Mathematical Falsification of the Fossil-Dominant Hypothesis for Rising **Atmospheric CO_2 via the Keeling Relation**

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Manuscript under review, August 2026

The Claim on Trial

IPCC, NASA, NOAA, EPA and the **CO2 Coalition (!)** all state:

> *Essentially all of the observed rise in atmospheric CO_2 since the pre-industrial era originates from fossil-fuel combustion.*

This paper shows that claim is FALSE.

The falsification uses only three inputs, all endorsed by the IPCC

1. Mass conservation and elementary algebra
2. Standard isotopic signatures, e.g., $\delta^{13}C_F \approx -28‰$
3. Scripps, sclerosponge, Law Dome, CGAA $\delta^{13}C$ datasets

Isotopic Signatures of the Sources

Fossil-fuel carbon carries the lightest isotopic signature. Natural reservoirs carry heavier signatures.

The flux-weighted mean signature of all sources and sinks over a period of time is what drives the change in signature of the atmospheric reservoir.

This is elementary arithmetic.

Reservoir	$\delta^{13}C$ (VPDB)
Fossil-fuel carbon (90-400 Mya RuBisCO-fixed)	≈ −28‰
Terrestrial respiration (C3 plants)	≈ −25‰
C4 biomass (tropical grasses & crops)	≈ −13‰
Ocean-outgassed CO_2 (after fractionation)	≈ −8‰
Mantle / volcanic CO_2	≈ −5‰
Carbonate weathering	≈ 0‰

Sources span nearly 30 ‰,
from fossil-fuel and C3 respiration near −28 ‰ to carbonate near 0‰.

The Keeling Relation (for isotopic signature $\delta^{13}C$)

To simplify, use $S \equiv \delta^{13}C$ *at time* t_1.
$C_0 \equiv$ *concentration of* CO_2 *at some starting time* $t_0 < t_1$ • $C \equiv$ *concentration of* CO_2 *at* t_1
$S_I \equiv$ *isotopic signature of the* ***net*** CO_2 ***flux*** *between* t_0 *and* t_1.

$$S = S_I + (S_0 - S_I)\, C_0 \cdot (1/C)$$

A plot of S against 1/C is a straight line with y-intercept S_I.

1. **S_I is the signature of the NET ADDITION over the time period.**
   Not a source-only quantity. Not modeled. Read directly off any $\delta^{13}C$ record.
2. **Includes every source and every sink.**
   No ocean chemistry assumptions. No biosphere parameterization. No transport scheme. No models.
3. **Standard since 1958 throughout the carbon-cycle literature.**
   Keeling 1958. This slide contains nothing new. What follows are its necessary consequences.

Keeling-Plot Intercepts by Record

Eight regressions across independent measurement chains. One answer.

Record	$\delta^{13}C_I$ intercept	r^2	Time span
Barrow, Alaska (Scripps)	**−13.2‰**	98.7%	1982 to present
La Jolla Pier (Scripps)	**−13.3‰**	97.8%	1978 to present
Mauna Loa (Scripps)	**−13.3‰**	98.1%	1978 to present
South Pole (Scripps)	**−12.9‰**	98.6%	1977 to present
Cape Grim Air Archive (CGAA)	**−13.06‰**	93.2%	1978 to 1996
Law Dome ice+firn (Francey et al., 1999)	**−13.06‰**	95.9%	1006 to 1993
Law Dome ice+firn+air (Francey et al., 1999; CGAA)	**−13.32‰**	97.9%	1006 to 1996.8
Caribbean sclerosponge (Böhm et al., 2002)	**−13.3‰**	95.9%	1520 to 1997

Mean of eight regression fits from six independent records **−13.18 ‰**

Sources: Koutsoyiannis, Sci 2024, 6, 17, Tables 3–4 (Scripps sites, sclerosponge; explained variance is Nash–Sutcliffe efficiency, open-loop). Law Dome and Cape Grim Air Archive regressions computed directly from Francey et al. (1999) Tables 1–3.

Simple Arithmetic Reveals the Answer

$$S_I = f\,S_F + (1 - f)\,S_N \quad \Rightarrow \quad f = (S_N + 13.2) \,/\, (S_N + 28)$$

with $S_F = -28$ ‰ *(fossil-fuel) and* $S_I = -13.2$ ‰ *(observed intercept)*

44-year Scripps alone bounds $f \in [\,0,\, 0.26\,]$ *for* $-13.2‰ \le S_N \le -8‰$.

