



Columbia University

Department of Economics Discussion Paper Series

The Birth of Coinage

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Discussion Paper #:0102-08

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February 2002

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September 1999

Introduction

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Prepared for publication in the *Zagreb Journal of Economics*, 1999.

The introduction of coinage marks an important innovation in the history of money and a transition in the development of civilization itself. Sometime in the first millennium BC, coinage was invented, probably in Asia Minor, and it rapidly spread throughout the Mediterranean area. Tradition attributes the invention to Lydia but it quickly became a Greek affair. Wherever Greeks settled coinage followed. In the span of hardly a century the innovation had become established around the Aegean area, Sicily, southern Italy, southern France, Spain, Libya and the Black Sea. It was also taken up by neighboring peoples, including the Persians, the Etruscans and the Carthaginians.

Coinage is a subject of interest for many disciplines: history, archaeology, metrology, numismatics, epigraphy, linguistics, classics, metallurgy, history of art, political science and of course economics. Its literature is enormous. Nevertheless, some of the most relevant questions remain unanswered. Why did coins suddenly appear in Asia Minor and the Aegean area in the early seventh century? What is the evidence that coinage was invented in Lydia? What were the early coins used for? Did the device or mark on the early coins guarantee the weight, the purity or the value? What was the purchasing power of the early denominations? Did the coins exchange at their “intrinsic worth” or were they overvalued? How were the coins related to prevailing weight systems? This essay attempts to answer some of these questions and provide an introduction to our knowledge about the invention of coinage.

1. Greek Weights and Values

Analyzing the origins of coinage is like trying to find the origin of a river with many tributaries: we find many possibilities but it is difficult to ascertain which is the main stem. It is best therefore to begin at some point where coinage had already developed and try to work backward. We know that by the end of the sixth century BC most of the city-states in the Greek world had their own coins, whereas in the middle of the seventh century BC, we cannot be sure that any state had coinage. Sometime between 650 and 500 BC, coinage was invented and spread throughout the Greek world. Dates earlier than 650 BC have been suggested by earlier writers, and the incredibly precise date of 687 BC has been inferred from early Greek writings. Such an early date cannot be ruled out but there is no hard evidence to support it and it has been suggested, therefore, even that: In default of convincing new evidence it is better to emphasize the secure *terminus ante quem* of c. 560 BC, and to admit that we are not sure how much earlier coinage began.”¹

In the middle of this period, Athens, destined to be one of the two dominant cities in Greece, introduced coinage. The great lawgiver, Solon, revered universally as one of the seven sages of Greece, who lived between, say 630 and 560 BC, made a currency reform. At the time Athens was ruled by an aristocracy that had excluded the middle class, reduced the lower classes to debt serfs, and was itself split into factions. Solon had achieved distinction with his patriotic support of Athenian foreign policy in urging the war against Megara for the island of Salamis. Basking in this success, Solon was elected archon in 594 BC and twenty years later he was given huge powers to enact fundamental reform, in the course of which he promulgated a new set of laws. These replaced the harsh decrees of Draco (c. 621 BC), which applied the death penalty to even minor crimes, prohibited enslavement for debt, and established a political system that shifted powers from the nobility to the wealthy citizens, on the basis of a wealth census he organized. By putting Athens on a

sustainable political and economic basis with fundamental reform, while stopping short of radical measures like land redistribution Solon earned the respect of all his countrymen.

Solon's currency reform, which also involved shifting weight standards, must have occurred sometime between 594 BC, when he was archon, and c.560 BC. The word "reform" implies that a coinage system already existed² and it has never been suggested that Solon was the first to establish currency in Athens. The earliest coins of Athens are known to have had a variety of designs: pomegranate, wheel, Gorgon-head, beetle, amphora, etc., typically with only a simple punch mark or incuse square on the reverse. These coins have been called "heraldic" because, according to one theory, they represent the heraldic emblems responsible for the production of each issue.³ There is apparently no way of identifying these issues with Solon or even those which Athens made so famous.⁴

A case can be made that Aegina, a small island near Athens, and possibly a colony of Argos, produced the first coins on (or just off) the mainland of Greece and there is a literary suggestion that King Pheidon of Argos produced the first coinage. In the late seventh century Aegina was asserting its maritime influence over the Aegean and its weight standard for currency was being adopted over much of the Peloponnese and Aegean. It is probably that Athens and Corinth, the two cities destined to become dominant in the north i.e., excepting Sparta), initially adopted the Aeginetan standard but soon asserted their own independence in setting a standard of their own.

The famous "owls" of Athens were tetradrachms, four drachm pieces weighing 17.2 grams—had, on the obverse, the helmeted head of Pallas Athene with the "archaic" eye, depicted from the front.⁵ The reverse in the owl, sacred to Athena, and a spray of olive, the tree being, traditionally, Athena's gift to mankind.⁶ These coins were produced from sometime in the second half of the fifth century BC, discontinued with the closing of the mint with the fall of Athens in 404 BC to Sparta, but it was reopened after the end of the Peloponnesian War in 393 BC, with the tetradrachms similar in style to their predecessors, except for the eye of Athena being correctly (but unfortunately!) represented in profile. By about 338 BC, however, the owls were superseded as a consequence of the rise of the Macedonian power, when the coins of Philip II and then Alexander the Great superseded the Athenian as the chief currency of the Greek world.⁷

Sometime after the reform the system was as follows:

5 silver oboli = 1 silver drachma, about 65 grains fine
20 drachmas = 1 chrysos or gold stater, 130 grains fine
5 staters = 1 talent of 100 drachmas, containing 6500 grains of coined silver, .

Reflecting a bimetallic ratio, the amount of silver that was equivalent to the same weight of gold, of 10:1.⁸

Drachma means "handful," oboli means "digit," and stater implies "standard." The stater was a standard that was also common through the Middle East. The word itself is derived from Ishtar, the Babylonian "Goddess of the Universe," Ishtar, and the prototype of the Greek Aphrodite and the

Roman Venus. The coins or pre-coins that in Assyria were dubbed the “head of Ishtar” became the stater, the basic standard for the coinage systems of Lydia, Greece and Persia.⁹

The talent at this time represents not the talent weight of 60 pounds but a value that in this connection meant 100 drachmas or 5 staters, weighing 6500 grains (less than 1 pound avoirdupois) of silver and only 650 grains of gold, about 1 1/3 ounces. The coexistence of the talent *weight* and the talent *value* has given rise to enormous confusion in the writings on coinage, equivalent to the confusion that would result if the “pound sterling” were taken to be a pound of silver!¹⁰

It should not be thought that the Greeks had anything like a unified system of weights. They had as many different weight standards as, say, Germany in the Middle Ages! Each weight standard gave rise to a different “currency area.” The main ones have been delineated earlier as follows:

Table 1. Maximum Weights for Silver Coins According to Different Standards in Grains						
1 grain= .0648 grams 1 gram = 15.432 grains	<i>Attic</i>	<i>Aeginitic</i>	<i>Phoenician</i>	<i>Rhodian</i>	<i>Babylonian</i>	<i>Persic</i>
Dekadrachm	675	----	560	-----	----	----
Tetradrachm	270	----	224	240	----	354
Didrachm	135	194	112	120	169	177
Drachm	67.5	97	56	60	84	88
Tetrobol	45	----	37	40	56	59
Triobol or hemidrachm	33.75	48	28	30	42	44
Diobol	22.5	32	18	20	28	29
Trihemibol	16.9	24	14	15	21	22
Obol	11.25	16	9	10	14	14

Seaby (1975: 19), based on Barclay Head’s *Historia Numorum*.

The Aeginetan standard was widely used in most of mainland Greece, the Aegean islands and Crete in the fifth and fourth centuries BC, while the Attic or Euboeic standard was used by Athens and her allies, and in Euboea and Sicily.¹¹ Corinth and her colonies used the Corinthian stater of 8.6 grams, containing three drachmae. The Rhodian standard was used in Rhodes and Chios and many other cities in the fourth century BC.¹² The Persian or Lydian shekel or double siglos and the Phoenician shekel was used not only in Phoenicia but in Thrace and Macedonia.¹³ Alexander the Great however adopted the Attic standard and that soon became dominant throughout much of the eastern Mediterranean and beyond.¹⁴

What accounted for the differences in weight standards in the Greek world? The clue to it lies in different and possibly changing bimetallic ratios. That explanation, for example, accounts for differences in weight standards in northern Europe.¹⁵ A century after Solon the Persian ratio, which overvalued gold, was 13:1, whereas the Phoenician ratio was 10:1. Thus the stater of 130 grains of gold was equivalent to 1690 grains of silver in the Persian Empire, but only 1300 grains of silver in Phoenicia. States like Lydia and the Ionian states on or near the coast of Asia Minor probably fell under the influence of the Persian ratio, whereas other states remained under the influence of the earlier Phoenician ratio. Much more research, however, is needed on this question.

The superpower of the Near East before the Persians was Assyria. A case can be made that the bimetallic ratio in Assyria was 13:1, not very different from what it was in Egypt.¹⁶ “The inscribed plates of gold and silver found under the palace of Khorsabad—which Sargon, king of Assyria, is believed to have erected in 706 BC, i.e., the plates weighed by Oppert, give the ratio in Assyria at 13, as follows:—The gold plate weighed 2577 ½ English grains, equal to the content of 20 gold darics (properly dharanas) of 129 grains each; the silver plate weighed 6769 2/3 grains, equal to the contents of 80 shekels of 84 ¾ grains each. This silver plate evidently represented the Assyrian money-talent. As we know (from several equivalents mentioned in the oldest Hebrew scriptures) that there were 20 shekels to the daric, it follows that the gold plate was 5 talents and that the ratio was 13, or exactly double the Indian ratio.”¹⁷

“This Assyrian mint-valuation between gold and silver possibly dates back to the period when the Phoenician traders commanded the product of the Iberian silver mines. It bears the marks of a deliberate and permanent policy, which was to buy silver, or, what is the same thing, levy it in tributes, at the ratio of 13, and transport it for sale to India, where it was coined and exchanged for gold at double this price. The silver knife-money found by Schliemann at Ilium was probably made in the West, possibly in Greece, for the Indian trade. When, at a later epoch, the Greeks of Asia freed themselves from Assyrian control or influences, which was probably during the eighth century, they fixed their ratio at 10, and made efforts to open commercial intercourse with India by establishing factories, as the Veneti had done before them, in the Crimea and other parts of the Euxine, with the view of trading through Scythia and Persia. But they were not successful. They had trouble with the Scythians in the seventh, and with the Persians in the sixth, century, when their attempts at overland commerce were definitely blocked by the conquests of Cyrus and the Persian adoption of the old Assyrian ratio of 13 to 1.”¹⁸

2. Antecedents in Babylonia

We should now try to understand where the Greek or “Solonian” system came from. Weights and measures go back to the earliest civilizations. The place to start is certainly Ancient Sumer, which, with their penchant for astronomy, had developed a sexagesimal weight system, using the talent, mina and shekel as follows:

1 talent (biltu) = 60 minas (manûs) = 67 pounds
1 mina (mana) = 60 shekels (shiklus) ≈ 18 ounces
1 shekel = 180 Babylonian grains¹⁹ (she) ≈ 3/10 oz.

Thus:

$$1 \text{ talent} = 3600 \text{ shekels.}$$

One practical convenience of the sexagesimal system is that it is divisible by 30 the length of the ancient month, and a shekel a month, plus a pan of barley, was the standard pay for a workman. Whatever its uses, these weight relations spread throughout the Middle East in the third millennium BC and were passed on to other civilizations as shown in Table 1.

Table 1. The Spread of the Babylonian Weight System

	Talents	Minas	Shekels or
Babylonian	1/60	1	60
Hittite	?	1	40
Ugarit	1/60	1	50
Hebrew (sacred)	1/50	1	60
Hebrew (Talmudic)	1/60	1	25
Persian	1/60	1 (light)	60 darics
Attic-Greek	1/60	1	100 drachmas

The talent in ancient Sumer was about sixty-seven pounds. This would make the mina about eighteen ounces and the shekel about 3/10 of an ounce, or somewhat less than 9 grams. Among the Greeks, the biltu became the talent, the mana became the mna, and the shiklu became the sigloi. Shekel means “to count” or to “weigh” and around the time of Hammurabi, a shekel, plus a pan of barley, was a month’s pay for a hired man, a not inconsiderable sum.

What was the origin of the shekel? One theory—not very plausible--holds that the basic unit was scientifically arrived at by Sumerian scientists in the 3rd millennium BC by calculating the weight of a volume of water, based on a unit of length equal to the apparent diameter of the sun.²⁰ Another theory is that the talent is the basic weight, equivalent perhaps to the weight a man can comfortably carry. Some linguistic support for this theory is provided by the fact that the word “talent” derives from the verb “to bear.”²¹ Still another theory is that the talent was equal to the weight of some metal, perhaps copper, that had the same value as an ox. Yet another theory is that the mina came first because it is the unit that is first referred to in ancient documents.

