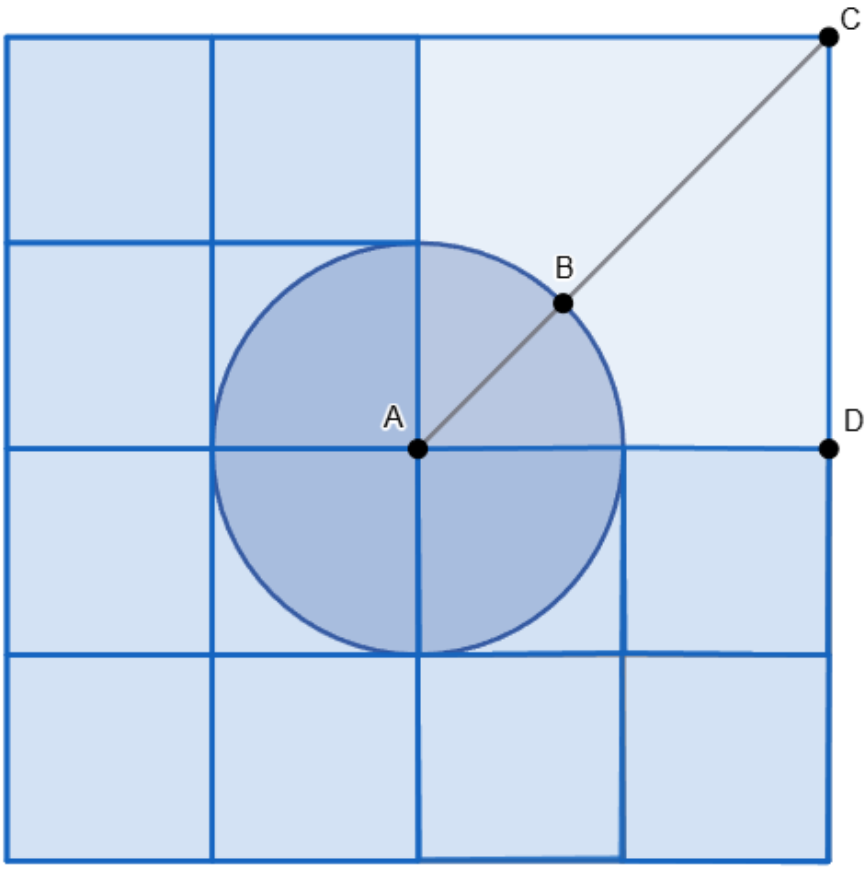


From the Meter to the Royal Cubit & Yard

Carl Balowski | May 2026

Abstract

This paper extends my previous studies on the possible, seemingly anachronistic, relationship between the modern meter and the Egyptian Royal Cubit by asking whether the traditional 'yard' may also be derived from the same meter-length through simple Euclidean geometry. In earlier work on Large Scale Metrology, I proposed that an ancient geodetic unit equivalent in length to the modern meter may have existed as one ten-millionth of the earth's quarter circumference. From this unit, the Royal Cubit can be generated exactly by constructing a 1:2:√5 right triangle and dividing its perimeter by ten, yielding 0.523607 meters. That value aligns with the Great Pyramid, the King's Chamber, later cubit rods, and pentagonal geometry associated with the Egyptian Duat. In this paper, I apply the same method to the yard. By constructing the diagonal of a 1-meter square and subtracting a half-meter radius, the remaining segment equals √2 – 1/2, or 0.914214 meters. This is only 0.186 mm shorter than the modern yard of 914.4 mm, an error of approximately 0.020391%. I do not claim to know what this means historically. The relationship may reflect transmission, inheritance, convergence, or coincidence. Nevertheless, the geometry is striking: both the Royal Cubit and the yard appear to emerge from the meter through simple straightedge-and-compass constructions requiring no advanced algebra. The meter may therefore be modern in name, while the underlying length may be accidentally ancient.

