Retreating Stage formation of gravel sheets in south-central Asia

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Tall erosional remnants indicate rapid, continent-wide erosion, which is consistent with the Retreating Stage of the Flood. While the floodwaters were retreating and eroding the continents, resistant rocks were transported long distances, as has been documented for the United States. A similar pattern of coarse gravel transport is evident in the mountains of south-central Asia. These areas are south of the Himalayas, north of the Tibetan Plateau, all around the Tian Shan Mountains, southwest of the Zagros Mountains, and east of the Tibetan Plateau on the west edge of the Sichuan basin. The character of the coarse gravel shed from the rising south-central Asian mountains is best interpreted within the Retreating Stage of the Flood, which also implies that the Flood/post-Flood boundary is in the very 'late Cenozoic' in this area, assuming the uniformitarian timescale.

During the Retreating Stage of the Flood, continents and mountains rose above the floodwaters while the ocean basins and valleys sank, causing the waters to flow off the continents (Psalm 104:6–9).[1,2] During the Retreating Stage, the runoff first caused sheet erosion as the continents rose, which transformed progressively, starting at higher altitudes first, into channelized flow. The channels were probably relatively wide at first (c. 75 km wide), and by the end of the Flood they were relatively narrow (c. 2 km wide). There is abundant geomorphological evidence for this runoff event, which occurred between Day 150 and 371 of the Flood,[3] but the evidence is very difficult for uniformitarian scientists[4] to explain.

An estimated average of 2,500 to 5,000 m of sedimentary rock was eroded from the *entire* Colorado Plateau during this runoff event.[5] This is also consistent with evidence from many other continental areas of the world.[6] Mounting evidence is increasingly portraying the Retreating Stage of the Flood as a period of continental erosion, so most of the sedimentary rocks left behind were likely deposited during the early part of the Flood, before Day 150, the Inundatory Stage. The sediments eroded during the Retreating Stage formed the thick continental-margin sedimentary rocks.

Continental erosion rapid

Floods often leave behind erosional remnants (figure 1). Many erosional remnants were left behind during the catastrophic Lake Missoula flood, such as Steamboat rock at the upper end of Upper Grand Coulee (figure 2) and Umatilla Rock, which splits the plunge pools seen at Dry Falls, Washington, USA.[7] It therefore follows that, since there are many tall erosional remnants on the continents that could not have remained if erosion was slow over millions of years, continental erosion had to be rapid.

Moreover, such erosional remnants would not last millions of years, even under uniformitarian conditions, because a vertical face erodes much faster than a horizontal surface. Pazzaglia stated: "Erosion rates are most rapid where slopes are steep."[8] Twidale reinforced this statement:

> "… valleys incised in a new surface tend to be relatively deep and steep-sided. … It is safe to predict, however, that with the passage of time, the valleys will be widened, and that eventually they will develop a narrow V-shaped cross section."[9]

Devils Tower, Wyoming, is a typical example. The tower should be a pile of boulders in thousands of years, especially since it is strongly jointed, and freeze-thaw weathering should be aggressive. Rapid erosion during Flood runoff is a more straightforward explanation.[10]

Long distance transport of hard rocks

During the Retreating Stage, ostensibly erosion-resistant rocks were eroded and transported great distances. Where these eroded rocks are found on the surface, they are called coarse gravel—a general term for rocks from gravel up to boulder size. Less resistant rocks are pulverized during transport and end up as finer-grained sediments down-current in depositional areas, especially along the continental margins. As the rocks were eroded and carried down-current, they were rounded and their size decreased. There could occasionally be so many fine-grained sediments mixed in with the coarse gravel that the flow would have been a type of mass flow, such as a turbidity current, debris flow, or hyperconcentrated flow.

