

## ON THE MISSING NAVIGATIONAL MARKERS – BEACON TOWERS-PHAROS OF ANTIQUITY – AND NOTICE OF TWO EXTANT SMALL MARKER BEACON TOWERS OF ROMAN LATE I<sup>ST</sup> C. B.C. – EARLY I<sup>ST</sup> C. A.D. ANEMORIUM

SEYİRLERE IŞIK TUTAN KAYIP İŞARETLER – ANTİKÇAĞ’DA PHAROS’LAR İLE SİNYAL KULELERİ – VE M.Ö. I. YÜZYILIN SONU – M.S. I. YÜZYILIN BAŞINDA ROMA DÖNEMİ ANEMORIUM’UNDAN GÜNÜMÜZE ULAŞAN İKİ KÜÇÜK SİNYAL KULESİNE İLİŞKİN NOTLAR

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**Abstract:** This article addresses the importance, in the well documented practice in antiquity of nocturnal navigation, of marker-beacons/pharos for navigation. It suggests the presence of a Pharonic territorial marker on the consequently named Pharos Island from c. 1400 B.C. marking the port of Rhacotis, with the tower standing in the IV<sup>th</sup> c. B.C. noted in Arrian’s *Anabasis* being its probable replacement, prior to the construction of the Hellenistic Pharos. It suggests that maritime place-names beginning with the letters *Pha/Phar*, such as, Pharsalos, indicate the former presence of harbour marker lights, in this case with *salos* meaning an open roadstead. The matter of the importance of the size of the marker structure relative to the surrounding topography, the number of light sources, possible fuels employed, and if these marker-beacons functioned at night in winter are raised. The article concludes with remarks upon two late I<sup>st</sup> c. B.C. or early I<sup>st</sup> c. A.D. *in-situ* structures at the Cilician port city of Anemorium, previously published as examples of, “a unique form of conical tomb”, which seem rather to be markers on the hillside for the probable landing quay below them, their relative heights reminding of the pharos and anti-pharos marking a harbour entrance in antiquity.

**Keywords:** Anemorium • Navigational Marker-Beacons • Pharos • Signalling

**Öz:** Bu makale, gece deniz yolculuğunun antikçağda iyi bir şekilde belgelenmiş yöntemi içerisinde deniz yolculuğu açısından işaret sinyallerinin/*pharos*’un önemini vurgulamaktadır. Bu, Pharonic toprak varlığının işareti dolayısıyla ca. M.Ö. 1400’den itibaren Pharos Adası ismini alan ve Rhakotis limanını işaret ederek Hellenistik Pharos’un yapımından önce, ca. M.Ö. IV. yüzyılda ayakta duran kulesiyle Arrianus’un *Anabasis*’inde belirtilen bir kulenin varlığı ileri sürülebilir. Pharsalos gibi *Pha/Phar* harfleriyle başlayan denizcilik isimleri liman işaret ışıklarının daha önceki varlığını gösterdiğini akla getirmektedir. Bu durumda *salos* açık bir liman anlamı vermektedir. İşaret yapısının/kulesinin büyüklüğünün önemi çevredeki topografya ile ilişkilidir. Işık kaynaklarının sayısı, kullanılan olası yakıtlar ve eğer fenerlerde bu işaret sinyalleri kış gecelerinde de faaliyet gösteriyorsa önemi daha da artar. Makale, daha önce “konik mezarın ünik bir formu”nun örneği olarak yayınlanan Kilikia liman kenti Anemorium’da *in-situ* halindeki altında muhtemelen iniş iskelesi için işaretlerden ziyade geç antikçağdaki bir liman girişi işaret olarak pharos ve anti-pharos’u hatırlatan göreceli yükseklikleri görünmekte olan yapıların, geç M.Ö. I. yüzyıl ya da erken M.S. I. yüzyıla tarihlene görüşleriyle sona ermektedir.

**Anahtar Kelimeler:** Anemorium • Deniz yolculuğu İşaret Sinyalleri/Fenerleri • Pharos • İşaret Verme

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For millennia in the Mediterranean navigation has been by means of significant coastal landmarks and seamarks, both the natural, such as promontory, hilltop and mountain peak, as also such marks as the smoke from the volcano of Etna, Homer's, "*the blasts of baneful fire*" and, "*But when we had left the island (of the Sirens), I presently saw smoke and a great billow, and heard a booming*", as, "*From this smoke*", as likewise the marker provided by Versuvius and the Chimera; and also those navigational markers which were man-made that directly or indirectly also served this same marker function, facilitating maritime passage from port to port along the coastline, as through straits; and, at night, through numbers of beacon and pharos<sup>1</sup> lights when in coastal waters within sight of land and port, within sight of beacon fire, of temple light: "*Hieron. You see the temple yonder, I am sure, the columns that surround it, and the beacon light at the entrance that is hung up to warn from danger the ships that sail out from the Pontus*"<sup>2</sup>; of the sight of beacon tower or pharos light; and when on the open sea beyond sight of land, landmark and seamarke, through the position of the sun and the moon and stars, the same means by which many mariners on smaller vessels still navigate today.

Sailing at night was practiced in antiquity, first by the Phoenicians,<sup>3</sup> opening the trade route across the centre of the Mediterranean from the Syrian coast via Cyprus, Crete, Sicily, Sardinia, to the Balearics and Spain, and impossible to achieve given the distances involved without sailing at night. Later, sailing at night is mentioned repeatedly by Homer in the *Odyssey*: as when Telemachus sails from Pylos at night, "*And all night long and into the dawn the ship ploughed her way*"<sup>4</sup>; and when Diomedes sails from Troy to Argos and, "*And a shrill wind sprang up to blow, and the ships ran swiftly over the teeming ways, and at night (during the night the ships) put in to Geraestus*"<sup>5</sup> and consequently the entrance to the port was marked by lights; and, "*For nine days we sailed, night and day alike, and now on the tenth our native land (Ithaca) came in sight*"<sup>6</sup>; likewise, "*So for six days we*

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<sup>1</sup> The ancient Greek word Pharos, It. Faro, Osmanlica-Turkish, Phaner-Fener, is said to be derived from the name of the Hellenistic lighthouse tower erected on the Pharos Island by Alexandria in the III<sup>rd</sup> century B.C., and hence, pharology, the study of lighthouses. It is evident from the sources that structures serving a similar marker beacon/signaling function were constructed prior to this date, but the word often employed to describe these structures was in many cases different, relating to: Ναυπλίου τ' Εὐβοικὰ πυρπολήματα, τό σύμβολον, ὁ φρυκτός, πυρπολέοντας, προσπλέουσαι, as later *turris-turris ardens*. However the word pharos Φάρον was employed by Homer, in the name of the Pharos Island, *Od.* IV. 351; 354; *Plin. nat.* XIII. 70, and it was also employed twice by Pseudo-Scylax in respect to the Pharos Island and to another island, and also by Euripides, that may suggest that this word was associated with larger marker beacons at these important locations at a much earlier date than the III<sup>rd</sup> century B.C. Hellenistic Pharos; as also perhaps in the Φάρ- form found in the names of coastal ports and other placenames, see below.

The word pharos was first used in English in 1522, (Phare in 1615 for a strait marked by lighthouses) that is, following the demolition of the physical remains of the Pharos and of its partially constructed 14<sup>th</sup> century replacement at Alexandria, and was employed to mean: "*a most high tower like unto the Pharos of Alexandria*" (S.O.D.).

<sup>2</sup> The Fanum Asiaticum light at the entrance to the Bosphorus, facing the Fanum Europaeum, Philostratos (Maior), *de Imag.* I. 12.1-5 (II<sup>nd</sup>-III<sup>rd</sup> century A.D.) cited in, Moreno 2008, 655-709, 697. Also translated as: "...till we come to a shrine. You see the temple yonder, I am sure, the columns that surround it, and the beacon light at the entrance which is hung up to warn from danger the ships that sail out from the Euxine Sea".

<sup>3</sup> Braudel 1998, 214.

<sup>4</sup> Hom. *Od.* II. 434.

<sup>5</sup> Hom. *Od.* IV. 269. The name of the headland and Euboean port

<sup>6</sup> Hom. *Od.* X. 28.

sailed, night and day alike, and on the seventh we came to the lofty citadel of Lamusas”<sup>7</sup>, and that it, “took a day and a night to reach (the Pharos Island) by sailing-ship from the land”<sup>8</sup>; and, “and at set of sun we never spent a night upon the shore, but sailing over the deep in our swift ship we waited for the bright Dawn, lying in wait”<sup>9</sup>. Sailing at night therefore seems to have been an entirely usual, not any extraordinary practice to Homer; and it was later recorded by Herodotus in the V<sup>th</sup> century B.C., for example: “a ship will for the most part accomplish seventy thousand fathoms on a long day’s voyage, and sixty thousand by night”<sup>10</sup>, clearly indicating the ordinariness of sailing at night at this time and, upon the basis of these calculations, taking into account the different distances covered in sailing by night and by day, he goes on to describe the extent of the Pontus/Black Sea: “To sail from the entrance of the Black Sea to Phasis...takes nine days and eight nights... from Sindica to Themiscyra on the Thermedon, it is a voyage of three days and two nights”<sup>11</sup>. Strabo, records the 3-4 days and nights taken in sailing from Crete (Cape Samonium) to Egypt;<sup>12</sup> Diodorus records the 3 days and nights taken in sailing from the Pillars of Hercules to the Balearic Isles in the late I<sup>st</sup> century B.C.<sup>13</sup>; Pliny in the I<sup>st</sup> century A.D. records the 7 days and nights taken to sail from Ostia to Cadiz,<sup>14</sup> and the practice of sailing at night is clearly indicated in his description of the function of the Alexandrian Pharos itself, that, “it guides the course of ships at night”<sup>15</sup>; as also by Lucan, “The west wind never slackened the cordage of the ships until the seventh night revealed the coast of Egypt by the flame of the Pharos”<sup>16</sup>, and nocturnal sailing is recorded by numerous others. These relations clearly indicating that ships frequently travelled through the night, not only in exceptional circumstances but as a matter of course, with, for example, the annual grain fleet from Alexandria, the *embole*, sailing night and day across the Mediterranean, direct to and from the harbours for Rome, of Portus, Ostia or Centumcellae, as later to Constantinople, rather than travelling from port to port around the coastline;<sup>17</sup> while sailing at night is likewise recorded by later Roman and by early East Roman authors<sup>18</sup>. Hence the importance of the constant light maintained on a temple marker, on a marker beacon or on a tower – or upon a pharos at night, serving as a navigational marker and guide, and

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<sup>7</sup> Hom. *Od.* X. 80.

<sup>8</sup> Plin. *nat.* XIII. 70: “Homer had written that the island of Pharos, now joined to Alexandria by a bridge, took a day and a night to reach by sailing ship from the land”.

<sup>9</sup> Hom. *Od.* XVI. 367-8

<sup>10</sup> Hdt. IV. 86

<sup>11</sup> Hdt. IV. 86. That the calculation’s result is incorrect is irrelevant to the matter at hand, the practice of nocturnal navigation. ‘Herodotus, it should be noted, is not stating that ships purposefully slowed their speed at night, but merely acknowledges that there is more daylight during the fairer months of the year when ships are usually at sea.’ Davis, 2009, 64.

<sup>12</sup> Strab. X. 475.

<sup>13</sup> Diod. V. 16. 1.

<sup>14</sup> Plin. *nat.* XIX. 3.

<sup>15</sup> Plin. *nat.* V. 129.

<sup>16</sup> Luc. IX. 1004-5, cited by, Giardina 2010, 14.

<sup>17</sup> Casson 1979, 158. An outward journey from Rome that took from 10 days to three weeks to Alexandria, but the return ladened took twice as long if not longer, idem, 151. These ships were 60 m. long, 15 m. wide and nearly 15 m. deep, able to transport 1,000 tons of grain and 1,000 passengers, idem 159. Contra, Clayton 1989, 147, who states: “Since sailing at night was avoided in antiquity”, rather it was usual practice.

<sup>18</sup> For example in 404 A.D. Synesius with more than 50 other passengers and a crew of thirteen, at midnight sailed into a storm on their way from Alexandria to Cyrene, Casson 1979, 161-162.

thereby facilitating the quite un-exceptional practice of nocturnal navigation, with these marker lights established for the recognition of the exact location of dangerous promontories, straits and of a harbour's location and entrance(s) at night, for mariners from the pre-Homeric period onwards.

The practice of maritime navigation was seemingly associated in the Hellenic world in Homeric times with the God Apollo, as Homer relates it was Kalchas, Thestor's son, "*who guided into the land of Ilion the ships of the Achaeans through that seer-craft of his own that Phoibos Apollo gave him*"<sup>19</sup>; and so, via Apollo,<sup>20</sup> navigation and marker beacons, tower lights-pharos, the sun and light were related and linked, lighting a path and making the course visible by both night and day for the navigator of a vessel.

Palamedes of Nauplia the personification of time-honoured wisdom was traditionally awarded the distinction of inventing maritime navigational beacons, small-pharos towers/lighthouses, and whose Palamedeion-sanctuaries are only found on major coastal headlands (*acroteria*) such as the Lectum cult at Baba Burnu, Cape Baba, Cape Lectum/Lectum Promontorium, lying 96 km. from Çanakkale, in the Troad.<sup>21</sup> Palamedes is said to have been stoned to death due to a false report given by an envious and unforgiving Odysseus during the course of the Trojan War.<sup>22</sup> To Palamedes was attributed, in addition to the marker beacon, the arrival of some letters added to the Greek alphabet,<sup>23</sup> dice and other things, standing in a position like Daedalus, as later Thales, of introducing

<sup>19</sup> Hom. *Il.* I. 71-2. Later the Dioscuri, Castor and Pollux became the patron deities of navigation.

<sup>20</sup> As in the paen to Apollo recorded in ca. 160 A.D., of the vocal fragments of Contrapollinopolis on a papyrus originating from Thebes, preserved in the Berlin Museum, No. 6870 verso (Ajax Tragedy):

*"Paean, O Paean! Let our songs exalt the glory of Phoebus who is gladdened by the cape of Delos and the valley of the Inopus, the whirlpools of the Xanthus and the alurel-flowered Ladon, the springs of the Ismenus and of Crete, famed for temples. Paean, who, uniting your beautiful voice with those of the Muses, established the songs before the sacred founts of Delphi, you who, with tresses surrounded by flaming beams, with your powerful bow protected Leto, your mother, from insult; may your eternal glory honor the inextinguishable light that Zeus, exchanging it for yours, sent to illuminate the shining splendor by which the fruits, born out of the pale-colored clods of earth, are nourished".*

<sup>21</sup> Hasluk 1973, 347; Giardina 2010, 3.

<sup>22</sup> Apollod. *Epit.* III. 6: "And while many were eager to join in the expedition, some repaired also to Ulysses in Ithaca. [7] But he, not wishing to go to the war, feigned madness. However, Palamedes, son of Nauplius, proved his madness to be fictitious; and when Ulysses pretended to rave, Palamedes followed him, and snatching Telemachus from Penelope's bosom, drew his sword as if he would kill him. And in his fear for the child Ulysses confessed that his madness was pretended, and he went to the war. [8] Having taken a Phrygian prisoner, Ulysses compelled him to write a letter of treasonable purport ostensibly sent by Priam to Palamedes; and having buried gold in the quarters of Palamedes, he dropped the letter in the camp. Agamemnon read the letter, found the gold, and delivered up Palamedes to the allies to be stoned as a traitor".

<sup>23</sup> Plin. *nat.* VII. 57: "I have always been of opinion, that letters were of Assyrian origin, but other writers, Gellius, for instance, suppose that they were invented in Egypt by Mercury: others, again, will have it that they were discovered by the Syrians; and that Cadmus brought from Phœnicia sixteen letters into Greece. To these, Palamedes, it is said, at the time of the Trojan war, added these four, θ, ξ, φ, and χ"; Tac. *ann.* XI. 14. 1: "The Egyptians also claim to have invented the alphabet, which the Phœnicians, they say, by means of their superior seamanship, introduced into Greece, and of which they appropriated the glory, giving out that they had discovered what they had really been taught. Tradition indeed says that Cadmus, visiting Greece in a Phœnician fleet, was the teacher of this art to its yet

into Hellenic culture important devices, methods, knowledge and skills from elsewhere, and hence in part Odysseus's envy and the omission of Palamedes from Homer's *Odyssey*, as he had seen through Odysseus's attempt to avoid service with the Achaeans before '*the topless towers of Ilium*'. It was in consequence of his son's murder that it is said that Palamedes's father, the King of Naupilus or of Euboea, then lit a series of false beacons leading to the shipwreck off Euboea of much of the Achaean fleet returning from the Trojan War,<sup>24</sup> using false maritime navigational beacons to serve as a wrecker's device,<sup>25</sup> and with the use of these false navigational beacons quite clearly indicating the presence at this date of considerable numbers of genuine navigational beacons along coastlines to provide an expected navigational guide for ships sailing through the night.<sup>26</sup>

The confusion in antiquity over the King Nauplion, the father of Palamedes,<sup>27</sup> the question of was it the earlier, the son of Poseidon, or that contemporary with the Trojan War, and the confusion of this later king, was he ruler of Nauplion or Euboea, would seem to indicate that the maritime marker beacon, as distinct from a pharos, was of non-Hellenic, possibly Cretan, via Clymene, daughter of the King of Crete, or perhaps more probably, if implicitly, that the maritime beacon was of remote Phoenician origin. Pliny explicitly attributes the invention/practice of navigation to the

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*barbarous tribes. According to one account, it was Cecrops of Athens or Linus of Thebes or Palamedes of Argos in Trojan times who invented the shapes of sixteen letters, and others, chiefly Simonides, added the rest*".

<sup>24</sup> Eur. *Hel.* 766-7. Giardina 2010, 3, links Nauplius's wrecking '*torches*' not to Euboea, but to Cape Sigeum on the basis of Philostr., *Eroico* 1997, 46-7, perhaps a somewhat improbable location for the returning Achaean fleet to be shipwrecked upon. See also, Strab. VIII. 6. 3: "*Next to Temenium is Nauplia, the naval station of the Argives. Its name is derived from its being accessible to ships. Here they say the fiction of the moderns originated respecting Nauplius and his sons, for Homer would not have omitted to mention them, if Palamedes displayed so much wisdom and intelligence, and was unjustly put to death; and if Nauplius had destroyed so many people at Caphareus. But the genealogy offends both against the mythology, and against chronology. For if we allow that he was the son of Neptune, how could he be the son of Amymone, and be still living in the Trojan times?*" It seems possible that Strabo chose not to question Homer's choice to make Odysseus's cleverness apparent through the excision of Palamedes from his work; see also Paus. II.23.1: "*For when the Greeks, as they were returning from Troy, met with the shipwreck at Caphereus, those of the Argives who were able to escape to land suffered from cold and hunger*" and Ammianus Marcellinus, IV<sup>th</sup> century A.D., *Rerum Gestarum*, Amm. XXII. 8. 2 "*Athos, that lofty mountain in Macedonia through which the Medic ships once passed, and Looking eastward, Caphereus, the headland of Euboea where Nauplius, father of Palamedes, wrecked the Argive fleet*".

<sup>25</sup> Apollod. *Epit.* II. 1.

<sup>26</sup> While Giardina 2010, 23, relates: "*If we are to credit what Philostratus recounts about Palamedes in his Heroicus, it seems also that the first lighthouses (simple beacons lit on promontories) came about with the opposite intention of later lighthouses: not to guide sailors into harbour but rather to deceive them, luring them to their deaths, just as the Plataese did during the Peloponnesian War*". Surely it was rather the case that beacons were at that time in common use as markers, and it was their displacement from their expected positions as a guide for navigation that is remarked upon in this text, their displacement being to avenge the death of Palamedes and causing the loss of much of the fleet. The Achaean fleet it seems relied upon these beacons as clear indicators of position, as navigational markers.

<sup>27</sup> Amymone had a son Nauplius by Poseidon. This Nauplius lived to a great age, and sailing the sea he used beacon lights to lure to death such as he fell in with. It came to pass, therefore, that he himself died by that very death. But before his death he married; according to the tragic poets, she was Clymene, daughter of Catreus; but according to the author of *The Returns*, she was Philyra; and according to Cercops she was Hesione. By her he had Palamedes, Oeax, and Nausimedon.

Phoenicians,<sup>28</sup> and navigation at night is certainly facilitated today, as it was in antiquity, by the distribution of beacon lights in positions aiding navigation on major sailing routes, when combined with the Phoenician practice of sailing at night, and their trade route across the centre of the Mediterranean from the Syrian coast via Cyprus, Crete, Sicily, Sardinia, to the Balearics and Spain and their utilisation of other island ports such as Thasos, it therefore seems reasonable to associate the first use of navigational marker beacons with the Phoenicians, as distinct from the large Pharonic territorial marker, the Pharos constructed on the Pharos Island.

### The first Φάρον Pharos

The presence of a pharos rather than the more usual beacon tower marker is recorded in the Odyssey in Homer's reference to the name, Φάρον Pharos, in the name of the Island of Pharos itself.<sup>29</sup> It seems most probable that the earliest pharos to be so called was on the Pharos Island, hence the name of this island, off the Pharonic harbour city of Rhacotes/Rhacotis founded *ca.* 1500 B.C., the precursor of Alexander's Alexandria and a port-city well known to Homer and to others. It was probably this structure standing on the Pharos Island which gave to the island its name, and it was it seems, this Pharonic marker, this Φάρον structure, which was the source of the Greek word employed for a considerable lighthouse, this first identifiable Φάρον being a Pharonic structure, dating perhaps to before 1400 B.C., and being a tall marker with a light on it at night (possibly an obelisk with a light on its summit at night, as well as reflective gold/metal plates to reflect the sun during the day), defining and marking the territory of the Pharaoh, as well as physically marking the island and the location of the harbour of Rhacotis by both day and night.<sup>30</sup>

<sup>28</sup> Plin. *nat.* V. XIII. Noteworthy in this context are Thucydides (VI. 6.) remarks on the location of Phoenician settlements in Sicily on promontories and islets, i.e. marker-signaling stations: "[6] *There were also Phoenicians living all round Sicily, who had occupied promontories upon the sea coasts and the islets adjacent for the purpose of trading with the Sicels. But when the Hellenes began to arrive in considerable numbers by sea, the Phoenicians abandoned most of their stations, and drawing together took up their abode in Motye, Soloeis, and Panormus, near the Elymi, partly because they confided in their alliance, and also because these are the nearest points, for the voyage between Carthage and Sicily*". Further there is the hill today called *Jebel el-Manar*: "Fire Mountain" said to be so named from the fires which were lit here in Phoenician times to guide sailors into the Bay of Cathage.

<sup>29</sup> Hom. *Od.* IV. 351: "*In Egypt, eager though I was to journey hither, the gods still held me back, because I offered not to them hecatombs that bring fulfillment, and the gods ever wished that men should be mindful of their commands. Now there is an island in the surging sea [355] in front of Egypt, and men call it Pharos, distant as far as a hollow ship runs in a whole day when the shrill wind blows fair behind her. Therein is a harbor with good anchorage, whence men launch the shapely ships into the sea, when they have drawn supplies of black water [360]*". As also; *Od.* IV. 354-9.

Plin. *nat.* XIII. 70 "*Homerum... postea adaggeratum Nilo, siquidem a Pharo insula, quae nunc Alexandriae ponte iungitur, noctis dieique velifico navigii cursu terram afuisse prodidit*". Recorded in Orion's 'Etymologicum', 160, 23, from Philoxenus Grammaticus, (On Monosyllabic Words) *Fragmenta* 26. 1 to *Fragmenta* 26. 4, is that the word *Pharos* derives from the *Pharos Island*, from the root: *Pha-w*, meaning, to shine. For more on this see Beekes 2010, 1546

<sup>30</sup> Strab. XVII. 1 records: "*The former kings of Egypt, satisfied with what they possessed, and not desirous of foreign commerce, entertained a dislike to all mariners, especially the Greeks (who, on account of the poverty of their own country, ravaged and coveted the property of other nations), and stationed a guard here, who had orders to keep off all persons who approached. To the guard was assigned as a place of residence the spot called Rhacotis, which is now a part of the city of Alexandria, situated above the arsenal. At that time, however, it was a village. The country about the village was given up to herdsmen, who were also able (from their numbers) to prevent strangers*

Arrian mentions a subsequent replacement of this original Pharonic marker as the tower on Pharos island in his *Anabasis*, when Alexander ordered the construction of a heroon to the deceased Hephaestion in 324 on the Pharos island, “*where the tower is situated*”. “*For the letter (from Alexander) commanded Cleomenes to prepare heroon for the hero Hephaestion in Egyptian Alexandria, one in the city itself and another on the island of Pharos, where the tower is situated*”<sup>31</sup>. Arrian’s record of the text of Alexander’s letter clearly indicating there was already a tower standing on the Pharos Island when Hephaestion died, decades before the later Hellenistic lighthouse was constructed and therefore clearly referring to an earlier Pharonic tower/Pharos structure, which he terms a tower.<sup>32</sup> This was probably not the original Pharos given the passage of perhaps a millenium between the construction of the first Pharos and the tower which was standing there in the IV<sup>th</sup> century B.C., but the island of Pharos was already known for its marker tower at this time, the phrase: “*where the tower is situated*” indicating it was a considerable, a noteworthy and memorable tower structure that defined this island.

It seems the word Φάρον pharos employed by Homer, stems from the sun, of the Egyptian P-ra or Ph-ra recorded in Egyptian hieroglyphics, hence pharaoh, in Greek φαραώ *pharaō*, (as in the successor to Sesostris, the name/title Pheros, recorded in Herodotus<sup>33</sup>), Egyptian *pr-* : *pr*, house + “, great, as in Hebrew, *par’ō*. As may also be indicated in the φα- Pha-/Fa- as in the initial letters of the name of the son of Apollo-Helios<sup>34</sup>, Phaethon φαέθων; and which was also the same name Homer gives of one of the horses that pull the sun, Phaethon, the other being Lampus (lampas-to

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*from entering the country*”; and presumably there was a guard by the Pharos from its construction onwards to maintain the light and to inquire into foreign arrivals including Phoenician traders. Its noteworthy that Strabo says the city of Rhacotis was a village, yet it had a population sufficient to prevent strangers by ship from entering the country, and secondly, that the Egyptians were “*not desirous of foreign commerce*”, not, that is, with the Greeks, there was however considerable Egyptian trade with the Phoenicians, who sailed at night and would have found a Rhacotis harbour marker most useful. See also, Thuk. I. 104, Marea, the town above Pharos, and the terminus of shipping on the Canopic branch of the Nile from where presumably goods were then carried to and from the port of Rhacotis, where there was a very ancient, pre Hellenistic cult centre of Serapis and Isis, Tac. *hist.* IV. 84: “*A temple, proportioned to the grandeur of the city (Alexandria), was erected in a place called Rhacotis, where there had stood a chapel consecrated in old times to Serapis and Isis. Such is the most popular account of the origin and introduction of the God Serapis*”.

