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Article

Unraveling the Mystery of Ancient Megalithic Engineering through Cosmology and Materials Mechanics

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Abstract

This paper proposes a new hypothesis that breaks through the framework of traditional archaeological chronology and engineering to explain the mystery of megalithic structures that exist widely around the world and whose technical features exceed current understanding. The core of this hypothesis is: 1) The Earth civilization has periodicity with the period of the Sun's movement around the Milky Way as the period, and at least two periods have already existed; 2) The continuous expansion of the universe leads to the continuous expansion of atoms and the continuous reduction of material strength. Based on this, a coupling model of "atomic characteristic scale - material strength - individual human physique and physiological function - engineering technology limit" was established, and the quantitative relationship between the maximum weight of a single stone in a megalithic building and its construction year, as well as the qualitative relationship between the splicing accuracy and the construction year, were derived. Analysis using this model indicates that the construction dates of ultra-precise megalithic structures such as Pumapungu, the Pyramids of Giza, and Balbek may be much older than traditional dating results, or they might be the products of the previous or even earlier civilization cycle.

Keywords: megalithic architecture; cosmic expansion; atomic expansion; material strength; ancient giants; civilization cycle; quantitative chronology; engineering archaeology; interdisciplinary verification

1. Introduction

The huge stone structures around the world (such as the Three huge stones in Baalbek, Lebanon, the Pumapungu in Bolivia, the Sarcehuaman in Peru, and the Pyramids of Giza in Egypt, etc.) [1,2] reveal three core technical mysteries: the first is the transportation and lifting of hundreds to 1,000 tons of huge stones (for example, a single huge stone in Baalbek weighs 1,000 tons, far exceeding the modern limit of pure manual transportation); The second is sub-millimeter level splicing accuracy (the splicing gap of Puma Penggu 'an rock components is less than 0.1 millimeters, comparable to modern mechanical processing); The third is the precise processing of high-hardness rocks (the hardness of the granite beams of the Giza Pyramids reaches 6-7 on the Mohs scale, making it difficult for Stone Age tools to achieve cutting and grinding). Traditional archaeology attributes it to "a large amount of manpower + simple tools + long construction period", but there are three core contradictions: First, the physical feasibility is questionable - according to ergonomic calculations, the effective weight that a single adult male can carry does not exceed 50 kilograms. Even if thousands of people work together, they still cannot overcome the static friction force between the huge rock and the ground. Secondly, the technical consistency cannot be explained - the huge stone structures that span continents around the world (such as the Moai statue on Easter Island and Stonehenge in the UK) are highly similar in terms of processing accuracy and transportation logic. Thirdly, the dating methods have inherent flaws - mainstream methods such as carbon-14 and thermoluminescence rely on associated organic substances (such as charcoal and bones), which

cannot directly determine the construction age of the huge stones themselves. Moreover, the associated organic substances may belong to the late period after the building was abandoned or the remnants of the next civilization cycle after its construction, leading to misjudgment of the age. Based on the interdisciplinary integration of cosmology and mechanics of materials, this paper constructs a brand-new explanatory paradigm: starting from the macroscopic effects of the universe's expansion, it deduces its chain influence on the microscopic atomic structure, material properties, and the functions of living organisms, re-evaluates the engineering capabilities and construction ages of ancient civilizations, and provides self-consistent and quantifiable solutions to the above mysteries.

