

Did the Ancients Invent the Telescope?

By

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The word *telescope* is derived from the ancient Greek word *tēle*, meaning “far off,” plus *skopein*, meaning “to look.” The primary definition of a *telescope*, according to the 1927 *Encyclopedic Edition of The Winston Simplified Dictionary*, is: “An optical instrument for viewing distant objects, especially heavenly bodies: called *refracting* if bringing the rays to a focus by a lens, *reflecting* if by a concave mirror.” However, this authority’s editors: Yale University Dr. H. S. Canby, the editor of *The Saturday Review of Literature*; Dr. T. K. Brown Jr., formerly of Haverford College, and Dr. W. D. Lewis, formerly the Superintendent of Public Instruction for the Commonwealth of Pennsylvania made no mention of who invented the telescope, perhaps because of the previous controversy surrounding the subject.

“The credit of the discovery of the telescope has been a fruitful subject of discussion,” declared the 1911 edition of *Encyclopaedia Britannica*. “Thus, because Democritus announced that the Milky Way is composed of vast multitudes of stars, it has been maintained that he could only have been led to form such an opinion from actual examination of the heavens with a telescope. Other passages from the Greek and Latin authors have similarly been cited to prove that the telescope was known to the ancients.”

One of these passages is found in *The Face of the Moon*, written by the first-century Greek biographer Plutarch. He claimed, “The moon is very uneven and rugged.” How could he have determined this if the ancients were not using telescopes to observe its terrain at the time?

In another of these passages, speaking of Pythagoras’s wisdom in the sixth century B.C., the ancient philosopher Iamblichus suggested that the Greeks used telescopes by spelling out the word when he announced, “Sight is made precise by the compass, rule, and *telescope*.”

The ancients apparently used the telescope long before Pythagoras’s time. Babylonian astronomers catalogued the non-planetary fixed stars, observed and recorded their observations on occultations of the planets by the sun and moon, and determined correctly within a small fraction the length of the synodic revolution of the moon. They also knew the true length of the solar year was 365 days and a quarter. In fact, the exact length of the ancient Babylonian year has been determined to have been 365 days, 6 hours, and 11

minutes, which varies less than two minutes from the sidereal year. They also ascribed eclipses of the sun to the interposition of the moon between the sun and the earth, and they apparently knew the arrangement of at least seven planets and spotted some of their moons—which certainly requires the use of a telescope.

Their long line of astronomical records on clay tablets stored in the British Museum, dating back to 747 B.C., indicate they observed some of the moons of Jupiter and Saturn. “There is said to be distinct evidence that they observed the four satellites of Jupiter, and strong reason to believe that they were acquainted likewise with the seven satellites of Saturn,” wrote the English Orientalist George Rawlinson, in the 1860’s. “It has generally been assumed that they were wholly ignorant of the telescope,” added this Camden professor of ancient history. “But if the satellites of Saturn are really mentioned, as it is thought that they are, upon some of the tablets, it will follow—strange as it may seem to us—that the Babylonians probably possessed optical instruments of the nature of telescopes, since it is impossible, even in the clear vapourless sky of Chaldea [ancient Babylonia], to discern the faint moons of that distant planet without lenses.”

Some of their ancient astronomical instruments likely consisted of single-lens refracting telescopes, larger and more sophisticated than the ancient Babylonian lens A. H. Layard found at Nimrud and brought to England in 1853. Since then, in *The Crystal Sun*, Robert Temple has identified and provided photographs of several previously unrecognized ancient lenses, scattered around in various museums. In this scholarly work, he also included a photograph of an over-2000-year-old fragment of Greek pottery in the Acropolis Museum at Athens; and on it there is a man peering up through what appears to be a set of telescoping tubes, which looks amazingly like one of our more modern refracting telescopes.

These, however, need no tubes to fulfill their purpose. “Refracting telescopes may consist of a double-convex lens placed upon a stand, without tube or eyepiece,” states the 1873 revised edition of Elijah H. Burritt’s *Geography of the Heavens and Class-Book of Astronomy*. “Indeed, a pair of ordinary spectacles is nothing less than a pair of small telescopes, for aiding impaired vision.”

