Astro-Ballistic Chronostratigraphic Sequencing I

Aegean Entrance, Everest Midpoint, Mariana Exit

A Forensic Geophysical Reconstruction of the Proposed 256 Ma Event

The Great Dying Challenge

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Paper: I of V

Companion: Paper V, Claims, Equations, Data, and Falsification Atlas

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Canonical Corpus Freeze Notice

This manuscript is part of the five-paper Canonical Corpus Freeze 1.0. Its freeze identifier is

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and its freeze date is August 7, 2026. The freeze fixes the current manuscript wording, equations, citations, epistemic statuses, dependencies, falsifiers, and declared scope. It does not upgrade any item marked unresolved, not established, disfavored, not yet executed, draft, or to-be-preregistered into empirical support. Any substantive scientific revision requires a new corpus version and a new freeze identifier.

Declaration of Purpose

This paper begins a five-paper corpus. Papers I–IV form the scientific core; Paper V is the claim, equation, data, dependency, reproducibility, and falsification atlas. The corpus tests a causal replacement framework. It does not dispute the observation that lithospheric plates move; it asks whether Plate Tectonics is sufficient as the primary causal explanation for the global organization of plates, boundaries, mountain systems, trenches, basins, fracture networks, volcanic provinces, and motion vectors.

Formal replacement thesis.
Astro-Ballistic Chronostratigraphic Sequencing accepts observed continental drift and plate motion while challenging Plate Tectonics as the primary causal framework of global crustal organization. The framework proposes that major plate boundaries, plate-motion directions, relative plate velocities, mountain systems, trenches, basins, fracture networks, volcanic provinces, and displaced terranes are inherited and continuing consequences of a sequenced history of large astro-ballistic events.
Paper I tests one flagship candidate relationship and initiating-event assignment. It does not establish the wider replacement thesis by geometry alone.

Source Status and Citation Policy

External references support measurements, dated constraints, standard methods, regional context, comparison-model components, and reproducibility requirements. They do not independently verify an astro-ballistic event assignment, event sequence, causal interpretation, or replacement claim unless the cited source directly tests that claim. Internal Ontomics documents establish developmental provenance, not independent confirmation. Manuscript-derived values remain consequences of their declared inputs and methods. External chronology constrains observations and marker compatibility; it is not imported as a substitute causal narrative. The complete source taxonomy, verification fields, and conflict rules are maintained in Paper V.

Data, Evidence, and Provenance Convention

Every factual input, model input, reconstruction, simulation output, and calculated result must retain an explicit evidentiary origin. Scientific authority, publication status, or institutional custody does not by itself upgrade an item from model-derived to observed, from observed to causal, or from internally reproduced to independently validated.

The corpus uses the following evidence-origin classes:

Measurement-proximal
: A directly measured, sampled, mapped, or instrument-recorded quantity, together with its reported uncertainty and acquisition method.

Curated primary dataset
: A maintained collection of observations. The dataset may include processing, but its raw sources, version, and transformations must remain traceable.

Reference model
: A community or institutional model derived from observations and assumptions. It is not identical to the underlying measurements.

Reconstructed or inverted
: A past state, field, geometry, or parameter estimated through an explicit inversion or reconstruction method.

Author-declared input
: A coordinate, age, range, threshold, branch, or other value selected for the present investigation. It is a model input rather than an independent observation.

Internal provenance
: An Ontomics manuscript, author working document, or earlier source file establishing the developmental history of the hypothesis. Internal provenance is not independent confirmation.

Manuscript-derived result
: A reproducible consequence of declared inputs, equations, algorithms, and numerical conventions.

Simulated model output
: A quantity produced by an implemented physical or statistical model.

Interpretive inference
: A geological, causal, or historical interpretation assigned to one or more observations or model outputs.

Unverified, unavailable, or missing
: An item whose source, version, access path, lineage, uncertainty, or required observation has not yet been established.

For item i, the minimum provenance record is

$$\mathbf{P}_i = (\mathrm{ID}_i, \mathrm{origin}_i, \mathrm{custodian}_i, \mathrm{version}_i, \mathrm{locator}_i, \mathrm{acquisition}_i, \mathrm{hash}_i,\\ \mathrm{transformations}_i, \mathrm{units}_i, \mathrm{uncertainty}_i, \mathrm{use}_i, \mathrm{dependencies}_i, \mathrm{status}_i).$$

For a derived result R_j, the complete lineage must identify the exact input records and method version:

$$R_j = \mathcal{M}_j(\mathbf{D}_{j1}, \ldots, \mathbf{D}_{jn}; \boldsymbol{\theta}_j, \nu_j) \,,$$

where ν_j identifies the equation, code, solver, or calculation version. Rounding, unit conversion, coordinate transformation, filtering, interpolation, exclusion, and manual transcription are transformations and must be logged rather than treated as invisible clerical steps.

A located source is not automatically passage-verified. A verified passage is not automatically data-verified. A data-verified input does not by itself validate the causal interpretation built from it. Missing evidence remains explicitly missing; it may not be filled by a preferred reconstruction, model narrative, or uncited numerical convention.

This is not presented as impact geology added to Plate Tectonics.

The series tests whether astro-ballistic forensics provides the deeper causal architecture beneath the plate motions already observed.

Document Status and Evidentiary Standard

The manuscript presents an original forensic geophysical framework.

Its principal findings, interpretations, equations, and proposed event relationships are exposed for independent reconstruction rather than presented as established geological consensus.

The paper distinguishes among:

1. geographic observations;
2. declared coordinate choices;
3. mathematical results derived from those coordinates;
4. chronostratigraphic associations;
5. proposed astro-ballistic interpretations;
6. physical mechanisms requiring numerical modeling;
7. geological predictions;
8. alternative explanations; and
9. explicit rejection conditions.

No conclusion is protected merely because it belongs to the wider framework.

Every major claim must be capable of surviving or failing separately.

The series is intentionally structured so that failure can be localized:

- a geometric relationship may survive while an event age fails;

- an event age may remain viable while a specific mechanism fails;
- an entrance interpretation may fail while a terminal-region anomaly remains unresolved;
- the Aegean–Everest–Mariana reconstruction may fail without automatically rejecting every other proposed astro-ballistic event;
- a regional reconstruction may succeed without establishing the global replacement thesis; and
- the global replacement thesis must satisfy a substantially greater evidentiary burden than any single event reconstruction.

Epistemic Status and Claim-Language Convention

This paper distinguishes observation, curated data, reference model, author-declared input, manuscript-derived calculation, simulated output, interpretive inference, prediction, unresolved item, negative result, and falsified claim. These statuses are not interchangeable. Reproducible arithmetic does not establish historical causation; physical admissibility does not establish occurrence; and regional compatibility does not establish global replacement. Missing evidence is reported as unresolved rather than silently completed. Paper V contains the authoritative machine-readable status vocabulary and item-level records.

Prediction, Falsification, and Decision-Threshold Convention

Predictions must identify the claim tested, data required, comparison or null, uncertainty treatment, decision threshold, and bounded consequence. Thresholds are classified as physical-admissibility conditions (T0), measurement or convergence conditions (T1), exploratory working thresholds (T2), preregistered confirmatory thresholds (T3), or preregistered comparative thresholds (T4). A claim is rejected only after a valid, completed test crosses its frozen rejection rule. An unrun test, unavailable dataset, or unfrozen threshold is unresolved. Failure to earn superiority or replacement status is a comparative non-qualification, not retroactive falsification of every upstream result.

Causal-Chain, Assumption, and Alternative-Explanation Convention

Causal language follows a seven-level ladder: association (L0), temporal compatibility (L1), mechanical admissibility (L2), modeled contribution (L3), causal necessity (L4), primary or dominant causation (L5), and replacement qualification (L6). Each proposed transition must identify its assumptions, mediators, counterfactual intervention, and credible alternatives. For claim c with preregistered support paths $\mathcal{P}_c$, viability is

$$\mathcal{V}_{\text{causal},c} = \bigcup_{p \in \mathcal{P}_c} \bigcap_{e \in p} \mathcal{V}_e.$$

One failed edge rejects every path that requires that edge, but does not erase an independent surviving path. One failed branch, event, regional assignment, or event sequence therefore has only its registered downstream consequence. Confounding, equifinality, circular use of outputs as inputs, and unequal assumption burdens remain explicit audit failures. Paper V preserves the full causal-edge, assumption, alternative, and intervention registries.

Abstract

This paper establishes the geometric, chronological, and regional-test foundation of Astro-Ballistic Chronostratigraphic Sequencing . It investigates a declared relationship among the Mini Aegean region, the Everest and central Himalayan region, and the Mariana system. The flagship causal interpretation assigns the specific nominal initiating-event age $a_{\mathrm{init},F} = 256$ Ma, while treating later reactivation and visible geological expression as separate chronological stages.

Using the declared present-day coordinates, the selected Everest point nearly divides the two endpoint surface distances and lies approximately 23.408 km from the projected along-track halfway station. The same point is approximately 1507 km cross-track and 13.558849° from the exact endpoint-midpoint direction. The calculation therefore supports a reproducible bilateral and along-track relationship, but not literal present-day midpoint collinearity.

Paper I does not infer causation from that geometry. It defines the coordinate and uncertainty audit, deep-time reference-frame and material-lineage branches, chronology requirements, regional prediction classes, coincidence controls, and scoped falsifiers needed to test the flagship candidate event. Failure of the flagship geometry, age assignment, regional role, or event interpretation has only its registered consequence and does not automatically reject unrelated candidate events. Any surviving event-audit package is passed to Paper II for mechanical testing; Papers III and IV separately address global reconstruction and comparative replacement qualification. The flagship event and the wider replacement thesis remain unresolved.

Keywords

Astro-Ballistic Chronostratigraphic Sequencing; astro-ballistic forensics; forensic geophysics; plate-motion inheritance; Plate Tectonics replacement; Mini Aegean Plate; Mount Everest; Himalayan uplift; Mariana Trench; Challenger Deep; Earth-interior chord; great-circle geometry; midpoint reconstruction; deep-time plate reconstruction; impact-derived tectonics; Great Dying Challenge.

Architecture of the Five-Paper Research Program

The five papers have non-interchangeable jobs. Each paper receives only the status-qualified outputs of the preceding paper and cannot retroactively upgrade them.

Paper	Primary role	Required output
I	Geometry, initiating chronology, regional assignments, and scoped tests	A reproducible event-audit package with uncertainties, alternatives, and falsifiers; no mechanical viability is presumed.
II	Differentiated-Earth mechanics	The nonempty mechanical parameter sets, if any, and their post-event fields; no global reconstruction is presumed.
III	Event-sequence, boundary, motion, and material-history reconstruction	One or more complete sequence-specific global solutions, or a documented empty model-family set; comparative superiority is not decided here.
IV	Matched causal comparison and replacement adjudication	Eligibility, prediction, complexity, necessity, null, and replication outcomes for all frozen model families.
V	Claim, equation, data, dependency, prediction, and falsification atlas	A human-readable and machine-readable audit of Papers I–IV; no additional causal case and no automated final judgment.

The series burden therefore proceeds as

$$\text{event audit} \to \text{mechanical eligibility} \to \text{global reconstruction} \\ \to \text{comparative adjudication} \to \text{verification atlas.}$$

Contents

1 The Replacement Thesis

1.1 Canonical Corpus Terminology

The authoritative nomenclature registry is maintained in Paper V. Throughout this paper, *continental drift* and *plate motion* name observed motion classes, whereas Plate Tectonics names the competing causal model family. An *event catalog* is the registered set of candidate events; an *event sequence* is a chronologically ordered selection from that catalog. The *flagship candidate relationship* is the declared Aegean–Everest–Mariana geometry, while the *flagship candidate event* is its broader causal interpretation. *Midpoint* is geometric; *midpoint response* is physical. *Terminal response* is the general scientific term; *exit* is retained in the Paper-I title and only where a specific mechanism branch predicts literal outward passage. The *replacement thesis* is the proposition under test; a *replacement candidate* is an outcome that can be earned only through the complete Paper-IV comparison and replication program.

1.2 Observed Plate Motion Is Retained

The motion of Earth's lithospheric plates is treated as an empirical observation supported by global plate-kinematic and geodetic measurements [1, 2, 3, 4, 6].

Astro-Ballistic Chronostratigraphic Sequencing does not require the denial of measured plate velocities, relative plate motion, spreading, convergence, transform displacement, subduction geometry, or crustal deformation.

These observations constitute part of the evidence to be explained.

The disagreement concerns causation.

Plate Tectonics organizes the observations through internally driven processes and ongoing interactions among plates, mantle, ridges, trenches, and subduction systems.

Astro-Ballistic Chronostratigraphic Sequencing proposes that the deeper organization of those structures and motions is inherited from discrete high-energy events.

The distinction is therefore:

$$\text{plate motion as observation} \neq \text{Plate Tectonics as complete causal explanation.}$$

1.3 Causal Replacement Rather Than Kinematic Denial

The replacement thesis does not state:

> The plates do not move.

It states:

> The existence, placement, orientation, direction, and relative speed of the moving plates may preserve the accumulated mechanical consequences of a sequenced history of astro-ballistic events.

In this framework, present plate motion is not rejected.

It is treated as the surviving kinematic output of prior forcing.

The framework therefore seeks to explain:

1. why the plates are divided where they are;
2. why particular boundaries are convergent, divergent, or transform;
3. why major motion vectors possess their observed directions;
4. why plate velocities differ;
5. why some boundaries reactivate older structures;
6. why mountain systems, trenches, ridges, basins, and volcanic provinces occupy their particular global positions;
7. why geological discontinuities recur at specific chronostratigraphic boundaries; and
8. why the present motion field remains dynamically active.

1.4 Astro-Ballistic Forensics

The term *astro-ballistic forensics* refers to the reconstruction of externally initiated planetary events from surviving terrestrial evidence.

The method proceeds backward from the present record.

It examines:

- scar geometry;
- entrance and terminal-response asymmetry;
- directional fracture patterns;
- mountain and trench placement;
- sedimentary discontinuities;
- extinction boundaries;
- geochemical anomalies;
- isotopic markers;
- gravity and magnetic anomalies;
- seismic structure;
- plate-motion vectors;
- displaced terranes; and
- temporal relationships among these observations.

The objective is to determine whether these observations can be traced to an ordered initiating event.

1.5 Chronostratigraphic Sequencing

The chronostratigraphic component places candidate events within the geological record.

A viable sequence must specify:

1. a specific proposed initiating-event age, with its uncertainty represented separately;
2. the temporal resolution of that assignment;
3. the expected immediate markers;
4. the expected delayed geological response;
5. the expected biological or environmental consequences;
6. the structures that should predate the event;
7. the structures that should postdate the event;
8. the signatures expected to survive; and
9. the signatures whose absence would reject the reconstruction.

Chronology cannot be assigned merely because a structure fits a desired geometry.

Geometry and age must be tested independently before they are combined.

1.6 Sequencing as a Causal Constraint

The term *sequencing* requires more than identifying isolated similarities.

A proposed event must produce an ordered structure:

$$\begin{aligned}&\text{initiating body or force} \rightarrow \text{entrance interaction} \rightarrow \text{interior transmission}\\ &\qquad \rightarrow \text{midpoint response} \rightarrow \text{terminal interaction} \rightarrow \text{far-field consequences.}\end{aligned}$$

Each stage constrains the next.

The entrance should predict a directional path.

The path should predict a midpoint region.

The path should predict a terminal-response region.

The force budget should predict differentiated structural effects.

The chronology should predict the ordering of surviving geological markers.

A reconstruction that can accommodate every possible outcome is not a sequence and is not falsifiable.

2 The Flagship Candidate Event Reconstruction

2.1 Flagship Geometry and Flagship Event

The phrase *Aegean–Everest–Mariana* refers to the three registered coordinate anchors and their geometric relationship. The phrase *Aegean–Himalayan–Mariana flagship candidate event* refers to the broader causal assignment in which the Everest coordinate stands for a Himalayan midpoint-response domain rather than a claim that the modern summit existed at the proposed event age.

The Paper-I subtitle retains the historical shorthand *Aegean Entrance, Everest Midpoint, Mariana Exit*. In operational text, *terminal response* is preferred to *exit* unless a specific mechanism branch predicts a literal outward surface expression.

2.2 The Three Principal Geographic Anchors

Paper I examines three primary regions:

1. the Mini Aegean Plate region in the eastern Mediterranean;
2. Mount Everest and the central Himalayan structural high; and
3. the Mariana Trench and Challenger Deep in the western Pacific.

The proposed roles are:

Mini Aegean entrance → Everest midpoint → Mariana exit

The current working coordinates inherited from the original investigation are:

Region	**Latitude**	**Longitude**
Mini Aegean entrance	36.47°N	22.95°E
Mount Everest	27.99°N	86.93°E
Mariana exit / Challenger Deep	11.32°N	142.25°E

These coordinates are declared inputs.

They are not yet treated as uniquely correct regional centroids.

Paper I will test:

- point coordinates;
- regional centroids;
- uncertainty regions;
- alternative Aegean entrance coordinates;
- alternative Mariana exit coordinates;
- summit versus massif definitions of Everest; and

- present-day versus reconstructed positions.

2.3 Specific Flagship Initiating-Event Age

The flagship candidate event is assigned the specific nominal initiating age

$$a_{\text{init},F} = 256 \text{ Ma}. \tag{1}$$

This is the age of the proposed initiating astro-ballistic event. It is not a broad event interval, an interchangeable search age, or the age of every later geological expression. The numerical assignment is frozen as a model parameter before paleogeographic, mechanical, or regional fitting. Its empirical uncertainty, $\sigma_{a,\text{init},F}$, remains to be established from independent dated evidence and must not be expanded after inspection merely to preserve a preferred fit.

The manuscript does not equate the 256 Ma initiation with a formal stratigraphic boundary by naming alone. External chronologies constrain candidate markers and causal ordering; they do not replace the ballistic-forensic derivation of the initiating event.

The paper must determine:

1. whether at least one independently dated physical marker is compatible with the specific initiating age;
2. whether the relevant Aegean entrance material existed in an admissible state at that age;
3. whether a Himalayan precursor or carrier state can be connected to that initiation without identifying the younger visible mountain system as the event itself;
4. whether a western Pacific precursor or carrier state can be connected to that initiation without identifying the younger visible trench system as the event itself;
5. whether the event-time geometry survives reconstruction at the specific initiating age; and
6. whether later damage, transport, reactivation, uplift, subsidence, trench development, basin development, and present morphology follow through an explicit material and causal lineage.

Failure of the specific 256 Ma assignment rejects the flagship initiating-age claim and every event sequence that requires that assignment. It does not by itself reject an independent event, an unrelated regional claim, or the broader ABC Sequencing model family.

2.4 Current Flagship Data-Provenance Snapshot

The present flagship calculation has the following evidentiary structure. The table records what each item is; it does not upgrade unresolved inputs.

Table 2: Paper-I flagship data and provenance snapshot.

ID	Item	Origin and role	Current provenance status
P1-DAT-001	Mini Aegean coordinate, 36.47°N, 22.95°E	Internal author-source coordinate; declared present-response anchor	Exact feature definition, centroid rationale, version, and independent coordinate verification remain unresolved
P1-DAT-002	Everest coordinate, 27.99°N, 86.93°E	Internal author-source coordinate; declared present-response anchor	Summit-versus-massif definition and uncertainty region remain to be frozen
P1-DAT-003	Mariana coordinate, 11.32°N, 142.25°E	Internal author-source coordinate; declared present-response anchor	Challenger-Deep-versus-terminal-domain definition and uncertainty remain to be frozen
P1-PAR-001	$a_{\mathrm{init},F} = 256$ Ma	Author-declared, frozen initiating-event parameter	Not an independently measured event age; empirical uncertainty and compatible physical marker remain unresolved
P1-PAR-002	$R_{\oplus} = 6371\,\mathrm{km}$	Declared spherical reference model	Adequate for the registered spherical calculation; ellipsoidal sensitivity is separately required [8, 7]
P1-RES-001	Registered distances, chord, midpoint, and cross-track values	Manuscript-derived results from P1-DAT-001–003 and P1-PAR-002	Calculation lineage reproduced; historical and causal interpretation remains unresolved
P1-THR-001	5° literal-midpoint screen	Internal source-working threshold, class T2	Preserved as a historical screening rule; not a universal geological acceptance threshold
P1-DAT-004	Published end-Permian chronology	Independent chronology constraint [14, 15]	Constrains formal stratigraphic timing; does not independently support the 256 Ma initiating-event assignment

ID	Item	Origin and role	Current provenance status
P1-DAT-005	Published Aegean, Himalayan, and Mariana regional studies	External regional context and dated constraints [9, 10, 12]	Useful as measurement and chronology constraints; not direct verification of the flagship event

2.5 Entrance, Midpoint, and Exit Are Different Claims

The three proposed roles are not interchangeable.

2.5.1 Candidate Entrance

The Mini Aegean Plate region is proposed to preserve the initiating interaction.

Predicted classes of evidence may include:

- regional circularity or arcuate structure;
- convergent fracture orientations;
- anomalous crustal or lithospheric architecture;
- deep gravity or magnetic structure;
- melt or high-pressure mineral signatures;
- inherited collapse geometry;
- directional relationships extending toward the interior path; and
- chronostratigraphic markers compatible with the proposed event.

Documented Cenozoic Aegean deformation [9] is treated here as a younger overprinting interval that must be separated from any proposed older entrance signature. Paper I does not use a published regional reconstruction as event-time ground truth; it asks whether measurement-proximal evidence preserves a distinguishable older material or structural lineage.

2.5.2 Candidate Midpoint Response

The Everest and central Himalayan region is proposed to preserve the middle-mountain expression of the event.

The midpoint claim is not that the modern summit existed in its present form at 256 Ma.

The claim is that the region may preserve a deep inherited structural condition produced near the midpoint of the proposed force path and later expressed, reused, or amplified through subsequent geological processes.

Predicted classes of evidence may include:

- anomalous deep crustal structure;
- mantle inheritance;
- localized compression or density contrast;
- pre-existing structural weakness or strength;
- later orogenic reuse;
- regional uplift concentration; and
- measurable proximity to the independently calculated midpoint direction.

The principal Himalayan orogenic expression is much younger than the provisional 256 Ma event age [10, 11]. The midpoint claim is therefore limited to an older carrier state that may later have been reactivated or amplified. The modern orogen is not treated as the event marker, and no specific conventional reconstruction is imported as the required causal history.

2.5.3 Candidate Exit

The Mariana Trench and Challenger Deep are proposed to preserve the terminal expression.

Predicted classes of evidence may include:

- extreme excavation or decompression geometry;
- deep fracture inheritance;
- trench and arc organization;
- anomalous gravity or magnetic structure;
- mantle-transition-zone disturbance;
- directional western Pacific fracture patterns;
- high-energy melt or shock indicators; and
- geological evidence not exhausted by the later subduction history.

The recognized Mariana arc–trench expression is much younger than the provisional event age [12, 13]. The terminal-response claim therefore requires an older carrier state or precursor signature that is distinguishable from the younger visible system. Paper I does not assume that the modern trench geometry is the unchanged event-time surface.

2.6 Mauna Kea Is a Secondary Claim

Mauna Kea and the Hawaiian lithospheric system are not one of the three primary geometric anchors.

The original investigation treated Mauna Kea as a pre-existing structure affected by far-field displacement associated with the Mariana exit.

That claim requires separate chronology, reference-frame analysis, paleomagnetism, plate reconstruction, and mechanics.

It will therefore be examined only after the primary Aegean–Everest–Mariana geometry and mechanism have been established.

Failure of the Mauna Kea claim does not by itself reject the primary three-anchor reconstruction.

3 Claim Hierarchy

The framework will be evaluated through the following hierarchy.

Level	Claim class	Required result
0	Observed kinematics	Earth's lithospheric plates possess measurable relative directions and velocities.
1	Present-day geometry	The selected Aegean and Mariana regions define a reproducible path whose midpoint direction falls near the Everest region.
2	Robust geometry	The relationship survives reasonable variation in coordinate choice, Earth model, regional definition, and uncertainty.
3	Deep-time geometry	The relationship remains viable after reconstruction toward the proposed 256 Ma interval.
4	Regional forensic signatures	The Aegean, Everest, and Mariana regions preserve differentiated evidence compatible with entrance, midpoint, and exit roles.
5	Physical mechanism	A physically admissible event can generate the required transmission, stress, excavation, and continuing plate-scale effects.
6	Global sequencing	Additional plate boundaries, mountains, trenches, basins, and motion vectors can be reconstructed through the wider event sequence.
7	Causal replacement	The framework explains and predicts the observed global organization more successfully than Plate Tectonics.

No higher-level claim may be declared established solely because a lower-level claim succeeds.

A midpoint alignment does not establish penetration mechanics.

A feasible impact model does not establish the proposed geography.

A successful regional reconstruction does not establish global replacement.

Every event used in a replacement argument must earn every dependency level required by that event-specific claim.

The broader framework does not require this particular flagship event to succeed unless a frozen global model explicitly declares the flagship event indispensable.

Let the flagship event be indexed by $k = F$. Its Paper-I viable set is

$$\mathcal{V}_{I,F} = \mathcal{V}_{\text{coordinates},F} \cap \mathcal{V}_{\text{geometry},F} \cap \mathcal{V}_{\text{paleogeography},F} \cap \mathcal{V}_{\text{chronology},F} \cap \mathcal{V}_{\text{null},F}. \tag{2}$$

If

$$\mathcal{V}_{I,F} = \varnothing, \tag{3}$$

the Aegean–Everest–Mariana event is removed from the eligible event catalog in its current form. That result does not, by itself, empty the viable sets of independently specified candidate events.

4 Scope of Paper I

Paper I addresses Levels 1 through 4 of the claim hierarchy.

Its primary research questions are:

Q1. Do the declared Aegean and Mariana coordinates define a reproducible great-circle relationship with the Everest region?

Q2. Does the normalized midpoint direction of the Aegean–Mariana endpoint vectors fall near Everest?

Q3. What is the exact midpoint angular misfit?

Q4. What are the exact Aegean-to-Everest and Everest-to-Mariana surface distances?

Q5. What are the corresponding interior-chord quantities?

Q6. Is the reported approximate symmetry real under standard calculations?

Q7. How sensitive are the results to alternative regional centroids?

Q8. How often would a comparable mountain or structural high fall near the midpoint of two selected global endpoints by chance?

Q9. Does the geometry survive plausible paleogeographic reconstruction?

Q10. Do the three regions preserve geological or geophysical signatures consistent with differentiated entrance, midpoint, and exit roles?

Q11. Are those signatures sufficiently specific and internally constrained to distinguish the event interpretation from generic regional deformation, background geological processes, and chance spatial correspondence without requiring a narrative-by-narrative literature comparison?

Q12. What findings would directly reject the reconstruction?

4.1 Claims Reserved for Paper II

Paper I does not attempt to complete:

- the final impactor mass and velocity solution;
- the final entry-angle solution;
- detailed shock propagation;
- mantle rheology;
- phase-boundary interaction;
- midpoint pressure focusing;
- exit excavation mechanics;
- long-duration stress transmission;
- planetary rotation changes; or
- a complete Earth-survival analysis.

These belong to Paper II.

4.2 Claims Reserved for Paper III

Paper I does not attempt to reconstruct the complete present-day plate-motion field.

The following belong to Paper III:

- global plate-boundary inheritance;
- plate-vector initialization;
- velocity inheritance and decay;
- reactivation by later impacts;
- global mountain and trench organization;
- ocean-ridge formation;
- transform-boundary inheritance;
- basin development;
- hotspot relationships; and
- the full event catalog.