Introduction

The claim appears, at first, to be anachronistic and nonsensical: how could the modern meter serve as a basis for the Egyptian Royal Cubit thousands of years before the metric system was formally created? But in my previous studies I have argued that the anachronism lies in the word "meter," not necessarily in the length itself. In this hypothesis, the modern meter is modern in name and official adoption, but the underlying length may be "coincidentally" ancient: not because the French knowingly recovered an Egyptian unit, but because both the modern meter and a far older geodetic unit may have derived from the same earth-based principle — one ten-millionth of the earth's quarter circumference. This implies that the ancient Egyptians possessed the ability to carry out high-precision Large Scale Metrology. I first addressed a treasure trove of circumstantial evidence for this possibility in my earlier papers: "The Great Pyramid of Heliopolis: An Osirian Calendric Unit from Khufu's Pyramid Used for Large Scale Metrology (LSM)," "The Great Pyramid and the Approximated Circle Square Template (ACST) at Stonehenge," and "The ACST and the Great Pyramid of Stonehenge: The Role of the Circle, Square, and Silver Ratio in Large-Scale Megalithic Design, Orientation, and Astronomical Observation."

All the constructions I am proposing do not require advanced mathematics. They do not depend upon algebra in the modern symbolic sense, nor upon trigonometry, calculus, sophisticated numerical theory or ultra precise estimations of pi. Algebra may be used afterward to describe what has happened, but the actual procedures are simple Euclidean constructions. They require only a straightedge and compass. This is central to the argument. I am not imposing a modern mathematical apparatus on ancient metrology; I am asking whether very simple geometric acts — acts available to ancient surveyors, architects, and temple builders — could have generated some of the most important traditional measures, despite us not having direct evidence (papyri, etc.…) of their knowledge of Euclidean geometry. In my earlier studies, I proposed that the Royal Cubit can be derived from the meter by such self-evident geometry. In this paper, I extend the same inquiry to the yard, asking whether it too may be derived from the same meter-length by an equally simple construction.

I should also be clear about the interpretive status of this argument. I am not entirely sure what to make of all this historically. The implications remain open and should be handled cautiously. But the geometrical facts themselves are difficult to ignore. The Royal Cubit and the yard both appear to have simple, ultra accurate relationships to the modern meter, whatever one finally decides that means for ancient metrology, transmission, coincidence, or historical interpretation.

In The Meter and the Royal Cubit in Ancient Egypt (Figure 1), I proposed that an Egyptian, or perhaps pre-Egyptian, tradition of large-scale metrology may have possessed a unit actually equivalent in length to the modern meter, even though it was not called "the meter" and did not belong to a modern bureaucratic system. In that earlier paper, I employed the Egyptian term Met-hah-ua, meaning "one of ten-million," for my own metrological purpose: to designate a unit equal to one ten-millionth of the earth's quarter circumference, corresponding to what we today recognize as one meter.[1] It should not be lost on us, however, that Met-hah-ua begins unmistakably with Met, just as meter derives from the Greek metron, meaning "measure." Did the Greek metron somehow preserve, echo, translate, or coincidentally resemble an older Egyptian metrological expression such as Met-hah-ua? I do not know. At this stage, I offer it only as a suggestive linguistic resonance, not as proof of transmission. But if both the length and the root-sound converge around "measure," then it is, at the very least, a happy coincidence.