They are sometimes called binoculars, which were also known in antiquity. The *Fragments* of Polybius, a second-century-B.C. Greek historian, speak of “a telescope with two tubes.” Furthermore, in arguing the Earth’s position in the universe, in the first century, the Roman encyclopedist Pliny the Elder confirmed their use in his day by maintaining: “Binoculars confirm this *very powerfully*.”

Before introducing the Julian calendar in 46 B.C., Julius Caesar may have used binoculars to confirm the Earth’s position also. After all, according to Roger Bacon, a Medieval Franciscan monk of Ilchester, before crossing the English Channel nine years previously, he used some sort of telescope to survey the shores of Great Britain from Gaul (France).

He may have used just a simple double-convex lens, similar to the telescope illustrated in Fig. 1, which Burritt's revised textbook on astronomy explains as follows: "Here the parallel rays are seen to pass through the lens at A, and to be so converged to a point as to enter the eye of the beholder at B. His eye is thus virtually enlarged to the size of the lens at A."

"Having some time ago procured a very large lens, 26 feet in focal distance and 11½ inches in diameter, I have tried with it various experiments of this kind upon different objects," claimed Dr. Thomas Dick, in an 1857 article titled: *Telescope formed by a Single Lens*. "Standing at the distance of 25 feet from it, I can see distant objects through it magnified about 26 times in diameter, and consequently 676 times in surface, and remarkably clear and distinct, so that I can distinguish the hour and minute hands of a public clock in a village two miles distant," he added. "This single lens, therefore, answers the purpose of an ordinary telescope with a power of 26 times."

Nevertheless, the ancients did not need to rely on this type of telescope. They also made reflectors, which work even better. "In employing a mirror if the thickness of the metal has been polished and beaten out into a slightly concave shape," wrote Pliny, "The size of the objects reflected is *enormously magnified*." This observation certainly proves that the ancients invented the telescope!

In fact, astronomers still use Pliny's concave type of mirrors, similar to the searchlight mirror in Fig. 2, to prevent precious light from being absorbed by additional lenses and/or mirrors often employed in modern telescopes. They ignore these extra optical devices, and revert to a simple concave mirror to make photographic plates of the stars; and the highly magnified results prove its efficiency and effectiveness.

Despite this blatant fact, recent dictionaries and astronomy books still fail to define simple concave mirrors (or double-convex lenses) as telescopes. Yet, years ago, as *Winston's Dictionary* has fully affirmed, with its definitions of a telescope, this was not always the case. And other, older, authorities, like astronomers Dick and Burritt, also pointed out the fact. The revised edition of Burritt's work plainly exemplifies this by stating: "The *Reflecting Telescope* is one in which the light is converged to a focus by means of a concave metallic reflector or speculum. Like *Refractors*, they may be constructed with very little mounting; though for convenience in use, it is necessary to place the reflector in a tube." And it goes on to explain Fig. 3, by relating that "In this cut, the light A is seen passing from the object on the right, and falling upon the concave surface of the reflector B, from which it is reflected back to a focus, and enters the eye of the observer at C. This *telescope* has no eye-piece."

"This mode of viewing objects is extremely easy and pleasant, especially when the mirror is of a large diameter, and the observer is at first struck and gratified with the novel aspect in which the objects appear," wrote Dr. Dick. "Were a concave mirror of this description—whether of glass or of speculum metal—to be formed to a very long focus, the magnifying power would be considerable. One of 50 feet of focal length, and of a corresponding diameter,

might produce a magnifying power, to certain eyes, of about 75 times; and, from the quantity of light with which the object would be seen, its effect would be much greater than the same power applied to a common telescope."

"Sir W. Herschel states that, on one occasion, by looking with his naked eye on the speculum of his 40 feet reflector, without the interposition of any lens or mirror [eyepiece], he perceived distinctly one of the satellites of Saturn, which requires the application of a considerable power to be seen by an ordinary telescope," added Dr. Dick, in his article entitled *A Reflecting Telescope, with a Single Mirror and No Eyepiece*. "Such an instrument is one of the most simple forms of a telescope, and would exhibit a brilliant and interesting view of the moon, or of terrestrial objects."

