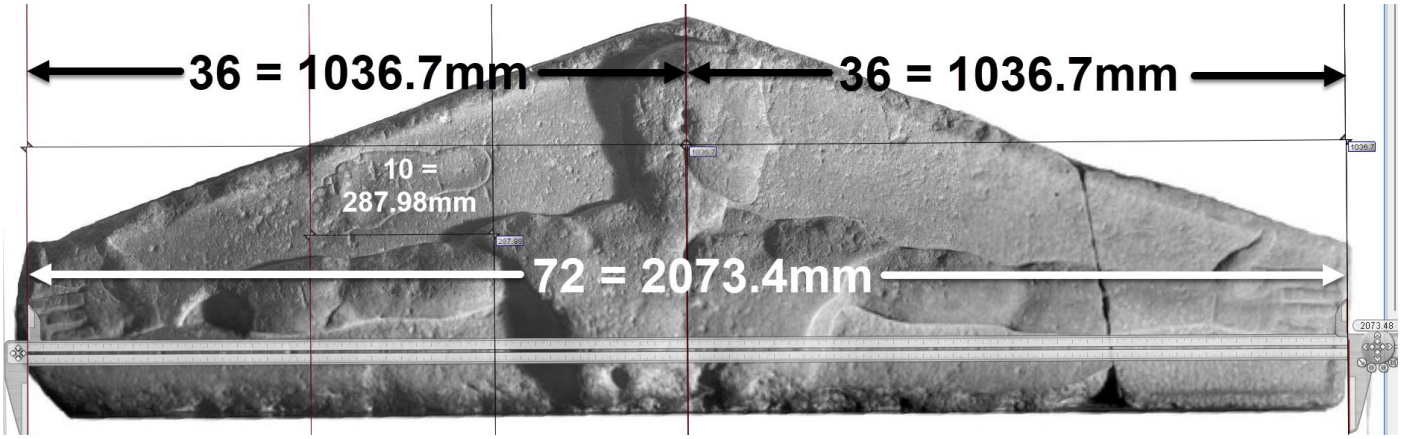


The Metrological Relief

CONNECTING ANCIENT SYSTEMS OF MEASUREMENT: THE GREAT PYRAMID AS A METROLOGICAL BENCHMARK

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Abstract

The Metrological Relief at the Ashmolean Museum, likely originating from the island of Samos during the 5th century BCE, represents a fascinating intersection of ancient metrology, trade, and intellectual exchange. Believed to have adorned the doorway of a building of weights and measures, the relief features a man with outstretched arms and an impressed foot, symbolizing standard units of measurement such as the fathom and foot. This artifact offers insight into ancient systems of measurement, suggesting a link between Samos, Egypt, and broader European and Mediterranean civilizations.

This study investigates whether ancient systems of measurement were influenced by a prototypical "mètre de archive," possibly derived from the estimated circumference of the Earth, a concept tied to the Silver Ratio Cubit (SRC) and ACST in my earlier studies. Analysis of the relief's dimensions reveals an arm span of approximately 2073.4 millimeters, recalibrated from Adolf Michaelis's original 1883 measurements, and a foot length of 287.98 millimeters. These measurements correspond remarkably well with Herodotus's reported base of the Great Pyramid, measured as 800 feet, implying either direct use of the same standard or knowledge of a tradition linking the Samian foot to 1/800th of the Great Pyramid's base.

Further examination reveals that the 'arm span to foot' ratio on the relief is not tied to any 'fathom to foot' ratio on record, but uniquely has a ratio of 1 : 7.2 feet, which also equates to the length of Alexander Thom's hypothesized 'Albion' Megalithic Rod. Comparative analysis of related units—including the Egyptian Royal Cubit, Egyptian Remen, Albion Megalithic Rod, Samian Fathom, Roman Pace, and others—demonstrates a striking convergence of these measures at 103.672 meters, equivalent to 198 Egyptian Royal Cubits.

This study posits that such alignment is not coincidental but could reflect an underlying metrological framework rooted in the SRC, developed around 2600 BCE by the Ancient Egyptians based on their estimation of the Earth's circumference. The Great Pyramid and Stonehenge may have served as immovable "mètres de archive," eternal benchmarks linking these systems of measurement. This hypothesis underscores the interconnectedness of ancient metrological traditions, cross-pollinated through trade routes and intellectual exchange, with Egypt playing a pivotal role in disseminating this knowledge across the ancient world.

