PUBLIC EVIDENCE EDITION

COHLER AND SOON KEELING RELATION — SCIENTIFIC AUDIT

DOI 10.53234/scc202612/05

Prepared 6 November 2026, Pacific/Auckland

Status: COMPLETED SCIENTIFIC AUDIT WITH DECLARED LIMITS.

Public evidence edition; audit date is not a publication date.

Final disposition: THE CLAIMED GENERAL MATHEMATICAL FALSIFICATION IS NOT ESTABLISHED. Several important numerical observations and conditional calculations are reproducible. The decisive problem is an identification assumption: a signed net isotope flux is treated as a positive two-component mixture with independently bounded signatures. Conservation does not supply that assumption. The constancy argument and the residence-time argument do not repair it.

Source-bound report text SHA256

f6c4279a6babdd7693ff3b2699443a0a4da52a19405c7dd1a66255339a03c7bf

1. QUESTION, DISPOSITION AND SCOPE

Jonathan Cohler and Willie Soon claim that the atmospheric Keeling relation mathematically falsifies a fossil-dominant explanation of rising atmospheric CO2. This audit tests the strongest net-flux interpretation, including the later defenses in §§9.2–9.5. It does not replace that claim with the weaker proposition that gross fossil emissions alone must have the observed atmospheric signature.

Final disposition: THE CLAIMED GENERAL MATHEMATICAL FALSIFICATION IS NOT ESTABLISHED. Several important numerical observations and conditional calculations are reproducible. The decisive problem is an identification assumption: a signed net isotope flux is treated as a positive two-component mixture with independently bounded signatures. Conservation does not supply that assumption. The constancy argument and the residence-time argument do not repair it.

This finding is about the proof in this paper. It is neither a measurement of actual fossil attribution nor a validation of a competing carbon-cycle model. No finding rests on author reputation, journal reputation or institutional consensus. Logical counterexamples below are explicitly synthetic; observational fits are labeled separately. No Lean or other formal proof system was used.

Target: “Mathematical Falsification of the Fossil-Dominant Hypothesis for Rising Atmospheric CO2 Using the Keeling Relation”, Science of Climate Change 6.4, pp.81–99, 19-page frozen PDF: https://scienceofclimatechange.org/wp-content/uploads/SCC-Vol.6.4-04_Cohler.pdf SHA256 7df483cdab73904ba5839f53eef5589cb84a7ce4c9e5e9e01667440d8a6d6822. The DOI landing and author-hosted copy identify the same article; the downloaded author PDF is byte-identical. The filename “04” versus DOI suffix “05” is retained as a naming discrepancy, not treated as evidence of a different version. Printed submission/acceptance dates are 25 August/21 October 2026; landing publication date is 1 November 2026. Source URLs, recorded retrieval times, versions and hashes are in sources/SOURCE-INPUTS.json. Source publication dates and audit dates are distinct.

2. WHAT THE STRONGEST ARGUMENT WOULD ESTABLISH

If net atmospheric growth is a positive mixture of two contributions, their signatures are independently known and fixed, and a fitted intercept identifies the effective net signature over that interval, then the mixture weight follows. At delta_I=-13.2 per mil, delta_F=-28 and delta_N=-8, ordinary delta arithmetic gives f=.26. Replacing delta_N by zero gives .4714286. Fixing delta_N=-13 gives .0133333. These are valid conditional calculations to a very small ratio correction.

The authors do include sinks in their definition of the net addition and explicitly distinguish gross emissions, resident fossil stock and its net change (§9.3). The objection is that including sinks verbally does not establish positivity of the residual components or fix their effective isotope signatures. A reservoir signature, an emitted-fuel signature and a signed residual signature are different quantities. Distinguishing stock and flux also does not identify a counterfactual causal contribution to the atmospheric increase.

