# Flood processes into the late Cenozoic: part 4—tectonic evidence

*Michael J. Oard*

This paper presents five Cenozoic Erathem tectonic processes best explained by the Flood. These are the stupendous differential vertical tectonics: huge horizontal plate movements, including the crashing of India into Asia (assuming catastrophic plate tectonics); the emplacement of ophiolites; the development of metamorphic core complexes; and the emplacement of ultrahigh-pressure minerals.

Tectonics, more than any other process or event, should show whether the Cenozoic Erathem, mainly the Paleogene and Neogene Systems, was a result of the Flood. The sheer magnitude of the Cenozoic tectonic events should be most persuasive. This paper will explore five tectonic processes evident in the Cenozoic Erathem. These are additional evidences that are best explained by Flood tectonics and not post-Flood catastrophism (table 1).

## Huge Cenozoic vertical tectonics

The Cenozoic Erathem is characterized by huge vertical tectonics. Many of the mountain ranges within the greater Rocky Mountains in the western US, which include about 100 individual small ranges, have uplifted *thousands of metres* relative to the same rocks in adjacent valleys or basins. The mountains rose or the basins sank or both. During uplift, the valleys and basins filled up with thousands of metres of sediment. Later, hundreds of metres of these same sediments were eroded off the top.[1]

### Differential vertical tectonics, Rocky Mountains

In Wyoming, the spread of quartzite cobbles and gravels during the Cenozoic ended up several mountain ranges from their source in the western Rocky Mountains. This indicates that the granitic upper crust probably was generally level at one time (figure 1).[2,3] Therefore, mountains must not have been a barrier at the beginning of quartzite transport. Moreover, the same sedimentary rocks found as erosional remnants on the tops of the mountains (figure 2) match tilted sedimentary rocks along the edges of the adjacent basins that continue underneath the flatter sedimentary rocks in the middle of the basins (figure 3). Since sediments are generally laid horizontally, it indicates a generally flat upper crust over large areas at the time of deposition.

So, if we compare the height of the granite and gneiss upper crust in the mountains and the same crust in the adjacent valleys or basins, we can determine the amount of uplift of the mountains relative to the valleys and basins. This comparison suggests that the Beartooth Mountains rose 7,000 m,[4] the Teton Mountains rose about 9,000 m,[5] the Wind River Mountains about 13,500 m,[6] and the Rawlins uplift was 11,300 m with respect to the Hanna Basin.[7,8] Moreover, the Uinta Mountains of northeast Utah rose over 12,000 m.[9] Wallace Hansen summarizes:

> "The upbuckling that produced the mountains was accompanied by comparable downbuckling under the basins. *As the mountains rose, the basins subsided*, so that deposits once near sea level throughout the region are now 12,000–13,000 feet high in the mountains but are as much as 30,000 feet below sea level beneath the Green River and Uinta Basins [emphasis added]."[10]

Hansen essentially paraphrases Psalm 104:8 in discussing the differential vertical tectonics of the Uinta Range. Figure 4 is a schematic summarizing the 12,000 m of differential vertical tectonics between the Uinta Range and the adjacent basins.

Practically all this tectonic offset in the Rocky Mountains occurred during the Cenozoic. For instance, the Uinta Mountains rose in the Cenozoic. The Teton Mountains are believed to have risen mostly in the past 5 Ma (in the uniformitarian timescale), near the end of the late Cenozoic.[11]

**Table 1.** Summary of Cenozoic tectonic evidences best explained by Flood processes. The strength is based on my subjective opinion on whether a K/Pg Flood/post-Flood boundary interpretation can explain them with post-Flood catastrophes.

| Tectonic Evidences | Strength |
|---|---|
| 1. Huge vertical tectonics | Strong |
| 2. Tremendous horizontal plate movements | Strong |
| 3. Ophiolites | Strong |
| 4. Metamorphic core complexes | Moderate |
| 5. Ultrahigh-pressure minerals | Strong |

Differential vertical tectonics, worldwide

It can be shown that such uplift as deduced from the Rocky Mountains also occurred *worldwide*. Several examples will be presented with a summary from Ollier and Pain's book, *The Origin of Mountains*.[12] The Atlas Mountains of northwest Africa rose to a height of 4,167 m, while some of the basins within and surrounding the Atlas Mountains have sunk by at least this same amount.[13] All this uplift occurred in the late Cenozoic.[14]

The Mediterranean Sea basins, including the Pannonian Basin of Romania and Hungary, developed mostly in the Cenozoic.[15,16] At the same time, the surrounding mountains uplifted, many of which were overthrusted away from the basins during extensional tectonics accompanied by much metamorphism. The Cenozoic differential vertical tectonics amounted to thousands of metres.

