Chapter 29

Gravel Deposits around the South Central Asian Mountains

Figure 29.1. Southeast Asian Mountains (drawn by Mrs. Melanie Richard).

So far, I have personally studied the gravel transport from main mountain ranges of the United States, including Alaska. Since Noah's Flood was global, I would expect to see a similar pattern of hard, resistant rocks transported far from their source from most mountainous areas of the world. I would also expect there to be significant differences from location to location because of the type of rock eroded, the velocity and direction of water flow, the amount of differential vertical tectonics that took place late in the Flood, the nearness of the mountains to other mountains, among other things. Information on the long-distance transport of cobbles and boulders is available for the mountains of south central Asia. (Figure 29.1)[1]

Gravel Pattern South of the Himalaya Mountains

The Himalaya Mountains are the highest in the world. It is believed the high elevations are caused by the collision and underthrusting of Asia by the Indian subcontinent. This resulted in a thickened crust of light material that was lifted very high.[2] The collision, according to the plate tectonics paradigm, is said to have started about 65 million years ago at the beginning of the Cenozoic (see Figure 5.3), and it continues to this day.[3]

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[1] Oard, M.J., 2011. Retreating Stage formation of gravel sheets in south-central Asia. *Journal of Creation* 25(3):68–73.

[2] Schulte-Pelkum, V.G. Mosalve, A. Sheehan, M.R. Paney, S. Sapkota, R. Bilham, and F. Wu, F, 2005. Imaging the Indian subcontinent beneath the Himalaya. *Nature* 435:1,222–1,225.

[3] Brozović, N. and D.W. Burbank, 2000. Dynamic fluvial systems and gravel progradation in the Himalayan foreland. *GSA Bulletin* 112:394–412.

Around the southern Himalaya Mountains is a continuous sheet of conglomerate that was shed from the mountains. It is called the Siwalik Formation and is dated as Late Cenozoic. This formation piled up along the north edge of the deep basin where the Ganges River now flows toward the east-southeast. It was from the Siwalik Formation that scraps of what was thought to have been the oldest "fossil man," *Ramapithicus*, were found.[4] Later discoveries of more fossils showed that *Ramapithicus* was just a type of extinct ape.[5]

The Siwalik Formation is divided up into lower, middle, and upper members. There is a general increase upward in the size of the rocks that make up the sediment. The lower member and most of the middle member are composed of alternating shale, mudstone, siltstone, and sandstone. The middle member has sections of up to 1,640 feet (500 m) thick of conglomerate. The upper member is composed of about 3,300 feet (1,000 m) of predominantly conglomerate.

The formation can be many thousands of feet thick. One section adjacent to the western Himalaya Mountains is 11,150 feet (3,400 m) thick.[6] In eastern Nepal, the upper Siwalik conglomerate is up to 5,575 feet (1,700 m) thick.[7] The conglomerate is generally well rounded from water action.

There are sometimes many kilometers of Cenozoic sediments underneath the Siwalik Formation. The thickest sediments are closest to the Himalaya Mountains. So, the Cenozoic era in the uniformitarian timescale saw huge erosion of the mountains and deposition in the basins between mountains.

Paleocurrent directions are both parallel and perpendicular to the Himalayan Mountains,[8] indicating paleocurrents came straight off the mountains toward the south and flowed parallel to the mountains at different times.

The Siwalik Formation was deposited while the Himalayas were being uplifted.[9,10] Much erosion of the Himalayas has occurred with some estimates up to about 6 miles (10 km). The shed debris includes the Siwalik Formation, which sometimes is overthrust by the Lesser Himalayas, indicating that deposition occurred during tectonic uplift and overthrusting toward the south.[11] Finer-grained debris likely filled the Ganges trough

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4 Simons, E.L., 1977. Ramapithecus. *Scientific American* 236(5):38–35.

5 Andrews, P. and J.E. Cronin, 1982. The relationships of *Sivapithecus* and *Ramapithecus* and the evolution of the orang-utan. *Nature* 297:541–546.

6 Meigs, A.J., D.W. Burbank, and R.A. Beck, 1995. Middle-late Miocene (>10 Ma) formation of the Main Boundary thrust in the western Himalaya. *Geology* 23:423–426.

