Greenland Pt anomaly may point to noncataclysmic Cape York meteorite entry

Petaev et al. (1) tested the suite of hypotheses (collectively known as the "impact hypothesis") that a swarm of impacts or airbursts from comets, chondritic, or stony asteroids caused an abrupt climate change, continental-scale wildfires, mass extinctions, and collapse of the Clovis culture at or near the Younger Dryas Boundary (YDB). The authors identify a large Pt anomaly in the Greenland Ice Sheet Project 2 (GISP2) core and suggest that it hints at an extraterrestrial source. Because there is no corresponding Ir spike, Petaev et al. challenge the impact hypothesis by proposing a highly fractionated iron meteorite. The Pt anomaly predates ammonimum and nitrate peaks in the GISP2 core by decades, eliminating the possibility that the source event triggered wildfires, as proposed by the impact hypothesis. The authors rightly argue that it would not generate a wildfire-producing airburst anyway because iron meteorites do not deposit enough energy in the atmosphere for a cataclysmic airburst over a wide area.

By assuming a global anomaly, Petaev et al. (1) calculate an iron meteorite ∼0.8 km in diameter. This is an extremely rare event, recurring on timescales of tens of millions of years based on observed asteroid populations (2) and the fraction of meteorites that are iron. The authors also suggest that an impact of that size would be expected to form a crater of a few kilometers in diameter. However, a representative range of assumptions for velocity and entry angle yields a crater of between 15 and 20 km in diameter, unlikely to have eluded discovery. Petaev et al. (1) also suggest that the anomaly could be explained by multiple impacts of smaller iron meteorites, like Sikhote-Alin, a crater-forming cluster in 1947 with a total recovered mass of ∼23 tons (3). A global Pt anomaly would require on the order of 10^5 such impacts. Widely dispersed impact swarms of this scale have never been observed and no physical model has been proposed for their formation. A hypothetical cluster from a highly improbable iron asteroid encounter is not the simplest explanation, and there are many other probabilistic and physical problems with a globally catastrophic cluster impact (4).

Relaxing the global assumption leads to a much more likely hypothesis. Cape York is an iron meteorite from western Greenland with a total recovered weight of 58.2 tons (3). A terrestrial age of 12.9 ka cannot be ruled out (5). Whereas it is true that the Pt/Ir ratio in the GISP2 anomaly is inconsistent with Cape York, there are no data on heterogeneity of the pre-entry body, nor on Pt/Ir fractionation because of ablation, condensation, and precipitation. The YDB is surrounded by many other spikes, including the Laacher See eruption, an ammonium spike, and three large volcanogenic sulfate spikes. There is no reason to favor the Pt event as the trigger of the YDB climate change or its putative consequences. The simplest explanation is to associate the anomaly with a local noncataclysmic event that is independently known to have taken place, and that would have produced Pt-rich fallout: the Cape York meteorite fall.

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