The mountains of south-central Asia, including the Himalayas, the Tian Shan, and the Zagros Mountains, as well as the Tibetan Plateau, rose thousands of metres while surrounding basins sank thousands of metres. During this time, tremendous erosion of the mountains piled up coarse gravel deposits up to 3,000 m thick, extending from the edge of the mountains and thinning toward the centre of the basins.[17] The coarse gravel is generally rounded by water, and sometimes composed of boulders longer than 2 m. Gravel layers parallel to the mountains are sheet-like, hundreds of miles long. Figure 5 shows the sheet like gravels in the Sichuan Basin east of the Tibetan Plateau. All this activity is dated to the late Cenozoic.[18]

**Figure 2.** Beartooth Butte, 490 m thick, with marine fossils is an erosional remnant on top of the Beartooth Mountains, south-central Montana and north-central Wyoming.

**Figure 3.** Tilted Paleozoic and Mesozoic Erathem strata at the northwest edge of the Bighorn Basin at Clarks Canyon adjacent to the southeast Beartooth Mountains

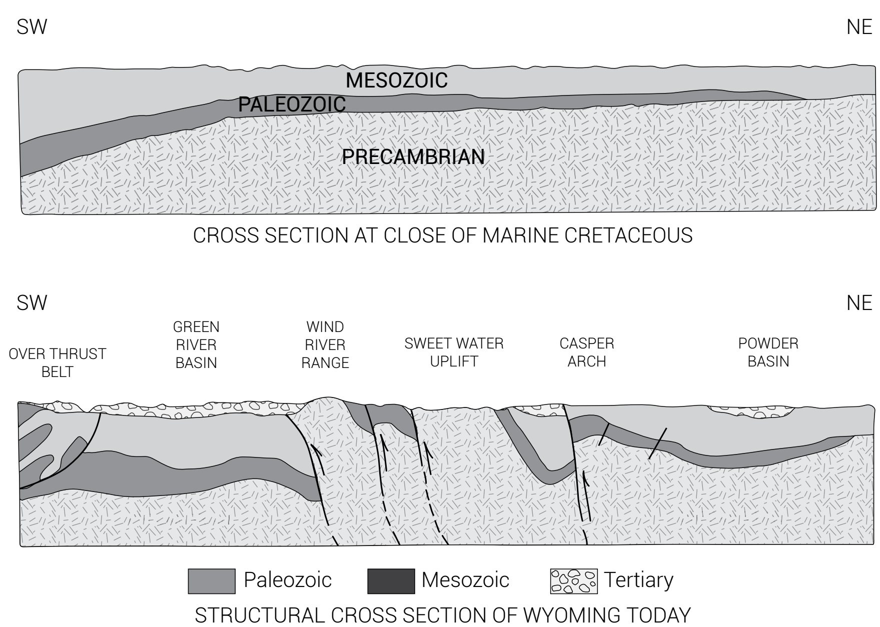


**Figure 1.** Schematic of the uniformitarian view of the Precambrian granitic crust below Paleozoic and Mesozoic Erathem sedimentary rocks in Wyoming at the end of the Mesozoic deposition and at present (redrawn by Mrs Melanie Richard from Glass, G.B., and Blackstone, D.L., Geology of Wyoming, Information Pamphlet No. 2, The Geological Survey of Wyoming, Laramie, WY, 1994, p. 3).