The long-distance transport of rocks has been well documented in the United States. John Hergenrather, Peter Klevberg, and I have shown that well-rounded quartzite rocks, predominantly as surficial gravels, were transported up to about 1,200 km east and about 650 km west of their source in the western Rocky Mountains.[11–15] Based on the interfluve outcrops in central Texas, the Ogallala gravel has been transported about 800 km from its nearest source in central New Mexico.[16–19] Resistant rocks, including chert, quartz, and quartzite, eroded from the Appalachians, have been transported long distances west, south, and east out onto the surrounding lowlands. Some chert gravels have been transported up to 800 km west of the Appalachians, and some quartzite gravels have been found up to 1,000 km

Figure 1. Erosional remnants (two arrowed) left after a flood in South Africa.

Figure 2. Steamboat Rock, a 2.5-km^2, 250-m-high erosional remnant left over from the Lake Missoula flood in the upper Grand Coulee, Washington, USA.

south of the Appalachian source in Florida.[20,21] Many other areas in the United States show long-distance transport of resistant rocks, such as: in the Rocky Mountains between Arizona and Montana,[22] from the lower terrain of southwest Arizona to the highest terrain of the southwest Colorado Plateau, [23] and all around the Uinta Mountains in Utah and Colorado.[24]

Similar pattern in south-central Asia

I have personally studied the main mountain ranges of the United States, and since the Flood was global, I expect similar patterns of long-distance transport of resistant rocks elsewhere. However, I would also expect significant location-specific differences caused by the many variables in the Flood, e.g. rock type, water flow regime, differential tectonics, and topographic differences. This is what we find concerning the literature on long-distance transport of cobbles and boulders in the mountains of south-central Asia (figure 3).

Gravel pattern south of the Himalayas

The Himalayas are the highest mountain range in the world. The high elevations thought to result from the collision and underthrusting of Asia by the Indian subcontinent resulted in a thickened crust of highly uplifted light material.[25] This collision is said to have started about 65 million years ago—beginning of the Cenozoic within the uniformitarian time scale—and continues today.[26]

A continuous sheet of conglomerate around the southern Himalayas was shed from the mountains. It is called the Siwalik Formation and is dated as Late Cenozoic within the uniformitarian time scale. There are sometimes many kilometers of Cenozoic sediments underneath the Siwalik Formation, with the thickest sediments closest to the Himalayas. This formation was deposited along the north edge of the deep foreland basin, where the Ganges River now flows toward the east-southeast. It was from the Siwalik Formation that scraps of the oldest 'fossil man',

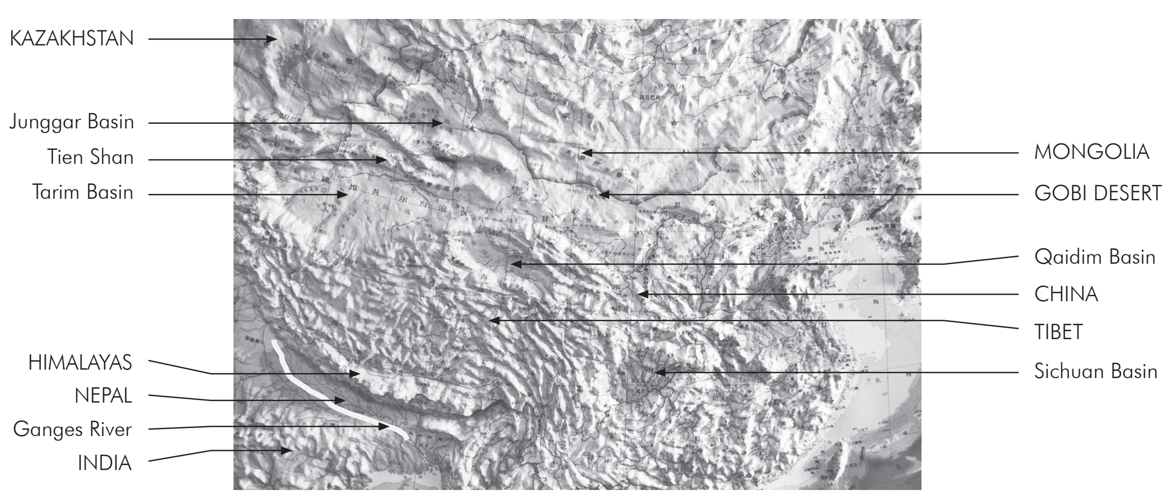

Figure 3. South-central and southeast Asia showing main geographic features.

