When and how did Science originate?

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Thales, one of the seven sages of antiquity, was the offspring of an illustrious Phoenician family established in Miletus. Thales might have duly recorded (in a lost diary) his observations of the occurrence frequency of *Natural events* such as Equinoxes, Solstices, New Moons and Solar eclipses and *made the best out of those data,* finding out *rules of thumb* to make sense out of them. The stories associated to his name lead to consider him not only as a talented trader, a smart philosopher, a bold mathematician, a legendary astronomer, but, before all, as the very first scientist. His observations of meteorological effects on the growth of olives, after a harsh winter, let him anticipate a huge harvest of olives, which made him rich. According to the legend, during his trip to Egypt, he realized that the ratio of his height to the length of his shadow cast by the sun is the same for the pyramid. He measured this way the height of Cheops pyramid, what is today called the Thales' theorem. One of his pupils, Pythagoras, another Phoenician born either in Tyr or Samos, became also famous for his advances in geometry and experimental physics. Other renowned pupils of his school were Anaximander, Anaxagoras and Heraclitus.

Unfortunately *none original writings of his or from his contemporary fellows did reach us,* except one coin which carries the name Walwet, the king of Lydia, called Alyattes in Greek. Walwet means Lion in Lydian. This coin is the very first ever struck. Walwet is written downwards under the guard of two lion's heads. This epigraphic-iconic pattern has been engraved on a hard bronze punch-die. Its dimension was too large for the available flans *(blank metal disk)*, the commonly certified 12 mm wide weight of 4,76 g Electrum, also called Electrum Trite or Third Stater. The strike of two flans has therefore been necessary, each covering the head of a lion, the name Walwet, and barely the opposite lion's mouth. Was it an early version of the dollar bill torn apart trick? I had the chance to identified two coins [1], [2] which have being struck on the same die. The overlap with Photoshop of the pictures of those two coins reveals the royal *Electrum Visit Card*, see Fig.1.

Fig. 1 *Photoshop 76% opacity* **overlap of the right- & left-side of** *WALWET's Visit Card Electrum*

What could well be the link between the strike of the first coin and Thales? The physicist Göran Henriksson identified [3] the dot on the lion's eye as a representation of a total solar eclipse. Indeed, all coins struck later under Croesus have rays around those solar discs.

According to the legend, it has been to king Alyattes that Thales confided his *qualified guess* concerning the date of the forthcoming solar eclipse. I suggest that having this trump card in hand, the Lydian king staged [4] the end of his too long-lasting war against the Medes, claimed himself shah of shahs, and distribute one part of his visit card to his most important allies.

Thales' *qualified guess* has being confused by generations of historians with a scientific prediction! As we know, in those old days, such a prediction would simply not have been possible. The neurobiologist W.H. Calvin **[5]** suggests: **It is potentially quite easy to foretell a solar eclipse, so long as you can be wrong half of the time!** As Pliny the Elder reported, ½ millennium after Thales, that the famous eclipse occurred on year **CLXX** Ab Urbe Condita **[6],** one now knows the exact date **-584.05.28.** Since year 2005, with the released by Xavier Jubier of a user-friendly freeware coupled to Google Earth, the *5 Millennium Canon of Solar Eclipses* **[7]***,* it has been relatively easy for me to find out how Thales did proceed. In Table 1 are listed the solar eclipses which occurred at Miletus.

Thales & solar eclipses at Miletus	Common Era	UT+2h @ Max	Height of the sun	Magnitude
at detection threshhold	-602.05.18	08:11	36°	50 %
Observation # 1	-596.07.09	05:09	3°	72 %
		04:47 dawn	-0.8°	
18th New Moon [	-595.12.23	16:55	-0.1°	61 %
		17:00 sunset		
Observation # 2	-587.07.29	19:17	-0.6°	88 %
		19:26 sunset	-0.8°	
17th New Moon [	-586.12.14	11:04	27°	74 %
Rule of thumb 17 or 18th New Moon	-584.05.28 Pliny I: CLXX (170 AUC)	17:58 19:14 sunset	13°	97 %

Table 1: List of Solar eclipses occurring over Miletus which Thales may have observed.
After X. Jubier's "5MCSE", in the so called &dT=xxx& url-mode, see **[8].**

