PHYSICAL GEOLOGY
Dr. Jan Rasmussen http://www.janrasmussen.com janrasmussen@ix.netcom.com 520-603-7656

Instructions for Plate Tectonic Laboratory Exercise

Introduction

This exercise was adapted from laboratory exercises by Professor Thomas Freeman of the University of Missouri at Columbia and Professor Jance Smith of the Austin Community College Rio Grande Campus.

A geomorphic fit of the east coast of South America with the west coast of Africa was noted as early as 1620 by Sir Francis Bacon. In 1922, the meteorologist Alfred Wegener presented evidence showing that there was also a geologic fit between the two continents. Wegener explained this with a theory of continental drift. His idea was not readily accepted for over four decades because there was not a plausible mechanism for the movement of continents. Oceanographic studies that began during World War II and extended into the 1960s provided the needed evidence. These studies demonstrated that the sea floor has spread apart slowly at mid-ocean ridges and has moved toward the deep ocean trenches.

Mid-ocean Ridges and Seafloor Spreading

As lava or magma chrystallizes, certain iron-bearing minerals impart magnetic fabric to the rock that records the orientation and intensity of Earth's magnetic field. From studies of the magnetic fabrics of rocks of various ages, it has become clear that, not only have orientation and intensity of Earth's magnetic field differed through time, but also the polarity of the magnetic field has reversed itself on numerous occasions. Polarity refers to the compass direction of the Earth's magnetic field (i.e., which way is north).

Ship surveys across oceanic volcanic chains (called mid-ocean ridges) have mapped ancient "paleomagnetic" stripes in the oceanic crust – each with its own orientation, intensity, and polarity – that run parallel to the mid-ocean ridges (Figure 13-1a). Closer study has revealed that the lateral succession of paleomagnetic stripes on one side of a ridge – a "bar colde" of magnetic history at that place – is the mirror image of that on the other side. This succession led to the suspicion that oceanic crust originates as lava along mid-ocean ridges, and then, following crystallization, is pushed to either side by younger lavas coming up the central crack or rift. Geologic dating of samples obtained by the drilling ship Glomar Challenger confirmed that oceanic crust is, in fact, progressively older away from mid-ocean ridges (Figure 13-1b).

The diagrams follow this page and the exercise that you will turn in is on a separate set of pages.