500-year Böhm sclerosponge

collapses the band to a single point

At $t_0 \approx$ 1500 AD, fossil emissions ≈ 0

⇒ $S_N(t_0) \approx S_I(t_0) \approx -13$ ‰

Ocean-buffered on multi-century timescales

⇒ $S_N(t) \approx -13$ ‰ throughout the industrial era

$$f = (-13.2 + 13) \,/\, (-28 + 13) = 0.2 \,/\, 15 \approx 0.013$$

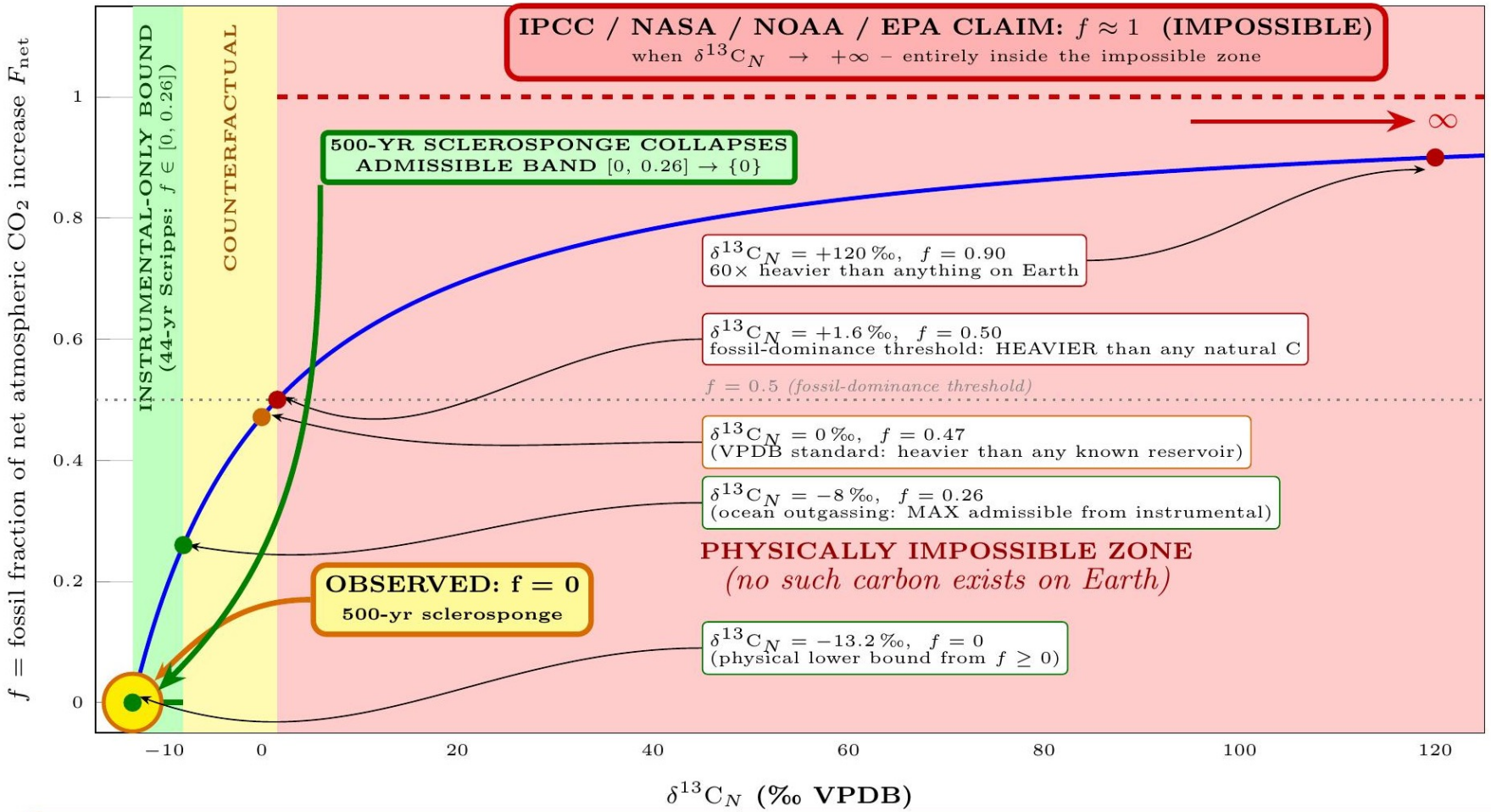
Fossil fraction of the net atmospheric CO_2 addition

$$f \approx 0$$

Not 0.26. Not 0.47. Not 1. Zero.

Fossil-fuel combustion contributes essentially <u>NOTHING</u> to the atmospheric CO_2 increase.

The Fossil-Fraction Function $f(\delta^{13}C_N) = \dfrac{13.2 + \delta^{13}C_N}{28 + \delta^{13}C_N}$ required by observed $\delta^{13}C_I = -13.2\,‰$



500-YEAR SCLEROSPONGE CONSTRAINT

(Böhm 2002 sclerosponge back to ∼1500 AD; Koutsoyiannis 2024 Scripps 4-site instrumental 1978–present)

$$f \cdot (-28) + (1 - f) \cdot (-13) = -13.2 \Rightarrow f_{\text{modern}} \approx 0.013 \approx 0.$$

The 500-year record collapses the instrumental admissible band [0, 0.26] to the single point $f \approx 0$.
Fossil carbon contributes essentially nothing to the net atmospheric CO_2 increase.

Conclusion

Fossil-fuel combustion drove essentially **NONE** of the atmospheric CO_2 growth since pre-industrial times.

Math & Physics force $f \approx 0$

*To reject this conclusion, one or more of these three **must** be rejected. **The IPCC has NOT done that.***

1 Physics

Mass conservation

2 Math & Logic

$$S(C) = S_I + (S_0 - S_I)\, C_0 \cdot (1/C)$$
$$S_I = f\, S_F + (1 - f)\, S_N \quad \Rightarrow$$
$$f = (S_N + 13.2) \;/\; (S_N + 28)$$

3 The DATA

Scripps at four sites, sclerosponge back to 1500, Law Dome ice core, Cape Grim Air Archive.

Nobody can reject any of these. The conclusion is unavoidable.