3. EXACT BALANCE AND THE KEELING INTERCEPT

Use carbon atom amounts n12,n13, N=n12+n13, r=n13/n12, reference s=.0111802, delta=1000(r/s-1), and heavy-isotope abundance q=r/(1+r). All exact synthetic fluxes below are total atom amounts per year, not measured GtC inventories. For incoming gross fluxes I_j and outgoing O_k, with corresponding abundances:

```
G=N'=sum I_j-sum O_k
H=n13'=sum I_j*q_j-sum O_k*q_k
N*q'=H-q*G.
```

Fractionation is represented by the output abundances; exchanges by paired inputs and outputs. For G nonzero set q_I=H/G. This effective quotient can fall outside [0,1] or become undefined at zero net growth although physical gross fluxes have positive amounts and ordinary abundances. Where q_I gives a positive ratio r_I:

```
N*delta'=G*(1+r)/(1+r_I)*(delta_I-delta).
```

For constant q_I, q=q_I+(q0-q_I)*N0/N. Thus q versus 1/N is exactly linear; delta versus 1/N is slightly rational. Delta versus 1/n12 is exactly linear for constant r_I. For variable signatures the general solution is N(t)q(t)=N0*q0+integral H(t)dt. It is not generally the paper's Eq.(4) with a single constant intercept. An OLS intercept depends on covariance, sampling and the chosen fit window; it need not be the carbon-weighted mean net-flux signature.

The paper calls isotope quantities masses but uses an atom-ratio standard, and its displayed identity preceding Eq.(2) is not exact for total carbon N. Consistent amount notation and the factor above repair this. These errors are not the reason the central attribution bound fails: a controlled exact-abundance trajectory from N=600 to 900, initial delta=-6.5 and delta_I=-13.2 gives fitted intercept -13.200333 per mil. The numerical correction is negligible in that example.

Two executed synthetic tests expose the separate identification issue. Sequential positive additions at -10 and -30 per mil to an initial -7 stock give an OLS intercept -16.9243, whereas the combined added material is -20.0011. A small oscillation added to a Keeling curve gives R^2=.9999586 while instantaneous net signatures range from -15.82 to -10.56. Neither is alleged to occur in the measured atmosphere. They show why the claimed unrestricted regression interpretation does not follow from the constant-signature derivation.

4. TWO-COMPONENT BOUNDS AND A NET-PROVENANCE COUNTEREXAMPLE

For positive amount fractions, exact mixing gives f=(q_I-q_N)/(q_F-q_N). The corresponding exact central values are .259957448, .471351417 and .013331151 for natural signatures -8, zero and -13 respectively. The correction to the paper's arithmetic is tiny. The problem is applicability.

For signed inputs and outputs, a net signature is a ratio of differences. It is not a convex average bounded by physical source signatures. Gross fossil input divided by total growth can exceed one when environmental exchange is a net sink. This alone addresses a gross-input interpretation; the following stronger example addresses the authors' NET ORIGIN-TAG STOCK GROWTH definition.

Choose a local atmospheric state with delta=-8.5, fossil-origin stock fraction .05 and fossil-origin signature -28. Exact mixing then gives natural-origin stock signature -7.4734512. Let all atoms have the same non-fractionating removal rate, with total output 100: fossil-origin output is 5 and natural-origin output 95. Supply fossil carbon 10 at -28 and natural-origin carbon 95 at -6.6942710. The input abundance is defined exactly, not by rounded delta values:

```
q_Nstock=[q(-8.5)-.05*q(-28)]/.95
q_Nin=q_Nstock+(5/95)*[q(-13.2)-q(-28)].
```

Total growth is 5. Fossil-origin stock growth is 10-5=5; natural-origin stock growth is zero. Thus f=dN_fossil/dN=1 while the exact effective net signature is -13.2. All gross amounts and isotope abundances are physical and positive. There is no preference by provenance in the removal process. Natural exchange adds .000809509665 amount units of isotope13 while removing the same amount of isotope12, at zero net carbon addition. Equation (7) multiplies the natural term by zero and loses this finite isotope exchange. Its effective natural endmember is undefined; no reservoir with an impossible signature is required.

Continuous perturbations allow small positive natural net growth, f just below one, and large effective residual signatures with finite ordinary gross signatures. These constructions refute a universal inference from conservation. They are not calibrated carbon-cycle histories, do not estimate actual f, and do not show that arbitrary alternatives fit all atmospheric observations. The exact identities and floating-point checks are in the mathematical review and analysis/math-review/verify_math.py; numerical assertions are not formal proofs.

The separate challenge supplied an analytic finite-duration extension: starting N=1000 with fossil stock50 and natural stock950, keep total growth5 and output100, set fossil stock=50+5t, natural stock=950, and give both origins the same removal rate100/N(t). Choose fossil input5+100*(50+5t)/N(t) and natural input95000/N(t). Let q_Nstock(t)=q_Nstock(0)+(5t/950)*(q_I-q_F), and choose natural input abundance q_Nstock(t)+5*(q_I-q_F)/natural_input(t). These expressions satisfy the balances identically with f=1 and constant q_I; exact rational checks at all integer years 0–20 retain positive physical abundances. This is a constructed trajectory, not fitted atmospheric history. A separate local example with natural net growth 5/9, fossil net growth5 (f=.9), gives gross natural input signature -6.7321 but effective natural residual +120.2184 per mil. The failed convex bound therefore does not rely solely on an undefined zero-net endpoint. See analysis/challenge.