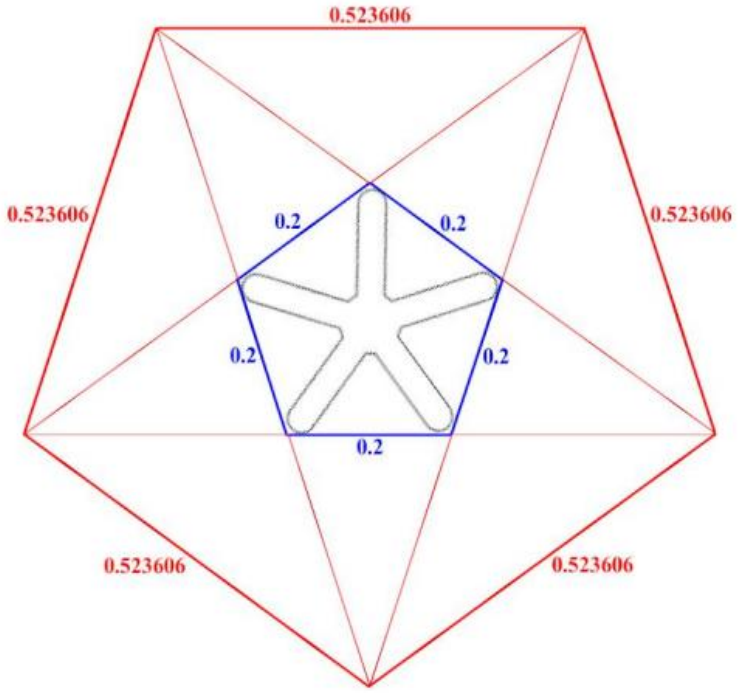


Figure 1

From that unit, I proposed that the Royal Cubit could be generated by one of the simplest possible geometric constructions. Begin with a right triangle whose height is 1 meter and whose base is 2 meters.

This is merely the diagonal of a double-square. Its hypotenuse is √5 meters (Figure 2). Its perimeter is therefore:

$$1 + 2 + \sqrt{5} = 3 + \sqrt{5} = 5.23606 \text{ meters}$$

Divide that perimeter into ten equal parts:

$$5.236068 \div 10 = 0.523606 \text{ meters}$$

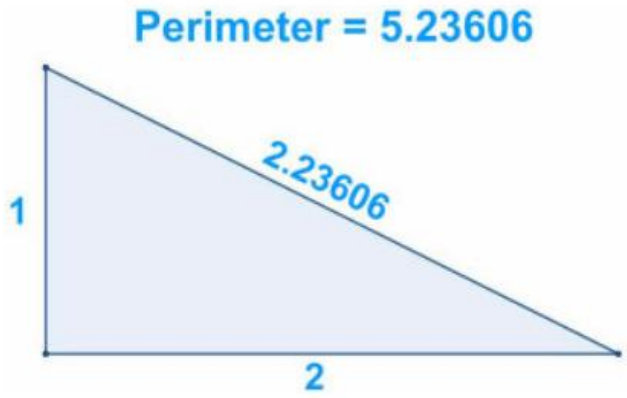


Figure 2

Within my system, this is not approximately the Royal Cubit. It is the exact geometrical derivation of the Royal Cubit: one-tenth of the perimeter of a 1:2:√5 triangle.[2] Nor is the division by ten arbitrary. It follows naturally from the Egyptian preference for a base-10 counting system, in which powers of ten structured numerical expression, calculation, administration, and measurement. The construction is therefore both geometrically simple and culturally appropriate. Draw a line of one unit. Double it. Construct the diagonal. Add the three sides. Then divide the resulting perimeter by ten. The result is a practical architectural unit generated from an earth-scale measure by elementary Euclidean geometry.

This makes the proposal more than a numerical coincidence. The Royal Cubit is not treated merely as a conventional royal forearm, nor as a vague body-measure later rationalized by scholars. It becomes the human-scale expression of a larger geodetic system. The meter supplies the earth-derived unit; the double-square supplies the √5 relation; decimal division supplies the cubit. In other words, the Royal Cubit is not simply measured. It is generated.

The Great Pyramid then provides an architectural test of the hypothesis. If its base was designed as 440 Royal Cubits, the proposed cubit gives:

$$440 \times 0.523606 = 230.387 \text{ meters}$$

This falls within the narrowed range I discussed for the measured base of the Great Pyramid. In that earlier paper, I argued that Glen Dash's reported base length, considered alongside Petrie's measurements, supports a miniscule range in which the proposed 0.523606 meter cubit fits precisely. The significance is not merely that the number is close, but that the exact geometric cubit derived from the meter lands inside the architectural evidence.[3]

