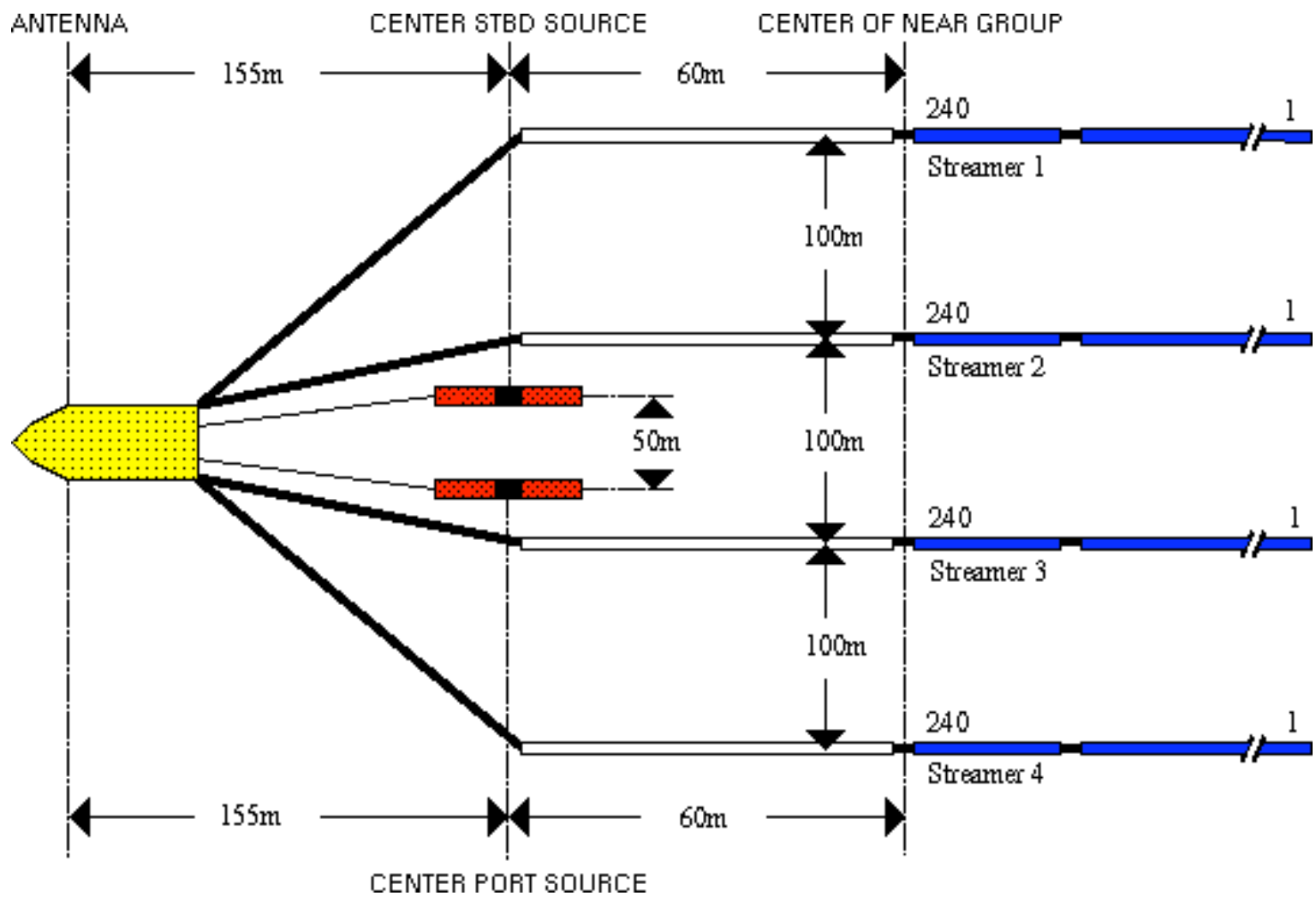