Even inside the paper's positive-mixture approximation, constant delta_I does not force a constant natural signature or f. Setting delta_N(t)=(-13.2+28*f(t))/(1-f(t)) with f increasing from zero to .26 keeps delta_I=-13.2 while delta_N moves from -13.2 to -8, inside the assumed range. An independent constraint on delta_N is necessary. Increasing absolute fossil emissions does not determine a fraction whose denominator and sinks also change.

The displayed ±.2 is inter-site variation/residual scatter, not automatically measurement precision or a confidence interval. Even treating it only as an allowed interval gives f=.25–.27 at fixed delta_N=-8 and .4643–.4786 at zero. At fixed delta_N=-13 the nonnegative range reaches .02667. Thus 26%, 47.1% and 1.3% are central-value conditional calculations, not propagated statistical upper bounds. Factors such as “42 times precision” are not significance tests.

5. OBSERVED STATION DATA — SUCCESSFUL NUMERICAL CHECK

Public Scripps CO2 and isotope series were preserved for Point Barrow/Utqiagvik, La Jolla, Mauna Loa and South Pole. These are the downloaded current vintage, not the exact November 2023 download used by Koutsoyiannis. Isotope file headers identify a June 2025 archive date. Missing values were excluded. Raw and adjusted columns use no audit imputation; filled modes use the publisher's filled columns. CO2 and isotope values are paired by station and month. Annual means require at least nine of the same paired months. A baseline requested window 1978–2022 therefore has different actual station coverage.

Seasonally adjusted annual baseline, delta versus reciprocal CO2:

station	n	actual years	intercept(per mil)	R²	HAC SE
Barrow	39	1982–2021	-13.246835	.994670	.067308
La Jolla	37	1983–2021	-13.343700	.992626	.087207
Mauna Loa	43	1980–2022	-13.282991	.993923	.066650
South Pole	41	1979–2020	-13.016555	.991546	.072949

Publisher-filled adjusted MONTHLY data for the same requested window give -13.2103, -13.3098, -13.2869 and -12.9738 respectively (n=480,528,516,528). This closely recovers the source's modern near -13.2 result. It does not justify a single pooled confidence bound or the fossil attribution inference.

The retained script computes 160 fits across raw/adjusted/filled modes, monthly and annual aggregation, extended endpoints through 2023/2024 and split windows. It retains all paired observations and baseline annual series. Exact-abundance fits change annual intercepts by about .0003 per mil. A separate covariance formula reproduces all four baseline intercepts within 1e-10 per mil.

Uncertainty is descriptive and conditional on the measured x values: ordinary OLS, Newey–West Bartlett lags12 monthly/3 annual, and 2,000 circular paired five-observation block resamples for baseline annual fits (seed20261105). Lags and blocks use retained ROWS, not elapsed calendar time; gaps occur in three annual series. “Five-year” in the saved result key is therefore only an approximation and should be read as five retained annual observations. Normal 95% intervals omit calibration, x error, isotope-scale uncertainty and model identification error. Global signals correlate stations. No claim of confidence coverage, formal stationarity or independence of pooled station estimates is made.

6. FIVE-CENTURY SOURCE CHAIN AND LAW DOME

Koutsoyiannis2024 §2 describes digitizing ATMOSPHERIC concentration and isotope curves from Böhm2002 Figure4. Those curves combine atmospheric ice/firn/air data; they are not a new atmospheric reconstruction from Caribbean sponge isotope measurements. Koutsoyiannis explicitly says the atmospheric isotope curve was scaled by its preindustrial mean and minimum to fit the shallow-water sponge record. These are therefore scaled/digitized atmospheric curves, not pristine raw atmospheric samples; the precise handling or reversal of that scaling in the digitized analysis cannot be checked without the actual inputs. Böhm's actual sponge data concern marine carbonate. Five original sponge series were inspected and are referenced by their primary archive but are not substituted for atmospheric observations. Thus the paper's purported separate sponge-based atmospheric corroboration is misidentified, and independence from the atmospheric ice/firn chain is unestablished. Exact overlap at sample level has not been reconstructed; do not claim all samples are identical or that the sponge measurements are invalid.

