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THE PRECIOUS METAL OUTLOOK

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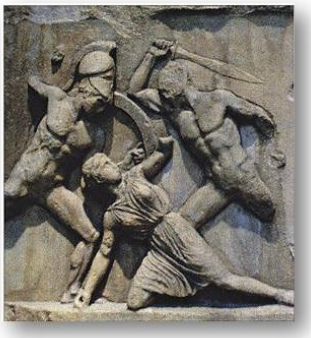
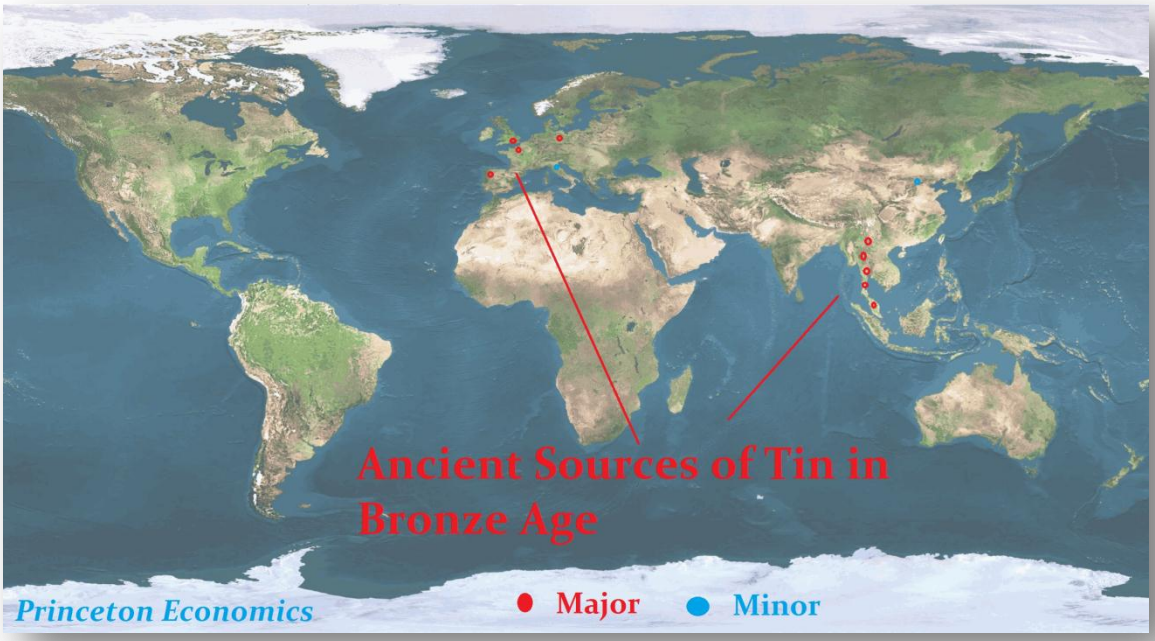
Discovery of Tools - Scene for 2001 Space Odyssey

THE BRONZE AGE & METAL

A history of man cannot be separated from a history of metal. The classic scene from 2001 A Space Odyssey is when the humanoid-ape discovers a bone and begins to use it smashing other bones. He then turns it into a weapon. Aside from the theological debate about our origins, the representation is quite accurate for with the invention of a knife to get food was the synonymous invention of weapons. For this dual purpose, the invention of bronze was such a profound advancement, we take it for granted and gloss-over what collateral change it made even economically. To the dismay of many, the importance of bronze (copper + tin) economically is that this single advancement inspired international trade establishing a global economy that most would simple do not appreciate. Here lie the origins of international markets that created the necessity for written language, navigation, foreign exchange with the standardization of mediums of exchange that led to the very concept of money.

ANCIENT GREEK BRONZE SWORDS





It was the discovery of adding tin to copper producing bronze, creating a harder metal to make plows and swords that inspired men to sail great distanced to obtain this rare additive - tin. In ancient times, the two major known sources of tin were the southeastern tin belt running from Yunnan province in China down the Malaysian Peninsula that enabled Asia to enter the Bronze Age and Devon as well as Cornwall in England. To obtain this rich source of tin that was mined well into the Middle Ages, the Minoans had to sail beyond the Pillars of Hercules and into the Atlantic Ocean up to England. Because of their skills, the Minoans became perhaps the greatest international traders giving birth to the global economy in ancient times. It was all about international capital flows. Yet all the collateral requirement of skill from navigation to language now was also required.

The Minoans created **Linear A** written language that is one of two currently undeciphered writing systems used in ancient Crete prior to its Mycenaean descendent **Linear B**. The other undeciphered written language is **Cretan Hieroglyphic,** which appears to be inspired by the Egyptians. Clearly, **Linear A** was the primary script that was used in palace and religious writings. **Linear B** was largely deciphered during the 1950s. **Linear A** and **B** share many symbols, this does not lead to the decipherment of **Linear A** and attempting to interject B into A merely produces unintelligible words. It is assumed that **Linear A** uses the same or similar syllabic values as **Linear B**, rather than symbolic Egyptian style, leads to the conclusion that the underlying language appears unrelated to any known language. This has been dubbed the Minoan language and it remains very baffling.

Minoan Written Language

Val./Phon.	Lin. B	Lin. A	Chypro-Minoan	KN Zf 13
A		52	102	
RE		54	–	
JO		61	–	
NE		57	56	
DI		51	–	
KO		78a	21	?
PI		41	51	
KE		102	110	
PA		2	6	
JA		32	72	
TA			–	
R/LI		?	–	
I		100a	104	
TE		92	7 62	
MI		46	–	
SO		?	–	

Minoan Linear A

The type of economic system prevailing on Crete is very well documented by hundreds of tablets found at multiple locations in Crete. Only the persistent resistance of the writing script, **Linear A**, to decipherment prevents these documents from being read. Thus, there has been the debate without any support that the economy was a "palace economy" in a perfect world of a communistic state where everything is fairly shared and the more realistic market-based economy. The information contain within thousands of these tablets once assimilated will end this vision of Utopia. Honestly, human nature suggests that such states of a perfect world have never existed and remain merely a dream in the mind of academics. Human nature has remained unchanged for thousands of years. It is simply driven purely by self-interest. That is what created all advancements in our political-economic-social-society.

Consequently, nothing is known about the economy beyond what can be deduced from the archaeology or inferred by observing other systems. Information from the Late Bronze Age documents under **Linear B** can be read and infer no such communistic state. The idea of the palace economy has been purely the speculation of the boundless mind.

The Minoans predate even the great empires of Babylon, Greece, and Rome. Their trading empire reached from Asia Minor to England. Their search for tin and spices reshaped the known world and with it the development of Bronze Age cultures that differed in their development sparking by necessity the first forms of writing. According to archaeological evidence, cultures in Egypt (hieroglyphs), the Near East (cuneiform), China (oracle bone script)—and the Mediterranean, with the Mycenaean culture (**Linear B**)—all developed viable writing systems around the same time. This Bronze Age period is thus characterized not merely by the use of copper and its alloy bronze and proto-writing, but it also marked the spread of many aspects of urban civilization.

The Bronze Age is the second principal period of the three-ages Stone-Bronze-Iron. These three-ages mark the process in the development of ancient societies illustrating the importance

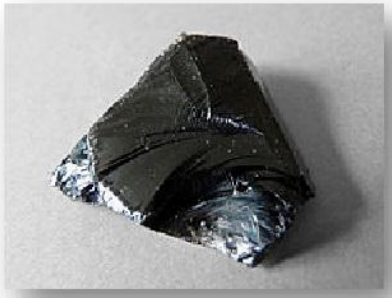
of (1) innovation, and (2) the practical utilization of the innovation. Most ancient civilizations entered the Bronze Age by trading products for bronze. Copper-tin ores were very rare and this is the primary reason we do not see the Bronze Age develop before the third millennium BC. Consequently, Bronze Age generally follows the Neolithic period in general yet in many areas we see the transition period of the Copper Age. Overall, we then see the Iron Age following the Bronze Age. Nonetheless, the Bronze Age created the international development of trade networks.

The emergence of bronze began in the Near East and the Balkans around 3000 BC where there were some deposits of tin. It was first mined in Europe around 2500 BC in Erzgebirge, and knowledge of tin bronze and tin extraction techniques spread from there to Brittany and then Cornwall in England around 2000 BC, It also spread from northwestern Europe to northwestern Spain and Portugal around the same time. Tin is a relatively rare element but the difference of bronze compared merely copper was a bronze sword could break a copper sword in half. The rarity of tin during ancient times is what truly forced international trade upon ancient societies.

The first major archaeological evidence of human travelling on the open seas exists before 9,000 BC and continues with the development of the Neolithic period. Pictured here are the Minoans were by far the dominant sailors of the Mediterranean. This ancient Mediterranean Trade became extremely important during this early period of the Minoans. International trade has existed even before recorded history. In the case of the Minoan society, this international trade spread the Bronze Age throughout the Mediterranean region. Bronze became exceptionally strategically important as oil is today for it improved tools for agriculture as well as weapons that could cut through those made simply from copper.

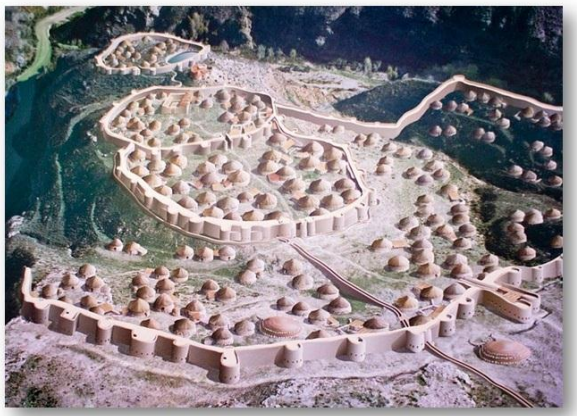
The key to the Minoan seamanship was their cypress ships that enabled trade between the East and Western Mediterranean civilizations. Once the first of their large planked Cypress ships took to the high seas, there was nothing anywhere else in the Mediterranean world that could compete with them either economically or militarily.

