EARTHQUAKE GAMES

Earthquakes and Volcanoes Explained by 32 Games and Experiments

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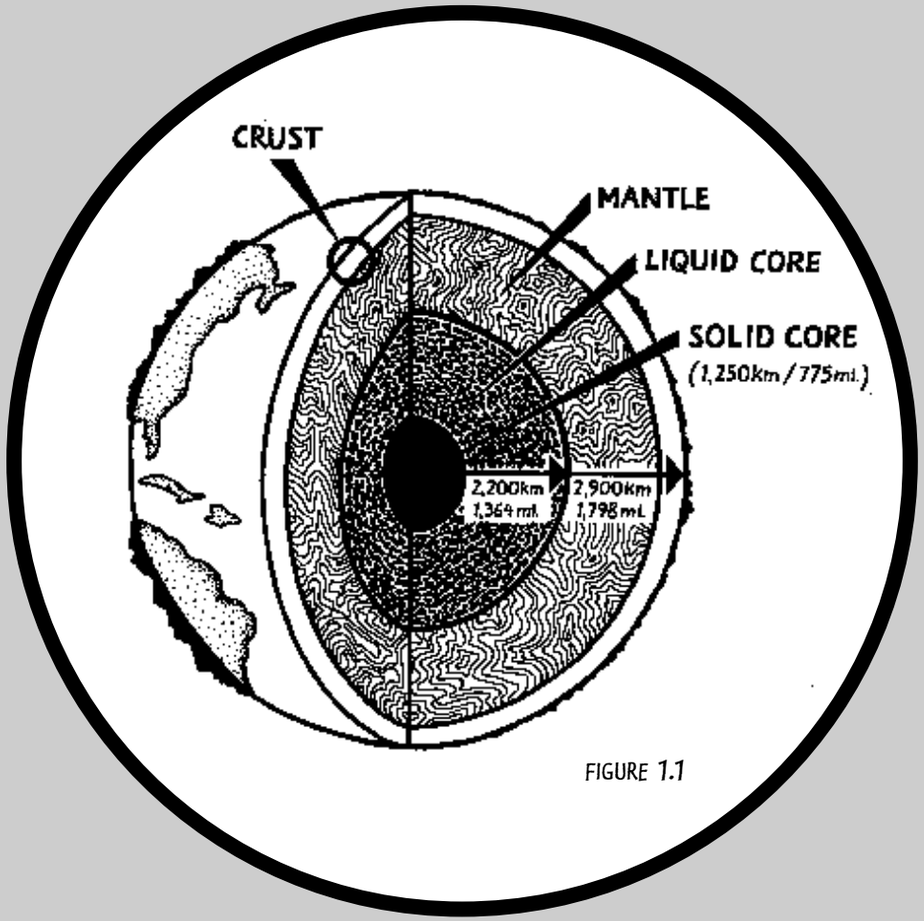

FIGURE 1.1

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THE SECRETS OF THE EARTH

We all live on the surface of the earth, but did you ever wonder what goes on under it, deep inside the earth, deeper than the deepest mine? Of course, no human being has ever been down there; yet earth scientists have been able to learn a lot about what it's made of and what goes on inside the big sphere on which we live. And at the same time, their discoveries have helped to explain much of the mystery of how earthquakes happen and volcanoes erupt.

