Chapter 26

Gravel Transported 500 Miles on the Southern High Plains

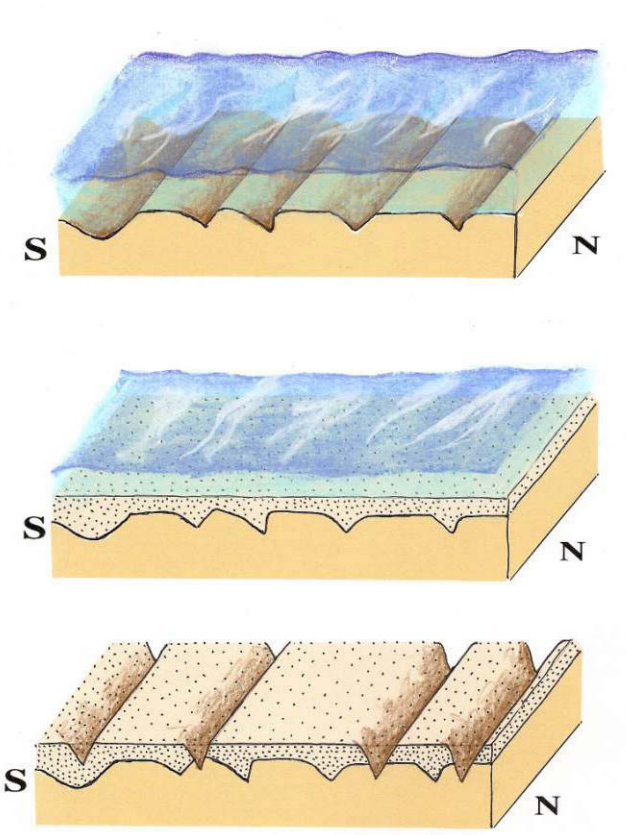

Figure 26.1. North-south schematic of southern and central High Plains showing east-west paleovalleys filling up with Ogallala Group sand and coarse gravel by sheet deposition (top two panels), followed by dissection during channelized Flood runoff (bottom panel) (drawn by Mrs. Melanie Richard).

Not only has gravel been spread over the northern High Plains of the United States, but it also has been transported long distances over the southern and central High Plains.[1] This gravel is called the Ogallala gravel and is significantly different from the characteristics of the gravel found farther north.

Ogallala Gravel on Central and Southern High Plains

An extensive deposit of mostly sandstone and interbedded gravel and conglomerate was deposited east of the central and southern Rockies across the High Plains of the United States.[2,3,4,5] These sediments, some of which have cemented to sedimentary rocks, are called the Ogallala Group (formerly the Ogallala Formation) because the rocks are now subdivided into two or more formations (the definition of a group). A number of anomalously thick, large-grained volcanic ash beds are also found in the Ogallala Group.[6] A few of these ash beds contain large vertebrate fossils.

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[1] Oard, M.J., 2008. Long-distance Flood transport of the Nenana Gravel of Alaska – similar to other gravels in the United States. *Creation Research Society Quarterly* 44(4):264–278.

[2] Frye, J.C., A.B. Leonard, and A. Swineford, 1956. Stratigraphy of the Ogallala Formation (Neogene) of northern Kansas. *Kansas Geological Survey Bulletin 118*, Lawrence, KS.

[3] Thornbury, W.D., 1965. *Regional Geomorphology of the United States*, John Wiley & Sons, New York, NY, pp. 300–301.

[4] McMillan, M.E., C.L. Angevine, and P.L. Heller, 2002. Postdepositional tilt of the Miocene-Pliocene Ogallala Group on the western Great Plains: evidence of late Cenozoic uplift of the Rocky Mountains. *Geology* 30 (1):63–66.

[5] Heller, P.L., K. Dueker, and M.E. McMillan, 2003. Post-Paleozoic alluvial gravel transport as evidence of continental tilting in the U.S. Cordillera. *GSA Bulletin* 115:1,122–1,132.

