Chapter 20

Quartzite Gravel Locations in Washington

Quartzite gravel and conglomerate locations are even more widespread in Washington,[1] mainly in southern and western Washington, and are found in a variety of environments, including unexpectedly in the Puget Sound area mixed with glacial debris. I will begin with southeast Washington and work my way west and then north to the Puget Sound area, ending with isolated finds in northeast Washington.

Southeast Washington and Hells Canyon

Gravel and conglomerates can be found at many locations in southeast Washington and Hells Canyon. The following is a brief survey.

Quartzite Gravel Extreme Southeast Washington and Hells Canyon

Quartzite gravel outcrops extensively in Lewiston, Idaho, and Clarkston, Washington, and upstream on the Snake River through Hells Canyon. There are also gravels associated with the Lake Missoula and Bonneville floods.[2] These gravels will not be discussed, although they picked up quartzite gravel along their flood paths. In the Clarkston area, the quartzite gravel outcrops are more than 330 feet (100 m) thick and up to a height of 1,230 feet (375 m) msl and contain a wide variety of igneous and metamorphic rocks.[3,4,5]

The gravels at Clarkston, Washington, were once thought to be "Pleistocene," that is Ice Age, but they are now considered to be "Pliocene" or "Miocene," pre-Ice Age, within the uniformitarian time scale.[6] Such re-dating of gravels seems to happen occasionally with other gravels and conglomerates. Why do these gravels often become "older" within the uniformitarian timescale?

Quartzite boulders are commonly scattered on eroded surfaces throughout the Hells Canyon area south of Clarkston, Washington.[7] Hells Canyon is a 60-mile (100 km) long water gap that is deeper than Grand Canyon. Quartzites even crop out beneath the Columbia River Basalts in the canyon (see Volume III on water gaps). One outcrop on limestone in southern Hells Canyon is described as follows:

---

[1] Oard, M.J., J. Hergenrather, and P. Klevberg, 2006. Flood transported quartzites: part 2—west of the Rocky Mountains. *Journal of Creation* 20 (2):71–81.

[2] Oard, M.J., 2004. *The Missoula Flood Controversy and the Genesis Flood*, Creation Research Society Monograph No. 13, Chino Valley, AZ.

[3] Lupher, R.L., 1945. Clarkston stage of the Northwest Pleistocene. *The Journal of Geology* 53:337–348.

[4] Pankratz Kuhns, M.J., 1980. *Late Cenozoic Deposits of the Lower Clearwater Valley, Idaho and Washington*, M.S. thesis Washington State University, Pullman, WA.

[5] Webster, G.D., M.J. Pankratz Kuhns, and G.L. Waggoner, 1982. Late Cenozoic gravels in Hells Canyon and the Lewiston Basin, Washington and Idaho. In, Bonnichsen, B. and R.M. Breckenridge (editors), *Cenozoic Geology of Idaho*, Idaho Department of Lands bureau of Mines and Geology, Moscow, ID, pp. 669–683.

[6] Kehew, A.E., 1979. Drainage history of the Lewiston Basin. *Northwest Science* 53(4):242–250.

[7] Vallier, T., 1998. Islands & Rapids: *A Geological Story of Hells Canyon*, Confluence Press, Lewiston, ID, pp. 33–34.

> Quartzite boulders and cobbles are scattered like watermelons along the eroded surface of Martin Bridge Limestone between McGraw and Spring creeks in southern Hells Canyon. The largest boulders are about two feet [61 cm] in diameter; common percussion marks on the boulders indicate that the boulders struck each other forcefully during transport in a raging stream.[8]

Quartzite Gravel along the Snake River

I have observed quartzite gravels well down the Snake River west of Clarkston, about half a mile (1 km) west of Little Goose Dam. The quartzites were typically well-rounded and iron-stained. This should not be too surprising, since the Belt rocks outcrop about 50 miles (80 km) to the east and 25 miles (40 km) to the northeast. Only a short distance of travel rounds rock in water. Some of the gravel is covered by a small lava flow that flowed down the Snake River Canyon after the canyon was carved. In the same way lava covered the gravel farther downstream at Lower Monumental Dam (see below).[4]

Figure 20.1. Quartzite and basalt rocks overlain by an intercanyon basalt flow in the Snake River Valley just downstream from Lower Monumental Dam.