Introduction

The Metrological Relief at the Ashmolean Museum (Figure 1) is a fascinating artifact, likely originating from the island of Samos during the 5th century BCE—a time of cultural and intellectual flourishing for the island. The gable-shaped relief is believed to have been displayed above the doorway of a building of weights and measures, as the marble features a man with outstretched arms and an impressed foot above his right arm. These elements are thought to represent standard units of measurement, such as the fathom and foot, making the relief a visual reference for metrological systems of the time. Its creation coincides with the era of Herodotus (c. 484–425 BCE), who held a deep fascination with Samos and its connections to Egypt, making this artifact a tangible link to the web of exchanges between these great civilizations.

Samos, a vibrant hub of trade, culture, and ideas in the ancient world, thrived as a crossroads between Greece and Egypt. During the 7th and 6th centuries BCE, Samian merchants traded in Egyptian cities like Naucratis, bringing back not just goods, but also artistic and intellectual influences. Herodotus, the "Father of History," visited the island in the 5th century BCE and wove its history into 'The Histories'. He vividly described the reign of Polycrates, the ambitious tyrant of Samos (ruled c. 538–522 BCE), and his alliance with the Egyptian pharaoh Amasis II (ruled 570–526 BCE), underscoring the deep ties between the two regions. Herodotus marveled at Samos's achievements, including its engineering wonders like the Eupalinian Tunnel, and recognized the island's importance as a key player in Mediterranean trade and diplomacy. Notably, Herodotus also measured the Great Pyramid in Egypt, recording its base as 800 feet—a length that aligns remarkably well with the 'Samian' foot measure derived from the relief.

The investigation of ancient measurement systems, like those suggested by the Metrological Relief, raises intriguing questions about whether these systems were influenced by a prototypical "mètre de archive" standard, possibly based upon an ancient survey which determined the average circumference of the earth. My goal in studying such artifacts is to determine whether there was a common linkage between pre-Byzantine systems of measurement based upon this 'standard'. While I do not expect to find exact correlations between these ancient systems and more modern measurement systems, such as the imperial foot, Italian braccia, or the 18th-century meter, there may be close approximations. These modern systems, being descendants of ancient measurements, and, the modern meter itself, being based on an estimation of the circumference of the earth, might show some resemblance. However, due to

inevitable "fiddling"—driven by regional and kingly preferences, competitive refinements, and multiple stages of attempted standardization—it is unlikely that approximations will exceed 99.5% accuracy between these more modern measures and the original ancient standards.[1]

Ancient systems of measurement were likely not isolated from one another in a broad sense. This hypothesis assumes that cross-pollination occurred primarily through trade routes and the dissemination of information, particularly by the ancient Egyptians, who were celebrated for their advanced knowledge and monumental achievements. Structures like the Great Pyramid—one of the most magnificent wonders of the ancient world—may have served as a shared standard, influencing otherwise distinct systems of measurement across Europe, the Mediterranean and beyond. Such a benchmark could help explain why Herodotus's report on the Great Pyramid's base length aligns precisely with the measures derived from the relief, suggesting the potential for a common, ancient metrological thread connecting these civilizations.

And then there's Pythagoras (c. 570–495 BCE), the most famous son of Samos, whose story adds another layer of connection. Born during Polycrates' reign, Pythagoras traveled to Egypt in the late 6th century BCE, studying mathematics, astronomy, and religious practices under Egyptian priests. The influence of Egyptian knowledge on Pythagoras's teachings is undeniable—and while the relief itself is not directly tied to Pythagoras, it emerges from the same cultural milieu that shaped his thinking.

Taken together, the Metrological Relief serves as more than a functional artifact—it's a testament to the profound interconnectedness of Samos, Egypt, and the figures of Herodotus and Pythagoras. This artifact encapsulates the flow of ideas and traditions between these civilizations, a legacy that flourished on the island of Samos during its golden age in the 5th century BCE. It also reminds us of the possible existence of shared knowledge and standards, such as the base of the Great Pyramid, that may have influenced these systems of measurement across the ancient world.

Analysis

In 1883, Adolf Michaelis made a landmark contribution to the study of this relief by publishing the first detailed account. His conclusions were so well-founded that, even in the 21st century, they remain

[1] In the early 20th century, metrologists often attempted to perfectly harmonize modern measurement systems with ancient ones, operating under the assumption that the fidelity of ancient measurements had somehow remained absolutely unaltered through millennia of societal changes, upheavals and attemptes at standardization.

difficult to dispute.[2] However, even the most diligent scholars can make minor errors. Michaelis mistakenly assumed that a major fragment of the figure's left hand and wrist added to the reconstruction was part of the original relief. In reality, this large piece was a 'modern' reproduction created to make the artifact functional as a decorative element. Despite this oversight, Michaelis's interpretation remains a testament to his deep understanding of the artifact's aesthetic and historical significance, believed to have been part of the entrance to a 5th-century BCE Greek building of weights and measures, possibly on the island of Samos itself.