[6] Rose, W.I., C.M. Riley, and S. Dartevelle, 2003. Sizes and shapes of 10-Ma distal fall pyroclasts in the Ogallala Group, Nebraska. *Journal of Geology* 111:115–124.

The Ogallala Group is complex containing many rapid changes of sediment type. The Ogallala Group sediments first filled east-west paleovalleys that were up to 330 feet (100 m) deep, and then deposition covered the area like a blanket. Later the deposit was dissected by generally eastward-trending channels (Figure 26.1).[7] The thickness of the Ogallala Group ranges from about 800 feet (240 m) to less than 3 feet (1 m).[2,4,5] It is thickest in buried valleys.

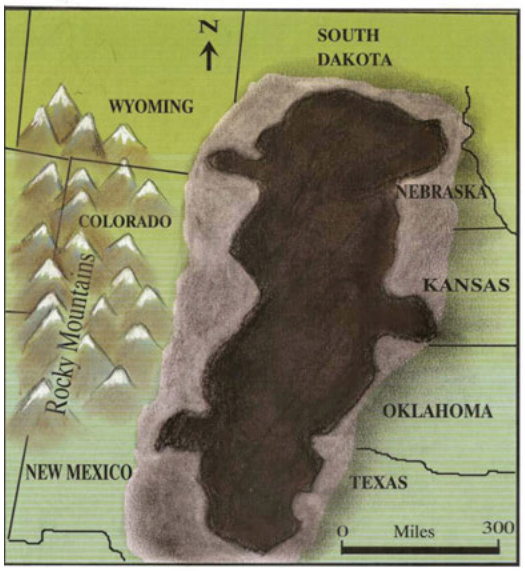

Figure 26.2. Distribution of the Ogallala Group on the central and southern High Plains of the United States, modified from Thornbury (1965) and Heller et al. (2003). Map shows observed (black) and inferred (shaded) original distribution.

Huge Extent

The sand and gravel extends from southern South Dakota into Texas (Figure 26.2). It originally was more extensive. A large part of it was removed by erosion, especially near the Rocky Mountain front and areas farther east into central Texas, western Oklahoma, and eastern Kansas and Nebraska. The present area is around 300,000 mi^2 (768,000 km^2),[8] while the inferred maximum area was around 590,000 mi^2 (1.5 million km^2).[9] The gravel commonly covers erosion surfaces, indicating the currents that spread the gravel also planed the land.

The Ogallala gravels are composed of a wide variety of igneous and metamorphic rocks, especially quartzite and vein quartz.[10,11] Some of the quartzite rocks exhibit percussion marks, mistakely called chattermarks by Byrd,[12] or crescentic marks and chattermarks by Helland and Diffendal.[13] The markings indicate a fast, turbulent flow. Figures 26.3 and 26.4 show an outcrop of Ogallala gravel from northwest Kansas.

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[7] Madole, R.F., W.C. Bradley, D.S. Loewenherz, D.F. Ritter, N.W. Rutter, and C.E. Thorn, 1987. In, Graf, W.L. (editor), *Geomorphic Systems of North America*, Geological Society of America Centennial Special Volume 2, Boulder, CO, p. 214.

[8] Frye *et al.*, Ref. 2, p. 6.

[9] Heller *et al.*, Ref. 5, p. 1,123.

[10] Bretz, J.H. and L. Horberg, 1949. The Ogallala Formation west of the Llano Estacado. *Journal of Geology* 57:477–490.

[11] Swinehart, J.B., V.L. Souders, H.M. DeGraw, and R.F. Diffendal, Jr., 1985. Cenozoic Paleogeography of Western Nebraska. In, Flores, R.M. and S.S. Kaplan (editors), *Cenozoic Paleogeography of the West-Central United States*, Rocky Mountain Paleogeography Symposium 3, Rocky Mountain Section, Society of Economic Paleontologists and Mineralogists, Denver, Colorado, pp. 209–229.