The theory of the mathematical origin of weight is, as noted, hardly plausible. A visitor from another planet looking today into the origin of a meter who took an early official definition of its length as 1,650,763.73 wavelengths of the orange-red line in the krypton-86 spectrum, or its redefinition in 1983 as the distance traveled by light in a vacuum in 1/299,792,458 seconds, would miss the point!

Just as modern measures were originated empirically, with the enlistment of science as a later embellishment, so was—probably—the ancient Sumerian system. It is much more likely that weights were obtained empirically and to a certain extent arbitrarily, and that it was only at a later period that mathematics was called in to fix scientifically the standards obtained by the older and cruder

methods.²²

A century ago, Sir William Ridgeway advanced the idea that was the first metal to be weighed and that very small units, typically grains, were the first weight reference points, the shekel, mina and talent being developed as multiples of the smallest unit, rather than the other way around.

In Ridgeway's framework, the ox was used widely as a standard of value in all the ancient civilizations and certainly over all over the Middle East. This animal had many advantages as a unit of account. As a basic instrument of production it was widely known and the most important asset held on farms outside the land itself. Its value was relatively stable in terms of grain and other basic commodities. But as good as the ox was as a standard of value, it was bad as a medium of exchange. It was neither homogeneous, divisible or portable. While alive of course it could provide its own transportation! But no one seriously thought of taking oxen along on long journeys merely for the purpose of effecting exchanges. It was much cheaper to use units of cheaply transportable homogeneous and divisible metals like silver and gold. But how to bring about the change?

Once the ox had become entrenched in the tribal or national consciousness as the standard of value, it was not easy to get rid of. What better means than to use a more mobile equivalent of the ox to replace it? By establishing the quantity of silver or gold that would, at least initially, have the same value as an ox, the piece of metal made up of that equivalent could take its place as a medium of exchange. It would have been natural to put a drawing of the ox's body or head on the piece, and almost inevitable that the piece itself would be called an ox. As time passed, an oxen used in accounts would mean not the animals themselves but their metallic representatives:

"In the regions of Asia, Europe, and Africa, where the system of weight standards which has given birth to all the systems of modern Europe had its origin, the cow was universally the chief unit of barter. Furthermore, gold was distributed with great impartiality over the same area, and known and employed for purposes of decoration from an early period by the various races which inhabited it...Practically all over the area there was but one unit for gold, and that unit was the same weight as the Homeric *talanton* ...Gold was the first object for which mankind employed the art of weighing...and over the area in question there was a strong evidence to show that from India to the shores of the Atlantic the cow originally had the same value as the universally distributed gold unit. From this we drew the conclusion that the gold unit, which was certainly later in date than the employment of the cow as a unit of value, was based on the latter."²³

There is no doubt that the ox unit of value was widespread in antiquity and it is probable that it appeared before gold was fished from the beds of streams. It is natural too that gold would have been the first equivalent to the ox to be used because silver was not found in its pure state and was harder to work; silver became plentiful only after metallurgical techniques had advanced. Copper, on the other hand, is not as eye-catching as gold and is not as frequently found in its natural state. The widespread development of gold mines in antiquity is also well known. It seems probable too that gold was the first metal to be weighed. Egypt was the country where gold was worked earlier than others and the earliest Egyptian weights were so small that they must have been used for a precious metal like gold. Ridgeway's theory therefore has *prima facie* plausibility.

If a piece of gold equaling in value an ox was called a talent, there should exist similar pieces in different countries, differing only according to differences in oxen between countries. To test this possibility, Ridgeway brought together evidence that demonstrated the remarkable similarity in the gold weight standards in early countries, reproduced in Table 2:

Table 2. Standards for Gold in Early Records

Standard For Gold	Grains
Egyptian gold ring	127
Mycenaean	130-135
Homeric talent (or “ox unit”)	130-135
Attic gold stater	135
Thasos	135
Rhodes	135
Cyzicus	130
Hebrew standard	130
Persian daric	130
Macedonian stater	135
Bactrian stater	130-132
Indian standard 7 th century A.D.	140
Phoenician gold unit (double)	260 (double)
Carthaginian	120
Sicily and Lower Italy	130-135
Etruscan	130-135
Gaulic unit	120
German	120

Source: W. Ridgeway. *The Origin of Coin and Weight Standards*. Cambridge 1892: 132.

The juxtaposition of the almost universal use of the ox as a unit of account with the remarkable coincidence in these standards for gold is strong support for the idea that the gold unit represented the value of an ox or a cow. Further evidence is of course needed. Do these standards, for example, approximate the value of an ox in the different countries or civilizations? Because most of the standards are in the range of 130 grains, it should be possible to show that 130 grains of gold was the approximate value of an ox.²⁴

3. The Talent Weight and the Talent Value

The talent has given rise to great confusion. As with the pound and mark, there was both a talent-weight and a talent-value. Failure to distinguish between the two has given rise to some absurd historical errors. Modern interpretations have almost invariably adopted the weight version with no recognition of the importance of its role as a value. Thus *Webster's Dictionary* defines a talent as follows: "a unit of weight or of money (the value of a talent weight in gold, silver, etc.). Used in ancient Greece, Rome and the Middle East, etc.; it...was usually large, the lowest estimated weight being about 58 pounds avoirdupois."

The history of the talent-*weight* has been described as follows: "Originating in the Orient, and weighing in remote times as much or more than the Chinese picul (133 ½ lbs avoirdupois), it afterwards fell to a hundredweight (the kikkah of the Bible and quintal of modern times). The talent of Cyrus probably weighed something less than the pical and more than the kikkah. Queipo, following English metrologists, gives the Hebrew kikkah the weight of 93 2/3 lbs avoirdupois. The Continental metrologists give lower equivalents. As to later ancient talents, for example the Euboic and Attic, they were lighter. The mean of various equivalents of the Attic talent is only about half an hundredweight."²⁵

If, however, the talent were *only* a weight, it would make much of ancient history absurd. It is frequently referred to in Homeric times.²⁶ In *The Iliad*, commodities were valued in oxen. Thus a slave girl was worth four oxen. But there is also in *The Iliad* a talent of gold. What was the relationship between a talent and an ox? If the dictionary were right, a talent of gold in ancient times would have meant a huge value. After all, 59 pounds (the minimum weight according to Webster) is 944 ounces which, at a price of \$350 an ounce, would be worth today \$330,400. By this calculation, a talent of gold weight must have been worth hundreds of oxen. But a look at the evidence shows this cannot be true. In the *Iliad*, Achilles gives prizes for the winners of the chariot races that he holds in commemoration of his friend Patroclus, slain by Hector. The *fourth* prize was two talents of gold! This, by the weight interpretation, would be worth \$755,200 today. If this is the fourth prize--worthy of a Grand Slam tennis match--what must have been the higher prizes?

The first prize (see Book XXIII) was "a woman skilled in all useful arts, and a three-legged cauldron that had ears for handles, and would hold twenty-two measures; this was for the man who came in first." For the second there was a "six-year old mare, unbroken, and in foal to a he-ass." The third prize was a "goodly cauldron that had never yet been on the fire; it was still bright as when it left the maker, and would hold four measures." The fourth prize, as already noted, was two talents of gold. The fifth prize was a "two-handled urn as yet unsoiled by smoke."

It is obvious from the above that a talent of gold could not have meant a talent *weight* of gold. Here we see that two talents of gold have a value somewhere in between a large shiny copper cauldron, but more than a new two-handled urn. Later on we find (from the wrestling prizes) that a woman skilled in all the arts is worth four oxen; and (from the running prizes) that a "large ox, well fattened" is worth more than half a talent of gold. We thus find that a talent of gold is worth less than two large fat oxen. It should be obvious that the "talent" Homer is talking about is not an enormous weight of gold, but a coin or a quantity of gold that has a value greater than a two-handled urn but less than a shiny copper cauldron, two oxen or "half" a woman skilled in all the arts.

Obviously a talent of gold did not refer to a talent weight of gold but a value.

It is not my intention to deny that the talent was a weight, only that it was never, or rarely, used as a weight in connection with gold or as a monetary value. Nor is it to reject the notion that gold was weighed, only that the weight of gold that is equivalent to a talent unit of account is not a talent *weight*. Near the same passage in *The Iliad*, King Priam *weighs out* the ten talents of gold which he takes to ransom Hector's body from Achilles:

*Then the father held out the golden scales,
And in them he weighed two fates of dread death.*

If Priam were able to "hold out" the scales that were to hold ten talents *weight* of gold, i.e., 590 pounds or more, he must have had the strength of two or three Hercules combined in one frail old man! Moreover, where would Priam have found 9,440 ounces of gold, and what would Achilles have done with them? It would have swamped the money supplies of ancient Argos.

There is other evidence. Pollux tell us, through data from Aristotle, that the ancient talent of the Greeks in Sicily contained 24 nummi, each weighing 1½ obols. If this was a silver obol it weighed 13 grains, so the ancient talent of the Syracusans would have weighed 468 grains, a little less than an ounce. The ten talents of gold that Priam weighed out were probably this weight; ten ounces of gold--at that time an enormous sum--sounds much closer to the right ransom for a dead hero. The talent of *The Iliad* was not much different from the talent used by the Syracusans a thousand years later.

The literature on classical Greece abounds with mistakes arising from misinterpretation of the talent. The city of Chersonesus was at one time a thriving Greek colony near Sevastopol in the Crimea and came under the influence of Athens when Peisistratus (d. 527 B.C.) was tyrant of that city; the latter had pursued a strategy of gaining control of the Hellespont, through which came the exported grain of South Russia. To this end he encouraged the Athenian Miltiades to lead a private venture that gained mastery over Chersonesus. Apparently the inhabitants of Chersonesus honored the Athenian council and people with a golden garland of sixty talents, which has been interpreted to mean 1½ tons! What an inconvenient garland for even an oracle to wear! By contrast, according to an authentic description of the period, a gold garland presented to the Delian Apollo at the great quadrennial festival cost only 1,500 silver drachmas, the equivalent of about 12 ½ ounces of gold.²⁷

Early in the 5th century BC, when Gelon was tyrant of Syracuse, Carthage made his queen-consort Demaretta a present of a gold garland of 100 talents to celebrate the ratification of peace between the two cities. It was probably made of thin beaten gold, suitable for wearing on the head. Even allowing for the fact that Demaretta was an exceptional woman, she would have had difficulty wearing a garland weighing $100 \times 60 = 6,000$ pounds = three tons! The correct interpretation is that the garland *cost* 100 talents, with each talent, in the age of Solon, equal to 100 drachmas = 5 gold staters, each weighing 130 grains. Thus 1 talent of money in terms of gold would weigh 650 grains, and the garland, 65,000 grains or about 8 ½ pounds--quite heavy enough for the head, as well as a handsome gift for a queen.²⁸

Before coinage the bullion of the precious metals were probably thrown into the shapes of some recognizable objects, whether they were rings, bells, knives or simply ingots. Weight systems had existed for millennia and it would have been automatic to make the weights conform to a known standard or its multiples and fractions. “Pieces of silver” or “pieces of gold” could have passed as current money but they might have been homogeneous in weight or purity. Weighing would be one way of getting around differences in weight. There is no reason therefore to doubt that Priam needed to weigh the gold talents or that, as noted in the Old Testament, Abraham, when he purchased the cave of Machpelah from Ephron the Hittite, “weighed to Ephron the silver, which he had named in the audience of the sons of Heth, four hundred shekels of silver, current money with the merchant.”²⁹

“Current money” in this sense meant that pieces of silver were acceptable in payment, not that every piece had a face value that in shekels that could expunge a shekel debt.

4. Attributes of Coinage

Earlier classifications in the history of money made of the useful distinction between money of “intrinsic” and “extrinsic” worth. It is true that the terms are not strictly appropriate. Worth and value do not reside in an inanimate object. Like beauty, they reside in the eye of the beholder. Value is conferred on a commodity by the esteem in which it is held as measured by outside valuations that relate demand to supply, i.e., by scarcity. Inaccessible gold has no worth whatsoever.

That said, the distinction was meant to get at an important truth. Commodity money has an exchange value because if not used as money it can be used as a commodity. But once money has been widely accepted for that use, it may take on a value as money that is independent of the value of the commodity of which it is composed. A premium could develop on the money commodity because it is more “liquid” than other commodities. At the extreme, what can be called token money may have no commodity value whatsoever. It may also be called “representative money” in the sense that, say, a piece of paper might “represent” or be a claim on the commodity. Gold or silver certificates, for example, which are claims on precise amounts of gold or silver, could be called representative money.

In his *Treatise on Money* (1930:7), Keynes distinguished between “commodity money” and “representative money,” dividing the latter into “fiat money” and “managed money.” These terms are useful for some purposes but they fail to recognize that the distinction between commodity money and token money is a continuum. At one end lies commodity money, at the other lies token money. But what about the cases in between?