<sup>31</sup> Arr. *anab.* VII. 23. 7: It is noteworthy that in the translation by A. De Selincourt and revised by J. R. Hamilton, Arrian, *The Campaigns of Alexander*, Penguin, London, 1971, 389, reads: “*The letter contained instructions for the erection of a shrine in Hephaestion’s honour in the city of Alexandria, and another on the island of Pharos, where the lighthouse is, both to be of great size and built regardless of expense*”. Understanding the word tower to mean in this context lighthouse, as later, for example: “*In between is a lighthouse that is called the tower “of Messina*”, the lighthouse on Cape Pelorus mentioned in, Petrarch 2002, 12. 1-12.2, the tower being a lighthouse.

<sup>32</sup> Contra, Giardina 2010, 34, who states: “*although of course, it had not yet been built at the time of which he is speaking*”. The possibility that there might have been an earlier marker/lighthouse in the same place is not considered.

<sup>33</sup> Hdt. II. 111. 1. From thence possibly Persian, *fer*, radiance, lustre, brightness.

<sup>34</sup> Diod. V. 23.

shine/λαμπάς light-torch)<sup>35</sup>; with Lampus being one of the sons of Aegyptus<sup>36</sup>; in consequence, Homer's names of the horses Lampus and Phaethon have Pharonic Egyptian φα- Pha-/Fa- and light bringing associations; while Plutarch relates that Phaethon was also the name of the first king of the Thesprotians and Molossians after the flood<sup>37</sup>; and with the word *phalērōs* (φαληρός) meaning "shining", as also employed as an early personal name, the name of one of the co-founders of the kingdom rich in copper and the port-city of Soloi, Cyprus;<sup>38</sup> as possibly also in Phalaris from Rhodos, the tyrant of Acragas, Sicily,<sup>39</sup> as also *phalarica* for a fire lance, and *phaenomena* for visual appearance, these being a consequence of the light, it seems to be quite within the realm of possibilities that the origin of the word pharos in ancient Greek stems from the word Pharaoh and that the Φά- in Greek, (Pha-/Fa-) was brought from Egypt and was associated with light/sun/shining/pharos through its association with the Egyptian word *P-ra* or *Ph-ra* meaning the sun, relating to the word/title Pharaoh: *pr*, house + " , great.

The source of the word pharos for lighthouse is remarked upon by Petrarch in 1358, following the final collapsed of the Pharos in 1341, its collapse a fact unrecorded in his *Itinerary to the Sepulcher of Our Lord Jesus Christ*: "*Videbus Pharum, unde hoc 'phari'*", "*You will see the Pharos from which the term pharos spread itself to other lands*"<sup>40</sup>, indicating, as suggested above, that the term pharos originated with the structure on the Pharos island, although not from the Hellenistic Pharos as Plutarch states, but from its much earliest precursor on this island.

It is recorded that the Watchtower of Perseus, possibly that bronze clad tower in which Danaë Δανάη conceived Perseus by Zeus, at the western end of the Delta on a spit of land extending out into the sea, according to Herodotus,<sup>41</sup> was termed σκοπιῆς a watchtower rather than a pharos, but

<sup>35</sup> Hom. Od. XXIII. 245: "*The long night she held back at the end of its course, and likewise stayed the golden-throned Dawn at the streams of Oceanus, and would not suffer her [245] to yoke her swift-footed horses that bring light to men, Lampus and Phaethon, who are the colts that bear the Dawn*".

<sup>36</sup> Apollod. Epit. II. 1. 5: "*The sons of Egyptus by Gorgo, cast lots for the daughters of Danaus by Pieria, and Periphas got Actaea, Oeneus got Podarce, Egyptus got Dioxippe, Menalces got Adite, Lampus got Ocypete, Idmon got Pylarge*". Apollod. Epit. II. 1, relates that Egyptus was the son of Belus and Anchinoe daughter of the Nile: "*Reigning over the Egyptians Epaphus married Memphis, daughter of Nile, founded and named the city of Memphis after her, and begat a daughter Libya, after whom the region of Libya was called. 21 Libya had by Poseidon twin sons, Agenor and Belus. 22 Agenor departed to Phoenicia and reigned there, and there he became the ancestor of the great stock; hence we shall defer our account of him. 23 But Belus remained in Egypt, reigned over the country, and married Anchinoe, daughter of Nile, by whom he had twin sons, Egyptus and Danaus, 24 but according to Euripides, he had also Cepheus and Phineus. Danaus was settled by Belus in Libya, and Egyptus in Arabia; but Egyptus subjugated the country of the Melampods and named it Egypt, after himself. Both had children by many wives; Egyptus had fifty sons, and Danaus fifty daughters. As they afterwards quarrelled concerning the kingdom, Danaus feared the sons of Egyptus, and by the advice of Athena he built a ship, being the first to do so, and having put his daughters on board he fled. And touching at Rhodes he set up the image of Lindian Athena*".

<sup>37</sup> Plut. Pyrrh. 1.

<sup>38</sup> K. Nicolau, 1976.

<sup>39</sup> Associated with the employment of a brazen bull to roast his enemies, possibly indicating Phoenician-Rhodian connections and possibly relating to the worship of the God Moloch.

<sup>40</sup> Petrarch 2002, 20.2 and fn.179.

<sup>41</sup> Hdt. II. 15. 1: "*Now if we agree with the opinion of the Ionians, who say that only the Delta is Egypt, and that its seaboard reaches from the so-called Watchtower σκοπιῆς of Perseus forty schoeni (~224 km, today the delta extends west to east along ~ 240 km of coastline) to the Salters' at Pelusium, while inland it stretches as far as the city of Cercasorus*". Hor. Carm. III. 16. 1 ff. mentions the brazen tower where she was seduced, although if this is



which seems to have been another Pharonic coastal marker building, given its location and Danaë/Perseus's Egyptian associations, presumably carrying a marker light at night, but which seems to have been of a smaller size from that of the Pharos on the Pharos Island, and hence presumably described as a tower rather than a pharos, although both had watchmen and both, one can surmise, carried marker lights for navigation at night<sup>42</sup>.

The use of beacon markers, if of a far less imposing scale than Homer's pharos, has also been suggested in respect to the rugged coastline of Ithaca in A. T. Murray's translation of the following passage from the *Odyssey*: "*and lo, we were so near (the shore) that we saw men tending the beacon fires*"<sup>43</sup>. Likewise Lesches the Greek poet of ca. 660 B.C. and author of "*The Little Iliad*" seems to have mentioned a beacon-pharos-lighthouse tower standing by Sigeum, Cape Incihisari, by Troy in the

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Herodotus and Strabo's Tower of Perseus is unclear. Soph. *Ant.* 944 mentions the brass bound walls which encompassed Danae: [944] "*So too endured Danae in her beauty to change [945] the light of the sky for brass-bound walls, and in that chamber, both burial and bridal, she was held in strict confinement. And yet was she of esteemed lineage, my daughter, [950] and guarded a deposit of the seed of Zeus that had fallen in a golden rain. But dreadful is the mysterious power of fate—there is no deliverance from it by wealth or by war, by towered city, or dark, sea-beaten ships*". Hom. *Il.* XIV. 319, omits the location.

<sup>42</sup> Strab. XVII. 1: "*After the Bolbitine mouth there runs out to a great distance a low and sandy promontory. It is called Agnuceras (or Willow Point). Then follows the watch-tower of Perseus, and the fortress of the Milesians. For in the time of Psammaticus (Psamtik I B.C. 664-610), and when Cyaxares was king of the Medes, some Milesians with 30 vessels steered into the Bolbitine mouth, disembarked there, and built the above-mentioned fortress. Some time afterwards they sailed up to the Saitic Nome and having conquered Inarus in an engagement at sea, founded the city Naucratis, not far above Schedia*".

<sup>43</sup> Hom. *Od.* X. 28:

ἐννῆμαρ μὲν ὁμῶς πλέομεν νύκτας τε καὶ ἡμαρ,  
τῇ δεκάτῃ δ' ἤδη ἀνεφαίνετο πατρὶς ἄρουρα,  
30 καὶ δὴ πυρπολέοντας ἐλεύσσομεν ἐγγὺς ἐόντες:  
ἐνθ' ἐμὲ μὲν γλυκὺς ὕπνος ἐπὶ λυθε κεκημηῶτα,  
αἰεὶ γὰρ πόδα νηὸς ἐνώμων, οὐδέ τῳ ἄλλῳ  
δῶχ' ἐτάρων, ἵνα θάσσον ἰκοίμεθα πατρίδα γαῖαν.

"For nine days we sailed, night and day alike, and now on the tenth our native land (Ithaca) came in sight, and lo, we were so near (the shore) that we saw men tending the beacon fires". Trans. A. T. Murray, Loeb Classical Library Volumes, Cambridge, MA, Harvard University Press; London, William Heinemann Ltd. 1919/1995. The same is translated as: "*come near enough to see people tending their fires*" in E. V. Rieu's 1946 translation; "*Nine days and nights we sailed, and on the tenth our own land was in sight, near enough to see men tending fires*". In A. S. Kline's 2004 translation. In the Turkish translation *Odyseia*, A. Erhat/A. Kadir, Can Yay. İstanbul, 2006: "*Dokuz gün dokuz gece durmadan gitmiştik, başlamıştı görünmeye vatanın onuncu günü, daha da yaklaştıydık ve gördüydük nöbetçi ateşlerini*". The matter of who and for what purpose these people were tending fires on the rugged coastline of Ithaca, presumably at night, the text records on the tenth, as at night these fires, not the smoke from them, could be seen, together with the people feeding the flames, would seem to suggest, as in A. T. Murray's translation, coastal marker beacon fires, given the Palamedion and other references to beacon fires, as on the coastline of Euboea, on promontories, like those mentioned in the *Iliad* and Agamemnon etc., see n. 21, 24, 26, 139, 164. Given the nature of raiding at the time there seems to have been little probability that the inhabitants would advertise the location of their homes or their presence at night along the coast through visible fires along the coastline; while the employment of marker beacons at this time, would suggest sensible serious limits to the lighting of other coastal fires, to prevent confusion in navigation on the basis of these lights, and the consequent inadvertent wrecking of ships.

Troad,<sup>44</sup> and this marker on this headland by the tomb of Ajax seems to have been the location of another of the earliest recorded Mediterranean beacon lights which were regularly maintained for the guidance of mariners, a ‘Palamedion’ like that in the Troad on Cape Lectum. Another, which was probably in origin Phoenician,<sup>45</sup> almost certainly stood where today there is the VI<sup>th</sup> century B.C. Aylakia Pyrgos marker tower<sup>46</sup> located on Cape Pargos on Thasos in the Strymonian sea (where there are also the remains of a classical round tower below the modern harbour arm suggesting a harbour marker tower), matching that on Lemnos. Phoenician, Minoan and Mycenaean ports, one can surmise, probably had earlier employed some form of beacon-markers, serving the needs of mariners at night by marking the physical entrance to a port with two lights, one on either side of the harbour mouth and so marking at night the width of the harbour mouth.

These man-made navigational marks also included the lamps that probably hung from the columns of the Temple of Apollo by the harbour at Side at night, as on the Ἀντίφαρος anti-pharos Temple of Apollo at Patara (see below), structures serving this same nocturnal marker function for navigation as those lights that were suspended from the columns of temples located on major coastal promontories, as at Poseidon’s Hieron at the mouth of the Black Sea, as on Cape Sunium<sup>47</sup>, and it seems reasonable to suggest that references to the several recorded Holy/Sacred/pharos-beacon/lighthouse promontories<sup>48</sup>, are to be understood as indicating the presence on these

<sup>44</sup> Purves 1900, 19, citing the Little Iliad. This Tower of Sigeum was probably also used as a marker for the important Tomb of Achilles as also for the port of Sigeum that Livy (XLIV. 28. 6) records sheltered the Macedonian fleet of Perseus of Macedon in 168 B.C.

<sup>45</sup> Hdt. II. 44. 4: “Then I went to Thasos, too, where I found a temple of Heracles built by the Phoenicians, who made a settlement there when they voyaged in search of Europe; now they did so as much as five generations before the birth of Heracles the son of Amphitryon in Hellas [5]”; with the straits of Thasos marked with a beacon either side by the Phoenicians, another possibly being located on Lemnos.

<sup>46</sup> Doehne – Podany – Showers 1992, 180, 182.

<sup>47</sup> One may think for example of the temple dedicated to Poseidon on Cape Sunion, Hom. *Od.* III. 276: “but when we came to holy Sunium, the cape of Athens, there Phoebus Apollo...”. For others, see Giardina 2010, 7, examples dedicated to Melkart-Herakles, Poseidon and Athena. Likewise, Strab. XIV. 1. 35: at Chios: “Then to Phanae, a deep harbor, and to a temple of Apollo and a grove of palm trees”, possibly indicating another Apollo marker temple for this headland port; as likewise the small hilltop temple by the port of Oiniadai in the Acheloos Delta by Kalydon, Greece, also presumably carrying a guiding navigational light at night.

<sup>48</sup> *Op. cit.* fn. 2 and, not only of Cape Pelorus and Holy Sunium, the Cape of Athens, as noted, but as also of the Sacred/Holy Promontory of Cape Gelidonya in Lycia, Scylax: “west of the holy promontory, and 60 stadia from Melanippe”. Strab. XIV. 3: “Then follow the Sacred Promontory Cape Chelidonia” which formed a serious maritime hazard and which would have carried a light, perhaps in this case dedicated to Apollo, hence Holy/Sacred Promontory as by Carian Cnidus, Triopium (C. Krio), the promontory sacred to Apollo, Thuk. VIII. 35.3, “and with the rest to cruise round Triopium and seize all the merchantmen arriving from Egypt. Triopium is a promontory of Cnidus and sacred to Apollo”. It was the point where ships bringing corn-supplies to Athens would leave the Anatolian coastline to cross the Aegean after a coasting voyage from Egypt, and was an important promontory which would in all probability, given the dedication to Apollo have carried a marker light at night as an aid to navigation. That an ancient beacon-pharos probably stood on the site of the modern lighthouse, eg. Freely 1997, 169, but that this may have also served as the observatory of Eudoxus constructed by the mid-IV c. B.C. where observations were made on the rising and setting of the constellations, given the matter of residual light handicapping observation from this position seems somewhat more problematic. It seems reasonable to suggest that references to Holy/Sacred Promontories are to be understood as indicating the presence on these promontories of a marker light, such as, Plin. *nat.* II. 112: “from Gades, going round by the

promontories of a significant marker light, a practice that can be understood as being a continuation of the practice associated with Palamedes and with the Palamedion promontory sanctuaries of Homeric and pre-Homeric times, but also associated with deities such as Poseidon, Apollo, Athena, and Melkart-Herakles, as at Monaco where the Phoenicians, as later the Greeks, constructed a temple on its headland in honour of Melkart-Hercules<sup>49</sup>; as also those temples, doubtless also lit at night, positioned as markers of straits, in the east, as in the west, like those by the Straits of Gibraltar<sup>50</sup>.

However, the number of known, catalogued, recorded and identified Mediterranean Pre-Classical, Classical, Hellenistic, Roman and East Roman pharos-beacon towers today seems to be very few indeed. Baldassarre Giardina catalogues only 77 known lighthouses in the entire Mediterranean dating from the time of the Roman Empire (this number excluding the Black Sea but including the Sea of Marmora, the Dardanelles and the Bosphorus) in his corpus of lighthouses published in 2010;<sup>51</sup> yet this work is entitled, *Navigare necesse est*.

Given the nature of the rugged and indented Mediterranean coastline, the numerous smaller ports and the islands, islets, reefs, straits, promontories, deltas, shallows and submerged rocky outcrops, when one considers firstly, the significant quantity of Mediterranean maritime trade during the Pre Classical, Classical<sup>52</sup> and Hellenistic periods, and later, the still further increase in the quantity of maritime trade during the Roman Period, as is known from the archaeological evidence proving the existence of long distance maritime trade in bulk, evidence for this derived from recorded and from excavated shipwrecks<sup>53</sup> and from finds of amphora, identified with their distant place of manufacture from the clay type, amphora form, glaze, graffiti or stamp employed<sup>54</sup>, as also

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*Sacred Promontory* (Cape St. Vincent), *to the promontory of Artabrum*", as likewise, IV. 35, and, Strab. II. 5; III. 3-4, for the Sacred Promontory of Cape St. Vincent. For other examples, see Giardina 2010, 7.

<sup>49</sup> One may wonder if the Phoenician great pillar that lit up at night, which was seen by Herodotus (II. 44. 2) in the Temple of Melkart-Heracles in Tyre was also a navigational marker, he writes: "*I took ship for Tyre in Phoenicia, where I had learned by inquiry that there was a holy temple of Heracles.[2] There I saw it, richly equipped with many other offerings, besides two pillars, one of refined gold, one of emerald: a great pillar that shone at night; and in conversation with the priests, I asked how long it was since their temple was built. [3] I found that their account did not tally with the belief of the Greeks, either; for they said that the temple of the god was founded when Tyre first became a city, and that was two thousand three hundred years ago*".

<sup>50</sup> Strab. III. 5. 2-3.

<sup>51</sup> Giardina 2010, V. Unfortunately the map on page V of Roman Imperial period lighthouse distribution, incorrectly indicates Side in Pamphylia, cat. no. 71, as being located in Rough Cilicia on Cape Anamur and incorrectly lists in the entry cat. no. 14 Seleucia Pieria as being Silifke, and lists cat. no. 18, Attaleia, as being in Galatia, rather than Pamphylia, etc. This new lighthouse corpus makes no mention of the beacon towers at Anemourion described below, nor of the Patara anti-pharos documented by inscription, and gives no hint of the *in situ* remains of the XIII<sup>th</sup> century mânar, Tore de Stalimure-Pyrgos H. Nikolau, at Taşdibi, marking the Medieval pilgrimage port of Myra, amongst numerous other antique and medieval omissions.

<sup>52</sup> Visible for example from the recorded find spots of Athenian Black and Red figure vases as recorded in Sir J. D. Beazley's catalogues of vases.

<sup>53</sup> More than 1,000 ancient wrecks are known in the Mediterranean, with the bulk transport of relatively cheap goods common from the IV<sup>th</sup> century B.C. onwards and the largest quantity of known shipwrecks dating to the period from the I<sup>st</sup> century B.C. to the II<sup>nd</sup> century A.D.

<sup>54</sup> See for example for the Hellenistic Period: 1) Lawall 2005, 211-214; 2) Rostovtzeff 1941, 692; 3) Berthold 1984, 195 ff.; 4) Koehler – Wallace – Matheson 2004, 164-165. For the Roman Period: 1) Peacock – Williams 1991,

from the surviving literary sources and from the epigraphic evidence, including those listing harbour customs duties<sup>55</sup>; and, secondly, the very great dependence that Rome, as later Constantinople, placed upon the fleets of merchant ships safely bringing large quantities of wheat, as also olive oil, wine, *garum* and other goods and raw materials from numerous ports around the Mediterranean and Black Seas to supply and feed the huge and otherwise entirely unsustainable populations inhabiting the capital city, Rome, as later of Constantinople, sustained in part by the supply of free bread - *panes aedium* until 618 A.D.<sup>56</sup>, and, in consequence, there would have been many more marker lights-beacon towers-pharos standing in Roman Imperial times than those 77 that are known today which have been recorded in a variety of sources and the remains of some of them surviving today on islands/islets and along the coastline of the Mediterranean Sea. In consequence, the total number known from antiquity today seems almost certainly to be only some quite small proportion of the far greater number that were constructed and maintained as navigational marker beacons, temple lights, beacon towers or pharos in antiquity.

Following the construction of the marker beacon tower standing by Sigeum, Cape Incihisari, by Troy in the Troad before the mid-VII<sup>th</sup> century B.C. there seems to be a dearth of references to this type of coastal-port marker structure bearing a light at night in the Eastern Mediterranean until the Hellenistic period. It seems however reasonable to suggest, given the increasing Mediterranean maritime activity over the course of these three centuries, together with the fact that maritime voyages were not infrequently continued through the night as noted above, and sailing in any event, could not, given the winds and weather, the nature of the coastline, the course set or the pressure of events be restricted to only daylight hours, that markers-marker beacons at ports, at straits and upon major coastal headlands, as for example on Cape Gelidonya remarked upon by Pliny as, “*fraught with disaster for passing vessels*”<sup>57</sup>, would have been frequently constructed and any earlier marker light supporting structures maintained during this period as an aid to navigation, notwithstanding their current absence from the present archaeological and from the surviving published record of such structures.

There is, I think, also the important matter of place-names possibly indicating the presence of a beacon-pharos, a light. Not only as mentioned above in Homer’s reference to the Pharos Island, as Φάρον, long before the Hellenistic Pharos was built there, as also in further references to the Pharos Island, mentioned by Euripides *ca.* 480 – 406 B.C. in his play *Helen* of *ca.* 412,<sup>58</sup> and also by the

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54 ff; 2) Şenol 2008, 109-131; 3) Şenol 1996, 165-172. And for the Byzantine Period: 1) Pieri 2005, 153-157; 2) Leonard – Demesticha 2004, 189-202.

<sup>55</sup> As survives for example from the Lycian port of Andriake, Takmer 2006, *passim*; see also re. *portoria*, Mitchell 1993, 256-257.

<sup>56</sup> Free grain for the citizens of New Rome was restored by Emperor Justinian in his Pragmatic Sanction of August 15<sup>th</sup> 554, although the quantity of grain, given the fall in population from the plague from 542 was far less than previously and would probably have been supplied from regions much closer to the capital, this ration was at times 2 lb of bread to 80,000 residents *per diem*, Wickham 2010, 260. The supply of free bread - *panes aedium* to the much reduced by plague population inhabiting Constantinople ceased by Imperial decree of Emperor Heraclius in 618 following the Sassanid Persian conquest of Egypt. With the reopening of Trajan’s canal by ‘Amr ibn-al ‘As, some of Alexandria’s grain surplus was before 644 sent by ship to feed the population of al-Madina and then Mecca, Hourani 1995, 59-60, a practice that then continued for centuries.

<sup>57</sup> Plin. *nat.* V. XXXV. 129-131

<sup>58</sup> Eur. *Hel.* I. 4-7 “*Helen: These are the lovely pure streams of the Nile, which waters the plain and lands of Egypt, fed by white melting snow instead of rain from heaven. Proteus was king of this land when he was alive, [5] living on*

Pseudo-Scylax,<sup>59</sup> in perhaps the mid-IV<sup>th</sup> century B.C. or earlier, and likewise both references prior to the construction of the later Hellenistic Pharos; together with Pseudo-Scylax's mention of another in perhaps the mid-IV<sup>th</sup> century B.C. or earlier, which was located in the Gulf of Manios on another island, on Φάρων/Phara, Nestia-Acarmania;<sup>60</sup> but further, there is perhaps also the possibility that the presence of beacon markers may be indicated in some of those ports-coastal place-names beginning with the letters Φάρ-,<sup>61</sup> including: the earlier name of Phaselis (Pamphylia), Pharsalos;<sup>62</sup> with the word Φάρσαλος - Pharsalos, seemingly formed through the combination of φᾶρος + σᾶλος, that is the word *pharos*-marker beacon combined with the word *salos*, meaning an open roadstead outside a port for ships to anchor in, with the word *pharos* shortened<sup>63</sup> to φάρ + σᾶλος = Φάρσαλος, and with the name Pharsalos to be understood therefore as describing the place, a harbour with a roadstead marked by a beacon light. On this basis, there was possibly one on the Aegean island of Pharmacusa Φαρμακοῦσα, ancient Pharmakousa, Pharmakos (Φαρμακονήσι Farmakonisi, Farmaco) southwest of Miletos in the Dodecanese; another at the promontory harbour of Phanae on Chios, another on the promontory of Cape Zephyros, Pharnakeia (Cerasus/Giresun) possibly constructed or more probably reconstructed by the Persian Satrap of similar name; while the name Phanagoras, the port on the Sindi (Σινδοί)/Taman Peninsula of the Pontus, might possibly also have been understood as implying the presence of a pharos and more than one agora, like the two agoras at Peiraios; as also perhaps, the Φά- of the name Phasis of the Colchis-Georgian Black Sea river with its largely submerged but formerly important port emporion, presumably with its port markers, with, for example, possibly another beacon marker located on the acropolis promontory of Pheraclos on Rhodos.

It seems evident therefore the Pharos of Alexandria, one of the seven wonders of the ancient world, should rather be understood as the culmination of a longstanding tradition extending over the course of a millennia of erecting marker beacons-pharos lighthouse tower structures to aid nocturnal maritime navigation, some of which had also considerably earlier been termed φᾶρος *pharos*, than that of the Hellenistic period Pharos itself initiating the increasingly widespread employment of architectural structures of this type in the Mediterranean in the centuries subsequent to its construction<sup>64</sup>. Both its great size and the manner of its construction also suggest

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*the island of Pharos and lord of Egypt; and he married one of the daughters of the sea, Psamathe, after she left Aiakos' bed".*

<sup>59</sup> Pseudo-Scylax, 107; see also Arslan 2012, 253.

<sup>60</sup> Mentioned by Pseudo-Scylax, 23; Arslan 2012, 242.

<sup>61</sup> With the Φάρ as noted above probably stemming from the *P-ra* or *Ph-ra* of "the sun", of Egyptian hieroglyphics, hence pharaoh, in Greek. *Pharao*, as also: *phalēròs* (φαληρὸς) "shining". For further on this see, Beekes 2010, 1546.