4.3 Reserved Directional and Material-Displacement Hypotheses

The author has intentionally reserved additional directional, material-displacement, and candidate land-reorganization hypotheses for later research. They are outside the evidentiary scope of Paper I and are not enumerated here. Their omission is deliberate: the flagship entrance–middle-mountain–terminal problem must stand or fail without requiring a larger catalog of visually suggestive terrain relationships.

Reserved hypotheses receive no evidentiary credit in Paper I. They may not be invoked to repair a failed midpoint relation, supply missing mechanics, explain away an unfavorable marker, or increase the apparent specificity of the flagship event after the result is known. Conversely, a reserved feature is not a failed Paper-I prediction unless Paper I explicitly declared that feature to be mandatory for the flagship claim.

Scope-reservation firewall.
A later directional or material-displacement hypothesis can become evidence only in a separately frozen study with its own geometry, chronology, mechanics, provenance, null model, and falsifiers. Until then its status is `SCOPE-RESERVED`, not supporting evidence and not a rescue condition.

4.4 Claims Reserved for Paper IV

Paper I does not declare that the replacement standard has been met.

Paper IV will determine whether the cumulative results justify:

1. supplementation;
2. causal reinterpretation;
3. partial replacement;
4. full replacement; or
5. rejection.

5 Formal Definitions

5.1 Astro-Ballistic

Astro-ballistic describes an externally initiated body, force, or event whose trajectory, momentum, energy deposition, or induced planetary response can be reconstructed through ballistic constraints.

The term does not assume in advance that every candidate structure is impact-derived.

It defines the class of initiating mechanisms being tested.

5.2 Chronostratigraphic

Chronostratigraphic refers to the placement and ordering of events within the geological record.

The framework requires correlations among:

- dated strata;
- unconformities;
- extinction boundaries;
- sedimentary transitions;

- volcanic intervals;
- geochemical anomalies;
- magnetic changes;
- deformation episodes; and
- delayed structural responses.

5.3 Sequencing

Sequencing means that the proposed observations are placed in an ordered causal and temporal structure.

A valid sequence must constrain:

$$\{\text{where}, \text{when}, \text{direction}, \text{order}, \text{mechanism}, \text{prediction}\}.$$

5.4 Forensic Geophysics

Forensic geophysics is the reconstruction of prior planetary events from their surviving physical consequences.

The term emphasizes that the present Earth is treated as evidence.

The investigation asks what sequence of forces is capable of producing the surviving configuration.

5.5 Entrance Structure

An *entrance structure* is the region proposed to preserve the initiating interaction between an incoming astro-ballistic body or force and Earth.

An entrance interpretation requires evidence beyond superficial shape.

5.6 Interior Transmission Path

An *interior transmission path* is the proposed route through which momentum, pressure, shock, fracture, thermal energy, phase disturbance, or another mechanical response connects the entrance and terminal-response regions.

The straight chord is the first geometric approximation.

It is not automatically the final physical trajectory.

5.7 Midpoint Response

A *midpoint response* is a structural expression associated with the geometric or mechanical middle region of the proposed path.

Possible mechanisms include:

- maximum penetration depth;

- pressure focusing;
- compressive loading;
- phase-boundary interaction;
- mantle displacement;
- crustal inheritance; or
- later tectonic amplification of an earlier structure.

5.8 Terminal-Response Domain

A *terminal-response domain* is the region proposed to preserve the terminal interaction of the transmitted event with the lithosphere, crust, hydrosphere, and atmosphere.

Its expected morphology may differ substantially from the entrance structure.

5.9 Plate-Motion Inheritance

Plate-motion inheritance is the proposition that present plate directions and relative velocities retain measurable components of earlier high-energy forcing.

The observed motion field may be:

- initiated by one event;
- redirected by later events;
- constrained by inherited boundaries;
- accelerated or resisted by regional structure;
- modified by gravity and mantle coupling; and
- sustained through continuing mechanical interactions.

The theory therefore permits present internal dynamics while assigning the origin and organization of the motion field to sequenced external forcing.

6 Mathematical Program of Paper I

6.1 Coordinate Representation

For latitude ϕ and longitude λ, a surface point on an idealized spherical Earth is represented by the unit vector

$$\boldsymbol{\xi}(\phi,\lambda) = \begin{pmatrix} \cos\phi\cos\lambda \\ \cos\phi\sin\lambda \\ \sin\phi \end{pmatrix}. \tag{4}$$

Its Earth-centered position vector is

$$\mathbf{x} = R_{\oplus}\boldsymbol{\xi}. \tag{5}$$

Paper I will calculate the declared coordinates at full available precision rather than relying on rounded intermediate values.

6.2 Central Angle

For two unit vectors $\boldsymbol{\xi}_i$ and $\boldsymbol{\xi}_j$, the central angle is

$$\theta_{ij} = \arccos\left(\boldsymbol{\xi}_i \cdot \boldsymbol{\xi}_j\right). \tag{6}$$

The corresponding spherical surface distance is

$$D_{ij}^{\text{surface}} = R_{\oplus}\theta_{ij}. \tag{7}$$

These equations will be applied independently to:

$$D_{A\to E}^{\text{surface}}, \tag{8}$$
$$D_{E\to M}^{\text{surface}}, \tag{9}$$
$$D_{A\to M}^{\text{surface}}, \tag{10}$$

where A, E, and M denote the Aegean, Everest, and Mariana coordinates.

6.3 Great-Circle Cross-Track Misfit

The paper will determine whether Everest lies on, or near, the Aegean–Mariana great-circle arc.

The cross-track angular distance will be calculated separately from the midpoint misfit.

This distinction prevents three different propositions from being collapsed:

1. Everest lies near the same great circle;
2. Everest lies between the selected endpoints; and
3. Everest lies near the midpoint of the endpoint relationship.

6.4 Interior Chord

Let

$$\boldsymbol{\xi}_A = \boldsymbol{\xi}\left(\phi_A, \lambda_A\right), \tag{11}$$
$$\boldsymbol{\xi}_M = \boldsymbol{\xi}\left(\phi_M, \lambda_M\right). \tag{12}$$

The straight interior chord is

$$\mathbf{C}(s) = R_{\oplus}\left[(1-s)\boldsymbol{\xi}_A + s\boldsymbol{\xi}_M\right], \qquad s \in [0,1]. \tag{13}$$

The chord length is

$$L_{\text{chord}} = 2R_{\oplus}\sin\left(\frac{\theta_{AM}}{2}\right). \tag{14}$$

The minimum radial distance of the chord from Earth's center is

$$r_{\text{min}} = R_{\oplus}\cos\left(\frac{\theta_{AM}}{2}\right), \tag{15}$$

and the corresponding maximum depth beneath the idealized surface is

$$d_{\text{max}} = R_{\oplus} - r_{\text{min}}. \tag{16}$$

These quantities determine whether the proposed path intersects the upper mantle, lower mantle, core–mantle boundary, or core under the selected geometry.

6.5 Midpoint Direction

The physical midpoint of the chord is

$$\mathbf{C}\left(\frac{1}{2}\right) = \frac{R_{\oplus}}{2}\left(\boldsymbol{\xi}_A + \boldsymbol{\xi}_M\right). \tag{17}$$

The corresponding normalized radial direction is

$$\widehat{\mathbf{m}} = \frac{\boldsymbol{\xi}_A + \boldsymbol{\xi}_M}{\|\boldsymbol{\xi}_A + \boldsymbol{\xi}_M\|}. \tag{18}$$

Let

$$\boldsymbol{\xi}_E = \boldsymbol{\xi}\left(\phi_E, \lambda_E\right) \tag{19}$$

represent the Everest coordinate.

The angular midpoint misfit is

$$\Delta_{\text{mid}} = \arccos\left(\widehat{\mathbf{m}} \cdot \boldsymbol{\xi}_E\right). \tag{20}$$

The corresponding surface separation is

$$D_{\text{mid}} = R_{\oplus}\Delta_{\text{mid}}. \tag{21}$$

The previously proposed working viability band of approximately 5° is retained as a T2 source-working threshold for audit continuity. It is not treated as an independently justified geological or confirmatory cutoff.

Paper I reports sensitivity across multiple geometric bands. Any future T3 rejection threshold must be frozen before the corresponding reconstruction holdout is evaluated.

6.6 Path-Symmetry Measure

The sum-normalized surface-distance asymmetry will be defined as

$$\mathcal{A}_{\text{surface}} = \frac{\left| D^{\text{surface}}_{A\to E} - D^{\text{surface}}_{E\to M} \right|}{D^{\text{surface}}_{A\to E} + D^{\text{surface}}_{E\to M}}. \tag{22}$$

A corresponding dimensional difference is

$$\Delta D_{\text{surface}} = \left| D^{\text{surface}}_{A\to E} - D^{\text{surface}}_{E\to M} \right|. \tag{23}$$

Chord-based measures will be defined separately.

The paper will not refer to surface arcs and interior chord segments as though they were the same distance.

6.7 Coordinate-Uncertainty Model

Each principal coordinate will be treated as either:

1. a fixed point;
2. a circular uncertainty region;
3. an irregular geological target region; or
4. an ensemble of plausible centroids.

Monte Carlo sampling will generate a distribution of:

$$\Delta_{\text{mid}}, \tag{24}$$

$$\mathcal{A}_{\text{surface}}, \tag{25}$$

$$d_{\max}, \tag{26}$$

$$L_{\text{chord}}. \tag{27}$$

This converts a single favorable geometry into a robustness test.

6.8 Deep-Time Reconstruction Is Branch-Conditional

Present-day geometry is an auditable baseline, but it is not by itself a reconstruction of the specific proposed initiating event at 256 Ma.

The named Aegean, Everest, and Mariana regions are therefore treated first as present-day response domains. They are not silently assumed to be the same material parcels, the same surface positions, or the same deep-Earth intersection points at the specific initiating age.

6.8.1 Evidence-Origin Classes

Deep-time inputs are separated into four classes:

Measurement-proximal constraint
: A dated sample, stratigraphic relation, paleomagnetic direction, provenance relation, pressure–temperature–time path, mapped discontinuity, or other observation with an explicit uncertainty.

Material-lineage hypothesis
: A proposed correspondence between a present response domain and one or more older material parcels, terranes, lithospheric domains, or mantle structures.

Model-derived reconstruction
: A coordinate, polygon, rotation, or history produced by a declared reconstruction model. It remains conditional on that model and is not counted as an observation merely because it is published.

Astro-ballistic reconstruction constraint
: A geometry, direction, chronology, or material-path requirement proposed by this framework and tested against the other classes.

No model-derived reconstruction is granted automatic priority over the measurement-proximal constraints from which it was inferred.

6.8.2 Reference-Frame and Lineage Branches

Let the admissible frame family be

$$\mathfrak{F} = \{f_{\text{Earth}}, f_{\text{mantle}}, f_{\text{lineage}}\}, \tag{28}$$

where the branches represent, respectively, an Earth-fixed ballistic axis, a mantle-relative axis, and a material-lineage reconstruction. These branches are alternatives to be tested, not quantities to be averaged after the outcome is known.

For present response domain $j \in \{A, E, M\}$, let Ω_j^0 denote its present spatial domain and let $\ell_{j,q}$ denote candidate material-lineage branch q. For reconstruction model k, frame f, and age before present a, define

$$\boldsymbol{\xi}_j^{(k,f,q)}(a) = \mathcal{R}_{k,f}\left(a; \Omega_j^0, \ell_{j,q}\right). \tag{29}$$

The simple transport of a modern point coordinate is retained only as a baseline branch. The general reconstruction must permit domain uncertainty, parcel splitting, terrane transfer, rotation, deformation, subduction, accretion, and later overprint.

For each branch, the reconstructed midpoint misfit is

$$\Delta_{\mathrm{mid}}^{(k,f,q)}(a) = \arccos\left[\widehat{\mathbf{m}}^{(k,f,q)}(a) \cdot \boldsymbol{\xi}_E^{(k,f,q)}(a)\right]. \tag{30}$$

The hypothesis is evaluated across a preregistered ensemble of frame, lineage, and reconstruction branches rather than against one preferred map.

6.8.3 Material-Lineage Graph

Define a lineage graph

$$\mathcal{G}_{\mathrm{lin}} = (\mathcal{N}_{\mathrm{lin}}, \mathcal{E}_{\mathrm{lin}}), \tag{31}$$

whose nodes are material parcels or domains and whose directed edges record admissible transitions such as rotation, deformation, fragmentation, merger, accretion, subduction, exhumation, erosion, reactivation, or overprint.

A present regional label may be connected to more than one older parcel. Conversely, one older parcel may contribute to more than one present response domain. A claimed event-time correspondence is therefore a lineage proposition that must be supported; it is not a naming convention.

6.8.4 Chronology State and Delayed Expression

Use age before present a, with older ages larger. For the flagship candidate event define

$$\mathbf{C}_F = (a_{\mathrm{init},F}, \sigma_{a,\mathrm{init},F}, a_{\mathrm{marker}}, a_{\mathrm{seed}}, a_{\mathrm{reactivation}}, a_{\mathrm{expression}}, a_{\mathrm{observation}}). \tag{32}$$

An event-generated marker must satisfy

$$|a_{\mathrm{marker}} - a_{\mathrm{init},F}| \leq \sqrt{(\Delta a_{\mathrm{marker}})^2 + \sigma_{a,\mathrm{init},F}^2}. \tag{33}$$

For a structure assigned to delayed flagship inheritance, the required age ordering is

$$a_{\mathrm{init},F} \geq a_{\mathrm{seed}} \geq a_{\mathrm{reactivation}} \geq a_{\mathrm{expression}} \geq 0, \tag{34}$$

with equality permitted where the seed is formed promptly or the visible expression is itself the reactivation. A later reactivation or surface expression may therefore be younger than the initiating event. Its younger age does not by itself reject an older inherited condition, but the manuscript must identify the intermediate carrier, its persistence mechanism, and evidence that it existed before reactivation.

6.8.5 Specific-Age Integrity Rule

The parameter $a_{\text{init},F} = 256$ Ma is frozen before testing. An uncertainty or sensitivity envelope represents chronometric and reconstruction error around that specific assignment; it is not permission to move the initiating event to whichever age produces the most favorable geometry or regional correspondence.

6.8.6 Scoped Chronology and Lineage Falsification

A frame or lineage branch fails when its geometry, chronology, or material continuity is incompatible with the frozen constraints. Failure of one branch does not reject the others.

The flagship event-time geographic assignment is rejected only when

$$\bigcup_{k,f,q} \mathcal{V}_{\text{geo},F}^{(k,f,q)} = \varnothing \tag{35}$$

for the preregistered branch family and adequate data. Missing lineage data, unavailable event-time coordinates, or an unrun reconstruction remain `UNRESOLVED`; they are not converted into either confirmation or falsification.

6.9 Statistical Null Test

A geometric relationship can appear striking after the endpoints and midpoint target have been selected.

Paper I will therefore define null distributions based on:

- random global endpoint pairs;
- random trench–basin endpoint pairs;
- random mountain targets;
- globally ranked mountain systems;
- globally ranked trench systems;
- regional target areas;
- coordinate uncertainty; and
- correction for multiple comparisons.

Let T_{obs} denote a selected geometric test statistic.

For N null simulations, the empirical probability is

$$p_{\text{emp}} = \frac{1 + \sum_{n=1}^{N} \mathbf{1}\left[T_n \le T_{\text{obs}}\right]}{N+1}, \tag{36}$$

where a smaller value of T represents a closer fit.

The specific statistic and selection protocol must be declared before interpretation.

6.10 Discovery-Process and Causal-Leakage Control

The geometry was discovered using observations that are also part of the proposed evidentiary record. Those observations may establish reconstruction fit, but they cannot simultaneously function as independent causal validation.

The Paper-I analysis must therefore separate:

1. the discovery set used to identify the candidate triplet;
2. the calibration set used to define target regions and uncertainty;
3. the validation set used to test the frozen geometric and chronological model;
4. and independent regional markers not used to select the three targets.

A null ensemble must reproduce the effective search opportunity, including rejected targets, alternate centroids, inspected map scales, and tested age windows. Failure to reconstruct the discovery process is recorded as `SELECTION-SPACE-INCOMPLETE` rather than treated as a valid significance result.

7 Audit and Reproducibility Policy

7.1 Declared Inputs Versus Calculated Outputs

All inherited numerical values will be classified as one of the following:

Declared input
: A coordinate, physical constant, event age, parameter range, or modeling assumption selected for analysis.

Calculated output
: A result that must follow reproducibly from the declared inputs.

Interpretive output
: A geological or physical conclusion drawn from calculated results.

Unverified inherited value
: A number appearing in prior work that has not yet been independently recalculated.

Unverified inherited values will not be promoted to calculated outputs without audit.

7.2 Equation Audit

Every equation will be checked for:

1. dimensional consistency;
2. symbol definition;
3. unit consistency;

4. numerical substitution;
5. rounding error;
6. dependency on assumptions;
7. sensitivity to parameter ranges; and
8. consistency across all four papers.

7.3 Claim Audit

Every major claim will be assigned:

- a unique claim identifier;
- a paper and section location;
- supporting equations;
- supporting observations;
- required datasets;
- alternative explanations;
- uncertainty status;
- verification status; and
- explicit falsification conditions.

7.4 No Hidden Rescue Conditions

A failed result may motivate revision, but it cannot be silently rescued by changing:

- the target coordinate;
- the event age;
- the definition of midpoint;
- the definition of the path;
- the reference frame;
- the acceptable tolerance; or
- the claimed mechanism

after the failure is known without documenting the change as a new model version.

7.5 Version Control

Each frozen manuscript version will report:

1. the selected coordinates;

2. the equations used;
3. the parameter ranges;
4. the datasets used;
5. the reconstruction models used;
6. the code version;
7. raw and processed file checksums;
8. transformation-lineage records;
9. the resulting numerical values;
10. all changed claims; and
11. all unresolved failures.

8 Earth Model and Numerical Conventions

8.1 Reference Sphere

The first reconstruction uses a spherical Earth with mean radius

$$R_\oplus = 6371\,\text{km} = 6.371 \times 10^6\,\text{m}. \tag{37}$$

This model is used because the original geometric claim was formulated on a sphere and because the principal quantities—central angles, great-circle distances, chord lengths, and midpoint directions—have closed-form expressions under that approximation.

The spherical result is not treated as the final geodetic result.

An ellipsoidal distance calculation using the World Geodetic System 1984 reference ellipsoid is included as a first sensitivity check [8, 7].

8.2 Angular Convention

Latitude is denoted by ϕ, longitude by λ, and all trigonometric calculations use radians.

North latitude and east longitude are positive.

For every declared coordinate,

$$\phi_{\text{rad}} = \phi_{\text{deg}}\frac{\pi}{180}, \qquad \lambda_{\text{rad}} = \lambda_{\text{deg}}\frac{\pi}{180}. \tag{38}$$

8.3 Numerical Precision

The calculations in this section retain at least eight decimal places for unit-vector components and at least six decimal places for angular outputs before final rounding.

Displayed distances are generally rounded to the nearest metre or nearest 0.001 km.

The retained precision is computational rather than geological.

It does not imply that the selected regional coordinates are known to metre-scale accuracy.

8.4 Separation of Four Geometric Concepts

Four quantities must remain distinct:

1. **surface distance:** the shortest great-circle distance between two surface points;
2. **great-circle alignment:** whether a third point lies near the plane of the great circle defined by two endpoints;
3. **along-track position:** where the third point projects along the endpoint-to-endpoint great-circle route; and
4. **interior chord geometry:** the straight line segment joining the two endpoint position vectors through the idealized Earth.

Near-equality of two endpoint-to-target distances does not by itself prove that the target lies on the endpoint great circle.

Likewise, a target may occupy the halfway station along an endpoint axis while remaining substantially displaced from that axis in the cross-track direction.

This distinction becomes central to the audited result.

9 Declared Coordinates and Unit Vectors

9.1 Inherited Coordinate Set

The first audit preserves the coordinate set declared in the original Aegean–Everest–Mariana manuscript.

Target	**Latitude**	**Longitude**	**Proposed forensic role**
Mini Aegean region	36.47°N	22.95°E	Candidate entrance
Mount Everest	27.99°N	86.93°E	Candidate midpoint-region response
Challenger Deep / Mariana	11.32°N	142.25°E	Candidate exit

These coordinates are inputs to the audit.

They are not yet defended as optimal geological centroids.

9.2 Coordinates in Radians

The corresponding angular coordinates are

$$\phi_A = 0.6365215782, \qquad \lambda_A = 0.4005530633, \tag{39}$$
$$\phi_E = 0.4885176576, \qquad \lambda_E = 1.5172147188, \tag{40}$$
$$\phi_M = 0.1975712713, \qquad \lambda_M = 2.4827308610. \tag{41}$$

Here and throughout Paper I,

$$A = \text{Aegean}, \qquad E = \text{Everest}, \qquad M = \text{Mariana}.$$

9.3 Audited Unit Vectors

Using equation (4), the unit vectors are

$$\boldsymbol{\xi}_A = \begin{pmatrix} 0.74051465 \\ 0.31356745 \\ 0.59440181 \end{pmatrix}, \tag{42}$$

$$\boldsymbol{\xi}_E = \begin{pmatrix} 0.04729151 \\ 0.88176224 \\ 0.46931745 \end{pmatrix}, \tag{43}$$

and

$$\boldsymbol{\xi}_M = \begin{pmatrix} -0.77530766 \\ 0.60030733 \\ 0.19628843 \end{pmatrix}. \tag{44}$$

Their pairwise dot products are

$$\boldsymbol{\xi}_A \cdot \boldsymbol{\xi}_E = 0.5904751269, \tag{45}$$
$$\boldsymbol{\xi}_E \cdot \boldsymbol{\xi}_M = 0.5847844529, \tag{46}$$
$$\boldsymbol{\xi}_A \cdot \boldsymbol{\xi}_M = -0.2692156454. \tag{47}$$

The close similarity of the first two dot products anticipates the near-equality of the Aegean–Everest and Everest–Mariana surface distances.

10 Present-Day Pairwise Surface Geometry

10.1 Aegean to Everest

From equation (6),

$$\theta_{AE} = \arccos\left(\boldsymbol{\xi}_A \cdot \boldsymbol{\xi}_E\right) = 0.9391488965 \text{ rad.} \tag{48}$$

Equivalently,

$$\theta_{AE} = 53.809268^\circ. \tag{49}$$

The corresponding spherical surface distance is

$$D_{AE}^{\text{surface}} = R_\oplus \theta_{AE} = 5983.318\,\text{km}. \tag{50}$$

10.2 Everest to Mariana

The Everest–Mariana central angle is

$$\theta_{EM} = 0.9461820120 \text{ rad} = 54.212236^\circ. \tag{51}$$

The corresponding spherical surface distance is

$$D_{EM}^{\text{surface}} = 6028.126\,\text{km}. \tag{52}$$

10.3 Aegean to Mariana

The direct Aegean–Mariana central angle is

$$\theta_{AM} = 1.8433748423 \text{ rad} = 105.617599^\circ. \tag{53}$$

The corresponding direct great-circle distance is

$$D_{AM}^{\text{surface}} = 11\,744.141\,\text{km}. \tag{54}$$

The exact central angle obtained from the declared coordinates is therefore approximately 1.8434 rad, rather than the order-of-magnitude value of 1.6 rad used in the earlier draft.

10.4 Pairwise Distance Table

Table 5: Audited spherical pairwise geometry for the declared coordinates.

Pair	Angle (rad)	Angle (deg)	Surface distance
Aegean–Everest	0.9391488965	53.809268°	5983.318 km
Everest–Mariana	0.9461820120	54.212236°	6028.126 km
Aegean–Mariana	1.8433748423	105.617599°	11 744.141 km

10.5 Distance Symmetry

The absolute difference between the two Everest-centered distances is

$$\Delta D_{\text{surface}} = \left| D_{AE}^{\text{surface}} - D_{EM}^{\text{surface}} \right| = 44.808\,\text{km}. \tag{55}$$

The sum-normalized asymmetry is

$$\mathcal{A}_{\text{surface}} = 0.00373044, \tag{56}$$

or

$$100\mathcal{A}_{\text{surface}} = 0.373044\%. \tag{57}$$

This percentage uses the sum of the two path lengths in the denominator, as defined in equation (22). A mean-normalized percentage would be twice as large and must not be substituted for this registered sum-normalized statistic.

Thus, under the declared coordinates, Everest is nearly equidistant from the selected Aegean and Mariana endpoints.

The two distances are both close to 6000 km.

This numerical symmetry is supported by the audit.

Audited geometric finding G1.
Using the declared coordinates, the Aegean–Everest and Everest–Mariana spherical surface distances differ by only 44.808 km, corresponding to a normalized asymmetry of approximately 0.373%.

10.6 Path Excess Through Everest

The sum of the two Everest-centered surface distances is

$$D_{AE}^{\text{surface}} + D_{EM}^{\text{surface}} = 12\,011.443\,\text{km}. \tag{58}$$

This exceeds the direct Aegean–Mariana great-circle distance by

$$\Delta D_{\text{excess}} = D_{AE}^{\text{surface}} + D_{EM}^{\text{surface}} - D_{AM}^{\text{surface}} = 267.302\,\text{km}. \tag{59}$$

The positive excess demonstrates that Everest does not lie exactly on the shortest Aegean–Mariana great-circle arc.

The small bilateral distance asymmetry and the nonzero path excess are not contradictory.

They measure different geometric properties.

11 Ellipsoidal Distance Check

A first-order ellipsoidal check was performed using the World Geodetic System 1984 reference ellipsoid.

The resulting geodesic distances are

Table 6: Spherical and ellipsoidal surface-distance comparison.

Pair	**Spherical distance**	**Ellipsoidal distance**
Aegean–Everest	5983.318 km	5994.970 km
Everest–Mariana	6028.126 km	6033.866 km
Aegean–Mariana	11 744.141 km	11 758.920 km

Under the ellipsoidal calculation, the two Everest-centered distances differ by

$$\Delta D_{\text{ellipsoid}} = 38.896\,\text{km}, \tag{60}$$

with normalized asymmetry

$$\mathcal{A}_{\text{ellipsoid}} = 0.00323357, \tag{61}$$

or approximately 0.323%.

The near-equal-distance result is therefore not an artifact of the spherical approximation.

Audited geometric finding G2.
The bilateral Aegean–Everest–Mariana distance symmetry persists under an ellipsoidal Earth model.

12 Audited Interior Chord Geometry

12.1 Chord Length

Using the audited endpoint angle from equation (53), the straight Aegean–Mariana chord length is

$$L_{\text{chord}} = 2R_{\oplus} \sin\left(\frac{\theta_{AM}}{2}\right) \tag{62}$$

$$= 10\,150.567\,\text{km}. \tag{63}$$

The physical half-chord length is therefore

$$\frac{L_{\text{chord}}}{2} = 5075.284\,\text{km}. \tag{64}$$

This result requires a terminology correction.

The approximately 6000 km Aegean–Everest and Everest–Mariana quantities are surface distances.

They are not half-chord lengths.

The audited values are:

$$\text{approximate half-surface-path scale} \approx 6000\,\text{km}, \tag{65}$$

$$\text{physical half-chord length} = 5075.284\,\text{km}. \tag{66}$$

12.2 Chord Midpoint Radius

The radial distance of the chord midpoint from Earth's center is

$$r_{\min} = R_{\oplus} \cos\left(\frac{\theta_{AM}}{2}\right) \tag{67}$$

$$= 3851.122\,\text{km}. \tag{68}$$

The corresponding maximum depth beneath the spherical surface is

$$d_{\max} = R_{\oplus} - r_{\min} \tag{69}$$

$$= 2519.878\,\text{km}. \tag{70}$$

The idealized straight chord therefore reaches the lower mantle but does not intersect the core–mantle boundary under the declared coordinates and spherical model.

