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Recent Rapid Uplift of Today's Mountains

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An ongoing enigma for the standard geological community is why all the high mountain ranges of the world—including the Himalayas, the Alps, the Andes, and the Rockies—experienced most of the uplift to their present elevations in what amounts to a blink of the eye, relative to the standard geological time scale. In terms of this time scale, these mountain ranges have all undergone several kilometers of vertical uplift since the beginning of the Pliocene about five million years ago. This presents a profound difficulty for uniformitarian thinking because the driving forces responsible for mountain building are assumed to have been operating steadily at roughly the same slow rates as observed in today's world for at least the past several hundred million years.

But the uplift history of today's mountains is anything but uniformitarian in character. Observational evidence indicates that the terrain where these mountains now exist, in many if not most cases, was nearly flat and near sea level when the recent intense pulse of uplift began. The expectation of uniformitarian thinking generally is that most of the time denudation by erosion ought to be more or less in equilibrium with uplift.

This lack of agreement between field observation and uniformitarian expectation has led to conflict among specialists in the ranks of the larger earth science community. Theorists who address these matters, confident that their uniformitarian models are sound, tend to ignore the observational reports or reinterpret them as much as they can to match the predictions of their theories. Geomorphologists who focus on this topic, on the other hand, confident their observations correspond to reality, tend to dismiss the explanations of the theorists as hopelessly out of touch with the real world. However, because of the specialization that typifies most of science today, a sizable fraction of the earth science community is largely oblivious that the uplift history of today's mountains is even an issue at all.

This disconnect between the uniformitarian theorists and uniformitarian observationalists on the issue of mountains is nicely documented in a recent book

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by Cliff Ollier and Colin Pain entitled, *The Origin of Mountains*.[1] The authors are geomorphologists who focus on field data relating to the processes such as faulting, uplift, volcanism, and erosion that sculpt mountains. In their book they repeatedly relate how geological features they and other fellow geomorphologists observe in the field fail to match the explanations of their theorist colleagues. Yet in the end they offer no suggestion as to how the disparity between the existing uniformitarian theories and their observational data can be resolved, or where the errors in the theoretical framework might lie.

The Biblical record concerning the Flood that destroyed the earth and its inhabitants in Noah's day just a few millennia ago, however, provides a straightforward and credible way of resolving this uniformitarian impasse. In a nutshell, the catastrophic processes unleashed in the Flood not only deposited thousands of feet of fossil-bearing sediments on all the continents and moved North and South America some 3000 miles westward relative to Europe and Africa, but also increased the thickness of the buoyant crustal rock in the belts where high mountains now exist. When the catastrophic driving processes shut down, the zones with the thickened crust promptly moved toward a state of what is called isostatic equilibrium, resulting in many thousands of feet of vertical uplift of the surface.

The principle of isostatic equilibrium is similar to Archimedes' principle concerning objects that float. According to Archimedes' principle, the weight of a floating object equals the weight of the volume of fluid it displaces. For example, an ice cube, weighing one ounce and floating in water, displaces exactly one ounce of water. Because the density of ice is about 10% less than that of water, its volume for an equal weight is about 10% greater. From Archimedes' principle one can calculate the fraction of the ice cube that extends above the water surface. It is about 10%.

The principle of isostasy is very similar. It states that when in isostatic equilibrium, all columns of rock of equal cross sectional area (including any height of water that may be present) lying above some "compensation depth" in the earth weigh the same. The compensation depth is a point sufficiently deep in the mantle such that the rock is warm enough and therefore weak enough to flow plastically so as to relax any horizontal differences in hydrostatic pressure. This principle simply expresses the fact that when horizontal pressure differences are relaxed, the pressure at depth is equal to the total weight per unit area in the column above.

To apply this principle it is helpful to realize that the ground beneath our feet consists of two primary kinds of rock. One type, known as continental crust, rich in quartz and feldspar minerals, has a typical density of 2800 kg/m^3. The other type is mantle rock containing denser iron-bearing minerals with a typical density about 20% higher, or 3400 kg/m^3. Areas away from mountain belts such as the U.S. Midwest commonly display a crustal thickness on the order of 35 km. Mountain belts, however, frequently have crustal thicknesses greater than 50 km and sometimes as much as 70 km. Under conditions of isostatic equilibrium, continental regions with thicker crust usually display higher surface topography. For example, relative to a region with a 35 km crustal thickness, a zone with a 60 km crustal thickness, for the densities quoted above, would have a surface 14,500 feet higher.