The Minoans probably began exploring the shores of the Mediterranean for mineral ores around 3900 to 3700 BC arriving on the eastern coast of Iberia (Spain) at this time. They would have been looking for some observation along the beaches for glimmering signs of various objects including alluvial gold or silver shining in the sands and sediments under the sunlight. Further evidence of their extensive trading network is the existence of ***Obsidian*** from the island of Milos near Crete, which is a black volcanic glass found all around the Aegean settlements. Looking for glimmering objects on the sands might signal that further inland they could find interesting ore that could be used in trade.



Minoans exported Obsidian from Milos
(Black Volcanic Glass)

The Minoans discovered in the river basins of southeastern Spain (today's province of Almeria) everything they were looking for and eventually they established a more permanent mining settlement there. By 3200BC, they had founded several fortified towns creating a new Aegean Minoan colony known as the ***Los Millares*** culture (3200-2600BC). This was set up as a strategic mining operation. Prior to the early radiocarbon dates for Millarens being confirmed, academics attributed this region to the Mycenaean colonization. However, the Mycenaeans were a warrior society and not interested in building trade at this point in their history. The Mycenaeans did not inhabit this area until after they conquered the Minoans post-Thera.



A model of the prehistoric town of Los Millares, with its walls

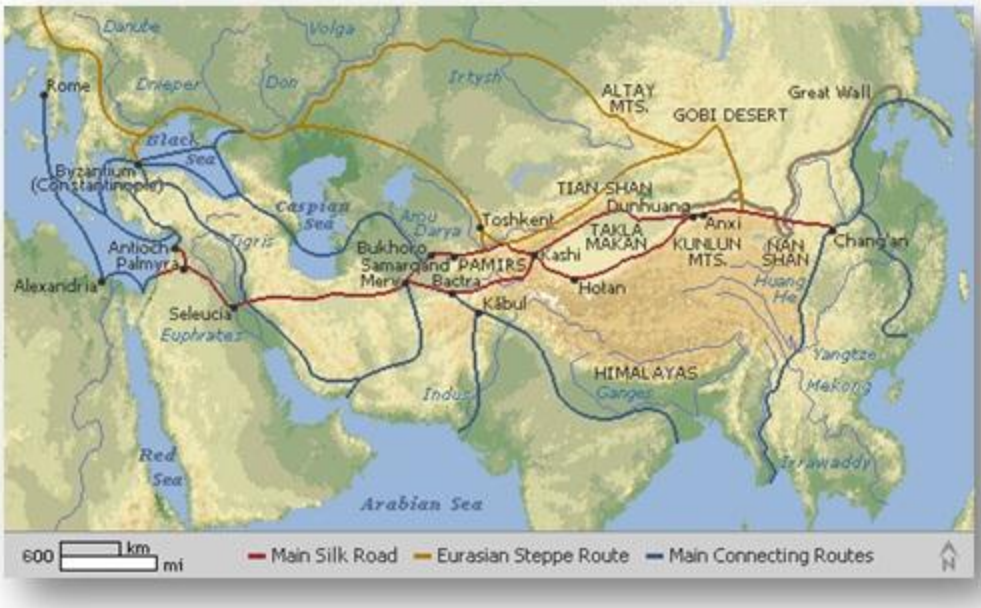
The Eastern Mediterranean region was working in purified copper where it truly originated. However, by about 3200BC, the Millarens were working with the advanced Aegean alloy technology of arsenical copper. The Millarens appear to have bypassed the pure copper period and began with arsenical copper from the outset.

The Minoan explorers appear to have ventured into the Atlantic and methodically investigated the Atlantic coastlines and its river valleys for further evidence of metals to the north and south of the Pillars of Hercules (today's Strait of Gibraltar). The famous alluvial sediments of the gigantic Rio Tinto, copper, silver, and gold mines in southwestern Spain on the Atlantic coast, show archeological evidence that they were worked also during the 3rd Millennia BC. (***Journal of Archaeological Science 35 (2008) 717-732)***. There is no evidence that the Minoans

discovered any metallic ores south of the Pillars of Hercules along the African coast. They may have discovered the tin in Brittany in northwestern France before making such discoveries in southwestern Britain and Wales.

The ***Los Millares*** culture was a large copper mining settlement of over 1,000 people. The actual Bronze Age (copper with 6% to 15% tin) began to rise to dominance over arsenical copper as the metal of choice among the Aegean Minoans by 2600 BC. Bronze became the cornerstone of the Minoan economy. Bronze was a superior metal and is significantly harder than arsenical copper. Tin, however, is a rare metal and quite sporadically distributed geographically compared to gold, silver, and copper. The ores containing tin are exceptionally rare in the eastern Mediterranean. The only known source was a small town in the mountains of south-central Turkey that supplied tin to the east from 3290 into 1840BC. Additional tin supplies could be obtained from northeastern Afghanistan. Tin was far more abundant in the west including Iberia (Spain), Brittany in northwestern France, and especially Cornwall in southwestern Britain.

During the period of 2600 to 2400 BC, the Millaren reinforced their fortifications and there appears, like Rome, an invasion from the north of uncivilized people known as the Bell Beaker people. By 2400BC the Millarens settlements began to depopulate. The graves of this period begin to show elites were buried with weapons. By 2200BC the town of Los Millares was abandoned all together after a sequence of calamities that befell upon them from large-scale warfare. From the ashes rose the El Argar (today's province of Almeria, Spain) and the Beaker people used bronze to invade Britain. The whole Iberia region was populated with different groups of Beaker people by 2600 BC. Most likely, the war that led to the fall of the Millarens begins with the development of bronze and thus implies that this became a valuable resource. Bronze at that point in time was the primary commodity of tremendous importance akin to oil today that fuels our economy. This is also a period of changes in climate. The ***Bell Beaker*** people spread northward along the Atlantic and Mediterranean maritime trade routes. They infiltrated the coastal regions of France, Britain, Ireland, the Netherlands, and Denmark. They even moved eastward into the interior of central Europe. They became the genetic code base of the Celts. The ***Bell Beaker*** people were indeed the people that erected the first stones at **Stonehenge** in about 2600BC. This tends to coincide with the earliest known copper mining in the British Isles, which took place in Ireland at Ross Island in Killarney about 2400 BC.



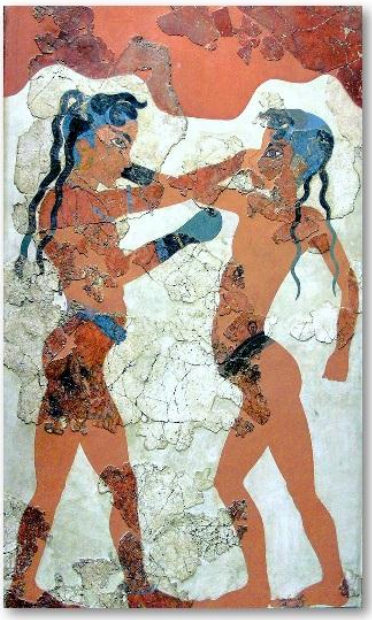
With the fall of the Millarens, Aegean Minoans could only obtain tin from Afghanistan or south-central Turkey. In about 1840BC, the south-central Turkey mines shut down and tin from the west became virtually a monopoly. The Minoans now had total control of the supply of western tin into the eastern Mediterranean with their maritime structure making them tremendously wealthy. We can see how comparative advantage of David Ricardo worked in ancient times and that there was a vibrant international trade that existed based on the ***Silk Road*** between East and West as well as on the high seas as controlled by the Minoans. The ***Silk Road*** was clearly a viable trade highway going back to pre-recorded history at least to about 6,000BC. The start of the ***Silk Road*** with official sanction is dated 2nd century BC when Chinese ambassador Zhang Qian visited the countries of Central Asia with diplomatic mission. The export of silk really began formally with the Han Dynasty (206BC – 220AD). There are even the ***Silk Road Mummies***.

Beaitiful Silk Road Mummy

The Aegean Minoans would have most likely come to the aid of their Millaren colony when faced with the collapse of the tin trade since it was vital to their economic interests. This would have been no different from the United States and Europe invading the Middle East to ensure oil supplies flowed no matter what they claimed to the contrary. There were many settlers that from the Aegean following the trade that no doubt helped to reinforce the surviving Millarens. This included the new settlements of the ***El Argar*** that eventually flourished as an Early Bronze Age culture (1800-1300BC). One distinguishing factor was its early adoption of bronze well ahead of most Greeks. They also developed sophisticated pottery and ceramic techniques, which they traded with other Mediterranean tribes, via the Minoans.

We therefore see in 2200BC the decline of the Millarens, the rise of ***El Argar***, and the first use of bronze in Britain within the same general period. This also coincides with the beginning of the Minoan Atlantic tin trade with Cornwall in Britain directly based from their new Iberian ***El Argar*** colony. Some have argued that the price of tin would have naturally collapsed with greater supplies from the east. This probably unfolded in the normal course of an economic cycle that made it less profitable to mine tin in Turkey resulting in the collapse of mining there by 1840 BC. The ***El Argar*** mining and metallurgy were quite advanced, with bronze, silver and gold being mined and worked for weapons and jewelry.

What is important to understand is the case of natural resources. The western Mediterranean area is much more heavily mineralized than in the east except in the Balkans and northern Greece. The merchant trade of the Minoans discovered that southern Portugal and Spain were rich in minerals. This area is quite renowned as a geological formation known as the “Iberian Pyrite Belt”. It is indeed perhaps one of the most heavily mineralized places on earth. It has yielded truly an abundance of the prestige metals including gold, silver, and copper along with a critical mineral being tin, which is still being mined to this day.



Minoan Sports

Clearly, the Minoans, the Land of the Labyrinth, were both great traders and merchants who thrived 3000-1100 BC. Perhaps their greatest contribution was their documented ***Atlantic Tin trade*** between England and the Minoan that spread the Bronze Age throughout Western civilization. The Minoans were great seafarers whose civilization revolved around trade making them an extremely cultured metropolitan society with a high standard for wealth and living. They have left behind numerous representations of sporting events from boxing to bull leaping.

Then there is the famous Labyrinth. Bull's Head Rhyton, which is a spectacular artifact dating to the Late Minoan IB period (ca. 1450 BC). In Greek mythology, the Labyrinth was possibly the elaborate complex structure at Knossos designed and built by the legendary artificer Daedalus for King Minos. Its function was to hold the Minotaur, a mythical creature that was half man and half bull and was eventually killed by the Athenian hero Theseus. Daedalus had so cunningly made the Labyrinth that he could barely escape it after he built it. Theseus was aided by Ariadne, who provided him with a skein of thread, literally the "clew", or "clue", so he could find his way out again.

