# Youthfulness of Antarctic ice sheets

I have two comments related to Michael Oard's recent article regarding the lack of erosion beneath the Greenland and Antarctic ice sheets.[1]

First, it is interesting to note that uniformitarians had already claimed years ago to have solved the mystery of the youthful appearance of the Gamburtsev Mountains beneath the Antarctic ice.[2] However, their explanation never seems to have progressed beyond the 'storytelling/ hand-waving' stage and did not address the fact that the Antarctic ice sheets would have been warm-based for much of their history, as Oard pointed out.

Uniformitarians have since devised a new, completely different explanation: supposedly basal heat melts ice in deep valleys under the ice to form lakes and rivers. This water is then pushed uphill over the mountain tops by the pressure of the overlying ice. Because of colder temperatures within the ice far from the bedrock, this water freezes, providing a protective layer that supposedly protects the mountains from erosion.[3,4] Clearly, the simplest explanation for the lack of erosion in these mountains is that the ice sheets are young, and my suspicion is that this newest 'explanation' is more 'hand-waving'. However, it would be prudent to carefully examine this new argument, as biblical skeptics will surely bring it up if we attempt to use this lack of erosion as a recent-creation argument.

Second, Oard makes another argument for the youthfulness of the ice sheets, also presented in his technical monograph *The Frozen*

*Record*, which I do not really understand.[5]

He argues that isochronous layers within the ice sheets, revealed by ground penetrating radar, is another evidence for the youthfulness of the ice sheets, because hills and troughs within these isochronous layers 'line up' vertically with corresponding hills and troughs in the underlying bedrock. Oard argues that this would not be the case if the ice sheets were millions of years old, as shearing within the ice would cause these vertical lines to 'curve' forward, so that corresponding hills and valleys within the layers would no longer lie directly over the their corresponding topographical features.

However, it is not clear to me that this would be the case, and hopefully the accompanying illustrations will show why. Imagine that you could take a giant knife and slice open the Antarctic ice sheet, like a birthday cake. Imagine also that these isochronous layers are visible, as are their corresponding topographical features within the underlying bedrock. Suppose one were to take a giant can of spray paint and paint a prominent vertical line above a given location within the ice, say at $x = 0$ (figure 1). Shearing in the ice may very well distort this vertical line over time (figure 2), but one can imagine that the undulations within the ice would *still* lie above their corresponding topographical features within the bedrock. In other words, I don't think any possible depth-dependent horizontal velocities of the *undulations themselves* necessarily equate to depth-dependent horizontal velocities of tiny parcels within the ice. They may very well move at different speeds. In fact, I have a very hard time even visualizing a scenario in which the undulations themselves are horizontally displaced (however, the problem may very well be with me!).

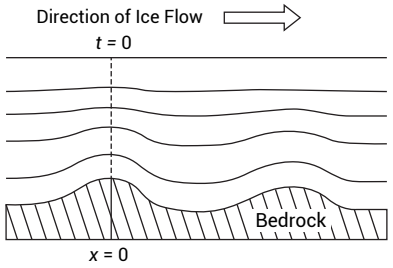


**Figure 1.** At time t = 0, an imaginary vertical line is drawn that connects undulations in isochronous ice layers with the corresponding undulations in the bedrock topography. Undulation heights exaggerated for clarity.

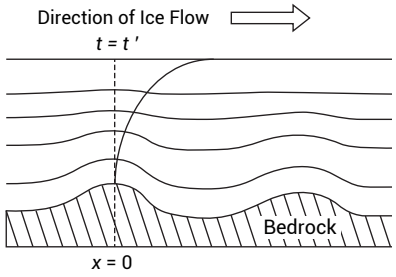


**Figure 2.** At some later time t = t′, shearing would cause this line to be distorted, as horizontal ice velocities are faster near the surface. However, the undulations themselves could conceivably remain in their original locations. The precise mathematical shape of the distortion would depend upon the assumptions within the particular ice flow model being used.

I think Oard's argument may be valid in principle, but I don't see how we can make it without some kind of clear vertical 'reference' line against which we can judge relative depth-dependent motions of parcels within the ice, and unfortunately, giant spray-painted vertical lines within the ice don't exist!

Also, I have done a little reading on this and I get the impression that shearing within the ice is a rather complicated topic, and I personally would be hesitant to make this argument without a *lot* more analysis.

I commend Oard for pointing out additional potential arguments for the youthfulness of the high-latitude ice sheets, but it may be a little premature to use these arguments, especially the second one (shearing within the ice) until more study by creationists has been done in this area.