Koutsoyiannis Table4 reports proxy intercept -13.3 and modern values -13.2,-13.3, -13.3,-12.9. This agreement is a real reported numerical result. Separately, its §5.3 proxy-model calculation FIXES -13.2 to the modern-site average; it is not another independent optimization. A whole-record regression spanning five centuries does not prove that every subperiod had the same effective signature, especially when early concentration variation is small. The exact 53 digitized atmospheric points/code were not located, so this audit cannot exactly rerun that regression or propagate its digitization, dating and smoothing uncertainties. The retained Koutsoyiannis source is the author-hosted v4 PDF, which includes alternative-figure editorial notes; publisher access was rate-limited. It is identified as that retrieved version rather than assumed byte-identical to the publisher's final typesetting. The provenance statement above is explicit in §2.

Köhler2006 Figure1 really gives Law Dome -13.1 and R^2=.96. The source also explicitly discusses why ocean/land exchange biases long-term intercepts away from original emitted signatures. Numerical agreement is not confirmation of the paper's source-identification claim. These source conclusions use the full retained PDFs and the source review's locators, not abstracts alone.

As a separate diagnostic, current Rubino2019 Law Dome files were matched by unique CO2 sample identifier to isotope records. All105 matched rows have equal reported gas ages. The 1500–1993 subset gives n99, intercept -12.3683, R^2=.9454; 1800–1993 gives n90, -12.3197, R^2=.9362; 1500–1800 gives only n9, -5.6133, R^2=.0299. These are unweighted diagnostic regressions with no chronology, age-distribution, calibration or sampling-dependence propagation. They are NOT reproductions of the 2006 analysis or of the 53-point digitization, and the sparse early fit is not an estimate of an actual preindustrial source endmember.

7. LATER DEFENSES — MODEL FITS, RESIDENCE TIMES AND CAUSAL CLAIMS

The W-H comparison was reconstructed from van Wijngaarden–Happer2026 governing Eq.(57), with total-carbon timescale60years, isotope-mode8years, initial280ppm and -6.5per mil, and fossil input signature -28. The printed Eq.(74) omits the isotope increment factor found in Eq.(57). A targeted mathematical addendum confirms the omission visually. Our reconstruction retains that factor and does not claim execution of either author's unavailable source code.

Forcing is the verified final GCB2025v1.0 workbook, SHA256 a928cf06c57576b66761d1fec8224c9a41a781eb63442afc03ba902858dd64a9. Its historical annual estimates end2024. Baseline uses1850–2024 fossil/industry including cement, without subtracting carbonation; starts at zero perturbation in1850; integrates constant input exactly within each year; divides by2.124GtC/ppm. Two other conversion factors and end-year impulse input give sensitivity runs. Comparisons pair model end-year values with NOAA Mauna Loa annual means1959–2023; that timing mismatch is disclosed. No fit to optimize model parameters was made.

Metric	Paper	Retained reconstruction
CO2 raw squared correlation	.9995	.999545
CO2 cubic residual r²	.36	.359002 (r=.599168)
Growth raw r²	.576	.575801
Growth linearly detrended r²	.021	.021347
Observed/model growth SD ratio	3.0	3.010258
Isotope raw r²	.959	.956516
Isotope cubic residual r	-.45	-.075083 — NOT reproduced

CO2 results substantively recover the reported diagnostics. A high raw correlation does not establish causation; poor residual performance limits the selected model. Neither proves that the long-term anthropogenic contribution is negligible. Monotone curves with the same endpoints need not have r² near1: the executed synthetic t versus t^10 example has r²=.4373. “Tautology” is therefore too strong.

Squared correlation differs from prediction skill 1-SSE/SST. For this fixed reconstruction CO2 raw prediction skill=.94860, bias=-6.11ppm, RMSE7.05ppm; cubic residual skill=.29366; growth residual skill=-.01328. These are additional diagnostics of this reconstruction, not alternate reproductions of the paper's reported correlation statistic. They do not validate the competing model.