The Minoans were obviously the first Greek civilization that was heavily influenced by two older Near Eastern civilizations, Mesopotamia and Egypt. Minoa is the name

of several bronze-age settlements on the Aegean coasts centered on Crete, and the inhabitants are known as Minoans who were named by Arthur Evans (1851–1941), the British archaeologist, after the legendary king Minos. The bronze-age Minoan civilization flourished in Crete and in the Aegean islands (2000-1470 BC).

Sir Arthur John Evans (1851–1941)

The Aegean Minoans were much like the Egyptians, whereby they were organized into a complex caste system: Nobles, Merchants, Artisans, Bureaucrats, and Laborers. The Minoans were the first true masters of ship construction and their use of the movements of the Sun and North Star(s), to determine latitude, were well understood allowing them confidently to navigate the open sea. Their skills in navigation were not exceeded until John Harrison's invention of the marine chronometer in the 18th century AD that allowed ships at sea to accurately determine their position's longitude. Without a doubt, the accomplishments of the Minoans were formidable to say the least for it was the spread of the Bronze Age that provided trade and created the incentive for the written language.

The Minoan technological maritime and naval advantage was so boundless that they would eventually come to dominate and impose their will upon all shipping in the entire Mediterranean Sea including the Black Sea. Their commercial shipping was apparently unopposed anywhere they traveled in the Mediterranean and their economic success was built upon trade – the early Mercantilism era. They most likely inspired the emergence of the first pirates who saw their wealth as attractive and ultimately its chief nemesis became the barbaric Mycenaean Greeks. Few weapons appear among archeological finds for being an island and a seafaring nation; most were not capable of either reaching them or challenging them on the high seas. Egyptian influence on the Minoans is especially apparent. Minoan architecture used columns much as Egyptian architecture did. Minoan art also seems to emulate Egyptian art by only showing people in profile, never frontally. The Minoans were clearly a society that benefited from trade that appreciated culture.

The Minoans did not develop coinage, and may not actually have developed the concept of a standardized medium of exchange. It appears that at least post 1600BC, Minoan currency may have been copper ingots rather than bronze, which would have had a utilitarian value, but they did not have a standard weight ranging from 20.1 to 29.5 kg. Two main Bronze Age finds of these ingots have been the Uluburun and Gelidonya shipwrecks with former being dated to 1300BC containing 317 ingots. Nevertheless, Minoan Bronze Age copper ingots have been found in Cyprus, Crete, Egypt, the Peloponnese in Greece, Sardinia, Cannatello in Sicily, Boğazköy in Turkey (ancient Hattusa, the Hittite capital), and Sozopol in Bulgaria demonstrating a wide range of trade. The data shows that all of these copper ingots that have been analyzed, dating to about 1400-1200BC and later, were made of copper consistent isotopically with only the Apliki mining region in the geographical north of Cyprus. The Cypriot origin for the copper used to make copper ingots further demonstrates the economic extent of the Minoan Empire and is important from the socioeconomic discussions of the organization of copper production on Bronze Age. They have been called “oxhide ingots” implying the value was one ox.


Minoan Saffron-Gathering

Previously, there may have also been use of spices as a medium of exchange similar to cocoa beans to the Maya. A critical commodity in the economic, political, medicinal, agricultural and even religious sphere of Minoan society was saffron. Saffron was a commodity that was held in high

regard in their culture as cocoa was to the Maya. Saffron was a highly prized regionally traded commodity both in final form as a spice, perfume and medicinal form bulbs. Historically at this juncture in time, saffron was the most expensive spice in the Western World comprised of the dried stigmas of the plant ***Crocus Sativus*** that occurs in the Aegean islands. Crete may be considered as "the birthplace" of this cultivated plant as shown in fresco fragments. Saffron with its ritual significance and was used in the everyday life predating recorded history. In addition, written information on pottery tablets give unequivocal evidence for the participation of the plant material in the economy of the Cretan kings of Knossos (1500–1450BC).

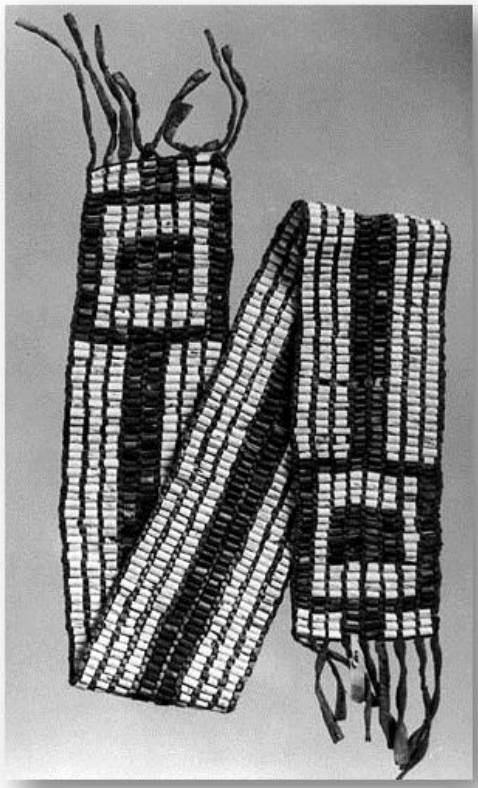
It is possible that saffron was used also as a form medium of exchange within early Minoan society. The use of the word ***"phoinikion"*** and the use of the ***"saffron sign"*** do occur many times in early Minoan **Linear A** with respect to commerce and trade. The prominent Minoan scholar John Chadwick, identifies that "***[p]hoinikion…remains a mystery***" and that the word was also meant ***"dark-red"***. It is unlikely that saffron extended beyond the early dates for as trade expanded, so would have the availability. The amount of weight involved with respect to its use, would have ranged between 1 and 5kg. It takes approximately 150,000 saffron flowers to produce 1kg of saffron. Therefore, the amount of labor involved to produce any quantity would have been expensive making it a rare commodity. Egyptians used perhaps the earliest form of paper money, which were warehouse receipts for grain. These receipts circulated on a bearer basis filling the role of a medium of exchange. There, these receipts made the large quantities of grain useable for money. It is unlikely that there would have been a sufficient quantity of saffron to support the warehouse receipt model.

Valentinian III (425-455AD)

Tax Collector's Gold Bar 211.8 grams (6.809 troy ounces)

Commodities have often served as money. When Rome monetarily collapsed, taxes were being imposed "in kind" meaning they took commodities. Taxes were payable in gold, but not by coin, rather by weight as illustrated by this Roman Tax Collector Bar from the 4th century. They would melt the coins and assess you taxes be weight not by official denominated coinage.

During the 14th to 16th centuries, precious metals would become scare and the economy fell often into barter. The spice that was so valuable in Europe was pepper. This commodity became worth more than gold by weight and thus as bankers often emerged from merchants, this gave rise to bankers in Germany being called ***"peppermen"***. Therefore, commodities would often emerge as money. We see the same trend appear in Japan where rice replaced money during the Middle Ages. In the American Colonies, such items as tobacco, rice, sugar, beaver skins, wampum, and country pay all served as money. These various commodities were generally accorded a special monetary status by various acts of colonial legislatures. Money was certainly not "fiat" when monetizing these commodities. Sugar was used in the British Caribbean; tobacco was used in the Chesapeake, and rice in South Carolina, each being the central product of their respective plantation economies. Wampum signifies the stringed shells used by the Indians as money before the arrival of European settlers. Wampum and beaver skins were commonly used as money in the northern colonies in the early stages of settlement when the fur trade and Indian trade were still mainstays of the local economy.



Wampum Belt

"Country pay" is far more interesting and complicated. Country pay consisted of a mix of locally produced agricultural commodities that had been **monetized** by the local colonial legislature. This often included Indian corn, beef, and pork, with each being assigned a specific monetary value expressed by a standard quantity or weight such as per bushel or barrel. Debtors were permitted by statute to pay certain debts with their choice of these commodities at nominal values set by the colonial legislature. Country pay was declared a ***legal tender*** for all private debts although contracts explicitly requiring another form of payment might be exempted. However, what made country pay ***legal tender*** was the fact that it was in payment of obligations to the colonial or town governments. Even where country pay was a ***legal tender*** only in payment of taxes, it often served as a unit of account. For example, the probate inventories from colonial Connecticut, where expressed in country pay.

There appears to be no standard form of a medium of exchange or the concept of a standardize weight that did not emerge until about 700BC in Lydia followed by impressing a standard. This does not imply that the ingots were not "money" or a standard medium of exchange since even the Bible states regarding money transfers the metal required being weighed. Even when there were coins, we still see moneychanger marks applied certifying that they tested the coin previously. Consequently, the lack of a standard weight for the ingots is not relevant insofar as confirming that they are not money. During this period, all evidence in the surviving tablets suggests that everything was essentially a commodity of value for each is listed separately, and there is never any sign of equivalence between one unit and another.

Commodity prices were at first expressed in grain or barley and later also silver. Eventually it evolved into metal about 800BC. The Babylonian king Nabonassar (747-743BC) most likely furthered astrology for he created the Babylonian institution of astronomers who began to make a daily record of the starry sky. These astronomers were professional scholars that we know from a tablet in Yale (YBC 11549) dating to the early Hellenistic period, that at least 14 of them were fully

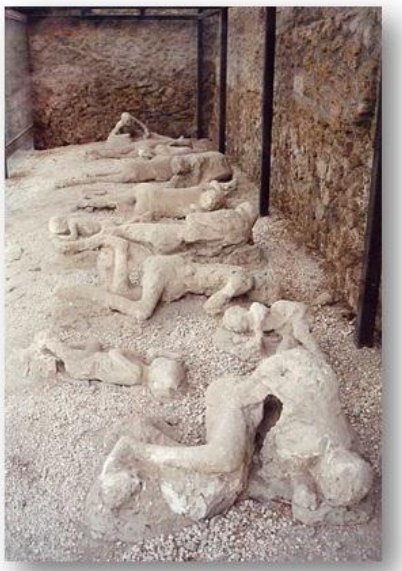
employed by the temple. They each received 180 litres of barley per month. According to some very late texts (127-119 BC) we know that the job was hereditary on condition that the scholars were capable to do the job. We also know that the annual salary paid by the temple was 60 - 120 shekels of silver, which was about 120 - 240 drachms with a weight of 500 to 1,000 grams of silver. Additionally, they seem to have also received some revenue from some tract of arable land. Therefore, from about 800BC, the concept of money as the unit of account began to emerge as precious metal shifting away from payment in grain or barley into payment in standardized metal by weight. Consequently, the lack of a standardize weight in 1600-1000BC is consistent with all commerce of the period.