In southwest Asia, the Greater Caucasus Mountains have risen as much as 5,642 m while the South Caspian Basin has subsided around 27,000 m.[19,20] The Alborz Mountains, Iran, wrap around the southern part of this basin and are believed to have uplifted a significant amount at the same time as the South Caspian Basin subsided.[21] This tremendous differential vertical tectonics of 32,600 m all happened in the Cenozoic: "The South Caspian basin evolved adjacent to the rapidly uplifting Greater Caucasus Mountains since the Paleogene [early Cenozoic]".[22]

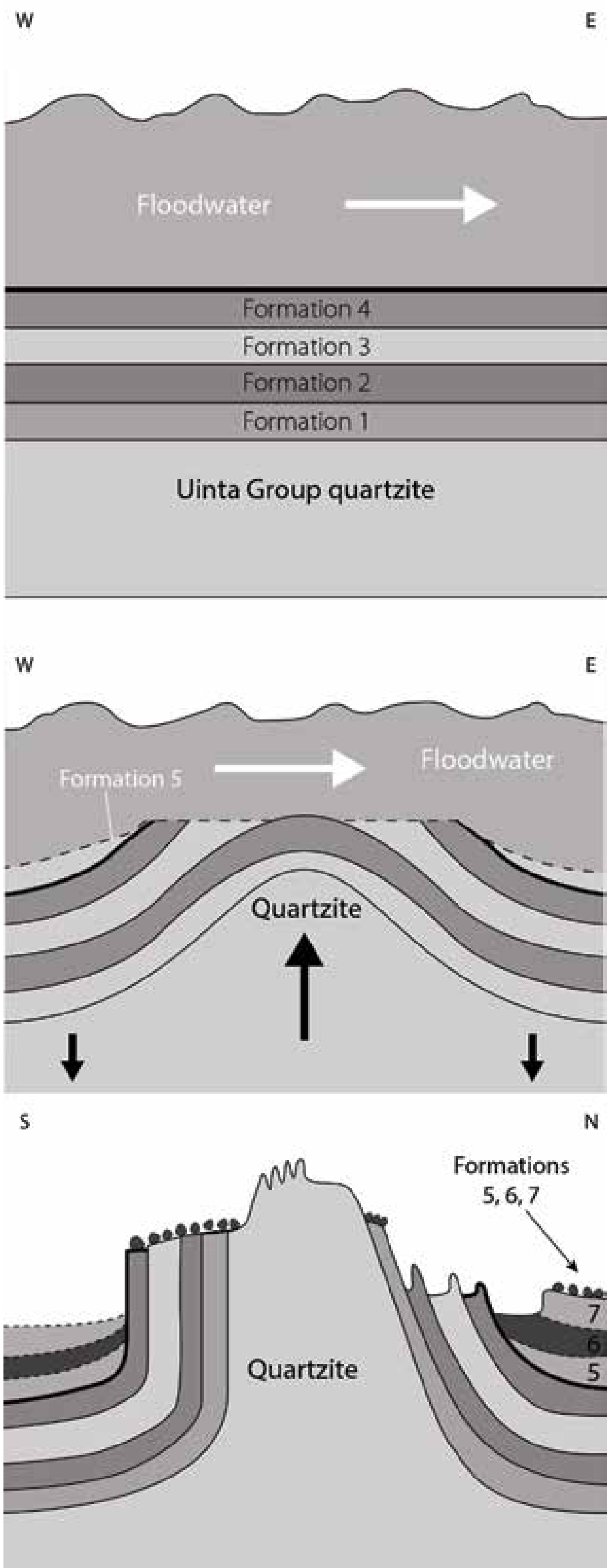


**Figure 4.** Three-step schematic of differential vertical tectonics during the Flood for the Uinta Mountains and the adjacent basins (drawn by Mrs Melanie Richard)

Implication

Ollier and Pain stated that the major uplift of nearly *all* the mountains of the world occurred in the last part of the latest Cenozoic Erathem.[14] Presumably the basins and valleys sank at the same time. Whitmore has suggested uplifts of a thousand metres or so after the Flood,[23] but the actual Cenozoic differential vertical tectonics is sometimes an order of magnitude or more than he has suggested. Such tremendous global-scale differential vertical tectonics is more likely characteristic of the Flood and harder to explain with a local catastrophe after the Flood.

