

Chapter 18 from *Mysteries of Terra Firma*: The Tapestry

The moving finger writes, and having writ,
Moves on; nor all your Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all your Tears wash out a Word of it.

Omar Khayyam

Over several hundred years, starting with only the raw wool of thought, observation and experiment, science has crafted many threads and woven them into a beautiful tapestry of knowledge. The earliest threads were observations; repeated confirmation converted them into the strongest threads of all: facts. The fibers that represent certain facts are as strong as steel: the speed of light, the gravitational constant, the frequency of harmonic oscillation of a quartz crystal, the rate of decay of uranium-238.

As facts accumulated, scientists invented theories to explain them and wove the theories into the fabric. Though facts are a permanent part of the weave, theories are ephemeral, always at risk of being replaced. As new observations and interpretations weaken a theory and remove it from the weave, its replacement is woven in right behind it, strengthening the whole.

In spite of the human failings of scientists, the tapestry of science grows ever stronger. Egoisms, prejudices, poor guesses, and outright mistakes, all in the long run make no difference. Their effect is only to delay truth, not to deny it. The invisible moving finger of science weaves a tapestry far stronger than scientists themselves.

The thread that represents the age of the earth is one of the strongest in the tapestry, woven firmly in place by crossing threads from astronomy, biology, chemistry, paleontology, and physics. But the other two revolutionary discoveries of twentieth-century earth science also bind the thread of time. Without geologic time, geologists would have to abandon both plate tectonics and meteorite impact.

Many lines of research combine to show that the giant plates that divide the earth's surface move at a rate of a few centimeters per year—about the rate at which our fingernails grow. The paleomagnetic time scale derived from volcanic rocks on land; the symmetrical magnetic anomaly stripes; the paleomagnetic record in deep sea cores; the age of the oldest sedimentary rocks in different regions of the ocean basins: all criss-cross perfectly as warp and woof. The simplest of calculations gives the Atlantic spreading rate. Divide the distance separating the continents on either side (about 6,000 kilometers), by the age of the rocks at the margins (about 180 million years), and derive the rate: 3.3 cm/yr. Using global positioning systems, laser ranging, and other techniques, scientists today actually measure the otherwise imperceptible motion of the plates. The rates that they obtain are exactly the same as those they deduce from geology and geophysics. Plate tectonics unifies geology, but it takes time.

Throughout the thousands of years of recorded human history, no one has seen a meteorite fall and create a crater. Over the hundreds of years since Galileo, in spite of the countless hours that have been spent observing the moon through a

telescope, no one has ever seen a new crater appear (though a few have claimed they did). On earth, impact craters are so rare that it took well over a century for geologists to recognize them. Evidently, craters form on a much longer timescale than our human one. Yet myriad craters from the immense down to the submicroscopic saturate the moon's surface. The hidden farside is even more densely cratered. Craters pock the surfaces of Mercury, Venus, and Mars—indeed, they coat every solid body that we have observed since the space age began, save those that are still volcanically active. A process so slow that we can never observe it happening, yet that has had such ubiquitous effects, must have been going on for a long time. To saturate an entire solar system with craters takes time.

Threads from all fields of science bind the tapestry into a tight and interdependent cloth. A single, strong, time-tested thread, especially one representing the fundamental laws of mathematics, chemistry, and physics, cannot be removed from the fabric, lest it pull with it many other threads, eventually shredding the entire weave. If the thread that represents the age of the earth were to be extracted, along with it would come not only the threads of plate tectonics and meteorite impact, but the essential facts and theories of the physical and biological sciences. If the tapestry is to remain whole, the thread that stands for the age of the earth must remain.

The tapestry of science is one of the crowning achievements of our species. To tamper with it is no different than tampering with another great tapestry of human invention: the arts. Imagine removing every fourth note from *Eine Kleine Nachtmusik*, every fourth line from *Hamlet*, every fourth brush stroke from Van Gogh's *Iris*. To do so would be to deny and desecrate the finest that our species has achieved.