<sup>62</sup> Steph. Byz. *Ethnika* 660, records the initial name of the city as: Πιτύουσα Pityousa, possibly relating to the pine forests; its second name as: Φάρσαλος Pharsalos; and its third name as, Φάσηλις Phaselis. The pharos tower constructed by Herod at Caesarea was called Phasaelus after the name of his brother, Ioseph, *Ant. Iud.* XVI. 142 rather than from the port of Phaselis.

<sup>63</sup> Φᾶρ, τό, occurs in the Apocalypse as a form of φᾶρος, (*pharos*) Hadrian Grammaticus I. 394. My thanks to M. Alkan for his assistance in this matter.

<sup>64</sup> Contra the emphasis placed upon the Hellenistic Pharos as the example by, P. A. Clayton: "Since the Pharos was the first architecturally designed and developed lighthouse it obviously acted as a model, both direct and indirect, for others throughout the Graeco-Roman world". Clayton 1989 145; by Giardina 2010, 48; by Handler 1971, 58, records the Alexandrian Pharos as: "This first true lighthouse"; as do others.

there would have been some significant precedents for this type of structure already standing, albeit of a smaller size, and it seems most probable that there was a smaller one that was already standing on the Pharos Island itself in pre-Homeric times and it, or more probably its later replacement recorded by Arrian, was then demolished to make way for the Hellenistic Pharos, or with its material incorporated into it. It was this earliest structure that gave its name to the island, serving as a marker beacon for the city of Rhacotes, and marking the gateway to Egypt with its “*harbour with good anchorage*”<sup>65</sup>, the precursor of Alexander’s city of Alexandria and its later Pharos<sup>66</sup>, and, as Pliny records, Homer had employed in the *Odyssey* this name for this island: “*Now there is an island in the surging sea [355] in front of Egypt, and men call it Pharos. Therein is a harbor with good anchorage, whence men launch the shapely ships into the sea*”<sup>67</sup>, some several centuries before the Hellenistic Pharos was constructed.

Possibilities that can be suggested in this respect extend from some type of pharos like-beacon structures which would almost certainly have marked at night the physical entrance to ancient harbour mouths, such as at: Tyre, Sidon, Valletta/Ricasoli, Carthage, Gades/Cadiz, Thera, Pylos, Pelusium, Naucratis, Soloi and Paphos; those few known and dating from three centuries prior to the construction of the Pharos at: Jelsa-Tor (Croatia), at Thasos and Nora (Sardinia)<sup>68</sup>, and it seems evident, given the practice of nocturnal navigation recorded above, that the entrances to the harbours of Zea, Munichia and the main harbour of Kantharos (Megas Limen) for Athens would have been marked with marker beacon towers from before 493/2 B.C. when the harbours of the Piraeus were enlarged, and these structures would then have been rebuilt again in 429 when moles were constructed by each harbour entrance from which chains were suspended to close the mouth of these harbours for defence. Athens also employed other signalling beacons which are mentioned by Thucydides as employed during the Peloponnesian War<sup>69</sup>, which were able to communicate complex messages, and beacons-pharos would have marked the harbour and also the physical entrance(s) to ports such as: Pharsalos-Phaselis as noted above, of Side<sup>70</sup>, and presumably also marking the delta entrances to Caunos and to Silifke and marking the estuary entrance to Perge<sup>71</sup> and other harbours with their entrances in similar, less than immediately visible locations from the sea; as also for example, marking the harbour at Elaia serving the important city of Pergamum, 24 km. distant from the sea.

Simply put, vessels travelled at night as a matter of course as noted above, and therefore *navigare necesse est*, navigational markers were required, both those indicating the location of the harbour and of the harbour mouth, as also on significant promontories and straits, serving as essential maritime markers for the mariners’ practice of nocturnal navigation. The cost of the maintenance of

<sup>65</sup> Plin. *nat.* V. 11.

<sup>66</sup> As Vit. de Arch. II. 4: “*There (Egypt) when Alexander had observed a port naturally protected...he ordered Dinocrates to lay out a city in his name, Alexandria*”.

<sup>67</sup> Hom. *Od.* IV. 351; Plin. *nat.* XIII. 70.

<sup>68</sup> For these see Giardina 2010, 24 cat. no. 32, 28 and 49 respectively.

<sup>69</sup> Thuk. (III. 80. 2): “*But the Peloponnesians after ravaging the country until midday sailed away, and towards nightfall were informed by beacon signals of the approach of sixty Athenian vessels from Leucas, under the command of Eurymedon, son of Thucles; which had been sent off by the Athenians upon the news of the revolution and of the fleet with Alcidas being about to sail for Corcyra*”. See also Thuk. II. 94.

<sup>70</sup> Giardina 2010, cat. no. 17, numismatic evidence.

<sup>71</sup> Giardina 2010, cat. no. 16, numismatic evidence.

these structures was perhaps born in some cases not by the *portoria*, the port tax and the duties levied on vessels, sometimes on people, and on the goods both leaving and entering a port, which usually paid for a harbour's upkeep, but perhaps at times came from the state, or from the treasury of the relevant deity, Pharaoh, Poseidon, the father of the King of Nauplion and an ancestor of Palamedes, Apollo, Zeus, the Dioscuri, Castor and Pollux, Melkart-Herakles, etc., in the case not only of the insular/coastal/promontory marker beacons, but also in the case of some harbour marks/lights positioned in or on religious/cult structures, such as temple lights.

### Harbour Marks

The Colossus of Rhodes, the 33 m. high bronze statue of Apollo Helios holding a torch was erected on its tall white marble base by 282 B.C. and which was felled, broken at the knees, in an earthquake in 227 B.C. and which was not re-erected, may have been constructed not only to mark the defeat of Demetrius Poliorcetes' siege of Rhodes and of the victory of a city state against a tyrant, but clearly, given its great height, it would also have physically served, and may have been deliberately designed to serve, as a visually noteworthy navigational marker for both the city and for its important harbours. It does not seem to have stood at the harbour entrance<sup>72</sup>, but rather at the top of the Street of the Knights, at a higher elevation within the city *ca.* 30 m. ASL, within the temenos of the Temple of Helios, and although it was described by Philo of Byzantium as "*a second Sun to the world*"<sup>73</sup>, paraphrasing Pliny, "*the colossal statue of the Sun at Rhodes*"<sup>74</sup>, it is unclear if it contained or supported any light-source, nor if Apollo's torch was gilded and was illuminated in some way at night, and that it thereby served at night as a navigational beacon for mariners; although it certainly would have been a significant navigational marker for sailors in daylight for nearly 6 decades, standing to a height of over 65 m. ASL.

Likewise, the earlier Mausoleum of Maussollus of Caria completed by *ca.* 350 B.C.<sup>75</sup> and rising to a height of 45 m. from an elevation of 10 m. ASL. and the remains of which still stood to some considerable height into the 15<sup>th</sup> century A.D. on the slope of the hillside facing the entrance to the main harbour at Halicarnassus-Bodrum, and likewise originally supporting a freestanding statue of Apollo<sup>76</sup>, would, like the Colossus of Rhodes, have served as a significant navigational landmark, a maker to mariners of the position of the harbour entrance in daylight, although, as with the Colossus of Rhodes, it is not recorded that this major Carian monument constructed more than half a century before the Pharos of Alexandria, ever carried a light source at night to aid nocturnal navigation into the harbour, although this may have been the case for both of these structures and for other such structures of a noteworthy size erected in similar harbour related and other locations important for maritime navigation elsewhere, such as those marking the position of straits.

### The later Pharos by Alexandria

The Hellenistic beacon tower, the Pharos at Alexandria<sup>77</sup>, built, or rather constructed on behalf of

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<sup>72</sup> Higgins 1989, 135-6.

<sup>73</sup> Higgins 1989, 132.

<sup>74</sup> Plin. *nat.* XXXIV. 41.

<sup>75</sup> Waywell 1989, 100.

<sup>76</sup> Waywell 1989, 111.

<sup>77</sup> Giardina 2010, cat. no. 8.

Sostratus of Cnidus<sup>78</sup> in Caria, during the first quarter of the III<sup>rd</sup> century B.C. completed in the reign of Ptolemy II Philadelphus, 287-247 B.C. on the island of Pharos<sup>79</sup> and which was still functioning as such in the VII<sup>th</sup> century A.D.<sup>80</sup> and which still served as a lighthouse into the 12<sup>th</sup><sup>81</sup> and which continued to serve this function as late as the mid 14<sup>th</sup> century, when it was known in Latin sources as the *Torre di Arabi*, the Arab Tower<sup>82</sup>, originally rose to a height of well over a hundred and fifty meters<sup>83</sup>, probably reaching about 170 meters and was probably crowned for a time by a bronze statue of Poseidon.<sup>84</sup> Evidently from out to sea on a clear day or night the Pharos was visible as a mark on the horizon long before the low coastline came into view. When it was completed, it would have been first visible to mariners from a distance of perhaps 47 kilometres/29 miles/25.4 nautical miles or more out to sea<sup>85</sup>, and a significant part, the lowest square in section

<sup>78</sup> P. A. Clayton suggests he was a wealthy man, not the engineer of that name who erected the first promenade supported by piers at Cnidus, as stated by Pliny, Clayton 1989, 142-5, but was possibly the engineer's wealthy grandson. Likewise Giardina 2010, 57, citing Barbagli 2003, 110.

<sup>79</sup> Where, it was falsely related in a letter of Aristeas to his brother Philocrates, that the Pentateuch/Torah was translated from Hebrew into the Greek Septuagint in the III<sup>rd</sup> century B.C. under Ptolemy II Philadelphus, 287-47 B.C. for the library of Alexandria; but in the I<sup>st</sup> century A. D. both Jews and Gentiles did celebrate an annual festival on the island, marking this translation supposedly made on the Pharos island, Philo *Mosis*, 2-44.

<sup>80</sup> Hitti 1991, 164 n. 1; or perhaps even into the early VIII<sup>th</sup> century, Price – Trell 1977, 181.

<sup>81</sup> Benjamin of Tudela in 1168 records in his *Sefer ha-Masa'ot*, The Book of Travels: "*The lighthouse is still a mark to all seafaring men. It is observed at a distance of 100 miles by day and at night bears a light which serves as a guide to all mariners*". In Benjamin 2005, 105; Wright 2003, 122. Contra Hourani 1995, 61, of: "*The wonderful Pharos fell to ruin and nobody could be found to repair it*", as it had not fallen into a ruin, it was still functioning as a lighthouse in 1168 and continued to function as such, if at a reduced height until ca. 1341. There was a earthquake in Alexandria in 741 Thulhijjah/May 1341, Ambraseys – Melville – Adams 1994, 108, not to be confused with that of 1303; likewise: Pararas-Carayannis 2011, 257; and it seems the remains of the structure, the square in section base, finally collapsed at this time.

<sup>82</sup> The name also given to that at Abusir, see Fakharani 1974, 257-272, 257.

<sup>83</sup> Pearson 2003, 4, suggests at total height of 466 ft., 142 m. Giardina 2010, 59, 62, states a reduced height of 100-110 m., although 'Abd al-Latif al-Baghdadi's visit to Alexandria and his record of the Pharos in ca. 1202, al-Baghdadi 1965, 133-5, records that it stood 233 cubits high, 466 ft. = ~142 m. with a 10 cubit/~6 m. high mosque on top, that is, ~152 m., which remains, I think, its most probable XIII<sup>th</sup> century height, although it was probably somewhat taller in antiquity, given that both the lantern and the cylindrical section were lost from the building possibly standing originally more than 170 m. high. From this height the light on the pharos would have been visible from about 25.5 nautical miles, from over 47 km. out to sea.

<sup>84</sup> Rather than of Zeus Soter. See Giardina 2010, 59-61, particularly the quote cited from the Anthologia Palatina: "*I am a tower, I bring aid to wandering sailors, by lighting the rescuing fire of the god Poseidon*".

<sup>85</sup> Benjamin of Tudela in 1168 records it was visible in daylight from 100 miles away, Wright 2003, 122; Josephus gives 300 stadia/34 miles, while Casson 1979, 258, gives a visibility to the Pharos of 30 miles = 48 km. Depending on the miles employed by Benjamin of Tudela, this would imply it had a height of just over 2 km which is not possible and was probably a figure of speech simply indicating a great distance. To calculate the distance visible out to sea in daylight from a lighthouse-tower is a matter of triangulation, measure the distance from eye-level on the lighthouse platform to sea level and then determine the square root of this number and then multiply it by 1.23 to give miles or by 1.17 to give nautical miles of visibility from the lighthouse platform. Reverse the calculation to find the approximate height of a structure if the point at sea level from where the structure becomes visible is known. For an observer standing on the ground with h = 1.70 m. (5 ft 7 in) (average eye-level height), the true horizon is at a distance of 4.7 kilometres (2.9 miles). For a tower with a height of 100 m. (330 ft.), the horizon distance is 35.7 km. (~22 miles) away on a clear day/night. Thus an observer on a beach can see the top of the 100 m. high tower, as long as it is not more than 40.35 km. (~25 miles) away. Conversely,



base remained standing until probably 1341,<sup>86</sup> giving a physical footprint of more than 1600 years

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if an observer on a boat standing 1.7 m. high can just see the tops of the trees on a nearby shore ( $h = 10$  m.), those trees are probably about 16 km. away. Visibility often increases over water in the spring due to atmospheric refraction caused through warm air overlying cold water. The results of these calculations are in practical terms dependent upon: the weather, low cloud, humidity, mist, dust/sand storms and the degree of atmospheric refraction, all influencing visibility at any time, on the eyesight of the mariner, and at night upon the luminosity of the light source, dependent upon the fuel and the quality of any light intensifying devices employed.

<sup>86</sup> *Op. cit.* n. 81. It seems to have stood well over 150 m. high. Comprising 3 stages, in section from the base upwards, square, octagonal and then cylindrical, and had an entrance door initially near ground level, later raised up and accessed via a flight of steps, and subsequently a *masjid-mescit* was constructed on top of what remained of the cylindrical section in the X<sup>th</sup> century, and this mescit building stood 5.49 m. h. 36.60 m. in d. with 4 doors and a cupola, which was visited by Abu Hajjaj al-Andalusi in 1166, Clayton 1989, 153-5. It is said convex mirrors were used to intensify the sun's rays as the light source by day and possibly also the flame's light at night, Marlowe 1971, 62; Giardina 2010, 58-9, 63; suggests a concave rotating mirror; while the traveller Naser-e Khosraw in his Book of Travels (Safarname), relates the East Romans destroyed the mirror, the Pharos now being in Muslim hands Khosraw 1986, 42; and the pilgrim-scholar M. H. Farahani relates the mirror was removed by (probably during the reign of) the Marwanid Caliph 'Abd al-Malik (685-705), Farahani 1990, 158. By 700 Bishop Arculf records it was: "a large tower, which is every night lighted up with torches, lest mariners might mistake their way in the dark". See Wright 2003, 10. It seems the uppermost lantern section fell in ca. 796, then most of the uppermost cylindrical section fell in the earthquake of 956, (contra Clayton, 1988, 155, who strangely suggests the original height of the cylindrical third storey was only 7.5 m. Rather this was all that remained of the cylindrical section of the Pharos after the 956 earthquake and this was certainly not its original height.) following which, the masjid 10 cubits high was constructed on top of what remained of this cylindrical section and this possibly served as a victory mosque, a 'Mashhad al-Nasr', constructed following the Fatimid conquest of Egypt in 969, and this mosque on top of the Pharos is recorded in the mosaic depicting the arrival of St. Mark in Alexandria in the chapel of Zeno in St. Mark's Cathedral, Venice, which shows the Pharos as a two stage tower topped by the *masjid-mescit*. Following Abu Hajjaj al-Andalusi's visit in 1166, and Benjamin of Tudela's visit in 1168, who records it was called the *minar (mānar)* of Alexandria and remarks: "The lighthouse is still a mark to all seafaring men. It is observed at a distance of 100 miles by day and at night bears a light which serves as a guide to all mariners". Wright 2003, 122; it would seem when Benjamin of Tudela wrote it was "observed at a distance of 100 miles by day", he meant it could be seen from a very great distance, and 'Abd al-Latif al-Baghdadi's visit to Alexandria and his record of the Pharos in ca. 1202, al-Baghdadi 1965, 133-5, that it stood 233 cubits high, 466 ft. = ~142 m., with a 10 cubit/~6 m. high mosque on top. The presence of the mescit on top, and the lantern section and most of the cylindrical section fallen meant the antique fire platform was not employed, and a possible change in the light source(s) may be indicated by Arculf in 700 at a date prior to the lantern collapse. There is no possibility that the statue was lost from the Pharos in the XIII<sup>th</sup> century as stated by Giardina 2010, 63, as the top of the Pharos, probably including the fire-platform and the lantern fell in the VIII<sup>th</sup> century.

It seems most probably that as a result of the 1303 earthquake and tsunami, all that which formerly stood above the square in-section lowest part was brought down, as when it was visited by ibn Battuta in 1326 only the lowest square in-section tower remained standing, which he entered and in part measured, one face of which in 1326 was in ruins and, on his next visit to Alexandria in 1349 the Pharos was so ruined (caused by earthquake damage possibly in 1341, given ibn Battuta's remarks of 1326, only one face of the lowest section seems to have been damaged in 1323, rather than it being badly damaged-destroyed in the usually cited 1303 and 1323 seismic events, e.g.: Clayton 1989, 153) that it was not possible to enter it, and therefore it would not have carried a light at night from ca. 1341 onwards, but the Mamluke Sultan Al-Malik al-Nasir al-Hasan b. Muhammad Nasir al-Din was then, in 1349, in the process of constructing a new but similar pharos to stand alongside it; however work was terminated on this replacement pharos with the sultan's death in 1361,

for the remains of this Hellenistic structure, indicating both the strength of its construction and its secure foundation in the bedrock of the Pharos Island. Strabo writes of it: "...[Pharos] is a rock, which is washed all round by the sea and has upon it a tower that is admirably constructed of white marble with many stories and bears the same name as the island. This was an offering made by Sostratus of Cnidus, a friend of the king's, for the safety of mariners, as the inscription says: for since the coast was harbourless and low on either side, and also had reefs and shallows, those who were sailing from the open sea thither needed some lofty and conspicuous sign to enable them to direct their course aright to the entrance of the harbour"<sup>87</sup>.

The form of the Alexandrian Pharos was re-employed for a mausoleum in the cemetery of Osiris by Abusir - Taposiris Magna and which seems to have served a similar daylight marker function to the Pharos itself 30 miles to the east<sup>88</sup>, although if it was lit at night is unknown, but not impossible, aiding through providing a navigational marker, travel on Lake Mareotis by day and possibly by night if it was illuminated, and serving together with the adjacent Temple of Osiris as a prominent marker in daylight for mariners on their approach to the coast at a point 30 miles from Alexandria.

From the minting of coins bearing the image of a beacon tower-pharos<sup>89</sup> which were struck for example by the port cities of: Corinth depicting the pharos by the Cenchreae and possibly the Lechaem<sup>90</sup>, at Heraclea Pontica<sup>91</sup>, these being of the Alexandrian Pharos three stage form, at Berytus-Beirut<sup>92</sup>, Laodicea-Apameia on the Orontes<sup>93</sup>, Laodicea ad Mare-Latacia, Syria<sup>94</sup>,

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Mackintosh-Smith 2002, 7, he reigned 1347-51 and 1354-61; and so contra Giardina 2010, 61, who states: "*In the summer of 1303, a violent earthquake caused the lighthouse to collapse. The Mamluke sultan Qaitbey decided at this time to build his fortress on this spot, the structure embracing what was left of the tower*". However, the Mamluke Sultan Qaitbey ruled from 1477-80 in the 15<sup>th</sup>, not the 14<sup>th</sup> century, and the Pharos was enterable and so presumably carried a light until ca. 1341 for the functioning port of Alexandria, which was not sacked by the Crusader fleet of Peter I of Lusignan Cyprus and largely destroyed by fire until 1365, and 30 years later in 1395 it was reported by the notary Nicholas of Martoni that one eighth of the city of Alexandria still remained burnt out from the Crusader 1365 sack, (Daniel 1979, 312), while the start of the construction of the replacement Pharos by Sultan Al-Malik al-Nasir before 1349 is mentioned by Giardina 2010, 62, yet the possibility is raised, Giardina 2010, fn. 316, that the original Pharos still remained of a height to have served as the minaret of this new fort, suggesting it retained a substantial height in 1477, which is not supported by any evidence, and is contradicted by the report of Sultan Al-Malik al-Nasir beginning the construction of the new replacement lighthouse before 1349 and by Ibn Battutah's report of its ruined state in 1349.

Constructed in the III<sup>rd</sup> century B.C. the then still standing remains of the lowest section of the Pharos, together with the incompleated Mamluke replacement pharos (*mânar*) were dismantled and incorporated into the fort guarding the harbour entrance built by the Mamluke Sultan Qa'it Bey in 1477-80; giving a footprint of more than 1600 years for the remains of this structure, while the Pharos at Patara stood for more than 1500 years, only destroyed in the earthquake and tsunami of 1609, these major pharos towers were often massive structures that were certainly engineered to last.

<sup>87</sup> Strab. XVII. 6.

<sup>88</sup> For the matter of its function see: Fakharani 974, 272; contra Giardina 2010, who catalogues it as a lighthouse, cat. no. 7. If there was formerly a pharos-type structure at the place called Pharagon mentioned by Pierre Belon in Egypt in 1547 seems unknown.

<sup>89</sup> Price – Trell 1977, 40-42; Clayton 1989, 148.

<sup>90</sup> Price – Trell 1977, fig. 147, 177-192 A.D.; Giardina 2010, cat. no. 29.

<sup>91</sup> Price – Trell 1977, fig. 63, 253-268 A.D.; Giardina 2010, cat. no. 25.

<sup>92</sup> Price – Trell 1977, fig 64, 198-211 A.D.

<sup>93</sup> Giardina 2010, cat. no. 12.

Panormus-(Palermo) Sicily<sup>95</sup> standing by 241 B.C., at Messina<sup>96</sup>, at Aegae-Cilicia (Aigai-:Lazio-Ayaş-Yumurtalık)<sup>97</sup> and at Abydos<sup>98</sup> under Septimus Severus and Maximinus I, with another across the Hellespont-Dardanelles, Hero's tower at Sestos, it would seem these ports also had pharos-like towers, and large pharos were constructed by the Romans in the I<sup>st</sup> century A.D. at Portus<sup>99</sup>, as also at Ostia with its pharos and anti-pharos<sup>100</sup>, and at Classe, the port of Ravenna<sup>101</sup>, with those constructed at Ostia and Ravenna mentioned by Pliny as being of a similar functional type to that of Alexandria<sup>102</sup>; the pharos and anti-pharos at Centumcellae-Civitavecchia constructed under Emperor Trajan 98-117 A.D.<sup>103</sup>; and another, standing by 24 A.D. at the mouth of the Guadalquivir, the tower of Caepio, mentioned by Strabo as being on an island and as also being like the Pharos of Alexandria<sup>104</sup>.

A pharos and anti-pharos were constructed by Herod on the harbour arms of the Sebastos harbour complex (21-10 B.C.) at Caesarea Palestina-Caesarea Maritima<sup>105</sup>, 40 km. south of Jaffa, and also marker beacons. It seems this pharos, a replica of the Pharos, was called the 'Drusion', so named by Herod after Tiberius's brother, Drusus, the structure that is referred to by Josephus as the 'Drusion'<sup>106</sup>. Its precursor seems to have been a IV<sup>th</sup> - III<sup>rd</sup> century B.C. Phoenician tower marking the port and therefore presumably carrying a marker light at night, named after one of the kings of Sidon, mentioned as the name of the harbour itself, Strato's Tower, by Zenon in 259 B.C., that is the port-city was known by the name of this marker tower, and the city of Caesarea was also later described as Strato's Tower, in the V<sup>th</sup>-VII<sup>th</sup> century A.D. in the record of Christian pilgrimage<sup>107</sup>, probably with these associations of the earlier Phoenician marker tower transferred to Herod's pharos, perhaps thereby avoiding Roman Imperial and Herodian, in favour of earlier Old Testament associations.

There are also in the number of extant Roman pharos, that of Patara<sup>108</sup>, of a cylindrical shaft upon a square podium constructed by Emperor Nero (54-68 A.D.), together with its known but still

<sup>94</sup> Price – Trell 1977, fig 65, a round tower of two stages with a flight of steps up to the entrance, mid II<sup>nd</sup> century A.D. It seems the change in the height of the doorway of the Pharos at Alexandria from ground level to being raised up, that occurred between 138-161 A.D., Clayton 1989, 150, was probably a consequence of the 141 earthquake and tsunami, and it may be that the stairs up to the entrance to the pharos at Laodicea in Syria were also constructed following this significant tsunami event. Giardina 2010, cat. no. 13.

<sup>95</sup> Price – Trell 1977, fig 67. I<sup>st</sup> century A.D.; Giardina 2010, cat. no. 48.

<sup>96</sup> Baydur 1998, pl. 8 no. 59, before 36 B.C.; Giardina 2010, cat. no. 47.

<sup>97</sup> Price – Trell 1977, fig. 66i, 485, a tower, 249-251 A.D.

<sup>98</sup> In the II<sup>nd</sup> - III<sup>rd</sup> century A.D., Price – Trell 1977, 486.

<sup>99</sup> Constructed by Claudius (r. 41-54) north of Ostia.

<sup>100</sup> Plin. *nat.* XXXVI. 87; Suet. *Claud.* 20. 3; see also, Mackendrick 1960, fig. 10.6; Giardina 2010, cat. no. 60.

<sup>101</sup> Giardina 2010, cat. no. 43.

<sup>102</sup> Plin. *nat.* XXXVI. 87.

<sup>103</sup> Giardina 2010, 18; Franco 1996, 295 figs. 17 a, 17 b.

<sup>104</sup> Possibly in respect to its island location. Strab. III. 1. 9; see also, Giardina 2010, cat. no. 72.

<sup>105</sup> Giardina 2010, cat. no. 10.

<sup>106</sup> Joseph. *Bell. Iud.* I. 411-20; see also, Rocca 2008, 192; İşkan-Işık, Eck – Engelmann 2008, 110.

<sup>107</sup> As by St. Jerome by 404, and the Piacenza Pilgrim, ca. 570, Wilkinson 2002, respectively, 79, 150.