2. Theoretical Framework and Core Hypotheses

2.1. The Hypothesis of Periodic Civilization

- 1) Life on Earth erupts and perishes in cycles of the Earth's revolution around the Milky Way with the Sun (galactic years, approximately 225 million years). In the orbital segment close to the galactic center, the Sun moves around the Milky Way at a high speed, with low radiation power and low Earth temperature, which is the Great Ice Age of the Earth. In the orbital segment far from the galactic center, the Sun moves slowly around the Milky Way, radiates high power, and the Earth's temperature is high, which is the Great Interglacial Age of the Earth [3]. When the Earth entered the Great Ice Age, most of the living things were destroyed (for example, during the Permian Ice Age 240 million years ago, the global average temperature dropped to -10°C , and 95% of the life on land became extinct). When it entered the Great Interglacial Age, there was a great explosion of life.
- 2) When the Earth enters a Great Ice Age, its civilization is destroyed along with the planet's life forms. When it enters a Great Interglacial Age, Earth's civilization arises alongside the explosion of life on the planet.
- 3) During each civilizational cycle on Earth, numerous asteroid impacts and explosions also occur. Such major astronomical catastrophes are sufficient to cause the extinction of human life on Earth. For example, during the Cretaceous-Paleogene extinction event 65 million years ago, the energy released by an asteroid impact and explosion was equivalent to 10^{23} joules, exceeding the Tunguska explosion [4] by a factor of 1000.
- 4) After the catastrophe, traces of civilization are primarily preserved through megalithic structures, as these structures exhibit high resistance to heat, weathering, impact, and geological movements. In contrast, remnants such as metal and wood would degrade over a timescale of hundreds of millions of years.

Five well-defined mass extinction events have been identified on Earth, occurring at intervals of approximately 250 million years, which aligns closely with the period of a galactic year [5].

2.2. The Hypothesis of Microscopic Effects of Cosmic Expansion

The core physical assumption of this model is that cosmic expansion not only acts on intergalactic space but also synchronously affects the interior of atoms, leading to the expansion of orbital electron radii over time [3,6]. This effect can be intuitively understood as: the universe is like an ever-expanding balloon, where the dots on its surface (analogous to atoms within the universe) will expand in size along with the balloon's inflation.

Let the present moment ($t = 0$) be defined as the origin of time, and adopt a backward-counting time t (i.e., $t > 0$ represents the past, with t decreasing as time approaches the present). The atomic radius $r(t)$ is proportional to the cosmic scale factor $a(t)$. Denoting the current atomic radius as $r(t_0)$ and the current cosmic scale factor as $a(t_0)$, we have:

$$r(t) = r(t_0) \frac{a(t)}{a(t_0)} \quad (1)$$

For a matter-dominated flat universe (Einstein-de Sitter model), the cosmic scale factor satisfies the following relation in proper time t' (measured from the Big Bang):

$$a(t) \propto t^{2/3} \quad (2)$$

Let the age of the universe be T , then the relationship between proper time and backward time is given by $t' = T - t$, where $t = 0$ corresponds to $t' = T$. Therefore:

$$a(t) = a(t_0) \left(\frac{T-t}{T} \right)^{2/3} = a(t_0) \left(1 - \frac{t}{T} \right)^{2/3} \quad (3)$$

Substituting formula (3) into formula (1) yields the relationship between atomic radius and backward time:

$$r(t) = r(t_0) \left(1 - \frac{t}{T} \right)^{2/3}, 0 \leq t \leq T \quad (4)$$

This formula indicates that as the backward time t increases (i.e., moving further into the past), the atomic radius $r(t)$ decreases, consistent with the change in the cosmic scale factor. If the universe follows a different evolutionary model, one only needs to substitute the specific form of the scale factor into formula (1). The physical meaning of backward time t is clear: $t = 0$ represents the current moment, and $t > 0$ indicates rewinding to the past. The atomic radius $r(t)$ decreases as t increases, meaning that in earlier periods, atoms were more "compact."

2.3. The Time Evolution Inference of Material Mechanical Properties

The strength of solid materials is fundamentally a macroscopic manifestation of the electromagnetic binding forces between atoms, based on the Lennard-Jones potential model (a classical model describing interatomic interactions):

Experiments show that when the atomic arrangement density of synthetic materials is increased, their strength can be significantly enhanced [7];

Corollary 1: The atomic radius $r(t)$ and the interatomic binding force $F_b(t)$ satisfy (ignoring the effects of cosmic expansion, i.e., time evolution):

$$F_b(t) \propto [r(t)]^{-n} \quad (5)$$

Magnetic dipole moment interaction $n = 4$; in silicon crystals, $n \approx 7 - 8$ [8];

Corollary 2: The macroscopic strength (compressive and tensile) $\sigma_s(t)$ and hardness $H(t)$ of a material are proportional to $F_b(t)$, thus:

$$\sigma_s(t), H(t) \propto F_b(t) \propto \left(1 - \frac{t}{T} \right)^{-2m/3} \quad (6)$$

where m is a positive parameter (considering that the spatial energy density decreases as the universe expands, that is, as time t decreases, while the force increases rapidly with the increase of spatial energy density, $m > n$), therefore, the more anciently a material was formed, the higher its strength and hardness.

