Plate Tectonic Puzzle

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For students from 3rd to 12th grade. This is a map of the world in which each major tectonic plate can be cut out as a separate piece of the puzzle. We suggest that you print the map on a poster printer 3-5' wide and 6-11' long, and have it laminated. Then cut along the major plate boundaries (in yellow) to make the puzzle pieces. Label the plates on the backside. We recommend that you don't cut out some of the smaller plates into their own puzzle pieces but the yellow lines still mark their boundaries.

Latitudes between ±70˚N are shown, which excludes the Arctic region and most of the Antarctic plate. All plates are labeled on the backside. The plate motions, with respect to the earth's underlying mantle, are shown as red arrows. For example the Pacific plate moves northwesterly at 10 cm/yr (4 inches/yr).

***How to teach with the puzzle*. We suggest you put the pieces on the classroom floor and let the students assemble the plates. Groups of 4-5 students each placing 1-2 pieces, works well, giving the entire class hands-on participation. Then ask students to participate in all of these discoveries:**

Effects of Plate Motions. **Once assembled, you can ask students to move an individual plate, such as the Pacific Plate, an inch or less and let other students report or comment on its consequences. In oceanic regions, this includes rifting along the ridges (space opens up in the rift zones, where lavas will be extruded and new plate material is formed); transform or strike-slip motion along the faults that link one ridge to another; and subduction of the oceanic plates beneath island arcs. For continental plate boundaries, this includes on-land strike-slip faults, such as the San Andreas, and compression of mountain belts such as in Tibet, the European Alps, and the Zagros of Iran.**

Plate Motions as Rotations on a Sphere. **All motions of a spherical cap or 'plate' on a sphere are actually rotations about a pole somewhere on the earth's surface. Thus on the larger plates the arrows form a concentric pattern. Ask students to estimate the pole for North America (it lies in S. Mexico).**

Hot-Spots and Mid-Ocean Island Chains. **Ask a few students to lift up the Pacific plate and hold the eraser-end of a pencil beneath the northern end of the Hawaii-Emperor Seamounts (near the Kurile peninsula). By moving the plate northward and then northwesterly over the pencil, one can see that the mid-ocean island chains are formed when plumes of hot mantle material (the pencil head) occasionally pierce the oceanic crust. The youngest island (Hawaii) is currently over the hot spot, with islands becoming progressively older and more eroded to the north. The elbow in the island chain also shows that the Pacific abruptly changed course about 35 million years ago.**

Relative and Absolute Plate Motions. **Point out that the mid-ocean ridges form where the relative motion between adjacent plates is rifting. Thus even though both the African and Indian plates move to the northeast, a rift forms in the Indian Ocean because the Indian plate moved faster than the African plate. Likewise subduction zones and mountain belts form where the relative motion between adjacent plates is collision. India moves faster than Eurasia, and so collides to form Tibet and the Himalayas. India has been crashing into Eurasia for 40 million years.**

Earthquakes and Active Volcanoes. **It is useful to compare the plate puzzle to a map of global earthquakes and volcanoes, such as the beautiful USGS-Smithsonian wall map, "This Dynamic Planet". The map lets the students see that plate boundaries are the sites of most of the world's earthquakes and volcanoes. From the puzzle they see that plates interact along their boundaries. The world's largest earthquakes strike at the subduction zones, such as where the Nazca plate collides with central Chile (1960 Mw=9.2) and where the Pacific Plate collides with Southern Alaska (1964 Mw=9.1).**