Long-distance boulder deposits

I commend Mr Oard for his article, *Long-distance boulder deposits reveal Noah's Flood*,[1] tackling this interesting question in geomorphology. This *Creation* article summarizes a number of papers published in *Journal of Creation* on this topic.[2] I question whether "Flood runoff seems to be the only way to account for these observations" is the only answer or even the best. All quotes below, unless otherwise indicated, will be from Oard's *Creation* article.

> "The floodwaters rushing off the land into the oceans, initiated by the mountains rising and ocean basins sinking, would have eroded massive amounts of rock from the continents. This flowing water would have transported the material for long distances, pulverizing the softer rocks and rounding the harder ones."

I will take this statement as a summary of his Flood model.

Psalm 104:8 clearly says, "The mountains rose and valleys sank." Not 'the continents rose and the oceans sank'. I don't believe any Hebrew scholar would support the conflated idea that mountains and valleys could be equated with larger continental landmasses and entire ocean basins.

"As the Rockies, running roughly north-south, uplifted, floodwater eroded hard quartzite rock from these mountains and spread it far away to the west and east." I think he is mixing actualistic thinking with his Flood model. Only the actualistic or uniformitarian models postulate flow in both directions from a slowly emerging mountain uplift, but today's flow off of these mountains, as he mentions, is not adequate to carry and distribute the quartzite to these locations, so the uniformitarian model fails. Only the catastrophic flow of the Flood is adequate. But, if that flow was initiated by continents rising and ocean basins sinking, why would it have been divided into two directions? If the rising Rockies divided that flow, wouldn't they also have divided the flow strength, and would that have been adequate? Seems reasonable to suggest it would not.

The transport direction to the west was the shortest (640 km) and, therefore, the weakest direction. Although, the west would be the direction of the Coriolis Effect at the mid latitudes, which one Flood modeller[3] suggested would have been the primary direction of current. Flow to the east while less predicted, is evidenced by Oard's cited statistics to be the strongest, transporting the greatest distance (1,000 km). Also, is he going to model the rise of the Appalachian Mountains at this same time? The flow off of them would directly oppose this flow off of the Rockies, decreasing its carrying power. Remember, we are modelling Flood runoff, so it would be far wider and deeper than any present river's flow.

Oard postulates that the topography of the eventual deposition places for the quartzite boulders had to be deep ravines (eastern Idaho) and high mountains (Rim Gravel of Arizona) already in those positions when the quartzite boulders were distributed. Either the topography already had to be in place or this model requires multiple risings. And, if this is the case, which one rising and sinking was the drastic event the model requires?

The assumption that the source of the Rim Gravel had to erode "a few kilometres" suggests a drastic amount of erosion. The Actualistic modellers regularly assume such erosion because their model has no alternative, but that is a lot of erosion for a very short timeframe, and is it necessary?

"As the water carried the quartzite boulders along, they would have crashed together ferociously leaving percussion marks on their surface." Some rounded boulders do not have them. If percussion erosion was the primary means of eroding the round shape, then all the boulders should be covered with percussion marks. It is evident by their lack that rounding of the boulders was a process without percussion, and only short turbulent transport of some boulders to their final resting place produced percussion marks. This suggests the boulders were not water transported most of the distance from their origin to their final resting place.

The boulders pictured in the article have black, red, and white rinds/surfaces, and further research will find the same colouring of individual grains in the rock. Although all of these colours are found in quartzite boulders, the grain colour in the particular boulders is not always the same as their rind, and occasionally the colour of quartzite grains will abruptly change in a single boulder at a line that mimics sedimentary layering. A clue to their origin may reside in these colour differences. All of them reflect different forms of iron oxide, primarily produced by different temperatures and pressures. The quartzite may have formed as vapour condensate from impacts and settled to earth, solidifying as it cooled. Then they would have been fractured and thrown into the air as ejecta by a second impact. The descent both times would have caused the same iron in the quartzite to be coloured differently depending on where it was in the cloud when it cooled to its solid state. Black, yellow, and purple denote reduced iron (less or no oxygen available) and brown and red denote oxidized iron (abundant oxygen available). Boulders don't have percussion marks all over them because they were rounded by ablation, subliming of the quartz in the rough surface as they passed through superheated air on their return to earth. The surface retained extra iron, which coloured the rind.

To accomplish this, we need a Flood process that would raise mountains and sink valleys (not erode them). Blasting molten material from the surface and mantle with sufficient heat and pressure to vaporize and condense rock, moving large quantities of rock 1,000 km away, would fill deep ravines and leave them on high mountains, ablating the rock surface as they fell, changing the colours as the iron oxide responded to local conditions. Multiple smaller events that produce these same conditions over a 500–600 km radius would be an alternative.

An impact model includes mountains rising with the expression of the shock wave, and an adjacent valley being formed by the release wave.[4] Maybe Psalm 104:8 is really a description of the effects of impacts on the earth?