Pure commodity money has the same value whether used as money or a commodity. One could say that the “fall-back” value of commodity money, measured as a proportion of the value, is 1 or 100 percent. At the other extreme, token money is virtually worthless as a commodity. Its fall-back value is virtually zero. In between the two limits of commodity money and paper (or bank or electronic) money, there is a spectrum ranging between 1 and zero.

Seigniorage is the profit made from money creation. Apart from costs of manufacture, seigniorage is

the difference between the nominal or face value of money and the costs of the materials of which it is made. In the case of pure commodity money, seigniorage is zero, whereas in the case of token money, it is virtually unity, measured as proportion of the face value. Seigniorage is the opposite of fall-back value. Seigniorage can also be thought of as the degree of “overvaluation” of the money: in the case of commodity money it is zero, for paper money overvaluation is complete.

Costs of manufacture cannot of course be ignored. This was especially true before mass production methods made money manufacture much cheaper. In the ancient world, each coin had to be struck individually. Dies and punches had to be manufactured and replaced. Costs of manufacture were of course much higher, as a proportion of face value, for small denominations rather than large denominations. Taking into account costs of the material, manufacture and seigniorage, we can establish that:

$$\text{seigniorage} + \text{costs of manufacture} + \text{fall-back value}^{30} = 1.$$

Through the history of money, countries have sought to use the profits from overvaluation as a fiscal resource. The extent to which they are able to exploit this resource depends on the power of the state and the extent of its empire. The most powerful autocracies have used overvaluation either indirectly through ancient banking systems or overvaluing one or more of the precious metals. The degree of overvaluation—or alternatively the extent to which money did not require a fallback value—could be looked upon as an index of the ability of the central state to monopolize the production and eliminate competing sources of money. Even today, while paper money is token money, subsidiary coinage has substantial tangible value. On the money continuum, it falls in between commodity money and token money.

The passage from the use of money of pure commodity money to overvalued money can only occur at a certain stage in the political organization of society. When a substance is worth more as a money than a commodity, the excess profits would invite entry into the money production industry. Competition would soon result in increased production of money and a consequent fall in its value until the latter was equal to its cost of production (thereby returning it to the category of commodity money). The only way an overvalued money can be maintained is by a restriction of the production of money, which requires a monopoly. The power to impose a monopoly in the money industry came about only with the centralization of political power. Protection of this money prerogative becomes a prime function of the state and it could be argued that such money power could be the most important basis of the “Social Contract.”

As it turned out historically, the ability to monopolize the money prerogative and overvalue it increased with the power of the state. The stronger the power the greater the monopoly and, unfortunately, the greater the penalties for infringing the monopoly. Thus it came about that draconian penalties were imposed for such attempts as counterfeiting to enter the money industry. The issue of overvalued money was thus a feature of civilizations with a centralized political (and as it turns out theocratic) machinery, a characteristic of all the great empires of antiquity.

Overvaluation did not depend on coinage. Banking is one form of such representative money. In the

ancient empires of Egypt, Babylon, India and China, the temples and palaces represented important centers of production and they quickly became the centers of storage of grains and the precious metals, typically under the control of palace administrators and the priesthood. When commodities were thus accepted in the centralized warehouses, it would have been natural for the stewards of the palaces to issue some kind of certificate of deposit that would certify the evidence of debt. Probably these certificates from the temple-banks would be readily accepted in general payments and could circulate as a form of (overvalued) money.

It has been suggested that the cylindrical seals of India, Iran, Babylon and Crete, and the glazed scarabs (literally beetle, from the Latin *scarabaeus* and the Greek, *karabos*) of Egypt, ingrained with symbols of rulers, animals and religious mottoes, fulfilled some of the roles of money before the advent of coinage.³¹ These seals were probably “titles” or “claims” on goods, including claims on grain or metals deposited in the storehouses of the temples and palaces. If these “seals” were not used for making payments, what were they for, and if they were merely “seals” signifying ownership, why were they so widely used in international trade?³²

If so--and some support to it is lent by the repetitive character of many of the scarabs and “seals”--it goes a long way to demonstrate the high degree of centralization of commercial and financial activities associated with the temples. It would also serve to explain one of the great mysteries of monetary theory: why coinage was so long delayed. Coinage, it can be argued, was at least partly a device for capturing seigniorage. If seigniorage was already being captured by clay scarabs, coinage--a poor sister of banking for capturing seigniorage--was not necessary.³³

The transition to coinage thus came long after the transition to representative money. It is both nearer to us in time and more precise in date than transitions like that from non-metallic commodity money to metallic money. But it remains a subject of doubt and controversy. Part of the problem resets with the definition of “coinage.” What is a coin?

Money is a primitive concept defined in terms of its functions: money is what money does! If the same idea were applied to coinage, however, it would be too broad: coins are certainly abodes of purchasing power readily accepted as means of payment. But this definition is too broad. It would include rings, which were a very common form early money and worn on the arm or the ear afforded a happy combination of ornament and utility,³⁴ used widely by the Egyptians, as well as bell-shaped money used by the Chinese, and knife-shaped money used in pre-historic India and Scythia. It would even include paper money!

The word “coin” derives from Latin *cuneus*, meaning wedge or punch, and a literal meaning of the word coin would be something that has been struck. But this definition would exclude modern coinage as well as ancient Chinese iron coins that were cast rather than struck. A satisfactory, if somewhat restrictive definition would be “a round, flat piece of some recognized metal bearing the stamp of an issuing authority to guarantee its weight, fineness or value.”

5. Literary Evidence

One problem arises from conflicting evidence from numismatic, archaeological, metrological, and literary sources. There is also a problem arising from different definitions of coinage. That it is a piece of metal with an identifying device leaves many alternatives: Is the device (a) stamped (b) struck or (c) cast? What does the device signify? These problems can give rise to dispute in the search for the “first” coin.

There is a widespread view that the first coin was created in Western Turkey, by the Lydians. It is sufficient perhaps to single out a famous dictionary, the *Oxford Reference Dictionary* (1988 edition), which asserts that “Coinage is reputed to be an invention of the Lydians of Asia Minor, probably in the mid-7th c. BC.” Dating has remained controversial but the basic theme relating Lydia to early coinage is repeated in nearly every book that touches on ancient money.

The chronicles of the Lydians are said to go back twelve centuries before the conquest of their kingdom by the Persians under Cyrus the Great in the middle 540s BC. But apart from what Herodotus tells us, knowledge of Lydia is scanty and superficial. According to the *Encyclopedia Britannica*, Lydia was an:

“ancient land of western Anatolia, extending east from the Aegean Sea and occupying the valleys of the Hermus and Cayster rivers. *The Lydians were said to be the originators of gold and silver coins.* During their brief hegemony over Asia Minor from the middle of the 7th to the middle of the 6th century BC, the Lydians profoundly influenced the Ionian Greeks to their west. In the 7th century BC Lydia filled the vacuum left by the Cimmerian destruction of Phrygia and established a dynasty at Sardis under the legendary king Gyges. The kingdom reached its zenith under Alyattes (c. 619-560), who parried a Median threat, pushed back the Cimmerians, and extended his rule in Ionia. The kingdom seemed destined to reach even greater heights under Alyattes' son, the wealthy Croesus, when the Persians under Cyrus brought the Lydian monarchy to a final and dramatic end (c. 546-540).

The Lydians were a commercial people, who, according to Herodotus, had customs like the Greeks and were the first people to establish permanent retail shops. *Their invention of metallic coinage*, which the Greeks quickly adopted, played an important part as a catalyst in the commercial revolution that transformed Greek civilization in the 6th century BC.” [my italics].

The italicized phrases illustrate a tendency in the literature on early money to go beyond verifiable knowledge. In the first paragraph, the Lydians “are said to be the originators of gold and silver coins.” In the last paragraph of the same essay, however, the Lydian role has been upgraded to “their invention of metallic coinage.” The first statement is certainly correct, but the last statement is a non sequitur.

Herodotus, the father of history,³⁵ is more qualified in his statement:

“So far as we have any knowledge, they (the Lydians) were the first nation to introduce the use of gold and silver coins, and the first who sold goods by retail.”(*History*, Book i, 94).

The statement is worth analyzing carefully. It contains three parts. The first part is a disclaimer “so far as we have any knowledge...” which brings up the question: what is Herodotus’ source for Lydian coinage? It is generally assumed that he was taking his cue from the philosopher Xenophanes³⁶ (c.570-c.478BC), who is referred to by Pollux, writing in the second half of the second century AD,³⁷ as saying that the Lydians were the first to use gold and silver coins. Xenophanes lived a good sixty years before Herodotus ((484 BC?--420 BC?).

The second part of Herodotus’ statement, that “the Lydians were the first to introduce the use of gold and silver coins” does not at all warrant the conclusion that Lydia created the first coinage. First of all, introducing the first gold and silver coins does not mean “inventing coinage.” Second, the statement is ambiguous. Does “introducing the first gold and silver coins” mean gold and silver coins before anyone else used either gold and silver coins, i.e., did the Lydians have priority in both coinages individually or only in the fact that they had priority in introducing both at the same time? Alternatively, could “gold and silver coins” refer to a combination of the two metals in a single coin, as in the well-known electrum coinages?

Xenophanes’ statement is frequently misquoted even by careful writers. Howgego³⁸ asserts that Xenophanes, as quoted by Pollux, claimed that “coinage was a Lydian invention.” But there is nothing in Pollux to justify this assertion and, indeed, I will argue that he claimed nothing of the sort. Howgego goes on to write: “Even if the quotation is genuine, the claim need not be true.”³⁹ Of course this could be said for any quotation, but it can be argued first, that Xenophanes did not claim that Lydia invented coinage, and second, that he claimed instead that Lydia was the first “to produce gold and silver coins” a statement which can be defended.

An analogous mistake is made in another work which concludes⁴⁰ that::

“[Herodotus] adds (confirming an earlier testimony ascribed to Xenophanes) that the Lydians were the first to strike and employ coins of gold and silver, a statement that prolonged modern research has confirmed, except that the initial metal has been found not to be gold or silver but electrum (pale gold)...”

This conclusion is not at all warranted either by Xenophanes’ statement or by modern research. Xenophanes was born in Colophon, located about 15 miles northwest of Ephesus, Once the most powerful of the Ionian cities, Colophon had been seized by Gyges, the founder of the Mermnad dynasty in Lydia, in 665 BC and made a part of the Lydian Empire. After Lydia succumbed to the Persians around 546 BC, Xenophanes fled his native city and spent most of the rest of his life in exile in Sicily. He would have been around twenty-five years old at the time of his flight and thus would have been familiar with the Lydian monetary system and its innovations under Croesus.

What were Croesus’ innovations in money? In place of the traditional electrum coinage, he introduced a double system of weights of gold and silver, probably struck at Sardis, with a bimetallic ratio (apparently) of 10:1. He apparently replaced the electrum coinage by a currency system of gold and silver, probably struck at Sardis, the capital, and bearing the head or forepart of a lion facing the head or forepart of a bull.⁴¹ This was a major innovation, at least a forerunner of a true⁴² bimetallic

system, and it is highly plausible that Xenophanes would have been referring to this innovation that made Lydia “the first nation to use gold and silver coins.” The priority of Lydia as the first proved example of bimetallism has never, as far as I know, been disputed and that the introduction of that system fully justifies the assertions of Xenophanes and Herodotus.

We cannot be so happy with the third part of Herodotus’ statement, that “the Lydians were the first who sold goods by retail.” This is an astonishing statement. How could Herodotus possibly know this? A few pages later in his history he writes:

“...Cyrus intended these words as a reproach against all the Greeks, because of their having market-places where they buy and sell, which is a custom unknown to the Persians, who never make purchases in open marts, and indeed have not in their whole country a single market-place.” In the time of Croesus and Cyrus, the Greeks had markets but did they import the idea from Lydia? It seems more likely that markets existed throughout much of the Mediterranean world under the Phoenicians, the greatest Maritime people of the ancient world. Their cities centered in Lebanon and Palestine spanned two millennia and included the great emporia of Ugarit and Katna, Byblos, Sidon and Tyre. These predecessors of the Greeks, gave to Greece the foundations of its alphabet, and transmitted to them from Egypt and Babylonia the knowledge of astronomy, weights and measures and banking. Instead of coinage they used probably leather money and clay seals representing transfers. Tyre became the center of the precious metals market in the Mediterranean and while they were late in striking coins—they probably used instead bank money, clay seals and, like their cousins the Carthaginians, leather money based on the lottery principle—they most certainly “traded by retail.” At the time Herodotus was writing Phoenicia had fallen to the Persians and he was probably unaware of the many achievements of the that commercial race.

The implication left by the final clause of Herodotus’ statement is that the Lydians were the first to use coins of gold and silver because they were the first to “trade at retail.” However, the earliest coins attributed to Lydia were of electrum and of a value much too large to be used for common retail transactions. The commonest coins were worth twelve sheep each, about a year or half a year’s salary. It seems most likely that these coins were used for paying mercenary, probably foreign, soldiers, or for religious contributions.

