The Heart Mountain catastrophic slide

Michael Oard

The Heart Mountain Detachment (HMD) was formed by a huge slide that occurred in north-central Wyoming during the early Cenozoic (about 50 million years ago within the uniformitarian timescale). The initial block of carbonate rock covered an area of 1,100 km^2 near the northeast edge of Yellowstone National Park. Although the current fault plane dips gently to the southwest,[1] uniformitarian scientists believe the carbonates slid down a slope of less than 2° toward the southeast. The block broke up into at least 50 large fragments and spread over an area greater than 3,500 km^2. The carbonates are about 1,650 feet (500 m) thick, but uniformitarian geologists believe the rocks were 2 to 4 km thick during the slide and were later eroded.[2]

Many of the fragments ended up over the valley fill sedimentary rocks of the northwest Bighorn Basin. Heart Mountain (figure 1) is one of those fragments, which slid about 60 km, coming to a stop on a gentle incline. The McCulloch Peaks represent the most distant fragments, 55 miles (85 km) from the breakaway point. Most fragments were soon covered by the Absaroka volcanics. A layer of carbonate fault breccia up to 1 m thick and groove casts at the slide contact provide evidence for the slide.

Figure 1. Heart Mountain, northwest Bighorn Basin. The light coloured strata at the top of Heart Mountain are 'Paleozoic' limestone and dolomite, which lie on top of valley fill sediments (view north).

A major uniformitarian puzzle

The cause and displacement of the slide has been the subject of much controversy for over 100 years:

> 'The Heart Mountain Detachment (HMD) has been one of the most enigmatic features in North American structural geology for nearly a century.'[3]

Hauge considers it a global enigma:

> 'Despite more than 100 years of study, the Heart Mountain Detachment remains among the world's most puzzling geological structures.'[4]

There are three major problems posed by the HMD. Firstly, what caused this sheet of rock to move?[5] The slide angle is so small that it is difficult to envisage how such a large block can have moved. The second problem is that the slide plane developed in resistant layers of the Bighorn dolomite, when the slide could more easily have occurred within the weaker underlying rocks.[6] Lastly, the strata directly below the slide plane are undeformed,[7] which is not expected following a slide of this magnitude.

Uniformitarian geologists have been arguing for years over whether the slide occurred rapidly or slowly. William Pierce has spent decades championing the view that the slide occurred catastrophically.[8,9] However, Thomas Hauge has argued that the emplacement of the slide blocks was much slower.[10] The latest opinion is that the Heart Mountain slide was catastrophic,[11–13] taking only 30 minutes![14] The problem now is to find a geodynamic mechanism.

How is this catastrophism explained?

Many mechanisms have been proposed,[15] but two favoured proposals are presently in competition. Both simply assume that the slide was initiated after a volcanic eruption. One is that friction along the sliding plane released CO_2 from the carbonates, providing a 'gas cushion' that aided further movement.[12] The second hypothesis suggests that friction was reduced by the heating of water within the lower-most layer, causing a 'fluid overpressure'.[11] This heating was aided by lava extruding upward in vertical cracks. Both these hypotheses, as well as all others, are unlikely and would be difficult to test. Hauge writes:

> 'These numerous mechanical models, in my view, reflect the astonishment facing these geologists as they attempt to explain the Heart Mountain faulting in the context of the tectonic denudation model.'[16]

Flood catastrophism offers a better model

Creationists at one time were skeptical that the Heart Mountain slide occurred, believing it to be one of numerous alleged overthrusts.[17] An overthrust is defined as the movement of a block of rock over another at an angle of less than 45°. In other words, the upper block is believed to have been forced uphill at a low angle. The Heart Mountain example was probably a slide, whatever the slope of the fault plane, which can be considered essentially flat today.

The catastrophic end of Noah's Flood about 4,500 years ago offers

a more straightforward mechanism. The events would have occurred underwater, reducing sliding friction and providing a cushion of water or steam.

Evidence for an underwater event during the Flood is provided by the emplacement of vertical trees that are entombed in the Absaroka volcanics. This volcanism consists of about 2,000 metres of layer upon layer of volcanic debris, flows and ash over the eastern and northern areas of Yellowstone Park and adjacent regions,[18] covering most of the fragments *following* the slide. These layers contain multiple layers of vertical trees (figure 2) at various locations, interpreted to be multiple 'fossil forests' by uniformitarian scientists. After emplacement, the Absaroka volcanics were greatly eroded into deep valleys.

Figure 2. Upright petrified tree from near Specimen Creek, northwest Yellowstone Park. The tree is sticking out about 4.5 m above the volcanic breccia. (Photo by David Oard).