I developed this further in The Geometrical Trifecta (Figure 3), where I examined the King's Chamber as a monumentalized 1:2 rectangle. The chamber's short side is 10 Royal Cubits; its long side is 20 Royal Cubits. In the proposed metric reading, that becomes 5.23606 meters by 10.47212 meters, with a diagonal of 11.708200 meters, or √5 times the short side. Thus the King's Chamber appears to preserve in stone the same 1:2:√5 geometry and length from which the Royal Cubit itself is derived.[4]

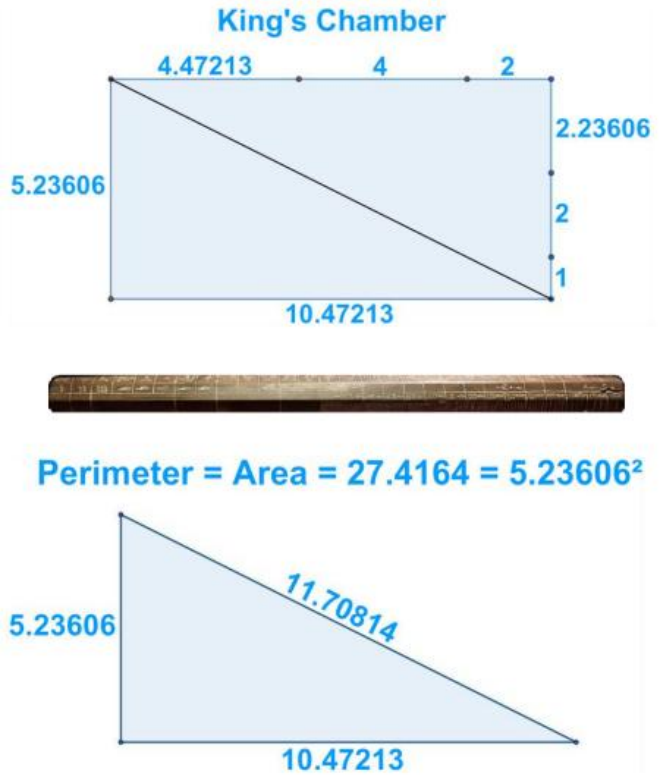


Figure 3

The deeper significance appears when the original triangle's perimeter, 5.23606 meters, is used as the short side of a larger proportional triangle. This produces what I called the geometrical trifecta. The scaled triangle has a shortest side of $3 + \sqrt{5}$, or 5.23606 meters. Both its area equals $(3 + \sqrt{5})^2$ and its perimeter equals $(3 + \sqrt{5})^2$! And the square root of both area and perimeter equals the shortest side:

$$\text{Perimeter} = (5.23606 + 10.47213 + 11.70814) = 27.41632$$
$$\text{Area} = (5.23606 \times 10.47213) / 2 = 27.41632$$
$$\sqrt{27.41632} = 5.23606$$

This is not merely rare, it is unique! This formulation alone achieves a mathematically unique triangle: its area and perimeter are identical, both equaling $(3+\sqrt{5})^2 = 27.4164$, while the square root of both values equals its shortest side, $3+\sqrt{5} = 5.23606$. This only happens with the number 5.23606, which coincidentally is the same number as 10 Royal Cubits expressed in meters, as displayed in the measure of the King's Chamber! (Figure 3).[5]

The preservation of the cubit standard is also an important part of the argument. In The Geometrical Trifecta, I compared the proposed 523.606 mm cubit with both the Great Pyramid and later physical cubit rods. The rods of Kha and Maya, though produced more than a thousand years after the Great Pyramid, cluster remarkably close to the proposed standard. Maya's rod, reported at 523 mm, falls only 0.606 mm below it; Kha's gold-leafed rod, reported at 524 mm, exceeds it by only 0.394 mm. I interpret these not as evidence of arbitrary variation, but as small craft or material deviations around a preserved target.[6]