Figure 20.2. Close up of the well-rounded cobbles and boulders shown in Figure 20.1. There is a well-developed imbrication of oblong rock with a dip to the east (left), showing that the current depositing the coarse gravel was flowing toward the west (right).

Quartzite cobbles below a lava flow can easily be viewed just south of Lower Monumental Dam on the Snake River, approximately 40 miles (65 km) northeast of Pasco, Washington. The quartzites are sandwiched between the valley side that is cut in the basalt and a local flow of Columbia River basalt down the Snake River Canyon (Figures 20.1 and 20.2). There are around 15 to 25% quartzites among the mostly basaltic cobbles and boulders. The average size of the quartzites is around 3 inches (7 cm) in diameter with a maximum of around 8 inches (20 cm).

---

[8] Vallier, Ref. 7, p. 34.

South-Central Washington

Northeast of the Columbia River Gorge in south-central Washington, there are many widely scattered locations where quartzites are found, often on top of buckled, high lava ridges of the Columbia River Basalt. The ridges are a series of east-west orientated basalt anticlines in south-central Washington (Figure 20.3). Quartzites outcrop *on top* of all these anticlines and are sometimes sandwiched between basalt flows near the top.[9,10]

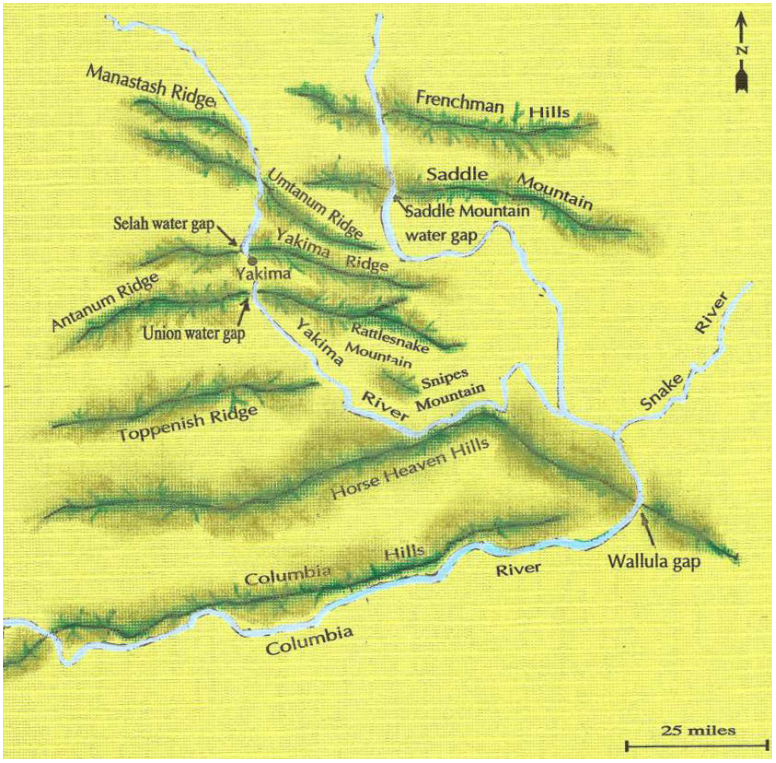

Figure 20.3. Map of Yakima lava ridges around Yakima, Washington, USA. The Horse Heaven Hills go up to altitudes over 4,000 feet (1,220 m) (drawn by Mrs. Melanie Richard).

Numerous Locations on the Horse Heaven Hills

The Horse Heaven Hills is a lava ridge that has lifted the Columbia River Basalts into an anticline, one of the most southerly of the buckled lava ridges. Quartzite gravel is found at many locations along the ridge axis and south flank of the Horse Heaven Hills at altitudes above 2,950 feet (900 m).[9,10,11] The highest location is at 4,360 feet (1,330 m) msl east of Satus Pass at the crest of the Horse Heaven Hills, north of Goldendale, Washington.[12] Quartzites can be seen around 5 miles (8 km) north of Goldendale along Highway 97. There, the quartzites are very iron stained and have very few percussion marks, probably because the rocks are small, even compared to other areas of the Horse Heaven Hills. The quartzites stretch both east and west of Goldendale in many scattered locations.

---

[9] Warren, C.R., 1941. Course of the Columbia River in southern central Washington. *American Journal of Science* 239:209–232.