Creation geologist Harold Coffin has studied Yellowstone National Park for several decades. He has concluded that the trees, representing widely different climatic regimes, were emplaced from a mat of floating logs during the Flood.[19]

Further evidence for an underwater slide is that more than 300 m of erosion of the valley fill strata in the Bighorn Basin has occurred, leaving Heart Mountain as a perched remnant. There are other sedimentary erosional remnants in the basin.

An analog for the HMD is provided by the large slides of hardened lava that broke off the edge of the Hawaiian Islands and slid into the sea.[20] Although the initial movement of the Hawaiian blocks was down a steep slope, the *continuous sliding over a low slope* on the bottom of the ocean simulates what could have happened to the Heart Mountain fragments during the Flood.

Since volcanic rocks had already been deposited before sliding,[2] the uniformitarian geologists are likely correct that a volcanic eruption caused the slide. It is questionable whether the type of eruption envisioned by uniformitarians is capable of initiating such a catastrophic slide within hard strata, especially if the slope was the same as today. Volcanic eruptions would have been much more catastrophic at the end of the Flood, depositing the Absaroka volcanics in a matter of days or weeks. Furthermore, the volcanism occurred during rapid uplift of mountains and continents,[21] which would be accompanied by great earthquakes. Much more energy is available in the Flood paradigm to initiate and sustain the slide.

References

1. Pierce, W.G., Nelson, W.H., Tokarski, A.K. and Piekarska, E., Heart Mountain, Wyoming, detachment lineations: Are they in microbreccia or in volcanic tuff? *GSA Bulletin* **103**:1,141, 1991.
2. Aharonov, E. and Anders, M.H., Hot water: A solution to the Heart Mountain detachment problem? *Geology* **34**:165, 2006.
3. Craddock, J.P., Nielson, K.J. and Malone D.H., Calcite twinning strain constraints on the emplacement rate and kinematic pattern of the upper plate of the Heart Mountain Detachment, *Journal of Structural Geology* **22**:983, 2000.
4. Hauge, T.A., The Heart Mountain detachment, northwestern Wyoming: 100 years of controversy: in; Snoke, A.W., Steidtmann, J.R. and Roberts, S.M. (Eds.), *Geology of Wyoming*, vol. 2, Geological Survey of Wyoming Memoir No. 5, Laramie, WY, p. 530, 1993.
5. Beutner, E.C. and Craven, A.E., Volcanic fluidization and the Heart Mountain detachment, Wyoming, *Geology* **24**:595, 1996.
6. Beutner, E.C. and Gerbi, G.P., Catastrophic emplacement of the Heart Mountain block slide, Wyoming and Montana USA, *GSA Bulletin* **117**:724, 2005.
7. Aharonov and Anders, ref. 2, p. 166.
8. Pierce, W.G., Clastic dikes of Heart Mountain fault breccia, northwestern Wyoming, and their significance, *U.S. Geological Survey Professional Paper* **1133**, U.S. Government Printing Office, Washington, D.C., 1979.
9. Pierce *et al*., ref. 1, pp. 1,133–1,145.
10. Hauge, ref. 4, pp. 530–571.
11. Aharonov and Anders, ref. 2, pp. 165–168
12. Beutner and Gerbi, ref. 6, pp. 724–735.
13. Beutner, E.C. and DiBenedetto, S.P., The Blacktail thrust-fold, Crandall conglomerate, and Heart Mountain detachment fault, northwestern Wyoming, *Rocky Mountain Geology* **38**(2):237–245, 2003.
14. Binns, C., Land speed record: mountain moves 62 miles in 30 minutes, <http://www.livescience.com/forcesofnature/060519_moving_mountain.html>, 2006.
15. Hauge, ref. 4, pp. 557–558.
16. Hauge, ref. 4, p. 557.
17. Whitcomb Jr, J.C. and Morris, H.M., *The Genesis Flood: The Biblical Record and its Scientific Implications*, Baker Book House, Grand Rapids, MI, pp. 181–184, 1961.
18. Coffin, H., Hergenrather, J., Bokovoy, D. and Oard, M., *Road Guide to Yellowstone National Park and Adjacent Areas from a Creationist Perspective*, Creation Research Society, Chino Valley, AZ, 2005.
19. Coffin, H.G., The Yellowstone petrified 'forests', *Origins* **24**(1):5–39, 1997.
20. Oard, M.J., Possible analogue for the Heart Mountain Detachment, *Journal of Creation* **10**(1):3–4, 1996.
21. Oard, M.J., Vertical tectonics and the drainage of Floodwater A model for the middle and late diluvian period—Part I, *Creation Research Society Quarterly* **38**(1):3–17, 2001.