There were some instances of a **Palace Economy** where the state owned all commerce, as was the case in the Venetian Empire (7th century AD until 1797). Such systems did exist in the pre-currency times. The real medium of exchange appeared to be labor creating what would appear to be a redistribution of assets in the absence of money similar to a communistic type state, but where you retained the freedom to decide your profession. However, this was in reality when labor was money almost in a barter type arrangement. All the productive forced involving work, including the seeding, harvesting and milling in agriculture as well as hunting while women engaged in weaving, was all carried on by individuals for a centralized entity. Xenophon (390-355 BC) wrote a book **Oikonomikos** (Οἰκονομικός) (meaning "home economics") that is the English word Economics. **Oikonomikos** was a dialogue that focuses upon home economics and agricultural science in a Socratic dialogue principally about household management and agriculture. Consequently, this work explains how to manage the household, which was in reality a privatization of the **Palace Model** whereby the household was that of the king rather than an individual.

Thera Volcano (Santorini, Greece)
Exploded about 1630-1620 BC

The decline and fall of the Minoans began with the eruption of Thera (modern Santorini Island, Greece) in the south-central Aegean Sea. That eruption effectively destroyed much of the Minoan trading empire. This single event was so massive it nearly destroyed the Minoan civilization in the Aegean. Therefore, the Thera explosion changed the economy of the ancient world in a very profound manner. It was a major catastrophic volcanic eruption with a Volcanic Explosivity Index (VEI) of 6 or 7 making it one of the largest volcanic events on Earth in recorded history.

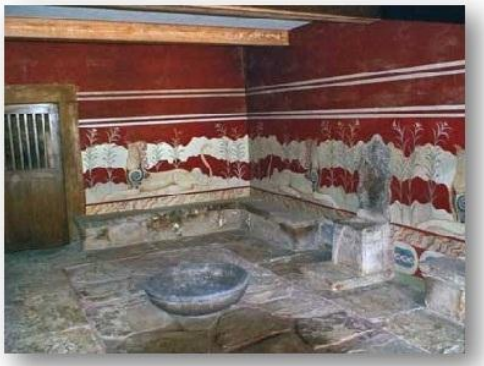
The Thera eruption devastated the island (now Santorini), leaving a fringe element surrounding the crater to which people still cling today. The eruption may have inspired perhaps various Greek myths such as that of Atlantis. It created turmoil in Egypt that was perhaps recorded as the Biblical plagues. The Chinese chronicled a volcanic winter from an eruption in the late 17th century BC that appears to have resulted in the collapse of the Xia dynasty in China and the rise of the Shang dynasty, dated about 1618 BC. The impact upon weather created a collapse in the economy and thus civil unrest. The Chinese recorded a "'yellow fog, a dim sun, then three suns, frost in July, famine, and the withering of all five cereals" (Foster, KP, Ritner, RK, and Foster, BR (1996). "Texts, Storms, and the Thera Eruption". Journal of Near Eastern Studies 55 (1): 1–14. DOI:10.1086/373781). This is similar to The Year Without a Summer which was the year 1816, where there was also a collapse in global temperatures as the historic low in solar activity coincided with major volcanic eruptions in 1815 of Mount Tambora, in Indonesia, which was the largest known eruption in over 1,300 years at that time. This resulted in massive food shortages across the Northern Hemisphere. The Chinese records describe similar events that toppled the government there at that time.



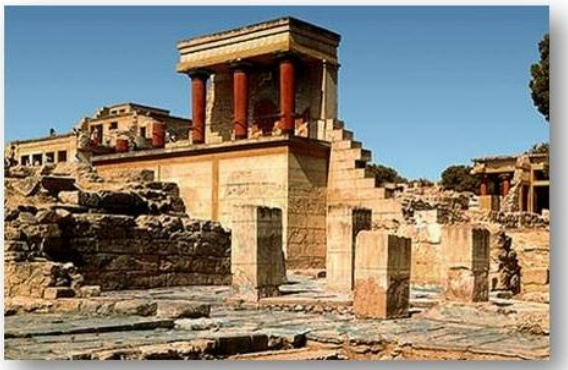
Corpses buried in the ash at Pompeii

The eruption of Thera was about four times that of the 1883 eruption of Krakatoa (Indonesia) insofar as measuring the amount of debris ejected into the stratosphere. On the island of Santorini, there is a 200 foot (60 m) thick layer of tephra, fragmental material, suggesting the dense fallout of ground zero. The eruption of Thera created such fallout of ash that it would have sterilized the island, as occurred on Krakatoa. Given the recorded events in China and the sterilization that caused a collapse in the agricultural economy there, one can easily see that the early Greek societies around the Aegean Sea had been primarily an agricultural economy. The Thera eruption would have been very devastating economically. Because of their international trade, the Minoans were severely weakened beginning their decline and fall. Pictured here are the corpses buried alive in the ash that fell from the 70AD eruption in Italy at Pompeii.

Those who have studied earlier tree rings have discovered that there was a very large event interfering with normal tree growth in North America occurring between 1629–1628BC (“Irish Tree Rings and an Event in 1628 BC”; The Thera Foundation). Additional evidence of a major climatic event around 1628 BC has been found in studies of growth depression of European oaks in Ireland and of Scotch pines in Sweden. Studies of the Bristlecone pine frost rings have also indicated a date of 1627BC.



Minoan Knossos - Throne Room



Knossos - Restored North Entrance

There must have been some pre-warning that prompted evacuation in advance of the catastrophe since only one gold object has been found at Akrotiri on the island of Thera (modern Santorini) and no corpses were buried in the ash as seen in Pompeii. Recent research supports the theory that much of the damage that was done to the Minoan sites may have resulted from a large earthquake that preceded the Thera Eruption. This may have occurred with the awakening of the volcano that explains the lack of Santorini corpses.

The eruption also generated a 115 to 490 ft (35 to 150 m) high tsunami that devastated many regions in the Mediterranean. The wind appears to have blown the ash primarily in the east and northeast of Thera (Santorini). Only the eruptions of Mount Tambora (Java, Indonesia) in 1815, Lake Taupo's Hatepe (New Zealand) circa 180AD, and Baekdu Mountain (China) circa 970AD would have been larger.

Mount Tambora (Java, Indonesia)

What is clear is that the ash fall from Thera choked off plant life and would have sent agricultural prices skyrocketing. This would also set in motion a trend of starvation that most likely caused political unrest and the fall of the Xia dynasty in China. In Egypt, it appears that the Thera eruption also adversely affected their primarily agrarian society. Records from the Egyptian Middle Kingdom discuss heavy rainstorms that devastated much of Egypt and were described as the Tempest Stele of Ahmose I. Others have argued that the myth of Atlantis, described by Plato, is based upon the Thera eruption. This of course is simply speculation and there is no data linking this event to the source of that legend.

It is clear that the Minoan civilization survived the eruption though severely weakened and overall the reduced agriculture triggered the eventual downfall of the Minoan economy. This opened the door for the barbaric warlike Mycenaeans during the Late Minoan II period. Mycenaean Greece (1600–1100 BC) was a culture that emerged during the latter period of the Bronze Age. Mycenae is located in northeastern Argolis of the Peloponnese. Several decades after the Thera eruption, the Mycenaeans conquered the surviving Minoans in Crete and its capital Knossos seizing control of the Minoan trade network. Once the Mycenaeans conquered the Minoans, they absorbed their culture and even adopted a form of the Minoan script (called **Linear A**) to write their early form of Greek in **Linear B**.

Mycenae - Lion's Gate

Previously, the Mycenaeans had not developed writing. The Mycenaeans advance came through their Minoan conquest and clearly began more as a barbarian type of mentality clamoring to get at the wealth of the Minoans. Their civilization was therefore dominated by a warrior aristocracy like that of Sparta compared to Athens about 1000 years later. The Iberian ***El Argar*** were incorporated and continued to function as an Aegean colony under the Mycenaeans. The Mycenaeans erected forts to defend their newfound wealth of the tin trade. The society is called the ***Mycenaean El Argar*** era and lasted for about two hundred and fifty years until its catastrophic collapse in about 1350 B.C.

The "Mask of Agamemnon" a Mycenaean gold funeral mask illustrates the wealth these people acquired by their conquests. Not only did the Mycenaeans defeat the stealthy Minoans, but according to later Hellenic legend preserved by Homer, they set sail and defeated Troy in Anatolia (modern Turkey) as well. Therefore, the massive eruption of Thera about 1630BC set in motion the Decline and Fall of Minoan society. This also marked the shifting of wealth and power to Mycenae. The Mycenaean civilization consequently flourished post-Thera based upon a ***Conquest Economic Model*** rather

than the ***Free Trade Model*** and it flourished roughly between 1600-1100BC, known as the Mycenaean Era.

The Mycenaean conquest of the Minoan civilization on Crete is a reoccurring pattern we see throughout history. A more warlike barbarous state "on the fringe" covets the wealth, culture, and civilized structure of the more sophisticated greater civilization. They conquer, assimilate their culture, and pretend then to be them. The barbarians that conquered Rome issued coins with their own images in Roman form.

