

## **A Broecker Brief**

### **An extraterrestrial impact at the onset of the Younger Dryas?**

When the Firestone et al. scenario first appeared, I was shocked by its grandiose claims, i.e., the comet did-in the Clovis people, it created a fire extending over at least two continents, it was the cause of the extinction of large mammals in North America... Then when it was shown that there were no Bucky Balls and no iridium spike, I joined many others scorning this idea. Later when, as part of a Nova TV show, the claim was made that nano-diamonds were present at the YD onset in an outcrop of Greenland ice, I backtracked a bit. But as questions regarding the occurrence of nano-diamonds cropped up, I relapsed to my negative stance.

When Alan Zindler, a friend and former colleague, asked me for suggestions as to how he might raise salary money to extend his temporary appointment at Harvard, I suggested that he propose a search for an iridium spike at the onset of the YD in Greenland ice. My thought was that there would be no spike and hence a fatal blow would be dealt to the comet hypothesis.

Zindler got an NSF grant with three month's salary. He also obtained a stick of GISP2 ice which contained the onset of the YD. He planned to do the analysis in cooperation with Stein Jacobsen who had befriended him during his Harvard visit. But alas, before he got things together, his salary money ran out and he had to leave.

Having thought that the project was dead, I was pleasantly surprised when I received a preprint from Jacobsen documenting a 300-fold increase in platinum right at the YD onset (see Figure 1). The rise and decay times of this peak were consistent with an air blast. The platinum suggested that it was produced by the impact of an iron asteroid. The absence of a companion peak in iridium suggested that it was a rare differentiated iron meteorite akin to Allende. This paper entitled "Large Pt anomaly in the Greenland ice core points to a cataclysm at the onset of Younger Dryas" was published in *PNAS* in 2013 authored by Petaev, Huang, Jacobsen, and Zindler.

I remember pleading with *Science's* Richard Kerr to do a piece on this discovery. He thought about it and decided that, as he had written a very negative piece about the original idea, he didn't want to revisit the subject.

About this time, I was alerted to a 2012 paper in *PNAS* by Bunch et al. The eighteen authors included West, Firestone and Kennett who had initiated the comet scenario in 2007. In it they claim to have found microspherules at 18 sites. At three of these described in detail in the paper, they found "vesicular, high-temperature, siliceous scoria-like objects". They view them as high temperature melts formed by an air blast. They resembled those produced by the Arizona Meteorite impact and by the Trinity A bomb test. Morgan Schaller who has spent the last year analyzing tectites found at the onset of the PETM agrees that the evidence reported in the paper is consistent with expectation for an air blast.

One of the three sites is in Syria and the other two are in eastern USA. Only the Syrian site is dated by radiocarbon. Five  $^{14}\text{C}$  ages range from 12.78 to 13.04 kyrs. Hence they nicely bracket the 12.9 kyr age for the Greenland platinum peak. The other two sites are dated only by OSL. The Blacksville, VA site yields an age of  $13.0 \pm 1.2$  kyrs. The Melrose, PA site has an OSL age of 16.4 kyrs at 28 cm depth. Interpolating to the present, the authors obtain an age about 13 kyrs for the 21 cm depth where the tectite-like material is found.

My take on this is that the Greenland platinum peak makes clear that an extraterrestrial impact occurred close to the onset of the YD. Perhaps the object was vaporized in the atmosphere accounting for the shape of the platinum peak. But if the Syrian tectite-like material was produced by the same event, then a more complicated scenario is required. If the object was a piece of an iron asteroid, then it must have hit the ground producing a crater which supplied the silicate material. Also, one might then expect a platinum spike to be present in Antarctic ice (a preliminary search for such a peak by Jacobsen and Severinghaus came up dry).

Although I don't for a minute believe that this impact did in the mammoths and the Clovis people, I do think that it triggered the YD. As is the case for McConnell's as yet to be published 17.8 kyr Antarctic chlorine episode and for Schaller's PETM tectites, I can't buy it's a

coincidence. The only way I can rationalize these three events is to view the system to be approaching instability in which case, a small jolt of noise pre-triggers a change which was due to occur spontaneously.

I realize that this subject is distasteful to many because of the early false claims. But the new evidence suggests that there was some kind of extraterrestrial impact. Hence it should be given further study.