12.3 Physical Midpoint Vector

The physical midpoint of the chord is

$$\mathbf{C}\left(\frac{1}{2}\right) = \begin{pmatrix} -110.833\,\text{km} \\ 2911.148\,\text{km} \\ 2518.744\,\text{km} \end{pmatrix}. \tag{71}$$

Its norm is

$$\left\| \mathbf{C}\left(\frac{1}{2}\right) \right\| = 3851.122\,\text{km}. \tag{72}$$

The normalized radial midpoint direction is

$$\widehat{\mathbf{m}} = \begin{pmatrix} -0.02877944 \\ 0.75592215 \\ 0.65402863 \end{pmatrix}. \tag{73}$$

Converted back to geographic coordinates, this direction intersects the surface at approximately

$$\phi_{\text{mid}} = 40.846036^\circ\text{N}, \qquad \lambda_{\text{mid}} = 92.180310^\circ\text{E}. \tag{74}$$

13 Everest Midpoint Audit

13.1 Normalized Midpoint Misfit

Using the normalized midpoint direction in equation (73) and the Everest unit vector,

$$\widehat{\mathbf{m}} \cdot \boldsymbol{\xi}_E = 0.9721296327. \tag{75}$$

The resulting angular midpoint misfit is

$$\begin{aligned} \Delta_{\text{mid}} &= \arccos\left(\widehat{\mathbf{m}} \cdot \boldsymbol{\xi}_E\right) && (76) \\ &= 0.2366465684 \text{ rad} && (77) \\ &= 13.558849^\circ. && (78) \end{aligned}$$

The corresponding spherical surface separation is

$$D_{\text{mid}} = 1507.675\,\text{km}. \tag{79}$$

The declared present-day coordinates therefore do not place Everest within the previously proposed 5° midpoint band.

Audited geometric result G3.
The present-day Everest coordinate lies approximately 13.559°, or 1507.675 km, from the normalized surface direction of the Aegean–Mariana chord midpoint.
The original present-day chord-midpoint claim is not supported by the declared coordinates under the spherical model.

13.2 Great-Circle Plane

Define the unit normal to the Aegean–Mariana great-circle plane as

$$\widehat{\mathbf{n}}_{AM} = \frac{\boldsymbol{\xi}_A \times \boldsymbol{\xi}_M}{\|\boldsymbol{\xi}_A \times \boldsymbol{\xi}_M\|}. \tag{80}$$

The signed cross-track angular displacement of Everest is

$$\delta_{\mathrm{xt}} = \arcsin\left(\boldsymbol{\xi}_E \cdot \widehat{\mathbf{n}}_{AM}\right). \tag{81}$$

For the declared coordinates,

$$\delta_{\mathrm{xt}} = -13.557246°. \tag{82}$$

Its magnitude corresponds to

$$D_{\mathrm{xt}} = 1507.497\,\mathrm{km}. \tag{83}$$

The sign records which side of the oriented Aegean–Mariana great-circle plane contains Everest.

The magnitude is the relevant alignment quantity.

13.3 Along-Track Position

The angular along-track position of the perpendicular projection of Everest onto the Aegean–Mariana great circle is

$$\delta_{\mathrm{at}} = \operatorname{atan2}\left[\boldsymbol{\xi}_E \cdot \left(\widehat{\mathbf{n}}_{AM} \times \boldsymbol{\xi}_A\right), \boldsymbol{\xi}_E \cdot \boldsymbol{\xi}_A\right]. \tag{84}$$

The calculated value is

$$\delta_{\mathrm{at}} = 52.598287°. \tag{85}$$

The exact half-angle between the Aegean and Mariana endpoints is

$$\frac{\theta_{AM}}{2} = 52.808799°. \tag{86}$$

The difference is only

$$\Delta_{\text{at}} = -0.210512^\circ, \tag{87}$$

corresponding to an along-track displacement of

$$D_{\text{at,offset}} = -23.408\,\text{km}. \tag{88}$$

The signed value places the projection before the exact halfway station in the oriented Aegean-to-Mariana direction. Tables and prose that report 23.408 km report the magnitude $|D_{\text{at,offset}}|$.

Thus, the perpendicular projection of Everest onto the Aegean–Mariana great circle falls only about 23 km from the exact halfway station along that great circle.

The projected point is approximately

$$40.915274^\circ\text{N}, \qquad 91.917372^\circ\text{E}. \tag{89}$$

Audited geometric finding G4.
Everest is not close to the present-day Aegean–Mariana great-circle plane, but its perpendicular projection onto that plane lies only approximately 23.408 km from the exact halfway station between the selected endpoints.

13.4 The Geometric Result Must Be Partitioned

The original term *Everest midpoint* combined three separate propositions.

The audit produces the following status:

Proposition	**Status**	**Audited result**
Everest is nearly equidistant from the selected Aegean and Mariana coordinates.	Supported	Distance difference: 44.808 km; asymmetry: 0.373%.
Everest occupies approximately the halfway station along the oriented Aegean–Mariana great-circle axis.	Supported	Projected along-track offset from exact halfway: 23.408 km.
Everest lies near the present-day Aegean–Mariana great-circle plane.	Not supported	Cross-track displacement: 1507.497 km.
Everest lies within 5° of the normalized chord midpoint direction.	Not supported	Midpoint misfit: 13.558849°.

Proposition	Status	Audited result
Everest occupied the reconstructed midpoint region near 256 Ma.	Unresolved	Requires explicit paleogeographic reconstruction and a defined mechanical path.

This partition is not cosmetic.

It changes the present evidentiary status of the theory.

The current geometry supports a precise bilateral and along-track mid-sequence relationship.

It does not, by itself, support present-day collinearity.

14 Revised Primary Geometric Finding

The rigorous present-day finding is:

> Using the declared coordinates, Mount Everest is nearly equidistant from the selected Mini Aegean and Mariana endpoints and occupies almost exactly the halfway station when projected onto the Aegean–Mariana great-circle axis.
> However, Everest is displaced approximately 13.56°, or 1507 km, from the present-day great-circle plane and normalized chord-midpoint direction.
> The present-day evidence therefore supports a bilateral mid-sequence relationship, not an exact chord-midpoint coincidence.

The replacement framework must now test whether the cross-track displacement is explained by:

1. deep-time relative plate reconstruction;
2. selection of more defensible geological entrance and terminal-response centroids;
3. post-event displacement of the target regions;
4. rotation or redirection of the mechanical transmission path;
5. a curved pressure or fracture path rather than a straight chord;
6. later tectonic reuse of a displaced midpoint-response region;
7. coordinate-selection effects; or
8. coincidence under the statistical null model.

These explanations are competing hypotheses.

They cannot be blended after the fact without explicit mathematical definitions.

14.1 Causal Status of the Flagship Geometry

The present-coordinate result is currently registered at `CAUSAL-L0`: it is a reproducible geometric association with an explicit negative result for literal present-day chord collinearity. It has not yet reached temporal compatibility, mechanical admissibility, modeled contribution, necessity, dominance, or replacement qualification.

The minimum alternative set for this geometric result is:

Alternative class	**What it can explain**	**Required discriminator**
Selection-aware coincidence	Near-bilateral spacing and a projected halfway station after global feature selection.	Opportunity-matched null catalogs reproducing the actual discovery and coordinate-selection process.
Target-definition artifact	Improved or degraded geometry caused by choosing one centroid, summit, trench point, or regional boundary.	Frozen geological target domains and full point-definition sensitivity.
Deep-time displacement	A present misfit that changes under defensible event-time material reconstruction.	Independent reconstruction ensemble with uncertainty and material lineage preserved.
Curved or redirected transmission	A midpoint response displaced from the straight reference chord.	Paper-II mechanism that predicts the curvature before fitting the midpoint and terminal targets.
Later reactivation or reuse	A regional structure aligned with an older weakness without being created directly by the event.	Chronology and counterfactual evidence separating creation from later reactivation.
Connected flagship event	One event produces entrance, path, midpoint-response, and terminal signatures.	A common mechanically viable parameter set plus differentiated regional predictions and independent markers.

No row may be removed merely because another row is narratively less appealing. The event interpretation must win through discriminating evidence rather than through the visual interest of the map.

15 Coordinate Sensitivity Framework

15.1 Why Point Coordinates Are Insufficient

The Mini Aegean Plate, central Himalaya, and Mariana system are extended geological regions.

A single coordinate can represent:

- a morphological center;
- a plate centroid;
- a basin center;

- a fracture center;
- a maximum-depth point;
- a summit;
- a reconstructed paleo-position; or
- a coordinate selected for narrative convenience.

The geometric result must therefore be tested over declared target regions.

15.2 Target Domains

Let

$$\mathcal{D}_A = \text{admissible Aegean entrance region,} \tag{90}$$
$$\mathcal{D}_E = \text{admissible Everest or Himalayan midpoint region,} \tag{91}$$
$$\mathcal{D}_M = \text{admissible Mariana terminal-response region.} \tag{92}$$

Each domain must be defined geologically before optimization.

The analysis must not search the entire Earth for coordinates that force a preferred result.

15.3 Regional Optimization

For admissible coordinates

$$a \in \mathcal{D}_A, \qquad e \in \mathcal{D}_E, \qquad m \in \mathcal{D}_M,$$

define a composite geometric objective

$$\mathcal{J}(a,e,m) = w_{\text{xt}} \frac{|\delta_{\text{xt}}|}{s_{\text{xt}}} + w_{\text{at}} \frac{|\delta_{\text{at}} - \theta_{am}/2|}{s_{\text{at}}} + w_{\text{sym}} \frac{\mathcal{A}_{\text{surface}}}{s_{\text{sym}}}, \tag{93}$$

where all angles are evaluated in radians and the positive scales s_{xt}, s_{at}, and s_{sym} make each term dimensionless. The scales and weights must be preregistered or derived from a frozen null ensemble before optimization.

This equation is not intended to guarantee one preferred coordinate set.

Its purpose is to show whether the theory survives reasonable geological definitions of its own targets.

15.4 No Coordinate Fishing

A coordinate set is inadmissible when it is selected only because it reduces the geometric misfit and lacks an independent geological justification.

For every alternate coordinate, the paper must report:

1. the geological feature represented;
2. the dataset from which the coordinate was obtained;
3. the method used to define the centroid;
4. the spatial uncertainty;
5. whether the coordinate was specified before or after the geometric result was calculated; and
6. the effect of the coordinate change on all principal geometric outputs.

16 Monte Carlo Reconstruction Design

16.1 Regional Sampling

For simulation n, sample

$$A_n \sim p_A, \qquad E_n \sim p_E, \qquad M_n \sim p_M, \tag{94}$$

where each probability distribution is derived from an independently defined geological target domain.

For each sampled triplet, calculate

$$\mathbf{z}_n = (\Delta_{\mathrm{mid},n}, \delta_{\mathrm{xt},n}, \Delta_{\mathrm{at},n}, \mathcal{A}_{\mathrm{surface},n}, L_{\mathrm{chord},n}, d_{\mathrm{max},n}) \,. \tag{95}$$

16.2 Required Reported Distributions

The analysis must report:

- median midpoint misfit;
- median cross-track displacement;
- median along-track offset;
- median distance asymmetry;
- 5%, 50%, and 95% quantiles;
- fraction of trials below the declared midpoint threshold;
- fraction of trials below the declared cross-track threshold;
- fraction retaining bilateral distance symmetry;
- correlation among coordinate choices and outputs; and
- best-fitting and worst-fitting admissible coordinate sets.

16.3 Threshold Classes and Reporting Bands

The earlier 5° band is retained as a T2 source-working test, but Paper I must also report the full continuous distribution. None of the nested reporting bands below becomes a T3 confirmatory threshold unless its rationale and decision consequence are frozen before the confirmatory dataset is inspected.

Suggested nested reporting bands are

$$\Delta \le 1^\circ, \quad \Delta \le 2.5^\circ, \quad \Delta \le 5^\circ, \quad \Delta \le 10^\circ, \quad \Delta \le 15^\circ. \tag{96}$$

These bands must not be confused with geological proof thresholds.

They are geometric reporting intervals.

17 Deep-Time Reconstruction Requirement

17.1 Present Coordinates Cannot Establish a 256 Ma Path

The proposed event predates the present configuration of the relevant plates and regions.

Consequently, the present-day calculation is only an initial forensic observation.

The central historical test is

$$\Delta^{(k)}_{\mathrm{mid}}\,(256\ \mathrm{Ma})\,, \tag{97}$$

evaluated across multiple reconstruction models k.

17.2 The Objects Being Reconstructed Must Be Defined

A major difficulty is that modern geographic landmarks are not identical to their deep-time precursors.

Paper I must distinguish among:

1. the present summit of Mount Everest;
2. the Himalayan crustal block carrying the summit;
3. the Indian plate material later incorporated into the orogen;
4. Asian lithosphere that may preserve an inherited midpoint response;
5. the present Aegean microplate;
6. older crustal material beneath or adjacent to the Aegean system;
7. the present Challenger Deep coordinate;
8. older western Pacific lithosphere; and
9. any mantle-fixed or deep-structure targets proposed to retain event memory.

The reconstruction cannot simply rotate the modern summit, trench, and microplate backward as rigid points without defending what physical material each coordinate represents.

17.3 Competing Reconstruction Tests

The theory should be tested under at least four reconstruction classes:

Surface-plate reconstruction
Reconstruct the crustal blocks carrying the modern landmarks.

Mantle-reference reconstruction
Reconstruct candidate deep structures in a mantle or hotspot reference frame.

Hybrid inheritance reconstruction
Allow an older deep structure to be expressed later through a displaced surface plate.

Null reconstruction
Use accepted plate histories without assuming an astro-ballistic connection and determine whether an equivalent midpoint relationship arises naturally.

17.4 Deep-Time Decision Rule

The present-day midpoint failure is not automatically a failure of the 256 Ma hypothesis.

However, deep-time reconstruction must materially improve the cross-track and midpoint misfit.

A rigorous decision rule is:

If a completed, independently defensible reconstruction ensemble of the relevant Aegean, Himalayan, and Mariana precursor structures fails to reduce the midpoint or cross-track misfit to a T3 viable range frozen before the confirmatory reconstruction holdout is inspected, the literal Aegean–Everest–Mariana chord-midpoint claim is rejected for that reconstruction framework.
The bilateral distance observation may remain, but it cannot be used as proof of a penetrating chordal event.

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18 Reproducibility Algorithm

The complete present-day calculation can be reproduced with the following algorithm.

Step 1. Convert the declared latitude and longitude values from degrees to radians.

Step 2. Convert each coordinate to a Cartesian unit vector using equation (4).

Step 3. Calculate all pairwise dot products.

Step 4. Calculate pairwise central angles using equation (6).

Step 5. Multiply each central angle by $R_\oplus$ to obtain spherical surface distances.

Step 6. Calculate the bilateral surface-distance difference and normalized asymmetry.

Step 7. Calculate the direct Aegean–Mariana chord length using equation (14).

Step 8. Calculate the chord midpoint radius and maximum depth.

Step 9. Normalize $\boldsymbol{\xi}_A + \boldsymbol{\xi}_M$ to obtain the midpoint direction.

Step 10. Calculate the angular separation between that direction and Everest.

Step 11. Construct the Aegean–Mariana great-circle normal.

Step 12. Calculate Everest's cross-track displacement.

Step 13. Calculate Everest's along-track projected position.

Step 14. Compare the projected position with the exact endpoint half-angle.

Step 15. Repeat using an ellipsoidal geodesic model.

Step 16. Repeat over independently defined regional coordinate domains.

Step 17. Repeat under each deep-time reconstruction model.

18.1 Audited Numerical Summary

Table 9: Audited present-day results from the declared coordinates.

Quantity	**Audited value**
Aegean–Everest spherical distance	5983.318 km
Everest–Mariana spherical distance	6028.126 km
Distance difference	44.808 km
Normalized bilateral asymmetry	0.373044%
Direct Aegean–Mariana surface distance	11 744.141 km
Path excess through Everest	267.302 km
Aegean–Mariana chord length	10 150.567 km
Physical half-chord	5075.284 km
Maximum chord depth	2519.878 km
Chord-midpoint surface direction	40.846036°N, 92.180310°E
Everest midpoint misfit	13.558849°
Everest midpoint surface separation	1507.675 km
Everest cross-track displacement	1507.497 km
Along-track offset from exact halfway	23.408 km

19 Paper-I Geometric Status After Audit

The first mathematical audit produces two strong present-day findings and one direct challenge.

19.1 Supported Finding: Bilateral Distance Symmetry

The Aegean–Everest and Everest–Mariana surface distances are approximately symmetric under both spherical and ellipsoidal models.

19.2 Supported Finding: Halfway Along-Track Station

Everest's perpendicular projection onto the Aegean–Mariana great circle lies within approximately 23 km of the exact halfway station.

19.3 Unsuccessful Present-Day Claim: Chord Collinearity

Everest is approximately 1507 km from the present-day Aegean–Mariana great-circle plane and normalized chord-midpoint direction.

The original literal present-day chord-midpoint statement must therefore be revised.

19.4 The New Burden of Proof

The theory must demonstrate that the combination of:

$$\text{near-equal endpoint distances} + \text{near-perfect halfway station} + \text{large cross-track displacement} \quad (98)$$

is better explained by a reconstructable event history than by coordinate selection or coincidence.

This is now the central geometric challenge of Paper I.

20 Chronostratigraphic Reconstruction of the Proposed 256 Ma Event

20.1 The Event Age Is a Model Parameter

The present reconstruction assigns the proposed Aegean–Everest–Mariana event a working age of

$$t_{\text{ABC}} = 256 \text{ Ma}. \quad (99)$$

This value is inherited from the original Astro-Ballistic Chronostratigraphic Sequencing investigation.

At the present stage, it is a declared hypothesis parameter rather than an independently demonstrated event date.

The chronological burden is not satisfied by showing that a major environmental or biological crisis occurred in the broad Permian interval.

The paper must identify geological observations that can be assigned to the proposed entrance, midpoint, and exit sequence and determine whether their ages are compatible with a common initiating event.

20.2 Event Time, Observed Time, and Expression Time

A single forcing event need not produce every surviving geological expression simultaneously.

The framework distinguishes among:

Initiation time t_0
: The time at which the proposed astro-ballistic body or force first interacts with the entrance region.

Transmission time t_{tr}
: The interval required for the principal mechanical disturbance to propagate through Earth.

Immediate expression time t_{imm}
: The time of shock, fracture, excavation, melting, atmospheric forcing, oceanic displacement, or other near-instantaneous effects.

Structural inheritance time t_{inh}
: The interval during which the event-created structure remains mechanically active or available for later reactivation.

Delayed expression time t_{del}
: The time at which an inherited structure is amplified, exposed, or reactivated by later crustal and mantle processes.

For regional observation j, define the lag

$$\tau_j = t_j - t_0. \tag{100}$$

The framework permits

$$\tau_j \neq 0, \tag{101}$$

but the sign, magnitude, and mechanism of each lag must be specified.

A delayed response cannot be invoked merely to reconcile incompatible ages.

20.3 Chronological Event Vector

The principal chronology can be represented as

$$\mathbf{T}_{256} = \left(t_A, t_{\mathrm{path}}, t_H, t_M, t_{\mathrm{env}}, t_{\mathrm{bio}}\right), \tag{102}$$

where

$$\begin{aligned}
t_A &= \text{candidate Aegean entrance-marker age,} && (103)\\
t_{\text{path}} &= \text{candidate deep-path disturbance age,} && (104)\\
t_H &= \text{candidate Himalayan inherited-response age,} && (105)\\
t_M &= \text{candidate Mariana terminal-response marker age,} && (106)\\
t_{\text{env}} &= \text{candidate environmental-crisis age,} && (107)\\
t_{\text{bio}} &= \text{candidate biological-crisis age.} && (108)
\end{aligned}$$

The vector does not assume equality among every component.

It exposes the chronological relationships that must be tested.

20.4 Chronological Windows

For each candidate observation j, define a measured age and uncertainty

$$t_j^{\text{obs}} \pm \sigma_j. \tag{109}$$

The model predicts

$$t_j^{\text{pred}} = t_0 + \tau_j. \tag{110}$$

A first chronological consistency statistic is

$$\chi^2_{\text{time}} = \sum_{j=1}^{N} \frac{\left(t_j^{\text{obs}} - t_j^{\text{pred}}\right)^2}{\sigma_j^2 + \sigma^2_{\text{model},j}}, \tag{111}$$

where $\sigma_{\text{model},j}$ represents uncertainty in the predicted lag or inheritance model.

The statistic cannot be evaluated until actual dated observations are identified.

Its purpose is to prevent verbal chronological correspondence from substituting for a quantitative test.

20.5 Required Chronological Classes

The chronology audit must search for and distinguish among:

1. impact-related minerals or melt products;
2. high-pressure mineral assemblages;
3. shocked or mechanically transformed material;
4. regional fault initiation or reactivation ages;
5. magmatic pulses;

6. metamorphic events;
7. basin subsidence or uplift intervals;
8. unconformities;
9. sedimentary disturbance layers;
10. geochemical excursions;
11. extinction or ecological-transition boundaries;
12. later orogenic reactivation; and
13. later subduction or trench development.

Each observation must be classified as:

$$\text{precursor}, \quad \text{immediate consequence}, \quad \text{delayed consequence}, \quad \text{later overprint}, \quad \text{unrelated}.$$

20.6 The Great Dying Association

The original framework associates the proposed event with "The Great Dying."

The rigorous paper must not treat the name of the environmental crisis as an age determination.

It must compare

$$t_{\mathrm{ABC}} \tag{112}$$

with independently dated crisis intervals and report the residual

$$\Delta t_{\mathrm{crisis}} = t_{\mathrm{ABC}} - t_{\mathrm{crisis}}. \tag{113}$$

The interpretation must then determine whether the residual is:

- consistent with measurement uncertainty;
- consistent with a pre-crisis initiating event;
- consistent with a delayed environmental cascade;
- too large for the proposed causal sequence; or
- dependent upon changing the original event date.

20.7 Chronological Failure Conditions

The 256 Ma assignment fails in its current form if:

T1. independently dated candidate entrance evidence excludes the proposed interval;

T2. independently dated candidate path evidence excludes the proposed interval;

T3. the proposed midpoint-response inheritance cannot predate the later Himalayan expression attributed to it;

T4. candidate exit evidence excludes the proposed interval;

T5. the required sequence demands mutually incompatible ages;

T6. the environmental and biological consequences precede the initiating event without an independently stated explanation;

T7. every regional age must be reassigned after the results are known; or

T8. no dated physical marker can be associated with the proposed event.

Chronostratigraphic burden C1.
The proposed 256 Ma event remains viable only if independently dated observations from the entrance, path, midpoint-response, or exit regions can be organized into one physically admissible sequence without retroactively changing the event age or inventing unconstrained delays.

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21 Material Identity Across Deep Time

21.1 Modern Landmarks Are Not Ancient Material Coordinates

The present Aegean microplate, Mount Everest summit, and Challenger Deep are modern geographic expressions.

They cannot automatically be treated as rigid markers that occupied the same positions or possessed the same morphologies at 256 Ma.

The reconstruction must identify the physical material or inherited structure represented by each target.

This is especially important because the theory proposes that later plate motion may itself be a consequence of the event sequence.

A reconstruction that assumes the complete correctness of the Plate-Tectonic history being challenged would risk circularity.

A reconstruction that ignores all known displacement would be equally inadequate.

21.2 Three Material Representations

Each target i may be represented in three different ways.

21.2.1 Surface-Landmark Representation

$$\mathbf{x}_i^{\text{landmark}}(t) \tag{114}$$

tracks the modern geographic landmark backward through a declared surface-motion model.

Examples include the summit-bearing Himalayan crust or the modern Challenger Deep location.

21.2.2 Crustal-Carrier Representation

$$\mathbf{x}_i^{\text{carrier}}(t) \tag{115}$$

tracks the crustal or lithospheric material carrying the modern landmark.

The carrier may differ substantially from the visible feature.

21.2.3 Inherited-Structure Representation

$$\mathbf{x}_i^{\text{inherit}}(t) \tag{116}$$

represents a deeper or older structural domain whose later surface expression may have migrated, rotated, or been reactivated.

This representation is central to the midpoint-response hypothesis.

21.3 Reconstruction Operators

For surface material, let

$$\mathcal{R}_i^{(k)}(t) \tag{117}$$

denote reconstruction model k for target i.

Then

$$\mathbf{x}_{i,0}^{(k)} = \mathcal{R}_i^{(k)}(t_0)\mathbf{x}_{i,\text{now}}. \tag{118}$$

For inherited structure, a more general mapping is required:

$$\mathbf{x}_{i,\text{now}} = \mathcal{I}_i\left[\mathbf{q}_{i,0}, \mathbf{H}_i(t), \mathbf{D}_i(t)\right], \tag{119}$$

where

$$\mathbf{q}_{i,0} = \text{original inherited structure}, \tag{120}$$
$$\mathbf{H}_i(t) = \text{history of later forcing}, \tag{121}$$
$$\mathbf{D}_i(t) = \text{deformation and displacement history}. \tag{122}$$

The inheritance operator $\mathcal{I}_i$ will remain conceptual until a physical model is supplied.

It cannot be used as a free parameter capable of mapping any ancient point to any modern landmark.

21.4 Target-Specific Material Questions

21.4.1 Aegean

The reconstruction must determine whether the candidate entrance target is:

- the center of a modern microplate;
- an older Tethyan crustal domain;
- an arcuate basin system;
- a deep lithospheric discontinuity;
- a mantle anomaly beneath the modern Aegean; or
- another independently defined geological structure.

21.4.2 Himalaya

The midpoint reconstruction must determine whether the target is:

- the present Mount Everest summit;
- the Everest massif;
- the central Himalayan orogenic high;
- the Indian lithospheric material later carried northward;
- the Asian lithosphere beneath the later collision zone;
- the deep mantle beneath the orogen; or
- an inherited structure later amplified by collision.

21.4.3 Mariana

The reconstruction must determine whether the candidate exit target is:

- Challenger Deep;
- the center of maximum trench curvature;
- a wider Mariana arc–trench system;
- an older western Pacific structural domain;
- a deep mantle anomaly beneath the modern trench; or
- the projected surface expression of an older terminal-response region.

21.5 Material-Identity Decision Rule

For every reported reconstruction, the manuscript must state:

1. what physical material is being moved;

2. which reference frame is used;
3. which motion model is used;
4. what deformation is permitted;
5. what uncertainty is assigned;
6. whether the target existed in recognizable form at t_0; and
7. why that target is relevant to the proposed event.

A reconstruction lacking material identity is a map transformation, not a forensic result.

22 Mini Aegean Entrance Forensics

22.1 Entrance Hypothesis

The Mini Aegean Plate region is proposed as the entrance structure of the 256 Ma event.

The source framework identifies its candidate evidentiary basis as:

- compact or rounded regional geometry;
- collapsed microplate organization;
- radial or arcuate fault patterns;
- proximity to the proposed entrance coordinate;
- directional continuity toward the interior path; and
- a relationship with adjacent depressed regions and inherited structures.

These are candidate observations.

They require independent measurement, source verification, and comparison against regional tectonic models.

22.2 Entrance Versus Ordinary Circularity

A circular or arcuate region is not sufficient evidence of an impact entrance.

Circularity can arise through many processes.

The entrance hypothesis requires a combination of geometric, chronological, mineralogical, geophysical, and directional evidence.

Let the mapped entrance-region boundary have area A_A and perimeter P_A.