2.4. The Time Evolution Inference of Biological Physiological Functions

Similarly, the strength of biological tissues (bones, muscles, skin, plant fibers) also follows the above-mentioned pattern.

Corollary 3: The bone strength, skin strength, and maximum contractile force to body weight ratio of ancient humans and animals were higher. This means that for ancient humans of the same body weight, their individual strength and collective collaborative lifting power far exceeded those of modern humans.

Corollary 4: Given that the bone strength, skin strength, and muscle fiber strength of ancient humans far exceeded those of modern humans, ancient individuals could bear greater body weight and achieve larger physical spans. Therefore, the body weight and size of ancient people were

significantly greater than those of modern individuals. Hence, the more distant the era, the larger the body weight and size of humans.

Corollary 5: From Corollaries 3 and 4, the following can be inferred: The individual lifting power and the team collaboration lifting power of ancient people far exceeded those of modern people. The older the time, the greater the lifting power of humans.

The size and weight of the largest ancient land animals far surpassed those of modern ones (for example, the largest dinosaurs reached lengths of 35-58 meters and weighed about 180 tons, roughly equivalent to 13 of the largest modern elephants). This is consistent with the logic: cosmic expansion → atomic expansion → decreased bone strength → reduced size and strength (the limit of bearable body weight and physical span).

2.5. The Inference of Rock Strength and Tool Efficiency

The strength and hardness of rocks are primarily related to the era when they formed from cooling magma.

Corollary 6: The more anciently a rock solidified from cooling magma, the higher its strength and hardness. Once formed, because the lattice constant is only slightly affected by atomic expansion, its strength and hardness do not change significantly over time.

The hardness and strength of tools (such as iron, copper, and wooden ones) are also related to the era of metal smelting and forging or plant growth.

Corollary 7: The more anciently metal materials were smelted and forged, the higher their strength and hardness; the more anciently plants grew, the higher the strength of plant-based materials.

Since the strength and hardness of rocks are solely related to the era of their formation from cooling magma (the more anciently they solidified, the higher their strength and hardness), once formed, their strength and hardness change very little over time. However, the strength and hardness of metal tools depend on the era of their smelting and forging (the more anciently they were made, the higher their strength and hardness). Therefore, using the same tools (such as iron chisels, wedges, and hammers), ancient people had a far greater capacity to work rocks than modern people. Due to continuous atomic expansion, plants that grew in ancient times had higher fiber strength, and ropes made from plant fibers that grew hundreds of millions of years ago were sufficient to meet the demands of transporting and lifting hundreds or thousands of tons of megaliths at that time.

3. Quantitative Model and Chronological Estimation of Megalithic Structures' Features

3.1. The Relationship Between the Maximum Transportable/Liftable Megalith Weight and Time

The largest stone that a Stone Age civilization could carry and lift was limited by its human, animal and tool capabilities. The core limiting factors (human strength and the strength of rope materials) all weakened over time. The simplified model is:

$$M(t) = M_0 \left[\left(1 - \frac{t}{T}\right)^{2/3} \right]^{-m} = M_0 \left(1 - \frac{t}{T}\right)^{-2m/3} \quad (7)$$

Here, M_0 represents the maximum weight of rock that can be handled (transported and lifted) in the current era ($t=0$) under the same conditions in ancient times, and m is a comprehensive index. If we assume $M_0 = 10$ tons [9], and if we suppose that the Great Pyramid of Giza was constructed during the previous civilizational cycle (214 million years ago), given that the weight of the beams in the King's Chamber of the Great Pyramid of Giza is $M = 80$ tons, then from formula (7), $m = 200$.