### Tremendous horizontal plate movements

Not only were there tremendous differential vertical movements during the Cenozoic Erathem, but there were also tremendous horizontal plate movements, assuming the catastrophic plate tectonics (CPT) model. The amount of movement can be calculated by marine magnetic anomalies. Advocates of plate tectonics translate the small intensity variations into different magnetic directions.[24] In areas of below average magnetic intensity, it is assumed that the magnetic field was reversed, and vice versa, with above average intensity. However, changes in magnetic intensity can be due to other causes, such as changes in magnetic susceptibility, which opens up other possibilities for the explanation of marine magnetic anomalies besides plate tectonics.[25]

According to CPT theory, the supercontinent Pangaea did not start breaking apart until about midway through the Mesozoic Erathem, just prior to the Cenozoic Erathem. This implies much of the total plate movement occurred during the Cenozoic, which Whitmore believes is post-Flood.[25] For instance, the South Atlantic Ocean opened up 2,400 km, the South Pacific 2,600 km, and the North Pacific 5,000 km during the Cenozoic alone.[26]

Also during the Cenozoic, India collided with Asia.[27] This is the time when Tibet, the Himalaya Mountains, and other mountains of south-central Asia started to rise with the greatest rise in the late Cenozoic. Such an event seems like it could only have happened during the Flood and not afterwards.

### Special catastrophic tectonics during the Cenozoic

Besides rapid and intense vertical and horizontal tectonics of the earth's crust and upper mantle, there were also a number of other catastrophic tectonic events during the Cenozoic. These include the emplacement of ophiolites, metamorphic core complexes, and ultrahigh-pressure minerals.

## Ophiolites

Ophiolites are claimed to be pieces of ocean crust and upper mantle that have been thrust up onto continental crust and are now found especially in mountains and along continental margins.[28–30] Numerous ophiolites outcrop extensively in the mountains from the Alps eastward into the Himalayas.[31] An ideal ophiolite suite consists from bottom to top of peridotite, gabbro, sheeted dikes, basalt with pillow lavas, and sedimentary rocks. The peridotite is an upper mantle rock, while the remainder of the sequence is considered ocean crustal layers. However, there are parts of this vertical sequence commonly missing, except for the upper mantle rocks. For instance, the sheeted dike complex and the sedimentary rocks are often missing. The basalt can also vary from thin to absent. So, ophiolites are mainly identified by upper mantle rocks, and they may not necessarily represent ancient ocean crust since one or more of the oceanic upper crustal components are missing. Ophiolites can be over 10 km thick and sometimes of large geographical scale, such as the impressive arc-shaped Oman ophiolite that is about 150 km wide and 550 km long (figure 6).[32,33]

