The African Foundation for STEM: A Narrative of Recovery

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There has descended upon historical knowledge over the past five hundred years the unfortunate falsification of the African record of fundamental achievements of science, technology, engineering and mathematics. This veil of ignorance has been both deliberate and accidental, but it has caused a tremendous misunderstanding about the nature of STEM in the modern world. Of course, not only is Africa, as we shall see, the home of *Homo sapiens*, but also the home of the first engineers, mathematicians and builders.

African science is at the heart of everything: monotheism, polytheism, meditation, rational thinking, tomb building, tunnel digging, iron making, epigraphs, and our ancestors brought us the single, longest lived continuous culture in the world. African scientists are deeply embedded in contemporary advancements of science. We know that two scientists, Kizzmekia Corbett, African American and an Nigerian, Onyema Ogbuagu were significant players in the creation of the moderna and Pfizer vaccines for Covid-19. We also know that Dr Oladipo Kolawole, and his team here in Nigeria announced the creation of a vaccine against Covid-19. Others have been working to combat all kinds of viruses throughout the continent.

As deep as 600 years into the current era the philosophy of ancient Egypt, a black civilization, was still practiced at the Temple of Philae dedicated to the African

goddess Auset whom the Greeks later called Isis (Obenga, 1995). For millennia, the Nile Valley Complex of cultures, was the richest and most powerful on earth, principally, because of science.

Mummification, perfected in Kemet, continued to give gifts of science in the fields of physiology, chemistry, biology, anatomy, with implications for medicine for the living.

Scientists in Africa have discovered *Homo sapiens* remains at Jebel Irhoud in Morocco that are 300,000 years old, in Florisbad, South Africa, that date to 260,000 years old, and in Omo Kibish, Ethiopia fossils are dated to 195,000 years ago. These sites are the oldest *Homo sapiens* sites in the world. While hominins have existed for more than seven million years in Africa the rise of homo sapiens is thought to have occurred around 300,000 years ago according to biological and archaeological evidence.

The Oldest Megalithic Structures on Earth

The people of the continent of Africa established the oldest record of technological inventions. This is not surprising since the rise of *homo sapiens* occurred on the continent nearly 300,000 thousand years ago and we would not exist today without their incredible achievements in responding to the multifarious challenges of the environment. Two-thirds of the time *Homo sapiens* have spent on the earth have been in Africa. Some Africans, that is, people who lived in Africa, began to migrate

out of Africa between 100,000 and 70,000 years ago. Consequently, there are no domestic tools anywhere in the world older than those found on the African continent. It is the objective of this paper to examine the African record of technological achievements, explain why Africa has been relegated to the sidelines in the discourse about technology, and to reassert Africa's place in hominin history as the foundation for modern technology.

We know now, that is, after the past five hundred years of denial, that Africans are at the very center of STEM's early history because of the contributions in architecture, design, metallurgy, mathematics, and geometry (Diop, 1974; Asante, 2019).

African Record of Technological Achievements

Since human activity has occurred so long on the continent of Africa it is certainly easy to see that creativity and invention had to be at the center of social and environmental relationships. But there is also the relationship with the supernatural and cosmic forces that impinge upon human life. What were the responses to the sun and other stars, the moon, and to the planets and meteorites seen best in the night sky? How would Africans looking into the night respond out of their creativity to what they witnessed in the sky?

It is believed that between 75,000 and 100,000 years ago Africans constructed the world's oldest and most extensive architectural sites (Tellinger, 2008). Humans have been creating, working, and designing in Africa for thousands of years and in the southern part of the continent anthropologists have discovered massive megaliths that

stretch over a vast territory in South Africa. The site is referred to by the local people as Inzala Y'Langa, the place of the rising sun, although it was called by white farmers "Adam's Calendar" after the name of a local farmer in Mpumalanga. Michael Tellinger, a contemporary authority on the site, estimates that there are more than 100,000 megalithic sites in southern Africa (Tellinger, 2008). Earlier it had been thought that there were 4000, then maybe 20,000 but now we know that the sites are more plentiful than imagined in the first instance when the Englishman Theodore Bent stumbled upon them in 1891 (Tellinger, 2009). By that time, however, they were ancient to the Africans who lived in the Mpumalanga area of South Africa and had been visiting them for ritual purposes for centuries. Only with the apartheid historians' attempt to rewrite the history of southern Africa in their own likeness did this information find itself behind the veil of historical ignorance.[1]

The Character of Inzala

Inzala Y'Langa constitutes a locus of reflection, design, construction, and interpretation by early African people who yearned to understand their own place in the cosmos. These stone circle sites appear to have an astronomical relationship and could be an earthly replica of the universe. These sites are thousands of years older than Stonehenge and even the ancient African pyramids of Giza. How is it that Insala Y'langa is just now coming into the vision of scholars and scientists? It has always been in the same place and nothing has changed in thousands of years, so what is the social contexts of our ignorance of these stunning megaliths?

When the white South Africans forced their government on the indigenous population in 1949 and began the aggressive taking of Africans' land by instituting a system of apartheid major areas of South Africa were considered white lands and blacks were not allowed to freely visit or live in areas they had occupied for centuries. During apartheid thousands of black people were moved away from areas declared white by the government and consequently Africans lost the continuity of knowledge about the sites since they were prevented by restrictive laws from areas thought too rich in history or fertile for agriculture for Africans. In some cases the whites not only captured African lands, they also revised the history of those lands.