At some New Moon days with clement meteorological conditions, an observer such as Thales may have had the chance to see a partial solar eclipse without any kind of protection glasses: *at dawn or sunset* when the sun is low on the horizon, or, *during daytime*, by looking for solar crescents cast on the any fair area through foliage, or through any 1 to 2 mm diameters holes.
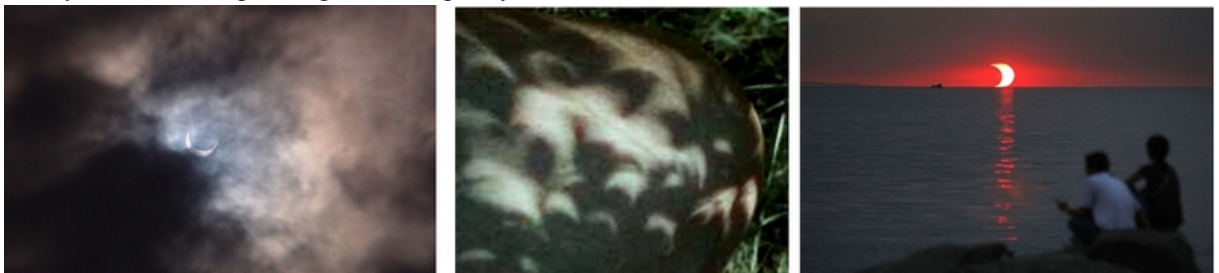

Fig.1 Solar Crescent: a/ through clouds   b/ cast on elbow, through foliage   c/ at sunset

Systematic observations of New Moons **[9]** led to the following *rule of thumb:* **A solar eclipse may happen 17 or 18 New Moons** (ca. 502 or 531 days) **after a first solar eclipse [10].** This empirical rule has no scientific support, though, over a given geographical area, solar eclipses statistically have the tendency to cluster in time. According to Table I, in observation round #1, after a first solar eclipse, 18 New Moons later another eclipse occurred, and, in observation round #2, 17 New Moons later. Therefore, after the -586 solar eclipse, the best guess was to wait 17 or 18 New Moons for the possible occurrence of another solar eclipse. Indeed Thales has been very lucky, and became famous for his prognostic.

Between -602 and -584 solar eclipses Thales might also have notice a span of 18 years (223 lunations). He might have candidly concluded that the 18 *solar years long* cycle is a *scaling up* of his 18 New Moons rule of thumb, a kind of *mirror-image of his theorem of the pyramid* ?! Reinforcing this (wrong) deduction, the Phoenician trade of colored glass beads with China, may in turn have conveyed to Thales the first two entries of Solar eclipses in the Chinese Chronicles **[11]:** on **-708.08.17** and on **-600.09.20**. He then might have recognized the link between the *1 X 18 years long period* he himself observed and the 6 X *18 years long period* the Chinese astronomers observed? In such a case, he is the one (instead of unknown Babylonian astronomers) who should be credited for the discovery of the SAROS cycle, not a rule of thumb this time, but a genuine astronomical law. But it is also well known that one gives credit only to the rich!

Conclusion : Indeed Natural Sciences did develop by such systematic recordings of observations and finding out *rules of thumb* to make sense out of them. Isn't that an answer to "When and how did Science originate?" ?

References

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[2]   https://www.cngcoins.com/Coin.aspx?CoinID=243839

[3]   https://www.astro.uu.se/archast/Antikythera-2014.pdf

[4]   https://irispublishers.com/oajaa/pdf/OAJAA.MS.ID.000583.pdf

[5]   http://www.williamcalvin.com/bk6/bk6ch1.htm

[6]   https://www.archaeometry.org/timelines.html

[7]   http://xjubier.free.fr/5mcse

[8]   https://www.archaeometry.org/saros.pdf

[9]   https://promenade.imcce.fr/fr/pages4/441.html

[10]   https://www.archaeometry.org/prehistoires.htm

[11]   Liu Ciyuan, *Records of Large Solar Eclipses in China Before 300 AD,* Acta Astr. Sinica (1985) p.286, Vol.5, N°4

Return to index https://www.archaeometry.org