<sup>108</sup> That stood over 30 m. tall, upon on a podium 20 by 20 m., Işık 2011, 71-72; Giardina 2010, cat. no. 21.

undiscovered *anti-pharos*<sup>109</sup>, probably a temple marker dedicated to Apollo, as at Side, marking the other side of the harbour entrance, both structures unmentioned by Pliny<sup>110</sup>; and, also in Lycia there are probably the remains of another pair, pharos and anti-pharos that once physically marked the entrance to the harbour at Andriake<sup>111</sup>, buried beneath the subsequent infilling of the ancient harbour mouth area, in part from the recent development of the new small port at Çayagzı at the western tip of the peninsular constructed from 1990-6, and, in part obscured through coastal subsidence and deposition<sup>112</sup>; and probably a further pair at the mouth of and marking the harbour

<sup>109</sup> The anti-pharos is recorded at Patara, Işkan-Işık – Eck – Engelmann 2008, 91-92 fn. 10, 109. It may have been located where the “*Cape Sanctuary*”, marked on the current site map of Patara is, as it is situated opposite the location of the Pharos, Işık 2011, 152, Map key No. 40, ‘temple’, as from this area came a dedicatory inscription to Apollo Patroos. For reference to the published remains and inscriptions from this area see: Onur 2001, 171, and Onur 1999, *passim*. In these works the possible connection of this location and inscription with the anti-pharos of Patara is not made. The remains may be in the adjacent tower incorporated into the later fortification wall.

<sup>110</sup> The pharos at Patara of a square base on a platform and with a cylindrical shaft was not mentioned by name in Pliny’s *Natural History*. It may be that pharos were usual at major harbours by the 1<sup>st</sup> century A.D. and so Pliny only names these three examples, or because the pharos at Patara was of this different cylindrical type, or because it was constructed under Nero whom Pliny disliked, for Pliny’s non participation in public affairs under Nero, his nephew Pliny the younger wrote: “*the slavery of the last years of Nero had rendered dangerous every study of a free and elevated character*”, *letters* III. 5. 5 as, although Pliny does mention some structures that were built in an extravagant fashion by Nero, such as his Golden House in Rome and also his rebuilding of the Temple of Fortune in onyx brought from Cappadocia, there are no indications that the pharos constructed by him at Patara was also an extravagant, rather than a functional, structure. A further possible reason is that it may have been damaged in the major earthquake and tsunami of 68 A.D. For the dating of the construction of the pharos at Patara to the reign of Nero 54-68 A.D., See Şahin 2008, 1-31. For the record made by Piri Reis of the lower section, the shaft of it, which still remained standing in 1524 and which then served as a coastal marker, a guide to navigation, which is why Piri Reis troubled to record it; for its probable reuse in the XIII<sup>th</sup> century, and for the probable destruction of much of the cylindrical shaft in the 1609 earthquake and tsunami, see Duggan 2010, 52 figs. 9-10.

<sup>111</sup> Given the nature of the coastline in this area, the flat, possibly marshy, land at the mouth of the river, the entrance to the harbour would have to have been marked from the Hellenistic period onwards by beacon towers-pharos, as the mouth of the river leading to the port would have been otherwise most difficult to identify from the sea. It is known that the harbour was guarded by a chain, App. *civ.* IV. 82, and this chain was presumably suspended from these tower/beacon-markers at the entrance to the port of Andriake, with the chain broken by the Roman Cornelius Lentulus Spinther in 42 B.C. It seems reasonable to suggest the entrance into the bay itself from the sea was likewise marked at night, by beacon towers or through the reuse of the Hellenistic watchtowers on this coastline. Vitruvius (*de Arch.* XII. 1) later remarks that: “*On either side (of the harbour entrance) towers are to be built from which chains (across the harbour mouth) can be drawn by machinery*”, and these structures were a feature of harbours into modern times, for example, the Pisan fleet in 1063 raided Muslim Palermo and removed the great chain, Manuel I Comnenus had a chain across the Bosphorus from Rumeli to Anadolu kavağı, while there were chains in Galley Creek, Grand Harbour, Valletta in 1565, and at the entrance from St. Elmo to Fort Ricasoli in 1939-45.

<sup>112</sup> Hohlfelder – Vann 1998, 29, suggests an average 2 m. slip at Aperlae but deeper towards the west and in places a drop of 6.25 m. This coastal subsidence extends as far east as Phaeselis and as far west as Fethiye as Charles Fellows records of the Lycian harbour sarcophagus, then standing in the waters of the harbour at Macri-Fethiye: “*thus making this tomb a register of a great change in the level of the ground, while its massive top, shaken from its original position, indicates an earthquake to have been the cause of such change*”. He notes that the water around this tomb indicated there had been at least a four foot (1.3 m.) drop in the ground level in this harbour

of Seleucia ad Pieria by Antioch-Antakya<sup>113</sup>, likewise also lost in part through subsequent seismic related coastal activity, given that all three of these harbours possessed major Roman *granarium-horreos*, presumably constructed for storage and maritime freight forwarding<sup>114</sup>, including the storage as tax revenue and trans-shipment of grain, a military reserve, and of other goods to Rome in the II<sup>nd</sup> century A.D., if not from somewhat earlier, given that the construction of the lighthouse at Patara was presumably intended to facilitate the significant freight storage and forwarding function of this port, yet it predates by some half a century the construction of the present *in situ* Roman granarium constructed by order of Hadrian (117-38 A.D.), suggesting the probable construction of an earlier, somewhat smaller *granarium-horreos*, probably in the same location, that would have been constructed contemporary with the Neronian lighthouse.

Chipiona's lighthouse, the tallest in Spain, was built in 1867 reportedly upon the site of a former Roman lighthouse that warned sailors of the dangerous waters surrounding the small island of Salmedina<sup>115</sup>; while other pharos stood at Trieste-Tergestum<sup>116</sup>; the Roman pharos at Salakta, (ancient Sullethum) in Tunisia<sup>117</sup>; at Akko by the entrance to the harbour<sup>118</sup> - the Tower of Flies, also called, Manara, *mânar* being the Arabic word meaning marker/light source/beacon tower and the word employed in Arabic sources to describe the Pharos of Alexandria<sup>119</sup>, and other lighthouses, hence also the word minaret-*minare*, the high marker constructed for the congregational mosque for Friday prayers from the latter VIII<sup>th</sup> century A.D. onwards, and this structure at Akko is probably of Roman date, and possibly another on Mt. Carmel on/by the site of the present lighthouse.

Another, but much larger example of the square in section type is that of La Coruna-Farum Brigantum in Galicia constructed by Emperor Trajan 98-117 A.D., a 56 m. high, four sided beacon tower<sup>120</sup>, each side measures 12 m. in length, located 2 km. from the present harbour and 56 m. ASL<sup>121</sup> giving a total height above sea level of 112 m., a height above sea level therefore similar to that of the Pharos of Alexandria, but which has been substantially remodelled-“restored” with an additional storey added in 1788; and there is the Roman pharos at Gijón, Asturias<sup>122</sup>; there is also the pharos at Leptis Magna constructed in the II<sup>nd</sup> century, the Severan square base of which

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area since this harbour tomb was erected, with the sea flowing in over this area. Fellows 1840, 302-303. It seems probable that the 601-2 earthquake was probably responsible for triggering this collapse, see, Guidoboni – Comastri – Traina 1994, 351; Vann – Hohlfelder – Shedrik 1999-2000, 207.

<sup>113</sup> For possible remains of the pharos at the end of the harbour arm, see Giardina 2010, cat. no. 14.

<sup>114</sup> It seems that the capacity of the Patara and Andriake *granarium-horreos* would have served a wider purpose than storing the surplus from the somewhat limited arable land of mountainous Lycia. One can speculate these may have stored imperial reserves raised through taxes, possibly for military purposes, for eastern campaigns. On the matter of relative transport costs, overland and maritime, and also the use of grain as tax revenue for Roman military purposes, see Mitchell 1993, 245-257, although its possible storage in Lycia is unmentioned.

<sup>115</sup> Fernandez-Chicarro, 1976.

<sup>116</sup> Giardina 2010, cat. no. 37; [www.lighthousesrus.org/showSql.php?page](http://www.lighthousesrus.org/showSql.php?page) Accessed 29-11-2011.

<sup>117</sup> The probable model for the minaret of the Great Mosque of Qairawan, Ifriqiyya, today in Tunisia.

<sup>118</sup> The Roman Lighthouse at Akko, Israel, see Rosen – Galili – Zviely 2012, *passim*.

<sup>119</sup> As also employed by Benjamin of Tudela in 1168: “a large tower, a lighthouse, called Manar al Iskandriyyah in Arabic”. Benjamin 2005, 104; Wright 2003, 122.

<sup>120</sup> Hutter 1973; Giardina 2010, cat. no. 73.

<sup>121</sup> Hutter 1973, 7.

<sup>122</sup> Ochoa – Cerdán – Valdés 2005, 129-146.

survives on the western breakwater today;<sup>123</sup> and at Forum Julii (Frejus) there is the Lanterne d'Auguste, the remains of a Roman lighthouse of a similar square in section type, together with another, a cylindrical 24 m. tall Roman pharos of which only the foundation survives<sup>124</sup>; while another is known to have stood marking the harbour at Smyrna-Izmir<sup>125</sup>, others marking the entrance to the Danube, the straits at Otranto (Dyrrhachium-Durres), Albenga on the Ligurian coast, at Gades (Cadiz), Ancona, at Marseilles (the Pharo)<sup>126</sup> and at Apollonia (Cyrenia)<sup>127</sup>.

These Hellenistic and Roman pharos were substantial structures, all of them originally rising to a considerable, some like the Pharos, its replica at Caesarea Palestina and that at Farum Brigantium rising to a very great height above sea level, and which were constructed primarily to serve as navigational markers of major ports and aids to navigators by night and day on the *mare nostrum* and elsewhere, marking coastal dangers for navigation and marking straits.

### Functions

Gaius Plinius Secundus, Pliny the Elder (23-79 A.D.), describes in his Natural History, the Pharos that stood at Alexandria and in this passage he clearly records its three main functions<sup>128</sup>:

*“Another tower built by a king also received praise. This is on the island of Pharos, and commands the harbour of Alexandria; it is said to have cost 800 talents. King Ptolemy, in a spirit of generosity allowed the name of the architect, Sostratus of Cnidus, to be inscribed on the building itself. Its purpose is to provide a beacon for ships sailing by night, to warn them of shallows and to mark the entrance of the harbour. Similar beacons now burn brightly in several places, for example at Ostia and Ravenna. The danger from a continuously burning beacon is that it may be thought to be a star since the appearance of the fire from a distance is very similar”*<sup>129</sup>.

The Pharos at Alexandria is described by Pliny as serving three distinct functions, with these functions combined within this single structure. They are: to provide a beacon-marker for ships sailing at night, to warn mariners of dangerous shallows and to mark the entrance to the harbour<sup>130</sup>. Pliny's passage records there was a group of similar, that is of this multi-functional type, tall pharos constructed by major harbour entrances, some of which he mentions by name: *“Similar beacons (to*

<sup>123</sup> See for example, Parker 2010, 445; Band 1976, 91-2; Redde 1995, 60-65; Giardina 2010, cat. no. 4.

<sup>124</sup> Giardina 2010, cat. no. 67. The Lanterne d'Auguste a later well-preserved square stone beacon tower with a pyramidal top built over the fire platform constructed during the reign of Augustus (27 B.C.-14 A.D.), marking one side of the entrance, the other marker beacon is lost, and the Butte Saint-Antoine ruin of a lighthouse tower built in the reign of Tiberius (A.D. 14-37). Both remains are on the Rue de la Lanterne d'Auguste on the south side of Fréjus, the Butte near the western end of the street and the Lanterne about 800 m. to the east.

<sup>125</sup> Rosen – Galili – Zviely 2012, 171-178; Bedon 1988, 54-66; Giardina 2010, 18, cat. no. 22.

<sup>126</sup> Jourdin 1993, 181; and see the catalogue listings in the lighthouse corpus: Giardina 2010, cat. no. 30, 45, 71.

<sup>127</sup> D. White, 1976.

<sup>128</sup> Its' important signaling function, supplying news of ships, long before their arrival in the harbour, to the city of Alexandria is not mentioned by Pliny; but the mirror in the Pharos was apparently employed to signal news of approaching vessels to the city into the VIII<sup>th</sup> century, Price – Trell 1977, 181.

<sup>129</sup> Plin. *nat.* XXXVI, 83-88.

<sup>130</sup> This was the case for the entrance to the harbour at Alexandria with the very tall Pharos marking the west side of the entrance, while a lower *anti-pharos* tower unmentioned by Pliny formerly marked the eastern side; as was certainly the case at the port of Ostia, at Centumcellae-Civitavecchia and at Patara, *op. cit.* fn. 108-110, and probably also at Andriake and elsewhere, given that these two Lycian ports were also involved in the storage of supplies of grain with substantial structures erected for storage, *Horrea-Granarium*.

the Pharos at Alexandria) *now burn brightly in several places, for example at Ostia and Ravenna*".

The combination of these three specified functions in the Pharos at Alexandria and *similar* pharos, as at Ostia and Ravenna, as elsewhere, may suggest that perhaps not all pharos that were constructed by the Romans or during the Hellenistic period served all of these three different functions that are noted by Pliny. For example, some pharos-beacons may have just marked the entrance to a port, others may have marked shallows, others may have served as hazard, others as coastal, marker beacons, others additionally may have served as communication towers across straits, while the Pharos at Alexandria and the other named similar pharos were noteworthy to Pliny, not just for their great height but, in part at least, it seems to this author, because they simultaneously served all three of these different functions.

### Communications

A second group of pharos-beacon towers, unmentioned as such by Pliny, seems primarily to have served as functional watchtower posts in a chain of communications, as well as in some cases also being coastal and/or port markers, resembling in this function the fire signal beacon system employed for communication along the Roman limes<sup>131</sup>, some towers of which at least carried a fire signal at the end of a long pole extending from the second floor well above the top of the roof of a three-storey watchtower, as is recorded for example in relief carved on Trajan's Column<sup>132</sup>; paralleling in use, if not in form or physical structure, the contemporary beacon signalling system along, and extending on both sides of the Great Wall of China, with some chains of these Chinese beacons extending to both provincial centres and to the Han capitals<sup>133</sup>.

Given the extent and variety of terrain of the territory under Hellenistic, Roman and East Roman rule, with for example the Roman emperor on occasion for lengthy periods on the Island of Capri or on Sicily, distant and separated by stretches of water from the Imperial capital of Rome; or a ruler such as Emperor Hadrian's peregrinations and visitations, or on campaign or being otherwise distant from the capital, there was probably at times the need for a communications system not entirely dependent upon the *mutationes*, the stations for the mounted couriers of the *cursus publicus* established from the reign of Augustus onwards, but a system which linked key centres via a rapid visual signalling system, as between Dubris and Gesoriacum across the Straits of Dover, and which at times may have been of some considerable importance; suggesting chains of tower beacons-pharos on headlands and islands, like the Hellenistic watchtower systems erected to enable rapid communication along parts of the coastline of Lycia<sup>134</sup> and Cilicia, and which originally probably also extended down the entire length of the Syrian-Palestinian coastline to Pelusium (al-Farama) and across the Egyptian delta; as also across important straits where courier traffic could be further restricted by the elements, but across which some form of communications needed to be maintained, if at all possible, even if the elements were somewhat less than propitious.

<sup>131</sup> Schleiermacher 1938, 250, my thanks to A. Aygün for notice of this reference. And as is suggested of the watchtowers, as at Walltown Gap on Hadrian's Wall, watchtowers for signalling along the length of the wall, Parker 2010, 35.

<sup>132</sup> Schleiermacher 1938, fig. 7.

<sup>133</sup> See for example, Sinor 1990, 118-120, for the Ch'in wall constructed from 324-270 B.C., for the Chao wall constructed *ca.* 300 B.C. and that built by King Chao of Yen *ca.* 290 B.C.; Christian 1998, 128: "*Intensified wall building in the third century (B.C.) was also a response to the northern pastoralists*", *idem* 185-6, 199, Pl. 8.1

<sup>134</sup> See for the location of these line-of-sight watch towers: Çevik – Pimouguet-Pedarras 2010, 260, fn. 27, 275.

A Linear B tablet from Pylos records the presence of coastal watchers, “*thus the watchers are guarding the coasts*”<sup>135</sup>, dating from just prior to the palace’s destruction before 1200 B.C., a practice likewise recorded in the *Odyssey*: “*Day by day watchmen sat upon the windy heights, watch ever following watch*”<sup>136</sup>; as also a watchman and a lookout post/watchtower located overlooking the haven employed by Agamemnon in his return, who was close enough to see the ship in the deep harbor and men furling the sail, and with oars in their hands<sup>137</sup>, and to identify the figure of Agamemnon. While signalling through beacon fires is mentioned in the *Iliad*<sup>138</sup>, by Aeschylus<sup>139</sup>, as by Euripides<sup>140</sup> and Thucydides<sup>141</sup>; with the watchtower/beacon tower and the watchers, and implicitly therefore, at least the local signalling function of some Roman pharos, is perhaps suggested by the guards depicted standing on the pharos platforms of coins struck at Beyrutus and at Aegeae;<sup>142</sup> while the Alexandrian Pharos’s important signalling function, supplying news of ships, such as the grain fleet, long before its arrival in the harbour, to the city of Alexandria, is not mentioned by either Strabo or Pliny; but a mirror reflector in the Pharos seems to have been employed to signal news of approaching vessels to the city of Alexandria into the late VII<sup>th</sup> – early

<sup>135</sup> Ventris – Chadwick 1973, no. 56, line 1. The watchers consisting of 780 men, including 10 captains spread around the Peloponnesian coastline; see also Palmer 1961, 132 ff.

<sup>136</sup> Hom. *Od.* XVI. 365-70.

<sup>137</sup> Hom. *Od.* IV. 520-30: “*But when from hence too a safe return was shewed him, [520] and the gods changed the course of the wind that it blew fair, and they reached home, then verily with rejoicing did Agamemnon set foot on his native land, and he clasped his land and kissed it, and many were the hot tears that streamed from his eyes, for welcome to him was the sight of his land. Now from his place of watch a watchman saw him, whom [525] guileful Aegisthus took and set there, promising him as a reward two talents of gold; and he had been keeping guard for a year, lest Agamemnon should pass by him unseen, and be mindful of his furious might. So he went to the palace to bear the tidings to the shepherd of the people, and Aegisthus straightway planned a treacherous device*”.

<sup>138</sup> Hom. (*Il.* XVIII. 210-213): “*and then at set of sun flame forth the beacon-fires one after another*”.

<sup>139</sup> Aiskh. *Ag.* : “*So now I am still watching for the signal-flame, the gleaming fire that is to bring news from Troy and [10] tidings of its capture. For thus commands my queen, woman in passionate heart and man in strength of purpose. And whenever I make here my bed, restless and dank with dew and unvisited by dreams—for instead of sleep fear stands ever by my side, [15] so that I cannot close my eyelids fast in sleep—and whenever I care to sing or hum (and thus apply an antidote of song to ward off drowsiness, then my tears start forth, as I bewail the fortunes of this house of ours, not ordered for the best as in days gone by. [20] But tonight may there come a happy release from my weary task! May the fire with its glad tidings flash through the gloom!*

*The signal fire suddenly flashes out Oh welcome, you blaze in the night, a light as if of day, you harbinger of many a choral dance in Argos in thanksgiving for this glad event!*

*[25] Hallo! Hallo! To Agamemnon’s queen I thus cry aloud the signal to rise from her bed, and as quickly as she can to lift up in her palace halls a shout of joy in welcome of this fire, if the city of Ilium [30] truly is taken, as this beacon unmistakably announces. And I will make an overture with a dance upon my own account; for my lord’s lucky roll I shall count to my own score, now that this beacon has thrown me triple six”.*

<sup>140</sup> Eur. *Hel.* 766-7: “*Menelaos [765] Truly you have asked a great deal all at once. Why should I tell you about our losses in the Aegean, and Nauplios’ beacons on Euboia, and my visits to Crete and the cities of Libya, and the mountain-peaks of Perseus? For I would not satisfy you with the tale, [770] and by telling you these evils I would suffer still, as I did when I experienced them; and so my grief would be doubled*”.

<sup>141</sup> Thuk. III. 80. 2 quoted, *op. cit.* fn. 69.

<sup>142</sup> Price – Trell 1977, 40. As, Liv. XLIV. 28. 7-8: “*were steering towards Phanae, a promontory of Chios, from whence they might cross over to Macedonia, A signal having been given to Antenor, [8] from a post of observation, that these ships were passing along the main, he left Subota, and met them between Cape Erythrae and Chios, where the strait is narrowest [9]*”.



VIII<sup>th</sup> century<sup>143</sup>.

<sup>143</sup> Price - Trell 1977, 181; Clayton 1989, 147. Mirrors of polished copper/bronze, iron, coated in silver, gold and tin, including glass mirrors backed with gold produced in I<sup>st</sup> century A.D. Sidon, were produced and some were used for signalling and there were mirrors that deliberately distorted (Casson 1979, 245. See for example, Plut. *De Faciae* 17: “For it neither appears of itself nor is confessed as true, that all reflections are at equal angles; but this position is first checked and contradicted in concave mirrors, when they represent the images of things, appearing at one point of sight, greater than the things themselves. And it is also disproved by double mirrors, which being inclined or turned one towards the other, so that an angle is made within, each of the glasses or plain superficies yields a double resemblance; so that there are four images from the same face, two answerable to the object without on the left side, and two others obscure and not so evident on the right side in the bottom of the mirror. Of which Plato renders the efficient cause; for he says, that a mirror being raised on the one and the other side, the sight varies the reflection, falling from one side to the other. And therefore, since of the views or visions some immediately have recourse to us, and others, sliding to opposite parts of the mirror, do again return upon us from thence, it is not possible that all reflections should be made at equal angles. Though those who closely impugn our opinion contend that, by these reflections of light from the moon upon the earth, the equality of angles is taken away, thinking this to be much more probable than the other”) which were produced in antiquity and: “The ancient Romans pioneered in making glass mirrors by blowing glass bowls and coating their insides with molten lead, then breaking them apart to form poor-quality convex mirrors” (Pendergrast 2008, 3). However Archimedes using mirrors to set fire to Roman ships during the siege of Syracuse, was a later addition to accounts of the siege and a theoretical rather than practical notion, an idea provoked by a burning glass, as also in Diocles III<sup>rd</sup>-II<sup>nd</sup> century B.C. in his work(s) included within the work entitled ‘On Burning Mirrors’, and it seems this idea of a burning glass/mirror was then transferred to the Pharos. For knowledge of this mirror/lens and its supposed incendiary functions, allegations which were maintained for centuries, see: The traveller Naser-e Khosraw relates in 1047: “There is a lighthouse (the Pharos-mânar al-Iskandriyya) that I saw at Alexandria, on top of which used to be an incendiary mirror. Whenever a ship came from Istanbul and approached opposite the mirror, fire would fall from the mirror and burn the ship up. The Byzantines exerted great effort and employed all manner of subterfuge, until they finally sent someone who broke the mirror. In the days of al-Hakem, the Sultan of Egypt (996-1021), a man appeared (It seems possible that this is a reference to the great scientist Abu ‘Ali al-Hassan ibn al-Haytham (Alhazen), his work on optics and his dealings with this Fatimid Caliph, for ibn al-Haytham’s feigned madness in relation to this Caliph, see Hitti 1991, 628) who was willing to fix the mirror as it once had been, but al-Hakem said it was not necessary, that the situation was well under control, since at that time the Rum sent gold and goods in tribute and were content for the armies of Egypt not to go near them”. Khosraw 1986, 42; while in addition in the XII<sup>th</sup> century Benjamin of Tudela writes fantastically of this device in the Pharos: “On the top of the tower there is a glass mirror. Any ships that attempted to attack or molest the city, coming from Greece or from the Western lands, could be seen by means of this mirror of glass at a distance of twenty days’ journey, and the inhabitants could thereupon put themselves on their guard”. Benjamin 2005, 104. While the Mamluke historian Taqi al-Din Abu al-Abbas Ahmad ibn ‘Ali ibn ‘Abd al-Qadir ibn Muhammad al-Maqrizi (1364 – 1442), describes the pharos at Alexandria which was no longer standing at this date, (S. de Sacy, *Chrestom. Arahe*, ii, 189) as having at the top a large mirror, around which criers were seated. Upon perceiving the approach of an enemy through the agency of this reflector, they gave warning to those in the immediate neighbourhood by loud cries, and flags were displayed to apprise others at a distance, so that people in all parts of the city were immediately on the alert. In chapter 43, Johann Schiltberger relates the mirror on the pharos was deliberately broken to enable the sack of the city by the Lusignan Crusaders in 1365, Schiltberger 1879, 62-4, when in fact the tower was no longer standing in 1365, and the mirror seems to have been lost some five to six centuries earlier. Later still the pilgrim scholar M. H. Farahani in the 19<sup>th</sup> century related the mirror had been removed by (during the reign of) the Marwanid Caliph ‘Abd al-Malik (685-705), Farahani 1990, 158. That fire pots of incendiary material could have been launched at passing enemy ships from brass mirror-like ballistae mounted on the tower does not strain ones’ cord of credulity, late VII<sup>th</sup> century A.D. catapults-ballistae on the high walls

An example of this communications type of pharos remains today by the Villa Jovis on Mount Tiberius, Capreae-Capri, initially constructed by Tiberius 14-37 A.D., square in section and which is standing today to a height of 16 m. It collapsed in an earthquake in 37 A.D.<sup>144</sup> and was later restored by Emperor Domitian between 91 and 96 A.D., and it continued to function as a lighthouse into the 17<sup>th</sup> century. It would have communicated with the aid of the signallers, *specularii*, to Sorrento and with Pozzuoli, and Mysenum-Miseno, via Roman pharos constructed on Campanella Point and Cape Miseno which were standing by 38 B.C.<sup>145</sup>, and including that constructed at the end of the harbour jetty of Puteoli-Cumae (Pozzuoli)<sup>146</sup> in the late 1<sup>st</sup> century B.C.