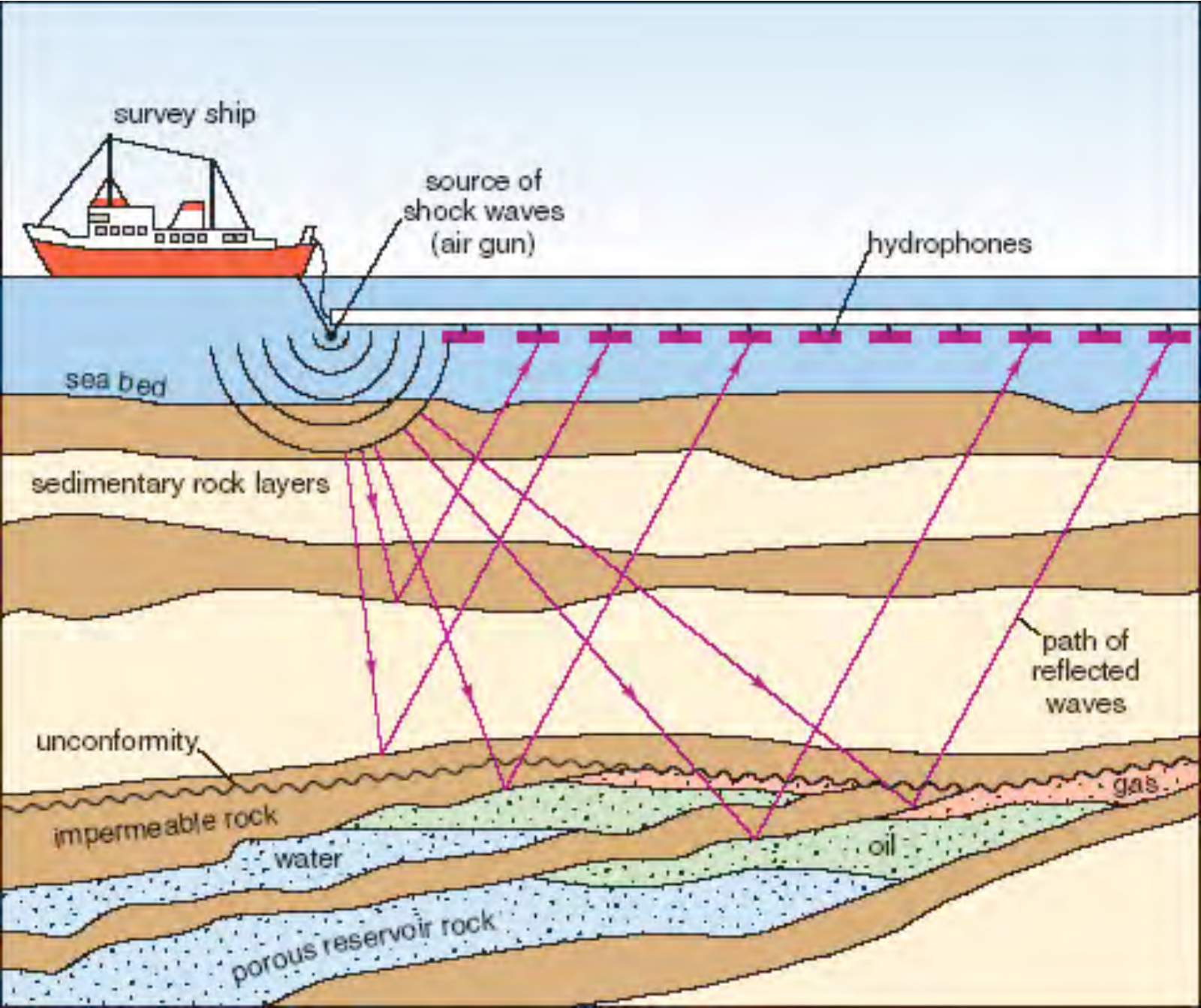
to get in trouble