Given the maximum stone weight M used in a structure, its construction date t can be back-calculated as follows:

$$t = T - T \left[\frac{M(t)}{M_0} \right]^{-3/2m} = T - T \left[\frac{M_0}{M(t)} \right]^{3/2m} \quad (8)$$

Application and Calculation (Example): Assuming the pure human/simple tool limit without heavy machinery in modern times ($t = 0$) is $M_0 = 10$ tons [9]; taking the age of the universe as $T = 13.8$ billion years, and $m = 200$, different t values can be calculated for different M values:

Ranking	Site Name	Location	Maximum Installed Single Boulder Weight	Traditional Dating Result	Model Calculation Result	Core Characteristics
1	Trilithon of Baalbek	Baalbek, Lebanon	≈1,000 tons	1st century AD (Roman period)	466 million years ago	Three boulders (each 800–1,000 tons) installed on a 6–7-meter-high platform
2	Grand Menhir Brisé (Locmariaquer)	Brittany, France	≈350 tons	4500 BC	363 million years ago	Once fully erected, later fractured; base and fragments remain
3	Sacsayhuamán	Cusco, Peru	≈300 tons	15th century AD (Inca)	346 million years ago	Lower wall boulders, dry-laid without gaps, still intact
4	Puma Punku	Tiwanaku, Bolivia	≈131 tons	500–800 AD	264 million years ago	Andesite “H-shaped” components, precision splicing, fragments remain
5	Moai “Paro” (Easter Island)	Easter Island, Chile	≈82 tons	Around 1400 AD	217 million years ago	Erected on the Ahu platform, the tallest surviving Moai
6	King’s Chamber Beam (Great Pyramid of Giza)	Giza, Egypt	≈80 tons	2580–2560 BC	214 million years ago	Granite load-bearing beam installed inside the pyramid
7	Göbekli Tepe	Şanlıurfa, Turkey	≈70 tons	10000 BC	198 million years ago	Circular stone circle, T-shaped stone pillars with carvings, Mohs hardness 7
8	Konark Sun Temple	Odisha, India	≈60 tons	13th century AD	172 million years ago	Sandstone components spliced without gaps, surface relief precision <0.5 millimeters
9	Ġgantija Temple Megaliths	Gozo Island, Malta	≈50 tons	3600–3200 BC	166 million years ago	Outer wall stones of the temple, still intact
10	Heel Stone (Stonehenge)	Wiltshire, UK	≈40 tons	2600 BC	143 million years ago	Entrance standing stone, still intact
11	Newgrange Passage Tomb Entrance Capstone	Meath County, Ireland	≈25 tons	3200 BC	94 million years ago	Tomb passage covering stone, still intact

3.2. A Model for the Closure of Megalithic Joints Over Time

This is key to explaining the phenomenon of “perfect fit”. Let the average gap width between two megaliths at the time of construction be δ_0 (determined by rock processing precision and masonry techniques). Due to cosmic expansion, every atom in the stone is “expanding,” causing the linear size $L(t)$ of the entire block to increase over time:

$$L(t) = KL(t_0) \left(1 - \frac{t}{T}\right)^{2/3}, 0 \leq t \leq T \quad (9)$$

where K is a coefficient. Since atomic expansion is isotropic, the gap shrinks proportionally. Note that t is backward time, so $L(t) < L(t_0)$. Due to lattice constraints, the expansion rate of solids is less than that of atoms (the universe).

Corollary: The more ancient the construction date and the larger the stone blocks used, the smaller the gaps observed in the stone structures today.

The above corollary provides a unified explanation for why the gaps in those ancient megalithic structures (such as the Trilithon at Baalbek, Puma Punku, and the Pyramids) are so small. In reality, when these megalithic buildings were first constructed, the gaps were of a normal size (e.g., around 5mm). It is because the stone blocks used were very large and the buildings were constructed in a very distant past that, under the long-term effect of cosmic expansion and atomic expansion, the gaps have been significantly compressed. Therefore, the gaps in these megalithic structures are now extremely small. For example, the currently observed average splicing gap at Puma Punku is only

0.08 millimeters, and the average observed splicing gap of the three giant stones at Baalbek is less than 0.1 millimeters.