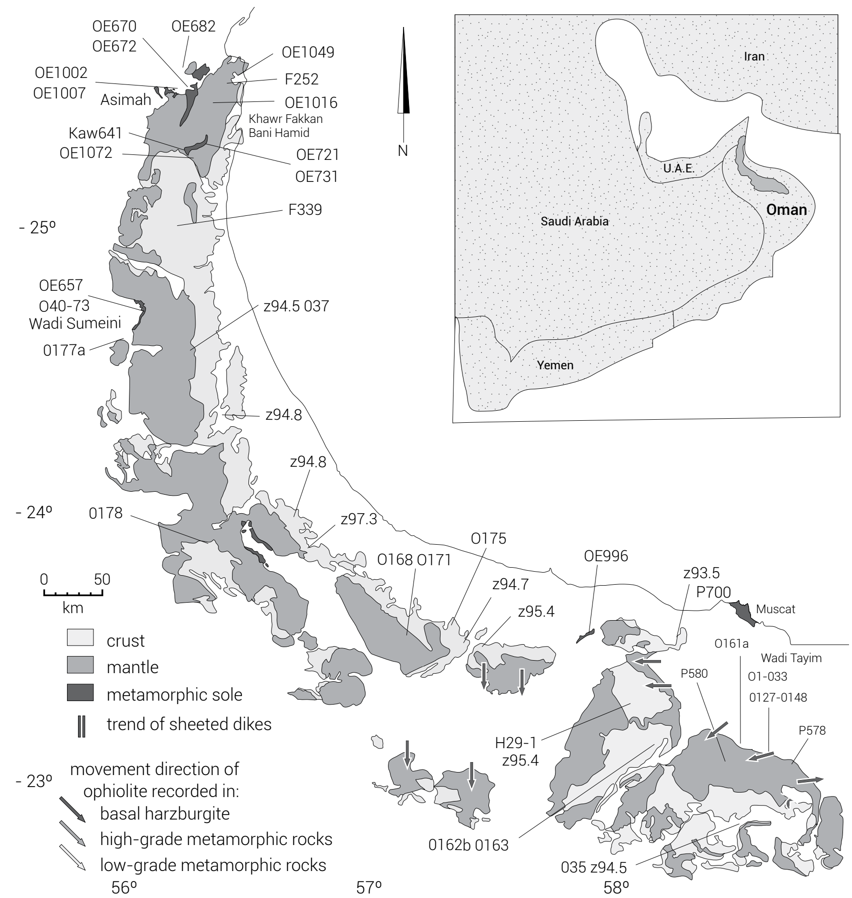


**Figure 6.** Oman ophiolite, also called the Samail ophiolite (from Hacker *et al.*,[32] p. 1231)

**Figure 5.** Thick gravel western Sichuan Basin, China (courtesy of Dr Vern Bissell)

The origin of ophiolites has long been a subject of controversy.[34] A favoured hypothesis is that ocean crust was generated at mid-ocean ridges (MORs); spread out from the MORs; and, after colliding with continents, was forced up and over the continental crust, in some cases for possibly hundreds of kilometres. Ophiolites sometimes possess high temperature metamorphic rocks at their bases,[35] the grade of metamorphism decreasing downward below the base, indicating heating from sliding friction.[36] However, most ophiolites are now believed to have something to do with subduction zones, in which an oceanic plate is diving below another oceanic plate or a continental plate. How this happens is a subject of dispute.[37]

Another problem is that there are no locations today where ophiolites are currently being 'slammed' against continental crust or being raised in mountains. In other words, there are no modern analogues,[38] which is contrary to the uniformitarianism principle upon which all mainstream geological interpretation is based. It also makes it difficult to develop a thorough understanding of any proposed mechanism. Dewey writes, "… no credible mechanisms have yet been devised for ophiolite obduction [pushed over continental crust] from ocean ridges onto rifted continental margins."[39] In regard to the Oman ophiolite, believed to have been thrust 200 km westward onto a passive continental margin, Hacker and colleagues are understandably mystified:

> "The emplacement of oceanic lithosphere [crust and upper mantle] onto continents remains one of the great mysteries of plate tectonics—how does ophiolitic material with a density of 3.0–3.3 $g/cm^3$ rise from its natural depths of ≥2.5 km beneath the ocean surface to elevations more than 1 km above sea level on continents with densities of 2.7–2.8 $g/cm^3$?"[40]

Ophiolites represent a conundrum to creationists also, but it is not the purpose of this article to define a mechanism.

Nonetheless, opthiolites are widespread and are dated anywhere from the mid Precambrian, about two billion years ago,[41] to the Cenozoic. There are not many Cenozoic ophiolites; they are more common in the Jurassic and Cretaceous System of rocks. Cenozoic ophiolites are found mainly in the southwest Pacific, especially Indonesia; the Red Sea area; southern Chile; and Japan.[42] Ophiolites have been studied in the northern Philippine Islands that are dated as late Mesozoic and early Cenozoic.[43] An ophiolite on Macquarie Island, south of New Zealand, is even dated as late Cenozoic.[44] Some of these Cenozoic ophiolites are on the continents and believed to have been emplaced somehow by plate tectonics. So, how would old ocean crust be emplaced by catastrophic plate tectonics *after* the Flood, if the Cenozoic was post-Flood?

**Figure 7.** Eastern Bitterroot Mountains showing the consistent 25° eastward slope of the edges of the mountains (view north down the Bitterroot Valley)

Ophiolites represent tremendous tectonic upheaval. The Flood was a colossal catastrophe and it seems more reasonable to emplace them during the Flood and not after the Flood.