Speaking again of Herschel, who discovered Uranus and several of its moons in the eighteenth century, he pointed out another occasion when he bypassed the eyepiece of one of his telescopes and just used its large mirror as a telescope. "Being sensible of the vast quantity of light which is lost by a second reflection from the small speculum, he determined to throw it aside altogether, and mounted this 20 feet reflector on a stand that admitted of being used without a small speculum in making *front observations*; that is, in sitting with his back to the object and looking directly towards the surface of the speculum," wrote Dr. Dick. "Many of his discoveries and measurements of double stars were made with this instrument."

Thousands of years before Herschel's time, a similar telescope stood atop a tower near the island where the Pharos Lighthouse was later built. According to Makrizi, it served as the prototype for the mirror that was later placed atop the Pharos Tower in the third century B.C. "In the ancient city of Rakoti [Rhakotis] there is said to have been a dome on pillars of brass, all gilded, and above this dome rose a lighthouse, on which was a mirror of composite metal [speculum], five spans [about 45 inches] in diameter," wrote this Medieval Arab historian. "It was in imitation of this that in Alexander's city [Alexandria] the mirror was erected on the summit of the Pharos."

Another large telescope, a mobile military type, from Pythagoras's time, is illustrated in Figure 4. Here, the concave mirror is tied down horizontally upon the hands of a statue by ropes so that a strong wind would not catch it enough to overturn the wagon. When the reflective telescope was ready for use, the guards protecting the prize had to release the ropes, and the mirror swung down in a vertical position to enable the spotters riding in the wagon to see its images easily. This little replica of an ancient telescope is stored in a museum in Stettweg, Austria. It represents one that was perhaps six actual feet in diameter, and it displays signs of Italian workmanship. However, nobody knows where, or by whom, it was made.

Figure 5 illustrates another ancient mobile telescope. This bronze replica, found in a Danish peat bog at Trundholm in 1902, is still partially decorated with gold leaf.

Both bronze and gold are highly reflective metals, and in antiquity, both were readily available for use in large telescopes, like the one on the Pharos. However, because of atmospheric effects, the metal in bronze mirrors quickly

becomes dull and often requires cleaning. This is not the case with gold because it does not tarnish or corrode. Except for periodically wiping off the accumulation of dirt, it requires no further cleaning—and it lasts forever. Gold coins found in old sunken galleons are as bright and shiny as the day they were cast. The gold recovered from Tutankhamun's grave is as lustrous as the day it was buried with the young Egyptian king, thousands of years ago! But in ancient Egypt, gold, like today, was rare and expensive; but, for the protection of Alexandria, a vital emporium of ancient trade, its wealthy Ptolemaic kings would have gladly supplied it to plate the mirror, or speculum, on the Pharos Lighthouse.

However, gold does not reflect as much light as the corrosive but cheaper metal alloy (copper, tin, and arsenic) called speculum also, or nearly as much as corrosion-resistant tinned glass. And the ancient Alexandrians, noted for their production of modern types of glass, probably manufactured both. "We meet, in ancient classical writers, with very ample and repeated testimony, that the Egyptians, in the glass-houses of Diospolis, knew how to fabricate mirrors of stupendous magnitude," wrote Thomas Maurice. "And, though hence it does not absolutely follow that these mirrors should be tinned glass, yet the use to which they applied, at least, two of these mirrors, afford very strong reason for that supposition; since, if composed of any metal-line substance, the situation in which they were placed must unavoidably have exposed them to obscuration or corrosion."

"One of these mirrors, according to Strabo (lib. xvii. p. 492), was elevated on the summit of the great temple of Heliopolis, or the city of the sun, to reflect into that temple the full splendor of its meridian beam," added the nineteenth-century Assistant Keeper of Manuscripts in the British Museum. "Another of still more prodigious dimensions was, in later periods, erected on the Pharos of Alexandria, and so placed as to reflect ships approaching Egypt at a vast distance, and imperceptible by the eye from the loftiest pinnacle."

