Oxygen isotope anomaly not present in water vapor from Alert, Canada

Lin et al. (1) claim to have discovered a positive ^{17}O anomaly in water vapor from Alert, Canada, indicative of a component of stratospheric origin. However, their data (Tables S1–S5) do not support that assertion. Their finding of $\Delta^{17}O = 76 \pm 16$ ppm (2 SE) in the Alert samples is relative to a reference fractionation line [designated Chicago local precipitation (CLP)] of much lower precision [slope 0.529 ± 0.003, ordinate axis intercept 70 ± 33 ppm from Vienna Standard Mean Ocean Water (VSMOW) on the logarithmic form of the oxygen triple-isotope plot] than is the norm for investigations that characterize $\Delta^{17}O$ values at the parts per million level. Furthermore, their reference line needs to be extrapolated substantially (by 28.5‰ in $\delta^{18}O$) for present purposes. The Alert samples themselves form a fractionation line of slope 0.528 ± 0.003, with an ordinate axis intercept of 91 ± 99 ppm. The reported anomaly is essentially an artifact of the divergence between the assigned reference line and that given by the sample data set.

Standard practice for calculating $\Delta^{17}O$ (^{17}O-excess) values in meteoric precipitation is from $\ln(1 + \delta^{17}O) - 0.528\ln(1 + \delta^{18}O)$; empirical findings have shown that the factor of 0.528 is accurate to ±0.0001 (2). Furthermore, individual ^{17}O-excess measurements may currently be determined to a precision of ∼5 ppm (2, 3). High precision data have, to date, shown no latitudinal ^{17}O-excess variation in meteoric waters (2), as acknowledged by Lin et al. (1). Alert snow samples analyzed at high precision for Lin et al. (1) and reported in their paper showed ^{17}O-excess of 43 ± 5 ppm, statistically indistinguishable from the 35 ± 13 ppm of snow and water vapor samples from the North Greenland Eemian Ice Drilling (NEEM) site (3), 44 ± 17 ppm of snow sampled from a transect in east Antarctica (4), and 40 ± 4 ppm of snow sampled at Edmonton, Canada (2).

In contrast, calculating the ^{17}O-excess data of the Lin et al. (1) Alert water vapor according to standard procedure gives 104 ± 75 ppm (2σ), whereas the comparable figure for the CLP samples is 59 ± 67 ppm. Clearly, no meaningful distinction can be made. Combining the CLP, Alert water vapor, and Dasuopu glacier data sets and regressing $10^3\ln(1 + \delta^{17}O)$ vs. $10^3\ln(1 + \delta^{18}O)$ gives a well-constrained line of slope 0.5265 ± 0.0007, with an ordinate axis intercept of 44 ± 18 ppm (2σ). The slope discrepancy from 0.528 is explicable if correction was not made for *m/z* 32 "tailing" into the *m/z* 33 collector of the Finnigan MAT Delta E mass spectrometer; this correction is important (5) for instruments that cannot fully resolve those beams.

Lin et al. (1) admit that "^{17}O-excess values quantified with a slope of 0.528 should not differ much for water vapor and snow," as indeed has been confirmed by high precision measurements on samples from the Greenland NEEM site (3). Finally, Lin et al. (1) also propose that "stratospheric influence may generate the ^{17}O-excess at the poles." This is illogical. Why should ^{17}O-excess be attributable to diffusion from the vapor source region (oceans) only at low latitudes?

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