SEISMIC OPERATIONS (SCHEMATIC ONLY)

ANTENNA CENTER STBD SOURCE CENTER OF NEAR GROUP

155m   60m

240   1
Streamer 1

100m

240   1
Streamer 2

50m   100m

240   1
Streamer 3

100m

240   1
Streamer 4

155m   60m

CENTER PORT SOURCE

survey ship

source of shock waves (air gun)

hydrophones

sea bed

sedimentary rock layers

path of reflected waves

unconformity

impermeable rock

gas

oil

water

porous reservoir rock

```
                  ┌─────────────────────────────────┐
                  │   SHIPBOARD DATA ACQUISITION     │
                  └─────────────────────────────────┘
                      ↓                        ↓
          ┌──────────────────┐      ┌─────────────────────────┐
          │   SEG-Y Files    │      │   Navigation Files      │
          └──────────────────┘      │ (stored in SEG-Y header)│
                      ↓             └─────────────────────────┘
          ┌──────────────────┐                  ↓
          │  Processing Flow │      ┌─────────────────────────┐
          └──────────────────┘      │    Format and Filter    │
                      ↓             └─────────────────────────┘
                       ↘               ↙
          ┌────────────────────────────────────────┐
          │ Processed profile and formatted         │
          │ navigation files input to interpretive  │
          │ software package                        │
          └────────────────────────────────────────┘
               ↙                          ↘
    ┌──────────────────┐        ┌─────────────────────┐
    │ Interpretive Map │←──────→│  Seismic Profile    │
    └──────────────────┘        │     Display         │
                                └─────────────────────┘
                      ↓
          ┌────────────────────────────────────────┐
          │ Optionally export surfaces,             │
          │ isopachs, etc. to 2-D or 3-D            │
          │ visualization software, GIS             │
          └────────────────────────────────────────┘
```
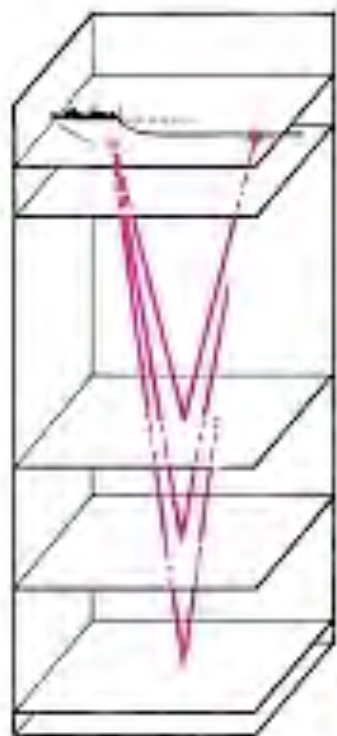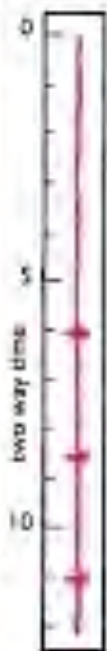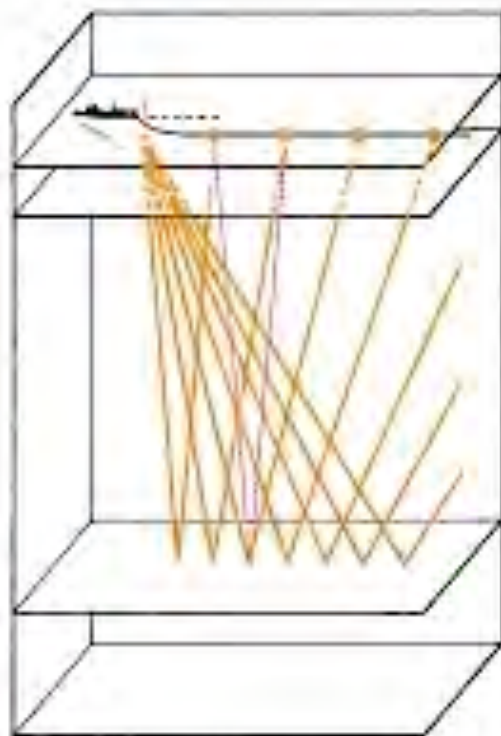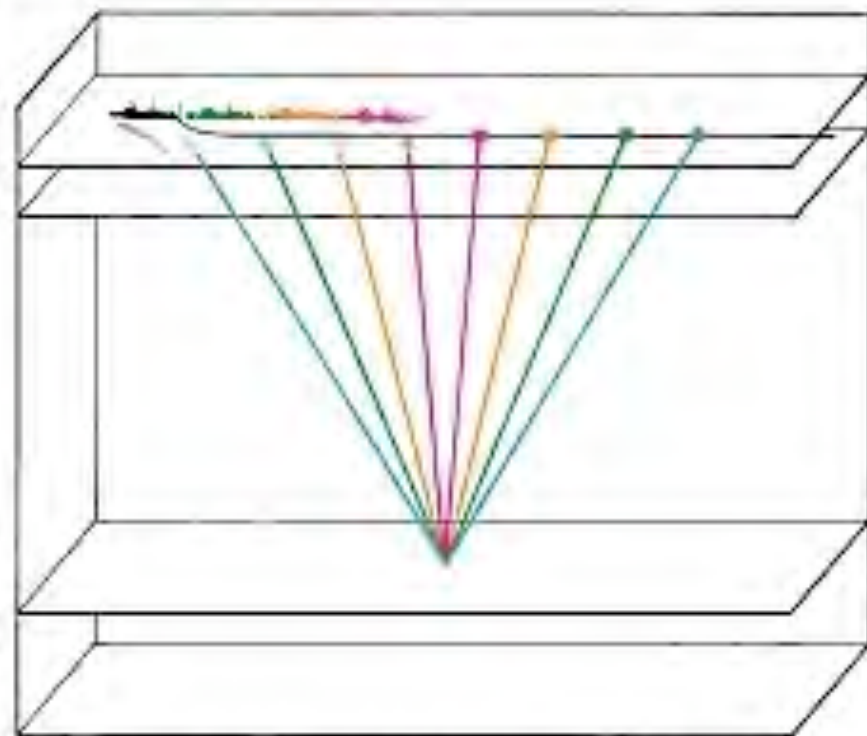
CDP gather