[10] Bretz, J.H., 1917. The Satsop Formation of Oregon and Washington. *The Journal of Geology* 25:455.

[11] Warren, C.R., 1941. The Hood River conglomerate in Washington. *American journal of Science* 239:106–127.

[12] Hodge, E.T., 1938. Geology of the Lower Columbia River. *GSA Bulletin* 49:875.

I have seen them as far northeast as Bickleton, about 28 miles (45 km) northeast of Goldendale. Quartzites are also north and east of Bickleton.[12] Many of them, which usually form the majority of the rocks, are heavily iron stained to an orange or reddish color.

Another easily accessible location is approximately 7 miles (11 km) north of Goldendale, where a side road turns west at Three Creeks Lodge. Driving 1 mile (2 km) along this road, there is a small exposure of quartzites on a large hill. On the steeper parts, it seems quartzites are incorporated 6 to 10 feet (2 to 3 m) deep into the sandy soils. The average size of quartzite at this location is about 1 inch (3 cm) in diameter with the largest about 6 inches (15 cm) in diameter. There are other quartzite locations west and southwest of this hill.

Several other quartzite localities are near the Columbia Hills of Washington, north of the Columbia River across from The Dalles, Oregon.[13]

To the north of the Columbia Hills, gravels with as much as 90% quartzites are found on High Prairie.[14] Hergenrather examined these extensive quartzites and those on hills west of the Klickitat River, where the locals call them "sugar agates, "potato rocks" or "river rocks." The quartzites are iron stained with an average diameter of about 1.5 inches (4 cm), but there is one boulder with a diameter about 12 inches (30 cm).
There are also a few quartzite gravel deposits on the northern slope of the Horse Heaven Hills. One location is just south of the town of Prosser.[15]

Quartzite Gravel on the Other Lava Ridges

The next anticline to the north of Horse Heaven Hills is Toppenish Ridge (Figure 20.3). One prominent quartzite location is on the summit of the east end of the ridge.[16,17] North of Toppenish Ridge, there are quartzites on Ahtanum Ridge,10 and on its eastward extension, the Rattlesnake Hills, at many locations.[18,19] They are also found on the eastern end of the Yakima and Umtanum Ridges.[20,21,22]

---

[13] Warren, Ref. 11, p. 123.

[14] Warren, Ref. 11, p. 110.

[15] Fecht, K.R., S.P. Reidel, and A.M. Tallman, 1985. *Paleodrainage of the Columbia River on the Columbia Plateau of Washington state: a summary*, RHO-BW-SA-318p, Rockwell Hanford operations, U.S. Department of Energy, Richland, WA, p. 34.

[16] Warren, Ref. 11, p. 111.

[17] Smith, G.A., 1988. Sedimentology of proximal to distal volcaniclastics dispersed across an active foldbelt: Ellensburg Formation(late Miocene), central Washington. *Sedimentology* 35:971.

[18] Warren, Ref. 11, p. 120.

[19] Schmincke, H.-U., 1967. Stratigraphy and petrography of four upper Yakima Basalt flows in south-central Washington. *GSA Bulletin* 78:1,417–1,418.

[20] Warren, Ref. 11, p. 113.

[21] Campbell, N.P., 1983. Correlation of Late Cenozoic gravel deposits along the Yakima River drainage from Ellensburg to Richland, Washington. *Northwest Science* 57(3):192.

[22] Lindsey, K.A., S.P. Reidel, K.R. Fecht, J.L. Slate, A.G. Law, and A.M. Tallman, 1994. Geohydrological setting of the Hanford Site, South-Central Washington: in, Swanson, D.A. and R.A. Haugerud (editors), *Geologic Field Trips in the Pacific Northwest*, Department of Geological Sciences university of Washington, Seattle, WA., p. 1C4.

Figure 20.4. Horizontally bedded Snipes Mountain conglomerate at its type section just south of Snipes Mountain in the Lower Yakima River Valley between Granger and Sunnyside.

A low east-west basalt ridge between Toppenish Ridge and the Rattlesnake Hills outcrops in the lower Yakima Valley south of Interstate 82 between Granger and Sunnyside called Snipes Mountain. Along the south flank of Snipes Mountain horizontally layered quartzites are found (Figure 20.4).[18] The gravel has been called the Snipes Mountain Conglomerates after the name of the basalt ridge. Horizontally bedded quartzite accounts for about 60% of the rocks, and the rocks are also heavily iron stained. It can easily be seen from Emerald road south of Snipes Mountain. Quartzites also outcrop within the city of Sunnyside.