Ramapithicus, were found.[27] However, later discoveries of more fossils showed that *Ramapithicus* was just a type of extinct ape.[28]

The Siwalik Formation is divided up into lower, middle, and upper members. There is a general increase in the sedimentary particle size with increasing elevation. The lower member and most of the middle member are composed of alternating shale, mudstone, siltstone, and sandstone. The middle member has sections of conglomerate up to 500 m thick, and the upper member is composed of about 1,000 m of mostly conglomerate.

The formation can be thousands of meters thick. One section adjacent to the western Himalayas is 3,400 m thick.[29] In eastern Nepal, the upper Siwalik conglomerate is up to 1,700 m thick,[30] and is generally well rounded by water action.

Evidence suggests paleocurrent directions are both parallel and perpendicular to the Himalayas.[31] Therefore, the paleocurrents were most likely flowing off the mountains and flowing parallel to the mountains.

The Siwalik Formation was deposited while the Himalayas were being uplifted.[32,33] There has been much erosion in the Himalayas, with some estimates up to about 10 km. The shed debris includes the Siwalik Formation, which is sometimes overthrusted by the Lesser Himalayas, indicating that deposition was syntectonic.[34] Therefore, the major uplift of the Himalayas is thought to have been in the late Cenozoic.

Uniformitarians typically say all this conglomerate came from braided streams or a network of rivers flowing from the Himalayas.[35,36] However, the upper member of the Siwalik Formation is hundreds of meters thick and extends as a *continuous* sheet along the southern edge of the Himalayas. This is very unlike braided stream deposits today; they deposit a variety of sediment, from clay to gravel, with rapid changes of facies (figure 4).

Figure 4. Braided river of the north fork of the Toutle River near Mount St. Helens, Washington, USA.

Gravel north of the Tibetan Plateau

The Tibetan Plateau is the highest plateau in the world, with much of it above 5 km. It spans approximately 700,000 km^2, or about the size of the state of Texas. The plateau is supposedly buoyed up by thicker crust caused by the Cenozoic collision of India with Asia. The Tibetan Plateau is also a huge erosion surface that is remarkably level, but strongly dissected.[37,38] North of the Tibetan Plateau is the relatively low and undeformed Tarim Basin.[39]

Just north of the Tibetan Plateau, in the foothills of the Tarim Basin, is a thick deposit of Cenozoic sedimentary rocks, the top of which is a thick sheet of conglomerate,[39,40] similar to the Siwalik Formation. The gravel sheet thins northeast toward the center of the Tarim Basin. The rocks are generally rounded with some boulders larger than 2 m, and reach a maximum thickness of about 3,000 m. It is called the Xiyu Formation and is also found along the northern edge of the Tarim Basin adjacent to the Tian Shan Mountains (see below). There are some coarse gravels above the Xiyu Formation that are called the Gobi gravels; these continue much farther eastward in China.

It is thought that much of the material was shed by debris flows as the Tibetan Plateau uplifted and the Tarim Basin sank in the late Cenozoic. The gravel close to the mountains has been folded and uplifted after deposition, indicating that the Xiyu Formation continued to be uplifted during and after its emplacement. It is also admitted, however, that the mechanism and timing of the uplift of the Tibetan Plateau is controversial.

Gravels shed from the Tian Shan Mountains

The Tian Shan Mountains, meaning 'the celestial mountains' in Chinese, extend 2,500 km east-west in central Asia (figure 3). They are just north of the Tarim Basin and border several countries, including China on the northwest. The Tian Shan Mountains are intraplate mountains that rise to a maximum height of 7,439 m. Despite being intraplate mountains, they are also believed to have taken part in the collision with India and so are shortening. This shortening is predicted to be only about 10% in the Tian Shan Mountains as a result of the collision with India because the Tian Shan Mountains are about 1,700 km from the collision zone. But recent GPS readings indicate that around 50% of the shortening or plate convergence of south-central Asia occurs in the Tian Shan Mountains![41] This anomalous result indicates that more seems to be happening in south-central Asia than just the claimed collision of India with Asia.