Another Roman pharos, partly preserved today, at Dover, England, inside the castle, consisted of an 8 storey rubble-stone near conical tower<sup>147</sup> faced with stone, the Roman remains stand 19 m. high, on top of a 91 m. high cliff, giving a height above sea level of approximately 110 m. thus with a visibility for this pharos somewhat similar to that of the Pharos of Alexandria<sup>148</sup>. It had wooden floors and probably had a wooden staircase, with a fire platform on its summit. The contemporary adjacent lighthouse that marked the further side of Portus Dubris is largely lost, only the Bredenstone remains, both were constructed by Emperor Claudius in 46 A.D.<sup>149</sup>. Another was possibly constructed by Lugdunum by Katwijk by the Rhine in the Netherlands by Caligula in A.D. 40, with the lime mortar employed in its construction made from the sea shells collected from the beach by legionaries<sup>150</sup>, while another was certainly constructed by Boulogne – Gesoriacum,<sup>151</sup> called the Tour d'Ordre - a name believed to be a corruption of the Latin expression "*turris ardens*" ("fire tower") – also constructed in 40 A.D. on the order of the Emperor Caligula, probably to be associated primarily with the marking of, and for signalling across these Straits following the Roman invasion and conquest of much of Britain, with these two ports, Dubris and Gesoriacum, being the twin bases of the Classis Britannica fleet, and this pharos was restored during the reign of Charlemagne, ca. 810 and was latterly a near conical 40 m. high 12 stage tower, and the light of the beacon fire on the top of this tower reportedly could be seen across the channel in Dover but it

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of East Roman Alexandria in 641 were recorded by the contemporary John of Nikiu, Hitti 1991, 164, but a laser on the Pharos of the Archimedes 'Syracuse' type seem rather more improbable.

<sup>144</sup> Suet. *Tib.* 74. 2; see also, Giardina 2010, cat. no. 53.

<sup>145</sup> From the coin series minted in Messina carrying the image of a tower; Giardina 2010, cat. no. 47 and 55.

<sup>146</sup> Finnegan 1981, 210.

<sup>147</sup> Booth 2007, 18, for its conical shape.

<sup>148</sup> For the fabulous eyesight of Strabo, presumably from the top of the beacon tower on the Promontory of Lilybeum/Lilybaion, Sicily, who reportedly could count from 123 miles away the ships coming from the harbour at Carthage, see Plin. *nat.* VII. 21.

<sup>149</sup> www.dovermuseum.co.uk Giardina 2010, cat. no. 76. The St. Catherine's lighthouse and Oratory was constructed by St. Catherine's Point on the Isle of Wight in 1328, and is not therefore a Roman pharos, although the passage to Portus Adumi and the Isle of Wight would surely have been marked by Roman pharos-beacons.

<sup>150</sup> In preparation for his aborted invasion of Britain, Parker 2010, 72. The importance of the high quality lime that the Romans extracted from sea shells and of Caligula's troops collection of this building material is not noted; rather it is suggested instead that the legionaries were sent to collect sea shells to prevent a mutiny. It is unclear if it was rather the pharos at Gesoriacum that Caligula began constructing to which this un-referenced passage refers.

<sup>151</sup> Suet. *Cal.* 46.

disappeared in 1644 when the cliff upon which it stood collapsed<sup>152</sup>. These beacon towers on either side of the Channel thereby serving a similar function to that constructed on Cape Pelorus marking the straits by Messina in Sicily by 35 A.D.<sup>153</sup>, doubtless replacing an earlier pharos on Cape Pelorus, and the contemporary tower of Regium, marking the other side of the Messina Straits, as recorded by Strabo<sup>154</sup> and probably likewise employed in signalling across these straits; as also pharos employed to signal across the Hellespont from the port of Abydos to Sestos, the tower at Abydos is known from its coins, as is that of Sestos, with, as Ovid records, “*unsleeping (watchful) lights on the tower’s top*”<sup>155</sup>; and presumably another pair marking the straits at the entrance to the Golden Horn and to Black Sea<sup>156</sup>, like the famous pair of pharos marking the “*Pillars of Hercules*”, probably constructed on Monte Hacho and on the Rock of Gibraltar<sup>157</sup>, that marked the passage from the Mediterranean to the Atlantic and perhaps likewise passed signals across these straits. One pharos of this pair, probably that on the North African coast, seems to have remained largely intact into the X<sup>th</sup> century as al-Mas’udi records it in his, *Meadows of gold and mines of precious gems – muruj al-Dhahab wa Ma’adin al-Jawhar*, of 947, “*At the point where the Mediterranean Sea joins the Atlantic Ocean there is a lighthouse of stone and copper (bronze), built by the giant Hercules (probably to be associated with the location of the Phoenician Temple of Melkart-Herakles on the North African side). It is covered with inscriptions and statues whose hand gestures proclaim to those coming from the Mediterranean who wish to enter the Atlantic Ocean, ‘There is no way beyond me’*”<sup>158</sup>, this being the X<sup>th</sup> century Muslim understanding of the conventional Roman right hand raised in salutation of these statues.

Zakarayyia al-Qazvini (1208-83) reports in his *Athar al-bilad wa akhbar al-ibad*, that, “*in the lighthouse (mânar) of Constantinople there is a horologium which is made up of 12 doors, each representing an hour. At every hour, one of the doors opens and a statue comes out... The Byzantines say it is the work of the wise Binas*”<sup>159</sup> and this pharos tower was located on the sea walls of the palace<sup>160</sup> and seems to have kept its automata even after the sack of 1204, if al-Qazvini was not reporting on what once was but now was no more, with this pharos most probably originally of Roman construction<sup>161</sup>, and it had served in the IX<sup>th</sup> century as the end of the line of fire beacons

<sup>152</sup> Seillier 2004, 1-211; Giardina 2010, cat. no. 75.

<sup>153</sup> Strab. III. 5. 5: “*the small column which the inhabitants of Rhegium erected by the Strait of Sicily, which is indeed a little tower; and the tower called after Pelorus, which is situated opposite to this small column*”.

<sup>154</sup> Strab. III. 5. 5.

<sup>155</sup> Ovid. *her.* XIX. 35-6, also XVIII 31-2, XVIII 85-6; Giardina 2010, cat. no. 23.

<sup>156</sup> Doubtless there was one at Hieron-Fanum-Kavak Point, Moreno 2008, 655-709, fn. 14: “*this may have been the site of a pharos, as mentioned by Philostratos and illustrated on the Tabula Peutingerian*” with another situated on the facing headland.

<sup>157</sup> Parker 2010, 501, or possibly on Jebel Musa. Giardina 2010, 18, cat. no. 71 for descriptions of those by the port of Gades/Cadiz.

<sup>158</sup> Mas’udi 2007, 6, and he elsewhere refers to this as the bronze lighthouse by the Straits (of Gibraltar), 14.

<sup>159</sup> El-Cheikh 2001, 65. The “*Binas*” referred to is most unlikely to have been Apollonius of Tyana a wandering holy man of the I<sup>st</sup> century A.D., not a known engineer. It is perhaps a garbled reference to Philon of Byzantium’s work on water clocks.

<sup>160</sup> Not to be confused with the VI<sup>th</sup> century Zeuxippos lighthouse largely constructed by Justinian but incomplete on his death in 578 and demolished by his successor Tiberius, Giardina 2010, 19.

<sup>161</sup> It is marked on the Peutinger Map. It is unknown if the pre 864 Church of the Virgin of the Pharos was close to this pharos or to another pharos in Constantinople; Mango 1991, 1446; likewise one can think of another

spaced between 60 and 35 miles apart that extended over 450 miles from the Cilician Gates to Constantinople, which were constructed to give early warning of Abbasid raids into Anatolia passing through the Cilician Gates<sup>162</sup>; with this warning beacon system revived under Manuel I (1143-80); while Emperor Leo VI (886-912) constructed a rectangular beacon tower on the summit at Acrocorinth<sup>163</sup> to signal of the approach of any hostile Muslim naval forces, as later in the XIII<sup>th</sup> century the Mamlukes established a chain of signal beacons extending from the Euphrates, via Palmyra, Damascus, Baysan and Nablus to Gaza to warn of Pagan Mongol incursions, as also from Cairo to Alexandria, Damietta and south from Cairo to Upper Egypt, thereby continuing the practice of maintaining watch over a landscape-seascape through a series of interconnected elevated observation-signalling beacon points from where signals could be exchanged by means of fire, possible mirror reflectors, and smoke, which doubtless in origin as a communication system predates the mention of long distance signalling by means of mountaintop beacons in the *Iliad*<sup>164</sup>, and which is later described by Aeschylus (*ca.* 525-456/5) in the *Agamemnon*<sup>165</sup> staged in 458 B.C. A part of the Hellenistic coastal watchtower system, Lebanese Christian tradition relates was reemployed in the IV<sup>th</sup> century A.D. when, it is said, Helena the mother of Emperor Constantine caused to be flashed from Jerusalem to Constantinople, by means of prepared signal fires on coastal watchtowers, the news of the discovery of the True Cross. However, given the length of time some important Roman official messages took to arrive, 11 days from Ulm to Sirmium (Serbia), 3 months for Rome to Syria in 40 A.D., 2 to 10 weeks from Milan to Rome in the IV<sup>th</sup> century A.D.<sup>166</sup> it seems evident that there was at no time a functioning Roman Empire wide integrated interconnected pharos-beacon tower signalling system. Rather specific signalling systems were constructed to communicate messages from Rome to the Emperor's villa on Capri and also to Sicily, and across the Straits of Dover, etc.; to pass messages across straits; and certainly along parts, and perhaps along entire sections of the Roman *limes*, supplementing and aiding the reach and speed of the *cursus publicus*, and, as times required, there was probably the Roman and East Roman re-use of the Hellenistic Eastern Mediterranean coastal line of sight watchtower systems. This system seems to

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pharos located in the area called Phaner=pharos, presumably named after a lighthouse. Giardina 2010, cat. no. 24. There is also the record provided by Ammianus Marcellinus, (XXII. 8. 7): [7] “*After reaching the extreme end of this part, it again contracts into a narrow strait, and flowing between Europe and Bithynia, passes by Chalcedon, Chrysopolis, and some obscure stations. Its left bank, however, is looked down upon by the port of Athyras and Selymbria, and Constantinople, the ancient Byzantium, a colony of the Athenians, and the promontory Ceras, which bears a tower built high and giving light to ships (a pharos); therefore a very cold wind which often blows from that quarter is called Ceratas*”.

<sup>162</sup> Browning 1980, 73. For Leo the mathematician and engineer, see Khazdan 1991, 1217, and for the excavated remains of one of these 8 signalling beacons by Kütahya, in a line of sight chain that stretched from Loulon via Argos to Constantinople, see C. Foss, *idem* “*beacons*” 273-4; C. Foss, *Survey of Medieval Castles in Anatolia I: Kütahya*, Oxford 1985, 86-94. It is evident that Leo was noted for the particular signalling code he introduced, rather than for the employment of the beacons themselves.

<sup>163</sup> Rife 2008, 281-306.

<sup>164</sup> Homer's (*Il.* XVIII 210-13): “*But as the sun goes down signal fires blaze out one after another, so the flare goes pulsing high for men of the neighbouring islands to see it, in case they might come over in ships to beat off the enemy*”.

<sup>165</sup> Aiskh. *Ag.* 1-34; 278-316. With a map depicting the suggested line of sight beacon sites down the west coast of Greece from Mt. Athos to Argos, see Quincey 1963, 121.

<sup>166</sup> These examples from Parker 2010, 10.

have been the precursor of the Islamic *ribat* - *mânar* watchtower-signalling system of stations, constructed along the Syria-Filistin/Palestine coastline,<sup>167</sup> and along the extent of the North African coastline; as later along the northern coastline of Sicily, these latter being connected to the capital at Palermo; and those constructed along the coastline in Andalusia, and those constructed in the contested borderlands of Central Asia; as also, later in areas of Afghanistan, as under the Ghurids (1000-1215)<sup>168</sup>, with these *mânar* marker/beacon/signalling/watchtowers constructed from the VIII<sup>th</sup> century onwards in both coastal and in inland locations in Islamic territory<sup>169</sup>.

It seems reasonable, given the importance of maritime and riverine traffic to Rome and the Roman economy, more important as being far cheaper and quicker than long distance haulage of bulk merchandise by road<sup>170</sup>, and noting the vast investment that was made in the Roman military and civil road network, to suggest that a dissimilar and probably much larger group of pharos-beacons, although smaller in physical size, would have been erected to mark shallows and doubtless other maritime hazards, and would have been constructed to mark the entrance to the smaller, less important ports, and which would also have been erected to serve as coastal markers, rather than being always markers of ports as, all three of the pharos named by Pliny, and as most of the other recorded and suggested above pharos-beacon towers were, with the exception of those marking straits, islands and river-canal-estuary entrances<sup>171</sup>, and, that the beacon-pharos of this dissimilar type were also not necessarily of the quite remarkable size or luminosity of those pharos that Pliny finds worthy of mention, while however, the practice of navigation at night by means of marker lights is reasonably explicit in Pliny's text<sup>172</sup>, but, rather, smaller beacon towers, constructed to serve one or another of these main functions, in a less spectacular, less ostentatious, but nonetheless in a practical manner for Roman maritime navigation and in some cases, doubtless also employed for relaying communications visually. It is suggested for example by Hohlfelder and Vann that a small

<sup>167</sup> The Filistin watchtowers were linked to the capital Ar Ramlah, by means of smoke in daylight and beacon fires at night, see for example, Strange 1890, 23-4: "Now the Watch-stations (with beacons) of this province of Filastin, where this ransoming of captives takes place, are these: Ghazzah, Mimas, 'Askalan, Mahuz- (the port of) Azdud, Mahuz- (the port of) Yubna, Yafah, and Arsuf"; see also: Khalilieh 1999, 212-225, and, H. S. Khalilieh 2008, 159-177; as also, El<sup>2</sup> "Ribat".

<sup>168</sup> Ball 2002, 21-45.

<sup>169</sup> An article is in preparation for publication in 2015 overviewing this system and its importance for communications, its ramifications in respect to coastal watchtowers, and signalling from *mânar*, minaret, *ribat* and fortification tower constructed in Islamic territory.

<sup>170</sup> For the medieval period the cost of road transport was likewise great, for example the cost of transporting hewn building stone from the quarry to the site, a distance of 12 miles was the equivalent of the cost of the quarried stone itself, Gimpel 1977, 61. For the Roman period see Mitchell 1993, 245-246 where cost ratio of 20:1 rather than 40:1 is suggested.

<sup>171</sup> Such as that for Perge. For those on canals, Baro Zavalea, Torre Caligo and Roque d'Odor, see Giardina 2010, 48-9 and Rimini, cat. no. 44; for that by Ctesiphon, recorded in the IV<sup>th</sup> century A.D. by Ammianus Marcellinus, XXIV. 2. 7: "Here a part of the river is drawn off by large canals which take the water into the interior parts of Babylonia, for the use of the fields and the neighbouring cities; another part, Naarmalcha by name, which being interpreted means "the kings' river," flows past Ctesiphon. Where it begins, a tower of considerable height rises, like the Pharos", as also the Tower of Neoptolemus, Strab. VII. 3. 16: "At the mouth of the Dniester there is a tower called the Tower of Neoptolemus, and a village called Hermônax". which marked the river mouth and doubtless also carried illumination at night.

<sup>172</sup> Plin. nat. V. 34: "Pharos, quondam diei navigatione distans ab Aegypto, nunc e turri nocturnis ignibus cursum navium regens".

beacon tower marked the end of the finger jetty at Aperlae<sup>173</sup>, perhaps like that at the Roman port colony of Cossa, Italy, constructed in the first half of the 1<sup>st</sup> century B.C. at the end of the breakwater<sup>174</sup>; as also the probably Roman, although possibly Hellenistic in foundation, two marker beacon towers - pharos and anti-pharos-like, formerly at either end of the harbour arms at Antalya<sup>175</sup>, as formerly also at Phoenix-Finike<sup>176</sup>, marking the entrance to these harbours, probably two more at the harbour entrance of Elaiussa Sebaste, and, like those at Aperlae and Cossa, belonging to this relatively smaller type of marker-beacon-pharos, not the major construction work associated by Vitruvius with the construction of the large pharos/anti-pharos towers at the ends of a major harbour's arms<sup>177</sup>, nor rising to the remarkable height of the Pharos of Alexandria.

## Practical considerations

### Size of Structure

It may be that in consequence of the expectations raised in the mind by Pliny and by others who recorded the great height and the massive construction of the Pharos at Alexandria, a wonder of the world, and which is also the case for other exceptional port pharos of this same port marker type that survive today, such as those at Farum Brigantium by La Coruna and at Caesarea Palestina, that possibly some of the smaller, probably originally far more common type of maritime navigational beacon towers that were erected over the course of the past four millennia, including those erected by Romans and East Romans, may have passed by un-noticed, have been described as something else, as seems to be the case with the pair of marker beacons described below, or may have otherwise been overlooked in the literature but which still remain *in situ* today; while it seems certain that the remains of others of these smaller beacon towers, as also pharos of a more noteworthy size, have been destroyed and others incorporated into the foundations or into the fabric of later lighthouses, which have been logically erected in precisely the same position as the former structure, as serving much the same navigational purpose, as for example with the Chipiona and with the Fenerbahçe<sup>178</sup>

<sup>173</sup> Hohlfelder – Vann 1998, 36.

<sup>174</sup> Fentress *et al.* 1987; Giardina 2010, cat. no. 64.

<sup>175</sup> The remains of these probably Roman, if not originally of Hellenistic date, towers marking the entrance to the harbour were photographed by Niemann and published as engravings in Lanckoroński 1890, pls. II, III, IV, and were photographed by Krickl 2005, Album III, 11, 13, 17, from two of these towers the harbour chain was suspended. In 1472 the harbour chain was taken by the Latin Cruaders in the sack of the port area and it is today in the Vatican. Benjamin of Tudela in 1168 records that: “*From Sidon it is half a day's journey to Sarepta (Sarfend), which belongs to Sidon. Thence it is a half-day to New Tyre (Sūr), which is a very fine city, with a harbour in its midst. At night-time those that levy dues throw iron chains from tower to tower, so that no man can go forth by boat or in any other way to rob the ships by night. There is no harbour like this in the whole world. Tyre is a beautiful city*”. Benjamin 2005, 31.

<sup>176</sup> Evliya Çelebi records the probably Roman in origin tower on the harbour arm at Finike and another on the shore, Çelebi 2010, 259

<sup>177</sup> Vitruvius remarks on the possibility of a tower being constructed on a wide new harbour arm, Vitruvius *de Arch.* V.12. 6, for these towers on either side of the harbour entrance, from which the chain closed off the entrance, Vitruvius *de Arch.* V. 12. 1. This practice was implemented where practical at harbours for centuries prior to these remarks being made by Vitruvius.

<sup>178</sup> Fernandez-Chicarro, 1976, Cádiz, Spain; Giardina 2010, cat. no. 72. In this respect, the Lighthouse in the Garden, that is the Pharos-Fener of Fenerbahçe, Istanbul, has remained on the same spot probably from when the first lighthouse was erected here, of early East Roman, if not of Roman date. The lighthouse at Fenerbahçe

lighthouses of today.

Further, it is perhaps worth noting as a factor of some real importance that it was the physical height above sea level of the beacon light itself and not the physical height of the support for the light, the physical height of the actual structure of the beacon tower or pharos, that in fact mattered for nocturnal navigation, marking and signalling, and therefore on coastlines lined with steep hills, a low beacon tower perhaps 8 to 10 m. high that was constructed 40 or 50 m. above sea level served this same function, at far less expense and was far less easily damaged by seismic events and storms, than a marker beacon tower which was constructed at sea level that stood to a height of 50 or 60 m. or more. The fact that this smaller, although in antiquity probably far more common type of beacon tower-pharos, were not the subject of extensive literary note in antiquity is not surprising and does not of course indicate this type of structure was not common, and in some cases probably a very long established feature of such coastlines by Roman times. The construction of the far more expensive and in daylight impressive type of pharos, was also influenced by matters of prestige and of publicising civic, the ruler's or Imperial pride, unlike the smaller beacon tower, as well as being influenced by the coastal topography of the particular location, as with the Pharos itself, or at Leptis Magna, both of these port markers being situated within topographically low lying coastal regions where the structure itself, rather than geological features including prominent coastal peaks, served in daylight as a marker for navigation, in part through triangulation.

### Luminosity and Fuel employed

Concerning the degree of visibility at night of the light from a marker beacon or pharos, it should be understood that the night today in most coastal areas does not possess the same absence of light at night as there was in antiquity, the Middle Ages and into the 20<sup>th</sup> century, a change caused by the development and through the widespread use of electric lighting on roads, homes, hotels and by vehicles today with this light reflected from clouds and refracted through the atmosphere<sup>179</sup>. Consequently the residue of ambient light in the atmosphere at night in coastal areas requires today a much brighter marker-signalling light source for it to be noticed today, than was the case in the past. Captain F. Beaufort in the second decade of the 19<sup>th</sup> century records that the light from the small fires from the burning gas at Yanar Taş/Chimera were visible at night from off the coast on board the ship *Fredrickssteen*<sup>180</sup>, but they seem to be unnoticeable at night today from out to sea, due probably to this change in the quantity of residual light in coastal areas at night.

Obviously the height above sea level (ASL) of the light source itself is important, as on the Lectum Promontorium, on the cliffs at Dover and Boulogne-sur-mer, or from the great height of the Pharos itself; but also of great importance is the type of fuel that was employed, which determined the intensity of the light source(s) and therefore the distance from which the light source was visible from out to sea, together with the employment of any light intensifying equipment, including reflecting and possibly light intensifying surfaces such as the mirror/s-*specchi*

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was mentioned in the late 15<sup>th</sup> century by Gioran-Maria Angiolelle, Yarasimos 1991, 115, before it was replaced by another lighthouse constructed by Sultan-Caliph Süleyman Kanuni, the firman for its construction survives dated, recep 969 = March 1562 and construction was complete by 1570 and it in turn was replaced in 1720-1 and yet again in 1837-8 in precisely this same place; Tekeli 1994, 285-6.

<sup>179</sup> See for example: [www.blue-marble.de/freegeographytools.com/2009/the-blue-marble-navigator](http://www.blue-marble.de/freegeographytools.com/2009/the-blue-marble-navigator), Blue Marble Navigator Night Lights 2012.

<sup>180</sup> Beaufort 1817, 47-49.

*ustori*/lenses reportedly installed in the Pharos,<sup>181</sup> which would have require repeated cleaning and polishing, dependent upon the nature of the fuel that was employed. I have been unable to find any recent scientific research concerning this matter of the luminosity generated by the fuel/s employed, before the 19<sup>th</sup> century, with for example the use of vegetable oils, such as those forced through an 18 mm. nozzle aperture under pressure, burning 42 grams of colza oil/hr. to produce a flame 40 m. high<sup>182</sup>, and the fact that kerosene burns with a brighter flame than vegetable oils, facts, which I think nonetheless, are of perhaps little help in understanding the fuels and the methods of generating the light that issued from these structures in antiquity, but this matter of the luminosity and of the fuel employed would have been an important factor in determining the distance from which the light source was visible at night from any beacon light, beacon tower or pharos to a mariner, or to the watchmen on the other side of a strait.

A resinous wood such as pine seems to have been the light source when burnt, employed for the beacons on the large platforms employed for signalling across breadth of Anatolia in the IX<sup>th</sup> century A.D.<sup>183</sup>, as perhaps resinous wood fueled those beacon fires mentioned in the Agamemnon<sup>184</sup>, while pine resin from pine trees was often employed for the regular re-caulking of wooden ships by the *calaphatii*, and both pitch pine resin and turpentine were long traded commodities<sup>185</sup>, and these commodities may have also been employed as fuel for beacon and for pharos light. Burning wood has been mentioned as the light source for the Pharos<sup>186</sup>, and, in addition to wood, vegetable oil has also been suggested<sup>187</sup>, together with, pitch and oil<sup>188</sup>, although bundles of reeds wrapped in hemp or linen and coated/soaked in an inflammable long burning substance, such as bitumen<sup>189</sup>, or in a vegetable oil, probably olive oil, forming torches, or torches of pitch/tar/olive oil on hemp or linen, given the scarcity of wood in Egypt, seems to this author to

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<sup>181</sup> It is said mirrors were used to intensify the sun's rays as the light source by day and possibly also the flame's light at night, Marlowe 1971, 62; Giardina 2010, 35, 48, 58, but, idem 23, for doubts about the use of mirrors/*specchi ustori* in the Pharos. However it seems from the Islamic sources that there probably was a mirror/s destroyed on the Pharos in the late VII<sup>th</sup>-VIII<sup>th</sup> century possibly employed for signalling rather than only relating to the intensification and projection of the flames' light into a beam, although this is unclear; while the burning glass/laser option, *op. cit.* fn. 143, given the state of glass manufacturing and grinding on the scale required for a glass lens on the Pharos or elsewhere to serve as a burning glass seems most improbable until relatively modern times, Robert Grosseteste (*ca.* 1175-1253) discusses magnification and burning glasses and eyeglasses appear in Italy in the XIII<sup>th</sup> century); and it seems more probable that incendiary missiles arcing down from the Pharos from some shining metal ballistae were reported as being burning beams of light, giving rise to this later myth.

<sup>182</sup> Giardina 2010, 59, fn. 324.

<sup>183</sup> For the excavated remains of one of the 8 of these signalling beacons, that by Kütahya, that stretched from Loulon to Constantinople, see Foss 1991, 273-4.

<sup>184</sup> *Op. cit.* fn. 139.

<sup>185</sup> For its antiquity see for example, Benozzo 2010, 29-42. Francesco di Pegolotti records the international trade in 'pitch for ships' between 1310 and 1340, Lopez – Raymond 1990, 112, and trade in both 'pine resin' and 'turpentine', idem 113.

<sup>186</sup> Giardina (2010, 23) indicates, 'wood, bitumen, oil or animal or vegetable fibers,' idem, 35.

<sup>187</sup> Giardina 2010, 59, in the displaced fn. 327.

<sup>188</sup> Giardina 2010, 63.

<sup>189</sup> Plin. *nat.* I. 105, refers to bitumen; and Arrian (*anab.* II. 19), records that against Alexander's siege of Tyre in 332 B.C. the Phoenicians employed fire-ships with cauldrons of bitumen mixed with sulphur and other combustibles.



have been a more probable provider of the light sources for the Alexandrian Pharos, "*faces*", rather than the "*lampades - Lūcerna*" oil lamps, or the somewhat more improbable burning wood.