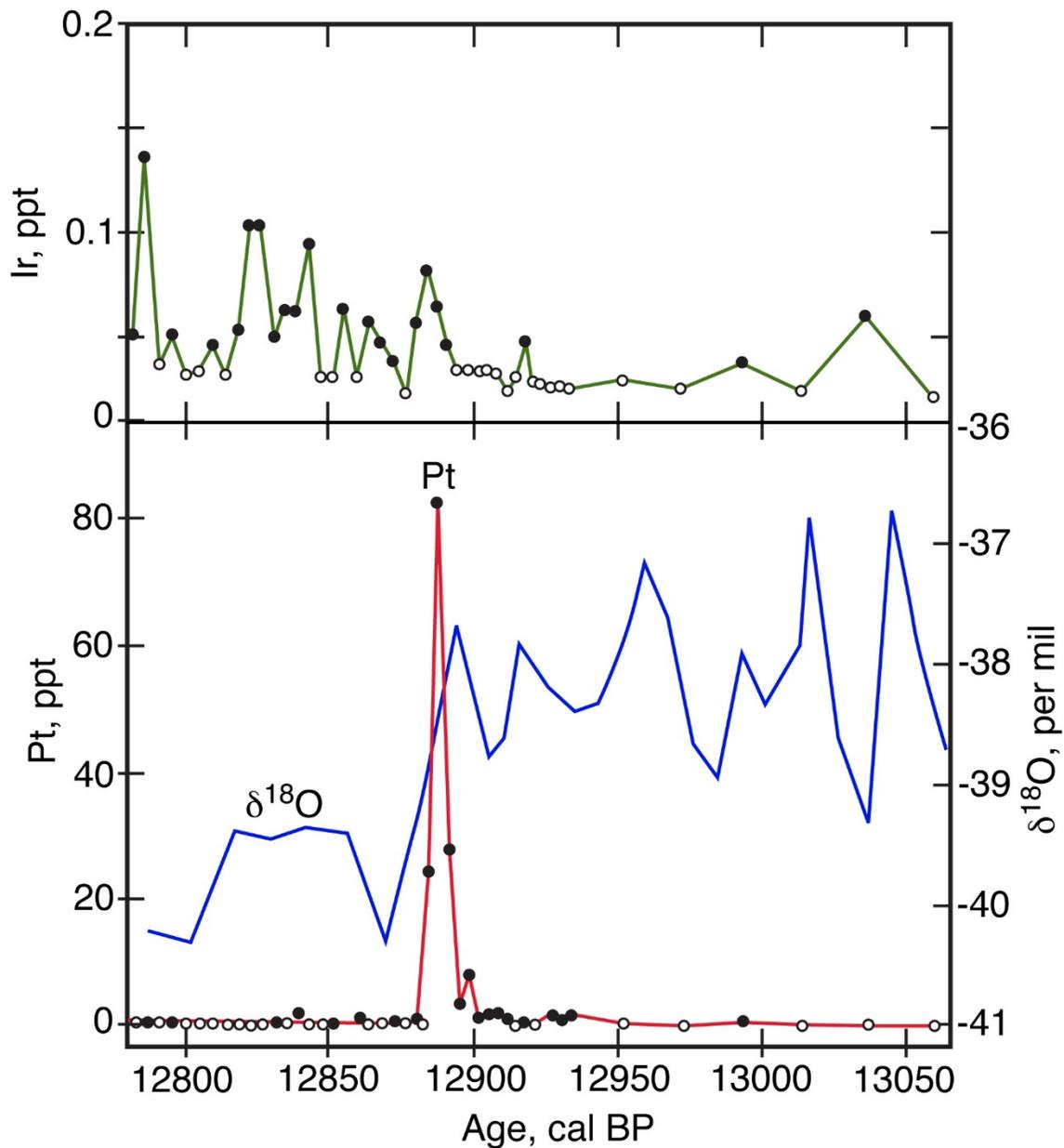


Figure 1. Records of iridium, platinum and ice  $^{18}\text{O}$  in a section from the Summit Greenland (GISP2) ice core encompassing the onset of the Younger Dryas. Although there is a small iridium peak at the onset of the YD, it could be just another part of the background scatter. By contrast, there is a platinum peak that is 300-fold larger than the background level. The rise time ( $\sim 15$  yrs) and the decay time ( $\sim 7$  yrs) are consistent with deposition from an air blast. The presence of Pt and near absence of Ir suggest that the impactor was derived from the core of a rare differentiated asteroid.

## References

- Bunch, T.E., Hermes, R.E., Moore, A.M., Kennett, D.J., Weaver, J.C., Wittke, J.H., DeCarli, P.S., Bischoff, J.L., Hillman, G.C., Howard, G.A., Kimbel, D.R., Kletetschka, G., Lipo, C.P., Sakai, S., Revay, Z., West, A., Firestone, R.B., and Kennett, J.P. (2012), Very high-temperature impact melt products as evidence for cosmic airbursts and impacts 12,900 years ago, *Proc. Natl. Acad. Sci. USA*, 109(28), E1903-1912, doi: 10.1073/pnas.1204453109.
- Petaev, M.I., Huang, S. Jacobsen, S.B. and Zindler, A. (2013), Large Pt anomaly in the Greenland ice core points to a cataclysm at the onset of Younger Dryas, *Proc. Natl. Acad. Sci. USA*, 110(32), 12917–12920.