[12] Byrd, C.L., 1971. Origin and history of the Uvalde Gravel of Central Texas. *Baylor Geological Studies Bulletin No. 20*, Baylor University Department of Geology, Waco, TX.

[13] Helland, P.E. and R.F. Diffendal, Jr., 1993. Probable glacial climatic conditions in source areas during deposition of parts of the Ash Hollow Formation, Ogallala Group (Late Tertiary), of Western Nebraska. *American Journal of Science* 293:744–757.

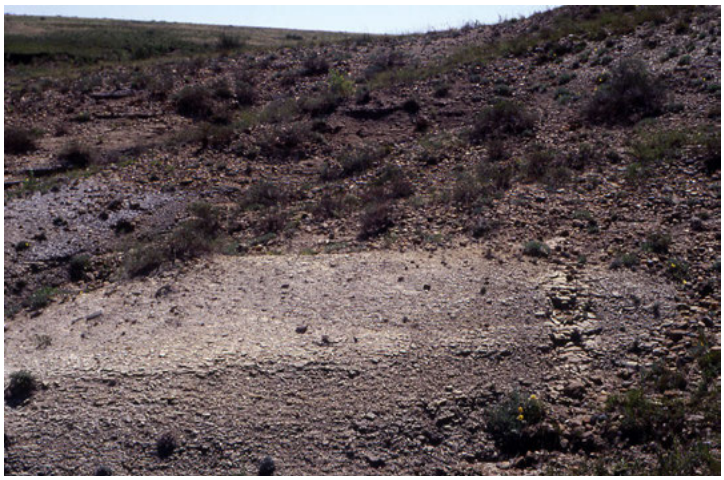

Figure 26.3. Outcrop of Ogallala Group gravel along highway 23 above Smokey Hill River in northwest Kansas.

Figure 26.4. Close up of gravel shown in Figure 26.3.

500 Miles of Transport Texas

Remnants of cobbles and boulders of the Ogallala gravel are found in central Texas (Figure 26.5), generally on top of higher areas, such as on inter-stream divides.[12,14] This gravel has been called the Uvalde gravel but is really an eastern extension of the Ogallala gravel. It is *not* associated with well-developed river terraces.[15] The gravel near Uvalde is found 400 to 1,000 feet (120 to 300 m) above the Rio Grande River.[16] It is about 75 feet (23 m) thick at one location.[15] The fact the gravel is above the river indicates significant channelized erosion happened after deposition. Some of it has been reworked into the river valleys and onto terraces. Based on the interfluve outcrops in central Texas, the Ogallala gravel has been transported about 500 miles (800 km) from its nearest source in central New Mexico.[17] Byrd stated that the origin of the Uvalde (Ogallala) gravel is a major problem:

> A major problem of origin and history of the Uvalde gravels exists because there is no apparent direct connection between the Uvalde gravels and existing drainage in central Texas. Transportation of gravels of such large size is beyond the competence of existing rivers. No source for such coarse siliceous gravels exists in the major basins of present central Texas streams.[16]

Uniformitarian Conundrum

Uniformitarian geologists have a difficult time explaining the origin of the Ogallala gravel. This should not surprise us, since they have trouble explaining any long transported gravels. Some have assumed the Ogallala gravel represents the coalescence of huge

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[14] Byrd, C.L., 1969. The geomorphic evolution of the Leon River system. *Baylor Geological Studies Bulletin No. 17*, Baylor University Department of Geology, Waco, TX.

[15] Byrd, Ref. 12, p. 9.

[16] Byrd, Ref. 12, p. 7.

[17] Byrd, Ref. 12, p. 6.