In this respect it is perhaps of some considerable importance that Pliny writes repeatedly concerning the light source in the Pharos that: "*it directs ships by means of fires which are lighted at night on the tower there*"<sup>190</sup>, and, "*The only danger is, that when the fires are kept burning without intermission*"<sup>191</sup>, with Pliny's use of the words, *ignium, ignes, ignibus, flammorum* – meaning fires in the plural, and, with the repeated use by Pliny of these plural forms indicating, it seems evident, the employment of multiple light sources in the Pharos, not that there was only one single light source, and therefore perhaps in antiquity, the light sources employed in the upper section of the Hellenistic Pharos, had some resemblance to the several torches recorded in Bishop Arculf's account of the Pharos in 700 A.D., nearly a millennium after its commission and when it was newly in Muslim hands. Arculf states that torches, rather than wood, were used to light the Pharos which he describes as: "*a large tower, which is every night lighted up with torches, lest mariners might mistake their way in the dark*"<sup>192</sup>. While more than 450 years later Benjamin of Tudela also records in 1168 a torch as being lit in it at night: "*To this day the lighthouse is a landmark to all seafarers who come to Alexandria; for one can see it at a distance of 100 miles by day, and at night the keeper lights a torch which the mariners can see from a distance, and thus sail towards it*"<sup>193</sup>.

It is recorded that some streets were lit at night in antiquity, at Antioch (Antakya)<sup>194</sup>, Ephesus<sup>195</sup>

<sup>190</sup> Plin. (nat. V. 34): "*Pharos, quondam diei navigatione distans ab Aegypto, nunc e turri nocturnis ignibus cursum navium regens*", "Navigation was regulated by means of fires on the tower". But also translated as: "*now it guides the course of ships at night from its lighthouse tower*", suggesting the single light source of a modern lighthouse.

<sup>191</sup> Plin. nat. XXXVI. 25.

<sup>192</sup> Wright 2003, 10.

<sup>193</sup> Benjamin 2005, 105.

<sup>194</sup> The Sophist philosopher Libanius 314–393 A.D. wrote about his hometown, that with the lights of his city "*We citizens of Antioch have shaken off the tyranny of sleep, here the lamp of the sun is succeeded by other lamps, surpassing the illumination of the Egyptians. With us night differs from day only in the kind of lighting*". The brilliant lighting of the city of Antioch is mentioned also by Hieronymus (Amm. Marc. XIV. 1. 9 fn. 1) and, Amm. Marc. XIV. 1. 9: "*Finally, following an unprecedented and destructive course, Gallus also ventured to commit the atrocious crime which, to his utter disgrace, Gallienus is said to have once hazarded at Rome. Taking with him a few attendants with concealed weapons, he used to roam at evening about the inns and street-corners, inquiring of every one in Greek, of which he had remarkable command, what he thought of the Caesar. And this he did boldly in a city (Antioch) where the brightness of the lights at night commonly equals the resplendence of day*". There may have been some continuation of this Antiochene practice of illuminations recorded in 943 by Al-Masudi in his Meadows of Gold: "*The month of the latter Kanun (January) has thirty-one days. On the first of the month is the day of the Kalandas (Kalends) which is a feast-day among the Syrians. At Antakiyyah on the eve they make illuminations and exhibit the Eucharist (Idsima). This takes place generally in the Church of Al Kusiyan, which is one of the most venerated churches of that city. The Christians of Antakiyyah, both of great and of low degree, take part in these rejoicings and diversions, and in the lighting of illuminations; for in this city of Antakiyyah is their Patriarch, and the day is held in much honour among them. The Christians call Antioch the City of God, also the City of the King, and the Mother of Cities, for Christianity was first shown forth here*". In Strange 1890, 368, citing Masudi, ii. 406.

<sup>195</sup> Arcadius Street/the Arcadian Way/Harbour Street, was ablaze with 50 lights installed when Emperor Arcadius (395-408 AD.) refurbished the street.

and Rome<sup>196</sup>, lit through some means of suspended olive oil fuelled lamps, olive oil in glass lamps (?)<sup>197</sup>, olive oil lamps in candelabra on poles, torches soaked in pine resin, tar or bitumen, or some compound of these, or perhaps some other hydrocarbon based product, with these torches held in brackets, although the type of fuel and the light fixtures employed seems to be unrecorded in the sources. Likewise, “Kyros, Prefect of Constantinople installed lighting devices on major thoroughfares of the capital after 437 and Theodosius II imposed a tax on the houses and shops in the area of the Baths of Zeuxippos to maintain the luminaria”<sup>198</sup>, although likewise the fuel employed for these luminaria is not specified, while olive oil in glass lamps in polykandela were employed in churches before the VIII<sup>th</sup> century and more candles in churches from the IX<sup>th</sup> century onwards.<sup>199</sup>

Later, street lighting, likewise presumably with olive oil, which was held in glass lamps that burned all night is recorded of the streets lit in X<sup>th</sup> century Muslim Andalusia,<sup>200</sup> as also for instance by Naser-e Khosraw in the lanes and bazaars in Fatimid Old Cairo in 1047,<sup>201</sup> as also in the open air in the area surrounding the Ka’ba in Mecca, as noted below, and in Khulam in the 12<sup>th</sup> century,<sup>202</sup> probably in this case with torches rather than with olive oil in glass lamps; in Mamluke Damascus at night the streets were lit with glass lamps in 1384, recorded by Frescobaldi, Gucci and Sigoli,<sup>203</sup> while there were illuminated glass globes strung from a rope to illuminate at night the At Meydan, Istanbul in 1582, forming the pattern of the Prophet Süleyman/Solomon’s Seal, and also forming the shape of an Ottoman galleon-göke<sup>204</sup>.

However, mineral oil was not unknown in antiquity and Vitruvius remarks: “Others (waters) flow through such greasy veins of soil that they are overspread with oil when they burst out as springs: for example, at Soli (Viranşehir, Mersin), a town in Cilicia, the river named Liparis (from liparos meaning fat-oil, today called the Mezetli Su, Mersin), in which swimmers or bathers get anointed (with oil) merely by the water. Likewise there is a lake in Ethiopia which anoints people who swim in it, and one in India which emits a great quantity of oil when the sky is clear. At Carthage is a spring that has oil swimming on its surface and smelling like sawdust from citrus wood, with which oil sheep are anointed. In Zacynthus and about Dyrrachium and Apollonia are springs which discharge a great quantity of pitch with their water. In Babylon, a lake of very great extent, called Lake Asphaltitis, has liquid asphalt swimming on its surface, with which asphalt and with burnt brick Semiramis built the wall surrounding Babylon. At Jaffa in Syria and among the Nomads in Arabia, are lakes of enormous

<sup>196</sup> As seems possibly to be indicated in reference to Gallienus in Rome, Amm. Marc. XIV. 1. 9 as noted above fn. 194.

<sup>197</sup> For examples of Roman and early Christian glass lamps, see Antonaras 2008, 23-30. The first recorded use of glass lamps serving as marker lights in a lighthouse marker dates from the XI<sup>th</sup> century although they were doubtless employed before this date.

<sup>198</sup> Kazhdan - Bouras 1991, 1227 ff.

<sup>199</sup> Bouras 1991, 1227.

<sup>200</sup> Scott 1904, III, 483, records streets “lighted at night with tens of thousands of twinkling lamps”.

<sup>201</sup> Naser-e Khosraw, 1986, 52, while 100 lamps were kept burning every night in Al-Azhar, idem 53.

<sup>202</sup> “Then they go forth and kindle lights in all the market places and all the streets, and then do their work and business at night-time. For they have to turn night into day in consequence of the great heat of the sun”. In, Benjamin, 2005, 90-91.

<sup>203</sup> Frescobaldi, 1948, 183.

<sup>204</sup> Atasoy 1997, 106, 114.

size that yield very large masses of asphalt, which are carried off by the inhabitants thereabouts”<sup>205</sup>. Further, there were the oil springs at the port of Pozzuoli, by Naples, the oil from which, when it was recorded by Benjamin of Tudela in the XII<sup>th</sup> century, was being employed medicinally<sup>206</sup>. Although if mineral rather than vegetable oils, such as crude oil/tar was employed as a light source for navigational beacons on coastlines near to these petroleum deposits in antiquity seems unrecorded, it remains a possibility.

There was considerable work conducted on combustion in Late Antiquity including the late VII<sup>th</sup> century development of the napalm-like ‘Greek fire’<sup>207</sup>, for maritime use, said to have been brought by Kallinikos of Syrian Heliopolis in newly conquered Islamic territory to Constantinople, or which was manufactured there, employed as “sea fire” during the siege of 674-80 in 680, destroying most of the Muslim fleet off Cyzicus, and which has been said to consist of crude oil sourced from east of the Sea of Azov or from the Baku wells<sup>208</sup>, although Baku was then in Muslim hands; but it seems much more probable that it was at least in part the *maltha* that was sourced much more locally from Samosata-Samsat, the capital of Commagene, from the “marsh that exudes an inflammable mud called fossil pitch. When it touches anything solid, it sticks to it... Water feeds the flames”<sup>209</sup>, although resin and sulphur<sup>210</sup>, or possibly quick lime and sulphur<sup>211</sup>, have also been suggested, together with references in the literature to the siphons employed<sup>212</sup> and to flame throwers<sup>213</sup>; while Muslim flame throwers from Sind on the backs of elephants are recorded in Bagdad in the X<sup>th</sup> century<sup>214</sup>, and more ships with flame throwers in the 12<sup>th</sup> century<sup>215</sup>. However, if flares were at times employed from beacon towers-pharos for communication purposes seems to be

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<sup>205</sup> Vitruvius, *de Arch.* VIII. 3. 8.

<sup>206</sup> Benjamin, 2005, 12.

<sup>207</sup> On this matter see for example: Partington 1999. The Chinese imported this technology under the Song Dynasty, presumably not directly but via the Islamic world, and employed it with a piston engine flame thrower, Delgado 2009, 67.

<sup>208</sup> Pliny refers (*nat.* II. 235) to *naptha* as being found in Babylon and Parthia.

<sup>209</sup> Plin. *nat.* II. 235. It was probably this which was also used earlier in Constantinople’s defence under Anastasius I (491-518), reportedly manufactured by an Athenian Proclus.

<sup>210</sup> Greer 1991, 873.

<sup>211</sup> Hassan – Hill 1986, 146.

<sup>212</sup> Hatipoğlu 2005, 54-5; Pryor 1992, 72.

<sup>213</sup> As mentioned in the V<sup>th</sup> century B.C. Boeotian siege of Delium, of a blast of air from a bellows through a pipe over a cauldron of lighted charcoal, sulphur and pitch by Thucydides (IV. 100) as in the III<sup>rd</sup> to II<sup>nd</sup> century B.C. Alexander Romance where Candace, Queen of Meroe=Semiramis replies to Alexander’s letter: “We have eighty flame throwers ready to do harm to those who attack us”. Bk. 3, 18, Stoneman 1991, 136.

<sup>214</sup> At the reception of the East Roman Emperor’s envoys John Rhadinus and Michael Toxaros in 917 the Baghdad palace of the Caliph al-Muqtadir (r.908-32) it is recorded by al-Masudi: “they were next taken to the wild beasts enclosure then to a palace where there were 4 elephants caparisoned with motley of brocade and silk: on the back of each elephant were eight men from Sind (India) with artificers armed with flame-throwers which struck terror into the hearts of the envoys”.

<sup>215</sup> Ibn Jubair records the use of flame throwing vessels by the Emir Saif al-Islam in the Red Sea, in 1183-4, cited by, Gaury 1951, 77 and earlier, the Fatimid navy and its fleet in the second half of the XII<sup>th</sup> century included, 20 *harraqat* that were armed with ‘Greek fire’ in 1163, see L. Yaacov, The Fatimid Navy and the Crusades 1099-1171, 257; for the XIII<sup>th</sup> century see for example, Hassan – Hill 1986, 131 fig. 5.9.

un-recorded<sup>216</sup>; although flares are recorded as early as Homer's *Iliad*<sup>217</sup>, with the burning flare fired through some device to a great height in the air, to call for assistance from neighbouring islands; while flaming arrows have been a part of warfare for millenia including those fired by the Phoenecians in Tyre at Alexander's forces in 332 B.C.<sup>218</sup> The phalarica was perhaps first employed by the Phoenecians, and these were employed in the defence of the island city of Saguntum/Zante off the coast of Elis against Hannibal, recorded by Livy<sup>219</sup>, where the fuel of these flaming spears was tow-hemp/flax and pitch, rather than tar. While burning arrows are recorded by Herodotus as employed by the Persians: "*The Persians took up a position on the hill opposite the acropolis, which the Athenians call the Areopagus, and besieged them in this way: they wrapped arrows in tar and set them on fire, and then shot them at the barricade*"<sup>220</sup>. The use of crude oil on arrows which were lit and then fired is recorded in 'Uman in 752<sup>221</sup>, while the flame-thrower, then the explosive fire-lance, then gunpowder bombs and genades<sup>222</sup> were employed by the Chinese from the X<sup>th</sup> century onwards.

There is also the absence of any record of the possible use of chemical additions to the flame(s)/fire(s) to produce a coloured flame for marking/signalling purposes in antiquity; as also of any evidence for the use of coloured filters for signalling purposes from these light sources, torches or lamps, although both of these practices seem to have been possible in antiquity; with for example the addition of salt to the flame to provide an orange flame to a marker light or for signalling purposes. Coloured glass filters over lamplight are recorded in the XII<sup>th</sup> century by Ibn Jubair<sup>223</sup> and could have been employed for signalling at an earlier date. The transition in East

<sup>216</sup> Flares-'rockets' are recorded, as for example in Ottoman festivities in Istanbul, in Atasoy 1997, 106, 114, together with other fireworks, globular lamps and large candles; employed on the Hajj pilgrimage from Damascus in 1876, Doughty 1990, 46, 96; at Arafat in 1853, Burton 1964, 200; at Mina, idem 218. And also in 1876, paper lanterns and candles, Doughty 1990, 46, and, '*The night was dark and showery when we removed, and cressets of iron cages set upon poles were borne to light the way, on serving man's shoulders, in all the companies.*', 47, with wood in the cresset for light, and for the dignitaries a little incense as well, see Burton 1964, 132, fn. 1. While explosives were employed in the 1291 siege of Acre, Hassan – Hill 1986, 122.

<sup>217</sup> Hom. (*Il.* XVIII 207-8): "*As when a flare goes up into the high air from a city from an island far away, with enemies fighting about it, summoning assistance from friends in adjacent islands*". That is, the flare was fired through some device to a great height, to call for assistance.

<sup>218</sup> Arr. *anab.* II. 18. 6. For probable Mamluke examples see for example: "In the castle (at Bir on the Euphrates) a large room full of old arms; I saw there glass bottles to be shot at the end of arrows; one of them was stuck at the end of an arrow, with four pieces of tin by its sides, to keep it firm". Henry Maundrell in 1699, cited in, Wright, 2003, 508

<sup>219</sup> Liv. XXI. 8 "[10] *The Saguntines had a javelin, called a phalarica, with a shaft of fir, which was round except at the end whence the iron projected; this part, four-sided as in the pilum, they wrapped with tow and smeared with pitch. [11] Now the iron was three feet long, that it might be able to go through both shield and body. But what chiefly made it terrible, even if it stuck fast in the shield and did not penetrate the body, was this, that when it [12] had been lighted at the middle and so hurled, the flames were fanned to a fiercer heat by its very motion, and it forced the soldier to let go his shield, and left him unprotected against the blows that followed*".

<sup>220</sup> Hdt. VIII. 52.

<sup>221</sup> Shaban 1992, 58.

<sup>222</sup> For the spherical ceramic fragmentation bomb, including the *tetsuhau*, see for example: Delgado 2009, 67.

<sup>223</sup> Ibn Jubair's account of the water-clock constructed in 1164 on the Jayrun Gate - Bab al-Jabiye of Damascus; also called from this public clepsydra, the Gate of the Hours, which remained working into the 14<sup>th</sup> century, given when he reached Damascus in July, 1184 (Second Rabi' A.H. 580): "*When the hour is past, the light of the lamp, coming down, illumines the glass, and the rays shine out of the round opening in front of it, and it appears to*

Roman territory from the widespread use of clay oil lamps in households to largely candles occurred during the VII<sup>th</sup> century<sup>224</sup>.

Although olive oil<sup>225</sup> fuelled glass lamps were frequently employed in lighting mosques from the VII<sup>th</sup> century A.D. onwards, the source of some lighting changed in some areas through the distillation of kerosene - that is, white, meaning clear, *naft*, employed in some lamps from the IX<sup>th</sup> century onwards<sup>226</sup>, with unrefined *naft* mentioned by Abu Hanifa (d. 767) as fuel for lighting a fire,<sup>227</sup> and it was employed to light the grand mosques of Mecca and Medina until it was replaced by candles in 860<sup>228</sup>; and both olive oil lamps<sup>229</sup> and wax candles were at times used together. While Ibn al-Faqih records in 903 the export of Chinese lamps<sup>230</sup> and Naser-e Khosraw in Fatimid Cairo in 1047, records that the, "*Lamp oil (in Cairo) is derived from turnip seed and radish seed and is called 'zayt harr'*"<sup>231</sup>. *Sesame is scarce, and the oil derived from it is expensive, while olive oil is cheap*"<sup>232</sup>. In addition to these oils, Benjamin of Tudela records that fish oil, a type of the staple fuel for Northern European medieval and later lighthouse fuel, whale oil, was also used for lamp oil in Egypt in 1168. He writes that following the annual recession of the Nile flood: "*Then, when the waters have receded, the fish remain behind in the trenches, and the owners of the fields take them and either eat them or sell them to the fishmongers, who salt them and deal in them in every place. These fish are exceedingly fat and large, and the oil obtained from them is used in this land for lamp-oil*"<sup>233</sup>. Although if this lamp oil was employed in lighthouses/marker towers, *mānar* in Egypt seems to be unrecorded. Unfortunately the fuel for the torches employed to light the way of the haj caravans in 1184 and

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*the sight as a red circle. This same happens to each circle in turn, till all the hours of the night are passed, and then all the circles have red light in them. There are eleven workmen (belonging to the Mosque) who attend to this gallery, and keep the mechanism in order, and see to the opening of the doors, and the running back of the weights into their proper places. This (piece of mechanism) is what the people call Al Mikaniyyah*". Strange 1890, 249-250.

<sup>224</sup> Bouras 1991, 1228.

<sup>225</sup> Olive oil is more refractive than water. Naser-e Khosraw records in 1047 that by Jerusalem: "*There are villagers who collect each up to five thousand maunds of olive oil in pits and tanks to be exported all over the world*". Khosraw 1986, 21, 1 maund=3.5 lbs=1.59 kg., ~8,000 kg. of olive oil.

<sup>226</sup> The mid-IX<sup>th</sup> century *Kitāb al-Asrār* of Muhammad al-Razi records the distillation of naft/naptha to produce white naft-kerosene, as is later recorded in the 1285 Book of Horsemanship and the Art of War, *Kitāb al-Furūsiya wa'l-munāsab al-Harbīya*, by Najm al-Din Ahdab.

<sup>227</sup> Shaban 1992, 57.

<sup>228</sup> Shaban 1992, 58, citing Tabari III, 1471.

<sup>229</sup> Ibn Jubayr records in 1184 at Mecca that: "*The Mash'ar al-Haram was completely lit that night with brilliant wax candles, and as for the mosque itself, it had become one large light...It was the same on Friday night for the Mount of Mercy and its mosque, since the non-Arabs of Khurasan and other pilgrims of the Iraqi caravan are the most moved to bring candles and use them in profusion to illuminate the venerated sanctuaries*". Peters 1994, 125. Lamps such as gave the name to the Suq al-Qandil beside Al-Azhar Mosque in Cairo, recorded by Naser-e Khosraw, Khosraw 1986, 53.

<sup>230</sup> Delgado 2009, 33.

<sup>231</sup> 'Abd al-Latif al-Baghdadi records at the start of the XIII<sup>th</sup> century that radish, lettuce and turnip oils were used for cooking, al-Baghdadi 1965, 190-1.

<sup>232</sup> Khosraw 1986, 55. Naser-e Khosraw also records that one year the Fatimid governor of Syria wrote requesting to use "*zayt harr*" in the mosques as olive oil was scarce that year, the Fatimid Caliph refused this request, idem 58.

<sup>233</sup> Benjamin 2005, 101.

1326<sup>234</sup> likewise passes unrecorded; as does the fuel of the lanterns of the poor, described by al Hariri of Basra in the XI<sup>th</sup> century in his Maqamat of Sanaa, “*and make its light to shine in every direction, and displayed it like a lantern to guide the poor*”<sup>235</sup>. Olive oil from Modon and Coron was employed for the lamps within the Topkapi Palace at the start of the 17<sup>th</sup> century<sup>236</sup> including fueling for example the, “*very great lantern, the form of which is round, and the bars of silver-gilt, and set very thick with rubies and emeralds, and Turquoises; the panes are of fine crystal*”<sup>237</sup>.

The fuel for the light source on top of the marker towers, *mânar*<sup>238</sup> erected in Islamic territory to mark the edge of a desert or to mark a major route, such as the beacons erected to mark the desert hajj route<sup>239</sup>, lit for the passage of the pilgrimage caravans by night, as it was by order of the Abbasid Caliph al-Saffah (r. 749-54) in 751, that fire signals be established, together with milestones,<sup>240</sup> all the way from Kufa to Mecca marking this route<sup>241</sup>; by those stations established by Zubaydah, wife of the Caliph Harun al-Rashid (r. 786-809) on this same route, Zubaydah’s Way<sup>242</sup>, as most caravan travel in summer was by night, although the type of fuel employed at this time as the light source for these fire signal beacons passes unrecorded, as likewise the fuel employed for the lights on the towers of ribats, which also seems to be unrecorded; as also the fuel of those lights positioned on the

<sup>234</sup> Peters 1994, 76, 77.

<sup>235</sup> Al Hariri 1986, 91.

<sup>236</sup> Bon 1996, 100.

<sup>237</sup> Bon 1996, 31, perhaps reminding of the crystal of the lamp mentioned in the Holy Koran Sura Al-Nur.

<sup>238</sup> Such as: the Minarah Hassan built in the late VII<sup>th</sup> century overlooking the lagoon Hawr-al-Muhammadiyah, as a part of draining the Great Swamp on the Tigris ordered by Hajjaj, Strange 1905, 43; or that constructed at Akhur by the Caspian shore in Jurjan, visible from a great distance across the desert, Strange 1905, 379; the whitewashed obelisk of granite and limestone, the Makam/*Mada’a Sayyidna Adam* on the summit of Mount Arafat, Burton 1964, 193; the Minaret without a Mosque, the tower in the Mashar al-Haram, halfway between Mina and Arafat, Burton 1964, 181. Ibn Jubayr remarks on this marker function, serving like a pharos, when he records in 1184 at a distance of 5 miles from Medina that: “*What can first be seen from here is the tall white minaret of the Mosque of the Prophet*”. Peters 1994, 103.

<sup>239</sup> Hence the probable source of Burton’s observation concerning reports concerning the light said to be visible from three days away on top of the Green Dome over the Prophet’s tomb at Medina: “*The glowing imaginations of the Moslems crown this gem of the building with a pillar of heavenly light, which directs from three days’ distance the pilgrims’ steps towards Al-Madinah*”. Burton 1964, 316, as for other places, formerly marked by a beacon light on the summit of the structure itself or upon an adjacent marker. As the hadith states: “*Choose early darkness for your wayfarings as the calamities of the earth do not appear at night*”. Burton 1964, 67.

<sup>240</sup> See, Doughty 1990, 51 for columns-milestones on the hajj road, in addition to the towers on the route, 51, ‘*six or seven ancient mile-stones by the wayside without inscriptions*,’ 67; for the two whitewashed pillars of ‘Alamayn, marking the limits of Arafat, Burton 1964, 182, and for the example of the two small milestone marker constructed at Arafat by 1883, 3 *zar* (123 inches = 312 cms.) high of brick and plaster, see, Farahani 1990, 239; or the Milayn al-Akhzarayn and the two pillars marking the running between Safa and Marwah on the Haj, Burton 1964, 245. Noteworthy in this context is that Naser-e Khosraw describes in 1050 these two pairs of markers as being *mânar* – minaret markers. He also records in 1052 that along the Biyaban road from Isfahan: “*small towers with water tanks have been built to collect rainwater in places that are not brackish, so that people will not lose their way and also that travellers may stop off and rest for a while out of the heat and cold. We saw great areas of shifting sand along the way. If anyone were to stray from the markers and wander into these shifting sands, there is no way he could come out again and he would surely perish*”. Khosraw 1986, 99.

<sup>241</sup> Peters 1994, 70, citing Tabari’s Account.

<sup>242</sup> Peters 1994, 71, 73.

summit of XI<sup>th</sup> century tomb towers and XII<sup>th</sup> century minarets.<sup>243</sup> It is however recorded that a prince of Aden in the XI<sup>th</sup> century, funded the building of, “*a dome of four large arches on top of the Mount of Mercy (‘Arafat) so that during the day and night that people are at ‘Arafat, lamps are visible for two parasangs<sup>244</sup> can be lit atop the dome*”<sup>245</sup>. These lamp lights on this dome on top of Mount ‘Arafat were therefore visible over a distance of about 12 km. at night, marking the position of ‘Arafat, like the light on a pharos-lighthouse marking a harbour, straits, hazard or headland.