7 Schelling, D., 1992. The tectonostratigraphy and structure of the eastern Nepal Himalaya. *Tectonics* 11:925–943.

8 Kumar, R., S.K. Ghosh, and S.J. Sangode, 1999. Evolution of a Neogene fluvial system in a Himalayan foreland basin, India. In, Macfarlane, A., R.B. Sorkhabi, and J. Quade, (editors), *Himalaya and Tibet: Mountain Roots to mountain Tops*, Geological Society of America Special paper 328, Boulder, CO, pp. 239–256.

9 Critelli, S. and E. Garzanti, 1994. Provenance of the Lower Tertiary Murree redbeds (Hazara-Kashmir Syntaxis, Pakistan) and initial rising of the Himalayas. *Sedimentary Geology* 89:265–284.

10 Clift, P.D., 2006. Controls on the erosion of Cenozoic Asia and the flux of clastic sediment to the ocean. *Earth and Planetary Science Letters* 241:571–580.

11 Burbank, D.W., 1992. Causes of recent Himalayan uplift deduced from deposited patterns in the Ganges basin. *Nature* 357:680–683.

south of the Himalayas and formed some of the huge river deltas of India and Bangladesh, such as the Bengal River delta. So, the major uplift of the Himalaya Mountains is thought to have been in the late Cenozoic.

All this conglomerate is interpreted as originating from braided streams or a network of rivers coming out of the Himalayas.[12,13] One of the huge problems with this interpretation, like other such interpretations, is that the upper conglomerate member of the Siwalik Formation is thousands of feet thick and extends as a *continuous* sheet along the southern edge of the Himalayas. This is very unlike braided stream deposits today, which deposit a variety of sediment, usually in a narrow valley, from clay to gravel with rapid changes in sediment type (see Figure 2.4). A better interpretation is that the Siwalik Formation was deposited during uplift, erosion, and water running off the Himalaya Mountains as a sheet.

Gravel North of the Tibetan Plateau

The Tibetan Plateau is the highest plateau in the world with much of it above 3 miles (5 km) msl high. The area is approximately 273,400 mi^2 (700,000 km^2) or about the size of the state of Texas. The plateau is supposedly buoyed up by thicker crust from the Cenozoic collision of India with Asia. The Tibetan Plateau is another huge erosion surface that is remarkably level, but strongly dissected.[14,15] North of the Tibetan Plateau is the relatively low and undeformed Tarim Basin.[16]

Just north of the Tibetan Plateau in the foothills of the Tarim Basin is a thick deposit of Cenozoic sedimentary rocks with the top portion being a thick sheet of conglomerate,[16,17] similar to the Siwalik Formation. The sheet of gravel thins northeast toward the center of the Tarim Basin. The rocks there are generally rounded with some boulders larger than 6.5 feet (2 m) across. Maximum thickness of the gravels is 9,910 feet (3,022 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 gravels above the Xiyu Formation that are called the Gobi Gravels, which continue much farther eastward in China. These are late stage gravels from the erosion of the Himalayas.

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 itself is close to the mountains and has been folded and uplifted after deposition, indicating that the Xiyu Formation continued to take part in uplift of the Tibetan Plateau after and during its emplacement. It is also admitted, however, that the mechanism and timing of the uplift of the Tibetan Plateau is controversial.

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12 DeCelles, P.G., G.E. Gehrels, J. Quade, T.P. Ojha, P.A. Kapp, and B.N. Upreti, 1998. Neogene foreland basin deposits, erosional unroofing, and the kinematic history of the Himalayan fold-thrust belt, western Nepal. *GSA Bulletin* 110:2021.

13 Parkash, B., I.P. Bajpai, and H.P. Saxena, 1974. Sedimentary structures and palaeocurrents of the Siwaliks exposed between the Yamuna and Gola Rivers, U.P. (India). *Geological Magazine* 111:1–14.

14 Dewey, J.F., R.M. Shackleton, C. Chengfa, and S. Yiyin, 1988. The tectonic evolution of the Tibetan Plateau. Philosophical Transactions of the Royal Society of London, A327:379–413.

15 Clark, M.K., L.H. Royden, K.X. Whipple, B.C. Burchfiel, Z. Zhang, and W. Tang, 2006. Use of a regional, relict landscape to measure vertical deformation of the eastern Tibetan Plateau. *Journal of Geophysical Research* 111:1–23.

16 Zheng, H., C.M. Powell, Z. An, J. Zhou, and G. Dong, 2000. Pliocene uplift of the northern Tibetan Plateau. *Geology* 28:715–718.

17 Tungsheng, L., D. Menglin, and E. Derbyshire, 1996. Gravel deposits on the margins of the Qinghai—Xizang Plateau, and their environmental significance. *Palaeogeography, Palaeoclimatology, Palaeoecology* 120:159–170.