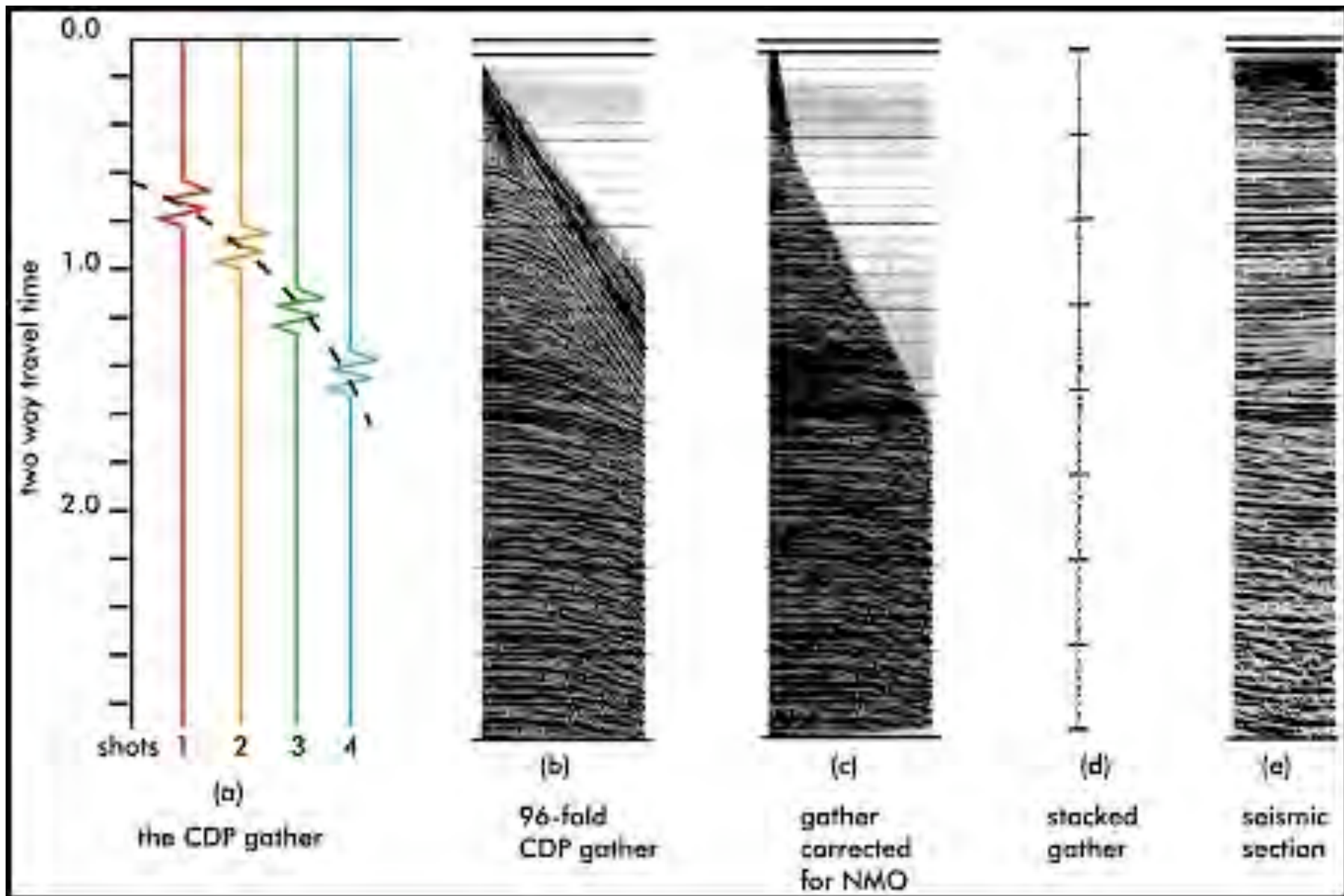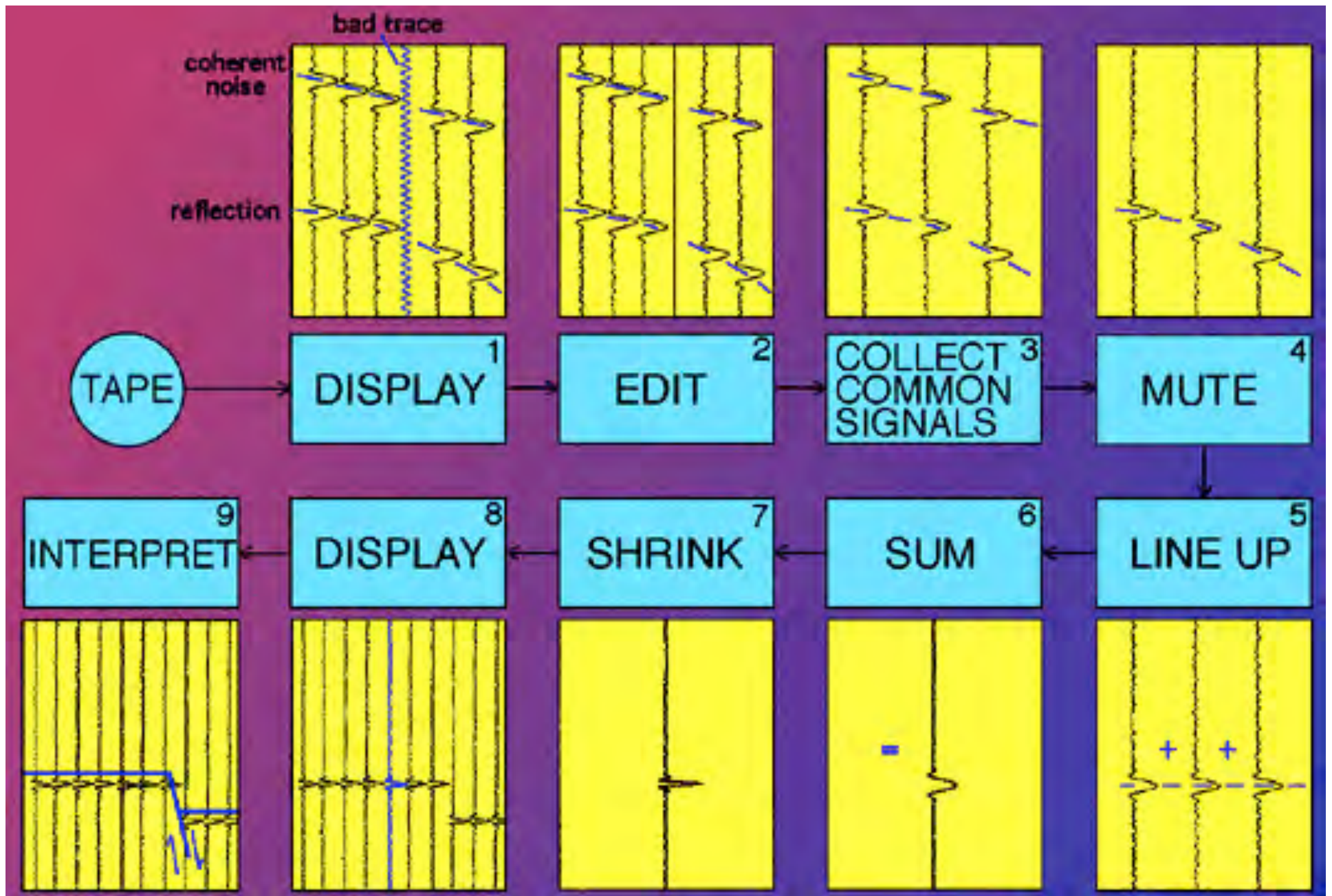a) seismic ray-paths from several reflectors