Theoderic the Great
(king of the Ostrogoths (471–526), Ruler of Italy (493–526), Regent of the Visigoths (511–526)

It is appears that the economy of the region was devastated by the Thera Eruption to such an extent that it never really recovered fully. The eventual collapse of the ***Mycenaean El Argar*** culture about 1350BC, may have transformed into the complex phenomenon known as the ***Sea Peoples*** that over the next 175 years would rain apocalyptic devastation on the entire eastern Mediterranean. Almost every culture in the eastern Mediterranean including the Hittites in Anatolia was engulfed in destruction by 1175BC. Egypt would barely survive the repeated attacks of the ***Sea Peoples*** who were most likely these Greek warriors. Still, Egypt was so severely weakened it finally collapsed later during the reign of Ramses VI (1145–1137BC). Only the Phoenicians in the Levant (modern Syria) were apparently spared any destruction throughout this period. The ***Sea Peoples'*** raids and invasions from the land and sea would put an end to an era of international trade. However, this destruction opened the door for the next great trading empire that followed - the Age of the Phoenicians.

It is clear that the Bronze Age was a major step forward in social advancement. It was this rarity of tin deposits that compelled exploration creating a international trading network that necessitated the development of written language. In addition to the two major sources, being the Malaysian Peninsula in China and England, there were additional sources beyond Spain in Brittany located in France, Italy, as well as at the border between Germany and Czech Republic where tin was discovered.

Brittany had significant sources of tin, which show evidence of being extensively exploited after the Roman conquest of Gaul during the first century BC by Julius Caesar (100-44BC). Brittany remained a significant source of tin throughout the medieval period. Spanish tin was widely traded across the Mediterranean during the Bronze Age. However, it was Britain, which had the

lion's share bringing the Minoans out into the Atlantic Ocean. Spanish tin continued to be exploited into Roman times. Spain ceased to be a source of tin during medieval times. English tin dominated the market even into the late Roman times of the 3rd century AD. Cornwall remained as the source for tin throughout medieval times and into the modern period.

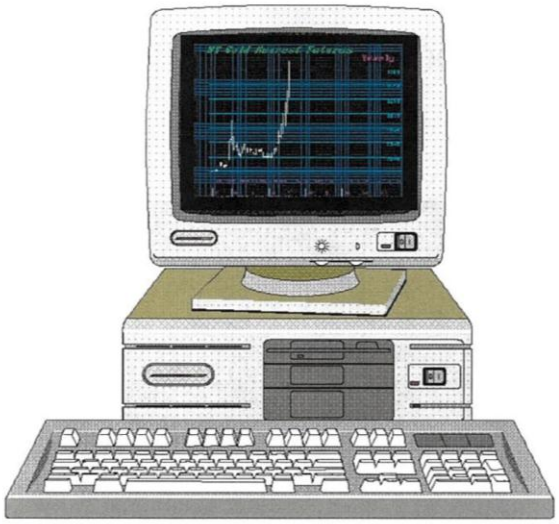
Consequently, the importance of bronze as a utilitarian metal is why we find that while gold first emerged as coins in Asia Minor, silver in Greece, it was bronze in Italy. We do not see gold coinage appear in Rome until the invasion of Hannibal and this was largely political to show Rome had great power despite her losses to Carthage at first. Previously, all we see are bronze ingots and round coins that were cast. What silver coinage Rome produced was fashioned to the Greek weight standard clearly to facilitate trade. They did not appear until about 280BC.

The ***Roman Monetary System*** was thus based upon bronze for the first 500 years of more. The weight of one pound comes from the ***Roman Monetary System*** and its division into 12 parts being uncial (ounces). Thus, there is little doubt that copper formed into Bronze was perhaps the most important metal historically. It was bronze that truly further civilization.

Roman Bronze As - idealized original weight 1 pound

Perhaps the best surviving ancient bronze statute is that of the ***Boxer of Quirinal***, also known as the ***Terme Boxe***r. This is a Hellenistic Greek sculpture dated around 330BC of a sitting boxer with *Caestus*, a type of leather hand-wrap. The Boxer was discovered buried on the slopes of the Quirinal. It appears to have been carefully buried in antiquity perhaps at the time of the approach of the Vandals from North Africa to protect it or the Visigoths from Spain who sacked Rome in 410AD. The statue is a masterpiece of Hellenistic athletic professionalism, with a top-heavy over-muscled torso and scarred face. Parts of the statute are worn suggesting it was revered being kisses by people for some reason, perhaps athletes before a game. Rome was sacked several times where even the bronze was ripped off the roofs of temples. No doubt, this statute would have been turned into scrap.

Visigothic king Alaric Sacks Rome in 410

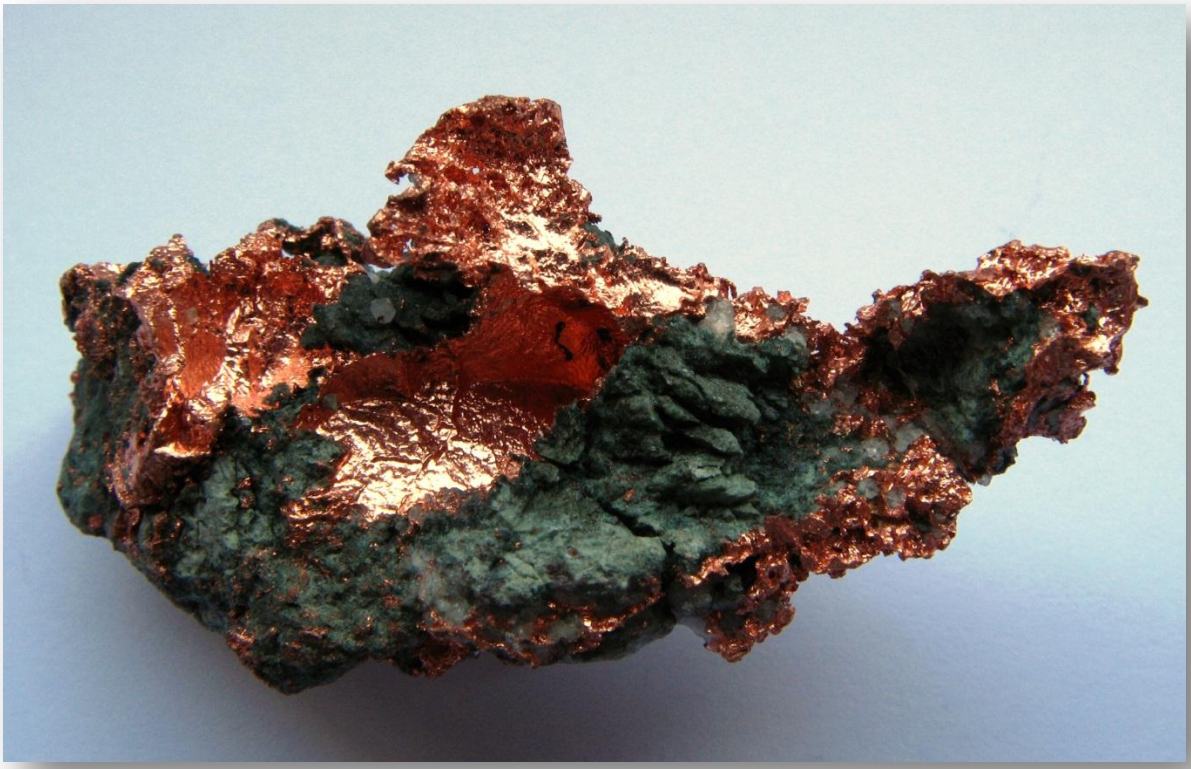


WARNING

THE FOLLOWING SECTIONS WERE WRITTEN BY THE COMPUTER WHICH HAS NOT YET BEEN FULLY TESTED.

ANY TRADING POSITIONS IT STATES HAS TAKEN ARE HYPOTHETICAL AND DO NOT REPRESENT ACTUAL TRADING.

A TECHNICAL OUTLOOK FOR NY COPPER



Our long-term view in Copper recognizes that the current bearish trend may reach a final conclusion during 2013 with a potential to extend on an intraday basis into the following year 2014 leaving 2013 as the lowest yearly closing. Nevertheless, as long as 13235 holds on an annual closing basis, then the broader long-term bull market will remain intact. Assuming that a 2013/2014 low holds, then the next high may form during 2020-2021 with a possible extension into 2024. We should see the bulk of any decline take place in 2013 with a Directional Chance in 2015. We do expect to see higher volatility in 2014 and this should be a Panic Cycle target as well warning of wild price swings ahead. For now, we see July/August 2013 as a primary target followed by November, January, and then April.

Our projected resistance for 2020-2021 stands at 65900-69050. This extends upward to reach the 78500 area by 2024. The projected support during the 2013-2014 period lies at 30890-31273 followed by 22340-22605.

YEARLY LEVEL

Looking at COPPER since 1784, it has exploded to the upside since 2001 on target peaking 8.6 years later. The high in 2010 was also 78 years up from the historic 1933 low. The major high of 1814 was exceeded in 1974, but it was not until 1988 before copper could close above it. On the Yearly level, short-term momentum indicators are neutral. Short-term trend, on the other hand, is in a bearish posture. As far as the Yearly, we find that the intermediate indicators are bullish. This suggests that the 27200 level followed by 23000 is where intermediate support will be found this year. On the broader perspective, the Cyclical Strength Model is currently bullish. Everything on the long-term models, including momentum and trend, is still in the bullish mode on the Yearly level. Therefore, major support appears to rest under the market at the 13955-13710 level. Our Yearly Bearish Reversals are 13235 and 12475. We do not see these as possibly being elected. Resistance stands at the 33500 level for 2013-2014.