All around the Tian Shan Mountains there is a continuous sheet of gravel like that found around the Himalayas and the Tibetan Plateau. It is also called the Xiyu Formation, and is widespread throughout central Asia.[42] The gravels around the Tian Shan Mountains, including the northern Tarim Basin and the Junggar Basin to the east, are on top of many kilometers of Cenozoic strata, much like the Siwalik conglomerate and the gravels north of the Tibetan Plateau.[43] The gravels are over 3,000 m thick at some locations and thin away from the mountain front.[44,45] The rocks are said to have been shed by powerful streams originating from the mountains during Late Cenozoic uplift, becoming smaller and more rounded away from the mountains. The gravel near the mountain front, once deposited, was also caught up into the mountain tectonics, being folded, uplifted, and overthrust by the mountain front.[46,47]

The Xiyu Formation has been dated anywhere from Quaternary to Miocene, but the dates have changed many times.[48] It has also been dated to different ages in different areas. One reason for the poor dating is that there are few fossils in the formation, which is understandable within a conglomerate. But a few fossils have been found, e.g. a fossil horse that once gave a date of Plio-Pleistocene to the Xiyu Formation in one area.[44] Researchers now seem to be accepting the older dates and are leaning more toward a Miocene date for the Xiyu Formation.

However, a Miocene date eliminates climate change as the cause of the erosion that formed the Xiyu Formation. This is because the large change of climate that caused glacial and interglacial stages is not said to have started until the late Pliocene, supposedly about 2.5 million years ago. So, the gravel is now believed to have been shed during tectonic uplift in the Late Cenozoic.

Gravels shed from the Zagros Mountains

The pattern of thick, widespread coarse gravel at the base of other mountains occurs in south-central Asia, but I will only point out a few observations since I do not possess detailed information.

The Zagros Mountains of southwest Iran show the same pattern of thinning upward sediments on the southwest side that were shed from the rising Zagros Mountains.[49] The Upper Bakhtiari Formation consists of a sheet of conglomerate on top of fine-grained sediments of the Lower Bakhtiari and Fars Formations. Thomas Oberlander interprets the conglomerates as caused by violent erosion from 'streams' unlike those of today;

> "Massive conglomerates everywhere overlie the Lower Bakhtiari formations along a strong angular unconformity. Both the unconformity and the nature of the succeeding deposits—the Upper Bakhtiari formation—indicate a violent upheaval of the entire mountain belt in the late Pliocene. … The Upper Bakhtiari formation is the local product of the violent denudation of a near-homogeneous orogenic system reaching from the western Alps to the eastern Himalayas. Thus it is hardly distinguishable from the *nagelfluh* molasses of Switzerland or the Siwalik beds of India. … the Bakhtiari conglomerate filled basins, flooded through cols, blanketed the plain in front of the orogen, and at present stands before and amid the fold belt in commanding pink escarpments, buttes, and mesas, having vertical faces frequently 1,500 feet high … . It seems impossible that a load of such tremendous bulk, lacking the rudest semblance of stratification, could have been delivered by streams operating under the present climatic regime."[50]

Overlander's observations indicate that thick sheet gravels are even more widespread than in south-central Asia, extending clear to the Alps.

Gravels in the Western Sichuan Basin

To the east of the Tibetan Plateau lies the deep Sichuan Basin (figure 3). Thick conglomerates that were likely shed to the east from the rise of the eastern Tibetan Plateau (Vern Bissell, personal communication) lie on the western edge. Figure 5 shows this gravel along a hiking trail to Mount Qingcheng, Sichuan, China.

Figure 5. Thick gravel in the western Sichuan Basin, China.