4. Discussion

4.1. Self-Consistency and Explanatory Power of the Model

This model provides a unified explanation for several mysteries of ancient megalithic structures:

- 1) How massive stones were transported and lifted (ancient people were much larger and stronger than modern humans, and materials used for transportation, such as ropes and wood, were also much stronger);
- 2) How hard rocks were processed (tools at that time were much harder than those now);
- 3) Why the gaps are so small (long-term atomic expansion has compressed the gaps);
- 4) The “precision grooves” on the surface of megaliths, such as the rectangular grooves in Puma Punku components with depth errors <0.2 mm—why could ancient tools achieve this? (The model indicates that the ratio of tool hardness and strength to rock hardness and strength was greater in ancient times, meaning tools had relatively higher hardness and strength, and ancient people had stronger muscle power, enabling high-precision cutting and drilling);
- 5) The stability of mortarless joints—for example, the megalithic walls of Sacsayhuamán can withstand earthquakes without adhesive (although the gaps were larger at the time of construction, around 5 mm, atomic expansion led to gap closure, forming a “mechanical interlock” between the stones, enhancing the building’s integrity and stability);
- 6) The similarity of technologies worldwide (different locations and civilizational cycles follow the same physical laws: cosmic expansion-atomic expansion).

4.2. A Deepened Analysis of the Limitations of Traditional Dating Methods

This model posits that organic materials (charcoal, bones) attached to megalithic structures may belong to later human activities after the buildings were abandoned, rather than being contemporaneous with their construction. Therefore, traditional carbon-14 dating methods may systematically underestimate the true construction dates of these structures. The misjudgment of the construction dates of megalithic buildings by traditional dating methods is essentially a “desynchronization between carrier and sample.” For example:

- 1) The Giza Pyramids: Traditional carbon-14 dating based on charcoal samples from the burial chamber concluded around 2500 BCE, but the charcoal could be remnants from a subsequent civilizational cycle, not contemporary with the construction;
- 2) Puma Punku: Associated organic matter consists of plant remains from around 600 CE, which were actually left behind when the Incas restored the building, unrelated to the megalith’s construction date;
- 3) Core flaw: Traditional dating methods can only determine the “existence date of organic matter,” not the “processing date of the megaliths,” while the key to studying megalithic architecture lies in the temporal attributes of megalith processing and construction.

4.3. The Limitations of the Model and Its Future Direction

Limitation 1: The model does not account for differences in the level of technological development across different civilizational cycles. In the future, a “civilizational technology maturity coefficient” could be introduced to classify the technological stages of these cycles based on the correlation between megalith processing precision and weight.

Limitation 2: There is a lack of direct observational evidence for cosmic expansion-atomic expansion. In the future, this hypothesis could be verified by comparing the interatomic distances in rocks from different geological eras using X-ray diffraction technology.

Future Directions: More refined physical models are needed to describe: the precise form of how interatomic forces change with atomic scale, the exact relationship between human size/strength and time, and the precise relationship between the gaps in stone structures, their age, and the size of the stones.

5. Conclusions

This paper constructs an interdisciplinary coupled model of cosmic expansion-atomic expansion-material strength and hardness-human body size and strength-engineering capability, providing a quantifiable and verifiable explanatory framework for the “technological impossibility” of megalithic structures. The core conclusions are as follows:

- 1) Earth’s civilization is periodic, with a cycle length of approximately 225 million years. Global cyclic catastrophes lead to the annihilation of civilization, with megalithic structures being the primary surviving relics.
- 2) Cosmic expansion causes atomic radius to increase over time, while material strength, human body size, and strength diminish over time. Ancient civilizations possessed the physical conditions to process, transport, and lift megaliths.
- 3) The construction dates of megalithic structures such as Puma Punku, Baalbek, and the Giza Pyramids may be 100-500 million years ago, far exceeding traditional dating results, and they are products of the previous or even earlier civilizational cycles.
- 4) The key to validating the model lies in three major directions: direct verification of atomic expansion, systematic testing of ancient material strength, and the development of technologies for directly dating the construction of megaliths themselves.

This study breaks down the disciplinary barriers between archaeology and cosmology, proposing a new paradigm of engineering archaeology that “returns to basic physical laws.” It provides a novel perspective for the study of prehistoric civilizations and lays the theoretical foundation for the interdisciplinary research of global megalithic structures.

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