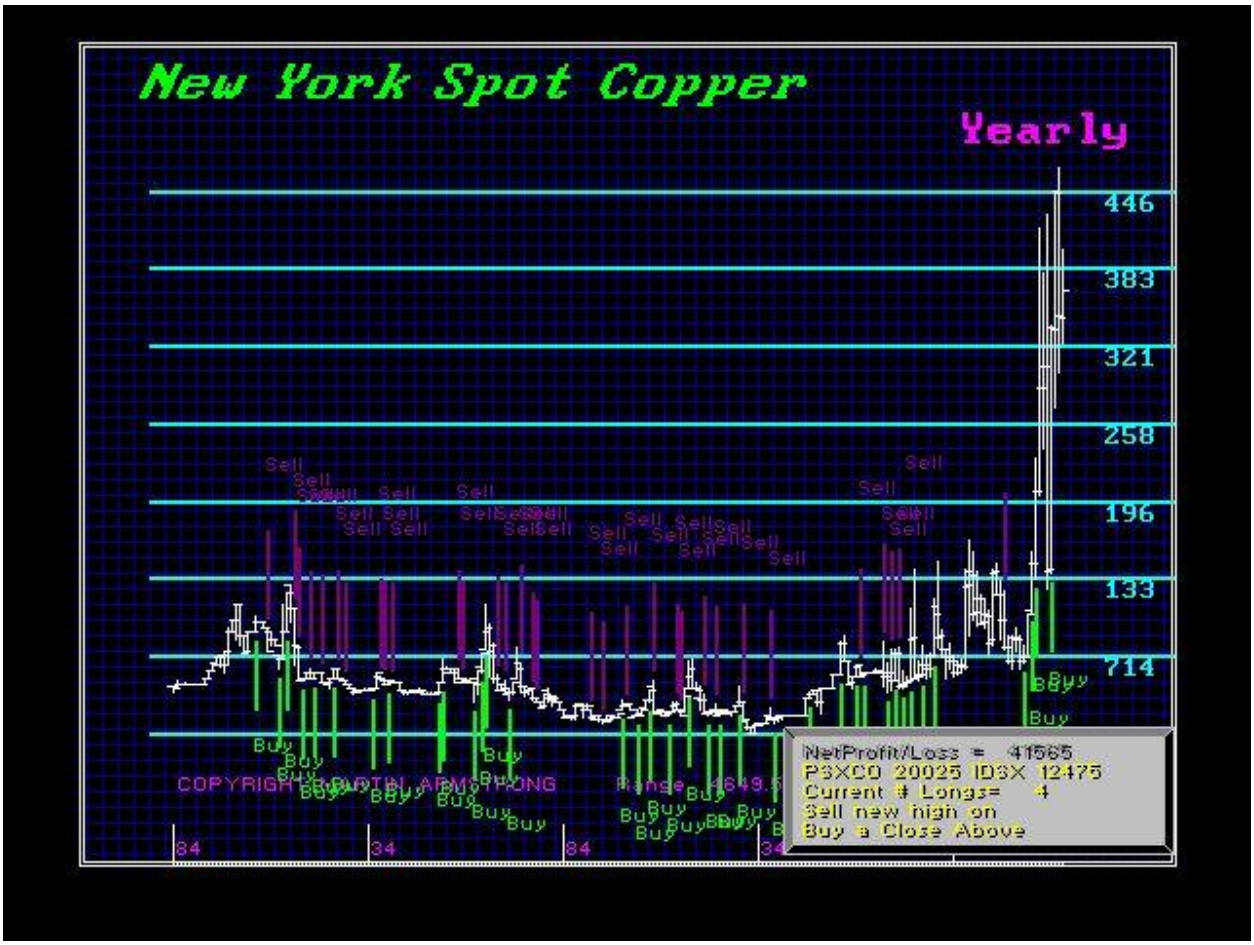
YEARLY REVERSAL SYSTEM

COPPER remains in an extremely strong position. As long as this market holds ABOVE 30010 on a closing basis, then new record highs are still possible. Our Projected Bullish Reversals for this year stand at 48453 and 49105. Therefore, a yearly closing above this area will signal that this market should continue to advance to new highs. As long as this market remains below 48453 on a closing basis, then the immediate trend is at best perhaps neutral for the moment with a bearish bias. However, only a closing BELOW 30010 for 2013 would imply that at least a temporary high is in place for now and that a retest of key support is likely to develop going into 2014.

At this time, the Minor Yearly Bearish Reversal is 30010. Thus, only a yearly closing below 30010 will signal that a continued decline into 2014. According to our model, the Major Yearly Bearish Reversals are found at 13235, 12475, 6449, and 5450. Hence, only a yearly closing below 13235 will signal that a sell-off is likely to follow. Nonetheless, only a close below 12475 will suggest a reversal in long-term trend.

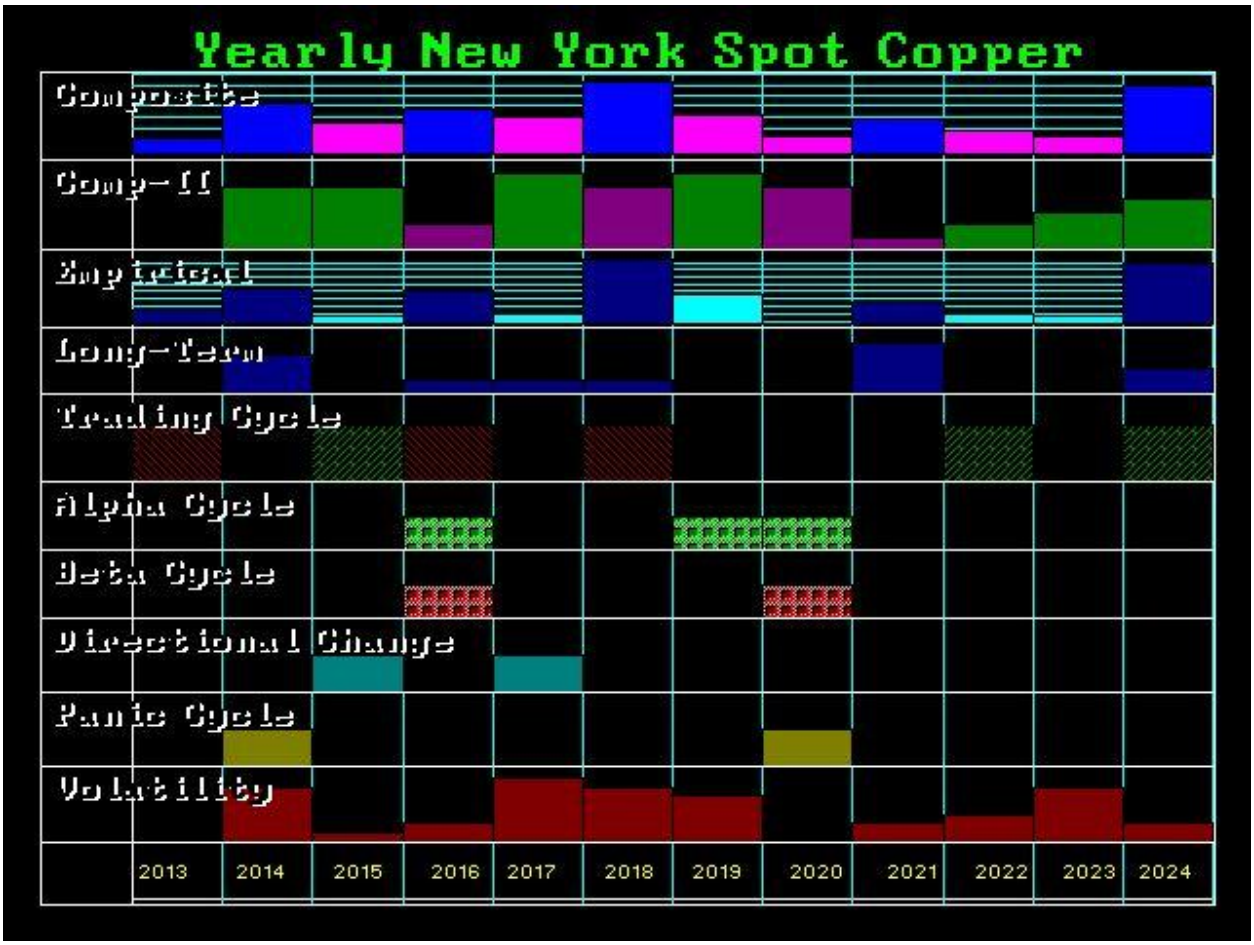
Yearly Reversals

Major Bullish 48453 49105
Minor Bullish 44520 46500
Major Bearish 13235 12475 6449 5450
Minor Bearish 30010



YEARLY COMPUTER RECOMMENDATION

On the Yearly level of our model we remain LONG 4 positions. The last LONG position was taken on the close of 2009 at 33465. Our general target objective would be to Sell a new high near 65900. We would use a PSXCO at 20025 on a Yearly closing basis OCO with a IDPSX at 12475. Reversing into a short position should be considered if 20025 is penetrated on a closing basis. From a timing perspective, you may want to consider taking profit if new highs are established during 2020, 2021 or 2024.



YEARLY TIMING

On our empirical models, the ideal primary target for the next key cycle low on the yearly level, remains 2014, particularly since our last target objective of 2011 produced a high at 4649.50 in COPPER. If this new target objective is successful, we then expect to see a reaction in the opposite direction unfold on the next major cycle target leading into 2015. Thereafter, a re-test of support should develop 2017 which is the next minor target objective. In the event that the high of 4649.50 is penetrated on an intraday basis prior to 2014, or the key Yearly Bullish Reversals are executed, then a cycle inversion would be implied. A cycle inversion would also be implied if the high of the previous year were penetrated during the 2014. Therefore, under a cycle inversion scenario, it would then appear that 2014 should ideally unfold as a high instead of a cycle low and all subsequent targets would also invert causing the next cycle low to unfold during the 2015. Nevertheless, as it appears now, 2014 should produce a key cycle low followed by a major high in 2015 with a minor re-test of support come 2017. The ideal target where a major turning point is due will be the 2015 in the period ahead.

Employing composite cycle analyisis, the key years for a turning point in COPPER will be 2019 and 2028.

Our Directional Change models indicate that turning points are due the years of 2015 and 2017. Our Panic Cycle Models suggest that higher volatility is due the years of 2014 and 2020.

Yearly Turning Points:

2013-2014, (2018), 2020-2021, (2023), 2024

YEARLY TECHNICAL OUTLOOK

RESISTANCE: 47649
SUPPORT: 36303 32346 23427 22579

TABLE #1

Yearly Technical Projections

2013... 22579 23427 32346 36303 47649
2014... 22823 23705 32734 36471 48226
2015... 23067 23983 33123 36639 48804
2016... 23311 24262 33511 36807 49381
2017... 23556 24540 33899 36976 49958
2018... 23800 24818 34287 37144 50535
2019... 24044 25096 34675 37312 51112

Yearly Indicating Ranges

Date	Momentum	Trend	Long-Term
2013	14100-6005	27200-7425	42700-9340
2014	16475-6050	30010-8640	33790-8650
2015	27200-6550	32380-7945	39895-9930

2013 MOMENTUM INDICATORS HLC 43636 29863 38451

QUARTERLY LEVEL

QUARTERLY REVERSAL SYSTEM

At this time, the Major Quarterly Bearish Reversals are 28500, 27200, 21345 and 11210. Accordingly, only a quarterly closing below 27200 will signal that an immediate downtrend could become more serious in the near-term. When we look at the Minor level, our Quarterly Bearish Reversal is found at 31030 and a closing beneath this level should signal a test of the 28500-27200 level.