Discussion

It is likely long transported gravels are common around most mountains of the world. In the United States, the gravel is often transported many hundreds of kilometers away from their mountain source. Unlike the United States, the south-central Asia gravels are piled up the thickest in front of the mountains and thin out toward the basin centers. This pattern likely formed because the basins are relatively isolated by mountain ranges relatively close to each other. It also seems like the deepest paleovalleys are adjacent to the mountain front, the location of the mountain range bounding fault, and would catch the majority of the cobbles and boulders shed during uplift.

That the conglomerate can be several thousand meters thick and consist of a sheet hundreds and thousands of kilometers long implies sheet deposition. The sheet pattern is consistent with the Retreating Stage of the Flood as the mountains rose and the intervening basins sank, just as stated in Psalm 104:6–9.[1,3] If streams and rivers issuing from the mountain front deposited the gravels, then the gravel would accumulate locally. And just as Oberlander pointed out above, the idea of streams depositing all this gravel seems preposterous. So, the pattern of gravel accumulation around the mountains of south-central Asia provides more evidence for the global extent of the Retreating Stage of the Flood.

Huge deposits of fine-grained sediment have been deposited east of the high mountains of Tibet and western China. Much of this material is considered loess (wind-blown silt). One large area in central China is called the Loess Plateau;[51] the loess being over 150 m thick. There is a large literature on this loess, the top of which is reworked by occasional strong winds today. Chinese loess is beyond the scope of this article, but there is so much of it that it could easily represent the fine-grained pulverized rocks shed from the rising mountains and transported long distances into central and eastern China as the Flood currents drained eastward off the high mountains.

Further implication for the Flood/post-Flood boundary

I could not help but notice in this study that the mountain uplifts and the accumulations of thick sheet gravels is dated to the late Cenozoic. This seems to be a pattern all over the world in the late Cenozoic.[52] Furthermore, the conglomerate is often rounded by water action and consolidated, indicating that water was running off the mountains and transporting the coarse gravel long distances. The pattern fits the Retreating Stage of the Flood so well, both in south-central Asia and in the United States, that the only conclusion that I can come up with is that the late Cenozoic in these areas is from the Flood. Therefore, the Flood/post-Flood boundary would be in the very late Cenozoic, assuming the geological column for sake of argument.

Creationists who believe the Cenozoic or late Cenozoic is post-Flood must postulate that most of the south-central Asian mountains were uplifted and eroded by water to deposit very thick sheets of conglomerate around the mountains—all *after* the Flood. It is not only the violent activity after the Flood that must be explained, but also how *sheet* gravels accumulated after the Flood. Such sheet deposition implies sheet flow, which does not seem possible on the continents after the Flood, let alone at the highest post-Flood altitudes. I have found much geological data that Cenozoic strata fit the expected pattern during the Retreating Stage in many places on the continents.[3,53] There are significant challenges to this view from Cenozoic paleontology and biogeography. However, there are many unknowns in these fields. Regardless, how can all this Cenozoic geological activity have happened after the Flood?

According to plate tectonics and catastrophic plate tectonics (CPT), India is supposed to collide and cause all the tectonics of south-central Asia in the Cenozoic. If the CPT model is accurate, one would expect that such long-traveled plates—not only the one that caused India to crash into Asia, but also all plate movement during the Cenozoic—would have manifested during the Flood. So, even if we assume the geologic column and plate tectonics, long-distance plate movement would be another indication that the Cenozoic is not post-Flood, at least in most locations.

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4. I am aware most mainstream geologists consider themselves 'actualists' and not uniformitarians. Actualism is similar to uniformitarianism except that the former believe in a few large catastrophes sprinkled throughout earth history, such as meteorite impacts. They also admit that the present is not necessarily the key to the past, but that geology must always believe natural processes operated in the past. I believe this philosophical point of view (i.e. naturalism) can be used as an excuse when deductions from the rocks and fossils are contradicted by present processes. But since few people understand the distinction between actualism and uniformitarianism, I will continue using the term 'uniformitarianism', especially since this latter doctrine was the philosophical principle used in geology to throw out the Flood.
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