In Euclidean Metrology and the Egyptian Duat, I then widened the symbolic and geometric frame (Figure 4). There I argued that the encircled five-pointed star of the Duat belongs to a world of pentagonal, golden-ratio, and dodecahedral geometry. The Duat symbol was not the easiest possible emblem to draw or carve. A triangle or square would have been simpler. The pentagon and pentagram, by contrast, require more complex proportional knowledge: 36°, 72°, and 108° angles, golden-ratio relations, and the geometry underlying the dodecahedron.[7]

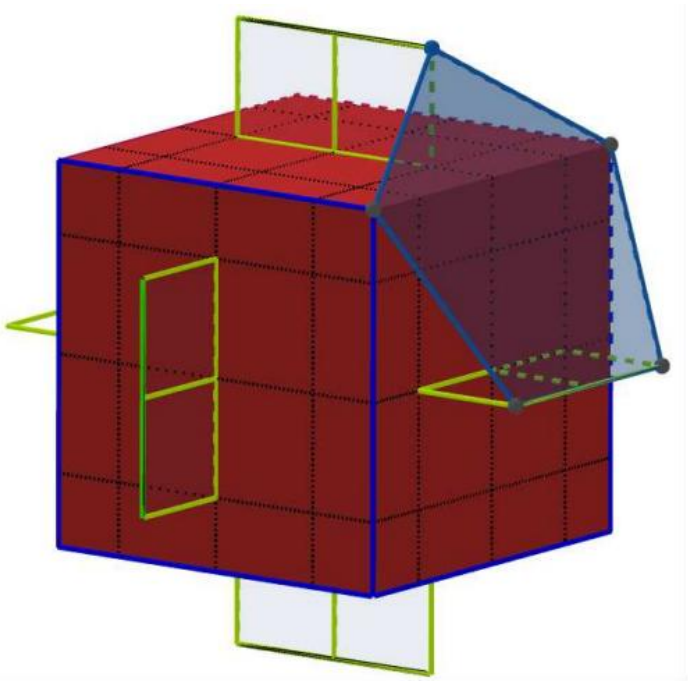


Figure 4

Yet even here, the essential construction remains Euclidean and visual. The pentagon may be more complex than the triangle or square, but it still belongs to the world of straightedge and compass. The same point holds: I am not proposing an abstruse mathematical code. I am proposing that certain ancient measures may have emerged from a visual grammar of simple forms — square, diagonal, triangle, pentagon, circle — and from the ratios naturally produced by them.

The pentagram provides a compact way of expressing the meter-to-cubit transformation. If the inner pentagon of a pentagram has a total perimeter of 1 meter, each side is 0.2 meters (Figure 1). In pentagram geometry, the outer pentagon is related to the inner pentagon by ϕ^2, or approximately 2.618033. Therefore:

$$0.2 \times 2.618033 = 0.523607 \text{ meters}$$

That is the Royal Cubit again. The inner pentagon preserves the meter as a complete perimeter; the outer pentagon converts that meter into five Royal Cubit sides. Thus the pentagram, reminiscent of the Duat, becomes a metrological diagram as well as a cosmological symbol.[8]

Extending the Argument to the Yard

This new paper extends the same line of reasoning to the traditional unit known as the yard. If the same meter-length could generate the Royal Cubit through √5, and if the same meter-to-cubit relationship could be expressed through the pentagram and ϕ^2, then it is reasonable to ask whether another traditional unit may also be generated from the meter by elementary geometry. Again, I do not yet claim to know exactly what to make of this historically. The interpretive implications remain open. But the mathematical facts are difficult to ignore: the Royal Cubit and the yard both appear to have simple, highly accurate, straightedge-and-compass relationships to the modern meter. The Royal Cubit emerges through the 1:2:√5 triangle; the yard, I now suggest, emerges through the square and √2.

Again, this construction requires no advanced geometry or algebraic skill. It is even simpler than the pentagram. It is based upon the most elementary Euclidean fact: the diagonal of a square (Figure 4).