b) wiggle trace from one hydrophone group

c) ray-paths from CDPs on one reflector layer

d) reflections from a single 'common depth point' make up a CDP gather

(a)	(b)	(c)	(d)	(e)
the CDP gather	96-fold CDP gather	gather corrected for NMO	stacked gather	seismic section

two way travel time

0.0

1.0

2.0

shots 1 2 3 4

bad trace

coherent noise

reflection

TAPE → DISPLAY [1] → EDIT [2] → COLLECT COMMON SIGNALS [3] → MUTE [4]

INTERPRET [9] ← DISPLAY [8] ← SHRINK [7] ← SUM [6] ← LINE UP [5]

A Bit of Physics

- Acoustic Impedance = Velocity X Density
- Reflections occur where there is an impedance contrast between two rock layers
- ~0.01% of the seismic wave is reflected
- Interval seismic velocities generally increase with depth
  - 10 msec at 1 sec TWT represents less rock than 10 msec at 2 sec TWT

  Unmigrated seismic data is displayed relative to the receivers
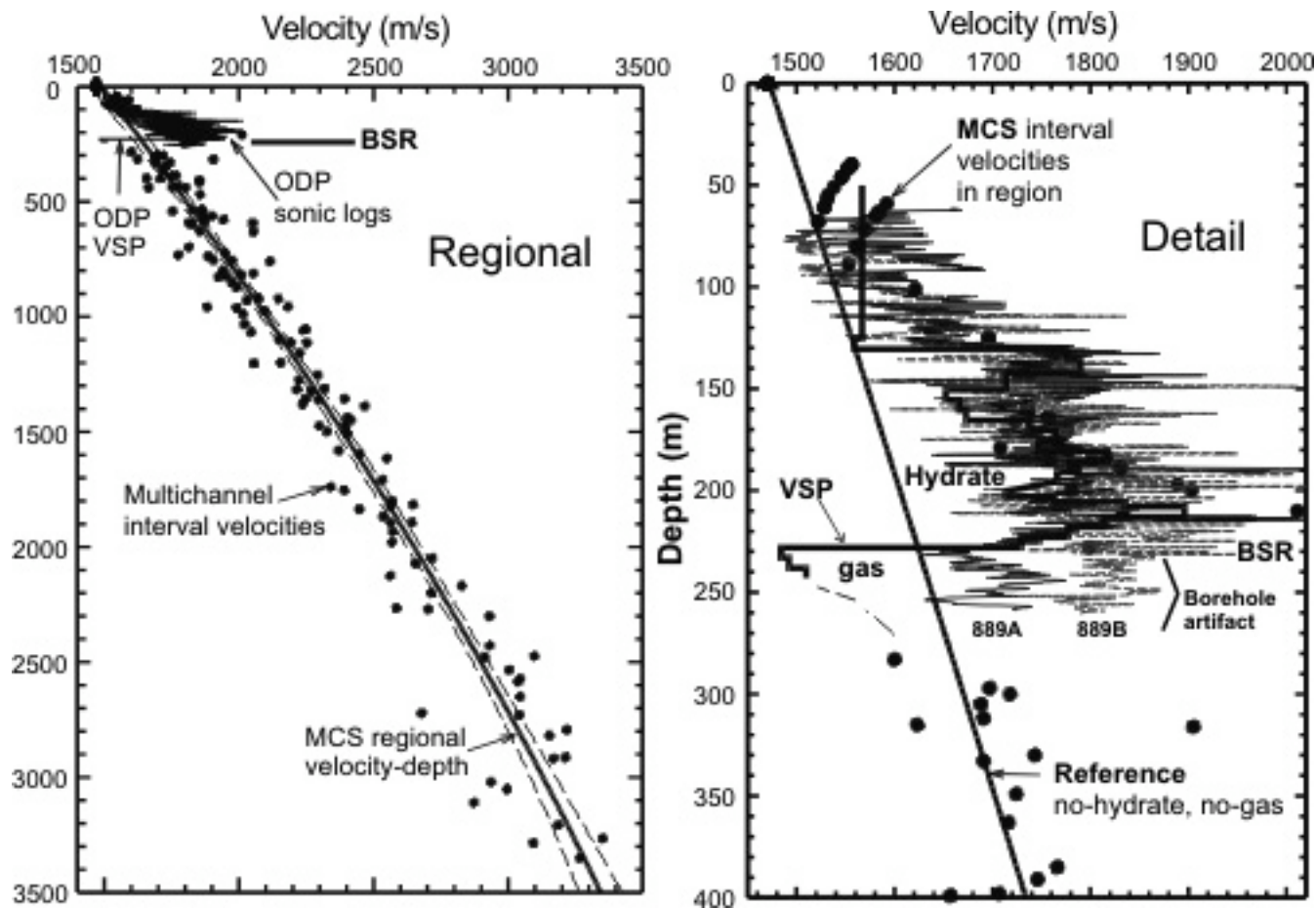 Migrated seismic data is displayed relative to the Earth