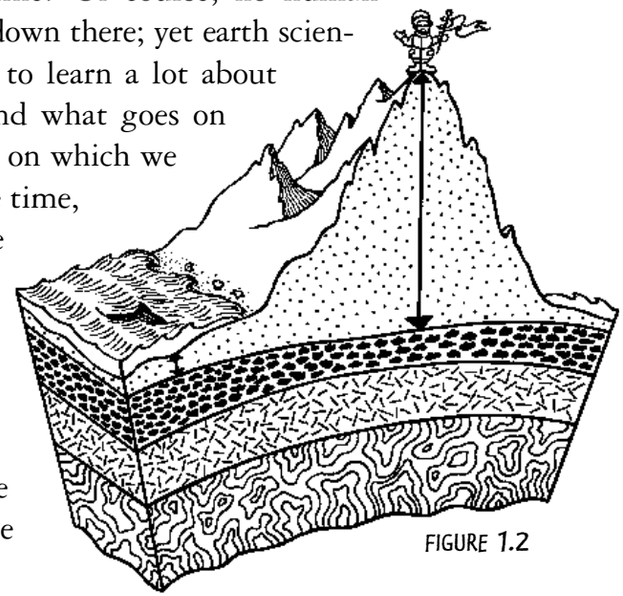


FIGURE 1.2

Imagine that the earth is like an apple

or a peach and consists of a skin, a meaty part, and a core or pit. The core of the earth is solid metal (iron and nickel) surrounded by hot liquid metals. The meat of the earth, the *mantle,* is a hot, somewhat soupy mass of melted rock called *magma.* The skin of the earth is its *crust,* the hard surface of the earth on which we live (Fig. 1.1).

The crust is not equally thick all around the earth. It is as deep as 40 kilometers (25 miles) under the surface of the continents and as thin as 5 kilometers (3 miles) under the ocean floor (Fig. 1.2).

Until a few years ago the crust was assumed to be a solid sphere of rock, but recent discoveries have shown instead that it is cracked into seven large separate sections, called *tectonic plates,* some of them so large that they determine the boundaries of an entire continent (one of them supports the entire United States!) or ocean (the whole Pacific Ocean sits on another), and many small sections that support only part of a continent or a small group of islands, like the plate under the Caribbean (Fig. 1.3).

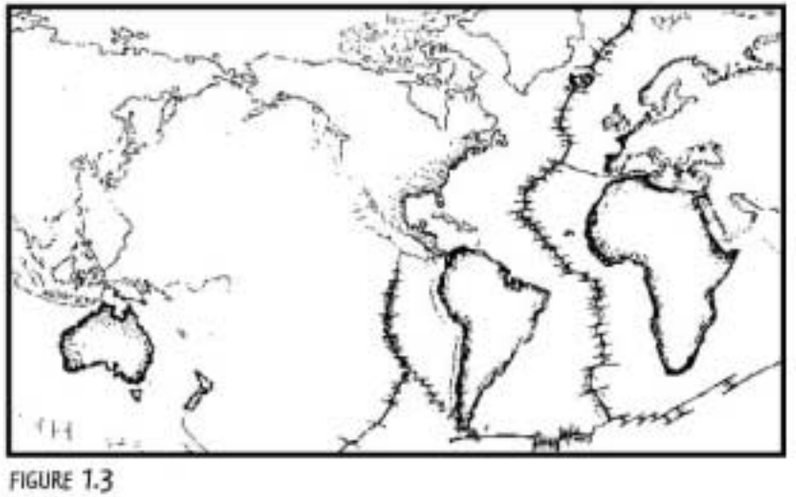


FIGURE 1.3

THE CRACKED EGG EXPERIMENT

In this experiment you will use a boiled egg to simulate the behavior of the tectonic plates on the earth's surface.

FIGURE 1.4

Put enough cold water in a pot to cover an egg and bring the water to a boil. Lower an egg into the boiling water with a spoon. Turn the heat down to low and boil the egg for about 7 to 9 minutes. Take the egg out of the water and cool it under cold water. The egg should be medium cooked and not hard.

Strike the boiled egg gently against a hard surface, like the top of a kitchen table, and break the eggshell into a number of pieces, some large and some small, that will be the tectonic plates of your "earth." If you now squeeze the egg gently between two fingers, the "plates" will move and some will bump against adjoining plates; others will slide along them and some will move away from each other. One plate may even slide under an adjoining plate (Fig. 1.4).

Note: Since the consistency of a boiled egg varies depending on its age, the suggested boiling time is approximate and you may have to proceed by trial and error to be successful with this experiment.