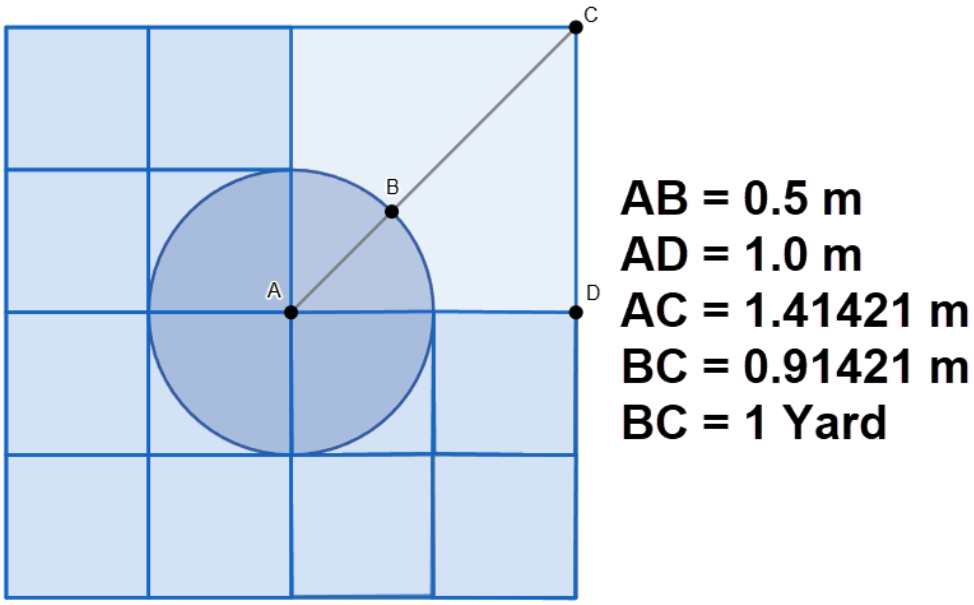


Figure 5

Begin with a square in which the relevant quadrant is 1 meter by 1 meter. In the diagram, point A is the center, point D lies on the midpoint of the right side, and point C is the upper-right corner. Since AD equals 1 meter and DC equals 1 meter, triangle ADC is a 1:1:√2 right triangle. Therefore:

$$AC = \sqrt{2} = 1.414214 \text{ meters}$$

Now construct a circle centered at A with a radius of 0.5 meters. The circle is not decorative. It is the construction device that transfers a half-meter length onto the diagonal. Where the circle intersects diagonal AC, mark point B. Thus:

$$AB = 0.5 \text{ meters}$$

The remaining segment from B to C is:

$$BC = AC - AB$$

$$BC = \sqrt{2} - 0.5$$

$$BC = 1.414214 - 0.5 = 0.914214 \text{ meters}$$

This gives 914.214 mm. The modern yard is 914.4 mm. In practical terms, it is a near-perfect yard generated from the diagonal of a one-meter square after subtracting a half-meter radius. Being off by only 0.186 mm from the modern value for a yard, it results in a minuscule error of only 0.020391% — a little more than the width of a human hair spread over 36 inches.

The elegance of the construction lies in the absence of arbitrary manipulation. I do not begin by forcing the meter into an obscure fractional system. I begin with the square, the most basic figure of land measurement. I draw the diagonal, the most basic irrational extension of the square. I then swing a half-meter circle from the starting point. The circle cuts the diagonal, and the remaining segment is the yard-like measure. The operation is visual, repeatable, and simple enough to be performed with straightedge and compass.

This creates a striking parallel with the Royal Cubit derivation. The Royal Cubit is generated from the meter by the double-square and $\sqrt{5}$:

$$(1 + 2 + \sqrt{5}) \div 10 = 0.523607 \text{ meters}$$

The yard-like unit is generated from the meter by the square and $\sqrt{2}$:

$$\sqrt{2} - 1/2 = 0.914214 \text{ meters}$$

Both derivations begin with the same meter-length. Both use elementary geometry. Both produce historically significant units. And both do so without requiring complex calculation, hidden numerology, or speculative arithmetic. The cubit arises from the perimeter of the 1:2:√5 triangle. The yard arises from the diagonal of the 1:1:√2 square after subtracting a half-meter radius.