### Metamorphic core complexes

Metamorphic core complexes (MCCs) are generally domal or arch-like uplifts of metamorphic and granitic-type rock overlain by unmetamorphosed rocks that have usually slid downhill on a low-angle fault during doming.[45] The slide is commonly called a detachment fault. The resulting dome can sometimes be called a gneiss dome,[46] since it is mostly gneiss and granite that make up the dome. Sometimes ultrahigh-pressure minerals (see below) are associated with MCCs.[47] MCCs are relatively large structures; they can range from a few tens of km to around 100 km in width.[48] It is believed by many that the domes uplifted around 16 km,[49] and as a result the MCCs are often the highest mountains in the region.[50] MCCs are accompanied by much volcanism.

MCCs are numerous and their uniformitarian age is *predominantly* Cenozoic.[51] There are 25 MCCs near the axis of the mountains of the western United States, from southern Canada to northwest Mexico.[52] They are dated as both early and late Cenozoic. The largest is the Bitterroot dome-Sapphire block of west central Idaho and southwestern Montana.[53,54] In this MCC, the eastern edge of the Idaho Batholith uplifted and a block of rock 100 km long, 70 km wide, and 15 km thick broke off and apparently slid eastward about 60 km. The block that came to rest is the Sapphire Mountains. In between the Sapphire Mountains and the eastern edge of the Idaho Batholith, the Bitterroot Mountains, is the straight Bitterroot Valley (figure 7). Along the western edge of the valley, the angle of the mountain slope is the same at about 25°, which represents the slide surface for the eastward slide of the Sapphire block. Below the slide surface, several hundred feet of sheared rock, called mylonite, caused by the slide, are found.

Other Cenozoic MCCs are located in the Aegean Sea, Greece, Turkey, Iran, Tibet, Slovakia, Venezuela, Trinidad, New Zealand, and eastern New Guinea. The latter is the youngest, being dated as 2 to 8 Ma old.[55] It is also associated with ultrahigh-pressure minerals (see below).

MCCs are a uniformitarian conundrum. In regard to the rapid exposure of the core of the MCC in Papua, New Guinea, Little and colleagues stated, "The tectonic [uplift] processes by which this rapid exposure has been accomplished remain poorly understood."[56] MCCs are believed to have formed during extension when the crust was being pushed apart horizontally. The late date of MCCs, mostly in the Cenozoic, was a surprise.

MCCS represent tremendous tectonic events. Scott Rugg points out that they uplifted rapidly with the sliding of huge blocks occurring rapidly late in the Flood.[57] Just like with ophiolites and ultrahigh-pressure metamorphic rocks (see below), the catastrophism of the Cenozoic was tremendous, which seems more like a Flood signature than a post-Flood phenomenon.

### Ultrahigh-pressure minerals

Ultrahigh-pressure (UHP) minerals, as well as high-pressure (HP) minerals, and microdiamonds have been increasingly discovered on the earth's surface over the past 40 years or more.[58] These minerals have caused much frustration to uniformitarian scientists because such UHP minerals imply metamorphism at high pressures deep down in the earth, but the minerals are now found in a low-pressure environment at the earth's surface.

UHP minerals are believed to have originated predominantly from continental crust, which is lighter than ocean crust and the mantle. So, how does buoyant continental crust sink to depths deep enough to form UHP? Uniformitarian scientists used to say it could not happen. But the UHP minerals have forced these scientists to conclude that continental rocks must have been rapidly forced downward to great depths and then rapidly exhumed to the surface. Furthermore, the rocks often remained at low temperature while descending into a much hotter environment, implying rapid descent. UHP minerals must have also ascended rapidly because a slow exhumation should cause retrograde metamorphism and destroy the UHP minerals by converting them back to low pressure forms.

