At this stage, we are comfortable with the operations of picking continuous seismic reflections, timing them at intervals along the line, posting the values on a base map, and contouring the result to obtain a time structure map. Further, we may do this for two or more reflections, and subtract one map from another to obtain an isopach map expressed in time—a time interval map. If the geology is such that we have confidence in our velocities, we may construct a velocity map; then (usually after an interpretation/smoothing stage) we may multiply this map by the former time maps to obtain depth structure maps and isopachs. But all of this—useful as it is—tells us next to nothing about the nature of the rocks. Let us see what we can do.

One approach is to attempt to measure from the seismic data the physical properties of the rocks. The physical properties which lend themselves to this, at the present stage of the established art, are velocity and hardness. Velocities are computed, as we have already discussed, from studies of normal moveout—the difference in time between near and far traces. Hardness is computed from the strength of the reflections; this is possible because, as we have noted previously, the strength of a reflection represents the contrast of hardness.
across an interface between two rocks. Usually the calculations are verified by setting up a model of the reservoir, with the expected velocities and hardnesses, and by checking that the seismic response of the model matches the observed data. This is the modelling approach.

Another approach is to use the observed reflection configurations—the patterns of reflections—to identify the conditions under which the rocks were deposited...even to establish the basin history. This is seismic stratigraphy.

These approaches are quite different, and in reservoir studies we need both. From the approach through physical properties and modelling we hope to learn the thickness and extent of the reservoir, possibly its porosity (for an assumed saturant), and possibly the position of any gas-liquid contact. From the approach through seismic stratigraphy we hope to learn the most likely lithology of the reservoir, the probable shape, the likely variation of porosity within the reservoir, the risks of permeability barriers—and where to look for another one like it.

We shall return to the approach through physical properties in Chapter 3. Here we explore the approach through seismic stratigraphy.

In our discussion of seismics for structure, we restricted ourselves (for simplicity) to well-marked and continuous reflections. Let us say we see such a reflection—strong, uniform and continuous—on line after line over the whole basin. What is the message? The first conclusion is that the reflecting sediments are almost certainly marine, laid down in water depth sufficient to give calm depositional conditions. This fact, and the strength of the reflection, probably suggest that the reflection comes from an interface between marine shale and limestone.

We see that the reasoning can be very simple—but very useful.

If the two formations are both massive, we obtain supporting evidence from their general appearance on the seismic section. For example, the two formations A and C in Figure 12, separated by reflector B, show a “grain” of smooth continuity within them—no strong reflectors, but the general aspect of