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PROGRAM 5: THE BIRTH OF A THEORY VIDEO

0:00-2:20 Remarks by series host

In the 1960s, earth scientists developed the theory of **(#01)**. This theory is built on the premise that Earth's **(#02)** consists of "plates" which slide around on a partially molten mantle layer, and it explains a wide variety of geologic processes, rocks, and geologic structures.

2:21 -3:51 Interviews with Robert Douglas, University of Southern California; Jason Saleeby, California Institute of Technology

(#03) observations of geographic relationships and conclusion that continents must have moved are described. These ideas were not accepted at the time, but became the foundation for a revolution of geology. Wegener's matching geologic patterns (plant fossils, climate zones, glaciation, rock formations, and contacts) across major ocean basins is used to demonstrate **(#04)**, particularly of the former Gondwana. Included is a collage of images: Earth in space, old maps of the Atlantic Ocean coastlines, and a portrait of Alfred Wegener.

(A) Alfred Wegener's (B) continental drift (C) Lithosphere (D) plate tectonics.

3:52-5:16 Animation • Images

A graphic globe demonstrates some of the interesting matches and linkages (fossils, mountain ranges, rock types) between South America and **#05** which show that they were once joined. Also included are old maps showing how the continents might have fit together at one time and then moved into their current positions.

5:17-7:01 Interviews with Tanya Atwater, University of California, Santa Barbara; Gary Ernst, Stanford University

The importance of Wegener's contributions and his use of **(#06)** are described, along with how geologists from the southern continents accepted Wegener's ideas earlier than those who worked in **(#07)** and North America. The main problem with Wegener's **(#08)** theory was that it required that continental crust "plow through" ocean crust, yet the driving forces that Wegener invoked to explain this process are too small. Evidence in the rocks does not support it either. Because of these weaknesses, Wegener's theory was initially **(#09)**

(A) Africa (B) continental drift (C) Europe (D) evidence (E) rejected

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7:02-13:15 Interview with Tanya Atwater (with images and animation)

Scientists are careful and inherently conservative. They require evidence to support new ideas. **(#10)** from World War II was key to understanding geology of the ocean basins and yielded evidence used to understand the process of **(#11)**. Included are old photos of WWII ships, the fathometer, and maps of the California coast and Pacific Ocean showing the **(#12)** and offshore bathymetry. A cross-section of seamounts shows how they form and are subsequently submerged as a result of sea-floor spreading. An animated model of and mantle showing how magma movement is thought to affect sea-floor spreading and **(#13)** is shown. It includes a rotating model of Earth showing all major **(#14)** .

A.) Technology (B) sea-floor spreading (C) seamounts (D) subduction zone (E) plate movement

13:16-16:14 Interview with Scott Bogue, Occidental College (with images and animation)

(#15) in rocks and how it is used to understand Earth's **(#16)** in the past is explained. Samples of the ocean floor provided evidence for many **(#17)** of Earth's magnetic field in the geologic past. Discovery by Fred Vine and Drummond Matthews of the symmetrically striped pattern of magnetic anomalies associated with mid-ocean ridges provided crucial evidence of both magnetic reversals and the process of sea-floor spreading.

16:15-16:53 Animation • Images

An Earth model shows a **(#18)** spreading center, new crusts forming at the ridge, plate movement, transform faults, seamounts, and an alternating color pattern mimicking the magnetic anomaly pattern.

(A) Paleomagnetism (B) magnetic reversals (C) magnetic field (D) mid-oceanic ridge

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16:54-18:59 Interview with Tanya Atwater (with images and animation)

The excitement of the discovery of **(#19)** and the impact on traditional oceanography is described. The discovery of **(#20)**s by J. Tuzo Wilson and Lynn Sykes and its impact on the sea-floor spreading hypothesis is also explained.

19:00-20:21 Images

Research using the vessel Glummer Challenger was instrumental in refining the sea-floor spreading theory and developing the theory of **(#21)**. The break-up of the super-continent **(#22)** and how plate movement accounts for the modern positions of continents is explained.

(A) Transform faults (B) sea-floor spreading (C) plate tectonics (E) Pangaea

20:22-23:07 Interviews with Gary Ernst; Robert Douglas (with animation)

The development of the concept of plate tectonics is a good example of the **(#23)** in action. Plate tectonics has become one of the major unifying in science, and probably the most important development of geologic thought. The importance of skeptics and intellectual honesty in science is discussed.

23:08-23:17 Interviews with Jason Saleeby; Robert Douglas (with animation)

Problems remain in understanding the driving mechanisms of plate tectonics and determining the rates of associated geologic processes. **(#24)** has contributed greatly to our understanding of the entire Earth as a single system. Animation of plate movement, subduction, and collision is shown.

23:18-end Remarks by series host

Since the 1960s, sea-floor spreading and plate tectonics have gained wide acceptance, resulting in a global model of **(#25)**.

(A) Collision (B) crustal dynamics (C) Plate tectonics (D) scientific method