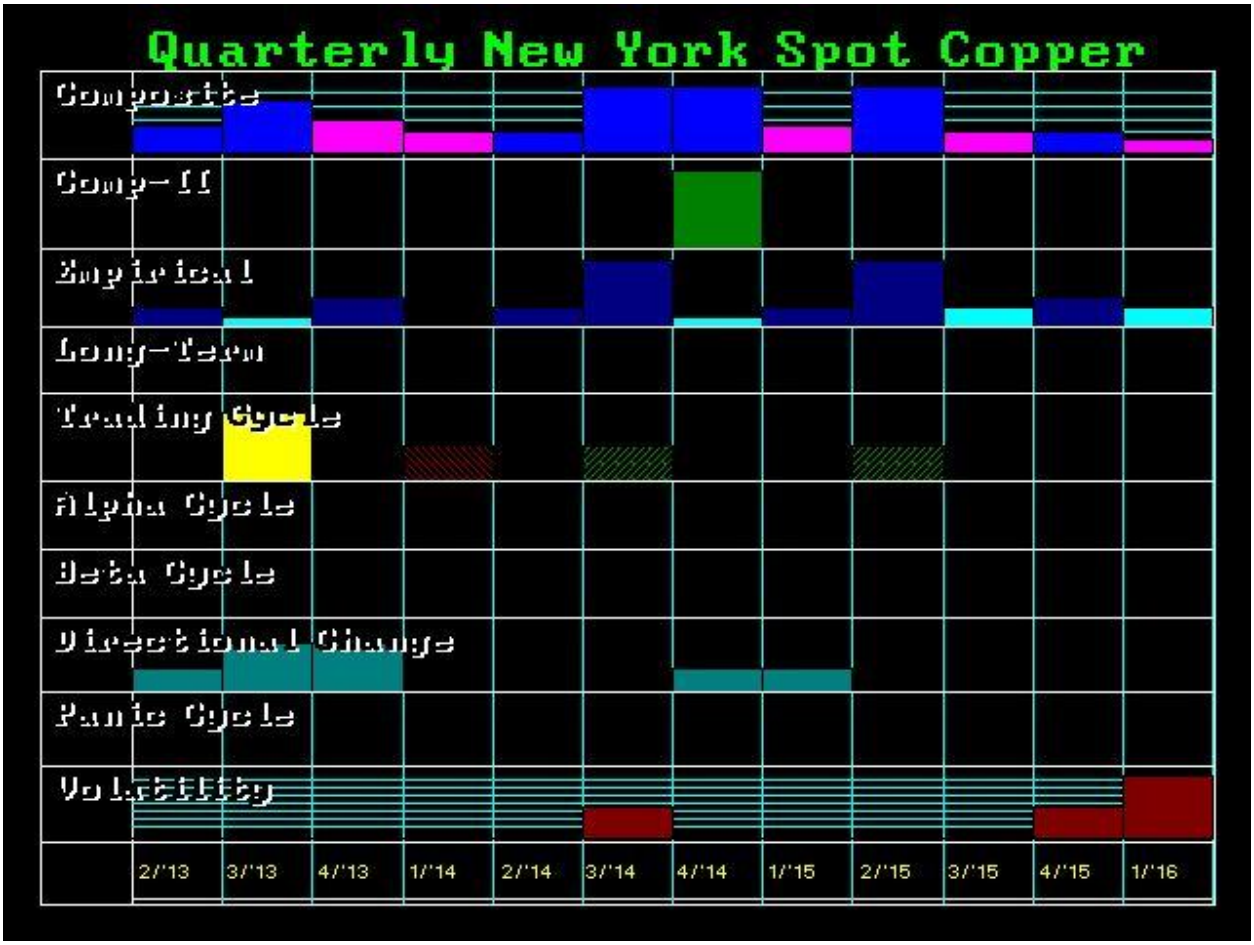
Right now, Major levels of our system models indicates that the Quarterly Bullish Reversals exist at 42700 and 46600. Hence, only a quarterly closing above 46500 will signal that an immediate uptrend should unfold thereafter with a sharp rally to test the 50000 level.

Quarterly Reversals

Major Bullish 42700 46600
Major Bearish 28500 27200 21345 11210

QUARTERLY COMPUTER RECOMMENDATION

On the Quarterly level of our model we remain LONG 2 positions. The last LONG position was taken on the close of the 2nd Quarter 2009 at 22580. Our general target objective would be to Sell new high at 49000. We would look to COVER all positions using an MIT just below the 49000 price level. We would reenter a long position by buying a Quarterly close above 50100. We would use a PSXCO at 27100 on a Quarterly closing basis. Reversing into a short position should be considered if 27200 is penetrated on a closing basis. From a timing perspective, you may want to consider taking profit if new highs are established during the 2nd Quarter 2015 or 1st Quarter 2017.



QUARTERLY TIMING

According to our empirical models, we see turning points shaping up for the 07/2013, 01/2014, 07/2014, 10/2014, 04/2015 and 10/2015.

Using a composite of a variety of timing intervals, the key quarters for a turning point in COPPER will be 07/2017 and 01/2018.

Our Directional Change models indicate that turning points are due the quarters of 04/2013, 07/2013, 10/2013, 10/2014 and 01/2015.

We should see a rise in volatility for 10/2014 and 10/2015.

Quarterly Turning Points:

07/2013, (10/2013-01/2014), (07/2014), 10/2014, 04/2015, 10/2015

QUARTERLY TECHNICAL OUTLOOK

RESISTANCE: 39858 60858
SUPPORT: 29247 26376

TABLE #2

Quarterly Technical Projections

04/2013... 26376 29247 39858 60858
07/2013... 26477 29660 39120 61546
10/2013... 26578 30073 38382 62234
01/2014... 26679 30486 37645 62922
04/2014... 26780 30899 36908 63610
07/2014... 26881 31313 36170 64297
10/2014... 26982 31726 35432 64985

Quarterly Indicating Ranges

Date	Momentum	Trend	Long-Term
04/2013	35600-28110	35775-28300	38520-32885
07/2013	34030-23850	36800-27200	38260-31600
10/2013	36665-28445	37925-31075	37950-32885

2ND QUARTER '2013 MOMENTUM INDICATORS HLC 38235 33573 36091

MONTHLY LEVEL

MONTHLY REVERSAL SYSTEM

At this time, the Major Monthly Bearish Reversals are 30345, 26490, followed by 14100, 13950 12620 and 12475. Hence, only a monthly closing below 30345 will signal that a sharp downtrend could unfold near-term. On a short-term basis, our Minor Monthly Bearish Reversals are found at 31035 and 30600, with additional reversals at 27200 and 19850. Consequently, only a monthly closing below 31035 will signal that an immediate downtrend should unfold thereafter.

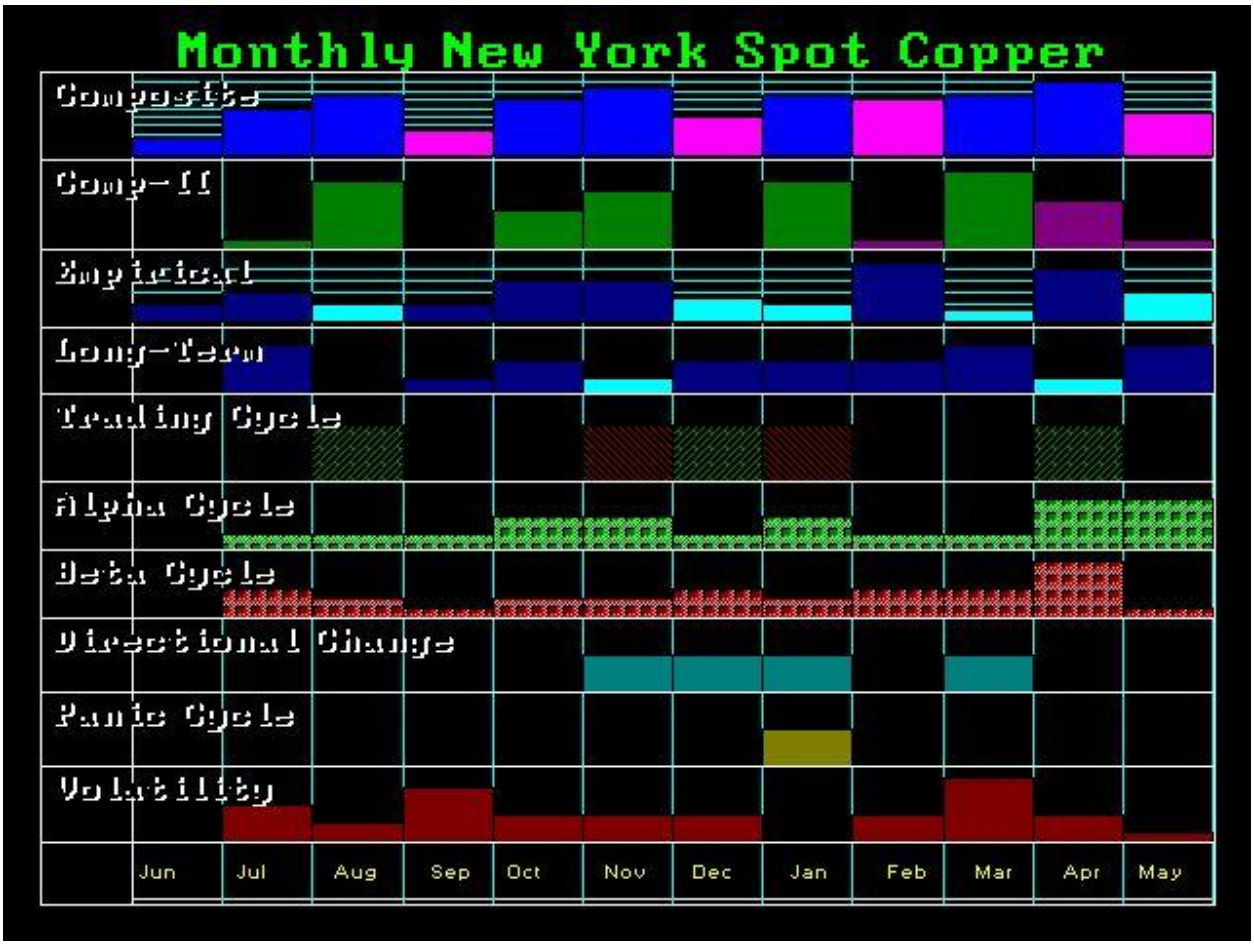
On the Major level of our Reversal System, the Monthly Bullish Reversals exist at 45020 and 45335. Thus, only a monthly closing above 45020 will signal that an immediate uptrend should unfold thereafter. Immediately, our Minor Monthly Bullish Reversals exist at 39390 and 39895. Thereupon, only a monthly closing above 39390 will signal that an immediate uptrend should unfold thereafter.