Each new discovery of UHP minerals has pushed the depth of descent farther downward, causing a predictable cycle of uniformitarian disbelief followed by forced acceptance.[59] Therefore, a paradigm change has been underway in geology because of UHP minerals:

> "The story of ultrahigh-pressure metamorphism (UHPM) is a confused mixture of surprising, sometimes spectacular, discoveries and emotional reactions. Surprisingly, the process has been a repeating cycle of disbelief followed by confirmation, with little evidence that the community response in a given cycle has learned from previous cycles."[60]

Uniformitarian geologists have hypothesized that continental collisions may account for the data, but the depth of descent is overwhelming. How such radical vertical tectonics can occur with continental collisions remains enigmatic:

> "As a consequence, thermomechanical insights inferred from P-T-t [pressure-temperature-time] reconstruction and structural studies of high-pressure terranes have relentlessly failed to reproduce the trajectories and the velocity field of mass transport in the crust during the entire orogenic [vertical tectonic] period and, most importantly, show no clue to the basic processes responsible for burial and rock exhumation and their relation to the global velocity framework of plate tectonics."[61]

That is not all. An analysis of UHP minerals suggests that some minerals had been driven down to depths of around 300 or 400 km and exhumed![62,63] Ultrahigh-pressure minerals, therefore, imply rapid sinking and uplift, unless they are the result of asteroid impacts, which can also cause such ultrahigh-pressure minerals to form, as well as microdiamonds.

Ultrahigh-pressure minerals are *commonly* found in Cenozoic rocks. UHP minerals in the Alps imply rapid uplift from about 100 km depth.[64] Late Cenozoic ultrahigh-pressure rocks are found in eastern Papua New Guinea, in a gneiss dome, also implying rapid exhumation from about 100 km depth.[65] High-pressure minerals from the mountains of southeast Spain are believed to have been uplifted from about 65 km in the *late* Cenozoic.[66] The ultrahigh-pressure rocks in the Himalayas, implying uplift from below 90 km, also have a Cenozoic age.[67] Diamonds in rocks from an intrusion in Japan indicate uplift of over 170 km.[68] It is interesting that the rock is assumed to be scrapped off and deformed material from the ocean as the Pacific Plate subducted beneath Japan. This means that the origin of the rock is believed to be from shallow depths, but the diamonds say otherwise. So, the diamonds with the assumed uplift are another uniformitarian mystery.

Catastrophic tectonics with sinking and uplifts of over 300 km would be expected during the Flood, since the Flood was a time of intense vertical tectonics, and possibly numerous impacts,[69] which may also have been a cause for the UHP minerals and microdiamonds. However, one would not expect such radical vertical tectonics after the Flood.

## Conclusion

Evidence of major tectonics of various sorts occurred during the deposition of the Cenozoic Erathem rocks. This includes the many thousands of metres, sometimes over ten thousand metres, of differential vertical tectonics; the thousands of kilometres of horizontal plate movement, including the collision of India with south-central Asia; the emplacement of ophiolites; the development of metamorphic core complexes; and the emplacement of ultrahigh-pressure minerals.

Such enormous Cenozoic tectonics is much better placed in the Flood instead of afterwards. Every time the plates of the earth shift several metres, seismic waves cause intense earthquakes that kill people. With so much horizontal plate movement, including the crashing of India into the Himalayas, large movements on strike-slip faults, extreme differential vertical tectonics, and other tectonic events, the seismic violence would be immense and continuous for hundreds of years. The earthquakes would most likely have been equally intense all over the world. Huge areas would have flooded as regions tectonically sank. How could man and the animals spread and thrive after the Flood as God directed them if all these tectonics in the Cenozoic are placed after the Flood? It would be more logical for these events to have been part of the Flood catastrophe, as advocated by Baumgardner, one of the original authors of CPT.[70] In that way, significant CPT would not occur after the Flood; it would really have to have been part of Flood, if it occurred at all.[71]

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***Michael J. Oard*** *has an M.S. in atmospheric science from the University of Washington and is now retired after working as a meteorologist with the US National Weather Service in Montana for 30 years. He is the author of* Frozen in Time, Ancient Ice Ages or Gigantic Submarine Landslides?, Flood by Design, Dinosaur Challenges and Mysteries, *and* Exploring Geology with Mr. Hibb.. *He serves on the board of the Creation Research Society.*