Jake Hebert
Dallas, TX
UNITED STATES of AMERICA

## References

1. Oard, M.J., Little erosion beneath Antarctica and Greenland ice sheets, *J. Creation* **30**(1): 11–14, 2016.
2. Lovett, R.A., Antarctica's 'ghost' mountains explained, *National Geographic News*, posted 18 November 2011 at: news.nationalgeographic.com/news/2011/11/111116-antarctica-mountains-mystery-ice-science-earth/, accessed 27 April 2016.
3. Creyts, T.T., Ferraccioli, F., Bell, R.E., *et al.*, Freezing of ridges and water networks preserves the Gamburtsev Subglacial Mountains for millions of years, *Geophysical Research Letters* **41**(22):8114–8122, 2014.
4. Anonymous, Fountain of youth underlies Antarctic Mountains, *Phys.org*, posted November 2014 at: phys.org/news/2014-11-fountain-youth-underlies-antarctic-mountains.html N, accessed 27 April 2016.
5. Oard, M.J., *The Frozen Record: Examining the ice core history of the Greenland and Antarctic ice sheets*, Institute for Creation Research, Dallas, TX, pp. 135–140, 2005.

### » Michael Oard replies:

I thank Jake Hebert for his compliments on my article on the bottom profiles of the Greenland and Antarctic ice sheets showing little erosion. The uniformitarian suggestion of a layer of ice pushed up from subglacial lakes to coat the lower slopes of the remarkably preserved Gamburtsev Mountains under the Antarctic ice sheet seems possible.[1] This of course is only plausible once there is a thick cover of ice that would become warm-based with meltwater.[2] The Gambrutsev Mountains show seismic evidence for mountain glaciation, such as cirques, which should have eroded the mountains at the beginning of buildup during hundreds of thousands of years. Mountain glaciation and periglacial processes are efficient at eroding

bedrock.[3] Also, such refrozen melt also had to survive the late Oligocene and Miocene Climatic Optimum. Within the uniformitarian system, there should have been abundant pre-glacial erosion.

The second question relates to the isochronous layers being vertical and reflecting the bottom profile of the ice sheet, as shown by the author's figure 1 and in my monograph on the ice cores on the ice sheets.[4,5] It is difficult to understand the argument for youth from these isochronous layers, one reason being that uniformitarian scientists believe the ice sheet has been at generally the same thickness for 14 Ma, although they have drilled down to about 100 m above bedrock in the Dome C core with an age of only about 800,000 years.[6,7] So, most of these millions of years are supposedly in the bottom 100 m of ice, which is probably deformed.

So for 800,000 years, the isochronous layers must start from the surface, as volcanic ash layers, and move vertically down with a horizontal component as the ice moves, sort of like the author's figure 2, which would depend upon the particular deforming layers and the amount of time of deformation.[8] Ice streams, defined as streams of ice moving at more than 800 m/yr, drain 90% of the Antarctic ice sheet.[9] The other 10% is slow moving, but still there would be a horizontal component to the isochronous layers in these layers. If the ice of slow-moving areas moves about 3 m/yr, a conservative value, at 800,000 years the layer 100 m above the bottom would have moved 2,400 km, if all movement was by basal sliding, which should occur with warm-based ice. The layer, say at 400,000 years would have moved 1,200 km. So, in hundreds of thousands of years timescale, it seems like there should be significant distortion of the isochronous layers. The near-vertical line in the author's figures 1 and 2 should become nearly horizontal over hundreds of thousands of years.

Otherwise, the straightforward impression is that the snow quickly accumulated over a short period of time. For there to be no change in the vertical profile of the isochronous layers for 800,000 years, the flow of ice would have to always run through a stationary wave, up and over mountains. This seems unlikely to me (of course, it could be that I am looking at the uniformitarian view wrong).

Michael J. Oard
Bozeman, MT
UNITED STATES of AMERICA

## References

1. Creyts, T.T., Ferraccioli, F., Bell, R.E. *et al.*, Freezing of ridges and water networks preserves the Gamburtsev Subglacial Mountains for millions of years, *Geophysical Research Letters* **41**(22):8114–8122, 2014.
2. As ice thickens, the base warms.
3. Creyts *et al.*, ref. 1, p. 8114.
4. Oard, M.J., *The Frozen Record: Examining the ice core history of the Greenland and Antarctic ice sheets*, Institute for Creation Research, Dallas, TX, 2005.
5. This monograph is still available in print from ICR on demand.
6. Parrenin, F. *et al.*, The EDC3 chronology for the EPICA Dome C ice core, *Climates of the Past* **3**:485–497, 2007.
7. They stopped drilling several metres above bedrock because seismic evidence suggested meltwater, which means the bottom of the ice sheet below Dome C is warm-based and hence the ice sheet can move at the base.
8. The exact profile will depend upon the precise flow in that area of the ice sheet.
9. Eyles, N. and Ross, M., Ancient ice streams and their megalineated beds, *Sedimentary Geology* **338**:1, 2016.