On this marble relief (Figure 1), Michaelis recorded an arm span of 2069 millimeters, measuring fingertip to fingertip. However, this measurement included the reconstructed fragment of the right half, which the sculptor made a hair shorter than true original symmetry would require. By digitally analyzing a high definition image of the relief from the Ashmolean Museum using screen calipers calibrated to Michaelis's measurement, we can detect this asymmetry. The man's left side (on the right side of the relief) is approximately 4.5 millimeters shorter than his right side (on the left side of the relief), making the total arm span shorter than the original marble by about 4.5 millimeters.[3]

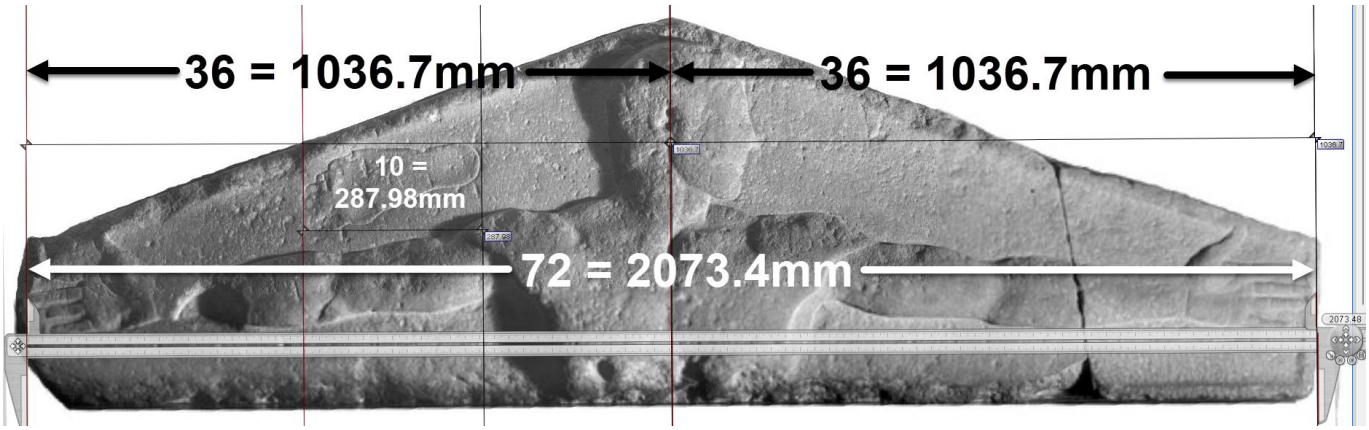


Figure 1

To determine the original span length, we can use the tip of the apex of the relief, a couple of inches above the man's head, as a central reference point. By mirroring the length of the intact left side (the

[2] Michaelis, A. T. F. (1883). The metrological relief at Oxford; Fernie E. The Greek Metrological Relief in Oxford. *The Antiquaries Journal*. 1981;61(2):255-263. doi:10.1017/S0003581500029516

[3] We can see that the total, original, unrepaired left side measures 1036.7 mm to the center (apex) of the relief. When this is mirrored to the right side, then it is 4.8 mm past the end of the reproduced right-side fingertip, giving us the impression that the sculptor made the replacement piece, although well crafted, 4.8 mm too short.

man's right side) to the reconstructed right side (the man's left side), we find that the original arm span is slightly longer than the reconstructed fragment suggests. Using Michaelis's recorded measurement of 2069 millimeters, we can adjust for the discrepancy caused by the shorter reproduction. The mirrored arm span produces a total length of approximately 2073.4 millimeters, 4.48 millimeters longer than Michaelis's measurement—just under 1/500th of the total length (Figure 2).