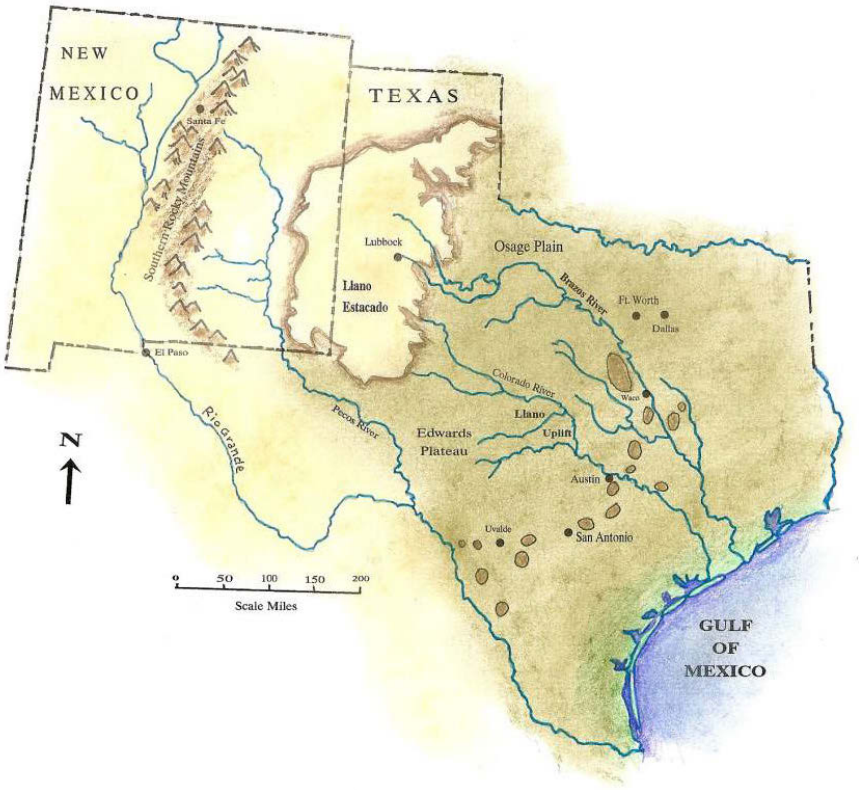

Figure 26.5. Map of Texas and New Mexico showing outcrops of Uvalde (Ogallala) Gravel in Central Texas on interfluves between rivers (from Byrd, 1971, p. 6 and redrawn by Mrs. Melanie Richard).

alluvial fans from the Rocky Mountains.[18] It is not very likely,[19] since the gravel was spread very far eastward from the Rocky Mountains. Furthermore, the thickness of the Ogallala Group *increases* away from the mountain front—unlike any alluvial fan.[3]

The Ogallala sand and gravel most likely spread while the Rocky Mountains were uplifting.[4] After deposition of the Ogallala Group, erosion occurred just east of the Rocky Mountains, forming east-west channels,[20] and on its eastern edge. In the North Platt River valley of southeast Wyoming, 1,900 feet (575 m) of strata was removed. A lot of strata were also removed from just east of the northern Colorado Rockies. Why should so much erosion happen so close to the Rocky Mountains?

Consistent with Flood Deposition and Erosion

The Ogallala Group gravel is consistent with events that occurred during the Retreating Stage of the Genesis Flood. It is the most reasonable explanation for the vast spread of sand and gravel over such a massive area, the central and southern High Plains. The Ogallala Group is different than the quartzite gravel farther north and the Rim Gravel of

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[18] Bretz and Horberg, Ref. 10, p. 478.

[19] Frye *et al.*, Ref. 2, p. 49.

[20] Leonard, E.M., 2002. Geomorphic and tectonic forcing of late Cenozoic warping of the Colorado piedmont. *Geology* 30:595–598.

Arizona in that the Ogallala gravel was deposited with abundant finer-grained sediments. The material came from the Rocky Mountains, probably as they were uplifting.

After the Ogallala Group was deposited, much of it eroded,[7] especially the areas close to the Rocky Mountains where the uplift of the Rockies probably accelerated the eastward flow. Flood current velocities reduced as they moved away from the Rockies, and so the Ogallala Group was not eroded as much far from the Rockies. The east-west channels currently occupied by streams and rivers were most likely cut during the last phase of the Flood, the Channelized Flow Phase. Weak post-Flood river erosion would have continued the downcutting of these channels.