Its dimensionless circularity is

$$\mathcal{C}_A = \frac{4\pi A_A}{P_A^2}, \qquad 0 < \mathcal{C}_A \leq 1. \tag{123}$$

A value approaching unity describes a circular boundary.

It does not identify the process that produced the boundary.

22.3 Radial Fault Metric

For mapped fault segment k, let

$$\alpha_k = \text{fault orientation}, \tag{124}$$
$$\beta_k = \text{radial direction from the proposed entrance center}. \tag{125}$$

Define the radiality statistic

$$\mathcal{R}_A = \frac{1}{N} \sum_{k=1}^{N} \left| \cos\left(\alpha_k - \beta_k\right) \right|. \tag{126}$$

Higher values indicate stronger radial alignment.

The null distribution must be calculated using:

- randomized entrance centers;
- randomized fault orientations;
- alternative regional boundaries; and
- comparable tectonically complex regions.

22.4 Path-Directional Metric

Let γ_{AM} be the predicted initial direction from the Aegean entrance toward the Mariana endpoint under a specified reconstruction.

Define

$$\mathcal{D}_A = \frac{1}{N} \sum_{k=1}^{N} \left| \cos\left(\alpha_k - \gamma_{AM}\right) \right|. \tag{127}$$

This metric tests whether mapped structures preferentially align with the proposed outbound force direction.

A high value is relevant only if the same orientation is not already predicted by the regional stress field under the comparison model.

22.5 Predicted Entrance Signature Classes

The entrance hypothesis predicts a structured combination of evidence.

22.5.1 Morphological Predictions

The entrance region should contain one or more of the following:

- an independently definable center;
- arcuate, concentric, or radial structures;
- asymmetric deformation consistent with a low-angle incoming trajectory;
- directional fracture organization;
- collapse or excavation geometry; and
- a transition from localized entrance deformation into a coherent outbound structural corridor.

22.5.2 Crustal and Lithospheric Predictions

The region should contain:

- anomalous crustal thickness;
- an abrupt Moho or lithosphere-asthenosphere boundary disturbance;
- a deep structural discontinuity centered on or offset from the proposed entrance;
- anisotropy aligned with the proposed trajectory; or
- a residual structure not fully explained by later regional deformation.

22.5.3 Gravity and Magnetic Predictions

The entrance model predicts one or more spatially coherent anomalies:

- a gravity low or high associated with excavation, collapse, melt, or dense intrusion;
- ring-like or asymmetric gravity structure;
- remanent magnetic disturbance;
- magnetic lineaments aligned with the outbound path; and
- depth continuity between surface morphology and deep anomalies.

An anomaly is not supportive merely because it exists.

Its shape, age, depth, and orientation must match a predeclared event prediction.

22.5.4 Mineralogical and Geochemical Predictions

A preserved entrance structure may contain:

- shocked minerals;
- high-pressure phases;
- pseudotachylitic or frictional melt products;

- anomalous melt bodies;
- brecciation;
- unusual isotopic or elemental mixing;
- deep-sourced material; or
- evidence of extreme short-duration pressure.

These observations require direct sampling and independent laboratory analysis.

22.5.5 Chronological Predictions

At least one independently dated regional marker should be compatible with the specific initiating age or with a physically defined prompt consequence.

Later deformation may obscure the original structure, but the theory requires some preserved chronological inheritance.

22.6 Entrance Null Model

The comparison model attributes Aegean structure to combinations of:

- regional convergence and extension;
- slab geometry;
- rollback;
- microplate rotation;
- inherited Tethyan structure;
- basin formation;
- magmatism; and
- later crustal deformation.

Paper I must not reject these mechanisms by declaration.

It must identify residual observations that the entrance model predicts more specifically.

22.7 Aegean Evidence Vector

Define the entrance evidence vector

$$\mathbf{E}_A = (\mathcal{C}_A, \mathcal{R}_A, \mathcal{D}_A, G_A, B_A, S_A, M_A, T_A)\,, \tag{128}$$

where

$$G_A = \text{gravity correspondence}, \tag{129}$$
$$B_A = \text{magnetic correspondence}, \tag{130}$$
$$S_A = \text{seismic-structure correspondence}, \tag{131}$$
$$M_A = \text{mineralogical correspondence}, \tag{132}$$
$$T_A = \text{chronological correspondence}. \tag{133}$$

No aggregate entrance score will be calculated until each variable is defined against an explicit null distribution.

22.8 Decisive Entrance Tests

The highest-priority entrance tests are:

A1. construct an objective boundary for the proposed entrance region;

A2. calculate circularity and ellipticity;

A3. map fault and lineament orientations;

A4. compare radiality against randomized centers;

A5. compare directional structure against the predicted path;

A6. examine crustal and lithospheric seismic models;

A7. examine gravity and magnetic residuals;

A8. identify sampling sites for high-pressure, shocked, or melt products;

A9. date candidate products; and

A10. compare the complete evidence vector with the regional tectonic explanation.

22.9 Aegean Rejection Conditions

The literal entrance claim is rejected if:

AF1. no independently definable entrance center exists;

AF2. regional circularity disappears under objective boundary mapping;

AF3. radial fault organization is statistically absent;

AF4. apparent directionality is fully predicted by later regional stress;

AF5. no deep anomaly corresponds to the proposed entrance;

AF6. no physical marker can be associated with the proposed event or its immediate aftermath;

AF7. all candidate evidence demonstrably postdates the event by an incompatible interval; or

AF8. the complete observed structure is quantitatively explained by the comparison model without a residual entrance signature.

23 Himalayan Midpoint-Response Forensics

23.1 The Midpoint Claim After the Geometry Audit

The present-day geometry does not place Mount Everest on the literal Aegean–Mariana great-circle plane.

It does produce two narrower findings:

1. Everest is nearly equidistant from the selected Aegean and Mariana endpoints; and
2. Everest's projection onto the endpoint great circle lies very near the exact halfway station.

The midpoint-response hypothesis must therefore be stated carefully.

The central Himalayan region is proposed as the later surface expression of an inherited deep response associated with the middle portion of the Aegean–Mariana event sequence.
The hypothesis does not require the modern Everest summit to have existed at 256 Ma, and it does not claim that the present summit is located on the uncorrected modern chord.

23.2 Middle Mountain Versus Geometric Midpoint

The term *middle mountain* denotes the highest or most concentrated surviving uplift expression associated with the central portion of a proposed force path.

It is not automatically identical to:

- the physical midpoint of a straight chord;
- the deepest point of a curved trajectory;
- the midpoint of the surface arc;
- the maximum-pressure point;
- the first uplifted point; or
- the present summit.

Paper II must determine which mechanical midpoint is predicted.

Paper I tests whether the regional evidence is compatible with any predeclared midpoint-response model.

23.3 Inherited-Node Hypothesis

Let

$$\mathbf{q}_{H,0} \tag{134}$$

represent a candidate deep inherited structure created or modified near the event midpoint at time t_0.

Let

$$\mathbf{x}_H(t) \tag{135}$$

represent the later surface expression.

The inheritance relation is written abstractly as

$$\mathbf{x}_H(t) = \mathcal{I}_H \left[\mathbf{q}_{H,0}, \mathbf{F}_{\text{later}}(t), \mathbf{D}_H(t)\right], \tag{136}$$

where

$$\mathbf{F}_{\text{later}}(t) = \text{later regional forcing}, \tag{137}$$

$$\mathbf{D}_H(t) = \text{later displacement and deformation}. \tag{138}$$

This formulation allows later orogenic processes to amplify an older structural condition.

It does not permit an arbitrary mapping from any ancient point to Everest.

23.4 Deep-Time Geometric Test

For reconstruction model k, define the midpoint-region misfit

$$\Delta_H^{(k)}(t_0) = \arccos\left[\widehat{\mathbf{m}}^{(k)}(t_0) \cdot \boldsymbol{\xi}_H^{(k)}(t_0)\right]. \tag{139}$$

The target $\boldsymbol{\xi}_H^{(k)}$ must be separately evaluated for:

1. modern Everest summit material;
2. Everest massif material;
3. central Himalayan crust;
4. Indian plate precursor material;
5. Asian target lithosphere;
6. deep mantle structure; and
7. independently mapped inherited anomalies.

23.5 Selection-Bias Control

Mount Everest was initially selected because it is the highest present point on Earth.

That selection creates an extreme-value bias.

The statistical comparison must therefore include:

- all major global mountain systems;
- all regional elevation maxima;
- broad orogenic centroids;
- deep crustal-thickness maxima;
- mantle-anomaly maxima; and
- randomized target regions with comparable area.

The question is not merely whether Everest is impressive.

The question is whether its placement and subsurface structure are more compatible with the proposed midpoint role than those of alternative mountain systems.

23.6 Predicted Midpoint-Response Signatures

23.6.1 Deep Structural Inheritance

The theory predicts a coherent deep anomaly associated with the midpoint region.

Candidate expressions include:

- anomalous crustal thickness;
- lithospheric discontinuity;
- mantle anisotropy;
- density contrast;
- unusually deep structural roots;
- a persistent mechanical boundary; or
- a feature whose geometry predates later surface uplift.

23.6.2 Pressure and Deformation Geometry

Paper II will predict the pressure field

$$P_{\mathrm{ABC}}(\mathbf{r}, t)\,. \tag{140}$$

Paper I will compare its expected spatial maximum or gradient with observed structural fields.

Let

$$O_H(\mathbf{r}, z) \tag{141}$$

represent an observed Himalayan structural field, such as seismic velocity, density, anisotropy, or crustal thickness.

A spatial correspondence statistic may be defined as

$$\rho_H = \operatorname{corr}\left[P_{\mathrm{ABC}}(\mathbf{r}, z), O_H(\mathbf{r}, z)\right]. \tag{142}$$

No value is assigned until the mechanical prediction exists independently of the observed map.

23.6.3 Chronological Inheritance

The theory requires evidence that the relevant inherited structure is compatible with the proposed event age or existed before the later orogenic expression.

The modern mountain age is not itself the required date.

The relevant question is whether the deep precursor structure can be distinguished from the later uplift that exposed or amplified it.

23.6.4 Regional Rather Than Summit-Only Expression

The model predicts a regional response.

Testing must therefore include:

- the Everest massif;
- the central Himalayan arc;
- crustal-thickness gradients;
- metamorphic domains;
- deep seismic structure;
- gravity structure; and
- relationships to adjacent basins and plateaus.

23.7 Midpoint Null Model

The regional comparison model attributes Himalayan elevation and deep structure to processes associated with long-duration continental convergence, crustal shortening, underthrusting, metamorphism, erosion, isostasy, and mantle interaction.

The Astro-Ballistic Chronostratigraphic Sequencing interpretation must identify one or more observations that:

1. predate the principal later collision history;
2. align with the reconstructed event geometry;
3. possess a depth or morphology not predicted by the comparison model;

4. preserve an event-compatible chronology; and
5. improve predictive performance without adding unconstrained parameters.

23.8 Himalayan Evidence Vector

Define

$$\mathbf{E}_H = (\Delta_H, A_H, C_H, S_H, G_H, M_H, T_H, R_H)\,, \tag{143}$$

where

$$\Delta_H = \text{deep-time midpoint misfit,} \tag{144}$$
$$A_H = \text{along-track position,} \tag{145}$$
$$C_H = \text{crustal correspondence,} \tag{146}$$
$$S_H = \text{seismic correspondence,} \tag{147}$$
$$G_H = \text{gravity correspondence,} \tag{148}$$
$$M_H = \text{metamorphic or mineralogical correspondence,} \tag{149}$$
$$T_H = \text{chronological inheritance,} \tag{150}$$
$$R_H = \text{regional-model residual.} \tag{151}$$

23.9 Decisive Midpoint Tests

The highest-priority midpoint tests are:

H1. define the physical midpoint predicted by Paper II;

H2. reconstruct multiple Himalayan material targets to t_0;

H3. calculate $\Delta_H^{(k)}(t_0)$ for each reconstruction;

H4. compare Everest with all major mountain systems;

H5. map deep crustal and mantle anomalies;

H6. identify structures that demonstrably predate later uplift;

H7. date inherited metamorphic or structural domains;

H8. compare the predicted pressure field with independent subsurface data; and

H9. quantify whether an astro-ballistic inherited node improves the regional model.

23.10 Himalayan Rejection Conditions

The literal midpoint-response claim is rejected if:

HF1. no defensible reconstruction materially reduces the 13.56° present-day misfit;

HF2. the proposed midpoint target did not exist as a relevant material or deep structure at the event time;

HF3. no inherited structure predating later uplift can be identified;

HF4. the predicted pressure or deformation maximum falls outside the Himalayan target region;

HF5. the highest-mountain selection is statistically indistinguishable from chance;

HF6. all deep structure is quantitatively predicted by the comparison model without a residual event signature; or

HF7. the required inheritance operator is unconstrained and can map any ancient point to the Himalaya.

24 Mariana Exit Forensics

24.1 Exit Hypothesis

The Mariana Trench and Challenger Deep are proposed as the terminal-response region of the 256 Ma event.

The source framework identifies the candidate evidentiary basis as:

- exceptional trench depth;
- terminal position relative to the proposed event sequence;
- magnetic-anomaly alignment;
- trench-parallel scouring;
- fracture organization in the western Pacific;
- possible initiation or inheritance of a long-lived subduction-like geometry; and
- possible relationship to wider Ring-of-Fire organization.

Each item requires independent verification.

Exceptional depth alone does not distinguish an exit wound from a subduction trench.

24.2 Terminal-Response Geometry Is Not Required to Match Entrance Geometry

The model predicts mechanical asymmetry between entrance and terminal response.

At the entrance, energy is coupled into Earth.

At the exit, residual momentum, decompression, excavation, fracture, and ejecta may be expressed into a different pressure environment.

Define the entrance and terminal-response energy fractions as

$$f_A = \frac{E_A}{E_0}, \tag{152}$$

$$f_M = \frac{E_M}{E_0}, \tag{153}$$

where

$$f_A + f_M + f_{\text{interior}} + f_{\text{loss}} = 1. \tag{154}$$

Paper II will determine whether a physically admissible partition exists.

Paper I tests whether the predicted exit morphology is present.

24.3 Terminal-Response Morphological Predictions

A terminal-response structure may preserve:

- localized maximum excavation;
- asymmetric widening toward the exit direction;
- radial and circumferential fracture families;
- ejecta or displaced-material corridors;
- abrupt transition from deep interior disturbance to near-surface deformation;
- trench or basin overdeepening;
- later tectonic reuse of the exit scar; and
- a regional pattern distinct from ordinary trench continuity.

The exact predicted morphology must be generated by the Paper II mechanical model before bathymetric fitting.

24.4 Bathymetric Exit Metrics

Let

$$z_M(\mathbf{r}) \tag{155}$$

represent regional bathymetry relative to an independently defined exit center.

Candidate metrics include:

$$z_{\min} = \min_{\mathbf{r}\in\mathcal{D}_M} z_M(\mathbf{r}), \tag{156}$$

$$\nabla z_M = \text{bathymetric gradient field}, \tag{157}$$

$$\mathcal{K}_M = \text{trench-curvature field}, \tag{158}$$

$$\mathcal{A}_M = \text{exit asymmetry statistic.} \tag{159}$$

The exit model should predict the orientation and scale of these quantities before they are compared with the observed trench.

24.5 Trench-Parallel Scouring Test

The source framework proposes trench-parallel scouring.

To test this, lineaments, grooves, scarps, and elongated bathymetric features must be mapped objectively.

For feature k, let

$$\eta_k = \text{mapped feature orientation}, \tag{160}$$

$$\gamma_{M,k}^{\text{ABC}} = \text{predicted exit-flow orientation.} \tag{161}$$

Define

$$\mathcal{S}_M = \frac{1}{N}\sum_{k=1}^{N}\left|\cos\left(\eta_k - \gamma_{M,k}^{\text{ABC}}\right)\right|. \tag{162}$$

This statistic must be compared with orientations predicted by subduction, plate bending, faulting, sediment transport, and regional stress.

24.6 Magnetic and Gravity Predictions

The exit hypothesis predicts a spatially coherent anomaly related to one or more of:

- heating;
- melt formation;
- material removal;
- dense intrusion;
- remagnetization;
- lithospheric thinning;
- deep fracture; or

- displaced crustal material.

Let the observed fields be

$$B_M(\mathbf{r}) = \text{magnetic anomaly field,} \tag{163}$$
$$G_M(\mathbf{r}) = \text{gravity anomaly field.} \tag{164}$$

Paper II must produce predicted anomaly geometries

$$\widehat{B}_M^{\text{ABC}}(\mathbf{r}), \tag{165}$$
$$\widehat{G}_M^{\text{ABC}}(\mathbf{r}). \tag{166}$$

The comparison cannot be reduced to the existence of any anomaly near the trench.

24.7 Deep Seismic Predictions

The exit model predicts a residual deep structure that may include:

- a near-vertical or oblique disturbed corridor;
- mantle anisotropy aligned with the proposed path;
- a thermal or compositional anomaly;
- disruption of mantle-transition-zone boundaries;
- an anomalous relationship with deeper low-velocity or high-velocity structures; or
- a deep structure that cannot be generated solely by the modern descending slab.

The model must distinguish an astro-ballistic path from the strong seismic signature already expected from subduction.

24.8 Exit Chronology

The modern Mariana trench geometry need not have formed in its present shape at 256 Ma.

The exit hypothesis instead requires an inherited precursor capable of later organizing or localizing trench development.

The chronological search should therefore distinguish:

1. candidate immediate exit products;
2. older western Pacific crustal or mantle anomalies;
3. later trench initiation;
4. later arc volcanism;

5. later subduction overprint;
6. sedimentary destruction or recycling; and
7. surviving deep inheritance.

24.9 Exit Null Model

The comparison model explains the Mariana system through combinations of:

- plate convergence;
- subduction;
- slab rollback;
- plate bending;
- trench retreat;
- back-arc extension;
- arc magmatism;
- inherited oceanic structure; and
- continuing regional deformation.

The replacement paper must demonstrate that the exit hypothesis predicts residual observations more successfully.

24.10 Mariana Evidence Vector

Define

$$\mathbf{E}_M = (Z_M, \mathcal{A}_M, \mathcal{S}_M, B_M, G_M, V_M, Q_M, T_M)\,, \tag{167}$$

where

$$Z_M = \text{bathymetric correspondence,} \tag{168}$$
$$\mathcal{A}_M = \text{morphological asymmetry,} \tag{169}$$
$$\mathcal{S}_M = \text{scouring or lineament correspondence,} \tag{170}$$
$$B_M = \text{magnetic correspondence,} \tag{171}$$
$$G_M = \text{gravity correspondence,} \tag{172}$$
$$V_M = \text{seismic-volume correspondence,} \tag{173}$$
$$Q_M = \text{shock, melt, or geochemical correspondence,} \tag{174}$$
$$T_M = \text{chronological correspondence.} \tag{175}$$

24.11 Model-Likelihood Comparison

Let $\mathcal{M}_{\text{ABC}}$ denote the exit model and $\mathcal{M}_{\text{PT}}$ the regional Plate-Tectonic model.

The local evidence comparison is

$$\Delta \ln \mathcal{L}_M = \ln p\left(\mathbf{E}_M \mid \mathcal{M}_{\text{ABC}}\right) - \ln p\left(\mathbf{E}_M \mid \mathcal{M}_{\text{PT}}\right). \tag{176}$$

No likelihood advantage can be claimed until both models produce quantitative predictions for the same observations.

24.12 Decisive Exit Tests

The highest-priority exit tests are:

M1. define the exit center independently of Challenger Deep;

M2. map regional bathymetric asymmetry;

M3. test trench-parallel and radial lineament orientations;

M4. examine gravity and magnetic anomaly geometry;

M5. compare seismic tomography with the predicted interior path;

M6. distinguish slab structure from any residual non-slab anomaly;

M7. identify candidate melt, shocked, or brecciated material;

M8. establish the age of candidate precursor structures;

M9. model whether later subduction could reactivate an older exit scar; and

M10. compare the complete evidence vector with the regional Plate-Tectonic model.

24.13 Mariana Rejection Conditions

The literal exit claim is rejected if:

MF1. no objective exit-centered morphology exists;

MF2. claimed scouring patterns are absent or follow ordinary regional stress and sedimentary processes;

MF3. magnetic and gravity anomalies do not match any predeclared exit prediction;

MF4. seismic structure is fully attributable to the modern slab and contains no residual path-compatible anomaly;

MF5. no dated precursor structure is compatible with the proposed event;

MF6. exit mechanics require planetary consequences that are absent;

MF7. the inferred exit position must be repeatedly moved to fit the data; or

MF8. the regional Plate-Tectonic model predicts the full evidence vector more accurately with fewer unconstrained parameters.

25 Regional Prediction and Falsification Matrix

25.1 Purpose

The regional claims must be tested as a connected forensic sequence.

A successful entrance claim cannot compensate for a failed midpoint claim.

A successful midpoint claim cannot compensate for a failed exit claim.

The theory gains force only when independent regional evidence forms one ordered geometry, chronology, and mechanism.

Table 10: Primary regional prediction and falsification matrix.

ID	Claim	Required evidence	Primary comparison	Direct failure
C1	Initiating event at 256 Ma	Dated physical markers forming one admissible sequence	Independent regional geochronology	Required ages are mutually incompatible
A1	Aegean entrance center	Objective arcuate, radial, or asymmetric entrance geometry	Regional microplate and basin development	No robust center or entrance morphology
A2	Aegean directional structure	Faults or deep structures aligned with predicted outbound path	Regional stress field	Alignment disappears under null testing
A3	Aegean physical marker	Shock, melt, high-pressure, deep-source, or equivalent evidence	Regional magmatic and metamorphic processes	No event-compatible physical marker
H1	Himalayan reconstructed midpoint	Low deep-time midpoint or mechanical-path misfit	Alternative mountain and crustal targets	No defensible reconstruction reduces misfit
H2	Inherited midpoint node	Deep structure predating and conditioning later uplift	Continental collision model	No older inherited structure exists
H3	Predicted pressure correspondence	Observed subsurface field matches independent Paper II prediction	Collision-generated pressure and crustal-thickness fields	Predicted maximum misses target region

ID	Claim	Required evidence	Primary comparison	Direct failure
M1	Mariana terminal-response center	Objective terminal excavation or asymmetric exit geometry	Subduction-trench morphology	No exit-centered morphology
M2	Mariana directional scouring	Mapped lineaments match predeclared exit-flow field	Plate bending, faulting, sediment transport	No statistical directional correspondence
M3	Mariana deep path	Residual deep anomaly distinct from slab structure	Modern and inherited subduction structure	Tomography contains no non-slab residual
M4	Mariana event inheritance	Dated precursor compatible with the proposed event	Later trench and arc development	All relevant structure is demonstrably younger
X1	Connected regional sequence	Entrance, midpoint, and exit evidence share geometry and chronology	Three unrelated regional histories	Evidence cannot be joined without post hoc changes

25.2 Cross-Regional Directional Consistency

For each regional structural observation j, define the predicted orientation

$$\gamma_j^{\mathrm{ABC}} \tag{177}$$

and observed orientation

$$\gamma_j^{\mathrm{obs}}. \tag{178}$$

The angular residual is

$$\epsilon_{\gamma,j} = \mathrm{wrap}\left(\gamma_j^{\mathrm{obs}} - \gamma_j^{\mathrm{ABC}}\right). \tag{179}$$

A combined directional statistic is

$$\chi_\gamma^2 = \sum_{j=1}^{N} \frac{\epsilon_{\gamma,j}^2}{\sigma_{\gamma,j}^2 + \sigma_{\mathrm{model},j}^2}. \tag{180}$$

The entrance, midpoint, and exit orientations must be predicted by one mechanical model.

They cannot be optimized independently after the maps are examined.

25.3 Cross-Regional Chronological Consistency

Let the regional chronological evidence be

$$\mathbf{T}_{\text{regional}} = (T_A, T_H, T_M)\,. \tag{181}$$

The model must state whether each component is predicted to be:

$$\text{immediate}, \quad \text{inherited}, \quad \text{delayed}, \quad \text{reactivated}.$$

The lag structure must be produced by the mechanics rather than chosen solely to match the dates.

25.4 Cross-Regional Depth Consistency

The proposed interior path predicts a depth history

$$d_{\text{ABC}}(s), \qquad s \in [0, 1]. \tag{182}$$

The geometry batch currently provides the depth history of a straight chord.

Paper II may replace that chord with a physically modeled trajectory or pressure path.

Any replacement must preserve:

1. declared entrance conditions;
2. declared exit conditions;
3. continuity;
4. energy and momentum constraints;
5. the midpoint-response prediction; and
6. independently testable regional intersections.

25.5 Connected-Sequence Likelihood

Let

$$\mathbf{E}_{\text{all}} = (\mathbf{E}_A, \mathbf{E}_H, \mathbf{E}_M, \mathbf{T}_{256}, \mathbf{G}_{256})\,, \tag{183}$$

where $\mathbf{G}_{256}$ contains the audited and reconstructed geometry.

The overall model comparison may be written as

$$\ln K = \ln \frac{p\left(\mathbf{E}_{\text{all}} \mid \mathcal{M}_{\text{ABC}}\right)}{p\left(\mathbf{E}_{\text{all}} \mid \mathcal{M}_{\text{PT}}\right)}. \tag{184}$$

A valid comparison must penalize:

- extra coordinates;
- adjustable event ages;
- adjustable lag times;
- alternate path definitions;
- alternate target definitions;
- unconstrained inheritance mappings; and
- post hoc inclusion of favorable observations.

25.6 Minimum Regional Success Standard

Paper I cannot establish physical penetration.

That burden belongs to Paper II.

Paper I can establish a strong forensic case only if:

1. a defensible deep-time geometry exists;
2. the entrance region contains a specific residual signature;
3. the Himalayan region contains a specific inherited midpoint-response signature;
4. the Mariana region contains a specific residual exit signature;
5. the regional chronologies can be ordered coherently;
6. the same direction and event parameters connect the three regions;
7. the observations are unlikely under the declared null tests; and
8. no regional claim depends solely on visual resemblance.

25.7 Regional Failure Does Not Disappear Into the Global Theory

The replacement thesis must not absorb failed regional claims without consequence.

The following rules apply:

1. Failure of the Aegean entrance requires removal or relocation of that entrance claim in a new model version.
2. Failure of the Himalayan midpoint requires removal or redefinition of the middle-mountain claim.

3. Failure of the Mariana terminal-response assignment requires removal or relocation of that assignment.
4. Failure of the 256 Ma chronology requires a formally revised event age and a complete re-audit.
5. Failure of the connected sequence reduces the three regions to separate hypotheses.
6. Failure of this Paper-I event prevents Paper IV from using this event as evidence in any model version that requires it.

Paper-I forensic standard.
The Aegean–Everest–Mariana event stands only if its geometry, material identities, chronology, and differentiated regional evidence converge on one independently reconstructable sequence.
Near-equal distances are the initiating observation.
They are not the final evidence.

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26 Regional Findings and Open Variables

26.1 Findings Preserved From the Source Framework

The current manuscript preserves the following theory claims for direct testing:

1. the Mini Aegean region is the candidate entrance;
2. the central Himalayan region is the candidate middle-mountain or midpoint-response region;
3. the Mariana system is the candidate exit;
4. the event is provisionally placed near 256 Ma;
5. entrance, midpoint, and exit should retain differentiated physical signatures; and
6. the three regions are proposed as one sequenced astro-ballistic event rather than unrelated structures.

26.2 Variables Not Yet Established

The following remain unresolved:

- the precise entrance boundary;
- the precise entrance center;
- the ancient material corresponding to the modern Aegean target;
- the correct Himalayan midpoint material;
- the correct Mariana precursor target;
- the reconstructed geometry at 256 Ma;
- the physical midpoint definition;
- the event-compatible regional ages;

- the predicted entrance morphology;
- the predicted midpoint pressure field;
- the predicted exit morphology;
- the predicted seismic path;
- the regional likelihoods; and
- the model-complexity penalty.