Quartzite gravels are also found on the next east-west anticline to the north, the Saddle Mountains. There is a bedded outcrop just east of the Sentinel water gap on the Columbia River at 1,800 feet (548 m) msl through the western Saddle Mountains ridge.[20,23] Downstream from Sentinel Gap, quartzite is often found in a huge gravel bar about 120 feet (37 m) high covering about 80 mi^2 (200 km^2) that was laid down during the Lake Missoula flood (Figure 20.5). It is called the Wahluke slope. The Lake Missoula flood obviously eroded the quartzite beds around Sentinel Gap and incorporated them into the large gravel bar. Just north of the Vernita Bridge, about 40 miles (65 km) east of Yakima, we found that the bar contained 1 to 3% quartzites with an average diameter of about 2 inches (5 cm) and a maximum diameter of 8 inches (20 cm).

---

[23] Reidel, S.P., 1984. The Saddle Mountains: the evolution of an anticline in the Yakima fold belt. *American Journal of Science* 284:965.

Figure 20.5. View north of a long 100-foot (30 m) high gravel bar formed by the Lake Missoula flood. The Columbia River is outlined by trees running west to east in the middle of the photo. The gravel contains a small percentage of eroded quartzites from the east edge of the Saddle Mountains water gap. The Saddle Mountains, a basalt asymmetric anticline, is in the background.

I have also found quartzites on the south flank of the next and last anticline north of the Saddle Mountains, several miles east of the Columbia River. This ridge is called the Frenchman Hills. The quartzites probably eroded from the top and are now found on the gentle slopes of the western parts of both the Saddle Mountains and Frenchman Hills anticlines, as Bretz pointed out.[24]

Other Locations

Quartzite locations in south central Washington are commonly on ridges or anticlines, but there are several outcrops at other locations. One of the most surprising claims for a quartzite location is on the east slopes of the Cascade Mountains on some of the anticlinal ridges west of the Columbia River Basalt anticlines.[10] Unfortunately, no specific locations were mentioned in the report. Such quartzites on ridges probably would explain the discovery of two quartzites 1 to 2 inches (2 to 4 cm) in diameter in the Thorpe Gravels, 9 miles (15 km) west of Ellensburg, Washington, just north of State Highway 10 (see Appendix 12).

Another location is in portions of the Ringold Formation that outcrops in the vicinity of the Columbia River southeast of Sentinel water gap.[25,26] This is around the White Bluffs area that is now on the Hanford Nuclear Site. Most of the exotic clasts are quartzites. These quartzite gravels are extensive since they have been encountered in many drill holes in the central Pasco Basin.[27] The Ringold Formation is below deposits of the Lake Missoula flood.

---

[24] Bretz, J.H., 1969. The Lake Missoula floods and the Channeled Scabland. *The Journal of Geology* 77:536.

[25] Newcomb, R.C., 1958. Ringold Formation of Pleistocene age in type locality, the White Bluffs, Washington. *American Journal of Science* 256:328–340.

[26] Rigby, J.G. and K. Othberg, 1979. Reconnaissance surficial geologic mapping of the Late Cenozoic sediments of the Columbia Basin, Washington, *Washington Department of Natural Resources, Division of Geology and Earth Resources Open File Report* 79-3, Olympia, WA, pp. 15–17.

[27] Fecht *et al.*, Ref. 15, p. 32.

A small proportion of quartzites have already been noted for the Dalles Formation in north central Oregon, but there are spots in the Ellensburg Formation in Washington, likely equivalent to the Dalles Formation, where quartzites are included within the water-laid interbeds between lava flows.[11] Mackin describes conglomerates with 5 to 10% quartzites in the Ellensburg Formation south of Sentinel water gap and on the west side of the river that is now covered over by Priest Rapids Lake, and at another location north of Yakima between basalt flow on the Selah anticline.[28] A deep test well in the thick basalt of Pasco Basin may have penetrated quartzites, but they were considered "xenoliths,"[29] pieces of rock torn up from below the basalt. So, the quartzites are probably part of the deep bedrock beneath the basalt and not transported from central Idaho.