It seems possible that the lightning strike that brought down the south-eastern minaret of the Prophet’s mosque in Medina on the 23<sup>rd</sup> night of Ramazan 886 (November the 15<sup>th</sup> 1481) and which resulted in a fire that almost entirely destroyed the building, was caused by the oil from the lamps on the balconies of the minaret, lit during Ramazan nights, smashing onto the roof of the mosque and setting the mosque roof on fire<sup>246</sup>. While the glass oil lamps which were employed on the upper sections of minarets in the 19<sup>th</sup> century are recorded by Richard Burton in 1853: “*To these (wooden arms extending from the Munar (minarets) at the Prophet’s tomb in Medina) and to the galleries (muezzin’s balconies) on all festive occasions, such as the arrival of the Damascus caravan, are hung oil lamps...*”<sup>247</sup>. The longstanding practice of lighting the balconies of minarets for the two great festivals, is recorded, amongst others by Ottavio Bon, Venetian Balio in Istanbul 1604-7, who writes: “*at twilight they light lamps round about the steeples (minarets), which burn till morning*” in Ramadan<sup>248</sup> and he records that: “*the pillars in time of prayer shine most gloriously, by reason of the abundance of lamps that are burning: the which lamps are curiously fastened into round iron hoops, in compass as big as the hoop of a butt; upon which there are divers rounds of lamps one above the other, and are let down by copper chains from the roof of the masjid; in every Moschea there are three or four such circles of lamps, or more according to the bigness of the masjid*”<sup>249</sup>, a type of the polykandelum providing multiple light sources<sup>250</sup>.

Around the Ka’ba in 1050 there were, “*columns, each pair of which are spanned with wooden beams carved in decorative designs. These beams have rings and hooks for suspending lamps and candleholders at night*”<sup>251</sup>. While in 1680, “*there were pillars of brass about 15 foot high and 20 foot distant from each other; about the middle part of which iron bars are fastened, reaching from one to the other, and several lamps made of glass are hanged to each of the said bars, with brass wires in the form of triangles to give light in the night season... These glasses are half filled with water, a third part with*

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<sup>243</sup> Hillenbrand 2000, 154-5: “*A chance literary reference establishes that in 582/1186 the practice of placing a lamp at the top of a minaret was sufficiently common in Khurasan to occasion no comment*”, doubtless as was also the case for the 1006-7 Gunbat-i Qabus tomb tower, near Gurgan, Iran, hence the beacon light associations attached to it which for example R. Byron records: “*The military Governor called at dinner time, and told us of the tradition that something used to flash from the roof of the tower; it was of glass or crystal and was belived to hold a lamp. The Russians, he said, took it away: although he did not explain how they reached it*”. Byron 1994, 266.

<sup>244</sup> 1 parasang = ~3.5 miles - 6 km.

<sup>245</sup> Khosraw 1986, 81. In 1184 the sponsor was forgotten and Ibn Jubayr records this cupola was termed Umm Salima, Peters 1994, 122.

<sup>246</sup> Peters 1994, 141.

<sup>247</sup> Burton 1964, 334.

<sup>248</sup> Bon 1996, 135.

<sup>249</sup> Bon 1996, 140-141.

<sup>250</sup> See for further examples of these glass olive oil fueled lamps, Goodwin 1992, 232-233 fig 223.

<sup>251</sup> Khosraw 1986, 79.

oil, on which a round wire of brass buoyed by three little corks: in the midst of this wire is made a place to put in the wick or cotton, which burns till the oil is spent. Every day they are washed clean, and replenished with fresh water, oil and cotton”<sup>252</sup>. Burckhardt in 1812 records it surrounded “by 32 slender gilt pillars, or rather poles, between every two of which are suspended seven glass lamps, always lighted after sunset”<sup>253</sup>, and Burton records in 1853 that, “between each two hang several white or green glass globes-lamps, with wicks and oil floating on water; their light is faint and dismal. The whole of the lamps in the Harim are said to be more than 1000”<sup>254</sup>. All of these lamps were probably fueled with olive oil from 860 onwards, this in part due to its important religious associations, which are explicitly recorded in the Holy Koran Sura Al-Nur, (Chapter Light) 24:35, “God is the light of the heavens and the earth. His light may be compared to a niche that enshrines a lamp, the lamp within a crystal of star-like brilliance. It is lit from a blessed olive tree neither eastern nor western. Its very oil would almost shine forth, though no fire touched it. Light upon light; God guides to His light whom He will”. Read in temporal terms, the description of a ‘lamp within a crystal of star-like brilliance.’ fueled with olive oil, would seem to indicate in the VII<sup>th</sup> century knowledge of cutting rock crystal<sup>255</sup>, as well as glass, to protect and to maximize the luminosity of the flame from an oil lamp. Ordinary glass has a refractive index of  $n = 1.5$ , this refractive index also correlates with increased dispersion, when a medium through which the light passes separates the light into its component spectra, as in a prism, with crystal cutting techniques employed to exploit these properties to create a brilliant, sparkling effect as each cut facet reflects and transmits light through the object. In the X<sup>th</sup> century at Fatimid Cairo, as earlier elsewhere, crystal cutting was a high art<sup>256</sup>, and it may be that cutting techniques were employed to increase the luminosity of the lamp light deployed on some of these marker structures.

It is evident from the later Ottoman documentary record<sup>257</sup> that oil, olive oil and wicks (*fetil* from the Arabic) were employed in lighthouses from the 18<sup>th</sup> century onwards, and this may have also been the case for the light sources of many Mediterranean/Near Eastern pharos and beacon marker towers from antiquity onwards.

There are however also references to the production of other inflammable substances in addition to olive and other vegetable oils, including: *zift* (Ar. pitch, resin; Tu. pitch, tar, bitumen, asphalt), pitch<sup>258</sup>, to *naft-neft-naphtha*<sup>259</sup> and to the (oil-kerosene-petroleum) springs at Dakuk<sup>260</sup>, in

<sup>252</sup> Burton 1964, 371-2.

<sup>253</sup> Burton 1964, 307.

<sup>254</sup> Burton 1964, 307.

<sup>255</sup> Crystal=rock crystal=quartz:  $\text{SiO}_4$  silicon-oxygen tetrahedra, with each oxygen being shared between two tetrahedra, giving an overall formula of  $\text{SiO}_2$  with a refractive index of  $n_e = 1.552-1.554$ . Well-formed crystals can reach several meters in length and weigh hundreds of kilograms. There was a solid glass, or perhaps rock crystal, oil lamp of Roman glass that was found at either Herculaneum or Pompeii and formed part of the King of Naples collections at the Palazzo Reale di Portici, recorded in, Sir D. K. Sandford, The Popular Encyclopedia, Blackie and Sons, 1836, of pre-79 A.D. date which is quite early for a solid glass Roman lamp, if it was not an 18<sup>th</sup> century forgery; distinct from the vasa diatreta type such as the Constable-Maxwell cage-cup, and so was in fact a III<sup>rd</sup> century A.D. eastern Mediterranean oil lamp, carved from a single block of glass.

<sup>256</sup> Naser-e Khosraw records the rock crystal imported from the Maghreb was etched by master craftsmen and was displayed in the Suq al-Qandil in Fustat (Thackston Jr. W. M, 1986, 53).

<sup>257</sup> Such as: BOA, 3325/70; and BOA, 3239/69.

<sup>258</sup> Naser-e Khosraw near to Akhlat in November 1046 records: “There I saw men who roamed about the mountainsides and cut a wood something like cypress. I asked what they did with it, and they explained that when



Sinai, and in Mosul,<sup>261</sup> and to the *naft-naptha* spring near Khahikin, Irak, “that produced a great revenue” in the XIII<sup>th</sup> century<sup>262</sup>, those by Baku that produced a revenue of 1,000 dirhams/day, where the *naptha* flowed continuously and all the ground was on fire<sup>263</sup>, to *naffatta*, paraffin lamps from the IX<sup>th</sup> century onwards<sup>264</sup>, tar (black) fresh (liquid) bitumen<sup>265</sup>, asphalt<sup>266</sup> and to white tar<sup>267</sup>, to the petroleum oils from Baku recorded by Marco Polo<sup>268</sup>, which he notes is good for burning as a light source in the 1270’s, and he also mention its transport by camels<sup>269</sup>; to sulphur<sup>270</sup>, and to the

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one end of this wood is placed in fire, pitch comes out the other end. It is then collected in pits, put into containers, and sent all over for sale”. Khosraw 1986, 7.

<sup>259</sup> *Naptha-naft-neft* = mineral oil/petroleum. It is referred to in the second book of the Maccabees in the Septuagint with the word “*naphtha*” in reference to a miraculously flammable liquid and so came into Greek. For the use of *naptha* by Maslamah’s forces during the 716-717 siege of Constantinople see, Hitti 1991, 203. For remarks concerning *naft* see, Hassan – Hill 1986, 108, for heavy oil, the black, un-distilled *naft* and then the white, distilled *naft*, kerosene, recorded from the IX<sup>th</sup> century onwards, idem 144-5. This product was of such importance, both military and civilian that the Caliph early in the IX<sup>th</sup> century appointed in each *naft* producing district an *emir al-naft*, responsible for oil production and the 850’s saw the Abbasid employment of a military troop of *naftatun*, petrol-incendiary bombers. 20,000 jars of *naptha* and 10,000 torches were used in the deliberate burning of Fustat, to prevent an 1168 occupation of the city by Amaury, King of Crusader Jerusalem, Creswell 1978, 120. For its military use in 777, 811 and 837 see, Shaban 1992, 58. Naft was first taxed under the Caliph Abbasid Mansur in the VIII<sup>th</sup> century. Shaban 1992, 57.

<sup>260</sup> Mustawfi mentions the *naphtha* springs near Dakuk, (N. Irak) Jazirah, Strange 1905, 92.

<sup>261</sup> Hassan – Hill 1986, 145.

<sup>262</sup> Strange 1905, 63, citing Yakut.

<sup>263</sup> Strange 1905, 181, citing Istakhri. In 855 the Caliph al-Mu’tamid granted the revenues of the *naft* springs to the inhabitants of Darband, Hassan – Hill 1986, 145.

<sup>264</sup> Hassan – Hill 1986, 145.

<sup>265</sup> There were the bitumin spings by Hit, in Irak, Strange 1905, 65. Khosraw 1986, 16, records in 1047: “*The ramparts (of Fatimid Tyre) are all masonry, and the joints are plugged with pitch so that the sea water cannot seep through*”, this was certainly bitumen-tar, *qir/qar*, rather than pitch pine resin, (on *qar-qir* see for example: M. A. Shaban, Islamic History a new interpretation, A.D. 750-1050 (A.H. 132-448), C.U.P. Cambridge, 1992, 57) and it was also employed for waterproofing in bath houses and in shipbuilding. Yakut in the early XIII<sup>th</sup> century records its production in pits from by Mosul and its use in the surfacing of roads. Francesco di Pegolotti records the trade in ‘*fresh bitumen*’(?) probably meaning liquid tar, between 1310 and 1340, Lopez – Raymond 1990, 110.

<sup>266</sup> Francesco di Pegolotti records the trade in small quantities of ‘*asphalt*’ between 1310 and 1340, Lopez – Raymond 1990, 109. This is distinct from medicinal bitumen; the cave where there was a spring of medicinal bitumen near Arrajan, Fars, Strange 1905, 269 citing Qazvini; and the precious Kubbah al-Mumiya, The Dome of Bitumen, closed with an iron door, of medicinal bitumen employed for Royal use, Strange 1905, 289.

<sup>267</sup> Francesco di Pegolotti records the trade in white tar between 1310 and 1340, Lopez – Raymond 1990, 112. It is also mentioned together with bitumen by ‘Abd al-Latif al-Baghdadi, al-Baghdadi 1965, 168-9, as ingredients of mummy, employed in ancient Egyptian processes of mummification/embalment.

<sup>268</sup> The Travels of Marco Polo, 1969, 36, records: “In the neighbouring country (to Baku, Iran) no other is used in their lamps, and people come from distant parts to procure it”.

<sup>269</sup> Marco Polo 1969, 36: “To the North lies Zorzania, near the confines of which there is a fountain of oil (at Baku) which discharges such a great quantity as to furnish the loading for many camels”.

<sup>270</sup> Khosraw 1986, 3, records the production of *ammonia* (ammoniac?) and sulphur from a pit at the summit of Mt. Damavand, by Rayy, Iran, transported in sacks of hide. There was the sulphur of Fars, Iran, G. le Strange, Lands of the Eastern Caliphate, Cambridge, 1905, 295, and there was yellow sulphur from by the hot sulphur springs of Dawrak al-Furs, Khuzistan, Iran, Strange 1905, 242.

trade in yellow and black sulphur<sup>271</sup>; to saltpetre<sup>272</sup>, as well as both wax and tallow for candles. If any of these alternatives were also employed at times in the lights carried by beacon towers, minarets and markers seems to be unrecorded but is not improbable.

### Were the beacon/pharos lights lit in winter in antiquity?

Further, in addition to the question of the fuel that was actually employed for these marker lights in antiquity, there is also the question of exactly how the light source(s) were physically shielded from both the wind and the rain, as this would have been of great importance, as it was under precisely these inclement weather conditions that perhaps the greatest value was obtained by mariners/travellers from the light which was provided by the light source(s) on any marker beacon or pharos. Sir Lionel Casson indicates cloudiness played a part in limiting the sailing season in antiquity due to the limitations it placed upon visibility<sup>273</sup>. While Lucan records that, “*The west wind never slackened the cordage of the ships until the seventh night revealed the coast of Egypt by the flame of the Pharos*”<sup>274</sup>, and so in a strong west wind the light of the flames in the Pharos, as presumably also on top of a marker beacon, remained visible to mariners; likewise there is also record of a cluster of candles in an open area of a Pagan Temple that were never extinguished<sup>275</sup>, as also the natural burning vented gas of the Chimaera in Lycia,<sup>276</sup> as also burning gas known from

<sup>271</sup> Francesco di Pegolotti records the trade in both yellow and black sulphur between 1310 and 1340, Lopez – Raymond 1990, 113.

<sup>272</sup> For remarks concerning saltpetre, see, Hassan – Hill 1986, 108-111.

<sup>273</sup> Casson 1979, 150.

<sup>274</sup> Cited by, Giardina 2010, 14, from Lucan. IX. 1004-5: Lucano “*Farsaglia o la guerra civile*”. Ed. Garzanti, trad. R. Badali, Milano, 1999.

<sup>275</sup> Casson 1979, 246, perhaps reminding of the lamp ordered by the “Lord” to burn on the tabernacle of the Jewish Temple in Jerusalem, which was said to be an inextinguishable lamp: “*And thou shalt command the children of Israel, that they bring thee pure oil-olive beaten for the light, to cause the lamp to burn always*” (Exodus. XXVII. 20).

<sup>276</sup> Eg. Lucian, *The Ship of the Wishes*, Navigium 7–9, Loeb, 439-441, recently translated as: “*Then, as the wind blew against them from the west, they were carried abeam as far as Sidon. From there they encountered a great storm and on the tenth day came through the Strait to the Chelidoniae [isles]. 8 There they nearly sank. Having once sailed by the Chelidoniae myself I know how big the waves can get, and how big they climb around that area, especially with a southwest wind whenever it mixes with a southerly. For this happens to be the place where the Pamphylian and Lycian seas run together and where the swell is split in two by the many currents swirling around the headland—there there are sheer and sharp rocks sharpened by the surf—and the breakers echo with a great roar and make the coast a most horrific place. 9 The waves often reach up as high as the promontory itself. Such were the events the captain said occurred when it was still night and pitch black. But the gods took pity on their cries and showed them a fire from Lycia so that they knew the place. And one of the Dioskouroi showed them a bright light resting upon the mast-top and guided the ship to the left, toward the sea, just as it was about to slam into a cliff*”. Davis 2009, 297-298. In respect to ‘*showed them a fire from Lycia so that they knew the place*.’; this fire was presumably the fire from the Chimera.

It may be that it was the Temple-marker Light on the Hiera-sacred promontory, Strab. XIV,3,9, “*Then one comes to the promontory Hiera and to the Chelidoniae, three rugged islands,*”; today the promontory itself is called Cape Chelidonia, which was what was seen by the mast-head, being a light for navigation that was presumably dedicated to Castor/Pollux, the Dioskouroi, rather than necessarily being a bright star of the firmament, or evidence of St. Elmo's Fire on the masthead, neither of which would have had the immediacy that was necessary to cause the ship to suddenly at night turn to the west and so to avoid the nearing cliff. It seems more reasonable to suggest the sudden sight of an onshore navigational light seen at masthead, as on the

elsewhere<sup>277</sup>, the question is rather, how were the light source(s) on these structures protected in antiquity?

A fire-proof cupola over the light source would have sheltered the light source(s) from all but horizontal driven rain, but this cupola type of roof is depicted in the contemporary record for only a few of these structures<sup>278</sup>, and how was the heat generated from the light sources dispersed from beneath the cupola? Were flues, as in the hypocaust system, employed to prevent damage to the domed roof, sometimes supporting the weight of a large bronze statue?

Or was it rather the case that the light sources, such as lamps/torches were supported by brackets extending out from the platform or from the supports for the cupola, with the area beneath the cupola being the place where the reserve of combustibles/torches for the night were kept dry and the place where any light intensifying equipment were deployed?

Did the later practice of suspending lighting devices from the top, and from the exterior of minaret balconies, have its origin in the position of the torches or other lighting devices extending out from the sides/columns of the fire platform of the Pharos and from similar pharos in antiquity?

However, many depictions of these structures show the flame on top of a beacon tower-pharos with no cover over it<sup>279</sup>, like the flame burning on top of an altar or in a brazier in the open air, and in these more numerous examples, is it to be understood that this was an artistic convention, like the figure holding out a lamp on the top of the Abydos marker tower struck on bronze coinage under Septimus Severus, rather than these being factual representations, and, if these were factual representations, why were the light source(s) not extinguished during the course of any lengthy heavy downpour? Was there perhaps some precursor of Greek fire, containing pitch pine resin and tow (coarse hemp<sup>280</sup> or flax), or perhaps, pitch, *maltha*, *naptha* (oil-unrefined kerosene), tar, sulphur or some compound of these, employed as the light source(s) for important beacons and signalling devices at night during inclement weather?

Or were the torches employed in 700 A.D., as in the XII<sup>th</sup> century A.D., extinguished on the Pharos, as were also the lights on other beacon towers, by the powerful winter rains? And was it the extinguishing of navigational marker beacons during the winter - not just the variability of the weather and the danger of the winter storms, of the weather itself - but the extinguishing of these navigational markers at night during the winter, as an intermittent light, lost if it rains, provides no security for navigation, which was a major factor in the vastly reduced sailing undertaken during the winter months in the Mediterranean in antiquity? There is for example the Alexandrian Augustus calender of 25 B.C., today called the Coptic calendar, limiting the Mediterranean sailing season<sup>281</sup>;

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headland, would certainly have had that immediate impact upon the ship's captain to steer in a westerly direction.

<sup>277</sup> As for example in Geoffrey of Monmouth's account of Bath in his "*British History*," Book 11, p. 45: "*He (Bladud) built Caervaddon, and formed there a warm unguent to be a perpetual remedy for the diseased. Moreover, by sacrificing to the enchantress called Minerva, he kindled an inextinguishable fire there: which, when it appeared to burn out, rekindled in balls of fire*".

<sup>278</sup> A cupola is depicted on the panel by the remains of the pharos showing the reconstruction of the Patara lighthouse from the architectural finds and for additional examples see: Giardina 2010, 27 fig. 12-13, 19, 98c.

<sup>279</sup> Giardina 2010, 22, fig 29, 38a, 39, 72, 151b, 154b, 156a,b,c, 157c, 164.

<sup>280</sup> Hdt. IV. 74, mentions the hemp grown by the Scythians as like flax.

<sup>281</sup> L. Casson writes: "*the sailing season was limited by and large to the period from May to October*". Casson 1979, 150. See for example: Heikell 2001, 160, the Coptic Calendar lists strong winds for each year in the Eastern

followed by the 380 A.D. decree of Emperor Gratian prohibiting the sailing of grain ships from Africa to Rome between the Ides (15<sup>th</sup>) of October and the Kalends (1<sup>st</sup> of April)<sup>282</sup>.

It was recorded by Naser-e Khosraw during the XI<sup>th</sup> century A.D. that the lamps in coastal marker beacons were glassed-in, preventing the wind extinguishing the lamps, forming lanterns, on 3 watchtowers supported 27 m. above sea level, marking the treacherous shallows of the then Tigris estuary<sup>283</sup>, but was this also the case for any of the marker beacons-pharos of antiquity? He writes of sailing north from ‘Abbâdân in 1053: “At dawn something like a small bird could be seen on the sea. The closer we approached the larger it appeared. When it was about 1 parasang (~3.5 miles-6 km) to our left, an adverse wind came up so they dropped anchor and took down the sail. I asked what that thing was, and was told that it was called a “khashshâb”<sup>284</sup>. It consisted of four enormous wooden posts made of teak and was shaped something like a war machine, squarish, wide at the base and narrow at the top. It was about 40 ells (27 m.) above the surface of the water and had tile and stone on top held together by wood so as to form a kind of ceiling. On top of that were four arched openings where a sentinel could be stationed. Some said this “khashshâb” was constructed by a rich merchant, others that a king had made it. It served two functions: first, that the area was being silted in and the sea consequently becoming shallower so that if a large ship chanced to pass, it would strike bottom. At night lamps encased in glass (so that the wind would not blow them out) were lit for people to see from afar and take precaution, since there was no possibility of rescue. Second, one could know the extent of the land and, if there were thieves (pirates from al-Bahrayn, Qatar and from along the Iranian coast), steer a ship away. When the “khashshâb” was no longer visible, another one of the same shape came into view; but this one did not have the watchtower on top, as though it had not been finished”<sup>285</sup>. Two hundred years later Abu’l-Feda’s in his Geography of 1321, *Taqwin al-boldân*, records these marker beacons in the Gulf: “To the south and east of ‘Abbâdân are wooden (piles) “khashshâbat”, which are markers in the sea for boats to tie up to and not to go beyond, lest the tide be low and they strike ground. At night fire is placed on these markers as a beacon for ships”<sup>286</sup>.

Likewise documentary evidence for the length of time the flame burned before refuelling or replacing or re-lighting the light source was required, also seems to be lacking today. Was there sufficient fuel in the light source(s) on the platform to provide a light all night long, as with the later glass lamps of Mecca and Damascus, and if not, evidence for how this process of physically refuelling the light source was carried out seems somewhat lacking today, with the exception of the internal hoists suggested to raise the fuel up to the fire platform of the Pharos and the indications suggesting the presence of external hoists from the fire platform in some contemporary depictions of these structures.

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Mediterranean on the following dates: 27<sup>th</sup>-29<sup>th</sup>/09 from the west; 21<sup>st</sup>-23<sup>rd</sup>/10 from the west; 26<sup>th</sup>-29<sup>th</sup>/11 of strong gales from the west; 06<sup>th</sup>-13<sup>th</sup>/12 from the southwest; 20<sup>th</sup> of December from the southwest; 11<sup>th</sup>-13<sup>th</sup>/01 strong gales from the south; 19<sup>th</sup>-24<sup>th</sup>/01 from the west; 27<sup>th</sup>-28<sup>th</sup>/01 from the west; 18<sup>th</sup>-23<sup>rd</sup>/02 from the northwest; 10<sup>th</sup>-18<sup>th</sup>/03 from the southwest; 20<sup>th</sup>-22<sup>nd</sup>/03 gales from the east; 25<sup>th</sup> of March from the east; 29<sup>th</sup>-30<sup>th</sup>/04 from the east; and from the 16<sup>th</sup>-18<sup>th</sup> of July from the east.

<sup>282</sup> Theodosian Code, 13. 9. 3. 3, also, Codex Iustinianus, 11. 6. 3, cited by, Pryor 1992, 87

<sup>283</sup> For its movement at the rate of 72 ft/year in 1905, Strange 1905, 49 and fn. 1.

<sup>284</sup> For its S. E. Asian/Chinese derived form, see Hourani 1995, 69, fn. 66.

<sup>285</sup> Khosraw 1986, 96.

<sup>286</sup> Khosraw 1986, 96 fn. 37. These “khashshâbat”- “khashshâb” as watchtower/markers were probably numbered amongst the many ‘rubât-ribat’ of ‘Abbâdân noted in the XIII<sup>th</sup> century, Strange 1905, 49.

Homer seems, as noted above, to have recorded Odysseus seeing the, “*men tending the beacon fires*” along the coastline of Ithaca<sup>287</sup>, presumably adding fuel to beacon fires, and people, rather than statues, are depicted in the numismatic record standing on the light platforms of some pharos, but what was the name applied to the people who tended the coastal beacons in all weathers throughout the long nights of antiquity? Where is the record of their pay, under what authority were they appointed to this responsible position, was it voluntary, a community charged activity, a sort of public service, a tax? And who or what was the institution that paid for the construction of these beacon towers and for the fuel that was transported to these places and which was burnt every night throughout the sailing season to light the mariners’ way. There should somewhere be some record of this.

Further, it is worth noting that as a system, the degree of hegemony exerted by an authority over the Mediterranean, or over some greater or smaller part of its coastlines, would have been a factor of some considerable importance in both the construction and in the maintenance of a navigational system of marker beacon lights. Indicating at night the coastline through the marker beacon system would have certainly ceased over large areas of the northern Mediterranean coastline remaining in Christian hands from the VIII<sup>th</sup> century onwards, due to the possible presence of fleets of Muslim raiders off these coastlines, with beacon lights along a coastline, strung out on coastal promontories and marking harbour entrances implying security, a darkened coastline, the opposite. Likewise the presence of street lighting in Damascus and Cairo implied security to visiting Latins in the 11<sup>th</sup> – 14<sup>th</sup> century, the dark and the light and the Light, ‘*is the blind man equal to the seer, or is darkness equal to light?*’<sup>288</sup>, and navigating long distances blind, in the night at the mercy of the fickle winds without the benefit of the extinguished marker beacons following the collapse of the *mare nostrum* was not a venture which was to be lightly undertaken.

Not every Mediterranean coastal marker beacon in antiquity was constructed and maintained by order of a Pharaoh, a Ptolemy II Philadelphus, or by a Herod, or was an Imperial foundation of a Roman Emperor, or was constructed and maintained by a local ruler; some, as with the Lectum cult and probably other marker lights on sacred/holy promontories, in temples, and along coastlines, but what proportion one may wonder, seem to have been built and maintained by religious cults, others by the ports themselves and some perhaps by local communities. Some marker beacons were tall, others taller, and some, probably the majority, were relatively small.