So what is behind the uniformitarian puzzle concerning the uplift history of today's mountains? In terms of the time scale, it is useful to stress the vast difference between modern uniformitarian geology on one hand and the Biblical account of earth history on the other. Uniformitarians interpret the rock record since the abrupt appearance of multi-celled organisms in the rocks to represent more than 500 million years of time, while Biblical creationists interpret all but the topmost of these fossil-bearing rocks to represent the destructive work of a year-long global cataclysm that took place less than 5000 years ago. The Pliocene-Pleistocene timing of the main phase of mountain uplift, corresponding roughly to the Ice Age, while brief in the uniformitarian framework, still requires several million years on their calendar. By comparison, in the Biblical time frame, this uplift unfolds over several centuries following the main Flood cataclysm that itself lasted but a single year.

The case is compelling that the Flood involved massive tectonic transformation of the earth's surface. Many lines of evidence show that today's igneous ocean floor—all of it—has formed via seafloor spreading since roughly mid-way through the Flood. This implies that all the ocean floor formed prior to that point in earth history, including all the ocean floor formed at Creation and existing at the beginning of the Flood and all the ocean floor formed during the interval in which Paleozoic sediments were being deposited on the continents during the earlier stages of the Flood, has vanished from the face of the planet. Seismology provides a clue as to where it went. Seismic images of the mantle reveal a ring of dense, presumably cold, rock at the base of the mantle beneath the subduction zones surrounding the Pacific Ocean.

It has long been my conviction, along with several of my ICR colleagues, that the only way to fit all these observations together in a consistent manner is to conclude that the Flood involved an episode of extremely fast plate tectonics that cycled the pre-Flood ocean floor, as well as that formed early in the cataclysm, into the earth's mantle.[2] The energy to drive this event was readily available in the form of gravitational potential energy of the cold, pre-Flood ocean floor rocks. The stress-weakening tendency of silicate minerals comprising mantle rocks allows the process to unfold in a runaway manner.[3] Laboratory experiments document that these minerals can weaken by as much as 8–10 orders of magnitude for shear stress levels that can occur in the mantles of planets the size of the earth.

Calculations performed over the past decade show that the pattern of flow generated by subducting seafloor around a Pangean-like supercontinent similar to the one we believe existed prior to and again during the Flood, pulls the continental blocks apart in a manner similar to that indicated by the earth's present day seafloor record.

In addition, the huge amount of subduction at continent margins during an episode of runaway sinking of ocean floor leads to considerable thickening of the continental crust via two main processes. One is the melting of subducted sediments as they reach a depth of about 75 miles. This magma penetrates into the crust above as sills and dikes, with some being extruded at the surface as lava and volcanic ash. The other main process is the physical dragging of warm and ductile lower crust inboard relative to the continent by the subducting ocean slab. Both processes serve to produce zones of thickened continental crust at a continental margin adjacent to where slabs of ocean floor are plunging into the mantle. The west coast of South America is a prime illustration, where the crust has reached thicknesses of up to 70 km.

During the rapid subduction, the overlying continental surface tends to be depressed, even below sea level, due to the powerful dynamical forces produced by the sinking ocean slab below, despite the buoyancy of the thick layer of continental crust above. But when the process of rapid subduction shuts down, these dynamical forces disappear, and the buoyancy forces take over to elevate the zone of thickened crust toward a state of isostatic balance. The uplift of high mountains at the close of this episode of rapid subduction is therefore a logical after effect of this runaway process. Within the Flood framework, the timing of the uplift, unfolding in the centuries following the cataclysm, is just what one should expect based on simple mechanics considerations. On the other hand, no mechanical response in terms of uplift during tens of millions of years of tectonic forcing followed by a sudden pulse of uplift poses a serious problem for the uniformitarian framework.

Yet an equally bewildering difficulty for a uniformitarian is the widespread presence of what are known as planation surfaces that pre-date this global pulse of mountain building. Ollier and Pain document dozens of examples where regions that were later uplifted to form mountain ranges were first beveled to nearly flat surfaces by intense erosion just prior to uplift. These authors puzzle how the tectonic forces could have ceased operating long enough for erosion to have abraded away hundreds to thousands of feet of rock to form flat topography and then be unleashed again to uplift rapidly the entire region by many thousands of feet. The Flood framework provides the obvious answer. The beveling flat of such broad expanses of terrain was the logical consequence of the runoff from the Flood. And it would have occurred just prior to when the uplift took place.

Whitcomb and Morris, 45 years ago in their classic book, *The Genesis Flood*, pointed out the remarkable timing of the uplift of the present mountains as being after the Flood. They write, "It is extremely interesting . . . to note that most of the present mountain ranges of the world are believed to have been uplifted (on the basis of fossil evidence) during the Pleistocene or late Pliocene."[4] They then quote a paper that provides documentation from North America, Europe, Asia, South America, and Africa. Surely it is time for evolutionists as well as creationists to give attention to this evidence that so strongly supports a recent global Flood.

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