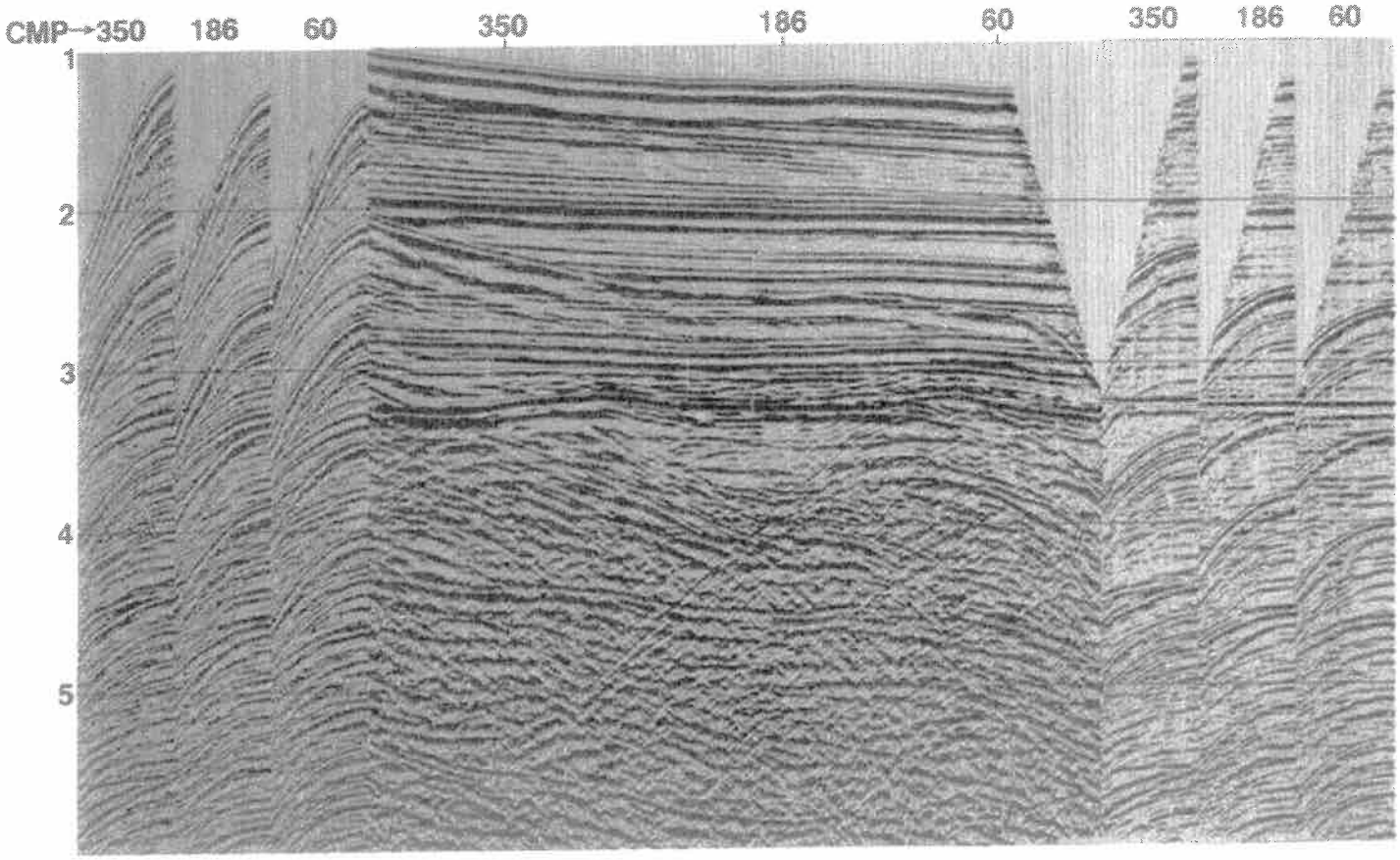
Exam Introduction to Seismology and Seismics, Part 2

31 January, 2013, 13:30-16.30

1. (a) Using the figure below, explain how a seismic reflection section is obtained.
   Use and explain the terms
   * common midpoint (CMP) gather
   * normal move out (NMO)
   * common midpoint stacking
   * root mean square (RMS) velocity

   (b) How is the thickness and seismic velocity of each of the layers determined?

   (c) Explain the term 'migration' in reflection seismics.
   Why is migration used?



2. (a) Give an expression for the ray parameter for a spherically symmetric velocity structure.

   (b) How can you determine the ray parameter of a ray arriving at a distance Δ_o when the travel time curve $T(\Delta)$ is given?

3. An earthquake is recorded by a large number (N) of seismic stations.
   Explain how location and origin time of the earthquake can be determined from the measured P-wave arrival times for a given seismic structure of the Earth.
   Explain this procedure for the case of a homogeneous medium of constant velocity in a Cartesian coordinate system.

4. (a) Sketch the radiation pattern (relative amplitude and displacement direction of first onsets) of P- and S-waves for a left-lateral strike-slip earthquake along a vertical fault plane with zero strike (i.e. $\phi = 0^o$, North).
   (b) Sketch the focal mechanism (=stereographic fault plane representation, or 'beach ball') for a normal faulting earthquake along a fault plane with zero strike (=North) and a dip of 80^o.

5. (a) Describe the particle motion of Love and Rayleigh waves at the free surface.
   (b) Sketch a phase velocity curve (phase velocity as a function of period) of a Love wave for a layer with shear velocity β_1 over a half space with shear velocity β_2.
   Draw a second curve for a layer with a larger thickness.
   Give a brief explanation of the curves.