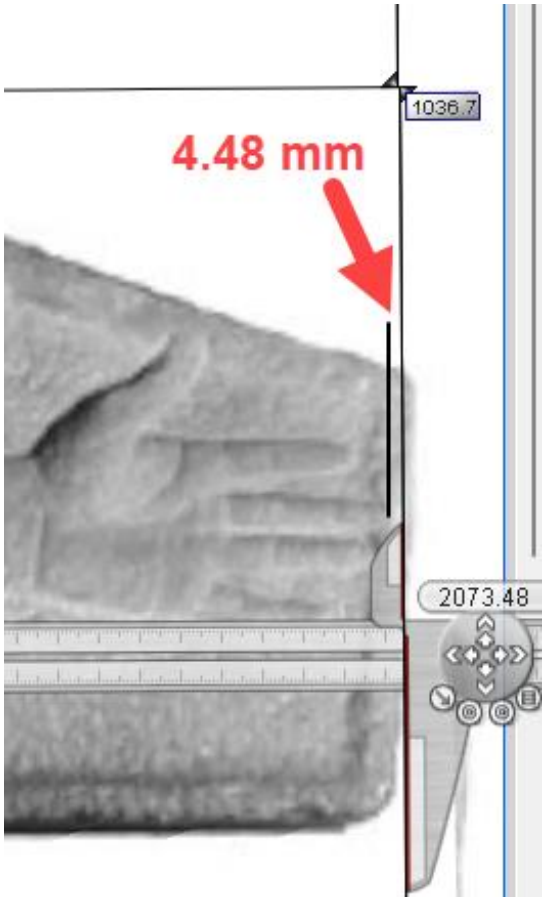


Figure 2

This recalibration not only allows us to determine the original arm span but also provides a precise reference to measure the impressed foot above the man's right arm. Using the calibrated digital measurement of the original arm span (2073.4 millimeters), we find that the length of the foot—from the back of the heel to the tip of the second toe—measures exactly 287.98 millimeters (Figure 3). This is particularly significant, as it matches the length of the "foot" Herodotus referenced when recording the dimensions of the Great Pyramid as 800 feet. This connection can be calculated by knowing the base of the Great Pyramid is 230.386 meters and dividing by 800, which yields precisely 0.28798 meters, or 287.98 millimeters.

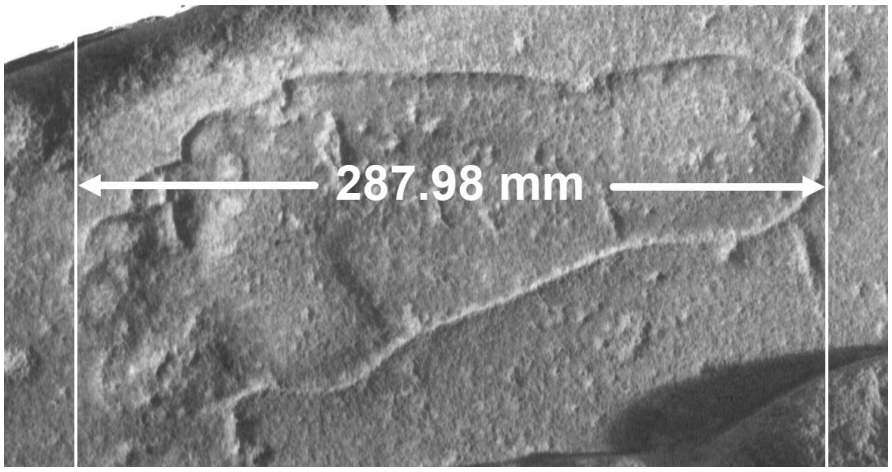


Figure 3

This analysis leads to two possible conclusions: either Herodotus directly measured the base of the Great Pyramid using the same "standard" of measurement as depicted on this relief, or he was already aware, through his extensive travels and knowledge of the strong interconnections between Egypt and Samos, of a tradition linking the Samian foot to 1/800th of the Great Pyramid's base. Either way, this evidence supports the accuracy of Herodotus's report on the base length of the Great Pyramid. It further suggests that the Great Pyramid itself may have served as a type of 'mètre de archive'—a standardized reference measure from which other units across the region were derived.

Additionally, it has long been assumed that the foot measure in this relief was tied to an unknown Greek "fathom" spanning 7 feet. However, the arm span depicted on the relief is not 7 times the length of the foot but precisely 7.2 times longer, indicating that this foot has nothing to do with a 'fathom' as is commonly supposed. This suggests that if the foot consisted of 10 units, the arm span would amount to exactly 72 units. Something else is going on here. Those familiar with my recent work will recognize the significance of this measure: an arm span of 2.0734 meters (2073.48 millimeters) corresponds precisely to Alexander Thom's hypothesized Megalithic Rod of 2.0734 meters and 2.5 of his Megalithic Yards. This connection provides further evidence of the shared mathematical and metrological principles linking these ancient systems.