Gravel Shed from the Tian Shan Mountains

In central Asia, The Tian Shan Mountains, or the "Celestial Mountains" extend 1,560 miles (2,500 km) east-west. They are just north of the Tarim Basin and border several countries including China to the southeast. The Tian Shan Mountains are intraplate mountains, those found within the interior of a plate, that rise to a maximum height of 24,406 feet (7,439 m). Despite being intraplate, these mountains also are believed to take part in the collision with India and are therefore becoming narrower in a north-south direction. The amount of narrowing is predicted to be only about 10% because the Tian Shan Mountains, after all, are about 1,060 miles (1,700 km) from the collision zone between India and Asia. But, recent GPS readings indicate that around 50% of the plate convergence of south central Asia occurs in the Tian Shan Mountains![18] This anomalous result indicates that more seems to be happening in the area of south central Asia than the claimed collision of India with Asia.

Similar to the Himalaya Mountains and eastern Tibetan Plateau, the Tian Shan Mountains are surrounded with a continuous sheet of gravel also called the Xiyu Formation. This formation is widespread throughout central Asia.[19] Importantly, the valleys or basins within the mountains are filled with up to 1.25 miles (2 km) of late Cenozoic sedimentary rocks. Similar to the Siwalik conglomerate and the gravels north of the Tibetan Plateau, the gravels around the Tian Shan Mountains, including the northern Tarim Basin and the Junggar Basin to the east, are on top of many thousands of feet of Cenozoic strata.[20] The gravels are over 10,000 feet (3,000 m) thick at some locations and thin away from the mountain front.[21,22] The rocks were shed by powerful streams originating from the mountains during Late Cenozoic uplift. As the rocks moved away from the mountains they became smaller and more rounded. The gravel near the mountain front, once deposited, was caught up with the mountain tectonics as they folded, uplifted, and were overthrust.[23,24]

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[18] Abdrakhmatov, K.Ye. et al., 1996. Relatively recent construction of the Tian Shan inferred from GPS measurements of present-day crustal deformation. *Nature* 384:450–453.

[19] Charreau, J., Y. Chen, S. Gilder, S. Dominguez, J.-P. Avouac, S. Sen, D. Sun, Y. Li, and W.-M. Wang, 2005. Magnetostratigraphy and rock magnetisim of the Neogene Kuitun He section (northwest China): implications for late Cenzooic uplift of the Tianshan mountains. *Earth and Planetary Science Letters* 230:177–192.

[20] Métivier, F. and Y. Gaudemer, 1997. Mass transfer between eastern Tian Shan and adjacent basins (central Asia): constraints on regional tectonics and topography. *Geophysical Journal International* 128:1–17.

[21] Charreau, J., Y. Chen, S. Gilder, L. Barrier, S. Dominguez, R. Augier, S. Sen, J.-P. Avouac, A. Gallaud, F. Graveleau, and Q. Wang, 2009. Neogene uplift of the Tian Shan Mountains observed in the magnetic record of the Jingou River section (northwest China). *Tectonics* 28:1–22.

[22] Charreau, J., C. Gumiaux, J.-P. Avouac, R. Augier, Y. Chen, L. Barrier, S. Gilder, S. Dominguez, N. Charles, and Q. Wang, 2009. The Neogene Xiyu formation, a diachronous prograding gravel wedge at front of the Tianshan: climate and tectonic implications. *Earth and Planatery Science Letters* 287:298–310.

[23] Charreau, J., S. Gilder, Y. Chen, S. Dominguez, J.-P. Avouac, S. Sen, M. Jolivet, Y. Li, and Q. Wang, 2006. Magnetostratigraphy of the Yaha section, Tarim Basin (china): 11 Ma acceleration in erosion and uplift of the Tian Shan mountains. *Geology* 34:181–184.

[24] Charreau, J., J.-P. Avouac, Y. Chen, S. Dominguez, and S. Gilder, 2008. Miocene to present kinematics of fault-bend folding across the Huerguosi anticline, northern Tianshan (China), derived from structural, seismic, and magnetostratigraphic data. *Geology* 36:871–874.

The Xiyu Formation has been dated anywhere from Quaternary to Miocene with the dates constantly shifting.[25] It is also said to be of different ages in different areas. One reason for the poor dating is that there are few fossils in the formation with which to date, which is understandable within a conglomerate. But a few fossils have been found. One is a fossil horse which once gave a certain area of the Xiyu Formation a Plio-Pleistocene date. Researchers now seem to be accepting older dates and leaning more toward the Miocene for the Xiyu Formation. This shows just one instance of the plasticity of radiometric and fossil dates.