Just like the pieces of the eggshell in the egg experiment, the separate tectonic plates floating over the magma don't stay put but move around at a snail's pace, at only 50 millimeters (2 inches) a year. As they move toward each

other, one plate may hit another (Fig. 1.5a) or slide along it (Fig. 1.5b) or even duck under it (Fig. 1.5c) in what are called *subductions.*

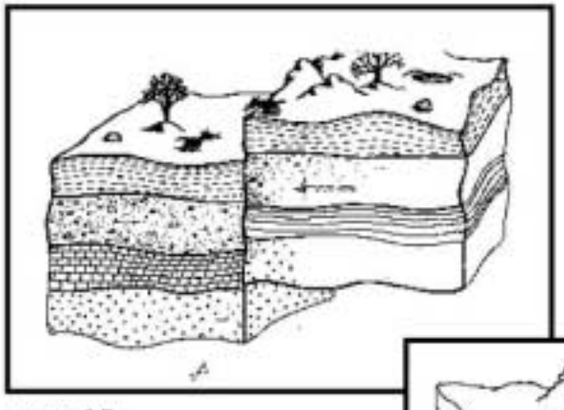


FIGURE 1.5a

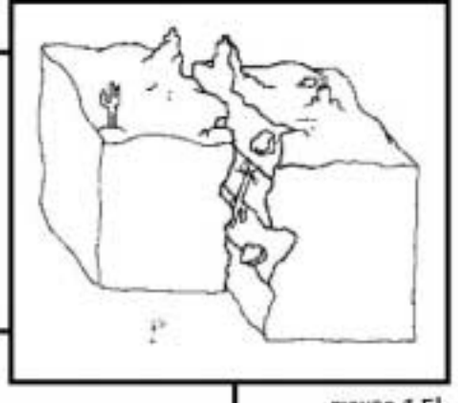
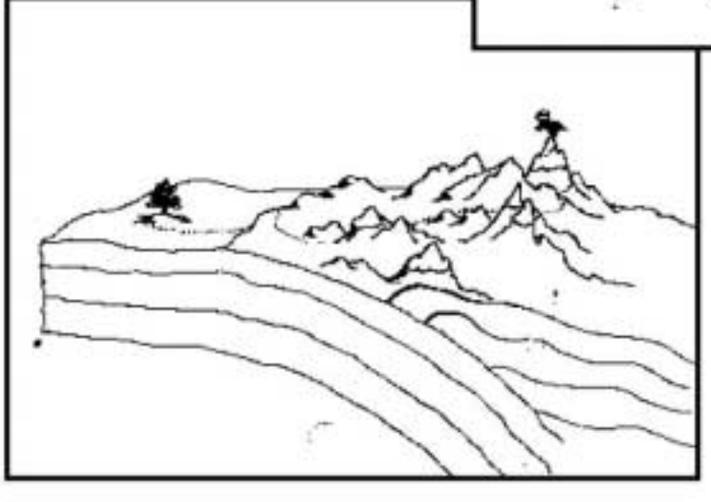


FIGURE 1.5b

FIGURE 1.5c



THE SCRAPING PLATES GAME

To feel how the tectonic plates bump into each other and excite earthquakes that damage buildings and kill people, you only need to use your hands.

Make your hands into fists with the knuckles bulging out (Fig. 1.6a). The backs of your hands will be your "plates" and the knuckles will represent the rough "edges" of the tectonic plates. Now push the knuckles together and, at the same time, try to make one hand slide with respect to the other (Fig. 1.6b). The harder you push your knuckles together, the harder it will be to make your hands slide; you will feel the *stress*—the force acting on a square millimeter (inch) of your knuckles—increase along your knuckles, just as it increases between the rough edges of the plates. If you keep pushing for a while, the muscles of your "plates" will start hurting because the knuckles are preventing the sliding. But eventually one "plate" will suddenly slide, releasing the energy accumulated in your hands. This is how an earthquake happens.

FIGURE 1.6a

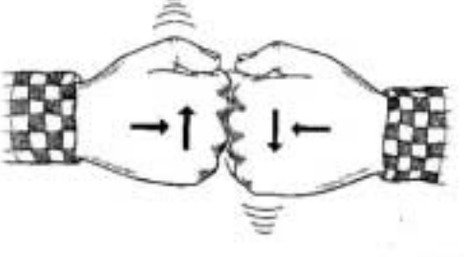


FIGURE 1.6b

From the time our planet was first created about five billion years ago, somewhere on earth two plates under the continents have bumped and pushed against each other, neither of them giving in: they pushed and pushed, and eventually bent up the earth's crust. This is how they created high mountains and still do (Fig. 1.7). You can feel how this can happen by playing the next game.

