

## Chapter Two

### The Physical Setting: “The Earth as a Sounding Board”

To appreciate the nature of the challenge that scientists face in this vital area of arms control, it is useful to visualize the Earth as a sphere with an approximate radius of 6 500 kilometres and a circumference of about 40 000 kilometres. It consists of three main components: the crust, the mantle and the core (see Figure 4).

The discontinuity between the mantle of the Earth and its liquid core presents an effective barrier to the transmission of most seismic waves, either reflecting them upwards or deflecting them into the Earth's core. Thus, the core of the Earth casts a “shadow” which prevents listening stations from clearly detecting certain seismic waves at distances beyond about 10 000 kilometres.

Another limitation stems from the fact that different geological formations transmit seismic waves with different degrees of efficiency. Hard granitic rocks and salt deposits, for example, transmit high frequency shocks comparatively well, whereas tuff (a rock composed of compacted volcanic fragments) transmits seismic waves poorly. Sedimentary deposits, often of sandy or muddy origin, are

even less efficient transmitters of seismic waves. The result is that the recorded size of the seismic waves produced by a given event, when measured some distance away, could vary by a factor as large as 10, depending on the type of terrain in which it occurred.

When a seismic event occurs in the Earth as a result of an earthquake or an underground explosion, it produces different types of seismic waves, of which the two main categories are body waves and surface waves.

#### Body Waves

Body waves travel through the “body” or mantle of the Earth. The fastest travelling body wave is the P (primary) wave, which is much like a sound wave travelling in the solid Earth. The second type of body wave is the S (shear) wave, which travels at about 60 per cent of the velocity of a P-type body wave.