**Two small, probably late I<sup>st</sup> century B.C. - early I<sup>st</sup> century A.D. Roman three stage harbour marker beacons – pharos and anti-pharos-like, indicating the probable extent of the Roman quayside at Anemorium, in the Province of Cilicia.**

The ancient port-city of Anemorium (İçel-Mersin Province), lying on the east side of the Anamur headland of the Turkish coastline facing Cyprus, remained inhabited from Roman times into the mid-VII<sup>th</sup> century when it became abandoned. From the Anamur headland on clear days the tops of the Pentadactylos/Beşparmak mountain range of Cyprus reaching 1024 m., standing 41 miles, 66 km. off-shore, are visible. In 580 the city was badly damaged by an earthquake and the settlement afterwards occupied a very much reduced area prior to its abandonment. The reduction in the

<sup>287</sup> Hom. *Od.* X. 28, Trans. A. T. Murray, as noted above, fn. 43.

<sup>288</sup> Holy Koran Sura Ar-Ra’d, The Thunderer, 13:16. Likewise 13:19, Sura 40:58 “*And the blind man and the seer are not equal*”.

number of Anemorium's inhabitants being largely a consequence of the 542 to 748 plague pandemic, as was also the case with cities and settlements such as Corycus, Kanlidivane, Anavarza and Canbazli which were totally or largely abandoned at this time, and only very much reduced in size settlements survived at Side, Perge, Arycanda-at Arif, Myra, Trebenna as elsewhere, that clearly indicate, rather than being any consequence of the not infrequent seismic activity along this coastline, such as that in the 580's<sup>289</sup>, the depopulation at Anemorium as elsewhere in East Roman territory in this period, was largely a function of the loss of life from the plague pandemic combined with post-655 settlement abandonment caused by the threat posed to East Roman coastal settlements by Muslim fleets and raiders and to settlements inland by the often yearly Muslim campaigns that extended through central Anatolia into the X<sup>th</sup> century. The threat posed by Muslim maritime activity in the area and to maritime trade came first through the conquest of adjacent Cyprus in 649 and then through the destruction of the East Roman fleet in the decisive Battle of the Masts - *dhat al-Sawari* - in Finike Bay of 655<sup>290</sup>, where Muslim fleets from Akko and Egypt manned by Syrian Greek-Egyptian Copt and Muslim sailors destroyed the East Roman East Mediterranean fleet led by Emperor Constans II, a battle which destroyed East Roman mercantile activity in the Eastern Mediterranean at this time; as also in part from the depopulation caused by the continuing plague pandemic. Anemorium was then re-settled on a much smaller scale probably from the X<sup>th</sup> century, following the East Roman conquest of Cyprus and Tarsus, into the XIII<sup>th</sup> century from the finds of late East Roman and possibly Lesser Armenian pottery<sup>291</sup> and of numbers of Seljuk coins<sup>292</sup>, even though the settlement footprint was greatly reduced from its pre-VI<sup>th</sup> century size. A port of a minor sort doubtless still functioned, as one still does today, as a mooring place for boats prior to rounding the hazardous Anamur headland lying immediately to the west of Anemorium.

The extensive Anemorium necropolis lying east of the city and headland castellum, and constructed on the steep slope of the southeast facing hillside in rising terraces of tombs, overlooking the sea, contains large first century A.D. and later, arcosoli house tombs<sup>293</sup> and a church<sup>294</sup>, and it also contains two structures that E. Rosenbaum has described as, "conical buildings"<sup>295</sup>, the 'Anemurion cones'<sup>296</sup>, of 'a rather unique tomb type'<sup>297</sup>, 'an unusual type of

<sup>289</sup> Haldon 1997, 109; Freely 1998, 132, 218. For the seismic activity see, Duggan 2004, 123-170; "Supplementary data to be added to the chronology of plague and earthquakes in Antalya Province and in adjacent and related areas". See Duggan 2005, 357-398; and the emended chronology in, Duggan (forthcoming).

<sup>290</sup> Hourani 1995, 57-59; Hitti 1991, 200-201, where 500 East Roman ships were destroyed.

<sup>291</sup> Volbach 1930, 197-201 figs. 205-207.

<sup>292</sup> Onurkan 1967, 85, and VIII.

<sup>293</sup> Rosenbaum 1971, *passim*.

<sup>294</sup> Rosenbaum 1971, 123.

<sup>295</sup> Rosenbaum 1971, 94.

<sup>296</sup> Rosenbaum 1971, 95.

<sup>297</sup> Tombs, A. VI 21, pl. 1-2 fig. 2. 94 & A. VI 15, fig. 2, Rosenbaum 1971, 94. Comparisons are drawn with the funerary 'towers' of Palmyra, of Italy, Massebes in Phoenicia and elsewhere, Rosenbaum 1971, 95, suggests a tomb marker function for these "cones" and she says: "But it seems possible that the Anemurion 'cones' are local variants of a type of tomb of which other forms have been developed in other parts of the 'ancient world'"; rather than them having any quayside-harbour marker function such as is suggested here. It should be noted in respect to Rosenbaum 1971, fig. 2 that the drawing of A.VI 15c. is somewhat oddly numbered on the published drawing as being both 14 c. and 15 c.

*columbarium*<sup>298</sup> and which are dated to the start of the I<sup>st</sup> century A.D.<sup>299</sup> and that their “*funereal character is assured by the ambiente*”<sup>300</sup>.

However, it can be understood that the funereal *ambiente* is not necessarily the defining characteristic of these conical topped structures, as although it is certainly the case today that these structures stand within the necropolis, it seems that their construction may actually predate the construction of the necropolis, and that therefore these two conical topped structures may refer to an entirely different *ambiente*, such an *ambiente*, it is suggested here, as would relate them to a probable late I<sup>st</sup> century B.C. – early I<sup>st</sup> century A.D. quayside constructed along the shoreline below them (Fig. 1, 2, 2a).



Fig. 1. Anemorium late 1st. c. B.C.-1st c. A.D. marker beacons (A. Aygün)

One may well think, and this seems to be perhaps somewhat more probable, that these two conical structures on three stepped platforms upon substantial square in section bases, are not ‘*conical tombs*’ of a rather unique type as Rosenbaum has stated, but rather are two *in situ* deliberately constructed small three-stage Roman beacon towers - that is pharos - serving as markers, one is about 100 m. distant and 10 m. higher on the hillside than the other, that marked the extent of the main Roman harbour’s quayside, the location of which is presently unknown, but which quayside, about 100 m. long, should therefore be located beneath the shingle on the beach below the steep hillside slope upon which these two, three-stage beacon-towers are located, with these pharos therefore somewhat similar in function, if smaller in size and in height above sea level, to the pair of stepped (each step of 0.30 m.) storied, near conical, Roman lighthouses that stood on the cliff-top marking the extent of Portus Dubris, the port of Dover<sup>301</sup>. Further, it seems probable that these two three-stage towers that seem to have marked the landing quayside area at Anemurion, one cannot be entirely certain until the area below them of the former coastline is excavated, were quite deliberately constructed at these different heights on the hillside so that the lights burning on top of them at night would resemble from the sea the lights on top of the pharos and anti-pharos of a harbour, with lights at different heights on either side of the entrance, with, from the examples of

<sup>298</sup> Rosenbaum 1971, 94.

<sup>299</sup> “*Their building technique shows that they belong to the earliest phase of the cemetery*”. Rosenbaum 1971, 94, that is, to the I<sup>st</sup> century A.D. Rosenbaum 1971, 122, if not to the end of the I<sup>st</sup> century B.C.

<sup>300</sup> Rosenbaum 1971, 95.

<sup>301</sup> Giardina 2010, 120.



Fig. 2. Location of the 'pharos' beacon tower from the shore

the large Severan square base of which survives on the western rather than the eastern breakwater today. This pair of beacon lights at Anemurion would thereby resemble at night, given their relative difference in height, the pharos and anti-pharos of a typical Roman harbour's entrance (Fig. 3) and would therefore suggest a quite different location for the main harbour in the I<sup>st</sup> century A.D. from that which has been suggested by Sancar and Russell in 1994<sup>303</sup>. It would appear from the architectural remains that the beacon tower on the right when approaching from the sea, that constructed somewhat lower down the slope and so resembling the anti-pharos, became partially obscured, at least much of its conical shaft, although not its top, as the necropolis expanded during the I<sup>st</sup> century A.D. into the area around this first beacon, but the second, to its left, of the same three-stage type but at a somewhat higher elevation, thereby resembling the tall pharos, remains today a noteworthy marker on this hillside in daylight. It appears both were probably constructed at the same time, at the end of the I<sup>st</sup> century B.C. or the beginning

Palermo and Ravenna<sup>302</sup>, and Patara, as later the Medieval Pharos at Genoa, often that on the starboard/left hand side when entering the port being the higher light on the taller pharos, with that standing on the port/right hand side when entering the port, being the lower light on top of the anti-pharos. This is the case with these two conical towers at Anemurion, with that on the starboard side in approaching this quayside/port being constructed approximately 10 m. higher up the hillside than the lower tower on the port side if one approaches the port/quayside from the sea, and it seems reasonable to suggest this relationship of a taller light on one side of the harbour entrance, a lower light on the other side of the harbour entrance may have become standardized before the start of the first millennium. That the pharos was not always located on the starboard side on entering a port is known for example from the pharos at Leptis Magna constructed in the II<sup>nd</sup> century A.D.,



Fig. 2a. The location on the hillside of both beacons 'pharos' and 'anti-pharos'

<sup>302</sup> Giardina 2010, cat. no. 48 and 43.

<sup>303</sup> For the suggested localization of the in-filled harbour see, Sancar – Russell 1994, 137, and fig. 6, and, 137 n. 2, for a secondary harbour by the cliff.



of the I<sup>st</sup> century A.D. at a time before the buildings of the necropolis expanded across this area of this steep hillside.

These two beacon towers at Anemorium would have fulfilled Pliny's first function of a pharos, serving as markers for mariners at night, and they provide a variant on his third function, as they do not mark the actual entrance to the harbour, as the harbour at Anemorium had no entrance, nor harbour arms at the ends of which beacons were usually located<sup>304</sup>, and there was sufficiently deep water presumably right up to the buried quayside-landing wharf<sup>305</sup>, so these markers instead seem to have indicated the extent of the landing quay-port area for mariners approaching the port, defining this mooring-disembarkation-quayside area as approximately 100 m. long. There is the possibility that the ends of the quayside also carried on supports marker lights, although any evidence for this awaits excavation, and these are not marked on (Fig. 3), but if this was the case, a clearly man-made parallelogram of 4 marker lights, important for navigation, would have been visible at night from out to sea when approaching the quayside in Antiquity (Fig. 4).



Fig. 3. *Impression of the Anemorium marker lights at night (A. Aygün)*

<sup>304</sup> There were also probably Roman, as there were certainly later East Roman, Seljuk, Lusignan/Beylik and early Ottoman repairs to the lighthouse-beacon towers of probably equal height that stood at the end of each harbour arm at Antalya harbour and between these towers the chain closing the entrance was suspended and on top of these towers were presumably the beacon-braziers mounted at different heights that when lit marked the actual entrance to the harbour at night when these marker towers were themselves largely invisible, as was also the case for the harbour at Rhodes, as elsewhere. There may well have been a Roman beacon-pharos on the harbour arm at Finike and another on shore serving this same chain suspension - harbour entrance marker function. The relative position of a harbour in daylight or in moonlight in many cases was known to pilots from the coastal topography with its markers-*nışan*, what needed to be marked was the actual harbour entrance, although in landscapes devoid of clear navigational markers such as the flat coastline by Alexandria, as on other parts of the North African and Syrian coastline, a tall pharos-beacon marker would in daylight have been an invaluable navigational marker. It seems probable that the lights on these towers marking the harbour entrance were, like the lights on the pharos and anti-pharos, of different heights either side of the entrance, with, from the example of Patara etc., that on the starboard/left hand side when entering the port resembling the taller pharos, with that on the port-side, the lower anti-pharos light.

<sup>305</sup> For the Roman seawall(s), which remains largely unexcavated today, one constructed by legionary troops under Matronianus, Comes Isauriae in A.D. 382 who built a new sea wall at Anemurium, (Jones 1972, 396-399) and for the coastal deposition and erosion see, Sancar – Russell 1994, 136-137.



Fig. 4. *Impression of the Anemorium marker lights at night from the sea together with those suggested located at the ends of the quay (A. Aygün)*

At night of course, when the lights on top of these two beacon towers would have been lit, the necropolis would have been invisible from the sea, while the lights from these two beacon towers, approximately 45 and 55 m. in height above sea level, against the blackness of the hillside rising behind them, would have been clearly visible from a considerable distance out to sea, and these beacon lights could not have been confused with the stars in the night-sky. This was a serious problem, and was recorded by Pliny in the 1<sup>st</sup> century A.D. and also by Clayton in the 20<sup>th</sup> century who states: “Pliny points out in respect of the Pharos at Alexandria, “The only danger is, that when the fires are kept burning without intermission, they may be mistaken for stars, the flames having very much



Fig. 5. *View of the remains of the Anemorium 'anti-pharos', from the north 2010 (A VI-15 c)*

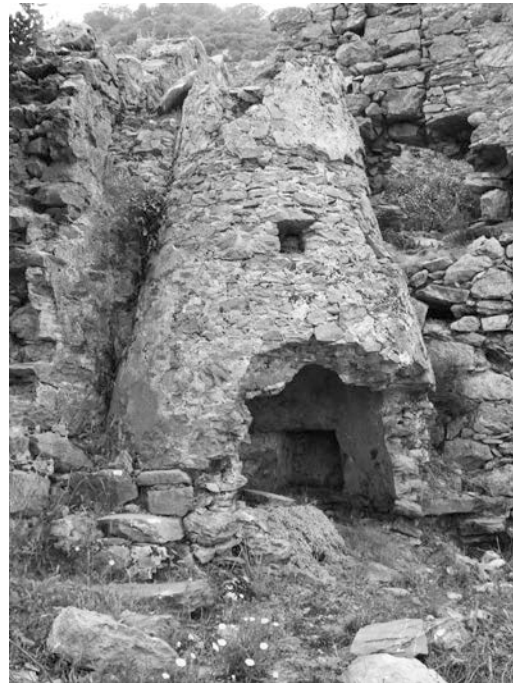


Fig. 6. *View of the beacon 'anti-pharos' from the west*



Fig. 7. Later opening from the adjoining south arcosoli tomb into the beacon tower

*that appearance at a distance”, This is still true enough of modern lighthouses seen on the far horizon at sea*<sup>306</sup>. Due to their location, this would not have been the case for these two pharos-beacons at Anemurion, as the black mass of the hillside rising steeply behind these beacons would have cut off the stars, which would otherwise have been visible at this height from out to sea and so, in this case and for beacons in similar locations elsewhere, this would have prevented any such dangerous confusion.

### The anti-pharos, beacon tower A. VI 15

The first marker beacon, the anti-pharos, the conical tomb tower recorded by Rosenbaum as A. VI 15, was built at a height of approximately 38 m. above sea level and has the south wall of a house tomb taller than the *in situ* remains of the beacon lying directly behind the beacon on the hillside and the arcosoli and wall of a house tomb has been

built in part around the tapering shaft of the beacon on its south side, indicating this tomb's construction was clearly subsequent to the construction of the beacon tower (Fig. 5, 6).

Although at least part of the conical shaft of this beacon was probably concealed, by the height of the house tomb to its south, from a boat approaching from the south in daylight in the I<sup>st</sup> - III<sup>rd</sup> century A.D, this was of no consequence, as in daylight the topography, the relation of headland, hillside and castle and then, closer in, the quayside itself would have been visible to the navigator. At night the beacon tower served its purpose, as the light located on top of this beacon tower would have been visible to shipping. An opening was much later made directly from the arcosoli of the house tomb to the west of the beacon through the abutting wall into the upper section of this beacon (Fig. 7).

This *in situ* beacon tower, the sides of the cone today stands 3 m. tall, does not stand to its full former height, the uppermost courses of rubble masonry, with the exterior coated in mortar, are today missing (Fig. 8) but this structure would have stood to a height of approximately 4 m. with the beacon light therefore approximately 45 m. above sea level (Fig. 9). From this height, dependent upon the height and the luminosity/strength of the light source located on or above the top of this conical shaft (Fig. 10) and also upon the height of the boat's watchman



Fig. 8. Remaining upper part of beacon

<sup>306</sup> Plin. *nat.* XXXVI. 88; see also, Clayton 1989, 146.



Fig. 9. View east, looking to the sea from on top of the suggested 'anti-pharos'



Fig. 10. Computer reconstruction of the beacon tower 'anti-pharos'. The uppermost section is speculative as no evidence survives for it. (A. Aygün)



Fig. 11. Looking south from by the 'anti-pharos' towards the 'pharos'



Fig. 12. The 'pharos' looking from the north towards Cape Anamur upper right



Fig. 13. The 'pharos' looking from the west



Fig. 14. The beacon 'pharos' from the southeast

and clear weather conditions, this light c. 45 m. above sea level would have been visible from about 7.04 nautical miles/13.074 km out to sea.

The wall of this conical shaft at the top measures 30 cm. in thickness and it is 90 cm. in diameter. The shaft is divided into two sections with the uppermost opening in the shaft measuring 38 cm. wide and 50 cm. high. The lower part has been partially destroyed but at its base it measures approximately 10 m. in exterior circumference and would presumably have had at least one other opening, like those in the lower two sections of Rosenbaum's conical tomb tower A. VI 21. The remaining opening in the shaft of A. VI 15 faces west while the openings in the more westerly beacon, A. VI 21, face east. The wall at the base of the shaft of this conical tower A. IV 15 has a thickness of 120 cm. The square base upon which the three stepped platform stands and upon the uppermost step of which the cone was constructed is of dressed stone and measures ~2.25 m. per side, the height of the base is today concealed by fallen rubble but is presumably similar in its proportions to the base of A. VI 21. The other major difference between them, in addition to the angle of the conical shafts and the orientation of the openings in these shafts, being that A. VI 15 has a single dividing stone floor, while A. VI 21 has two internal stone floors and, in consequence, a third opening in its shaft.

### **The 'pharos,' beacon tower A. VI 21**

Lying approximately 100 m. to the left when approaching from the sea and approximately 10 m. higher up the hillside and recorded by Rosenbaum as tomb tower A. VI 21, stands the second beacon, the 'pharos' which is a similar and a more complete structure<sup>307</sup> (Figs. 11, 12, 13) with the only substantive differences being that the sides of the upper section are closer to the vertical, there are two floors in the conical shaft and in the orientation of, and the number of the openings into the shaft.

This second pharos-beacon, A. VI 21, stands on this steep slope at a height of approximately 55 m. above sea level, upon a three stepped platform on a square base of dressed stone measuring 2.25 m. per side and this square base is more than 4 m. in height on its southeast-sea facing side (Fig. 14). Upon the top of this level, three stepped base there stands the considerable remains of the conical tower and, likewise the uppermost section of this conical tower no longer remains intact (Fig. 15), but which probably originally stood over 3.5 m. tall<sup>308</sup> (Fig. 16), giving a total height of the structure on its sea facing side of ~8 m. and on the landward side, a height of 3.5 m. above ground level. This would have been topped by an iron brazier or other lighting fixture – to hold the beacon light. From this height the light would have been visible from about 9.12 nautical miles = 16.89 km. out to sea, dependent upon weather conditions, the luminosity of the light itself, the height of the light source above the top of the conical shaft and upon the height of the boat's watchman above sea level.

The base of this conical tower is 10 m. in circumference and rises today to a height of over 3.5 m. It is constructed largely from rubble stone and mortar with a few tile inclusions (Figs. 17, 18). The few visible faced stone blocks which were employed in its construction form the sides and lintels over the three small openings above each other in the face of the tower, the lower opening measures 45 cm. x 60 cm. high, the middle opening, 45 cm. x 45 cm. high, and the upper opening, 30 cm. x 38 cm. high (Fig. 19). The function of these openings in both of these conical towers is presently uncertain, they provide no access to the upper shaft and are far too small to physically enter the

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<sup>307</sup> Rosenbaum 1971, 94 fig. 2.

<sup>308</sup> Rosenbaum 1971, 94 fig. 2.



Fig. 15. *The beacon tower-'pharos' from the south looking towards Anamur and Softa Castles*



Fig. 16. *Computer reconstruction of the beacon tower-'pharos'. The uppermost section is speculative as no evidence survives for it. (A. Aygün)*



Fig. 17. *From the south*



Fig. 18. *Detail of Fig. 17*



Fig. 19. *The conical top of the beacon tower from the west*



Fig. 20. *Detail of Fig. 19*

structure through, and the suggestion has been made that they were employed to house cinerary urns<sup>309</sup>, and it is perhaps noteworthy that Rosenbaum associates them with a process of burning, although she cites no evidence of finds of ashes or burnt material in them or around these two buildings, but it seems reasonable to suggest, given the suggested function of these conical towers as forming the upper sections of beacon towers, that these cupboard-like sections were employed to store in separate compartments the necessary fuel reserves, possibly olive oil or pitch from pine resin<sup>310</sup>, or bitumen, torches/wicks and other combustible material which were employed to keep the beacon light functioning during the night. There are no indications visible today to suggest that a ladder for the lamplighter was fixed to the exterior of these structures, although a ladder about 3 m. long would have been used to refill and probably to light the light source; while due to the present state of the tops of both of these cones, there remains no visible evidence to indicate the type of light fitting nor indications as to the kind of fuel employed to provide the light source for these beacons. It may be that the reason for the additional storage space in A. VI. 21 is because this pharos-like marker light possibly had a substance added to its fuel, so that it burned with a different coloured light, like the later traditional red and green, port and starboard maritime lights, but this is speculation.



Fig. 21. Base of conical section of tower from the north



Fig. 22. Bastion of Anamur Castle with signalling tower constructed c. 1450 on its roof top 2011

The shaft of both beacon towers, although apparently not the square in section bases which are constructed largely of squared dressed stone blocks with rubble infill, were covered by two thick layers of a very gritty mortar with a few fragmentary tile inclusions (Fig. 20), with the mortar on the sea facing side of the shaft of A. VI 21 remaining largely intact today (Fig. 17, 18, 21). Less of this mortar-plaster remains on the external surface of the more conical shaft of beacon A. VI 15 (Fig. 5).

<sup>309</sup> The suggestion has been made that these openings in these two ‘cones’ housed the proceeds in cinerary urns of Roman burial by cremation, presumably due to the small size of these openings, Rosenbaum 1971, 100 fn. 53, 122, although it seems to this author at least, more probable as noted above that they were employed to store the materials for servicing the beacon, wicks, spare lamps, and to securely store combustible material, oil in jars for fuel etc.

<sup>310</sup> See for its early production, made through the process of dry distillation or through the destructive heating of pine wood, Benozzo 2010, 39: “one of the most important innovations in Mesolithic societies, a period when fires, apart from other uses also previously documented, started to be deliberately prepared and lighted for the production of pitches and tars, and when tars were commonly used for the lighting of fires (burned tar torches are typical deposited artefacts in Mesolithic sites of central Europe see Zvelebil 2008, 32)”.

Both of these beacon towers have similar forms, a conical tower on top of a three-stepped platform upon a square in section stone base, are of approximately the same size, are constructed in the same way and from the same materials, have similar types of openings in the conical shaft and seem to have been constructed at the same time, and it can be understood their difference in elevation related to their function as providing pharos and anti-pharos type lights marking the extent of the quayside below them, and therefore this suspected quayside may have been constructed at the same time as these marker beacons, that is at the end of the 1<sup>st</sup> century B.C. or early in the 1<sup>st</sup> century A.D.

### Postscript

In the 13<sup>th</sup> century any lights shining from these beacons at Anemurion at night would have been visible not only to the passing coastal shipping but also from Anamur Castle and perhaps also from Sij-Sik-Sigh-Siki-Sechin-Softa Castle, Bozyazı to the east (Fig.15), each of which would doubtless have had beacon / signalling towers constructed on bastions within the fortifications, later, *ca.* 1450 Karamanid signalling-lookout towers remain *in situ* today at Anamur Castle (Fig. 22, 23), as well as from a probable Roman pharos, re-employed in the XIII<sup>th</sup> century as a coastal *mânar* which would have functioned after 1225, located on the



Fig. 23. Detail of uppermost exterior section of the Karamanid signalling tower on Anamur Castle, 2010

point of Cape Amamur where the present lighthouse constructed in 1912, at a height of 68 m. above sea level stands today<sup>311</sup>, and which would at that time have formed a part of a coastal communications system, linked and in part erected under Sultan Alaeddin Keykubat I following his conquest of this stretch of coastline in the 1225 campaign from Alanya eastwards to by Corycus<sup>312</sup>. This may have been connected through line of sight signal stations to the coastal communications system extending westwards from Antalya's 1225-6 Yivli *mübarak mânar* to Fethiye-Dalaman, including the re-use of the Roman pharos at Patara and the construction of the *mânar*, known in Latin sources as the tower of St. Nicholas at the Medieval port of Tasdibi (Myra)<sup>313</sup>, a network of coastal communications under the direct control of the Sultan or of the *emir-i sawahil* (Emir of the coastlines), as later of the Seljuk *malik-i sawahil* (Ruler of the coastlines) after 1250. The aim of this system was to provide communications along this rugged coastline and to provide some security from the threat to the ports provided by pirates and passing crusader fleets, as well as from adjacent Latin Cyprus, enabling a relatively rapid response to be made to these threats. Given the finds of Rum Seljuk coins at Anemurion<sup>314</sup> and of 12<sup>th</sup>-14<sup>th</sup> century pottery<sup>315</sup>, as also in the wider region, it seems not improbable that the better preserved, higher and more visible

<sup>311</sup> Constructed in 1911 by the French, with associated quarters for the lighthouse keepers, Sönmez 2010, 257-260.

<sup>312</sup> For note of this 1225 campaign see, Duggan 2012, 221-238.

<sup>313</sup> Duggan – Aygün 2010, 163. For a more extensive account of this subject, see, Duggan – Aygün (forthcoming).

<sup>314</sup> Onurkan 1967, 85.

<sup>315</sup> Volbach 1930, 197-201, figs 205-207.



of these Roman beacon towers at Anemurion (A. VI 21), may have been brought back into use in the XIII<sup>th</sup> century, not only to mark Anemurion at night as a stopping place for shipping during the XIII<sup>th</sup> century as earlier, before rounding from the east the headland of Cape Anemurion, but also, possibly to serve as a link in this Rum Seljuk coastal communications system.

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