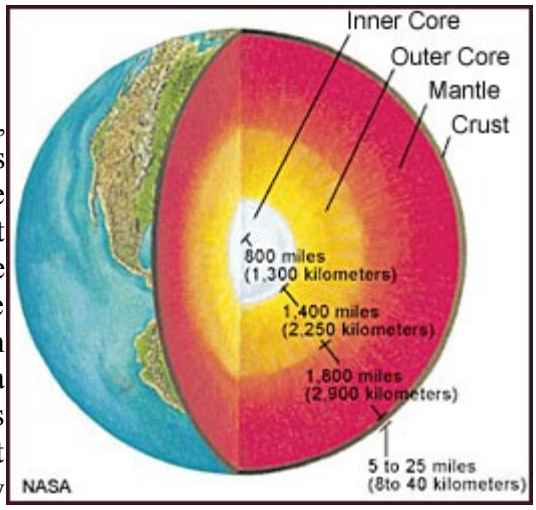
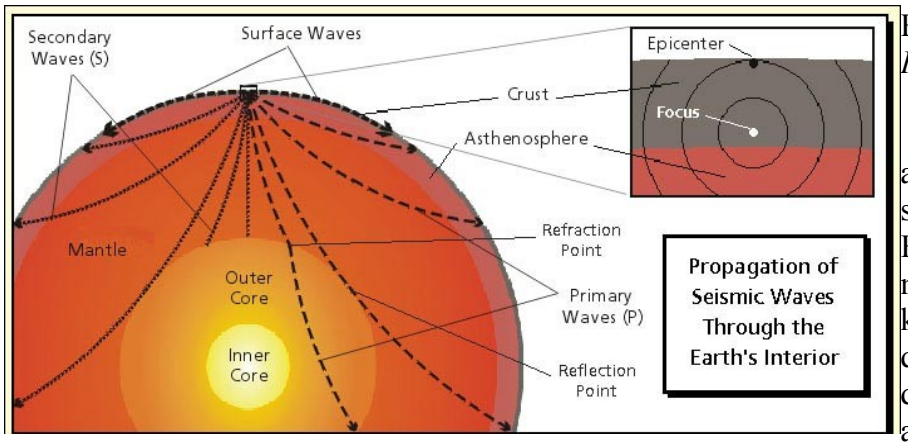
The Earth As a Black Box

SNC2D



The box used in the previous investigation was a **black box**, both literally and figuratively: a device whose inner workings are not accessible but must be inferred from its outputs. The Earth itself is another example of a black box. We have not been able to penetrate more than its very surface: the distance from the Earth to its centre is approximately 6370 km and the deepest South African gold mines reach only 3 km down. An ambitious Soviet drilling project in 1970 on Russia's Kola Penninsula penetrated only 12 kilometres down – still less than 0.2% of the total. And yet we are reasonably sure that the Earth is divided into distinct layers and that we know something about the processes that occur in those layers. How? Because those processes result in outputs – especially earthquakes – which give us information about what is inside the black box.



From Bill Bryson's *A Short History of Nearly Everything*:

Until slightly under a century ago, what the best-informed scientific minds knew about Earth's interior was not much more than what a coal miner knew – namely, that you could dig down through soil for a distance and then you'd hit rock and that was about it. Then in 1906, an Irish geologist named R. D. Oldham, while examining some seismograph readings from an earthquake in Guatemala, noticed that certain shock waves had penetrated to a point deep within the Earth and then bounced off at an angle, as if they had encountered some kind of barrier. From this he deduced that the Earth has a core. Three years later a Croatian seismologist named Andrija Mohorovicic was studying graphs from an earthquake in Zagreb when he noticed a similar odd deflection, but at a shallower level. He had discovered the boundary between the crust and the layer immediately below, the mantle; this zone has been known ever since as the Mohorovicic discontinuity, or Moho for short.

We were beginning to get a vague idea of the Earth's layered interior – though it really was only vague. Not until 1936 did a Danish scientist named Inge Lehmann, studying seismographs of earthquakes in New Zealand, discover that there were two cores – an inner one that we now believe to be solid and an outer one (the one that Oldham had detected) that is thought to be liquid and the seat of magnetism.

<u>Questions</u>

1. Describe how the discovery of more data led scientists to modify their model of the Earth's interior.
2. Besides earthquakes, what other sources of data do you think scientists have used to develop their model of the Earth's interior?