Gutenberg Discontinuity Encyclopedia Article

Gutenberg Discontinuity

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In the early 1900s, seismologists were monitoring and analyzing the Earth's seismic waves to better understand earthquakes and to probe the interior of the Earth. Richard Dixon Oldham's discovery in 1897 of *P* (primary) and *S* (secondary) seismic waves made it possible for scientists to study the structure of the Earth's interior. By studying changes in the velocity of the P and S waves from earthquakes, seismologists were able to recognize different rock structures beneath the Earth's surface.

For a long time, geologists and seismologists had suspected that there were distinct layers within the Earth's interior. In 1906, Oldham recognized the existence of the Earth's core and made a preliminary, but incorrect, estimate of its size. He also noted a seismic "shadow zone", where no P waves were recorded. It began about 150 degrees from the earthquake epicenter, and formed a "bulleye" on the side of the Earth opposite from the earthquake. In 1909, Andrija Mohorovicic (1857-1936) discovered a distinct layer just beneath the crust, the Earth's mantle. In 1914, German-American geologist Beno Gutenberg (1889-1960), proved the existence of the core. He showed that the P wave shadow zone was due to reflection and refraction of P waves by a molten core and the S wave shadow zone resulted from complete absorption of the S wave energy at the core, since shear waves cannot pass through liquids. After determining that the shadow zone actually begins 105 degrees from the epicenter, Gutenberg successfully calculated a highly accurate depth of 1,800 miles (2880 km) for the core-mantle boundary. However, scientists were not convinced of Gutenberg's estimate until better seismologic data became available. The core-mantle boundary, now called the *Gutenberg discontinuity* in Gutenberg's honor, is thought to be where the liquid iron and nickel of the core meets the solid rock of the lower mantle.