Acoustic Impedence = Velocity X Density

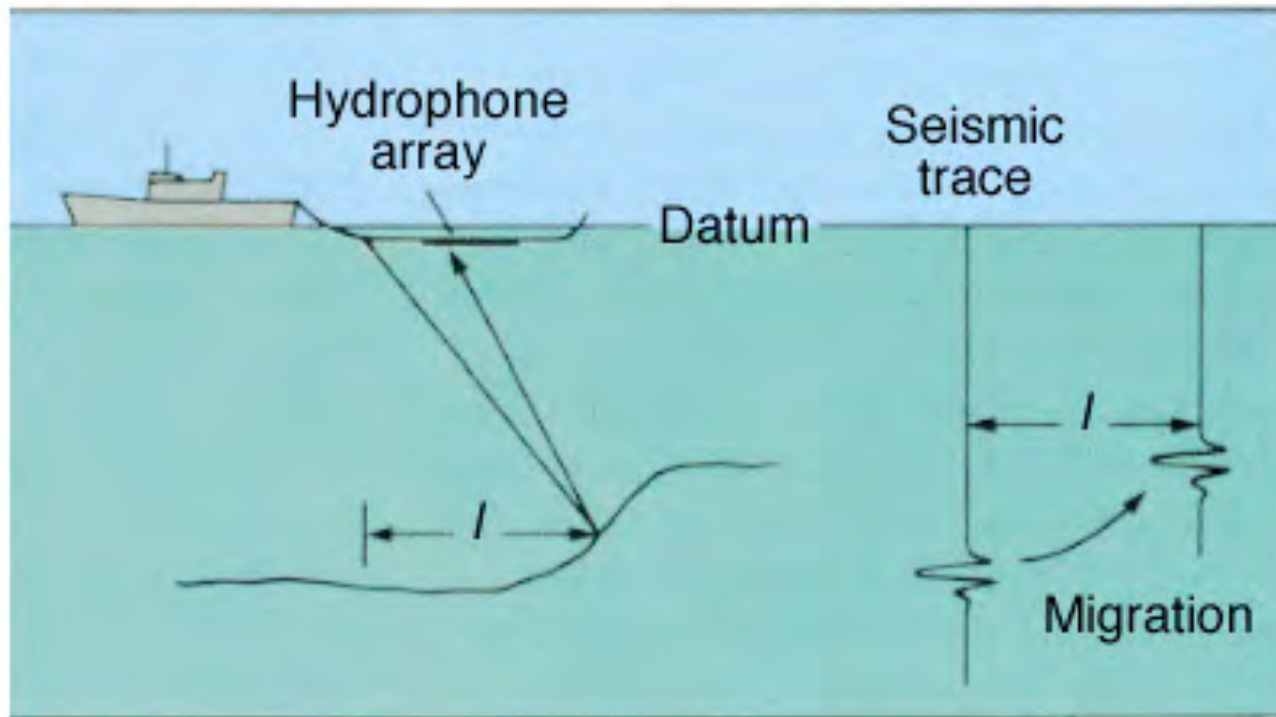http://www.glossary.oilfield.slb.com/DisplayImage.cfm?ID=210
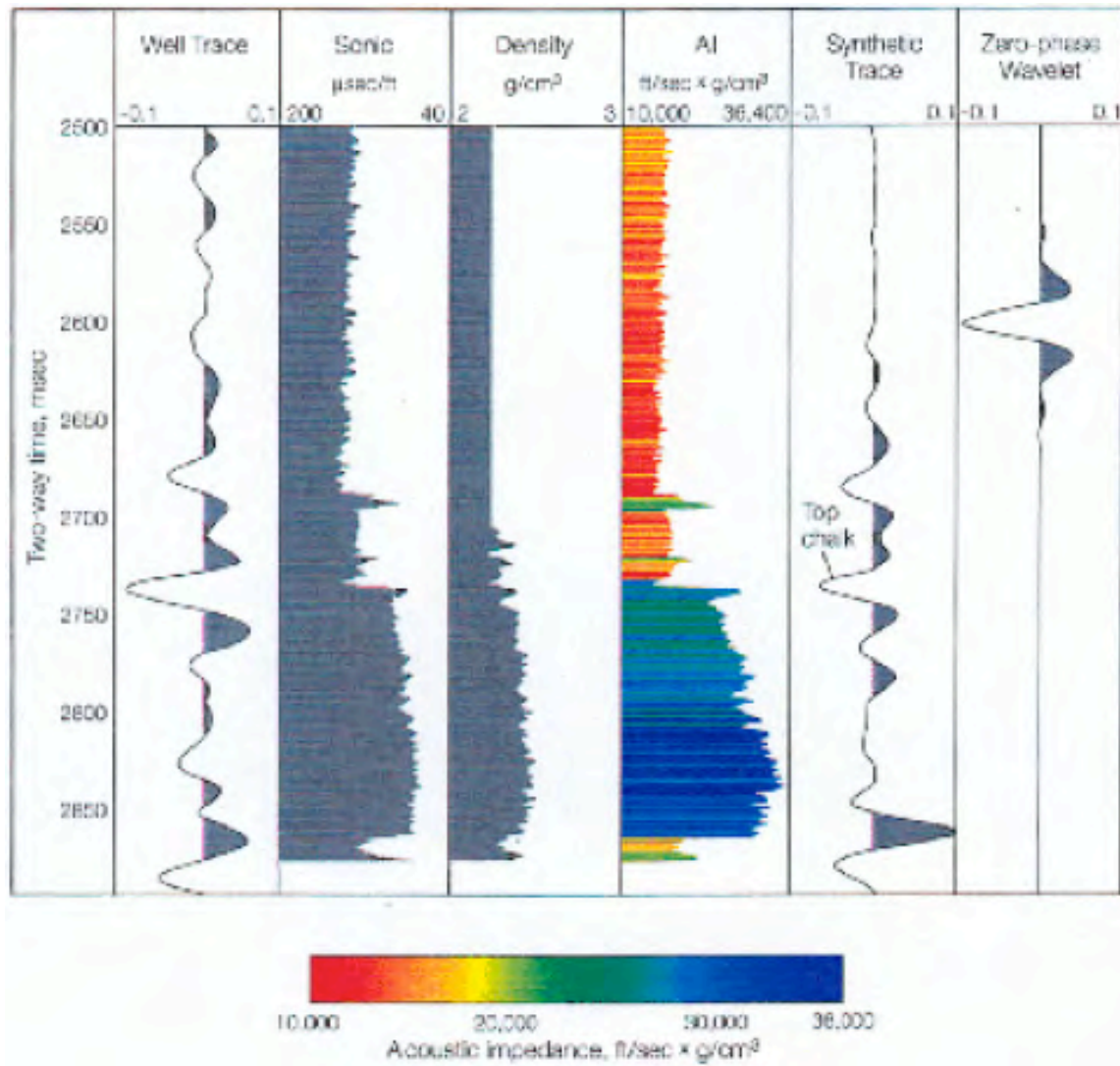
- Interval seismic velocities generally increase with depth
- 10 msec at 1 km represents less rock than 10 msec at 2 km

Seismic data is subject to much computer processing

Diagram of a datum and hydrophone array

During seismic processing, migration adjusts the location of events in seismic traces to compensate for dipping reflectors.

After today we will use Migrated Data in our exercises.

C21 LINE 152A

a   a'

MM
M

Aᵘ
A*
β

J₁

J₂

MIGRATED

DATA
GAP
(12 min)

0400

SB-242   BIO-3   SB-243   BIO-1

LOWER CONTINENTAL RISE

C21
LINE 152A →

500   1000

UNMIGRATED