"Some modern writers deny the fact that a great mirror was placed in the light-house of the Alexandrian port," wrote H. P. Blavatsky, "for the purpose of discovering vessels at a distance at sea." In her 1877 edition of *Isis Unveiled*, she went on to point out, "But the renowned [French historian] Buffon believed in it; for he honestly confesses that 'If the mirror really existed, as I firmly believe it did, to the ancients belong the honor of the invention of the telescope.'"

About the Author

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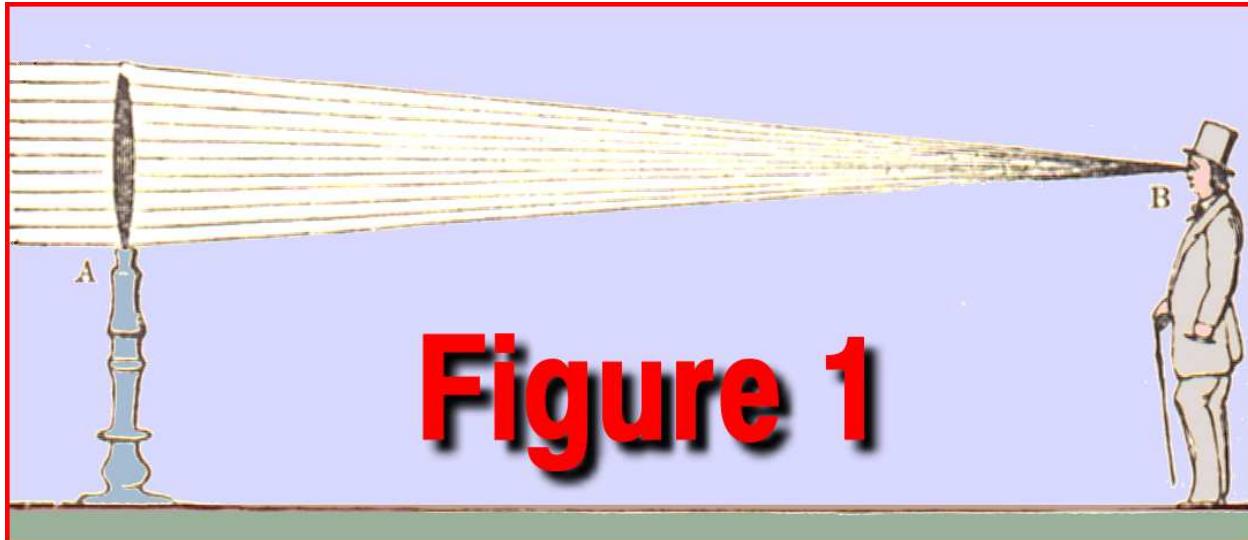