There is other literary evidence about coinage, but not so ancient and probably less reliable. An early tradition, repeated by Strabo and Pollux, argued that it was Pheidon of Argos who first struck silver money.⁴³ The earliest statement of the tradition comes from the Greek historian Ephorus (405-330 BC), the author of the first universal history (in 29 volumes), a treatise on discoveries, and some other works. He was a pupil of Isocrates, whose school was a rival of Plato’s Academy.

Literary evidence can neither be ignored nor believed. Pheidon is a somewhat shadowy figure, with Lycurgus and Solon one of the three great lawgivers of Greece; all three were supposed to have made a reform of the “currency.” One ancient writer, the great traveler and antiquarian, Pausanias, places⁴⁴ Pheidon in the eighth century, Herodotus puts him around 600 BC, and the modern fashion is to put him in between, early in the 7th century BC. Some scholars link Herodotus’ Pheidon to the grandson of the great tyrant. There is a connection between the great Pheidon’s Argos and nearby

Aegina, which may have been a colony of Argos. Aegina is frequently said to be the first *mainland* Greek state to coin money. It is quite plausible that Pheidon was the first to coin on the *mainland* of Greece, but in the great entrepôt trading island of Aegina, possibly a vassal of Argos.

The plot deepens. Whether or not the early Greeks had coins, most Greek writers believed they did. Plutarch attributed coinage to Theseus of Athens, centuries before Phaëdon: "To his money he gave the impression of an ox, either on account of the Marathonian bull, or because of Tauros, the general of Minos, or else because he would encourage the citizens of Athens in agriculture. Hence came the expression of a thing being worth ten or an hundred oxen." Much of Plutarch's stories of Theseus are fables, but this one is by no means implausible. Once upon a time, it will be remembered, historians thought the story of the Trojan War was a mere legend!

What about Theseus and his expedition to Crete? "Minoan plate and jewelry are amply represented in the wealth of mainland tombs at Mycenae and Vaphio...It has been thought that small gold disks, found in prodigious quantities (700 in one grave), were nailed on wooden coffins; but they may have been sewn on clothes. They are impressed with geometrical designs based on circular and spiral figures, stars and rosettes, and natural forms such as leaves, butterflies, and octopods..." If these small round gold discs impressed with designs could be dated after the seventh century B.C., scholars would determine that they were coins. But because they occur a thousand years earlier, no scholar wants to risk embarrassment by calling them "coins." One theory is that they were "buttons."

Athens was at one time a colony of Crete, as indicated by the story of the annual tribute of youths and maidens. The same might be said of nearby Sparta. Lycurgus, the real or mythical figure who is often credited with founding the constitution of Sparta, was said to have forbidden the use of gold and silver money and introduced instead an iron currency. What that iron currency signified is not at all clear. First of all, why iron? An iron currency by itself would have been cumbersome and difficult to administer. In Plutarch's account, its low value would have suited Lycurgus' aim of reducing money envy: he supposed that to lay up any substantial value of the iron money would have required "a pretty large closet and, to remove it, nothing less than a yoke of oxen."⁴⁵ Of course Plutarch is probably not taking into account the sharp fall in the value of iron between the time of Lycurgus—presumably soon after the Dorians conquered Laconia—in his own time. Plutarch also offers the theory that the use of iron as storable money would make it available for weapons in time of war.

There is, however, an other possibility. It is much more likely, however, that the iron money was overvalued, a numerical system of overvalued and inconvertible iron money. A prime requirement of an overvalued currency is a strong state, one that was capable of enforcing a monopoly over the money substance. Sparta, with its army-camp regime and stud-farm society that Lycurgus encouraged the Spartans to cultivate could be said to have a strong central state. Another possibility is that ancient Laconia was under the rule of a Cretan power and used iron money because it was forbidden to use money based on gold or silver. The iron money would therefore have served merely as subsidiary coinage in a wider imperial system.

Pausanias, the Lydian-born traveler and geographer who flourished in the middle of the second

century AD, of whom the famed anthropologist and classical scholar Sir James Frazer said that "without him the ruins of Greece would for the most part be a labyrinth without a clue, a riddle without an answer"⁴⁶ says that "even in the Trojan times [the Greeks] were in no want of money. This is evident from what Homer represents Achilles saying, in answer to the ambassadors of Agamemnon: 'Not all the wealth Orchomenus receives!' It is clear from hence that the Orchomenians were supplied with great riches at that time."⁴⁷ Modern scholars of course lean to the view that *The Iliad* and *The Odyssey* reached their final form only in the last half of the eighth century BC so money in *The Iliad* does not necessarily imply money at the time of the Trojan Wars.

Sophocles, the contemporary of Herodotus, in his *Antigone* makes Creon say: "Go, and buy if you will, the electrum of Sardis (Lydia) and the Indian gold." Thucydides places the era of Creon about sixty years after the Trojan War, so these Greeks must have believed that Lydia had coins much earlier⁴⁸ than modern scholarship believes.⁴⁹

6. Developments in Lydia

If Herodotus' statement does not refer to electrum coinage, it remains of course possible that the Lydians did produce some of the earliest electrum coins. The Lydians, Herodotus said, were probably originally the same people as the Etruscans before Lydia was colonized by Greeks; their chronicles go back centuries before Lydia was conquered by the Persians. However, it is clear that there was no Lydian coinage before Gyges, the first of the Mermnadae ("House of the Hawk" dynasty), an ancestor of Croesus, who was King of Lydia from about 680 to about 651 BC.⁵⁰

Lydia, it has been said, 'became on land what the Phoenicians were by sea, the mediators between Hellas and Asia.'⁵¹ Gyges appears in a famous tablet of Ashurbanipal (reigned, 668-627 BC), the last of the great kings of Assyria, which recounts, about 660 BC, how "Gugu [Gyges], king of Luddi [Lydia], a far land at the crossing of the sea, of which the kings my fathers had not heard the name," accepted Assyrian overlordship and concerted operations against barbarian invaders, the Gimirri (Cimmerians), a troublesome nomadic nation that had overrun Phrygia. The allies were successful, but Gyges failed to cement the alliance with Assyria. Instead he invaded Anatolia and made some of the Greek colonial cities, including Colophon (the strongest Ionian city and the rival of Miletus) on the coast of Asia Minor his vassals. When Gyges later formed an alliance to aid a revolt in Egypt against Assyrian rule, Ashurbanipal prayed that "Gyges body would be thrown down before his enemy."

Gyges Mermnad was an army officer who usurped power by killing King Candaules. According to Herodotus, Candaules had been inordinately proud of his wife's beauty and wanted to share a view of this beauty nude with his subordinate, the captain of arms, Gyges. Over Gyges' reluctance, the king arranged for him to spy on her undressing, but she caught sight of him and, reasoning that it would be unsufferable to have two men around her who had seen her nude, forced him to either kill himself or her husband; Gyges chose the latter and married the queen, founding the new dynasty.⁵²

Gyges' successor on the Lydian throne was his son Ardys who reigned from 651 to c.619. During

this reign Sardis was taken again, this time by a Thracian race that operated in alliance with the Cimmerians. Ardys now felt compelled to re-establish relations with the king of Assyria and with his help the invaders were finally routed.

It was under Alyattes, however, who reigned from c. 619 to 560 BC, that Lydia prospered and became powerful. The external position was favorable. Assyria was weakening, and with the fall of Ninevah in 612 BC to a combined force of Medes and Babylonians, the might of that superpower was drawing to a close. Freed for a time from trouble in the east, Lydia was able to expand in the west by continuing its attacks of the Ionian states, capturing Smyrna and subduing Phrygia and other inland regions, and making friends with the coastal states.

Alyattes made huge donations to the Greek oracles, including the Temple of Artemis at Ephesus. Objects recognizably similar to coined money have been found at this Artemisium and been dated to 600 BC or somewhat earlier. Thus it is reasonable to conclude that, if coinage did not originate in the reign of Alyattes in Lydia, it at least existed during his reign. The coins of Lydia were made of electrum, a Greek word meaning “amber,” for the color of the metal that was carried down from Mount Tmolus along the Pactolus River toward Sardis, the capital of Lydia.

Where did the gold in the Pactolus River come from? An ancient myth gives an answer: According to legend, Midas, King of Phrygia, captured Silenus, the satyr and companion of the god Dionysius. For his kind treatment of Silenus, Midas was rewarded by Dionysius with a wish. The king wished that all he touched might turn to gold, but when his food became gold and he nearly starved to death as a result, he realized his error. Dionysius then granted him release by having him bathe in the Pactolus River, an action to which the presence of alluvial gold in that stream is attributed.⁵³

The extant coins presumably (there is no proof) made at Sardis are fractions (typically thirds) of staters, small irregular pieces of metal stamped with a mark. The marks on the earliest coins are not identifiable, but later coins exhibit a lion's head or a bull, two animals that were culturally symbolic in Lydia, on one side, and irregular markings on the other side.

There is no general agreement on what the marks on the coins signify. It seems plausible to conclude that they represent a mark of authority that would be recognized--a state guarantee. But did the mark (of authority) guarantee the coin's (a) face value, (b) weight, (c) purity, (d) purchasing power, or (e) legal tender status? It will be necessary to discuss these alternatives. First, however, we must complete our historical digression through to the collapse of the Lydian state.

Alyattes died in 560 BC and he was succeeded by his son, Croesus, one of the most famous men in history. The last and richest of the Mermnadae, Croesus had acted as viceroy and commander in chief before his father's death. Under his aggressive leadership Lydia reached both the zenith of its power and prosperity and its nadir. He first completed the work of his predecessors, subduing the Greek cities of Anatolia, and planned to conquer the Aegean islands as well; lack of seapower, however, persuaded him to make friends with, rather than conquer, the islanders of Ionia and instead to look eastward for further expansion. At the peak of his power, he was now in possession of all Anatolia west of the Halys River.

Croesus maintained good relations with his Greek neighbors and his legendary wealth made a deep impression on them. He sent generous offerings to such oracles as Delphi, Miletus and Ephesus. The Artemisium at Ephesus, sumptuously endowed by Croesus, became noted as one of the seven wonders of the ancient world. The phrase, “rich as Croesus,” passed into the language.

Croesus can be credited with a remarkable monetary innovation, one that was to have a profound impact on the future of the international monetary system. He replaced the electrum coinage by a currency system of gold and silver, probably struck at Sardis, and bearing the head or forepart of a lion facing the head or forepart of a bull.⁵⁴ It has been claimed that this is the first known example of bimetallism, commonly defined as a monetary system in which the government fixes the exchange rate between gold and silver.

This definition, however, is a rather loose one. There is a world of difference between different systems that could, under the above definition, be considered bimetallic. To take two extremes, suppose in one case that the mint prices of gold and silver are fixed (so that their relative values are also fixed) and at the same time the government agrees to mint into money (with or without a seigniorage charge) all of the metal brought to it. This was more or less the system prevailing in the nineteenth century, say from 1815 to 1873, when the world price of gold in terms of silver never went outside the range of 15:1 and 16:1.

But there is an alternative possibility. Suppose the sovereign monopolizes the gold and silver mines and fixes the ratio of silver to gold not at a price related to the relative market value of the two metals, but at an arbitrary price based on profit (or seigniorage) considerations. In fact this was the system probably set up by Croesus, with a bimetallic ratio of 10:1, a ratio that substantially overvalued gold and could only have been maintained by monopoly of gold. The gold coins were used as a multiplier for silver coins.

If it was not true bimetallism, however, the new system adopted by the Lydians nevertheless represented an innovation of world-shaking importance. It set a monetary pattern based on a fixed bimetallic ratio, with one metal overvalued, that is convenient to term “asymmetric bimetallism.” It was widely imitated throughout the Mediterranean world and the Near East. It would find its echoes in the Persian, Greek, Macedonian and Roman Empires and endure until the breakdown of the international monetary system that followed the sack of Constantinople in AD 1204.

Getting back to Croesus, Herodotus entertains us with an ominous tale where Solon, the great lawgiver of Athens, visits Croesus and lectures his host on how good fortune, not wealth, was the basis of happiness. Divine nemesis waits upon excessive prosperity, and happiness can only be assured with death. The story fits Croesus perfectly but the dates of the two men leave something to be desired. Solon was probably long dead when Croesus began his reign.

After ten years on the throne, the international situation became dangerous for Croesus. The Persians under Cyrus the Great had overthrown the Median empire, and Croesus found himself confronted with the rising power of the new Persian Empire, a check to his own dreams of imperial expansion.

As was his custom, he consulted the Delphic Oracle, who told him that if he crossed the Halys River (the eastern boundary of Lydia), "a great empire would fall." Thinking this would be Persia's, Croesus made an alliance with Babylon, Egypt and Sparta, took the initiative and crossed the border between the two empires at the Halys River. The battle was joined but Cyrus had slyly put camels in the front line and the Lydian horse cavalry, unused to the unfamiliar stench, took flight. Although the battle was indecisive, Croesus decided to retire to Sardis, to await reinforcements from Sparta and his other allies in Babylonia, Egypt and Sparta before renewing the campaign in the spring. But Cyrus now unexpectedly advanced on the capital city and took Croesus by surprise. On 546 B.C. Sardis was taken and Croesus was captured.