26.3 Minimum Mechanical Constraints Retained in Paper I

Paper I does not attempt to complete the full mechanics reserved for Paper II.

It defines only the minimum physical constraints needed to make valid regional predictions and to construct the Paper-II handoff.

Those constraints include:

- trajectory class;
- penetration versus transmitted-pressure alternatives;
- event energy and momentum parameter space;
- depth-path alternatives;
- entrance coupling;
- midpoint-response mechanism classes;
- exit-energy partition;
- planetary-survival limits; and
- the geological signatures generated by each mechanism class.

27 Mechanism Classes and the Meaning of Passage Through Earth

27.1 The Literal Primary Claim

The primary Astro-Ballistic Chronostratigraphic Sequencing interpretation proposes that an incoming body or concentrated astro-ballistic disturbance entered Earth near the Mini Aegean region, traversed a deep interior path, generated a midpoint response in the Himalayan target region, and produced a terminal response near the Mariana system.

The phrase *passed through Earth* must be defined physically.

It cannot remain a visual description.

For Paper I, the strongest literal formulation is:

> A substantial fraction of the incident body’s momentum and energy remained spatially concentrated along one continuous Aegean-to-Mariana interior pathway, producing mechanically ordered entrance, deep-path, midpoint-response, and exit signatures.

This formulation does not require the impactor to remain an intact solid body throughout the path.

It does require continuity of the principal momentum and energy transfer.

27.2 Five Distinct Mechanism Classes

Five mechanism classes are separated so that failure of one cannot be silently repaired by switching to another.

27.2.1 Class I: Coherent-Body Penetration

A largely coherent projectile retains a recognizable material body through a substantial fraction of the interior path.

The body may deform, melt, ablate, or fragment, but its center of mass remains the dominant carrier of momentum.

This is the strongest and most restrictive interpretation.

27.2.2 Class II: Fragmented Penetration Column

The projectile loses macroscopic coherence but forms a concentrated high-density column of fragments, melt, vapor, and shocked terrestrial material.

The moving column remains directionally organized and carries the principal impulse toward the exit.

27.2.3 Class III: Shock-Dominated Transmission

The original projectile is stopped or dispersed near the entrance, but a concentrated shock and compression field propagates through the interior and produces a terminal response.

Under this branch, the body does not literally traverse the complete chord.

The disturbance does.

27.2.4 Class IV: Fracture and Phase-Front Transmission

The event initiates a coupled sequence of fracture, phase transition, melt migration, decompression, and structural failure that advances through the interior.

The path is carried by a propagating mechanical transition rather than by one coherent projectile or simple shock.

27.2.5 Class V: Hybrid Transmission

The event combines:

- an initial coherent or fragmented penetrator;
- a shock-dominated interior phase;
- phase-boundary and fracture interactions;
- focused midpoint deformation; and
- terminal decompression or excavation.

The hybrid branch is likely to contain the richest physical behavior, but it also creates the greatest danger of unconstrained explanation.

Every transition between mechanism classes must therefore be specified by pressure, temperature, depth, time, or material-state conditions.

27.3 Branch Declaration Rule

The manuscript must declare which mechanism class generates each prediction.

For prediction P_j, write

$$P_j = P_j\left(\mathcal{M}_q, \boldsymbol{\Theta}_q\right), \tag{185}$$

where

$$\mathcal{M}_q = \text{declared mechanism class}, \tag{186}$$

$$\boldsymbol{\Theta}_q = \text{its declared parameter set}. \tag{187}$$

A failed coherent-body result cannot be presented as a successful shock-transmission result unless the model is formally changed.

27.4 Continuity of the Event Path

Let

$$\mathbf{r}_{\text{ABC}}(s,t), \qquad s \in [0,1], \tag{188}$$

represent the evolving centerline of the dominant transmitted disturbance.

A connected event requires:

$$\mathbf{r}_{\text{ABC}}(0,t_0) \in \mathcal{D}_A, \tag{189}$$

$$\mathbf{r}_{\text{ABC}}(1,t_{\text{exit}}) \in \mathcal{D}_M, \tag{190}$$

and continuity over the interval:

$$\mathbf{r}_{\mathrm{ABC}} \in C^0\left([0,1] \times [t_0, t_{\mathrm{exit}}]\right). \tag{191}$$

The transmitted energy density must also remain sufficiently localized to distinguish the proposed path from a nearly spherical global disturbance.

27.5 Conservation Requirements

For a control volume containing the event, the minimum conservation requirements are:

$$\frac{d}{dt}\int_V \rho\, dV + \oint_{\partial V} \rho \mathbf{u} \cdot d\mathbf{A} = 0, \tag{192}$$

$$\frac{d}{dt}\int_V \rho \mathbf{u}\, dV = \mathbf{F}_{\mathrm{surface}} + \mathbf{F}_{\mathrm{body}}, \tag{193}$$

and

$$E_0 = E_A + E_{\mathrm{path}} + E_H + E_M + E_{\mathrm{thermal}} + E_{\mathrm{seismic}} + E_{\mathrm{rotation}} + E_{\mathrm{ejecta}} + E_{\mathrm{residual}}. \tag{194}$$

Every major claimed consequence must appear within one common energy and momentum budget.

28 Audited Event-Energy and Momentum Parameter Space

28.1 Inherited Energy Band

The source framework proposes

$$10^{29}\ \mathrm{J} \lesssim E_0 \lesssim 10^{31}\ \mathrm{J}. \tag{195}$$

This band is retained as a declared search interval.

It is not yet a derived viable interval.

The lower bound was selected to permit plate-scale structural effects.

The upper bound was selected to avoid complete planetary disruption.

Both boundaries require numerical validation.

28.2 Kinetic Parameterization

For initial impactor mass M_I and speed v_I,

$$E_0 = \frac{1}{2} M_I v_I^2. \tag{196}$$

Therefore,

$$M_I = \frac{2E_0}{v_I^2}. \tag{197}$$

For the inherited velocity interval

$$10 \text{ km s}^{-1} \leq v_I \leq 30 \text{ km s}^{-1}, \tag{198}$$

the complete energy–velocity grid gives:

Table 11: Impactor mass implied directly by the declared kinetic-energy and velocity ranges.

Energy	**Speed**	**Implied mass**	**Diameter at** $\rho_I = 3000\,\text{kg m}^{-3}$
10^{29} J	10 km s^{-1}	2.00×10^{21} kg	1084 km
10^{29} J	20 km s^{-1}	5.00×10^{20} kg	683 km
10^{29} J	30 km s^{-1}	2.22×10^{20} kg	521 km
10^{30} J	10 km s^{-1}	2.00×10^{22} kg	2335 km
10^{30} J	20 km s^{-1}	5.00×10^{21} kg	1471 km
10^{30} J	30 km s^{-1}	2.22×10^{21} kg	1123 km
10^{31} J	10 km s^{-1}	2.00×10^{23} kg	5031 km
10^{31} J	20 km s^{-1}	5.00×10^{22} kg	3169 km
10^{31} J	30 km s^{-1}	2.22×10^{22} kg	2419 km

The inherited mass estimate of $10^{18} - 10^{21}$ kg does not follow from the stated energy and speed intervals.

The audited combined range is

$$2.22 \times 10^{20} \text{ kg} \lesssim M_I \lesssim 2.00 \times 10^{23} \text{ kg}. \tag{199}$$

Mechanical audit result M1.
The originally declared energy and velocity bands imply substantially larger impactor masses than previously stated.
The physical viability of the upper portion of the energy band is therefore a major rather than secondary constraint.

28.3 Equivalent Radius

For spherical impactor density ρ_I,

$$R_I = \left(\frac{3M_I}{4\pi\rho_I}\right)^{1/3}. \tag{200}$$

At $\rho_I = 3000\,\mathrm{kg\,m^{-3}}$, the full declared parameter grid implies diameters from approximately

$$521\,\mathrm{km} \tag{201}$$

to

$$5031\,\mathrm{km}. \tag{202}$$

The entrance-wound scale cannot therefore be treated independently of the projectile scale.

28.4 Momentum Range

The initial momentum is

$$p_I = M_I v_I = \frac{2E_0}{v_I}. \tag{203}$$

Across the declared parameter interval,

$$6.67 \times 10^{24} \lesssim p_I \lesssim 2.00 \times 10^{27} \quad \mathrm{kg\,m\,s^{-1}}. \tag{204}$$

Momentum and energy must both be tracked.

Two impactors with equal kinetic energy but different velocity possess different momentum, mass, size, penetration behavior, and coupling.

28.5 Specific Kinetic Energy

The initial specific kinetic energy is

$$e_I = \frac{E_0}{M_I} = \frac{v_I^2}{2}. \tag{205}$$

The declared speed interval gives

$$5.0 \times 10^7 \leq e_I \leq 4.5 \times 10^8 \quad \mathrm{J\,kg^{-1}}. \tag{206}$$

The event must therefore be treated as a high-pressure, high-temperature, compressible-flow problem rather than as ordinary rigid-body penetration.

28.6 Earth-Binding-Energy Reference

Using the uniform-sphere reference expression

$$E_{\text{bind}} \approx \frac{3GM_\oplus^2}{5R_\oplus}, \tag{207}$$

the declared event band can be expressed as

$$\Pi_{\text{bind}} = \frac{E_0}{E_{\text{bind}}}. \tag{208}$$

Using the adopted Earth parameters,

$$E_{\text{bind}} \approx 2.24 \times 10^{32}\ \text{J}. \tag{209}$$

Thus,

$$4.5 \times 10^{-4} \lesssim \Pi_{\text{bind}} \lesssim 4.5 \times 10^{-2}. \tag{210}$$

The upper energy bound is below the approximate total binding energy, but that fact does not establish planetary survival.

Localized disruption, atmosphere loss, ocean vaporization, global melting, ejecta loss, rotation change, and crustal destruction can occur far below total unbinding.

29 Entrance Geometry and Coupling

29.1 Incidence Angle Required by the Audited Chord

For a straight chord subtending central angle θ_{AM}, the chord's angle below the local horizontal at the entrance is

$$\alpha_{\text{hor}} = \frac{\theta_{AM}}{2}. \tag{211}$$

Using

$$\theta_{AM} = 105.617599^\circ, \tag{212}$$

the required incidence is

$$\alpha_{\text{hor}} = 52.808799^\circ \tag{213}$$

below the local horizontal.

Equivalently, the chord is

$$\alpha_{\text{rad}} = 37.191201^\circ \tag{214}$$

from the inward radial direction.

The audited straight chord therefore does not represent a shallow or grazing entry.

It represents a moderately steep oblique entry.

Mechanical audit result M2.
The declared Aegean–Mariana endpoint geometry requires an initial straight-chord incidence of approximately 52.81° below the local horizontal.
Any low-angle entrance claim requires a curved interior path or a different endpoint geometry.

29.2 Entrance Energy Coupling

Define the entrance coupling fraction

$$f_A = \frac{E_A}{E_0}, \qquad 0 \le f_A \le 1. \tag{215}$$

The momentum-coupling fraction is separately defined as

$$\mu_A = \frac{\|\Delta \mathbf{p}_A\|}{p_I}. \tag{216}$$

Energy coupling and momentum coupling are not interchangeable.

The entrance may absorb substantial energy through heating, fragmentation, melting, excavation, and shock while transmitting a different fraction of the directional momentum.

29.3 Dynamic-Pressure Scale

A reference dynamic pressure is

$$q = \frac{1}{2}\rho_t U^2, \tag{217}$$

where ρ_t is target density.

Using

$$\rho_t = 4000\,\mathrm{kg\,m^{-3}}, \qquad U = 20\,\mathrm{km\,s^{-1}}, \tag{218}$$

gives

$$q = 8.0 \times 10^{11} \text{ Pa}. \tag{219}$$

This is a reference scale rather than a complete shock solution.

It demonstrates that strength-dominated solid mechanics cannot govern the primary interaction.

29.4 Entrance State Vector

The entrance condition is represented by

$$\mathbf{\Theta}_A = (M_I, v_I, R_I, \rho_I, \alpha_{\text{hor}}, \Omega_I, f_A, \mu_A, \mathcal{S}_I), \tag{220}$$

where

$$\Omega_I = \text{impactor spin state}, \tag{221}$$

$$\mathcal{S}_I = \text{material and thermodynamic state}. \tag{222}$$

The entrance morphology must be derived from $\mathbf{\Theta}_A$ rather than selected first and used to infer an unconstrained projectile.

29.5 Entrance Survival Fraction

Let

$$M_{\text{path}} = f_{M,A} M_I \tag{223}$$

represent the impactor-derived mass remaining in the concentrated interior disturbance after entrance coupling.

Let

$$p_{\text{path}} = f_{p,A} p_I \tag{224}$$

and

$$E_{\text{path}} = f_{E,A} E_0. \tag{225}$$

The literal passage theory requires non-negligible values of $f_{p,A}$ and $f_{E,A}$.

Paper II must determine whether those fractions can remain large enough to produce the proposed exit while satisfying the entrance evidence.

30 Interior Transmission Alternatives

30.1 Audited Straight-Path Length and Transit Time

The audited straight chord length is

$$L_{\text{chord}} = 10\,150.567\,\text{km}. \tag{226}$$

Ignoring deceleration, the transit time is

$$t_{\text{cross}} = \frac{L_{\text{chord}}}{U}. \tag{227}$$

For the declared speed range,

$$338 \text{ s} \lesssim t_{\text{cross}} \lesssim 1015 \text{ s}. \tag{228}$$

Thus, a literal direct transit would occur on a timescale of approximately six to seventeen minutes before accounting for deceleration or path curvature.

30.2 Maximum Path Depth

The audited straight chord reaches a maximum depth of

$$d_{\max} = 2519.878\,\text{km}. \tag{229}$$

The path remains above the core–mantle boundary under the adopted spherical geometry.

The direct theory is therefore a deep-mantle passage theory, not a core-crossing theory.

30.3 Encountered Column Density

For path coordinate s, target density $\rho_t(s)$, and effective disturbance area $A_{\text{eff}}(s)$, the encountered target mass is

$$M_{\text{enc}} = \int_0^{L_{\text{path}}} \rho_t(s) A_{\text{eff}}(s)\, ds. \tag{230}$$

For a simplified constant-radius projectile,

$$M_{\text{enc}} \approx \bar{\rho}_t \pi R_I^2 L_{\text{path}}. \tag{231}$$

The relevant column density is

$$\Sigma_{\text{Earth}} = \int_0^{L_{\text{path}}} \rho_t(s)\, ds. \tag{232}$$

A projectile's mass per frontal area is

$$\Sigma_I = \frac{M_I}{\pi R_I^2} = \frac{4}{3}\rho_I R_I. \tag{233}$$

Define the penetration-column ratio

$$\Pi_\Sigma = \frac{\Sigma_I}{\Sigma_{\text{Earth}}}. \tag{234}$$

A value

$$\Pi_\Sigma \ll 1 \tag{235}$$

indicates that the projectile encounters a target column whose mass per area substantially exceeds its own.

In that regime, ordinary rigid-body ballistic passage is not a viable description.

The process must instead be modeled as coupled high-energy hydrodynamics, shock propagation, entrainment, phase change, and momentum transfer.

30.4 Deceleration Equation

A reduced drag-like equation may be written as

$$M_{\text{eff}}\frac{dU}{dt} = -\frac{1}{2}C_D \rho_t A_{\text{eff}} U^2 + F_{\text{pressure}} + F_{\text{gravity}} + F_{\text{phase}}, \tag{236}$$

where every term becomes state-dependent under extreme pressure and temperature.

This equation is not a final model.

It identifies the minimum variables that a numerical penetration model must conserve.

30.5 Shock-Transmission Branch

If the body is arrested while a shock continues, define shock-front position

$$\mathbf{r}_s(t) \tag{237}$$

and shock speed

$$D_s = \left\| \frac{d\mathbf{r}_s}{dt} \right\|. \tag{238}$$

Across a local shock, the Rankine–Hugoniot conservation relations supply the minimum jump conditions. Their use in impact modeling still requires a declared equation of state, constitutive response, and damage model [20, 19, 18]:

$$\rho_1 u_1 = \rho_2 u_2, \tag{239}$$

$$P_1 + \rho_1 u_1^2 = P_2 + \rho_2 u_2^2, \tag{240}$$

and

$$h_1 + \frac{u_1^2}{2} = h_2 + \frac{u_2^2}{2}. \tag{241}$$

The relevant equations of state must vary with mantle composition, depth, pressure, temperature, melt fraction, and phase.

30.6 Path Concentration

The event requires a directional path rather than a purely global spherical shock.

Define the localization fraction

$$\Lambda_{\text{path}}(t) = \frac{\displaystyle\int_{\mathcal{V}_{\text{path}}} e(\mathbf{r}, t)\, dV}{\displaystyle\int_{\mathcal{V}_{\oplus}} e(\mathbf{r}, t)\, dV}. \tag{242}$$

The event model must maintain enough localization to produce a specific Mariana terminal response.

If the energy rapidly isotropizes, the entrance-to-exit interpretation fails even if a global shock exists.

30.7 Audit of the Inherited Dimensionless Numbers

The source model declared

$$U = 2 \times 10^4\,\mathrm{m\,s^{-1}}, \tag{243}$$
$$L = 6.4 \times 10^6\,\mathrm{m}, \tag{244}$$
$$\rho = 4000\,\mathrm{kg\,m^{-3}}, \tag{245}$$
$$\eta = 1 \times 10^{21}\,\mathrm{Pa\,s}, \tag{246}$$
$$g = 9.81\,\mathrm{m\,s^{-2}}, \tag{247}$$
$$\Omega_\oplus = 7.292\,115\,9 \times 10^{-5}\,\mathrm{s^{-1}}, \tag{248}$$
$$\lambda = 10^3 - 10^5\ \mathrm{s}. \tag{249}$$

Using those declared numbers literally,

$$\mathrm{Re} = \frac{\rho U L}{\eta} = 5.12 \times 10^{-7}. \tag{250}$$

This does not support the inherited statement $\mathrm{Re} \gg 1$.

However, the long-timescale effective mantle viscosity $\eta = 1 \times 10^{21}$ Pa s is not necessarily an appropriate constitutive parameter during a hypervelocity shock.

The correct quantity is a state- and timescale-dependent effective rheology:

$$\eta_{\mathrm{eff}} = \eta_{\mathrm{eff}} \left(P, T, \dot{\epsilon}, \chi_{\mathrm{melt}}, t\right). \tag{251}$$

The Reynolds number must be recalculated from that constitutive model.

The Froude number is

$$\mathrm{Fr} = \frac{U}{\sqrt{gL}} = 2.52. \tag{252}$$

Gravity is therefore not dominant on the immediate inertial timescale, but it is not negligible.

Using present rotation $\Omega_{\oplus}$ as a reference,

$$\mathrm{Ro} = \frac{U}{2\Omega_{\oplus} L} \approx 21.4. \tag{253}$$

This does not support $\mathrm{Ro} \lesssim 1$ for the declared U and L.

Rotation is unlikely to dominate the immediate minutes-scale transit, although it may influence longer-lived ejecta, atmosphere, ocean, mantle, and plate responses.

The characteristic advective time is

$$t_{\mathrm{adv}} = \frac{L}{U} = 320\,\mathrm{s}. \tag{254}$$

The Deborah number is therefore

$$\mathrm{De} = \frac{\lambda}{t_{\mathrm{adv}}} = 3.125 - 312.5. \tag{255}$$

The inherited relaxation-time interval spans strongly different viscoelastic regimes and cannot be summarized by one $\mathcal{O}(1-10)$ value.

Table 12: Audit of dimensionless numbers from the inherited parameter set.

Quantity	Audited value	Interpretation
Re	5.12×10^{-7}	Literal result using long-timescale mantle viscosity; unsuitable for claiming inertial turbulence without a shock-regime rheology.
Fr	2.52	Immediate inertia exceeds the selected gravity scale, but gravity remains relevant.
Ro	21.4	Rotation does not dominate the immediate reference transit.
De	$3.125 - 312.5$	Response depends strongly on the selected relaxation time and cannot be assigned one simple regime.

Mechanical audit result M3.
The inherited dimensionless-regime statement is not supported by its own declared parameter values.
Paper II must replace the single effective-viscosity approximation with a pressure-, temperature-, strain-rate-, phase-, and timescale-dependent material model.

31 Midpoint Compression and Structural Inheritance

31.1 Geometric Midpoint Is Not Automatically a Pressure Maximum

The physical midpoint of a straight chord is a geometric result.

The location of maximum pressure, energy deposition, strain, phase change, or vertical displacement is a mechanical result.

Let the path coordinate be $s \in [0, 1]$.

Define:

$$s_{\text{geo}} = \frac{1}{2}, \tag{256}$$

$$s_P = \arg\max_s P(s,t), \tag{257}$$

$$s_E = \arg\max_s \dot{E}_{\text{dep}}(s,t), \tag{258}$$

$$s_\epsilon = \arg\max_s \epsilon_{\text{vol}}(s,t), \tag{259}$$

$$s_z = \arg\max_s \Delta z_{\text{surface}}(s,t). \tag{260}$$

The theory must calculate whether

$$s_{\text{geo}} \approx s_P \approx s_E \approx s_\epsilon \approx s_z \tag{261}$$

or whether these characteristic locations diverge.

31.2 Stress Field

The total stress tensor may be written as

$$\boldsymbol{\sigma} = -p\mathbf{I} + \boldsymbol{\tau}, \tag{262}$$

where

$$p = \text{isotropic pressure}, \tag{263}$$

$$\boldsymbol{\tau} = \text{deviatoric stress}. \tag{264}$$

A midpoint uplift response requires a pathway from the deep stress field to a persistent vertical or buoyancy-related structural anomaly.

The surface displacement field is

$$\mathbf{u}_{\text{surface}} = \mathcal{G}\left[\boldsymbol{\sigma}, \Delta\rho, \Delta T, \chi_{\text{melt}}, \mathbf{F}_{\text{phase}}\right], \tag{265}$$

where $\mathcal{G}$ is the coupled geodynamic response operator.

31.3 Candidate Midpoint Mechanisms

The midpoint-response claim admits several distinct mechanisms.

31.3.1 Maximum-Depth Compression

The deepest portion of the path experiences the greatest confining pressure and may generate a persistent density, phase, or stress anomaly.

31.3.2 Shock Focusing

Geometry, impedance boundaries, or phase transitions concentrate part of the propagating disturbance near a central region.

31.3.3 Displaced Mantle Volume

The moving disturbance displaces mantle material laterally or vertically, producing a long-lived buoyancy anomaly.

31.3.4 Phase-Transition Memory

The event changes mineral phase, density, melt fraction, or seismic properties in a localized deep region.

31.3.5 Fracture-Node Inheritance

A deep fracture or weakness node persists and is later reactivated by regional convergence.

31.3.6 Pre-Stressed Orogenic Target

The event does not directly create the modern mountain.

It creates a structural condition that later concentrates deformation and uplift.

31.4 Inherited-State Variable

Define a midpoint inherited-state field

$$\mathbf{Q}_H\left(\mathbf{r}, t_0^+\right) = \left(\Delta\rho, \Delta T, \Delta\phi, \Delta\chi, \Delta\mathbf{C}, \Delta\boldsymbol{\sigma}, \Delta\mathbf{D}\right), \tag{266}$$

where

$$\Delta\phi = \text{phase-state change}, \tag{267}$$

$$\Delta\chi = \text{melt or damage fraction}, \tag{268}$$

$$\Delta\mathbf{C} = \text{elastic or rheological property change}, \tag{269}$$

$$\Delta\mathbf{D} = \text{fracture and anisotropy change}. \tag{270}$$

The later Himalayan response is then modeled as

$$\mathbf{Q}_H(\mathbf{r}, t) = \mathcal{U}_H\left[\mathbf{Q}_H(\mathbf{r}, t_0^+), \mathbf{F}_{\text{later}}(t)\right], \tag{271}$$

where $\mathcal{U}_H$ is a constrained evolution operator.

31.5 Minimum Midpoint Requirement

The midpoint theory requires at least one surviving field that:

1. originates within the event-compatible interval;
2. occupies a mechanically predicted path region;
3. persists or evolves through later geological history;
4. influences the later Himalayan deformation field; and
5. is not fully generated by the later comparison model.

A modern high mountain by itself does not satisfy this requirement.

32 Exit Excavation and Decompression

32.1 Inherited Exit Fraction

The source framework assigns

$$0.1 \lesssim f_M \lesssim 0.5, \tag{272}$$

where

$$E_M = f_M E_0. \tag{273}$$

Using the declared event-energy range, the exact combined interval is

$$10^{28}\ \mathrm{J} \lesssim E_M \lesssim 5 \times 10^{30}\ \mathrm{J}. \tag{274}$$

The earlier upper estimate of 10^{31} J does not follow from $f_M \leq 0.5$ unless the total event-energy ceiling is raised.

The exit fraction is presently an assumption.

It must be produced by the transmission model.

32.2 Exit Energy Partition

The exit-region energy is divided into

$$E_M = E_{\mathrm{exc}} + E_{\mathrm{fract}} + E_{\mathrm{heat}} + E_{\mathrm{melt}} + E_{\mathrm{ejecta}} + E_{\mathrm{ocean}} + E_{\mathrm{atm}} + E_{\mathrm{seismic}} + E_{\mathrm{plate}} + E_{\mathrm{residual}}. \tag{275}$$

No single term may be assigned the full exit energy.

32.3 Exit-Affected Volume

The source challenge proposed a cylindrical reference volume with

$$R_{\mathrm{tube}} = 300\,\mathrm{km}, \tag{276}$$

and

$$L_{\mathrm{exit}} = 2000\,\mathrm{km}. \tag{277}$$

The corresponding volume is

$$V_{\text{eff}} = \pi R_{\text{tube}}^2 L_{\text{exit}} \quad (278)$$
$$= 5.655 \times 10^{17}\ \text{m}^3. \quad (279)$$

For

$$E_M = 10^{30}\ \text{J}, \quad (280)$$

the mean reference energy density is

$$\bar{e}_M = \frac{E_M}{V_{\text{eff}}} = 1.768 \times 10^{12}\ \text{J}\,\text{m}^{-3}. \quad (281)$$

This is only an averaged bookkeeping value.

Actual deposition would vary strongly in space, time, and material state.

The result demonstrates that the proposed exit is an extreme high-energy structure whose missing global and regional signatures must be explicitly addressed.

32.4 Excavation Work

A minimum excavation work scale may be represented as

$$E_{\text{exc,min}} = \int_{V_{\text{exc}}} \rho(\mathbf{r}) g(\mathbf{r}) h(\mathbf{r})\, dV + E_{\text{fract,min}} + E_{\text{phase,min}}. \quad (282)$$

The final exit model must use:

- reconstructed pre-event topography and bathymetry;
- material density;
- confining pressure;
- fracture energy;
- melt and vaporization energy;
- ocean loading;
- ejecta escape;
- later sedimentation;
- later subduction; and
- preservation loss.

32.5 Exit Momentum

If a fraction μ_M of the directional event momentum reaches the exit,

$$\mathbf{p}_M = \mu_M \mathbf{p}_I. \tag{283}$$

The relationship between f_M and μ_M depends on the mass and velocity distribution of the exiting disturbance.

They cannot be assumed equal.

32.6 Terminal Decompression

A terminal disturbance moving from high-pressure mantle into lower pressure crust, ocean, and atmosphere may undergo rapid expansion.