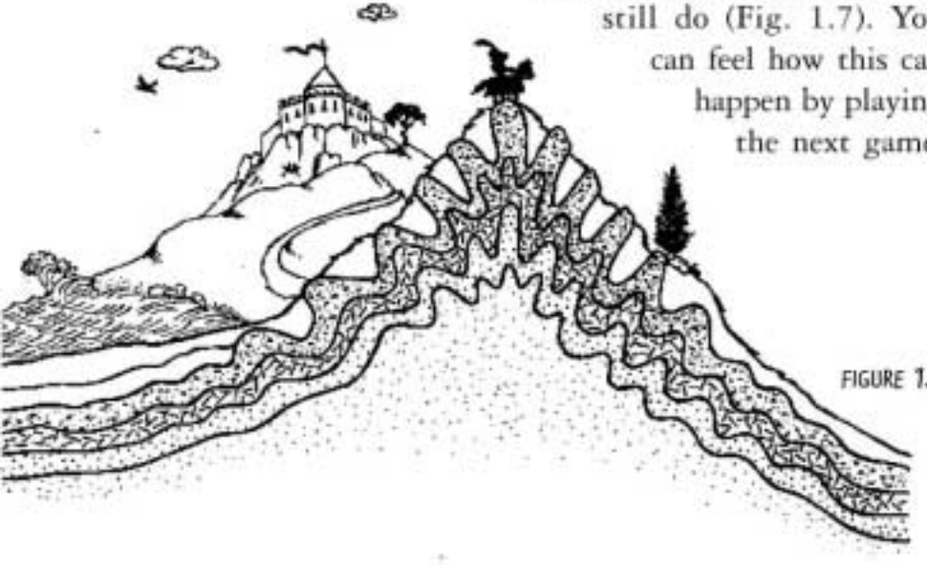


FIGURE 1.7

BIRTH OF MOUNTAINS GAME

Keep your hands flat, with palms down, and push the middle fingers one against the other (Fig. 1.8a). Your hands represent the tectonic plates, and if you keep pushing, you will feel the energy stored in them. If you then make one hand slide under the other in a "subduction," the stored energy will be released, generating an earthquake. But if you keep pushing harder and do not slide one hand under the other, your fingers will bend up, creating "mountains" (Fig. 1.8b). The middle finger forms the highest mountain; call it

Mount Everest, or by its Tibetan name, Chomolungma, Goddess Mother of the World. It is the highest mountain on earth, at 8,848 meters (29,028 feet) high. The ring fingers represent the second highest mountain, the K^2, or Godwin-Austen, which is 8,611 meters (28,251 feet) high. The index fingers form Kanchenjunga, the third highest mountain on earth, at 8,598 meters (28,209 feet) high.

FIGURE 1.8a

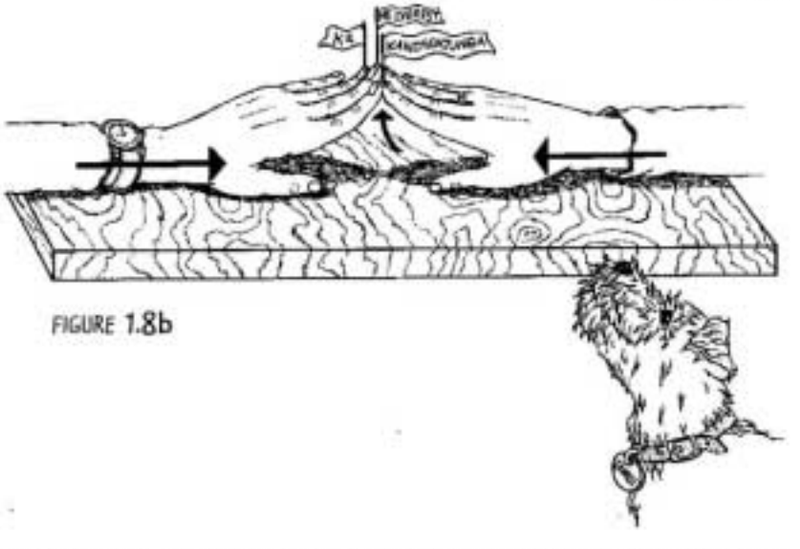


FIGURE 1.8b