There are several versions of Croesus' fate, not doubt because the priesthood, which generally influenced the histories, wanted to put a nice face on a man who had contributed so much to their welfare. In one, he was taken to Persia as a prisoner, received the governorship of Barygaza in Media and ended his days as a great noble at the royal court. In another, after his capture, molten gold was poured down his throat. In a third, he burned himself (in keeping with kingly custom) on a funeral pyre. In a fourth, condemned to be burned, he was saved by the god Apollo and eventually accompanied Cyrus' successor, Cambyses II, to Egypt. The most plausible is the fifth: Croesus followed the Oriental custom of immolating himself on a funeral pyre in order to escape the indignities and tortures heaped upon a captured monarch before he was put to death.⁵⁵ Within the next half-century, the Attic vase-painter Myson depicted Croesus enthroned upon a pyre which a servant was about to light.⁵⁶

I have argued that the statements of Herodotus and Xenophanes do not claim that Lydia was the birthplace of coinage, but only the place that first introduced both gold and silver coins, an event that took place sometime between 560-1 and 546 BC.. But it is well known, and proved by surviving coins that coinage predated that period by a century or more. It is entirely possible, but by no means certain, that the first coins issued in the eastern Mediterranean area were struck in Lydia.

Some scholars, including Mommsen, have argued that Lydia is an unlikely place for the invention of such a commercial instrument as coinage. One skeptic doubts that the Lydians, a pastoral people speaking a Hittite-related language, had the ingenuity to invent money: "If coined money was in reality first used by the Lydians, it is probable enough that it was invented by the Ionians. One can hardly imagine Lydians, a pastoral people ruled by country squires, inventing anything but a new tune on the pipes. But they controlled the gold of their river-beds, and the silver from the mines of the interior, and this gave their kings wealth and the power of employing Ionian intelligence in their service. To the commercial Ionian must be assigned the invention of money, first coined no doubt for his Lydian lords."

This author neglects the fact that Herodotus considered the Lydians commercially minded, if only because they allowed their daughters to engage in prostitution; their brothels became models for the Ionian states.⁵⁷ Modern writers also have a more respectful opinion of Lydian accomplishments. In the time of Croesus, Sardis was described as the financial capital of the near-eastern world.⁵⁸ They had inherited Phrygia's textile industries, and produced gaily patterned fabrics, purple rugs and smart hats. Jewelry and excellent cooking were said to be among their other specialties.⁵⁹

The argument that the Lydians were incapable of inventing coinage is circumstantial. It could as easily be argued that the Lydians and Greeks took over the invention of money from the Phoenicians, the people from which the Greeks received their alphabet; or from the Egyptians, the people from whom they took their gods. Nevertheless, it must be said that there are some rival possibilities for the first coinage in this area. Miletus (or Kyzikos, its colony), Ephesus and Phocaea are plausible candidates. Miletus was the home of Thales (believed to be of Phoenician descent), Anaximander, and other philosophers; it set the standard for the Ionic alphabet that was adopted by Athens and other Greek states; it founded colonies. The earliest *Greek* coins are attributed to Miletus. It is not out of the question that the idea of coinage originated in one of these commercial states but the conditions for its adoption were more favorable in its more powerful neighbor.

There is some archaeological argument in favor of the existence of coinage before Gyges. In 1963, Miriam Balmuth, a classical archaeologist at Tufts University, drew attention to the importance of discoveries of inscribed silver discs, discovered at Zinjirli, capital of the neo-Hittite kingdom of Samal, dating from the late eighth century, c. 730 BC. There were also found large cast ingots inscribed in Aramaic with the name of the local ruler (Barrekub).⁶⁰ These “coins” (730 BC) predate the Lydian coinage. The King of Samal was a vassal of the Assyrian monarch, Tiglath-Pileser III--called Pul in the Old Testament--when Assyria was close to the height of its power.⁶¹

Much earlier accounts of money verging on coinage in the Near East cannot be dismissed.⁶² As far back as the beginning of the second millennium BC, accounts of the sun-god temple at Sippar were reckoned in “circle” or “Shamash heads” of silver. Five centuries later, Egyptian reliefs picture the booty or tribute weighed out in silver rings. A few centuries later, the Assyrians used silver for loans of major importance, lead in minor transactions. Later, copper replaced lead, and afterward bronze took the place of copper. Sennacherib, king of Assyria between 705 and 681 BC, in describing the ease with which he cast huge bronze bulls, declared: “I built a form of clay and poured bronze into it as in making half-shekel pieces.” Bits of silver called “Ishtar heads” are mentioned in the agricultural loans made under the late Assyrian empire; how they looked may be discovered from the bits of stamped silver unearthed at Ashur.

Sir Arthur Evans, archeologist of Knossos, discovered early in this century a round piece of silver, slightly convex on one side, flat on the other, inscribed with a figure looking like “H” and adapted to an ancient Cretan weight standard. From other evidence this piece is to be dated about the twelfth century BC. Similar pieces have been found at Salamis in Cyprus. This might have been a bridge between coinage and earlier forms of money and it might lend credibility to the story of Theseus’ coinage. These instances suggest that coinage might have existed in the Aegean area before coins were struck in Lydia before, however, conditions were ripe for it to proliferate..

It must also be asked, however, whether earlier forms of coinage could have been developed outside the Aegean world. The claims of China, India, Egypt, Babylonia, Assyria and Palestine are conceivable rivals. Part of the answer depends on what a “coin” is. Its origin would be different if it were taken to be an object with a device indicating its weight or value than if it were taken to be round flat piece of metal stamped with a similar device. Stamped knife money was known to exist in

several countries, stamped ring money was widely used in ancient Egypt in the second millennium BC, and devices serving the function of coins apparently existed in the eighteenth Dynasty.⁶³ These examples of money served the same function as coins, but of course have very different shapes. There are also many literary references in the ancient civilizations to what might be considered coin substitutes in early times. These possibilities cannot be excluded categorically but they are beyond the scope of the present essay.

7. Characteristics of the Early Coins

It is time to turn to the actual coins themselves. A number of questions could be asked, but the most important are the following: Where were the coins found? How were they made? What metal or metals were used? Where were they struck? When were they struck? Under what authority were they struck? What was their denomination and value? What function were they designed to serve?

The first question is easier to answer than the others. Coin collecting has existed not long after coinage began and tens of millions of coins have been unearthed from hoards, the locations of which have been recorded. The study of the frequency, distribution and contents of hoards is itself a sub-specialty of “coinology” and given rise, for example, to studies that have correlated the frequency of periods of civil war or stress. Exceptional numbers of hoards, for example, have been found of coins collected during the Civil Wars in Rome between 100 and 50 BC, and in the Civil War in England during the 1640s AD.⁶⁴ The frequency of hoards in general, however, can be assumed to increase with the coin population and is most scant at the very beginning of coinage in the Lydian or Greek world when we need them most!

The most spectacular find of early coins was the hoard discovered at Ephesus during the British Museum’s excavations on the site of the temple of Artemis (Diana) in 1904-5. This temple—one the largest of all Greek buildings and certainly the first one made (except for the ceiling and roof beam) entirely of marble—was ranked as one of the Seven Wonders of the World.⁶⁵ The temple was built on a site of earlier temples to the same deity starting in 560 BC with the financial help of Croesus. The lowest drums of the frontal colonnades were presented by Croesus.

Ephesus, founded between 650 and 600 BC, at this time had close relations with Lydia (playing correspondingly little part in Greek affairs). A new dictator presiding over Ephesus, named Melas, had married a daughter of King Alyattes (Croesus’ father), and Croesus too married a daughter of an Ephesian autocrat.⁶⁶

At the Artemision, as it is called, there were more than a hundred pieces, most of them electrum but seven of them were unmarked lumps of silver of apparently regular weights.⁶⁷ Twenty-four of the electrum and four of the silver pieces were discovered, together with jewelry and other artifacts, in the oldest structure of the site (called the Central Basis), for which “a date of 600 BC has been argued.”⁶⁸ The other coins, including a pot hoard of nineteen pieces, are related to the Basis material and some were struck from the same dies. Of the ninety-three electrum pieces, more than sixty electrum pieces had punches on one side and a recognizable design on the other side, consisting of an animal or animal forepart on a *plain* background; there were another twenty pieces of the same description having a *striated* background. The data can be summarized in Table 3:

Table 3. ‘Pre-Coins and Coins from the Artemision in Ephesus						
	<i>Number</i>	<i>Metal</i>	<i>Marks</i>		<i>Standard</i>	<i>Weight</i>
			<i>obverse</i>	<i>reverse</i>		
lumps	7	silver	none	none		<i>regular</i>
pieces	2	electrum	none	none	‘Milesian’ or ‘Lydian’ stater of 14.1 grams	fractions of standard
pieces	3	electrum	none	single punch mark on one side	Milesian	fractions of standard
pieces	4	electrum	‘Design’ of parallel striations	punch or punches on one side	Milesian	fractions of standard
pieces	20	electrum	animal or part with a striated background	punches	Milesian	fractions
pieces	60+	electrum	animal or animal part	punches	Milesian stater	fractions
	2	electrum	animal or animal part	punches	Phocaic stater of 16.1 grams	fractions

Source: Based on Carradice and Price (1988: 24).

One of the coins has been inscribed, making it one of the most famous coins in history. It is a fraction of an electrum stater with, on the obverse, a grazing stag, and on the reverse the mark of an oblong incuse punch, all marked with irregular lines.⁶⁹ Above the stag on the obverse is the legend, in archaic Greek retrograde characters, φΑΝΟΣ ΕΜΙ ΕΗΜΑ, which has been interpreted in two ways: “I am the badge of Phanes” and “I am the sign of the Bright One.” The stag is the beast of Artemis, which is fitting for the temple of Ephesus, but the identity of Phanes has never been established.⁷⁰ There was, however, a historical mercenary leader from Halicarnassus called Phanes recorded fighting in Egypt in the 530s BC, inviting the inference that Halicarnassus may have been the origin of the coin, if, say, the grandfather of this Phanes had the same name.⁷¹ The other interpretation is that the stag symbolized Artemis, and the “Bright One” makes a direct reference to that goddess.

Other identifiable designs include a seal’s head, attributed to the Ionian city of Phocaea and a recumbent lion representing Miletus.⁷² Other coin type that cannot be clearly identified include confronting cocks, a goat’s head, a horse’s head, a beetle, a griffin’s head, a bull’s head and a human head.⁷³ They might not refer to cities at all but to rulers.⁷⁴

8. Art Periods

Coins can be classified into “artistic periods” as well as into “types.” An important clue with the early coins is the degree of crudeness of the technique and the artistic development and realism of the final product. An early classification made by the British Museum⁷⁵ is still useful:

Coinage by Artistic Periods			
<i>Period</i>	<i>Approximate Date</i>	<i>Key Characteristic</i>	<i>Other Observations</i>
Archaic Art	650-480 BC	rudeness, stiffness, mouth a fixed, vague smile	eye in profile shown as in front
Transitional Art	480-415 BC	technique of die-engraving and coin-striking advanced; attention to detail	human figure correctly rep.; show imagination and originality
Finest Art	415-336 BC	pinnacle of numismatic art around 400BC	graceful design; high finish of execution
Later Fine Art	336-280 BC	Idealistic becomes realistic	actual portraits supersede heads of divinities
Decline of Art	280-146 BC	lapse toward crudeness	lack of originality
Continued Decline	146-27 BC	increasing rudeness	mechanical
Graeco-Roman	27 BC - 268 AD	vast number of Roman coins	competent but of little artistic merit

Source: Based on Rawlings (1935: 20).

Coin types are extraordinary useful for identifying the later coins, after the type has been clearly established. The study of types—which cities or issuers used which symbols—is an enormous subject in itself and the subject of several books. A sample of a few suggest the many themes: Sardis (Lydia), lion’s head or forepart of an lion; Ephesus, stag or bee; Smyrna, lion’s head with open jaws; Samos, lion’s head or bull’s head or forepart of bull; Chios, seated Sphinx; Lesbos, calf or lion types; Phocaea, seal, griffin; Caria, archaic head (probably Aphrodite), tortoise shell, crab; Cyzicus, tunny; Lampsacus, forepart of winged horse; Parium, Gorgon head; Aegina, tortoise; Attica, owl; Tanagra (Boetia), Boetian shield?; Phocus, bull’s head; Corinth, Pegasus flying; Corcyra, cow and calf, and so on. Closely related are the types appearing in Magna Graecia, which frequently reflect those of the mother city but are sometimes independent: Metapontum, ear of corn; Heraclea, head of

Heracles; Sybaris, bull looking back; Croton, tripod; Agrigentum, eagle and crab; and Syracuse, four houses and chariot. The last coins of the early fifth century BC are usually considered some of the most artistically advanced coins ever struck.