The Amazing Quartzites in the Puget Sound Area

A surprising location for quartzites is in the Puget Sound area of western Washington.[30] This occurrence was described in an innocuous sounding article about a trace fossil in a quartzite rock found on Lopez Island in the San Juan Islands, northwest of Puget Sound! The article went on to reveal that quartzites are *common but minor lithologies* in the glacial deposits in the Puget Sound Lowland and San Juan Islands. The quartzites are well rounded and predominantly cobble size.

Their origin is an enigma, since quartzites do not form bedded outcrops anywhere close. George Mustoe, a geologist from Western Washington University, concludes that they must have been derived from the Belt/Purcell rocks of Idaho, Montana, or British Columbia (see Chapter 13) and transported into the area by water *before* glaciation. The quartzites were subsequently mixed into the glacial deposits of the region as the ice sheet from British Columbia moved into the Puget Sound area during the Ice Age. The occurrence of well-rounded quartzite cobbles in the Puget Sound area is truly remarkable.

The nearest source is around 250 miles (400 km) to the east, over the Cascade Mountains and the Okanogan Highlands and Mountains. This suggests that the dispersal of quartzites from the Rockies *preceded* the uplift of these mountains (see Chapter 23).

My investigations have confirmed Mustoe's conclusions. I found isolated quartzites in numerous glacial deposits north of Everett, Washington, even on the west side of Camano Island. I even found quartzite cobbles east of Chilliwack, British Columbia, about 60 miles (100 km) east of Vancouver in the lower Fraser River valley. One glacial deposit, about 25 miles (40 km) northeast of Everett, was being eroded by a stream, and sure enough about 1 out of 200 rocks are well-rounded quartzite cobbles. One cobble still retained percussion marks! I also found a cobble with multiple percussion marks along the Stillaguamish River (Figure 20.6). This indicates the ice sheet that surged south into the Puget Sound area to Olympia, Washington, barely weathered or damaged the surface of the quartzites.

---

[28] Mackin, J.H., 1961. *A Stratigraphic Section in the Yakima Basalt and the Ellensburg Formation in South-Central Washington*, Washington State Division of Mines andGeology Report of Investigations No. 19, Olympia, WA.

[29] Reidel, S.P., 1998. Emplacement of Columbia River flood basalt. *Journal of Geophysical Research* 103(B11):27,398.

[30] Mustoe, G.E., 2001. *Skolithos* in a quartzite cobble from Lopez Island—are Western Washington's oldest fossils Canadian emigrants. *Washington Geology* 29(3/4):17–19.

Figure 20.6. Boulder with numerous percussion marks found along the edge of the Stillaguamish River.

One disturbing note in Mustoe's excellent article is that such anomalous quartzites have been noted by many geologists, *but no one has published this intriguing information*: "Although many geologists have noticed these cobbles, I can find no published discussion of their occurrence."[31] One wonders why such an interesting observation full of provocative interpretations would not be published. I further wonder how common it is to ignore such key observations in geology, paleontology, and geomorphology. This is why Flood geologists need to go out and look at the rocks for themselves.

Isolated Quartzites Northeast Washington

Quartzites are found in many other isolated locations in northeast Washington where they are either reported in the literature or found by us. In northeast Washington, quartzite cobbles and boulders were discovered in a clay pit on a divide southwest of Spokane in the vicinity of Cheney, Washington.[32,33] Because the quartzites were scratched and one was marked with chattermarks, Bretz considered them glacial and thought that the Cordilleran Ice Sheet, which covered British Columbia and northern Washington during the Ice Age, had extended south of Spokane. Bretz thought glacial debris continued underneath the Palouse silts to the south. However, the ice sheet never developed this far south; it remained north of Spokane. So, the quartzites are pre-glacial, like the rest of them in the area. The scratched quartzites also indicate that other processes besides glaciation can scratch rocks.

Warren confirms that quartzites do occur on top of the basalt beneath the Palouse Formation, a silt deposit, in east-central Washington.[34] I have examined several of these locations below the Palouse silt formation and have seen rounded basalt rocks, which is the substrate, but no quartzites in the gravel.

---

[31] Mustoe, Ref. 30, p. 18.

[32] Leverett, F., 1917. Glacial formation in the western United States. *GSA Bulletin* 28:143–144.

[33] Bretz, J.H., 1923. Glacial drainage on the Columbia Plateau. *GSA Bulletin* 34:588–589.

[34] Warren, Ref. 11, p. 119.