Define the decompression ratio

$$\Pi_P = \frac{P_{\text{path}}}{P_{\text{exit}}}. \tag{284}$$

The exit model must determine how decompression changes:

- material velocity;
- fragmentation;
- melt and vapor fraction;
- ejecta angle;
- excavation width;
- fracture orientation;
- ocean displacement;
- atmospheric loading; and
- residual trench geometry.

32.7 Exit-Structure Requirement

The model must predict a terminal field

$$\mathbf{Q}_M^{\text{pred}}(\mathbf{r}, z) \tag{285}$$

before comparison with Mariana observations.

That field must specify:

1. the predicted exit center;

2. the predicted axis orientation;
3. the predicted affected radius;
4. the predicted depth profile;
5. the predicted asymmetry;
6. the predicted fracture orientations;
7. the predicted thermal and magnetic effects;
8. the predicted mantle structure;
9. the predicted ejecta or displacement field; and
10. the predicted preservation after 256 Ma.

33 Planetary-Survival and Missing-Signature Constraints

33.1 Survival Is More Restrictive Than Remaining Gravitationally Bound

An event may leave Earth gravitationally intact while radically altering:

- the crust;
- mantle temperature;
- atmosphere;
- ocean inventory;
- rotation;
- orbital parameters;
- magnetic field;
- mass distribution;
- surface habitability; and
- the geological record.

The viable parameter space must satisfy all relevant survival constraints simultaneously.

33.2 Thermal Constraint

Let the globally retained thermal fraction be f_{th}.

The average specific thermal input is

$$\Delta e_{\oplus} = \frac{f_{\text{th}} E_0}{M_{\text{heated}}}. \tag{286}$$

The associated reference temperature change is

$$\Delta T = \frac{f_{\text{th}} E_0}{M_{\text{heated}} c_p}. \tag{287}$$

The model must identify the heated mass rather than distributing the energy arbitrarily over the entire Earth or only the path.

33.3 Melt Constraint

The total melt mass cannot exceed the energy-limited scale

$$M_{\text{melt,max}} = \frac{f_{\text{melt}} E_0}{c_p \Delta T_m + L_m}, \tag{288}$$

where L_m is latent heat and ΔT_m is the required sensible-heating interval.

The predicted melt volume must be compared with the preserved geological record.

33.4 Seismic Constraint

Let

$$f_{\text{seis}} = \frac{E_{\text{seismic}}}{E_0}. \tag{289}$$

The event must predict:

- global seismic energy;
- attenuation;
- antipodal or path-related focusing;
- crustal fragmentation;
- landslide and basin disturbance;
- sedimentary disruption; and
- surviving seismite or deformation fields.

A sufficiently energetic event cannot be geologically silent outside the three selected anchors.

33.5 Atmospheric Constraint

The atmosphere receives energy through:

- entry;
- plume expansion;
- ejecta heating;
- ocean vaporization;

- combustion;
- dust and aerosol injection; and
- exit decompression.

The model must calculate whether it predicts:

$$M_{\mathrm{atm,loss}}, \qquad M_{\mathrm{vapor}}, \qquad M_{\mathrm{dust}}, \qquad M_{\mathrm{aerosol}}, \tag{290}$$

compatible with the surviving record.

33.6 Ocean Constraint

The exit interaction with an oceanic region requires estimates of:

$$E_{\mathrm{ocean}}, \qquad M_{\mathrm{ocean,vapor}}, \qquad H_{\mathrm{wave}}, \qquad D_{\mathrm{inundation}}. \tag{291}$$

The resulting deposits and erosion patterns must be searched for at global and regional scales.

33.7 Ejecta Constraint

For ejecta mass distribution dM_{ej}/dv, define escaped mass

$$M_{\mathrm{escape}} = \int_{v_{\mathrm{esc}}}^{\infty} \frac{dM_{\mathrm{ej}}}{dv}\, dv. \tag{292}$$

The model must predict:

- retained ejecta;
- escaped ejecta;
- orbital ejecta;
- re-entry heating;
- distal deposits;
- geochemical markers; and
- possible extraterrestrial transfer.

33.8 Rotation Constraint

The angular impulse is

$$\mathbf{\Delta L}_{\oplus} = \int \mathbf{r} \times d\mathbf{p}. \tag{293}$$

The first-order rotation change is

$$\Delta\boldsymbol{\omega} \approx \mathbf{I}_{\oplus}^{-1}\Delta\mathbf{L}_{\oplus} - \mathbf{I}_{\oplus}^{-1}\Delta\mathbf{I}\boldsymbol{\omega}. \tag{294}$$

The event geometry is oblique and therefore carries angular momentum.

A viable model must compare predicted rotation changes with independent paleorotational constraints.

Rotation claims are reserved for later treatment, but rotation cannot be omitted from the survival budget.

33.9 Global-Marker Constraint

For event energy in the declared range, the model must predict whether one or more global markers should exist:

- ejecta or spherule layers;
- shocked minerals;
- isotope excursions;
- iridium or siderophile anomalies;
- global soot or combustion markers;
- abrupt sedimentary boundaries;
- tsunami deposits;
- widespread deformation;
- volcanic triggering;
- magnetic disturbance; or
- atmospheric-loss signatures.

The absence of a predicted marker constrains the mechanism.

It cannot automatically be attributed to erosion, subduction, or preservation loss without a quantitative preservation model.

33.10 Missing-Signature Likelihood

Let predicted marker j have detection probability

$$P_{j,\mathrm{det}} = P\left(\text{marker detected} \mid \mathcal{M}_{\mathrm{ABC}}, \boldsymbol{\Theta}\right). \tag{295}$$

For an absent marker, the likelihood contribution is

$$P_{j,\mathrm{abs}} = 1 - P_{j,\mathrm{det}}. \tag{296}$$

The combined missing-signature likelihood is

$$\mathcal{L}_{\text{missing}} = \prod_{j=1}^{N} P_{j,\text{abs}}. \tag{297}$$

This prevents the theory from treating all absent evidence as uninformative.

33.11 Survival Window

Define the viable mechanical parameter set

$$\mathcal{V} = \left\{ \boldsymbol{\Theta} : \begin{array}{l} \text{entrance signature reproduced,} \\ \text{path remains sufficiently localized,} \\ \text{midpoint response reproduced,} \\ \text{exit signature reproduced,} \\ \text{Earth remains compatible with survival constraints,} \\ \text{predicted global markers match observations} \end{array} \right\}. \tag{298}$$

If

$$\mathcal{V} = \varnothing, \tag{299}$$

the mechanism is rejected.

Mechanical falsifier F3, formalized.
If no parameter set within the declared event family can produce a Mariana-class terminal structure while retaining Earth, its oceans, atmosphere, rotation, and geological record in an observationally compatible state, the Aegean-to-Mariana passage model is mechanically falsified.

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34 Mechanism-to-Observation Prediction Matrix

Table 13: Minimum mechanism-to-observation requirements.

ID	Mechanism component	Required prediction	Primary observation	Direct failure
P1	Impactor parameter set	Mass, diameter, speed, density, trajectory, spin, and state	Entrance scale and global consequences	No parameter set fits both
P2	Entrance incidence	Approximately 52.81° below horizontal for the straight audited chord	Aegean asymmetry and path orientation	Observed entrance requires incompatible direction

ID	Mechanism component	Required prediction	Primary observation	Direct failure
P3	Entrance coupling	Energy and momentum fractions transmitted into the path	Entrance excavation, melt, fracture, and deep structure	Exit energy requires more transmission than entrance permits
P4	Interior survival or transmission	Continuous concentrated momentum or disturbance to Mariana	Tomography, anisotropy, phase, and deep structure	Disturbance isotropizes or terminates near entrance
P5	Path depth	Maximum straight-chord depth near 2520 km unless a new path is declared	Lower-mantle intersections	Predicted path misses all relevant anomalies
P6	Midpoint mechanics	Predeclared location of pressure, strain, phase, or damage maximum	Inherited Himalayan deep structure	Mechanical maximum is incompatible with target
P7	Exit fraction	Derived rather than assumed f_M	Mariana excavation and retained energy budget	Required exit fraction violates conservation
P8	Exit expansion	Predicted center, radius, depth, asymmetry, fractures, and ejecta	Bathymetry, gravity, magnetics, tomography, samples	No predicted exit field matches observations
P9	Planetary survival	Atmosphere, ocean, crust, mantle, rotation, and habitability outcomes	Global geological and geochemical record	Required event produces absent catastrophic signatures
P10	Long-term inheritance	Mechanism connecting transient forcing to persistent plate motion	Boundaries, vectors, speeds, and later reactivation	No persistent state survives the transient event

34.1 Status of the Inherited Mechanical Claims

Inherited statement	Status	Audited treatment
Event energy is $10^{29}-10^{31}$ J.	Provisional	Retained as a search interval, not a validated viable band.
Impactor mass is $10^{18}-10^{21}$ kg.	Corrected	Declared energy and velocity imply 2.22×10^{20}–2.00×10^{23} kg.

Inherited statement	Status	Audited treatment
The entrance is low angle.	Not supported by straight chord	Audited geometry requires 52.81° below the local horizontal.
The physical half-chord is approximately 6000 km.	Corrected	Surface halves are near 6000 km; physical half-chord is 5075.284 km.
Exit fraction is $0.1-0.5$.	Assumed	Must be derived by the transmission model.
Exit energy reaches 10^{31} J.	Corrected	With the declared bounds, maximum is 5×10^{30} J.
$\mathrm{Re} \gg 1$.	Not supported by declared values	Literal value is 5.12×10^{-7}; shock-regime rheology is required.
$\mathrm{Fr} \gtrsim 1$.	Supported at reference scale	Audited value is 2.52.
$\mathrm{Ro} \lesssim 1$.	Not supported by declared values	Present-rotation reference gives approximately 21.4.
$\mathrm{De} \sim \mathcal{O}(1-10)$.	Only partly supported	Declared relaxation range produces $3.125-312.5$.

34.2 Paper-I Mechanical Conclusion

Paper I does not yet demonstrate that a body or concentrated disturbance passed from the Aegean region to the Mariana region.

It establishes the physical questions that the claim must survive.

The literal Astro-Ballistic Chronostratigraphic Sequencing event requires a continuous, directionally concentrated transfer of momentum and energy through approximately 10 151 km of differentiated Earth, reaching a maximum straight-path depth near 2520 km, while producing entrance, midpoint, and exit signatures and avoiding incompatible planetary consequences.
The declared parameter band does not yet establish that such a viable solution exists.
It defines the search space in which Paper II must find one.

34.3 Remaining Paper-I Analysis

The following sections address:

1. statistical significance of the selected three-region configuration;
2. formal null models and selection effects;
3. paleogeographic reconstruction requirements;

4. observation and dataset inventory;
5. complete Paper-I falsification matrix;
6. independent replication protocol;
7. discussion of what Paper I does and does not establish;
8. Paper-I conclusion; and
9. mathematical and data appendices.

35 Statistical Null Models and Selection Effects

35.1 Why Statistical Testing Is Required

The Aegean–Everest–Mariana relationship was identified after examining globally exceptional structures.

The selected regions include:

- a proposed compact entrance region;
- the highest modern terrestrial mountain;
- the deepest modern oceanic trench; and
- an approximately bilateral distance relationship among the three selected coordinates.

Because the targets were not drawn randomly before the pattern was observed, the apparent relationship is vulnerable to:

1. post hoc selection;
2. extreme-value selection;
3. coordinate tuning;
4. multiple comparisons;
5. regional-boundary flexibility;
6. selective reporting;
7. map-projection intuition; and
8. failure to compare equally striking alternative triplets.

Statistical testing must therefore reproduce the actual discovery process as closely as possible.

A null test that assumes the three final coordinates were selected in advance would underestimate the probability of finding a visually interesting configuration.

35.2 Observed Geometric Statistics

The present-day audit produced four principal statistics:

$$T_1 = \mathcal{A}_{\text{surface}}, \tag{300}$$
$$T_2 = |\Delta_{\text{at}}|, \tag{301}$$
$$T_3 = |\delta_{\text{xt}}|, \tag{302}$$
$$T_4 = \Delta_{\text{mid}}. \tag{303}$$

For the declared coordinates,

$$T_1^{\text{obs}} = 0.00373044, \tag{304}$$
$$T_2^{\text{obs}} = 0.210512^\circ, \tag{305}$$
$$T_3^{\text{obs}} = 13.557246^\circ, \tag{306}$$
$$T_4^{\text{obs}} = 13.558849^\circ. \tag{307}$$

The strongest observed quantities are the low bilateral asymmetry and the low along-track halfway offset.

The cross-track and literal midpoint quantities are not small.

The statistical analysis must preserve this mixed result.

35.3 Separate and Composite Tests

Each geometric quantity must first be tested separately.

A composite statistic may then be defined as

$$T_{\text{comp}} = w_1\widetilde{T}_1 + w_2\widetilde{T}_2 + w_3\widetilde{T}_3 + w_4\widetilde{T}_4, \tag{308}$$

where

$$\sum_{i=1}^{4} w_i = 1, \qquad w_i \geq 0, \tag{309}$$

and $\widetilde{T}_i$ denotes a normalized version of each statistic.

The weights must be declared before the null simulations are examined.

A composite statistic must not hide a failed cross-track result behind a successful bilateral-distance result.

35.4 Null Model N0: Uniform Global Points

The simplest null model samples three independent points from a uniform distribution over the sphere.

For random longitude and latitude,

$$\lambda \sim \mathrm{Uniform}(-\pi, \pi), \tag{310}$$

$$u \sim \mathrm{Uniform}(-1, 1), \tag{311}$$

$$\phi = \arcsin u. \tag{312}$$

This model tests pure geometric coincidence.

It does not reproduce the geological selection process.

It is therefore a baseline rather than the decisive null model.

35.5 Null Model N1: Fixed Endpoints, Random Midpoint Targets

Under Null Model N1, the Aegean and Mariana endpoints remain fixed while the midpoint target is sampled from:

- the global land surface;
- all mountain systems;
- all major orogenic regions;
- all regional elevation maxima;
- all crustal-thickness maxima; or
- all candidate inherited structural highs.

This model asks whether Everest is unusually positioned relative to the selected endpoint pair.

35.6 Null Model N2: Random Entrance and Exit Classes

Under Null Model N2, endpoint pairs are sampled from defined geological classes.

Candidate entrance classes may include:

- circular or arcuate basins;
- microplates;
- enclosed seas;
- regional gravity anomalies;
- crustal depressions; and
- candidate large impact or collapse structures.

Candidate exit classes may include:

- deep-ocean trenches;
- maximum bathymetric depressions;
- major subduction arcs;
- deep fracture zones;
- large oceanic basins; and
- candidate excavation structures.

This model tests whether the observed relationship remains unusual within geologically comparable endpoint selections.

35.7 Null Model N3: Extreme-Structure Selection

Because Everest and Challenger Deep are global extremes, Null Model N3 must reproduce extreme-value selection.

For simulation n:

1. select one candidate entrance structure from a declared entrance catalog;
2. select one of the deepest k_M trench or basin targets;
3. select one of the highest k_H mountain or crustal targets;
4. optimize only over the same coordinate freedom permitted in the original analysis;
5. calculate the best bilateral-distance and along-track fit; and
6. record the resulting minimum statistic.

The integers k_M and k_H must be predeclared.

This model measures how often a comparably striking pattern can be found after selecting exceptional structures.

35.8 Null Model N4: Coordinate-Flexibility Test

Let each target region possess a domain

$$\mathcal{D}_A, \qquad \mathcal{D}_H, \qquad \mathcal{D}_M. \tag{313}$$

Under Null Model N4, the optimization procedure used for the observed triplet is applied identically to randomized triplets.

Define

$$T_{\min} = \min_{a \in \mathcal{D}_A,\, h \in \mathcal{D}_H,\, m \in \mathcal{D}_M} T_{\text{comp}}(a, h, m). \tag{314}$$

The observed result must be compared with the distribution of $T_{\min}$ rather than with a null distribution using fixed random points.

This test penalizes coordinate tuning.

35.9 Null Model N5: Deep-Time Reconstruction Flexibility

Under Null Model N5, every random triplet is subjected to the same number of reconstruction models, reference frames, time windows, and coordinate variants as the observed triplet.

If the observed configuration is tested across:

- multiple event ages;
- multiple reconstruction models;
- multiple Aegean targets;
- multiple Himalayan targets;
- multiple Mariana targets; and
- multiple mechanical paths,

the null simulations must receive the same opportunity to improve.

Otherwise the observed model receives an unfair search advantage.

35.10 Empirical Probability

For statistic T, where smaller values indicate a stronger fit, the empirical probability is

$$p_{\text{emp}} = \frac{1 + \sum_{n=1}^{N} \mathbf{1}\left[T_n \leq T_{\text{obs}}\right]}{N+1}. \tag{315}$$

For a statistic where larger values indicate a stronger fit, the inequality is reversed.

The number of simulations must be large enough to resolve the claimed probability range.

35.11 Multiple-Comparison Adjustment

Suppose m distinct hypotheses, coordinate sets, event ages, or statistics were examined.

A conservative familywise correction is

$$p_{\text{Bonf}} = \min\left(1, m p_{\text{raw}}\right). \tag{316}$$

A false-discovery-rate procedure may also be reported, with the selected dependence assumptions stated explicitly [21].

The manuscript must disclose:

1. how many endpoint pairs were examined;
2. how many midpoint targets were examined;
3. how many ages were examined;
4. how many coordinate alternatives were examined;
5. how many geometric definitions were examined; and
6. which tests were specified before the final result was known.

35.12 Selection Ledger

Every major analytical choice will be entered into a selection ledger.

Table 15: Required selection-ledger fields.

Choice class	Selected value	Independent justification	Timing of selection
Entrance region	To be recorded	Geological definition	Before or after geometry
Entrance coordinate	To be recorded	Centroid method	Before or after geometry
Midpoint target	To be recorded	Mountain, crustal, or mantle definition	Before or after geometry
Exit region	To be recorded	Geological definition	Before or after geometry
Exit coordinate	To be recorded	Centroid method	Before or after geometry
Event age	256 Ma	Chronostratigraphic rationale	Inherited from source framework
Midpoint threshold	To be recorded	Predeclared test band	Before final simulations
Reconstruction model	To be recorded	Published or independently documented model	Before model comparison
Mechanism branch	To be recorded	Physical rationale	Before observation fitting

36 Random Endpoint and Mountain-System Tests

36.1 Triplet Test

For entrance candidate A_i, midpoint candidate H_j, and exit candidate M_k, define

$$\mathbf{T}_{ijk} = (\mathcal{A}_{ijk}, \Delta_{\mathrm{at},ijk}, \delta_{\mathrm{xt},ijk}, \Delta_{\mathrm{mid},ijk}) . \tag{317}$$

The complete candidate catalog produces

$$N_{\mathrm{triplet}} = N_A N_H N_M \tag{318}$$

possible triplets before regional coordinate variation.

The observed triplet must be ranked within this complete comparison space.

36.2 Bilateral-Distance Rank

Define

$$R_{\mathrm{sym}} = 1 + \sum_{i,j,k} \mathbf{1} \left[\mathcal{A}_{ijk} < \mathcal{A}_{\mathrm{obs}}\right] . \tag{319}$$

The corresponding percentile is

$$P_{\mathrm{sym}} = 1 - \frac{R_{\mathrm{sym}} - 1}{N_{\mathrm{triplet}}}. \tag{320}$$

This reports how unusual the bilateral-distance symmetry is among declared geological candidate classes.

36.3 Along-Track Rank

Define

$$R_{\mathrm{at}} = 1 + \sum_{i,j,k} \mathbf{1} \left[|\Delta_{\mathrm{at},ijk}| < |\Delta_{\mathrm{at,obs}}|\right] . \tag{321}$$

The unusually small observed along-track offset must be evaluated separately from the cross-track displacement.

36.4 Joint Mid-Sequence Statistic

A joint mid-sequence statistic can be defined as

$$T_{\mathrm{midseq}} = \sqrt{\left(\frac{\mathcal{A}_{\mathrm{surface}}}{s_{\mathcal{A}}}\right)^2 + \left(\frac{\Delta_{\mathrm{at}}}{s_{\mathrm{at}}}\right)^2 + \left(\frac{\delta_{\mathrm{xt}}}{s_{\mathrm{xt}}}\right)^2}, \tag{322}$$

where $s_{\mathcal{A}}$, s_{at}, and s_{xt} are scale parameters derived from the null distribution or predeclared scientific tolerances.

The statistic must report the cross-track penalty.

A formulation using only distance symmetry and along-track position would test a bilateral mid-sequence relationship, not a chordal alignment.

36.5 Mountain-System Catalog Requirements

The mountain comparison catalog must include:

- summit coordinates;
- massif centroids;
- orogenic-belt centroids;
- maximum regional elevation;
- crustal-thickness maxima;
- lithospheric-root maxima;
- associated uncertainties; and
- a statement of whether each target existed at the proposed event time.

Modern elevation alone must not define the only midpoint target class.

36.6 Trench and Exit Catalog Requirements

The exit comparison catalog must include:

- maximum trench-depth coordinates;
- trench centroids;
- trench-curvature centers;
- basin minima;
- deep fracture-zone targets;
- subduction-arc centroids;
- associated uncertainties; and
- reconstructed precursor structures.

36.7 Entrance Catalog Requirements

The entrance comparison catalog must include:

- circular and arcuate basins;
- microplates;
- crustal depressions;
- enclosed seas;

- large gravity-anomaly centers;
- verified impact structures above a declared size threshold;
- candidate collapse structures; and
- associated spatial uncertainties.

The catalog must be created independently of the final Aegean–Everest–Mariana result.

36.8 Positive Statistical Result

A positive statistical result requires:

1. a predeclared candidate catalog;
2. a predeclared statistic;
3. a predeclared coordinate-selection rule;
4. a correction for multiple comparisons;
5. disclosure of all tested alternatives;
6. robustness across reasonable target definitions; and
7. a low probability under geological as well as purely geometric null models.

36.9 Negative Statistical Result

If comparable or stronger triplets occur frequently under the null models, the geometry remains an observation but loses force as evidence for a unique astro-ballistic event.

The manuscript must report that result directly.

37 Paleogeographic Reconstruction Ensemble

37.1 Purpose

The present-day geometry cannot establish an initiating event at 256 Ma.

The central historical question is whether independently defensible precursor structures form a stronger entrance–midpoint–exit relationship at the proposed event time.

37.2 Reconstruction Model Index

Let

$$k \in \{1, 2, \ldots, K\} \tag{323}$$

index the reconstruction models.

Each model must declare:

- the reference frame;
- the plate or block identities;
- the rotation parameters;
- the treatment of deforming regions;
- longitude uncertainty;
- true-polar-wander treatment;
- mantle-reference assumptions;
- the time interval covered; and
- the source and version of the reconstruction.

37.3 Initiating-Age Sensitivity Ensemble

The flagship event retains the specific nominal age $a_{\text{init},F} = 256$ Ma. Where chronological or reconstruction uncertainty must be propagated, the sensitivity ensemble is

$$a \in [256 \text{ Ma} - \Delta a_{\text{init},F}, 256 \text{ Ma} + \Delta a_{\text{init},F}] . \tag{324}$$

The width $\Delta a_{\text{init},F}$ must be frozen from declared chronometric or reconstruction uncertainty before the geometric result is examined. This is not a broad alternative event interval.

For discrete sensitivity steps,

$$a_q = 256 \text{ Ma} - \Delta a_{\text{init},F} + q\Delta a, \qquad q = 0, \ldots, Q. \tag{325}$$

37.4 Target Ensemble

For each model and time, multiple material targets may be reconstructed.

$$\mathcal{X}_A^{(k)}(t) = \left\{ \mathbf{x}_{A,1}^{(k)}(t), \ldots, \mathbf{x}_{A,N_A}^{(k)}(t) \right\}, \tag{326}$$

$$\mathcal{X}_H^{(k)}(t) = \left\{ \mathbf{x}_{H,1}^{(k)}(t), \ldots, \mathbf{x}_{H,N_H}^{(k)}(t) \right\}, \tag{327}$$

$$\mathcal{X}_M^{(k)}(t) = \left\{ \mathbf{x}_{M,1}^{(k)}(t), \ldots, \mathbf{x}_{M,N_M}^{(k)}(t) \right\}. \tag{328}$$

Every target must represent a physically identified material or structure.

37.5 Reconstructed Geometric Vector

For each model, time, and target triplet, calculate

$$\mathbf{G}_{kqabc} = (\mathcal{A}_{kqabc}, \Delta_{\text{at},kqabc}, \delta_{\text{xt},kqabc}, \Delta_{\text{mid},kqabc}, L_{\text{chord},kqac}, d_{\max,kqac}) . \tag{329}$$

Here a, b, and c index the Aegean, Himalayan, and Mariana target alternatives.

37.6 Reconstruction Improvement

Define the midpoint improvement relative to the present result as

$$I_{\text{mid}} = 1 - \frac{\Delta_{\text{mid}}^{(k)}(t)}{\Delta_{\text{mid}}^{\text{present}}}. \tag{330}$$

Similarly, define cross-track improvement

$$I_{\text{xt}} = 1 - \frac{\left|\delta_{\text{xt}}^{(k)}(t)\right|}{\left|\delta_{\text{xt}}^{\text{present}}\right|}. \tag{331}$$

Positive values indicate improvement.

Values approaching unity indicate substantial improvement.

Negative values indicate deterioration.

37.7 Reconstruction Stability

A viable reconstruction should not depend on one isolated model.

Define the fraction of models satisfying declared thresholds as

$$F_{\text{viable}} = \frac{1}{K} \sum_{k=1}^{K} \mathbf{1} \left[\Delta_{\text{mid}}^{(k)} \le \Delta_{\text{crit}} \wedge \left|\delta_{\text{xt}}^{(k)}\right| \le \delta_{\text{crit}}\right]. \tag{332}$$

The values Δ_{crit} and δ_{crit} must be predeclared.

37.8 Reconstruction Complexity Penalty

If one reconstruction requires additional rotations, translations, inheritance mappings, or undeclared deformation parameters, its fit must be penalized.

For model k, define an information criterion

$$\text{IC}_k = -2 \ln \mathcal{L}_k + \kappa p_k, \tag{333}$$

where

$$p_k = \text{number of fitted parameters}, \tag{334}$$

$$\kappa = \text{chosen penalty coefficient}. \tag{335}$$

The exact information criterion will be selected after the statistical model is specified.

37.9 Required Reconstruction Outputs

Any completed deep-time reconstruction analysis must report:

1. maps for each reconstruction model;
2. reconstructed coordinates;
3. target material identities;
4. coordinate uncertainties;
5. midpoint and cross-track results;
6. path length and depth;
7. model-to-model variation;
8. best and worst admissible results;
9. complexity penalties;
10. failed reconstructions; and
11. the complete machine-readable output table.

37.10 Reconstruction Falsifier

Geometric falsifier G5.
If the Aegean, Himalayan, and Mariana precursor structures cannot be identified and reconstructed into a statistically non-random, mechanically admissible entrance–midpoint–exit relationship within the frozen initiating-age sensitivity envelope, the literal 256 Ma chordal-event reconstruction is rejected.

---

38 Dataset and Observation Inventory

38.1 Dataset Classes

Paper I requires a reproducible inventory of all datasets used to define, test, or reject the event.

The inventory is organized into the following classes:

D1. geographic and geodetic data;

D2. topographic and bathymetric data;

D3. plate and crustal reconstruction data;

D4. fault and lineament data;

D5. seismic-reflection and seismic-refraction data;

D6. seismic-tomography data;

D7. gravity data;

D8. magnetic data;

D9. heat-flow data;

D10. lithospheric-thickness data;

D11. crustal-thickness data;

D12. mineralogical data;

D13. geochemical data;

D14. isotopic data;

D15. geochronological data;

D16. sedimentological data;

D17. extinction and paleoenvironmental data;

D18. paleomagnetic data;

D19. paleorotational data; and

D20. comparative planetary-impact data.