The coins in the Artemision reflect many of the types typical of the cities of Asia Minor. Thirteen major types have been identified. But few of them can be related to later city coinages of the area.⁷⁶ The commonest pieces were those with a lion's head in profile (nineteen examples) or with a lion's paw (twenty two examples).⁷⁷ "The lion's head type is by far the commonest and most widespread of all the early electrum coins from Asia Minor, and it has therefore been attributed to the kingdom of Lydia, the major power in the area."⁷⁸ This is at best a tenable conjecture, rather than a firm basis for establishing that Lydia created the first coinage. If the Basis deposits can in fact be dated to the early sixth century, the coins could then be attributed to the time of King Alyattes (c. 610-560 BC).

The dating of the coins at the Artemision is, to say the least, controversial. The nineteen coins found in the pot has created substantial discussion. Art history considerations suggest the pot might be as old as 650-625 BC, which seems to push the date back in time. However, the pot could be either older or younger than the coins. Old coins in a new pot would push the date of coinage back to the literary tradition of the early seventh century, as older writers, relying on Aristotle and Herodotus had thought. On the other hand, the pot could be much older than the coins, and suggest a date not much earlier than the time of Croesus.⁷⁹

9. Weight and Purity

We cannot be sure which if any of the coins can be attributed to Lydia or the date at which the first coins appeared. Nevertheless, we can analyze the coins from an economic perspective and in particular try to find out the economic significance of the mark or so-called guarantee on the early coins? One theory, so widespread that it might be termed the conventional wisdom, is that coinage represented a service provided by the state to guarantee that the purity of the coins. But this theory is confronted immediately by a difficulty in the case of the earliest coins. They were made of electrum, a mixture of gold and silver. If the early coins are natural electrum, as has been generally assumed, how would the early producers making coins three centuries before Archimedes discovered how to determine specific gravity, determine the fineness of an electrum coin? And what would be the use of knowing the weight if the fineness were indeterminate? The coins under analysis will be those often attributed to Lydia and I shall refer to them as 'Lydian coins.'

This is not to say that it was impossible to assay the coins without the benefit of the technology Archimedes invented later. An alternative method, using touchstone, was known to the ancients: asserts: "Touchstone is a black siliceous stone used to ascertain the purity of gold and silver. Assaying by "touch" was one of the earliest methods employed to assess the quality of precious metals. The metal to be assayed is rubbed on the touchstone, adjacent to the rubbing on the touchstone of a sample of a metal of known purity. The streaks of metal left behind on the touchstone are then treated with nitric acid, which dissolves impurities, and thus, when the streaks are compared, the contrast between pure and impure metal is heightened. Because other metals, such

as copper, can be alloyed to silver without significantly changing its color, the touchstone method is not usually employed now to assay silver. It is still used, however, to assay gold and provides a reasonably accurate guide to quality.”⁸⁰

Did the ancient Lydians use touchstone? Sture Bolin argues plausibly that they did. Touchstone was mentioned as early as 500 BC by Theognis, a Greek poet from Megara, near Athens, who flourished in the late sixth and early fifth centuries. The fourth century philosopher Theophrastus (a native of Mytilene in Lesbos, who was a pupil of Aristotle and his replacement at the Lyceum) gives detailed information, saying it is possible to test gold either by fire or rubbing against a touchstone. Theophrastus also comments that touchstones are only found at Tmolus in Lydia, the land in which electrum coinage was first used.⁸¹ Other writers confirm that the ancient Greeks had this technique.⁸²

It is therefore clear that the ancient Greeks had the ability to recognize artificial electrum. Other evidence makes clear that some cities could and did coordinate the standard and weights of their coins. Mytilene and Phokaia, for example, signed an international monetary agreement in the late fifth or early fourth centuries that established uniformity in standard and weight of their “hectae” coins. Each was to coin for a year, in turn, Mytilene beginning. It is clear from the context that the treaty renewed agreements made much earlier. This was quite probably the earliest international monetary agreements on record.⁸³

We can now study some of the ‘Lydian’ coins. Fortunately, we have the careful studies summarized by Sture Bolin whose book on the Roman Empire, published in 1958, included an analysis of ‘Lydian’ coinage.⁸⁴ His first effort was to find out whether the early Lydian coins were of equal value and he therefore undertook first to examine their weights. From a sample of 61 of the coins--all 1/3 staters--that are generally assigned by numismatists to Lydia, he finds that their average weight is 4.7 grams, that the variation in weight is from 4.38 to 4.76. Apart from the extremes, Bolin finds that 57 of the 61 coins differ from the average by less than 2%. This is persuasive evidence that the staters were designed to have the same weight and that the error, given the comparatively primitive technology, is remarkably small.

The next question is to examine their fineness, i.e., the proportion of gold in the coins. Here Bolin shows that, in a sample of 19 coins, the coins are not even close to being uniform. The lowest percentage of gold is about 31%, the highest, approximately 54.9%. The average gold content of the 19 coins is about 45.7%.⁸⁵ It is therefore safe to say that for the early coins, the weight is very uniform but the fineness varies considerably.

This conclusion casts doubt on the common view that the function of the stamp on a coin is to guarantee either its fineness or to certify its value. It is clear that the coins varied considerably in their commodity value, by a range that depends on the relative valuations of gold and silver. To establish the range of variations in the values, Bolin selected what he considered to be lower and upper limits on the bimetallic ratio, the price of gold in terms of silver, choosing 10:1 for the lower limit and 15:1 for the upper limit, noting in passing that in the 7th century BC gold was typically worth 13 times as much as silver.⁸⁶ On his assumption, using the former ratio, the poorest of the 19 coins would then be worth 63.8% of the best; using the latter ratio, the corresponding figure would

be 61.5%. This is an enormous difference for coins that are expected to exchange at par.

The conclusion is quite remarkable. All the coins have the same weight and stamp, yet they have widely different metallic values.⁸⁷ This fact makes it extremely unlikely that the stamp on the electrum coins certified the commodity value of the coin, as is commonly assumed.

To discover the true significance of coinage, it is necessary to examine the early electrum coins to see whether their proportions of gold and silver are consistent with the traditional view that the early coins were made from electrum found in its natural state from the River Patroclus.

The first point to note is that, because there is no theoretical limit to the capacity of gold and silver in a crystalline state to form alloys, the proportions of gold and silver can vary considerably from coin to coin. Nevertheless, natural electrum from a vast number of different sources, Bolin concludes, nearly always have been found to have a gold content of over 49.6%.⁸⁸ Unfortunately, these samples do not include natural electrum from Lydia. To fill the gap, Bolin infers from a passage in Herodotus that natural electrum in Lydia had a high gold content. Herodotus relates that “King Croesus once presented a number of brick-shaped blocks of gold of equal size to the oracle at Delphi. Four of them were of *refined gold* and each weighed 2 ½ talents; the others which were of *white gold* [electrum], weighed 2 talents each. It was long ago pointed out that it is easy to use this information to work on the content of the white gold; it consists of approximately 71% of gold. What is of special interest in this reference is that Herodotus makes such a sharp distinction between “refined gold” and “white gold,” and deliberately contrasts them. The white gold is clearly not refined and so must correspond to the natural alloy of gold and silver found in Lydia. That natural electrum in that country should have an average gold content of approximately 71% seems very likely.”⁸⁹ Bolin then proceeds to relate this conjecture to samples from Transylvania, which show a gold content between 84.9% and 60.5%, and show an average percentage of approximately 70%.

If the proportion of gold in the natural electrum from Lydia is taken to be about 70%, it is obvious that the earliest ‘Lydian’ coins were not natural electrum. In the sample of 19 Lydian coins Bolin had assembled from various sources, the gold content ranged from a low of 31% to a high of 54.9%. From other sources, he noted that there have been isolated examples of coins with gold percentages as high as 75%, but “the overwhelming majority of the coins contain less than 60% gold, and about 70% of them less than 55% of gold.”⁹⁰

The evidence, therefore, proves that early Lydian coins were not natural electrum. They must have been *artificial* electrum. Is there a difficulty here? For a long time it was assumed that there was no alternative to electrum because the technology for separating gold from silver did not exist. Whereas base metals could be smelted from a mixture to make electrum, it was not possible to take the final step and eliminate the silver from the gold. But this view is no longer tenable. Evidence from Egypt shows that as early as the 12th dynasty (according to traditional dating, 1991-1786 BC), the technology for making pure gold existed. To check further, Bolin requested studies from an expedition to Cyprus that examined finds of gold objects from Cyprus in the period 1050 to 950 BC. The results showed that the poorest quality of gold was 21.2 carats and the finest, 23.85 carats, confirming that, in an area as close to Lydia as Cyprus, and taking into account the amount of trade

that was known to have taken place, 7th century Lydia must have either had or been able to import the technology to refine gold and therefore to make artificial electrum.

If the coins had the same weight but different proportions of gold and silver, would they be accepted for the same value? It is certainly possible that the answer is yes, and this for four reasons: (1) the ancient Lydians considered electrum as a separate metal⁹¹ and would accept the coins as of equal value even if one were paler than the other; (2) as long as the metal stayed in the coins, their composition did not matter as long as their exchange value was fixed; and (3) the convenience of being able to count the coins instead of weighing and assaying them may have been so great that the coins were in great demand, even as a store of value; and (4) Lydian was a strong central state which in its heyday (like that of Persia later) could force the acceptance of overvalued coins by making them “legal tender.” If the coins were used for troops, the latter might not have been in a position to refuse them. In all probability, the stamp on the coins was designed to specify a common value not the weight of the coins.

The true value of the coins, of course, depends on what they will buy in exchange. How much were the coins worth? The coins studied above were 1/3 staters. How valuable were they? A lump of electrum weighing 4.7 grams, or about 1/6 of an ounce, must have had considerable metallic value at the time. If the lump were pure gold, it would be worth--as metal--\$47 today, valuing gold at \$281.25 an ounce or \$10 a gram. If it were half gold and half silver, it would be worth about \$28.50, valuing silver at \$5.624 an ounce or \$0.20 a gram.⁹² By this reckoning, the metal in a gold stater would be worth \$180 and in an electrum stater that was half gold, \$100. The 1/3 stater coins must have had substantial purchasing power in the old days.

No sooner is one question answered than another presents himself! Why were the coins of such high value issued? They were clearly not coins suitable for the marketplace. Conceivably, they could have been used for paying troops, tributes, or for medals, or for use in international trade. The low gold content of the contributions to the Artemisium suggests, in accordance with the modern economic theory of charity, that the Lydian kings sent overvalued coins, perhaps on the belief that the god would not know the difference!

Let us now try to reconstruct the situation in Lydia before coinage existed. Refined metals could have been weighed for use in exchange but there was no point to weighing the pieces of electrum because of the wide variations in their value and the high transactions costs in assaying the coins by the touchstone method. Unlike gold and silver, electrum was not suitable for use in exchange when it exchanged by weight. On the other hand, Lydians were willing to accept electrum in the form of coins and presumably allow them to exchange at their stamped value.

Let us suppose that the average electrum in Lydia is 70 per cent gold. The government of Lydia gets the idea to take in (say) ounces of electrum and return in exchange, stater coins that are by law homogenous in value and that *must* be exchanged for one another at equal value without concern for purity. Since it is comparatively easy to standardize weight, the new electrum coins have more or less the same weight, according to the tolerance level set by technology and care.

The public is not hurt--at least in the short run--by this substitution. Insofar as staters are now

homogeneous in value and acceptable for payment of debt under force of law, the new currency is better than the old. The coins become “current” and are required by law to be accepted at face value. There is no longer the need to worry about weighing lumps of bullion and or ascertaining their gold content. It no longer matters if one coin has more or less gold in it than another as long as it can be exchanged without discount. It does not even matter if the average purity of the electrum coins is the same or smaller than the average purity of the electrum sold in exchange for coins.

Herein lies the motive for currency manipulation. The government can exact “seigniorage” by reducing the average purity of the electrum coins below the average purity of the natural electrum. If the government bought a pound of electrum containing 70% gold and turned it into coin containing 50% gold, it would reap the difference as seigniorage profits. The lower the purity of the electrum coins issued, the greater the seigniorage.

Far from balking at this innovation, the Lydians might have enjoyed it. They could use the stamped staters for trade just as well as weighed metal, but without the inconvenience. If the government made a profit, so be it; it was a benign alternative to increased taxation.

The idea of the state replacing weighed money with overvalued money might have been a novelty to the ancient world, but it should be easy for the modern world, which relies on nothing but overvalued money, to understand. In the 18th century, David Hume made much of the advantages (and dangers!) that could accrue to the government when it replaced specie with convertible paper money; and Adam Smith made famous his “highway in the sky” metaphor that seemed to suggest the replacement of specie with a token money was a free good. How much less radical is the act of replacing high quality electrum, not with cheap paper but with electrum of a lower standard? We shall see this experiment repeated time and again all over the ancient world and in the Middle Ages..