These old dates eliminate an Ice Age climate (earlier suggested as the cause of the thick gravels) as the cause for the mountain erosion that formed the thick sheets of gravel lining the edge of the mountains. This is because it does not fit with their scheme. The large climate change that caused glacial and interglacial stages did not start until the beginning of the Pleistocene, supposedly about 2.6 million years ago according to the uniformitarian time scale. So, the gravel is now believed to be shed during tectonic uplift in the Late Cenozoic without the aid of an Ice Age.

Gravels Shed from the Zagros Mountains

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

The Zagros Mountains of southwest Iran show the same pattern of sediments and gravel on the southwest side that were shed as the mountains rose.[26] The Upper Bakhtiari Formation consists of a sheet of conglomerate on top of the fine-grained sediments of the Lower Bakhtiari and Fars Formations, similar to the pattern for the Siwalik and Xiyu Formations. Thomas Oberlander describes the conglomerates as caused by violent erosion from “streams” unlike anything seen 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 (Figure 13).

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25 Heermance, R.V., J. Chen, D.W. Burbank, and C. Wang, 2007. Chronology and tectonic controls of late Tertiary deposition in the southwestern Tian Shan foreland, NW China. *Basin Research* 19:599–632.

26 Oberlander, T., 1965. *The Zagros Streams: A New Interpretation of Transverse Drainage in an Orogenic Zone*, Syracuse Geographical Series No. 1, Syracuse, NY.

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.[27]

Although loaded with technical terms, this quote indicates the powerful forces and large scale of the deposition of this sheet of massive gravel. It even indicates that thick sheet of gravels at the edges of mountains are more widespread than in south-central Asia, and extend to the distant Alps.

Gravel in the Western Sichuan Basin

The deep Sichuan Basin lies east of the Tibetan Plateau. Thick conglomerates line the western edge which were shed from the rise of the eastern Tibetan Plateau (Vern Bissell, personal communication). Figure 29.2 shows this gravel along a hiking trail to Mount Qingcheng, Sichuan, China.

Figure 29.2. Thick gravel western Sichuan Basin, China (courtesy of Vern Bissell).

Implications

Most mountains of the world are associated with long transported gravels. In the United States, the gravel is often transported many hundreds of miles from their mountain source. In the case of south central Asia, the gravel is thickest in front of the mountains and thins out toward the basin centers. This pattern is different from that in the United States and is probably due to the restricted nature of the basins—the mountain ranges are relatively close to each other. It also appears the deepest paleovalleys are adjacent to the mountain front, at the mountain range bounding fault. This is not an unusual tectonic effect. In this situation, the valleys would catch the majority of the cobbles and boulders shed as the mountains uplifted.

[27] Oberlander, Ref. 26, p. 34.

The conglomerate can be over 6,000 feet (a few thousand m) thick and form a sheet hundreds, and even thousands, of miles long. This fits well with the Sheet Flow Phase of the Retreating Stage of the Flood when the mountains rose and the intervening basins sank, as stated in Psalm 104:6-9.[1,3]

If deposition were by streams and rivers issuing from the mountain front, then the gravel would be only local accumulations as admitted in the quote from Oberlander above. The idea of streams depositing a thousand, plus, miles long sheet of gravel, often over a mile deep, seems preposterous. So, the pattern of gravel accumulation around the mountains of south central Asia buttresses a global Flood model. This Flood, a global disaster, is described in Genesis 6-9 and affirmed by Jesus in Matthew 24:37-39.

A large area called the Loess Plateau[28] lies east of the mountains of Tibet and Western China. The loess in this large area of central China is over 500 feet (150 m) thick. Much has been written about it, the top of which is still being reworked by occasional strong winds. Chinese loess is beyond the scope of this book, but it is such a huge deposit that it could easily represent the fine-grained pulverized rocks shed from the Tibetan Mountains as they rose and the Floodwater drained east into central China.

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[28] Guo, Z.T., W.F. Ruddiman, Q.Z. Hao, H.B. Wu, Y.S. Qiao, R.X. Zhu, S.Z. Peng, J.J. Wei, B.Y. Yuan, and T.S. Liu, 2002. Onset of Asian desertification by 22 Myr ago inferred from loess deposits in China. *Nature* 416:159–163.