The yard construction therefore becomes a natural sequel to my earlier cubit studies. The Royal Cubit construction shows how a meter-like geodetic unit could be transformed into an Egyptian architectural measure. The pentagram construction shows how the same meter-to-cubit relationship could be expressed through golden-ratio geometry. The yard construction now suggests that the same underlying meter-length may also have generated a traditional northern European measure by an equally simple act of geometry.

This does not prove that later users of the yard consciously derived it from a meter-square construction. Nor does it require that medieval or early modern English metrologists knew anything about the French meter. The point is subtler. If the meter-length is accidentally ancient — if it arises naturally from geodetic division and was known, approximated, or inherited in deep antiquity — then later units may preserve transformations of that length without preserving the memory of their derivation.

Conclusion

In my previous studies, I argued that the Royal Cubit can be derived exactly from a meter-length by means of the 1:2:√5 triangle. I then showed how that same value appears in the Great Pyramid, the King's Chamber, the rods of Kha and Maya, and the pentagonal geometry of the Duat. In this paper, I extend that same principle to the yard.

The proposed relationship is simple:

$$\text{Royal Cubit} = (1 + 2 + \sqrt{5}) \div 10$$

$$\text{Yard-like unit} = \sqrt{2} - \tfrac{1}{2}$$

Both are generated from the meter. Both emerge from the square and its diagonals. Both are Euclidean in the most basic sense: construct a square, draw a diagonal, swing a circle, mark an intersection, and read the resulting length. No advanced algebra is needed to construct them. Algebra merely records the result.

Thus the meter may be modern in name and official adoption, but the underlying length may be accidentally ancient. It may have functioned not merely as a unit, but as a generative root: a primordial geodetic length from which multiple traditional measures could be constructed. In this view, the Royal Cubit and the yard are not isolated accidents. They are members of a wider geometric family born from earth, square, diagonal, circle, pentagon, and compass.

Footnotes

[1] In The Meter and the Royal Cubit in Ancient Egypt, I proposed that ancient metrologists may have divided the earth's circumference into four quadrants and then subdivided each quadrant into 10,000,000 units, prefiguring the later metric principle. The same paper defines the hypothetical "Met-hah-ua" as "one of ten-million," corresponding to what we today recognize as one meter.

[2] The same paper derives the Royal Cubit by dividing the perimeter of a triangle with height 1 Met-hah-ua and base 2 Met-hah-ua into ten equal segments, each measuring 0.523606797 meters.

[3] In the Great Pyramid base discussion, I argued that the proposed 0.523606 meter cubit fits precisely within the narrowed measured range when the base is treated as 440 cubits. The paper also notes the resulting value: $0.52360679 \times 440 = 230.387$ meters.

[4] In The Geometrical Trifecta, I argued that the King's Chamber reflects a $1:2:\sqrt{5}$ geometry, with the short side measuring 5.23606 meters, or 10 Royal Cubits; the long side measuring 10.47212 meters, or 20 Royal Cubits; and the diagonal measuring 11.70820 meters.

[5] The same study identifies the unique trifecta in which area and perimeter both equal $(3 + \sqrt{5})^2$, while the square root of both equals the shortest side, $3 + \sqrt{5}$.

[6] The rods of Kha and Maya are used as evidence that a 523.606 mm Royal Cubit standard was preserved with very small physical deviations: Maya's rod at 523 mm and Kha's at 524 mm.

[7] In Euclidean Metrology and the Egyptian Duat, I argued that the Duat is frequently represented by a five-pointed star enclosed within a circle, and that the pentagon/pentagram belongs to a more complex geometric-symbolic world than simpler triangular or square forms.

[8] In the concluding pentagram section of Euclidean Metrology and the Egyptian Duat, I argued that the relationship between the meter and the Royal Cubit derives from ϕ^2, or 1:2.618033, and that a pentagram naturally demonstrates the correspondence between the inner and outer pentagons.