The isotope baseline combines eleven unique firn gas-year means1963–1991 with 23 Bermuda annual means1992–2014, using available valid months; n34. Data vintage, calibration harmonization, regional offset, firn age smoothing and the authors' precise sampling remain unresolved. Individual firn samples plus annual Bermuda give r=-.1794; monthly Bermuda variants give small positive r around .036–.039. Hypothetical Bermuda offsets ±.05/±.1per mil and polynomial degrees1–4 are documented stress tests, not measured corrections. Under unchanged cubic baseline, those offsets produce r between -.1564 and -.0036. None of this establishes that the authors' -.45 is erroneous; exact replay needs their input series and code. No significance claim is made from these short, correlated, spliced residuals.

The 2012–2024 GCB fossil+land-use-minus-carbonation trend reproduces slope .017222GtC/year², ordinary iid SE.017383 and two-sided Student p=.3431 (n13, df11). Failure to reject zero slope is not an equivalence test or proof of a plateau. Inventory uncertainty and serial dependence were not propagated.

Equation(15) correctly solves the stated one-way first-order ODE Nf'=Ef-Nf/tau. Using historical GCB forcing plus the EXPLICITLY ASSUMED paper value10.4GtC for 2025 yields38.72GtC at tau3.8 and147.62GtC at17.2, approximately the reported39 and147. Dividing by the paper's907GtC gives4.27% and16.28%. The appended2025 value is not an observed entry in the downloaded workbook. The reported425.6ppm global value is preliminary in GCB, and must not be confused with NOAA Mauna Loa.

These calculations verify conditional arithmetic, not the one-way kernel's physical adequacy. Carbon of fossil origin can return from ocean or land. Identical transfer laws for origins/isotopes allow multiple response modes: A'=E-kA+lB, B'=kA-lB, with k=1/3.8,l=1/38, has atmospheric first-exit time3.8yr but unit-pulse atmospheric share at30yr=.091063, rather than exp(-30/3.8)=.000373. Adding deep removal .001/year gives modes3.45yr and1100.35yr without preferential transport by origin. This synthetic example refutes a general impossibility claim; it does not calibrate Earth or validate W-H's60/8 choices or a Bern parameter set.

W-H actually distinguishes total-carbon and composition-mode eigenvalues; it does not simply assign60years to isotope12 and8 to isotope13. Physical closure still needs justification. A static Revelle factor alone does not specify a rate, as Cohler–Soon correctly say; coupled chemistry/exchange/storage can nonetheless affect system response without different transport laws for fossil molecules.

For the paper's separately stated linear emissions ramp alpha=10.4/175,T175, the exact one-way formula gives375.915GtC at tau50 (matching376) and421.634GtC at tau60, not445. The source of445 requires clarification. This minor discrepancy does not decide the main argument. Historical annual forcing and a linear ramp are different experiments and must not be compared as if interchangeable.

Finally, surviving fossil-origin atoms, their net stock change and the atmospheric excess caused by emissions are distinct. Replacing atoms through exchange can leave a perturbation whose cause was an earlier emission. Neither a

small origin fraction nor a short first-exit time alone bounds anthropogenic forcing or invalidates emissions metrics. This audit does not independently calculate forcing.

8. SOURCE CLAIMS, ACCESS AND REPRODUCIBILITY LIMITS

The source ledger checks what IPCC, NOAA and NASA actually assert: a human-caused increase, principally fossil/industry with land-use contributions and environmental uptake. They do not generally define causal attribution as the fraction of current atmospheric atoms bearing a fossil-origin tag. NOAA's educational isotope wording is simplified and can merit clarification; that does not equate the measured net intercept to fuel signature. Agency citations here establish their stated claims, not proof by authority. Their full oxygen/radiocarbon/inventory evidence was not independently remeasured in this single-paper audit.

The full methods of Keeling1958, Mook1986, Zhang1995 and Ciais1995 were not retrieved. Metadata/abstracts and distinct accessible primary sources were used within those limits. The audit does not certify every quoted fractionation number, the bomb-radiocarbon17.2year derivation, or every competing model parameter. The decisive logical counterexamples do not depend on those inaccessible methods.

The target says a replication package is available “with this submission”. No public package was located at the checked journal/author/linked-data locations. This is a search/access limitation, not evidence that a package does not exist. Unavailable exact author inputs block exact code replay, the 53-point proxy reconstruction and resolution of the isotope residual discrepancy; they do not block a scoped audit with those items explicitly unresolved. No authors contacted.

GCB acquisition preserved an initial .xlsx-named HTML license response and a different publisher workbook; neither was used as the final verified data. Only the checksum-verified ICOS finalv1.0 workbook supplied the reported results. The October2026 GCB corrigendum changes Table6 ocean-interior estimates, not the other reported budget results (source ledger G25). No sources were overwritten.