38.2 Dataset Record

Every dataset must have a record containing:

Field	**Required information**
Dataset identifier	Unique internal identifier used throughout the papers.
Dataset name	Formal title of the dataset.
Custodian	Institution, research group, or repository maintaining the data.
Evidence-origin class	Measurement-proximal, curated dataset, reference model, reconstructed, author-declared, internal provenance, manuscript-derived, simulated, interpretive, or missing.
Source locator	DOI, repository record, stable URL, archive path, or internal source-file ID.
Acquisition date	Date the exact version was obtained or created.
Raw-object checksum	Cryptographic hash of the unmodified source object where available.
Version	Exact version or release date.
Spatial coverage	Geographic extent and coordinate reference system.
Temporal coverage	Age range or acquisition interval.
Resolution	Spatial, temporal, depth, or measurement resolution.
Uncertainty	Reported or independently estimated uncertainty.

Field	Required information
Processing	Filtering, interpolation, transformation, or derived calculations.
Transformation lineage	Parent data IDs, code or method version, parameters, coordinate conversion, unit conversion, filtering, interpolation, rounding, and output IDs.
Unit convention	Original units, working units, and every conversion applied.
Use partition	Construction, calibration, reconstruction, validation, held-out test, prospective test, control, or illustration.
Missingness and exclusion	Missing fields, unavailable coverage, exclusions, and the registered reason for each exclusion.
Access status	Public, licensed, restricted, or unavailable.
Use in theory	Claim, equation, map, or test dependent on the dataset.
Alternative interpretation	Competing model using the same observations.
Reproduction instructions	Steps required for an independent analyst to obtain the same input.

38.3 Minimum Geometry Dataset

The minimum geometry package contains:

- declared point coordinates;
- declared target-region polygons;
- Earth-model constants;
- coordinate conversion code;
- spherical-distance code;
- ellipsoidal-distance code;
- great-circle projection code;
- chord geometry code;
- Monte Carlo coordinate-sampling code;
- candidate-structure catalogs; and
- complete numerical outputs.

38.4 Minimum Chronology Dataset

The chronology package must contain:

- dated Aegean candidate markers;
- dated Himalayan inherited structures;

- dated Mariana precursor structures;
- dated environmental markers;
- dated extinction or ecological markers;
- analytical methods;
- uncertainty ranges;
- sample locations;
- recalibration information; and
- rejected or incompatible dates.

38.5 Minimum Regional-Geophysics Dataset

For each principal region, the package must contain:

- topography or bathymetry;
- mapped faults and lineaments;
- gravity anomalies;
- magnetic anomalies;
- crustal-thickness models;
- lithospheric-thickness models;
- seismic-velocity models;
- seismic-anisotropy models;
- heat-flow observations;
- sample and borehole locations; and
- comparison-model predictions.

38.6 Data Exclusion Rule

A dataset may be excluded only for a stated reason.

Permissible reasons include:

- insufficient spatial coverage;
- insufficient resolution;
- incompatible coordinate frame;
- unquantified uncertainty;
- known processing artifacts;
- duplicate observations;

- lack of access; or
- direct irrelevance to the tested claim.

Unfavorable data cannot be excluded because they weaken the framework.

39 Paper-I Claim Ledger

39.1 Claim Classes

Each claim is assigned one of five classes:

Observation
A reported geographic, geological, geophysical, or chronological fact requiring a source.

Calculated result
A value derived reproducibly from declared inputs.

Interpretation
A forensic meaning assigned to observations or calculations.

Prediction
A result expected if the theory is correct.

Replacement claim
A comparative statement asserting superior causal explanation over Plate Tectonics.

39.2 Current Claim Ledger

Table 17: Paper-I claim ledger.

ID	Class	Claim	Current status	Primary test
P1-C01	Calculated result	Aegean–Everest surface distance is approximately 5983.318 km.	Reproduced	Independent coordinate calculation
P1-C02	Calculated result	Everest–Mariana surface distance is approximately 6028.126 km.	Reproduced	Independent coordinate calculation
P1-C03	Calculated result	The bilateral distance asymmetry is approximately 0.373%.	Reproduced	Independent coordinate calculation
P1-C04	Calculated result	Everest's projected along-track position is approximately 23.408 km from exact halfway.	Reproduced	Great-circle projection

ID	Class	Claim	Current status	Primary test
P1-C05	Calculated result	Everest is approximately 1507.497 km cross-track from the present endpoint great circle.	Reproduced	Great-circle-plane calculation
P1-C06	Calculated result	The present literal chord-midpoint misfit is approximately 13.558849°.	Reproduced	Normalized midpoint calculation
P1-C07	Interpretation	Everest occupies a bilateral mid-sequence relationship.	Provisionally supported	Geological null tests
P1-C08	Interpretation	The Mini Aegean region is an entrance structure.	Unverified	Regional forensic evidence
P1-C09	Interpretation	The Himalayan region preserves an inherited midpoint response.	Unverified	Deep-time geometry and subsurface evidence
P1-C10	Interpretation	The Mariana system is an exit structure.	Unverified	Regional forensic evidence
P1-C11	Interpretation	The three regions derive from one connected event.	Unverified	Combined geometry, chronology, and mechanics
P1-C12	Chronological claim	The event occurred near 256 Ma.	Unverified	Independent geochronology
P1-C13	Mechanical claim	A concentrated disturbance traversed the deep mantle.	Unverified	Paper-II modeling and tomography
P1-C14	Statistical claim	The observed triplet is unlikely under relevant null models.	Untested	Catalog and Monte Carlo analysis
P1-C15	Series-contribution claim	If it survives Papers I and II, the flagship event may contribute registered evidence to the global replacement test.	Not yet eligible	Papers II–IV

39.3 Claim Dependency Graph

The primary dependency chain is

$$
\begin{aligned}
&\{\text{P1-C01}, \text{P1-C02}, \text{P1-C03}, \text{P1-C04}, \text{P1-C05}, \text{P1-C06}\} \\
&\quad \longrightarrow \text{P1-C07} \\
&\quad \longrightarrow \{\text{P1-C08}, \text{P1-C09}, \text{P1-C10}, \text{P1-C12}, \text{P1-C14}\} \\
&\quad \longrightarrow \text{P1-C11} \\
&\quad \longrightarrow \text{P1-C13} \\
&\quad \longrightarrow \text{P1-C15}.
\end{aligned}
\tag{336}
$$

The final flagship-event contribution claim cannot bypass failed lower-level dependencies in this chain.

This dependency chain is event-specific. It does not make the flagship event a mandatory dependency of every alternative event sequence considered by Papers III and IV.

39.4 Claim-Version Rule

If a claim changes, the ledger must preserve:

- the original wording;
- the revised wording;
- the reason for revision;
- the evidence that triggered the revision;
- the equations affected;
- the dependent claims affected; and
- the new falsification condition.

40 Complete Paper-I Falsification Matrix

40.1 Falsification Standard

A falsifier is an observation or calculation whose failure removes a specified claim.

It is not merely an unanswered question.

The matrix distinguishes:

- claim rejection;
- claim weakening;
- model revision;
- event-specific rejection; and
- global-framework rejection.

Table 18: Complete Paper-I falsification matrix.

ID	Claim under test	Falsifying result	Consequence
F1	Present bilateral symmetry	Independent calculation does not reproduce the declared distances.	Reject calculated symmetry result.
F2	Along-track halfway relation	Independent projection does not reproduce the low along-track offset.	Reject halfway-station result.
F3	Present chord midpoint	Everest lies outside the frozen T2 source-working midpoint band.	Reject the literal present-coordinate midpoint claim under the earlier 5° working criterion; do not treat that source criterion as a universal geological threshold.
F4	Deep-time midpoint	No defensible reconstruction reduces midpoint and cross-track misfit.	Reject literal 256 Ma midpoint reconstruction.
F5	Statistical uniqueness	Comparable triplets occur frequently under appropriate null models.	Retain geometry as coincidence-compatible observation.
F6	Aegean entrance	After a preregistered search with adequate spatial, temporal, and instrumental sensitivity, no objective entrance center, residual morphology, deep anomaly, or event-compatible marker is detected.	Reject the tested Mini Aegean entrance claim; inadequate coverage leaves it unresolved rather than falsified.
F7	Himalayan inherited node	After adequate age, depth, and material-lineage testing, no relevant inherited structure predating later orogeny is detected.	Reject the tested midpoint-inheritance claim; missing deep-time data do not count as a hard negative result.

ID	Claim under test	Falsifying result	Consequence
F8	Mariana exit	After a preregistered search with adequate deep-geophysical and chronological sensitivity, no residual terminal-centered morphology, deep anomaly, or event-compatible precursor is detected.	Reject the tested Mariana terminal-response claim; incomplete coverage leaves the assignment unresolved.
F9	Common chronology	Required regional ages cannot be organized into one physical sequence.	Reject shared 256 Ma event.
F10	Connected geometry	The three regions require incompatible paths, coordinates, or material identities.	Reduce the regions to separate hypotheses.
F11	Physical passage	No parameter set transmits sufficient localized energy and momentum through the deep mantle.	Reject literal passage mechanism.
F12	Planetary survival	Every mechanically sufficient event predicts incompatible global destruction or missing signatures.	Reject declared event-energy family.
F13	Persistent inheritance	No mechanism preserves a state capable of influencing later plate motion or mountain building.	Reject long-term inheritance claim.
F14	Regional superiority	Frozen regional comparison models predict the tested observations better after effective-complexity and uncertainty accounting.	Do not establish the event as a necessary regional explanation; retain separate occurrence or compatibility questions unless a mandatory event prediction is directly contradicted.
F15	Paper-I event	Geometry, chronology, and all three regional roles cannot be jointly satisfied.	Reject this flagship event reconstruction.

ID	Claim under test	Falsifying result	Consequence
F16	Flagship-dependent global model	The flagship event fails, the frozen global model declares it necessary, and no independently specified mechanically eligible event sequence remains.	Reject the flagship-dependent global model version; retain unrelated regional claims and independently specified alternative sequences for their own tests.

40.2 Non-Detection and Missing-Data Rule

A blank map, absent sample, unavailable age, or unmodeled observation is not a falsifier. A non-detection becomes a hard negative result only when the relevant prediction, detection probability, survey domain, resolution, and decision threshold were frozen and the completed observation had adequate power to detect the predicted signal.

40.3 Partial Failure Rules

The following compartmentalization rules apply:

1. Failure of the literal present-day midpoint does not erase the reproduced bilateral-distance result.
2. Failure of the 256 Ma age does not erase the present geometry.
3. Failure of one regional role does not automatically reject every other proposed event in Astro-Ballistic Chronostratigraphic Sequencing.
4. Failure of coherent-body penetration does not automatically reject shock-dominated transmission.
5. A change of mechanism creates a revised model that must be re-audited.
6. Failure of this flagship event removes it from the eligible event catalog in its current form and weakens every model version that depends on it, but does not logically eliminate independently specified alternative sequences.
7. Full causal replacement cannot be claimed unless a sufficient set of independently supported event reconstructions explains the global boundary-and-motion field under one shared model.

40.4 No Asymmetric Falsification

Plate Tectonics and Astro-Ballistic Chronostratigraphic Sequencing must be judged against the same observations wherever possible.

The comparison must not require the replacement framework to predict every local detail while permitting the comparison framework to remain qualitative.

Conversely, unresolved questions within Plate Tectonics do not count as positive evidence for Astro-Ballistic Chronostratigraphic Sequencing.

The replacement framework succeeds only through its own correct, specific, and independently reproduced predictions.

41 Independent Replication Protocol

41.1 Purpose

The flagship event must be reconstructable by analysts who do not share the author's interpretation.

The replication package must permit a hostile, neutral, or supportive reviewer to reproduce the same inputs, calculations, maps, and claim statuses.

41.2 Replication Levels

41.2.1 Level R1: Numerical Geometry

The reviewer must be able to reproduce:

- coordinate conversion;
- pairwise distances;
- bilateral asymmetry;
- great-circle projection;
- along-track position;
- cross-track distance;
- chord length;
- chord depth;
- midpoint coordinate; and
- midpoint misfit.

41.2.2 Level R2: Coordinate Sensitivity

The reviewer must be able to reproduce:

- all target-region polygons;
- all alternate centroids;
- all uncertainty distributions;
- all Monte Carlo samples;
- all threshold results; and
- best- and worst-fitting admissible coordinate sets.

41.2.3 Level R3: Statistical Null Tests

The reviewer must be able to reproduce:

- candidate catalogs;
- randomization procedures;
- selection rules;
- null distributions;
- raw probabilities;
- adjusted probabilities; and
- all tested alternative triplets.

41.2.4 Level R4: Deep-Time Reconstruction

The reviewer must be able to reproduce:

- each reconstruction model;
- each target material identity;
- each reconstructed coordinate;
- each time step;
- model uncertainty;
- geometric outputs; and
- reconstruction-complexity penalties.

41.2.5 Level R5: Regional Forensics

The reviewer must be able to reproduce:

- Aegean structural metrics;
- Himalayan inherited-node tests;
- Mariana exit metrics;
- chronological comparisons;
- gravity and magnetic comparisons;
- seismic comparisons;
- mineralogical and geochemical tests; and
- regional-model residuals.

41.2.6 Level R6: Claim and Falsification Audit

The reviewer must be able to trace:

- every claim to its supporting inputs;
- every calculated result to its equations;
- every interpretation to its observations;
- every revision to its trigger;
- every failed test to its stated consequence; and
- every surviving claim to its remaining uncertainties.

41.3 Required Repository Structure

The replication package should use the following structure:

```
abc-paper-i/
|
|-- manuscript/
|   |-- main.tex
|   |-- references.bib
|   `-- figures/
|
|-- data/
|   |-- coordinates/
|   |-- target-regions/
|   |-- candidate-catalogs/
|   |-- reconstructions/
|   |-- chronology/
|   |-- geophysics/
|   `-- metadata/
|
|-- code/
|   |-- geometry/
|   |-- monte-carlo/
|   |-- null-models/
|   |-- reconstruction/
|   |-- regional-tests/
|   `-- validation/
|
|-- outputs/
|   |-- tables/
|   |-- figures/
|   |-- simulations/
|   `-- logs/
```

```
|
|-- claims/
|   |-- claim-ledger.csv
|   |-- equation-registry.csv
|   |-- falsification-matrix.csv
|   `-- dependency-graph.json
|
`-- README.md
```

41.4 Deterministic Reproduction

Every stochastic calculation must report:

- random-number generator;
- generator version;
- random seed;
- number of simulations;
- sampling distribution;
- rejection criteria;
- parallelization method; and
- numerical precision.

41.5 Independent Recalculation Rule

Replication must begin from the declared raw inputs.

Reviewers should not be required to trust intermediate tables.

For calculated quantity y,

$$y = f\left(\mathbf{x}, \boldsymbol{\theta}\right), \tag{337}$$

the package must provide:

1. raw input vector $\mathbf{x}$;
2. parameter vector $\boldsymbol{\theta}$;
3. explicit function f;
4. expected output;
5. tolerance for numerical agreement; and
6. unit test.

41.6 Adversarial Replication

The replication protocol must invite analysts to:

- substitute alternate coordinates;
- change target definitions;
- use alternate reconstruction models;
- use alternate event ages;
- apply stricter statistical penalties;
- use alternate regional comparison models;
- search for contradictory observations;
- report missing predicted signatures; and
- publish negative results.

41.7 Minimum Successful Replication

A successful independent replication of Paper I requires:

1. numerical reproduction of the declared present geometry;
2. agreement on the distinction between bilateral symmetry and chord alignment;
3. reproduction of the statistical test using the same catalogs;
4. reproduction of at least one deep-time reconstruction;
5. reproduction of the regional evidence matrices;
6. independent evaluation of the event chronology;
7. an explicit claim-by-claim status report; and
8. disclosure of all deviations from the original protocol.

41.8 Replication Outcomes

The possible outcomes are:

Reproduced
The calculation or observation agrees within the declared tolerance.

Partially reproduced
A subset of the result agrees, but one or more material assumptions or datasets differ.

Not reproduced
The reported result does not follow from the declared inputs.

Indeterminate
Required data, uncertainty, or material identity is insufficient.

Falsified

The result triggers a predeclared rejection condition.

41.9 Paper-I Replication Challenge

Independent reviewers are invited to reconstruct the Aegean–Everest–Mariana geometry from the declared coordinates, replace those points with independently justified geological targets, test the complete selection process against geological null models, reconstruct the target materials at the specific initiating age and within its frozen uncertainty envelope, and determine whether one coherent entrance–midpoint–exit sequence survives.

Positive, negative, and mixed results are equally relevant to the forensic test.

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42 Paper-I Evidence Architecture Summary

The Paper-I evidence architecture establishes the rules by which the flagship observation can become evidence.

The manuscript now contains:

1. the formal replacement thesis;
2. the five-paper architecture;
3. the present-day geometry audit;
4. the corrected distinction between bilateral symmetry and chord alignment;
5. the entrance, midpoint, and exit forensic programs;
6. the minimum physical-mechanism constraints;
7. the audited inherited parameter ranges;
8. the statistical null architecture;
9. the deep-time reconstruction ensemble;
10. the dataset inventory;
11. the Paper-I claim ledger;
12. the complete Paper-I falsification matrix; and
13. the independent replication protocol.

The concluding sections supply:

- integrated discussion;
- interpretation of the current mixed geometric result;
- relationship to Plate Tectonics;
- limits of Paper I;

- staged research program;
- final Paper-I conclusions;
- appendices;
- equation registry;
- figure and table registry;
- source-integration structure; and
- the final bibliography framework.

43 Downstream Model-Comparison Firewall

Paper IV may change the *comparative status* of the flagship candidate event, but it cannot retroactively change a Paper-I geometric calculation unless the coordinate definitions, source inputs, reference frame, or calculation itself changes. The downstream comparison must therefore distinguish:

Paper-I result retained
The registered geometry or null-test result remains reproducible.

Causal interpretation not established
The result remains real as a calculation but does not earn historical or causal attribution.

Replacement non-qualification
The broader model fails to outperform the comparison family without converting the Paper-I calculation into a false calculation.

Paper-I claim rejected
A completed valid Paper-I test crosses the frozen rejection condition for that exact claim.

No Bayesian evidence ratio, information criterion, integrated score, or hybrid preference may compensate for a failed hard geometric condition. Conversely, a later comparative loss cannot erase a surviving scoped Paper-I result; it only limits what that result can support.

44 Integrated Discussion

44.1 The Finding That Initiated the Investigation

The Aegean–Everest–Mariana investigation began with a global geographic observation:

1. the Mini Aegean region appeared suitable for testing as an entrance structure;
2. Mount Everest occupied an approximately central position between the selected Aegean and Mariana coordinates; and
3. Challenger Deep and the Mariana system appeared suitable for testing as an exit structure.

The original formulation interpreted these three regions as an ordered astro-ballistic sequence:

$$\text{Aegean entrance} \rightarrow \text{deep transmission} \rightarrow \text{Everest middle mountain} \rightarrow \text{Mariana exit.} \tag{338}$$

The purpose of Paper I has been to translate that observation into a formal forensic-geophysical program.

44.2 The Geometry Produced a Mixed but Specific Result

The declared coordinate set produces a strong bilateral-distance relationship.

The audited spherical distances are

$$D_{AE} = 5983.318\,\text{km}, \tag{339}$$

$$D_{EM} = 6028.126\,\text{km}. \tag{340}$$

Their difference is

$$\Delta D = 44.808\,\text{km}, \tag{341}$$

with normalized asymmetry

$$\mathcal{A}_{\text{surface}} = 0.00373044 = 0.373044\%. \tag{342}$$

This confirms that Everest is nearly equidistant from the selected Aegean and Mariana coordinates.

The perpendicular projection of Everest onto the Aegean–Mariana great-circle plane lies approximately

$$23.408\,\text{km} \tag{343}$$

from the exact halfway station.

That along-track relationship is substantially tighter than the raw pairwise-distance difference.

However, Everest is displaced approximately

$$13.557246^\circ \tag{344}$$

from the present-day Aegean–Mariana great-circle plane.

The normalized chord-midpoint direction is approximately

$$13.558849^\circ \tag{345}$$

from the declared Everest coordinate.

The corresponding surface displacement is approximately

$$1508\,\text{km}. \tag{346}$$

The present coordinate set therefore supports:

- bilateral endpoint symmetry;
- an exceptionally close along-track halfway station; and
- a geographically ordered mid-sequence relationship.

It does not support:

- present-day collinearity;
- a present-day midpoint within the inherited 5° tolerance; or
- a literal modern surface projection of one straight Aegean–Mariana chord through Everest.

44.3 The Corrected Finding Is More Precise

The original claim can now be stated more accurately:

> Mount Everest is nearly equidistant from the declared Mini Aegean and Mariana coordinates and occupies almost exactly the halfway station when projected along their great-circle axis. It is not presently located on that great-circle axis.
> The central forensic question is therefore whether its substantial cross-track displacement records deep-time relative motion, later structural expression, an inherited midpoint node, a non-straight mechanical path, coordinate-selection effects, or coincidence.

This corrected statement is stronger scientifically because it exposes both the unusual correspondence and the principal geometric failure.

44.4 Why the Cross-Track Displacement Matters

A cross-track displacement of approximately 1507 km is not a minor rounding error.

It is a first-order feature of the present geometry.

The theory must account for it through one of several explicit branches:

1. the relevant precursor materials occupied a stronger alignment near the proposed event time;
2. the modern landmarks are displaced expressions of deeper inherited structures;
3. the mechanical path curved through a differentiated Earth;
4. the central pressure or uplift maximum was offset from the geometric chord;
5. the declared entrance or exit coordinates are not the correct physical centroids;
6. later plate motion displaced the surface expression from its original deep node;

7. the bilateral-distance relationship is real but not causal; or
8. the observed relationship is a selected coincidence.

These branches make different predictions.

They must not be merged into one unrestricted rescue mechanism.

44.5 Geometry Is the First Gate, Not the Final Proof

The approximately equal distances are a legitimate mathematical observation.

They do not independently establish:

- an impact;
- a penetrating body;
- a deep shock path;
- an event age;
- Himalayan uplift causation;
- Mariana excavation causation;
- continued plate motion; or
- replacement of Plate Tectonics.

The observation becomes evidence only if it survives:

1. coordinate sensitivity;
2. selection-bias correction;
3. statistical null testing;
4. deep-time reconstruction;
5. regional geophysical comparison;
6. chronostratigraphic testing;
7. physical-mechanism modeling; and
8. comparison against established explanations.

44.6 The Event Must Be Reconstructed as One System

The theory is not three independent impact analogies.

Its evidentiary value depends upon one event producing:

$$\mathbf{E}_{\text{event}} = (\mathbf{E}_A, \mathbf{E}_{\text{path}}, \mathbf{E}_H, \mathbf{E}_M, \mathbf{E}_{\text{global}}) , \tag{347}$$

where

$$\mathbf{E}_A = \text{entrance evidence}, \tag{348}$$
$$\mathbf{E}_{\text{path}} = \text{deep-path evidence}, \tag{349}$$
$$\mathbf{E}_H = \text{midpoint-response evidence}, \tag{350}$$
$$\mathbf{E}_M = \text{exit evidence}, \tag{351}$$
$$\mathbf{E}_{\text{global}} = \text{global environmental and geological evidence}. \tag{352}$$

The event succeeds only if these evidence classes can be generated by one coherent parameter set.

44.7 The Mechanics Are More Restrictive Than the Map

The audited straight chord has length

$$L_{\text{chord}} = 10\,150.567\,\text{km}, \tag{353}$$

and reaches maximum depth

$$d_{\max} = 2519.878\,\text{km}. \tag{354}$$

The direct path therefore enters the lower mantle but remains above the core–mantle boundary.

The inherited event-energy range

$$10^{29} \le E_0 \le 10^{31} \quad \text{J} \tag{355}$$

and speed range

$$10 \le v_I \le 30 \quad \text{km}\,\text{s}^{-1} \tag{356}$$

imply an impactor-mass range

$$2.22 \times 10^{20} \lesssim M_I \lesssim 2.00 \times 10^{23} \quad \text{kg}. \tag{357}$$

These values imply enormous bodies and extreme consequences.

The upper portion of the search range approaches a significant fraction of Earth's gravitational binding-energy scale.

The mechanical burden is therefore severe.

The theory must locate a viable region in which the event is:

- energetic enough to create a deep connected path;

- concentrated enough to generate a terminal Mariana response;
- asymmetric enough to produce differentiated entrance and terminal-response structures;
- structured enough to create a midpoint-response inheritance;
- non-destructive enough to preserve Earth in a compatible state; and
- observable enough to leave the predicted global record.

44.8 The Absence of Expected Consequences Is Evidence

A sufficiently energetic event should not be geologically invisible.

The theory must account for expected:

- melt;
- ejecta;
- atmospheric disturbance;
- oceanic disturbance;
- global seismic effects;
- sedimentary discontinuities;
- geochemical anomalies;
- biological consequences;
- rotational effects;
- mantle anomalies; and
- long-lived structural inheritance.

If the event requires these consequences but the corresponding markers are absent, the absence weakens or rejects the relevant parameter range.

Preservation loss is a testable geological process, not a universal exemption.

45 What Paper I Currently Establishes

45.1 Established Mathematical Results

Subject to independent recalculation from the declared coordinates, Paper I establishes the following present-day mathematical results:

R1. The spherical Aegean–Everest distance is approximately 5983.318 km.

R2. The spherical Everest–Mariana distance is approximately 6028.126 km.

R3. The bilateral distance difference is approximately 44.808 km.

R4. The normalized bilateral asymmetry is approximately 0.373%.

R5. The bilateral symmetry remains under an ellipsoidal geodesic calculation.

R6. The direct Aegean–Mariana central angle is approximately 105.617599°.

R7. The direct spherical surface distance is approximately 11 744.141 km.

R8. The straight interior chord is approximately 10 150.567 km.

R9. The physical half-chord is approximately 5075.284 km.

R10. The maximum straight-chord depth is approximately 2519.878 km.

R11. The projected along-track position of Everest is approximately 23.408 km from exact halfway.

R12. The present cross-track displacement is approximately 1507.497 km.

R13. The present chord-midpoint angular misfit is approximately 13.558849°.

45.2 Established Methodological Results

Paper I also establishes that:

M1. bilateral distance symmetry and great-circle alignment are different tests;

M2. great-circle alignment and chord-midpoint alignment are different tests;

M3. modern landmarks and ancient material targets cannot be treated as identical without reconstruction;

M4. coordinate flexibility must be penalized statistically;

M5. the event age must be tested independently of the geometry;

M6. entrance, midpoint, exit, chronology, and mechanism are separable claims;

M7. the mechanical model must produce the regional predictions before those predictions are fitted to observations;

M8. global missing signatures constrain event energy and mechanism; and

M9. failure of a claim must propagate through the claim dependency structure.

45.3 Established Audit Corrections

The present audit corrects several inherited statements:

A1. the approximately 6000 km values are surface distances, not physical half-chord lengths;

A2. the straight-path incidence is approximately 52.81° below the local horizontal, not a shallow grazing angle;

A3. the inherited energy and velocity intervals imply masses up to approximately 2.00×10^{23} kg;

A4. the stated exit-energy fraction limits the exit-energy ceiling to 5×10^{30} J under the current total-energy ceiling;

A5. the inherited Reynolds-number interpretation does not follow from the inherited parameters;

A6. the inherited Rossby-number interpretation does not follow from the inherited parameters; and

A7. the inherited Deborah-number range spans substantially more than one nominal mechanical regime.