By incorporating the Samian foot and fathom into this hypothesis, we can now conclude this preliminary study with a fascinating comparison of eight lengths from four different systems.[4] I propose that these

[4] For the Roman system see: Rottländer, R. C. A. (2013). Antike Längenmaße: Untersuchungen über ihre Zusammenhänge. Germany: Vieweg+Teubner Verlag.

measures ultimately derive from the Silver Ratio Cubit (SRC), a unit I believe was developed around 2600 BCE by the Ancient Egyptians based on their estimation of the Earth's circumference as 44,800,000 SRC. By using the Silver Ratio Cubit (SRC) as a base unit, it was divided by √2 to create two fundamental Egyptian measures: the Egyptian Royal Cubit (ERC) and the Egyptian Remen (ERM), measuring 0.52360 and 0.37026 meters respectively.

Measures Derived from the SRC

Egyptian Royal Cubit (ERC): 0.52360 meters

Egyptian Remen (ERM): 0.37026 meters

Albion Megalithic Rod (AMR): 2.07345 meters

Albion Megalithic Yard (AMY): 0.82938 meters

Samian Fathom (SFM): 2.07345 meters

Samian Foot (SFT): 0.28798 meters

Roman Pace (RPC): 1.48104 meters

Roman Foot (RFT): 0.29620 meters

Remarkably, all these measures converge into a precise whole number equivalent at 103.672 meters, which is exactly 198 Egyptian Royal Cubits. This is not merely coincidental—198 Royal Cubits correspond precisely to the height of the King's Chamber floor below the apex of the Great Pyramid. This ratio divides the total height of the pyramid into the Silver Ratio (198 : 82), reinforcing its mathematical significance.

Furthermore, 198 Royal Cubits also match the planar distance from the Station Stones to the Heel Stone at Stonehenge. This suggests that both the Great Pyramid and Stonehenge may have served as primordial 'mètres de archive'—immovable and monumental standards of measurement. The massive and enduring construction of these sites underscores their purpose as eternal benchmarks for metrology.

Unified Measures (as 103.672 meters)

198 Egyptian Royal Cubits

280 Egyptian Remen

50 Samian Fathoms

360 Samian Feet

50 Albion Megalithic Rods

125 Albion Megalithic Yards

70 Roman Paces

350 Roman Feet

This profound alignment of measures across civilizations further strengthens the hypothesis of a shared ancient metrological system rooted in the SRC and estimated circumference of the earth, with monumental sites like the Great Pyramid and Stonehenge acting as interconnected standards.

Conclusion

The Metrological Relief at the Ashmolean Museum provides a compelling lens through which to explore the interconnectedness of ancient metrological systems. This study has demonstrated that the relief's dimensions, particularly the recalibrated arm span of 2073.4 millimeters and foot length of 287.98 millimeters, align with known measures such as Herodotus's report of the Great Pyramid's base length and Alexander Thom's hypothesized Megalithic Rod. Such correlations suggest a shared metrological framework that transcended regional boundaries, likely driven by trade, cultural exchange, and the dissemination of knowledge—particularly by the Ancient Egyptians, who were renowned for their advanced understanding of geometry and measurement.

By incorporating measures like the Egyptian Royal Cubit, Egyptian Remen, Samian Foor and Fathom, Roman Foot and Pace and the Albion Megalithic Yard and Rod, this analysis has revealed a remarkable convergence at 103.672 meters, equivalent to 198 Egyptian Royal Cubits. This convergence not only aligns with the height of the King's Chamber floor below the apex of the Great Pyramid but also matches the planar distance from the Station Stones to the Heel Stone at Stonehenge. These parallels reinforce the hypothesis that both sites served as primordial 'mètres de archive'—immovable standards of measurement designed to preserve and disseminate metrological knowledge.

While modern systems of measurement have undergone inevitable modifications and standardizations over time, the alignment of these ancient measures points to a sophisticated, interconnected framework rooted in the Silver Ratio Cubit (SRC). Developed around 2600 BCE, this unit was likely based on the Egyptians' estimation of the Earth's circumference, offering a foundation for diverse yet unified systems of measurement across the ancient world.

In conclusion, the Metrological Relief stands as more than an artifact of a bygone era; it is a testament to the ingenuity, collaboration, and shared knowledge of ancient civilizations. Its connections to the Great Pyramid, Herodotus, and broader Mediterranean and European systems underscore the enduring influence of these ancient metrological traditions and invite further study into their origins, evolution, and applications.