Figure 2

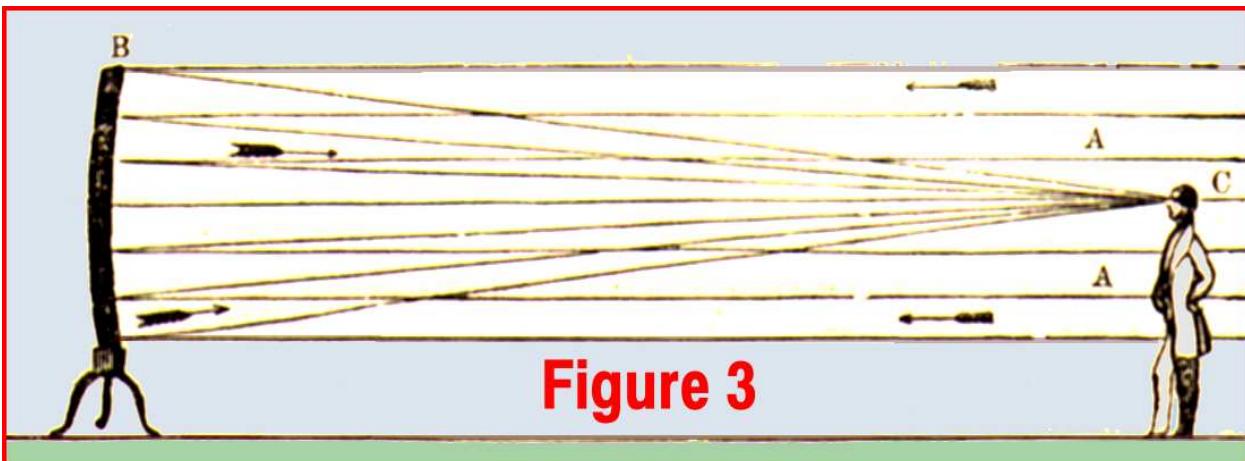
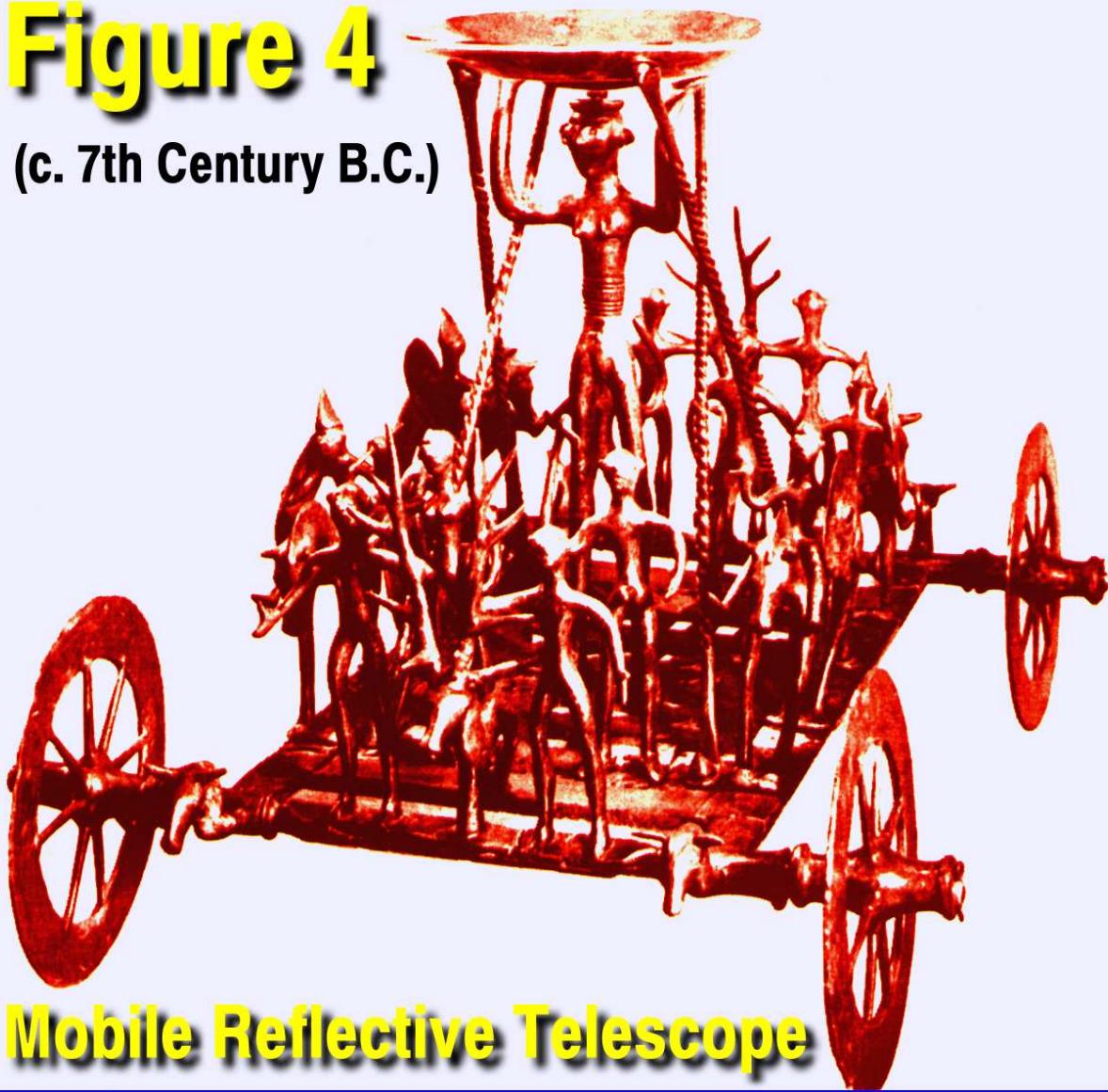
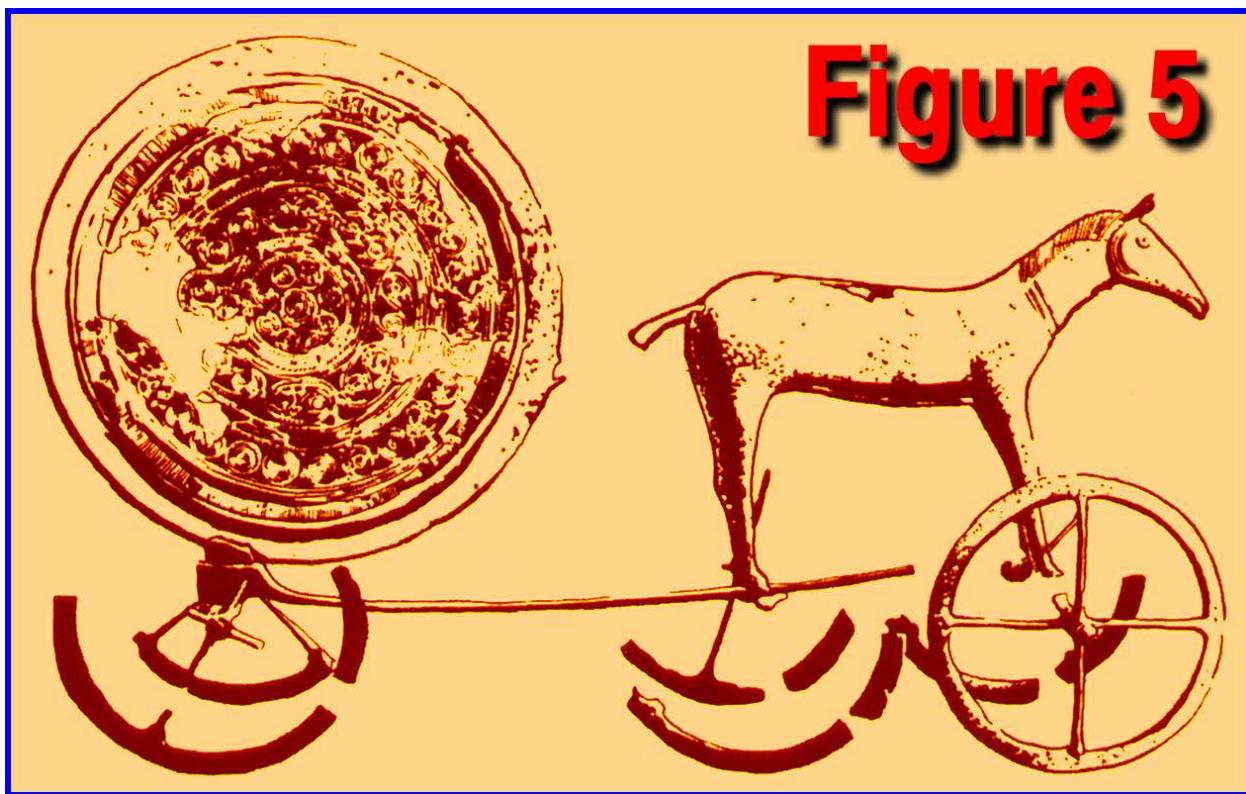


Figure 4

(c. 7th Century B.C.)



Mobile Reflective Telescope



Roman Goddess and Mirror (Or Reflective Telescope?)



(c. 2nd Century A.D.)

Mirror or Telescope?



GREEK
(5th Century B.C.)