These corrections are incorporated into the forward research program.

46 What Paper I Does Not Establish

Paper I does not presently establish that:

1. the Mini Aegean region is a confirmed entrance wound;
2. Mount Everest or the Himalaya were directly formed by the proposed event;
3. the Mariana Trench is a confirmed exit wound;
4. a coherent projectile crossed Earth;
5. a shock or fracture front crossed Earth;
6. the event occurred at exactly 256 Ma;
7. the observed triplet is statistically exceptional after all selection effects;
8. the relevant precursor structures occupied the required geometry at the proposed event time;
9. one mechanically viable parameter set exists;
10. the event initiated the present plate-motion field;
11. present plate speeds can be derived from the proposed event;
12. present plate directions can be derived from the proposed event;
13. all major mountain systems, trenches, ridges, and basins can be reconstructed through the event catalog;
14. Plate Tectonics has been replaced; or
15. every component of Astro-Ballistic Chronostratigraphic Sequencing is correct.

These are the burdens of Papers II through IV.

47 Relationship to Plate Tectonics

47.1 Plate Motion Is Evidence Shared by Both Frameworks

Both frameworks must account for measured plate motion.

Let the observed plate-motion field be

$$\mathbf{V}_{\mathrm{obs}} = \{\mathbf{v}_1, \mathbf{v}_2, \ldots, \mathbf{v}_{N_P}\}, \tag{358}$$

where each plate-motion vector contains direction and speed in a stated reference frame.

Plate Tectonics treats this field as the current expression of plate interactions and mantle-coupled geodynamics.

Astro-Ballistic Chronostratigraphic Sequencing treats the field as a surviving and repeatedly modified consequence of prior forcing, inherited boundaries, gravity, mantle coupling, and later events.

47.2 The Competing Causal Structures

A simplified Plate-Tectonic causal structure may be represented as

$$\mathcal{M}_{\mathrm{PT}} : \{\text{mantle dynamics}, \text{slab pull}, \text{ridge forces}, \text{gravity}, \text{boundary interaction}, \text{rheology}\} \to \mathbf{V}_{\mathrm{obs}}. \tag{359}$$

The Astro-Ballistic Chronostratigraphic Sequencing causal structure is

$$\mathcal{M}_{\mathrm{ABC}} : \left\{ \begin{matrix} \text{event impulses}, \ \text{event-created boundaries}, \ \text{inherited momentum}, \\ \text{gravity}, \ \text{mantle coupling}, \ \text{later reactivation} \end{matrix} \right\} \to \mathbf{V}_{\mathrm{obs}}. \tag{360}$$

The replacement claim is not established merely by adding event impulses to the existing model.

The framework must show that the event sequence supplies the primary causal organization.

47.3 Description Versus Origin

The replacement thesis distinguishes between:

Kinematic description
Measurement of how plates currently move.

Dynamic description
Calculation of the forces currently acting on plates.

Historical initiation
Explanation of how the boundaries and motion field originated.

Persistent inheritance
Explanation of how earlier forcing continues to influence current motion.

Astro-Ballistic Chronostratigraphic Sequencing is strongest where it produces historical and directional predictions unavailable from present kinematics alone.

47.4 The Required Replacement Test

For plate i, Paper III must predict

$$\widehat{\mathbf{v}}_i^{\mathrm{ABC}} = \mathcal{F}_{\mathrm{ABC}}\left(\mathcal{E}, \mathbf{B}, \mathbf{G}, \mathbf{M}, t\right), \tag{361}$$

where

$$\mathcal{E} = \text{event sequence}, \tag{362}$$
$$\mathbf{B} = \text{inherited boundary structure}, \tag{363}$$
$$\mathbf{G} = \text{gravitational field}, \tag{364}$$
$$\mathbf{M} = \text{mantle and rheological coupling}. \tag{365}$$

The plate-motion residual is

$$\boldsymbol{\epsilon}_i^{\mathrm{ABC}} = \mathbf{v}_i^{\mathrm{obs}} - \widehat{\mathbf{v}}_i^{\mathrm{ABC}}. \tag{366}$$

The corresponding Plate-Tectonic residual is

$$\boldsymbol{\epsilon}_i^{\mathrm{PT}} = \mathbf{v}_i^{\mathrm{obs}} - \widehat{\mathbf{v}}_i^{\mathrm{PT}}. \tag{367}$$

The replacement test must compare:

$$\left\|\boldsymbol{\epsilon}^{\mathrm{ABC}}\right\|, \qquad \left\|\boldsymbol{\epsilon}^{\mathrm{PT}}\right\|, \tag{368}$$

while penalizing each framework for its adjustable parameters.

47.5 Boundary-Origin Test

For observed plate-boundary network

$$\mathcal{B}_{\mathrm{obs}}, \tag{369}$$

Astro-Ballistic Chronostratigraphic Sequencing must predict a network

$$\widehat{\mathcal{B}}_{\mathrm{ABC}} = \mathcal{H}\left(\mathcal{E}, \boldsymbol{\Theta}_{\mathrm{event}}\right). \tag{370}$$

The comparison must evaluate:

- boundary locations;
- boundary orientations;
- boundary types;
- intersections;

- ages;
- reactivation histories;
- associated mountains;
- associated trenches;
- associated basins; and
- associated plate-motion vectors.

47.6 The Framework Must Explain Continuing Motion

An ancient impulse alone does not automatically explain hundreds of millions of years of continuing motion.

Paper III must identify the persistence mechanism.

Candidate components include:

- inherited momentum;
- gravitational potential;
- density disequilibrium;
- slab-like descending material;
- mantle coupling;
- boundary weakness;
- long-lived thermal anomalies;
- elastic and viscoelastic relaxation;
- subsequent event impulses; and
- ongoing interactions among event-created structures.

The theory may retain ongoing internal forces.

Its replacement claim depends upon showing that the global organization and directional initialization were produced principally by the astro-ballistic sequence.

47.7 The Replacement Standard

The replacement thesis requires all of the following:

R1. successful reconstruction of multiple independent events;

R2. derivation of event-created plate boundaries;

R3. derivation of plate-motion directions;

R4. quantitative treatment of plate speeds;

R5. prediction of mountain, trench, ridge, and basin placement;

R6. chronostratigraphic consistency;

R7. physically viable event mechanics;

R8. superior or complementary prediction of difficult observations;

R9. explicit treatment of observations favoring Plate Tectonics;

R10. model-complexity penalties;

R11. unique advance predictions; and

R12. independent replication.

Paper I supplies one candidate event.

It does not by itself satisfy this replacement standard.

48 Decisive Research Priorities

48.1 Priority 1: Freeze the Geographic Targets

The Aegean, Himalayan, and Mariana target domains must be defined geologically before further optimization.

Required outputs are:

- region polygons;
- centroid methods;
- coordinate uncertainties;
- alternative defensible targets;
- physical material represented by each target; and
- the date each target definition was frozen.

48.2 Priority 2: Complete the Statistical Null Tests

The bilateral symmetry and along-track relation must be compared with:

- random global triplets;
- geological candidate catalogs;
- extreme-structure selections;
- coordinate-optimized random triplets;
- alternate mountain systems;
- alternate trench systems; and

- multiple-comparison penalties.

This test determines whether the initiating observation is statistically informative.

48.3 Priority 3: Reconstruct the Relevant Materials

The reconstruction must identify what existed at the proposed event time.

The highest-priority targets are:

1. the precursor crustal or deep structure beneath the modern Aegean region;
2. the precursor material or inherited node associated with the later Himalayan region; and
3. the precursor western Pacific or mantle structure associated with the modern Mariana system.

48.4 Priority 4: Search for Dated Physical Markers

The event requires at least one independently dated marker and ideally a connected set.

Search classes include:

- high-pressure minerals;
- shocked minerals;
- melt products;
- breccias;
- deformation pulses;
- deep-source geochemistry;
- sedimentary disturbance;
- regional unconformities;
- magnetic disturbance;
- extinction-linked markers; and
- deep structural inheritance.

48.5 Priority 5: Build the Minimum Numerical Mechanics

Before a full planetary simulation, Paper II should test simplified viability.

The minimum numerical stages are:

1. entrance coupling;
2. projectile or disturbance deceleration;
3. path localization;
4. lower-mantle propagation;

5. maximum pressure and strain location;
6. exit energy and momentum;
7. planetary thermal consequences;
8. global seismic consequences;
9. atmospheric and oceanic consequences; and
10. long-lived inherited-state formation.

48.6 Priority 6: Produce Predictions Before Map Fitting

Paper II must output predicted:

- entrance shape;
- entrance asymmetry;
- path width;
- path depth;
- midpoint pressure field;
- midpoint inherited-state field;
- exit center;
- exit radius;
- exit asymmetry;
- exit fracture orientations;
- gravity anomalies;
- magnetic anomalies;
- seismic anomalies;
- global deposits; and
- plate-scale impulse vectors.

Only after these predictions are frozen should they be compared with Earth data.

48.7 Priority 7: Publish Negative Results

The research program should publish:

- failed coordinates;
- failed reconstructions;
- failed mechanism branches;
- incompatible dates;

- absent predicted markers;
- unfavorable regional-model comparisons; and
- parameter regions eliminated by survival constraints.

Negative results define the remaining theory more sharply.

49 Limitations of Paper I

49.1 Coordinate Limitation

The declared coordinates are inherited working points rather than fully defended geological centroids.

49.2 Deep-Time Limitation

No complete 256 Ma reconstruction has yet been performed within this manuscript.

49.3 Material-Identity Limitation

The physical relationship between modern landmarks and ancient target materials remains unresolved.

49.4 Statistical Limitation

The relevant candidate catalogs and null simulations remain to be constructed.

49.5 Chronological Limitation

The specific initiating-age assignment of 256 Ma has not yet been anchored by a verified sequence of regional physical markers.

49.6 Regional-Evidence Limitation

The Aegean, Himalayan, and Mariana forensic evidence vectors remain research programs rather than completed empirical results.

49.7 Mechanical Limitation

No hydrocode, shock-physics model, mantle-transmission model, or planetary-survival simulation presently demonstrates a viable entrance-to-exit solution.

49.8 Rheological Limitation

The inherited effective-viscosity treatment is unsuitable for direct application to the hypervelocity event regime.

49.9 Preservation Limitation

The manuscript has not yet calculated which original event markers should survive ~ 256 Ma of deformation, erosion, sedimentation, metamorphism, and recycling.

49.10 Comparison-Model Limitation

Paper I does not perform final regional causal-model adjudication. It tests the flagship forensic relationship and records the evidence needed to discriminate it from generic background processes. Strongest-defensible model comparison belongs to Paper IV and is implemented through common data, predictions, residuals, and decision rules rather than a narrative side-by-side review of every published geological interpretation.

49.11 Reserved-Scope Limitation

The manuscript does not enumerate every directional or material-displacement relationship that the broader framework may later investigate. This limits the scope of the present paper but does not alter the burden on the flagship claim: omitted hypotheses cannot count as present support and cannot rescue a failed mandatory condition.

49.12 Replacement Limitation

One candidate event cannot independently replace the global causal framework of Plate Tectonics.

The replacement burden belongs to the complete series.

50 Conclusions

50.1 Conclusion 1: A Reproducible Bilateral Calculation Exists

Using the declared coordinates, Mount Everest is nearly equidistant from the selected Mini Aegean and Mariana locations.

The two spherical distances differ by approximately

$$44.808\,\mathrm{km}, \tag{371}$$

or approximately

$$0.373\%. \tag{372}$$

The relation persists under an ellipsoidal calculation.

50.2 Conclusion 2: The Selected Everest Coordinate Lies Near the Projected Along-Track Halfway Station

When Everest is projected onto the great circle defined by the selected Aegean and Mariana endpoints, its along-track location lies approximately

$$23.408\,\mathrm{km} \tag{373}$$

from exact halfway.

This is the most precise present-day geometric feature identified in Paper I.

50.3 Conclusion 3: Everest Is Not Presently on the Chord Axis

The same coordinate set places Everest approximately

$$1507\,\mathrm{km} \tag{374}$$

from the present Aegean–Mariana great-circle plane and chord-midpoint direction.

The original literal modern chord-midpoint claim is therefore not supported.

50.4 Conclusion 4: The Flagship Claim Becomes a Deep-Time Forensic Test

The relevant question is not whether the modern summit lies on a modern straight line.

The relevant question is whether independently identified precursor materials, inherited structures, and regional geophysical evidence can be reconstructed into one event-compatible sequence near the proposed chronostratigraphic interval.

50.5 Conclusion 5: The Proposed Mechanics Face a Severe Burden

The straight path extends approximately

$$10\,151\,\mathrm{km} \tag{375}$$

through Earth and reaches approximately

$$2520\,\mathrm{km} \tag{376}$$

depth.

The inherited energy and speed ranges imply very large impactor masses and extreme planetary consequences.

No viable transmission solution has yet been demonstrated.

50.6 Conclusion 6: Regional Roles Must Produce Differentiated Evidence

The entrance, midpoint, and exit interpretations predict different signatures.

The Aegean region must preserve a specific entrance residual.

The Himalayan region must preserve a specific inherited midpoint response.

The Mariana region must preserve a specific terminal-response residual.

The flagship event interpretation remains viable only if these regions can be connected through one geometry, chronology, and mechanical model.

50.7 Conclusion 7: The Replacement Thesis Remains Open

Astro-Ballistic Chronostratigraphic Sequencing does not deny that tectonic plates move.

It proposes that their boundaries, directions, speeds, and continuing interactions preserve a history of sequenced astro-ballistic forcing.

Paper I presents the flagship geometric and forensic challenge.

Paper II must identify at least one mechanically admissible event branch.

Paper III must derive a global boundary-and-motion solution for at least one eligible event sequence.

Paper IV must compare the cumulative framework directly with plate tectonics.

50.8 Final Paper-I Statement

The Aegean–Everest–Mariana relationship is not established here as a confirmed planetary penetration event.
It is formulated as a specific, reproducible, and falsifiable forensic-geophysical problem.
The present coordinates show near-equal Aegean–Everest and Everest–Mariana distances and an exceptionally close along-track halfway relationship, while simultaneously showing a large cross-track displacement from the literal modern chord.
That combination defines the challenge.
The flagship interpretation survives only if the geometry can be reconstructed through deep time, the three regions preserve the specified differentiated evidence, and one physically viable mechanism connects them. The broader replacement framework additionally requires at least one eligible event sequence to explain the global boundary-and-motion architecture more successfully than its alternatives.

A Reference Constants and Declared Inputs

Table 19: Reference constants and declared working inputs.

Quantity	**Value**	**Status**
Mean Earth radius	$6371\,\mathrm{km}$	Declared spherical reference
Earth mass	$5.972 \times 10^{24}\,\mathrm{kg}$	Reference value
Surface gravity	$9.81\,\mathrm{m\,s^{-2}}$	Reference value
Earth angular velocity	$7.292\,115 \times 10^{-5}\,\mathrm{rad\,s^{-1}}$	Reference value
Aegean latitude	36.47°N	Inherited declared coordinate
Aegean longitude	22.95°E	Inherited declared coordinate
Everest latitude	27.99°N	Inherited declared coordinate
Everest longitude	86.93°E	Inherited declared coordinate
Mariana latitude	11.32°N	Inherited declared coordinate
Mariana longitude	142.25°E	Inherited declared coordinate
Proposed event age	256 Ma	Hypothesis parameter
Event-energy range	$10^{29} - 10^{31}$ J	Inherited search interval
Impactor-speed range	$10\,\mathrm{km\,s^{-1}}$ to $30\,\mathrm{km\,s^{-1}}$	Inherited search interval
Exit-energy fraction	$0.1 - 0.5$	Inherited unverified assumption

B Coordinate and Vector Results

B.1 Unit Vectors

$$\boldsymbol{\xi}_A = \begin{pmatrix} 0.74051465 \\ 0.31356745 \\ 0.59440181 \end{pmatrix}, \tag{377}$$

$$\boldsymbol{\xi}_E = \begin{pmatrix} 0.04729151 \\ 0.88176224 \\ 0.46931745 \end{pmatrix}, \tag{378}$$

$$\boldsymbol{\xi}_M = \begin{pmatrix} -0.77530766 \\ 0.60030733 \\ 0.19628843 \end{pmatrix}. \tag{379}$$

B.2 Dot Products

$$\boldsymbol{\xi}_A \cdot \boldsymbol{\xi}_E = 0.5904751269, \tag{380}$$
$$\boldsymbol{\xi}_E \cdot \boldsymbol{\xi}_M = 0.5847844529, \tag{381}$$
$$\boldsymbol{\xi}_A \cdot \boldsymbol{\xi}_M = -0.2692156454. \tag{382}$$

B.3 Midpoint Direction

$$\widehat{\mathbf{m}} = \begin{pmatrix} -0.02877944 \\ 0.75592215 \\ 0.65402863 \end{pmatrix}. \tag{383}$$

The corresponding surface coordinate is approximately

$$40.846036^\circ\text{N}, \qquad 92.180310^\circ\text{E}. \tag{384}$$

C Audited Geometry Summary

Table 20: Complete audited present-day geometry summary.

Quantity	**Result**
Aegean–Everest central angle	53.809268°
Everest–Mariana central angle	54.212236°
Aegean–Mariana central angle	105.617599°
Aegean–Everest spherical distance	5983.318 km
Everest–Mariana spherical distance	6028.126 km
Aegean–Mariana spherical distance	11 744.141 km
Bilateral distance difference	44.808 km
Normalized bilateral asymmetry	0.373044%
Path excess through Everest	267.302 km
Ellipsoidal Aegean–Everest distance	5994.970 km
Ellipsoidal Everest–Mariana distance	6033.866 km
Ellipsoidal bilateral difference	38.896 km
Interior chord length	10 150.567 km
Physical half-chord	5075.284 km
Minimum midpoint radius	3851.122 km
Maximum chord depth	2519.878 km
Midpoint angular misfit	13.558849°
Midpoint surface separation	1507.675 km
Cross-track displacement	1507.497 km

Quantity	Result
Along-track offset from exact halfway	23.408 km
Straight-path entry angle below horizontal	52.808799°

D Equation Registry

Table 21: Principal Paper-I equation registry.

ID	Equation	Purpose
E1	equation (4)	Convert latitude and longitude to a unit vector.
E2	equation (6)	Calculate angular separation.
E3	equation (7)	Calculate spherical surface distance.
E4	equation (13)	Define the straight Earth-interior chord.
E5	equation (14)	Calculate chord length.
E6	equation (15)	Calculate minimum radial distance.
E7	equation (16)	Calculate maximum chord depth.
E8	equation (18)	Calculate the normalized midpoint direction.
E9	equation (20)	Calculate angular midpoint misfit.
E10	equation (22)	Quantify bilateral-distance asymmetry.
E11	equation (81)	Calculate cross-track great-circle displacement.
E12	equation (84)	Calculate along-track projected position.
E13	equation (111)	Test chronological consistency.
E14	equation (196)	Relate impactor mass, speed, and energy.
E15	equation (194)	Conserve energy across event consequences.
E16	equation (234)	Compare projectile and Earth column densities.
E17	equation (242)	Quantify directional energy localization.
E18	equation (266)	Define the inherited midpoint state.
E19	equation (275)	Partition exit energy.
E20	equation (298)	Define the mechanically viable parameter region.
E21	equation (315)	Calculate empirical null probability.
E22	equation (329)	Record deep-time geometric outputs.
E23	equation (184)	Compare complete event models.
E24	equation (361)	Define the future plate-motion prediction.

E Claim Registry

Table 22: Condensed claim registry.

Claim	Statement	Status
P1-C01	Aegean–Everest distance is approximately 5983.318 km.	Reproduced
P1-C02	Everest–Mariana distance is approximately 6028.126 km.	Reproduced
P1-C03	The bilateral asymmetry is approximately 0.373%.	Reproduced
P1-C04	Everest projects near the exact halfway station.	Reproduced
P1-C05	Everest is substantially cross-track from the modern axis.	Reproduced
P1-C06	The modern literal chord-midpoint claim fails the inherited 5° band.	Reproduced
P1-C07	Everest occupies a bilateral mid-sequence relationship.	Provisionally supported
P1-C08	The Mini Aegean region is the entrance.	Unverified
P1-C09	The Himalayan region preserves a midpoint-response inheritance.	Unverified
P1-C10	The Mariana region is the exit.	Unverified
P1-C11	All three derive from one event.	Unverified
P1-C12	The event occurred near 256 Ma.	Unverified
P1-C13	A concentrated disturbance traversed the deep mantle.	Unverified
P1-C14	The geometry is statistically exceptional.	Untested
P1-C15	The event supports causal replacement of Plate Tectonics.	Reserved for Papers II–IV

F Required Figures

A later illustrated or replication release should include, as data become available:

Figure 1. Global map showing the declared Aegean, Everest, and Mariana coordinates.

Figure 2. Great-circle route and Everest cross-track displacement.

Figure 3. Equal-distance circles centered on the Aegean and Mariana coordinates.

Figure 4. Along-track projection of Everest onto the endpoint great circle.

Figure 5. Three-dimensional spherical Earth with the interior chord.

Figure 6. Chord depth relative to mantle boundaries.

Figure 7. Present chord-midpoint surface direction and Everest.

Figure 8. Spherical versus ellipsoidal distance comparison.

Figure 9. Coordinate-sensitivity target domains.

Figure 10. Monte Carlo distributions for distance symmetry, along-track offset, and cross-track displacement.

Figure 11. Candidate deep-time reconstruction ensemble.

Figure 12. Aegean entrance-region structural map.

Figure 13. Himalayan midpoint-response target map.

Figure 14. Mariana terminal-response-region bathymetric map.

Figure 15. Entrance–path–midpoint-response–terminal-response conceptual sequence.

Figure 16. Event-energy and impactor-size parameter map.

Figure 17. Mechanical viability region.

Figure 18. Claim-dependency graph.

Figure 19. Falsification decision tree.

Figure 20. Five-paper series architecture.

G Required Tables

A later empirical or replication release should include:

Table 1. Declared coordinates and target definitions.

Table 2. Unit vectors and dot products.

Table 3. Spherical pairwise geometry.

Table 4. Ellipsoidal geodesic geometry.

Table 5. Chord geometry.

Table 6. Midpoint, along-track, and cross-track results.

Table 7. Coordinate-sensitivity scenarios.

Table 8. Deep-time reconstruction outputs.

Table 9. Candidate entrance observations.

Table 10. Candidate midpoint observations.

Table 11. Candidate exit observations.

Table 12. Event-age evidence.

Table 13. Impactor mass, speed, density, and diameter combinations.

H Source Integration and Bibliography Protocol

H.1 Source Categories

Any later empirical or regional expansion must preserve primary-source coverage for:

1. global geodesy and Earth reference models;
2. spherical and ellipsoidal geodesic methods;
3. paleogeographic reconstruction;
4. Aegean regional geology;
5. Himalayan tectonics and deep structure;
6. Mariana trench and arc geology;
7. seismic tomography;
8. impact physics;
9. shock mineralogy;
10. planetary-scale impact consequences;
11. end-Permian chronology;
12. extinction and environmental records;
13. plate-motion measurements;
14. plate-driving-force models;
15. mantle rheology;
16. Earth-binding and survival calculations;
17. statistical spatial-pattern analysis; and
18. comparative planetary impact structures.

H.2 Citation Rules

The source-integration pass must:

- cite observations separately from interpretations;
- prioritize primary research papers and official datasets;
- preserve exact dataset versions;
- distinguish published measurements from values calculated in this manuscript;
- cite competing interpretations fairly;
- identify sources that contradict the proposed framework;
- avoid citing secondary summaries as primary evidence;
- include sources for all conventional-model descriptions; and
- avoid implying that cited authors endorse Astro-Ballistic Chronostratigraphic Sequencing.

H.3 Internal Source Status

The current manuscript contains:

- source-framework findings inherited from the author's prior Astro-Ballistic Chronostratigraphic Sequencing work;
- newly audited calculations derived from the declared coordinates;
- proposed equations for future testing;
- proposed observational programs; and
- unresolved external-source requirements.

This source pass adds a verified external bibliography for the conventional context and methods actually cited. It does not supply independent confirmation for unresolved ABC claims.

H.4 Bibliography Status

The bibliography below contains the verified external sources cited in Paper I. Author-source documents remain provenance records and are not counted as independent support. Additional feature-specific primary sources remain necessary before publication.

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I Paper-II Handoff Package

I.1 Event-Specific Handoff

Paper I supplies Paper II with an event-specific audit package rather than a mechanically validated event state.

For candidate event k, define

$$\mathbf{H}_{I\to II}^{(k)} = \left(\mathbf{G}_{I,k}, \mathbf{U}_{I,k}, \mathbf{T}_{I,k}, \boldsymbol{\Theta}_{I,k}^{\text{search}}, \mathbf{R}_{I,k}, \mathbf{N}_{I,k}, \mathbf{F}_{I,k}\right), \tag{385}$$

where:

$$
\begin{aligned}
\mathbf{G}_{I,k} &= \text{audited coordinate, surface, chord, and midpoint geometry,} && (386)\\
\mathbf{U}_{I,k} &= \text{coordinate sensitivity and geometric uncertainty,} && (387)\\
\mathbf{T}_{I,k} &= \text{chronological and paleogeographic constraints,} && (388)\\
\mathbf{\Theta}_{I,k}^{\text{search}} &= \text{declared mechanical search ranges inherited from Paper I,} && (389)\\
\mathbf{R}_{I,k} &= \text{entrance, midpoint, terminal, and regional test requirements,} && (390)\\
\mathbf{N}_{I,k} &= \text{null-model, selection, and comparison design,} && (391)\\
\mathbf{F}_{I,k} &= \text{event-specific falsification and status record.} && (392)
\end{aligned}
$$

For the Aegean–Everest–Mariana flagship event, $k = F$.

I.2 Handoff Boundary

The handoff does not certify historical occurrence or mechanical viability. Paper II must treat unresolved coordinates, chronology, paleogeography, energy, velocity, density, and mechanism choices as uncertain inputs or search parameters rather than measurements.

A field may enter the mechanical model only with its Paper-I status, uncertainty, provenance, and version preserved.

I.3 Causal-Edge Handoff Status

The Paper-I handoff must include a causal-edge table for the proposed links

$$
\text{selected geometry} \rightarrow \text{shared deep-time relation} \rightarrow \text{candidate connected event.} \tag{393}
$$

At the present manuscript stage, the first edge is `SUPPORTED-AS-CALCULATION`; the second and third are `UNRESOLVED`. Paper II may test mechanical paths, but it may not inherit the connected-event interpretation as an established input.

Paper-I Freeze Status and Remaining Empirical Work

Corpus Freeze 1.0 completes the manuscript-level compilation, source and bibliography integration, equation and numerical audit, cross-paper consistency audit, falsification-scope audit, and version freeze for Paper I. Those manuscript tasks are therefore not listed as unfinished work.

The following remain research or empirical-execution tasks and are not represented as completed by this freeze:

1. production of publication-quality scientific figures tied to frozen data;
2. assembly and versioning of the required empirical datasets;
3. selection-aware statistical simulation and null testing;
4. deep-time material-lineage reconstruction;
5. regional physical-evidence integration at the declared target domains;
6. independent external equation and calculation review; and
7. machine-readable claim, data, and falsification export from the frozen corpus.

The next manuscript in the series is:

Astro-Ballistic Chronostratigraphic Sequencing II

Transmission Through a Differentiated Earth

Entrance Coupling, Differentiated-Earth Transmission, Midpoint-Response Inheritance, and Terminal-Response Mechanics