Monthly Reversals

Major Bullish 45020 45335
Minor Bullish 39390 39895
Major Bearish 30345 26490 14100 13950 12620 12475
Minor Bearish 31035 30600 27200 19850

MONTHLY COMPUTER RECOMMENDATION

On the Monthly level of our model we remain SHORT 4 positions. The last SHORT position was taken on the close of 04/2013 at 31875. We would look to add another position by selling a Monthly close below 31035. We would look to COVER all outstanding SHORT positions by buying a Monthly close above 37025 and simultaneously REVERSING into a LONG position. We would look to buy back our short positions in the 28500-27200 area. From a timing perspective, you may want to consider taking profit if new lows are established during 07/2013, 08/2013, 12/2013 or 02/2014.



MONTHLY TIMING

Looking at our empirical models, the ideal targets for the turning points in COPPER are 07-08/2013, 10-11/2013, 01-02/2014, 03-04/2014 and 05/2014.

Employing composite cycle analysis, the key months ahead for a turning point in COPPER will be 04/2014 and 06/2014.

Our Directional Change models indicate that turning points are due the months of 11/2013, 12/2013, 01/2014 and 03/2014. Our Panic Cycle Models suggest that higher volatility is due the month of 01/2014.

Monthly Turning Points:

(07-08/2013), (10-11/2013), 01-02/2014, 03-04/2014, (05/2014)

MONTHLY TECHNICAL OUTLOOK

RESISTANCE: 39405 49789
SUPPORT: 28259 23355

TABLE #3

Monthly Technical Projections

06/01... 23820 26768 30215 38855 50038
07/01... 23510 26300 30299 38580 50162
08/01... 23201 25832 30382 38305 50287
09/01... 22891 25365 30466 38030 50411
10/01... 22582 24897 30550 37755 50535
11/01... 22272 24429 30634 36480 50411
12/01... 21963 23962 30718 35205 50287

Monthly Indicating Ranges

Date	Momentum	Trend	Long-Term
06/2013	37725-33415	38550-33805	41495-35500
07/2013	35155-30570	37925-32380	38460-34525
08/2013	35500-30510	35500-33475	40050-33805

MONTHLY PATTERN RECOGNITION

According to our pattern recognition models we see that a possible outside reversal may be due and in 08/2013 and 11/2013.

JUNE MOMENTUM INDICATORS HLC 34691 31628 32940

WEEKLY LEVEL

WEEKLY REVERSAL SYSTEM

At this time, the Minor Weekly Bearish Reversal is 30010. Consequently, only a weekly closing below 20010 will signal that a further decline is likely. Our model suggests that the Major Weekly Bearish Reversals resides at 29955, 28445, **26500,** 26245, 24165, 21345, and 20600. The 26500 Weekly Bearish Reversal is a Double warning that this is the critical area of support.

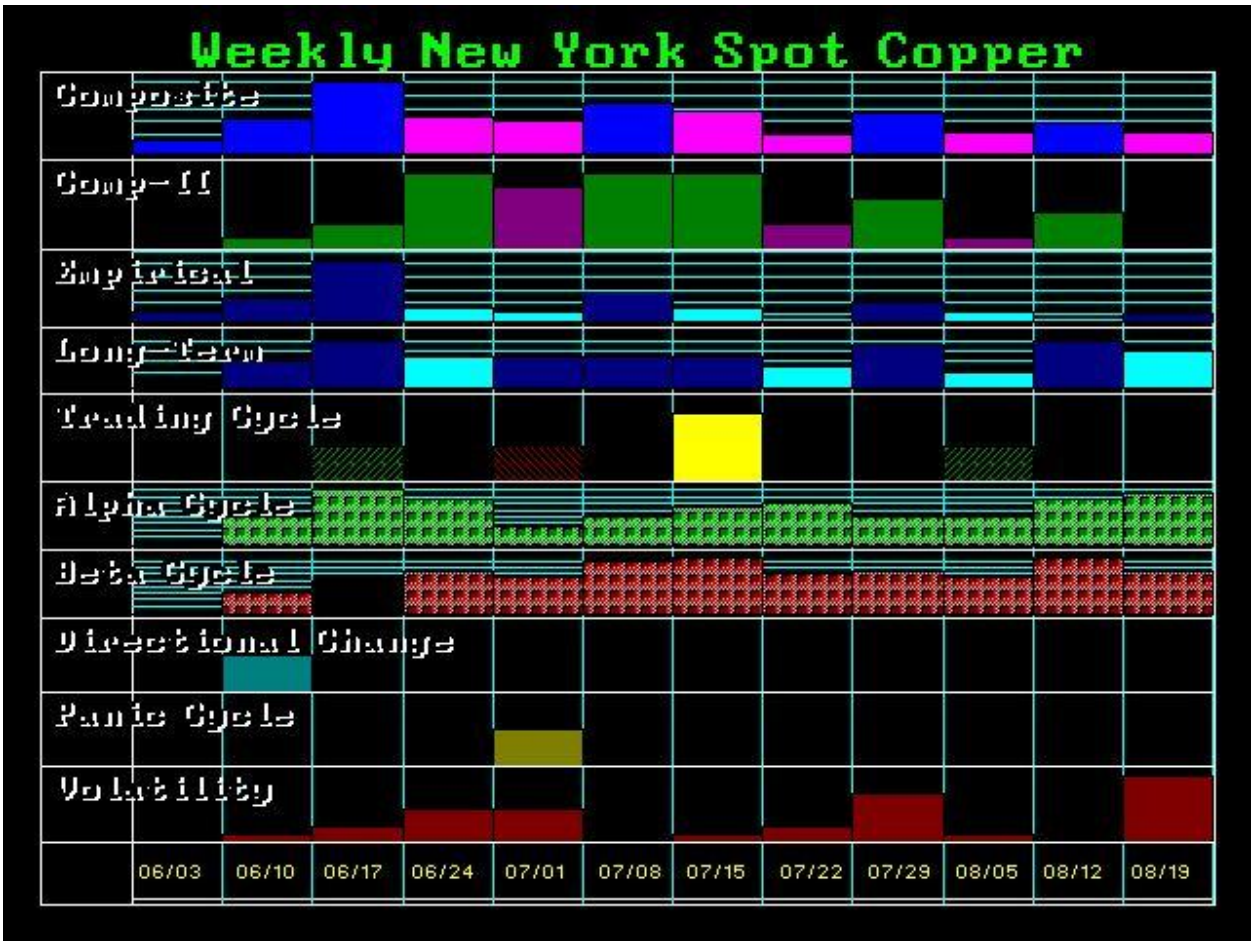
On a long-term basis, our Reversal System indicates that our Major Weekly Bullish Reversals are 41320 42055 44420 45250. Our model also highlights Minor Weekly Bullish Reversal standing at 34710, 35500, 37565, 37860, 38485, 38590 and 39175. Thus, only a weekly closing above 34710 will signal that an immediate uptrend should unfold thereafter. Such a closing would warn that traders should prepare for a potentially important change in trend. Eventually, an election of our Monthly Reversals will be the final confirmation that such a major change in trend has developed.

Weekly Reversals

Major Bullish 41320 42055 44420 45250
Minor Bullish 34710 35500 37565 37860 38485 38590 39175
Major Bearish 29955 28445 **26500** 26245 24165 21345 20600
Minor Bearish 30010

WEEKLY COMPUTER RECOMMENDATION

On the Weekly level of our model we remain SHORT 4 positions. The last SHORT position was taken on the close for the week of 04/15 at 31485. We would look to add another position by selling a Weekly close below 31060. We would look to COVER all outstanding SHORT positions by buying a Weekly close above 35500. We would REVERSE into a LONG position on a weekly closing above 37860.


Weekly New York Spot Copper
Composite
Comp-II
Intermediate
Long-Term
Trading Cycle
Alpha Cycle
Beta Cycle
Directional Change
Panic Cycle
Volatility
06/03
06/10
06/17
06/24
07/01
07/08
07/15
07/22
07/29
08/05
08/12
08/19

WEEKLY TIMING

The primary target on an empirical basis for the turning points ahead are the weeks of 06/17, 07/08-15, 07/29-08/05, and 08/12.

Our Directional Change models indicate that a turning point is due the week of 06/10. Our Panic Cycle Models targets the week of 07/01. Our volatility targets are the weeks of 07/01, 07/29, and 08/19.

Weekly Turning Points:

(06/03), 06/17, (07/01), 07/08-07/15, 07/29, 08/12

WEEKLY TECHNICAL OUTLOOK

RESISTANCE: 35847 39859 3774591
SUPPORT: 41869 37746 32351 31509

TABLE #4

Weekly Technical Projections

06/03... 31686 34870 41034
06/10... 31664 34772 41057
06/17... 31641 34674 41081
06/24... 31619 34577 41105
07/01... 31596 34479 41129
07/08... 31574 34381 41153
07/15... 31551 34283 41177

Weekly Indicating Ranges

Date	Momentum	Trend	Long-Term
06/03	34680-30510	35265-32355	36175-33150
06/10	34650-32650	35500-32660	36435-33900
06/17	33805-32355	34950-32570	35175-33310

WEEK OF 06/03 MOMENTUM INDICATORS HLC 33705 32528 33016