CHAPTER 2
BASIC THEORY AND METHODOLOGY

The basic concept of the seismic reflection method is to show the reflected upward–traveling seismic wave back toward the surface from the boundary between two rock layers. Explosives and other energy sources are used to generate the wave to the subsurface. The data is recorded digitally on conventionally magnetic tapes so that computer processing can be done to enhance the signals with respect to the noise, to extract the significant information, and to display it for geological interpretation. Seismic interpretation is an important technique used to identify hydrocarbon reservoirs. The basic theory and method are described in this chapter.

2.1 The characteristic of Reflections

In a seismic survey, the seismic wave (assume to) transmits through the rock with elastic behavior that transfers energy by the movement of rock particles. The speed in rock at which the particle motion transports the seismic energy determines the seismic wave velocity. For each rock type, when a seismic wave impacts, there is a particular intrinsic susceptibility to particle motion and characteristic velocity for passage of the seismic wave through the rock.

The predictable and characteristic acoustic properties of a rock are defined with its acoustic impedance (Z), product of density (ρ) and velocity (V).

$$Z = \rho V \tag{2.1}$$

When the seismic wave encounters a rock layer with different acoustic impedance from the rock, the wave front split. One component of the wave reflects back to the surface and the other travels further. The stronger the reflection, the greater the amplitude, and the greater acoustic impedance contrast (Badley, 1985).

2.2 Interpretation

1. The interpretation began where the seismic response is strongest. The horizons are chosen at regular intervals, to delineate geological structures in three dimensions.

2. All horizons were picked in seismic sections and carried throughout the study area. Horizons were traced laterally until there was a break in continuity such as a fault or poor data area. The line intersections in the study area were tied around the seismic grid. The picks were transferred onto a strike line then adjacent dip line and carry to the next strike-line intersection and back again to the original dip line, thus closing a loop. If the picks were fit, then the loops expand in this method until the entire grid was tried. Sometime the loop is not tied, a blacktrack tie must be done by locating a mis-tie and trying again to close the loop.

3. Base maps were drafted by hand. Seismic two-way travel times were displayed on the maps show at every 10th shotpoint position along each line and contoured to show the variation in subsurface elevation of the seismic horizons. The time thickness variations of intervals between seismic horizons were shown in "isochron" map.

4. Petroleum potential traps and the structural development were analyzed from structural maps and isochrom maps. Potential traps were considered in structural maps. Isochron maps with fault trace overlays were interpreted in terms of structural development.