It is important to notice, however, that a monetary innovation like that made by the Lydians could only succeed in the long run with a militarily secure state and a strong government. A militarily secure state is necessary because in its absence, at the first threat of invasion, the overvalued coins would succumb toward their commodity value and inflation would break out. Only states that are militarily secure can succeed in overvaluing their currencies.

A strong government is needed to prevent entry into the money industry and counterfeiting. To prevent this, the government must establish a monopoly, not only of coining but of the mining industries producing the raw material for the electrum coins. Such measures would be easy in an Oriental despotism like the Lydian monarchy. This fact, combined with the availability of the raw material in the Patroclus River explains why it was Lydia, and not, say, Miletus, that had the authority, if not the idea, to issue overvalued money.

The gains from this monopoly would be impressive. Suppose--just for the sake of illustration--that the money requirements of ancient Lydia amounted to one-quarter of national income, and that the state overvalued the coinage by 100 per cent. This means that the state produced gold worth, say, 100 staters and struck them into coins that it valued at 200 staters. In this case the seigniorage would be 12 1/2% of national income,⁹³ a once-for-all, not a recurring gain that can be repeated only to the

extent of depreciation-cum-replacement demand, and economic growth.

Economic growth can be achieved by increased population (and labor force), higher productivity or conquest. If Lydia expanded its boundaries, it would expand its market for overvalued coins and augment its seigniorage profits. Is it a coincidence that Lydia embarked on its period of greatest expansion after its discovery of the seigniorage machine, or was the latter merely a passive factor in financing the military outburst? Whatever the answer, seigniorage may be played a role in making Croesus the wealthiest man in his world.

Lydia was not a great power on the scale of the great empires of history, and it succumbed forever under the might of Persia. Its actual impact on the history of the international monetary system is slight. But ideas live longer than empires! The kind of monetary system started by Croesus was taken as a model by the empires of Persia, Macedonia, Rome and Byzantium, and established a pattern in the international monetary system that was to last throughout the western and then the eastern Roman Empire until the destruction of the power of Byzantium with the sacking of Constantinople by the Crusaders in AD 1204.

10. Conclusions

The literary evidence does not support the common claim that Herodotus or Xenophanes asserted that coinage was invented by the Lydians. Rather, they asserted that Lydia introduced the first coins of gold and silver. “Gold and silver” does not mean electrum; Herodotus knew perfectly well what electrum or “white silver” was. Because Xenophanes as a young man was a subject of the Lydian Empire, he was no doubt referring to the bimetallic system created by Croesus of gold and silver coins. In one of his poems he has some people sitting around drinking and asking each other: How old were you when the Mede came?” When as a very old man (he died at the age of 92) the world became accustomed to Persian coins circulating through the Aegean he probably wanted to point out that the Lydians had created coinage before the Persians (and their cousins, the Medes).

The earliest coins were made of electrum and had punch marks and some kind of identifying device. The remarks of Herodotus cannot be used to link Lydia with these electrum coins, at least before Croesus.⁹⁴ One of the most famous streams in antiquity was the Pactolus, which flowed just to the west of the acropolis of Sardis, before joining the River Hermus.⁹⁵ It is therefore likely that Lydia was the source of much of the gold in the early coins. But this does not imply that the coins were struck in Lydia.

The early coins, many of which have been attributed to Lydia, conformed to specific weight standards, which have been identified as staters or more commonly fractions of staters. Coins of the same denomination had a virtually uniform weight. Their fineness or purity, however, differed greatly and so therefore did the fallback value of the coins, taking into account the fact that gold was worth more than ten times the value of silver.

The coins were typically not much more than half gold. By contrast, natural electrum was about 70 per cent gold. The coins therefore gave indication of refining and probably the use of the touchstone

method for determining, before Archimedes, the fineness of the coins. The electrum coins were overvalued, yielding profit or seigniorage to the issuer.

If the early pieces were coins, those of the same weight would exchange at par, despite differences in fineness. This overvaluation indicates that the issuing state must have been strong enough to enforce a monopoly of coinage, inhibiting entry by drastic prohibitions. Lydia was probably such a strong state before the Persian conquest, but the designation would apply even more to Persia under Darius. By 500 BC massive quantities of Persian sigloi were being struck and making that coin an international currency along with the gold coins of Lampsacus and the electrum coins of Cyzicus..

Besides the possibility of Lydia, some of the earliest coins might have originated from Ephesus (stag or be), Phocaea (seal's head), Miletus (recumbent lion), the island of Samos (lion's head facing, or bullhead or forepart of bull), Chios (seated Sphinx), Caria (archaic head of Aphrodite), Cos (crab) or Parium (gorgon-head), the city of Cyzicus, or the island of Aegina (tortoise, symbol of Aphrodite).

Finally, the question of dates. These will always be to a certain extent at the mercy of the next archaeological discovery. It seems safe to conclude that coinage was being produced in the early years of the seventh century and certainly by 560 BC. A date of the origin of coinage in the last half of the seventh century cannot, however, be ruled out.

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ENDNOTES

1.Howgego (1995: 2).

2.It cannot be established definitely from existing coins that Athens had a coinage system before 600BC. Where there is no reference to a ruler, dating must depend on chronology by style, by the style periods themselves, especially in the "period of archaic art" are very uncertain. Seaby (1975: 91) lists some three-eighths obols (trihemitetartemoriion) coins attributed to 600 BC, with a pomegranate on the obverse and incuse square on the reverse; silver obols with a wheel and four spokes on the obverse; and silver drachmas of the same type that he dates c. 594-562 BC. The famous owl coins are dated 560-490 BC. They have on the obverse the head of Athena, of very archaic style, wearing a close-fitting crested helmet and round ear-ring, and on the reverse, a standing owl, head facing and wings closed; behind, spray of olive, all in shallow incuse, with the letters AΘE, the abbreviation for Athens.

3.The heraldic coins are called by the German term *Wappenmünzen* in the numismatic jargon. See Carradice and Price (1988: 37). .

4.*Ibid.* See also Carradice (1995: 25).

5.*Ibid.* The eye was "archaic" because it was in profile, creating an astonishing effect.

6.*Ibid.*

7. Seaby (1975: 8-9).

8. Del Mar (1895: 55). This differs from the equivalents used by many metrologists and numismatists, which is commonly taken to be as follows: 7 lepta = 1 chalcus; 8 chalchi = 1 obolus; 6 oboli = 1 drachma; 20 drachmas = 1 stater; 5 staters = 1 mina; 60 minas = 1 talent, with the talent from half a quintal to 72 pounds weight of silver. The system is “strangely defective,” according to Del Mar (*ibid.*), because it “embraces in one system the coins of different ages; it fails to distinguish coins that were issued at the ratio of 10 from those which were issued at the ratio of 12; it mistakes weights for coins, and the talent, which here was a sum of silver coins, for a weight or a sum of gold ones.” Other writers lean toward the equation 6 oboli = 1 drachma, but according to Del Mar, this occurs at a later period.

9. The equivalent of the stater in Persia was the daric, a coin containing 129.3 grains of gold. Its name derives either from the Persian word for king, or, more probably, from the effigy of a kneeling archer, which is stamped on them, Danaus being the Indian word for that Sign of the Zodiac. On this see Del Mar (1895: 26)..

10. An example may help to indicate the type of confusion that can arise. When Alexander the Great captured Persepolis and Susa in 331 BC and brought about the downfall of that historic empire, his spoils were said to amount to the sum of 170,000 talents of the precious metals. But are these talents *weight* or talents *value*? The two interpretations would have radically different values. The former would be worth billions of dollars in today’s money whereas the latter would be worth at best tens of millions of dollars. Keynes assumed that the former was meant and therefore that “it is no wonder that the release of this enormous sum into active circulation should have had a catastrophic effect on the price level.” He even offered the conjecture that release of this hoard “was responsible for the outburst of economic progress in the Mediterranean basin, of which Carthage attempted and Rome ultimately succeeded to reap the fruits...” Keynes followed writers who interpreted talents as talent weight rather than value, exaggerating by several magnitudes the impact on Roman history of the captured treasure.

What was meant by 170,000 talents of gold and silver?” Is the “talent” here a value or a weight? *Prima facie*, it would seem to be a value, otherwise, how could metals of such different value as gold and silver be added together. But if it is a weight, the value of the treasure would depend on the proportion of gold and silver. Let us assume, as the dictionary says, that the ancient talent-weight is 60 pounds or 720 troy ounces. By this reckoning, the Persian treasure weighed 122,400,000 ounces! If this were all gold it would be worth, at \$350 per ounce, \$41,840,000,000; if it were all silver, at a ratio of 12:1, it would be worth \$3,486,666,666. This would set, respectively, upper and lower limits on the value of the treasure.

A calculation made by Andréadès, and endorsed by Keynes, utilizes the estimated proportions of gold and silver in the treasure, and arrives at a value of £43,000,000, in the money of 1930, which was equivalent to 10,131,108 ounces of gold. Valued at \$350 per ounce, the treasure would correspond to \$3,545,887,760 of today’s money.

Alexander's army seldom numbered above 40,000 soldiers. If the conclusions are to be believed, it would mean that, had the hoard been divided up equally, each soldier would have received the equivalent of 800 ounces of gold, worth \$280,000 at today's prices (at \$350 the ounce). Such a sum would allow each soldier to bask in luxury for the rest of his life. But is the figure credible? There is no record that such quantities had ever been accumulated in ancient history.

It is more likely that the total of 170,000 talents found in the Persian hoards did not represent the talent weight of about 60 pounds but the talent value. It is unlikely that the "sum" of 170,000 talents would have been added together as a weight if they contained both gold and silver; it was more likely that it meant talent "value." In ancient Greece, the talent value was traditionally equal to 100 drachmas.

Taking the talent measuring the Persian treasure to mean $5 \times 127 = 635$ grains of gold, its value would be $170,000 \times 635 = 107,950,000$ grains of gold $= 107,950,000/480 = 224,895.8$ ounces of gold, or 5.6 ounces per soldier. This is still a large sum, especially taking account its greater purchasing power at the time, but it is of a different order of magnitude from the currently accepted figure. Had the figure Keynes accepted been correct, it would indeed have had a cataclysmic effect on the price level in the Mediterranean, the Middle East and the rest of the known world. Keynes says: "...it is no wonder that the release of this enormous sum into the active circulation should have had a catastrophic effect on the price level." But there is absolutely no evidence of any permanent change in the price level such as would have resulted from a sudden release of hitherto hoarded money.

To conclude, a talent applied to such a valuable metal as gold never meant the talent weight. Instead, it was a quantity of gold that might have had the same value as a talent-weight of some other substance, or it might have represented the value in gold of the most important unit of account in the ancient world, the ox or cow.

11. Carradice (1995: 11).

12. *Ibid.*

13. *Ibid.*

14. *Ibid.*

15. In Northern Europe the amount of silver that exchanged for a libra of five Roman aurei (or bezants), the standard unit of value in the Roman Byzantine Empire, was called a mark in Scandinavia and Germany and a pound in England. Because the bimetallic ratio was 8:1 in the Gothic countries and 12:1 in the countries that had fallen under the sway of Christendom, the mark settled as a weight that was $2/3$ of the pound, a relation that persisted throughout the Middle Ages. In Britain, a mark was 160 pennies or 13s. 4d.

16. Del Mar (1895: 36) writes: "Judging from the Egyptian ratio shown in the inscriptions of

Tutmosis at Karnak and the Persian and Greek ratios of a later period, the ratio in the punched moneys of Argos and Miletus was 13.” He refers to Brandis (1866) who gives the Egyptian ratio at 13 1/3.

17.*Ibid.*

18.*Ibid.*

19. In later times, the *she* was no longer the basic unit and small quantities were expressed as fractions of the shilu, the smallest being 1/24 *shiklu* = one *obol*. See Contenau (1954: 88). It may be noted here that Babylonian grain \approx 3/4 English grains, a difference that may have originated because wheat grains weigh on the average three-quarters of a barley grain.

20.Burns (1927: 250). Burns refers to Hultsch’s *Metrologie*, 393.

21.Burns (1927: 250).

22.Ridgeway (1892: 231).

23.*Ibid.*

24.Ridgeway (1892). Ridgeway, a classics scholar, seems to have been the only author to have noticed the absurdity of regarding a talent of gold as a weight and to have made the connection between the talent and the ox.

25.*Ibid.*

26.More precisely, the times in which the versions of Homer that came down to us were last modified. It is generally believed that the *Iliad* and the *Odyssey* were put in their final form not earlier than the eighth century BC, so ideas in it might reflect contemporary eight century conditions rather than actual conditions in the Mycenaean era several centuries earlier.

27.Del Mar (1895: 28).

28.Del Mar (1895: 57).

29.*Genesis*, 23, 16.

30.Fall-back value may be less than the value of the metal in a coin if there are costs to turning the coin into usable metal.