Neither Oard's nor my model may be the best one, but any model must take all known evidence into account. Then the model used will directly determine how much erosion we expect (kilometres or metres) and the sequence of other geomorphic change that were operating.

W.R. Barnhart
Grover Beach, CA
UNITED STATES of AMERICA

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» Michael Oard replies:

Mr Barnhart questions whether Flood runoff is the only way, or even the best way, to transport quartzite rocks up to boulder size that became well-rounded. Yes, Psalm 104:8 refers to the mountains rising and the valleys sinking, which is a global phenomenon of the mid to late Cenozoic.[1,2] Since the runoff stage of the Flood was a global pattern, it is not too much of an extrapolation to suggest that there were also long wavelength vertical motions (continents rising and/or ocean basins sinking) at the same time as short wavelength oscillations. Geological evidence for differential vertical tectonics is well established and abundant.[2] The change in potential energy that would accompany this widespread tectonic activity would have caused the floodwater to rush off of the continents. Floodwater quickly draining from the continents explains the abundant evidence for massive amounts of continental erosion,[3–5] such as the average 2,500–5,000 m of erosion from the Colorado Plateau.[6]

During such erosion, it is reasonable that the softer rocks would be pulverized and the harder rocks would be transported for long distances—exactly as observed in the northwest United States and adjacent Canada and many other areas of the world.[2] There is nothing 'actualistic' about such a scenario when we consider the 221-day timescale of the Recessive Stage of the Flood.

In regard to whether the Rocky Mountains rising was capable of splitting the flow, once the mountains were exposed above the floodwater, the increasing potential energy due to differential vertical tectonics would rapidly accelerate the flows toward the east and west.

The Coriolis force is a force that causes a current to veer toward the right in the Northern Hemisphere. It would have been operant, but not a significant force compared to the widespread, active tectonics, volcanism, differential vertical tectonics, etc. concurrent in the Recessive Stage of the Flood.

I would speculate that the Appalachians rose a bit earlier than the Rocky Mountains, since they are more rounded and they display about 6 km of erosion.[2,7] But, eventually the rising Appalachians would have split the flow about midway during flood runoff. After this, a westward-moving current would have begun on the west side of the Appalachians. This current would of course not have been blocked but would have converged with the one moving toward the east away from the Rocky Mountains. The two currents would have converged, creating an accelerating flow toward the south in the United States Midwest. It would have picked up an enormous amount of sediment and deposited it in Texas, Mississippi, and the Gulf of Mexico (which is what we see).

The metaquartzite rocks (from now on referred to simply as 'quartzite') were deposited over a wide area in a variety of contexts: deep rifts, mountain tops, valleys, plateaus, the plains, on top of the Columbia River Basalt, and into Puget Sound and the San Juan Islands. There are probably trillions of these well-rounded quartzites, rounded by the action of water scattered across the northwest United States and adjacent Canada.

The Rim Gravels of Arizona are similar and different than the coarse gravels farther northwest.[2] Based on imbrication of the rocks, the Rim Gravels originated tens of kilometres to the south and southwest from terrain that is now much lower. Since the Rim Gravels are essentially a lag after huge erosion, and since water generally runs downhill (depending also upon the floodwater surface slope), it stands to reason that vast erosion took place in southern and central Arizona during the flood runoff.

Percussion marks must have formed in the fastest, most turbulent flows.

Since there must have been a variety of flow regimes, I do not expect all quartzite rocks to have percussion marks. I can say that percussion marks are common, and some cobbles and boulders have hundreds of them on a surface. Some quartzite deposits have few rocks with percussion marks, and in other deposits almost every rock has the marks. There is no indication they are formed by normal flood runoff.

Yes, there could be a clue in the colour of the quartzite rocks as to their source. Quartzite rocks have a wide variety of colours and textures and are often coated with an iron-oxide patina. The colours are due to more than varieties of iron; they reflect various minerals mixed in with the original quartz sand deposited, not burial temperature. Of course, the quartzite was at one time deeply buried, which is why it is a metamorphic rock. The quartzite layers rose along with the mountains. Each single quartzite cobble and boulder deposit has a variety of these colours, suggesting mixing of sources. So, it would be difficult to find any particular source based on colour.

The source of the well-rounded quartzite rocks is mainly the western Rocky Mountains, where thick sheets of it are found mixed with argillite (a metamorphic shale) in the widespread, very thick Belt Supergroup. There are small areas of quartzite in the eastern Rocky Mountains and the Little and Big Belt Mountains of central Montana that probably contributed a small number of well-rounded quartzite rocks.

Barnhart needs to have scientific proof that quartzites can be condensates formed by an impact; otherwise Flood runoff provides a reasonable and straightforward explanation for the spread of the quartzite rocks.

Michael J. Oard
Bozeman, MT
UNITED STATES of AMERICA

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