9. FINDINGS AND REQUIRED REPAIRS

F01 CRITICAL — pp83,85–87, Eqs4,7–13; §§9.3–9.5. A universal fossil fraction bound does not follow from the signed isotope balance. Explicitly state a model that justifies component signs, net signatures and the quantity f represents; withdraw the unconditional mathematical-falsification conclusion without it. Reconciles M01/M03 and CS3/CS4.

F02 MAJOR — p83 Eqs3–4; p84. Integration needs constant effective signature; an arbitrary OLS intercept is not automatically a net-flux mean. Supply the general balance and regression assumptions. Reconciles M02 and CS4.

F03 MAJOR — pp84–87, §§4.2,7. Correct the atmospheric/sponge data provenance and independence claim; separate aggregate regression, fixed-input proxy modeling and subperiod constancy. Exact digitization remains unreproduced. Reconciles CS1/CS2.

F04 MAJOR — p86 Eqs11–12; p87 Eq13. Constant intercept does not independently fix the natural residual. Supply the missing constraint or remove the collapse to near-zero fossil contribution. Reconciles M04 and CS2.

F05 CRITICAL for secondary conclusions — pp89–96, Eq15. Distinguish first-exit turnover, returned provenance, composition modes and counterfactual response. The single-box stock calculation cannot by itself exclude long responses or bound anthropogenic forcing. Reconciles M07 and CS5.

F06 MODERATE — pp84–87,94–95. Distinguish scatter, precision and uncertainty; propagate endpoint/natural-signature uncertainty before making statistical upper bounds or significance claims. Reconciles M05 and CS6.

F07 MODERATE — pp90–92 Table1/Fig2. CO2 correlation checks substantially reproduce; the -.45 isotope residual does not under retrieved inputs. Provide exact code, spliced series, calibration and detrending choices. Separate particular model skill from general attribution. Reconciles M08, source limits and executed results.

F08 MODERATE/REPAIRABLE — pp82–83. Correct atom/mass notation and approximate identities. Ordinary-range numerical effect is small. Reconciles M06.

F09 MINOR/CLARIFICATION — pp94–95. Explain445GtC under the specified60year ramp; our arithmetic gives421.634. Different forcing would be a different calculation. Reconciles M09. W-H Eq74 omission is a separate source caveat, not F09's cause.

10. REVIEW, RECONCILIATION AND DELIVERABLES

Both initial reviewers separately read the full target including later defenses. The mathematical report and carbon/source report were frozen before either read the other's conclusions or the manager's empirical results. They shared the commission/intake context and exchanged acquisition/status messages with the manager. The mathematical addendum is explicitly post-freeze and non-blind: it followed the manager's discovery of the W-H formula issue. It is not counted as independent rediscovery. The manager reconciled the two reports with actual runs; substantive agreement concerns identification, not rejection of the observed intercept. Successful computations are preserved alongside adverse findings.

A separate challenger assessed this report, actual code/results and article. It independently recovered the four filled-adjusted monthly station intercepts, checked exact rational net-provenance balances and constructed the finite-duration and positive-natural-growth variants described above. It also recalculated the ramp and two-box response. This was a bounded challenge, not a second complete empirical replay. Its three corrections concerned historical-curve scaling, GCB estimate terminology and bounded author-package availability wording; all were applied and checked by the challenger. No substantive dissent remains about the narrowed disposition. REVIEW-RECONCILIATION.md records each resolution, remaining limits and final status changes. Original review and editorial history is preserved; sanitized scientific reviews accompany this public edition.

All reviewers use AI from the same provider under the existing configuration. This is not different-provider replication, external human peer review, formal verification or author endorsement. Richard Janutka of Qonduit Limited, New Zealand, commissioned the audit. Haivian's audit service and the Haivian Validation Journal share organizational control. This disclosure describes the audit process; release timing is separate.

Public evidence entry points: README.md — methods, environment, retrieval and replay instructions. sources/SOURCE-INPUTS.json — exact required input versions, URLs and checksums. sources/SOURCE-CLAIM-LEDGER.json — primary-source locators and access limits. reviews/ — sanitized original scientific reviews and correction check. REVIEW-RECONCILIATION.md — review sequence and corrections. analysis/ — original audit scripts and saved aggregate/synthetic outputs. PROVENANCE.json — original-record and public-copy identities and transformations. RIGHTS.txt — authorship, third-party input exclusions and reuse boundaries.