31.A similar comment applies to the seals of India, about 1" square, made of soapstone. Thousands of such seals have been found at Mohenjo Daro (2500-1500 BC) on the Indus River (nor far from the Arabian Sea) and many others as far away as Babylonia and the Persian Gulf. They were probably symbols of debt perhaps convertible into one of goods and could have served

the purposes of a circulating medium.

32.Del Mar (1885: 154) writes: “No coins have ever been found, either of Assyria or Babylon; yet mention is frequently made in the clay tablets upon which the public annals of these countries were inscribed, both of sales of property for money and of loans of money upon interest. It is difficult to escape the conviction that the moneys of these empires were made of baked clay, and that many of the exceedingly numerous so-called seals or signets of this material which have rewarded the researches of Layard, Loftus, and Botta, are in fact moneys. Such certainly seems to be the character of some of those found at Nimroud, and now in the British museum. They are small baked cylinders of baked clay, about an inch in length, and impressed with the figure of a king slaying a lion. If they were seals and not moneys, they would surely present a greater diversity of type, and have been made of some harder and more valuable material than clay. Their resemblance to the clay moneys of other countries is a strong argument in favour of attributing this character to them.” Keynes, Einzig and other economists have likewise believed clay money of this type was widely used in the ancient cultures.

33.The fact that systems of overvalued money require a strong central state has a converse: when a state breaks down, so does the monetary system. If a state with an overvalued money is invaded and conquered, the its money falls to its fallback value and prices soar. Soaring prices or “price spikes” is tell-tale evidence of a breakdown in central authority, providing to the historian invaluable clues with respect to particular dates.

34.Rawlings (1935: 5).

35.The original meaning of “history” was “inquiry.” Herodotus introduces his book with the following declaration:

“I, Herodotus of Halicarnassus, am here setting forth my history, that time may not draw the color from what man has brought into being, nor those great and wonderful deeds, manifested by both Greeks and barbarians, fail of their report, and together with all this, the reason why they fought one another. ”

It was the Roman statesman Cicero who first dubbed Herodotus the “father of history.”

36.Xenophanes was regarded by Plato as the founder of the Eleatic School, which in the hands of Parmenides and Xeno of Elea, came to mean a curious set of ideas that abstracted from the existence of time.

37.In his ten-volume “thesaurus,” *Onomasticon* (9, 83), Pollux writes: “It would probably be thought over-ambitious to add to an account of coinage a discussion of the question of whether Pheidon of Argos was the first to strike coins, or Demodice of Cyme, wife of the Phrygian Midas and daughter of Agamemnon king of Cyme, or the Athenians Erichthonius and Lycus, or the Lydians, as Xenophanes says, or the Naxians, which is the opinion of Aglaosthenese.” See Carradice (1995: 20). Pollux, a Greek scholar and rhetorician, was born in Egypt, and appointed by the emperor Commodus to a chair of rhetoric in Athens.

38.Howgego (1995: 1).

39.Howgego refers here to Kraay (1976: 313).

40. Grant (1988: 291).

41.Rawlings (1935: 23).

42.The precise nature of the Lydian bimetallic system, however, is by no means clear. There is a world of difference between bimetallic systems based on free coinage (which rules out overvaluation) such as that which existed in the nineteenth century until 1873, and bimetallic systems in which one or both of the metals is overvalued, the prevailing system developed later in the Persian and Roman empires.

43.Scholars differ, however, on exactly when Pheidon ruled Argos; the choice boils down to sometime between the middle of the 8th and the first half of the 7th century. See Ehrenberg (1973: 37). An earlier source, Del Mar (1895, p.39), places the action of Pheidon in 895 B.C., which now seems much too early. Einzig (1962) places Pheidon at c. 748-680 BC.

44.Pausanias (fl. A.D. 143-176) wrote a 10-volume work called *Description*, which takes the form of a tour of Greece. The great scholar, Sir James Frazer, said of Pausanias: “without him the ruins of Greece would for the most part be a labyrinth without a clue, a riddle without an answer.”

45.*Plutarch's Lives*. Modern Library Edition (Lycurgus).

46.*Enc. Brit* (CD-ROM , 1999: Pausanias).

47.Quoted in Del Mar (1895: 44). Del Mar argues that “...Pausanias, [Homer's] commentator—himself a learned Greek antiquarian, was of the opinion that wealth here meant money. Elsewhere the same author (*Argolics* 30) mentions the “ancient coins of the Troezen [the land of Argolis over which Theseus came to reign], which bear the figure of a trident and the head of Minerva,” and which he evidently alludes to (though not explicitly) in connection with the remote and mythical period when the Egyptian god Horus and the Greek god Neptune divided the dominion of Argos between them.”

48.Del Mar (1895: 46). Creon was the king of Thebes who assumed the throne after the deaths of his two warring nephews, Eteocles, who was defending the city and his crown, and Polyneices, who was attacking Thebes. After an elaborate burial of Eteocles, he forbade the removal of the corpse of Polyneices, condemning it to lie unburied, declaring him to have been a traitor. But Polyneices' half-sister and half-aunt, Antigone, buried him secretly, for which she was ordered to be executed by Creon and was immured in a cave, where, in Sophocles version, she hanged herself and her beloved, Haemon, son of Creon, committed suicide. Antigone was the daughter of King Oedipus and her own grandmother, Jocasta.

49.A final reference, not entirely satisfactory, is worth noting. What is said to be the earliest

reference to coinage in literature “records that two thousand staters, almost certainly in coin, were given to the poet-statesman Alcaeus by the Lydian king for military purposes in the early sixth century.”(Carradice and Price (1988). The poet, who was a favorite model of the Roman poet Horace, was believed to have captured the spirit and values of the city-states of the Aegean, as for example, when he declares where real greatness lies: “Not in well-fashioned houses, nor in walls, canals, and dockyards, but in men who use whatever Fortune sends them.” (*Enc. Brit.* CD-ROM: Alcaeus). There is a confusion somewhere, however, with respect to dates and the reference may be spurious. According to the encyclopedia, Alcaeus was born c. 620 BC in Mytilene, Lesbos and died c. 580 BC, too early for the connection referred to in Lydia. The poet was, however, involved in politics. His city, Myteline, had been stabilized, with Alcaeus’ help, by Pittacus (who was rated as one of the Seven Sages of Greece) who, however, turned against the poet and earned his hatred, deriding him for his splayfeet, fat belly, stinginess and intemperance and said: “They have set up the low-born Pittacus as a tyrant over our gutless and godforsaken city.” (*Ibid.*). With respect to Pittacus there is, among other maxims and a few lines of verse, a letter to Croesus (*Enc. Brit.* 1999: Pittacus). This is clearly spurious, and so may be the reference to Alcaeus.

50. On the date of the first Lydian coinage, see Robinson (1951: 156 ff.).

51. E. Curtius, quoted in Ridgeway (1892: 201).

52. Plato’s version of Gyges’ usurpation, in *The Republic*, is that Gyges was a shepherd who found a ring that made him invisible and used it to seduce the queen and murder the king. A third version, provided by Nicholas of Damascus in the first century B.C., drawing upon the fifth century Lydian historian Xanthus, depicted Gyges as an army officer, already suspected of treachery by the royal house, who killed Candaules after the queen had accused him of attempted seduction.

53. EB CD-ROM 1995 (Midas).

54. Rawlings (1935: 23).

55. Olmstead (1948: 40).

56. *ibid.*

57. According to Grant (1988: 155), Polycrates, tyrant of Samos, established a brothel based on those at Sardis. Polycrates rose to power about 540 BC. Besides embarking on a successful building program and expanding the economy with masterful engineering projects, he built up his army and especially the navy to make Samos the most effective maritime power in Greece, for a time holding the balance between the Persian and Egyptian empires. His ambition got the better of him, however, and he was lured into the Persian satrapy at Sardis, where he was crucified.

58. Grant (88: 291).

59. *Ibid.*

60.Howgego (1995: 13); his references are to Balmuth (1971) and Furtwängler (1986: 157).

61.See Sigler (1950); Howe (1950); Balmuth (1975); Banning (1988).

62.This paragraph is based on Olmstead (1959: 187).

63. Egyptian weight and value standards were based on a decimal system using the kedet, the deben and the sep such that 1 sep = 10 deben = 100 kedets. The deben weighed about 91 grams, its tenth part, the kedet, 9.1 grams, and its multiple, the sep, 910 grams. These weights, however, were not the unit of reckoning. There was another unit, sometimes called a “piece,” equal to 1/12 deben (7.6 grams); thus 12 pieces = 1 deben. The piece has been described as ‘a flat, round piece of metal...possibly with an inscription to indicate’ its ‘weight or the name of the issuing authority.’ The piece seemed to be used as the unit in which prices were quoted. In the 18th dynasty, eight “pieces” (2/3 deben) of silver would buy a bull or a cow or the service of a female slave for four days; six pieces, a heifer or three arouras (two acres) of (poor) land; and three and a half pieces, a linen garment of good quality. See Hayes (1973: 388). In view of recent discussions of a possible revision of Egyptian chronology, bringing the eighteenth dynasty closer to the turn of the millennium, a reconsideration of the Egyptian role in coinage should not be excluded.

64.See, for example, Casey (1986: 60). The study of English hoards is based on Brown and Dolley (1971).

65.The Artemision measured no less than 110 by 55 meters. The statue has also been characterized as an “un-Greek representation of a mummy-like goddess, standing stiffly straight, with her hands extended outward. The original statue was made of gold, ebony, silver, and black stone, the legs and hips covered by a garment decorated with reliefs of animals and bees and the top of the body festooned with breasts; here head was adorned with a high-pillared headdress.” *Encyc. Brit.* (CD-ROM: Artemis). It “stood beneath a columned canopy in the center of the shrine. The edifice was long and narrow and probably roofless, and although various features remain disputable, its interior apparently displayed a forest of colonnades, reminiscent of Egyptian and other near-Eastern temples. The exterior seems to have been surrounded by a double row of slender fluted Ionic columns supplemented by a third across the front, behind which the entrance porch (*pronaos*) contained two further parallel rows of four columns, leading into the main sanctuary. The façade, surmounted by huge, painted Ionic capital, supported a marble architrave, bridging an unprecedented span.” Grant (1988: 170).

66.*Ibid.*

67.The following description of the hoard relies importantly on Carradice and Price (1988: 24).

68.*Ibid.*

69.Rawlings (1935: 26).

70.*Ibid.*

71.Seaby (1975: 7) asserts that the coin wa found at Halicarnassus, but this seems to be an error.

72.Carradice (1995: 22).

73.*Ibid.*

74.*Ibid.*

75. More exactly, by the keeper of the coins of the British Museum, Barclay V. Head (1844-1914), who pioneered the use of published photographs in his study of the coinage of Syracuse in the *Numismatic Chronicle* of 1874 (see Carradice and Price (1988: 12)). The classification is useful in summarizing information for long periods in an area that is connected by common techniques. Nevertheless, it suffers from over-aggregation and cannot be relied on for wide areas between which the transmission of styles and techniques is slow.

76.Carradice and Price (1988: 25).

77.*Ibid.*

78.*Ibid.*

79.See the discussion in Howgego (1995: 2-3).

80.*Enc. Brit.* (CD-ROM: Touchstone).

81.*ibid.*

82. Ridgeway (1895: 104).

83.See the discussion in Rawlings (1908, 1935: 31-32); and Healy (1957): For further references and a recent discussion, see the article by Marotta (1995). The treaty, written on stone, was discovered in a home on the site of the ancient Mytilene acropolis by Charles Newton, British Vice Counsel, and published by him in *Transactions of the Royal Literary Society*, VIII in 1866.

84.Bolin (1958: Ch. 1).

85.*ibid.*

86.A defect of Bolin's work throughout is that, while recognizing the possibility of overvaluation of both silver and gold at different times in history, he fails to take into consideration the possibility that gold is overvalued *relative* to silver. The prevalent 7th century ratio of 13:1 is almost certainly the overvalued ratio of the Persian Empire.

87.*ibid.*

88.*ibid.*

89.*ibid.*

90.*ibid.*

91.Hammer (1908: 18ff.); Burns (1927); Bolin (*ibid.*)..

92.This implies a bimetallic ratio of 50:1. Of course in ancient Greece it was closer to 10:1 so the change in the ratio would not have been so abrupt with the change in purity. It should however also be noted that the value of gold in ancient times was much higher in terms of purchasing power over ordinary commodities than it is today.

93.The assumption that one quarter of national income is held as money might be appropriate for a modern economy but is probably a gross overestimate for an economy in the ancient world.

94.For a contrary view, however, see Carradice and Price (1988: 24) who write: “By the time of Herodotus the early electrum coinage had been replaced nearly everywhere by silver and (to a much lesser extent) gold, so that it is usually thought that Herodotus is not making a distinction between gold and silver, as opposed to electrum coinage, but is referring simply to the invention of coinage in general.”

95.Rutter (1983: 9).