What is the nature of the sites and why do they stand at the very source of STEM? To answer these questions, it is necessary to examine what we know about the buildings themselves as well as the peopling of Africa. In a book badly titled *Adam's Calendar*, Michael Tellinger is responsible for revealing the extent of one of the stone sites that first came to serious European attention around 2008 when first photographed from the air by Johannes Heine. Bent's 1891 observation of the massive stone circles was simply a curiosity, but with the photography of Heine the sites were seen to be more extensive than ever imagined.

South Africa is certainly one of the earliest cradles of humankind and the sites spread over the Mpumalanga region of South Africa are among the earliest known megaliths placed in the earth by human beings. Now what does this activity tell us about the knowledge, skill, and design capabilities of the people who erected these megaliths? The individuals who built these structures must be seen as the first human builders, the *mjenzi kwanza*. They existed before the writing of the Sumerian Tablets,

before the building of the pyramids in Egypt and Nubia, before the erection of Stonehenge in England, and before the construction of the Taj Mahal. Obviously, we now know that ancient South Africa was quite active in the evolution of what we have come to call STEM.

There have been various explanations for the stone structures. One theory is that these structures represented Nguni type cattle kraals to protect domestic animals from more predatory animals. Of course, this is a contemporary attempt to suggest that the structures were quite pedestrian and had nothing to do with more sophisticated uses of stone. We know that cattle kraals are normally made out of wood and not out of stone. Furthermore, there is no evidence that cattle ever occupied these sites and hence there must be other possibilities for the stone cities of the south.

One plausible theory is that they represent the ancients attempt to recreate on earth what they saw in the sky of the southern hemisphere. If this theory is correct, then it suggests that the early Africans had developed a philosophy of the sky that allowed them to pattern their own living spaces according to what they recognized in the firmament.

The South African sites are designed in circular fashion with most stones at least three meters high and two meters wide. It may be that these sites represented the first examples of city planning because they could have, much like the later Great Zimbabwe, have contained houses inside the stone enclaves. Among the materials found at the sites have been cone shaped tools, stone axes, stones that ring like bells, and ritual type of instruments like smooth stone phalluses. There are also stone birds, like the *hongwes* on pedestals, found in Great Zimbabwe. Hundreds of thousands of

tool instruments have been found in the area which has nearly 20 million stones. Perhaps the oldest statue on the earth is the *hongwe* made out of Hornfeld stone that has been dated to 100,000 years.

The Sahara Experience

By 10,000 years ago the people who lived in the Sahara were building structures that revealed megaliths and petroglyphs. Others had been created thousands of years before. Recently a lot of attention has been focused on Nabta Playa which is located in the southwestern quadrant of Egypt (Bauval and Brophy, 2011). This site which has been dated to between 8500 and 6500 BC. is located about 100 kilometers west of Abu Simbel where there is a large archaeological site. The area was once a wet savanna around 100,000 years ago. It supported fertile ground for animals and humans. Fossil remains of buffalo giraffe and antelopes have been recorded. A large lake appeared, and human activity became a regular part of the region. However, this changed around 6000 BC and the area became a part of the Nubian Desert. Bauval and Brophy wrote in their introduction that they wanted to use their "…intellect, knowledge and abilities to put right an issue that has long beleaguered historians and prehistorians alike: the vexed question of the Black African origins of the ancient Egyptian civilization" (Bauval and Brophy, 2011, p. 1).

Two important American scholars Fred Wendorf, who began writing about the area in the l970s, and Christopher Ehret, an ethno-linguist, have claimed that the people of the region left evidences of wild sorghum, ceramics, painted designs that seemed to be created by combs, and pottery (Wendorf,1980; Ehret, 2001). These

materials and objects have been found in Sudan and Chad as well. It has been demonstrated that Nabta Playa featured above-ground and below-ground construction and very deep wells. Of course, we also know now that there were many aspects of the pastoralist culture of ancient Nabta Playa that were related to dynastic Egyptian culture, for example, the Hat-heru-like drawings of cattle.[2]

What we learn from the Nabta Playa site is that one of the oldest known sculptures in the world was buried under the megaliths. In addition, the site suggests that the people of the region also knew how to dig wells through the increasingly arid land. Located now more than one hundred miles from Abu Simbel and the nearest water station one can only imagine the complex technological struggles around water that were necessary for the early travelers to and from Nabta Playa.

Lothagam North Pillar Kenya

The Lothagam North Pillar archaeological site was built by eastern Africa's earliest herders 5000 years ago. It is dominated by megaliths, stone circles and cairns around a platform mound. Here in this part of Kenya researchers have found an ancient monument that appeared to center the power, memory, and authority of the ancient society in this ceremonial place with numerous stone beads. Found on the shores of Lake Turkana the site is called Lothagam.

It is an important monument called the Lothagam North Pillar Site. It represents a massive investment of human energy for the building of a nearly 100-foot diameter circular earthen platform. In the middle of this platform is a three-foot pit that hits bedrock where these African pastoralists cut graves to bury their dead. Thirty-

six bodies have been found in a six -foot square test area of the pit. It is estimated that the mortuary cavity may hold between 580 to 1000 bodies.

Lothagam is one of the most powerful burial sites in antiquity. There are bodies decorated with jewelry made out of animal teeth hippopotamus tusk, multicolored beads of blue-green amazonite, and some pink analcimes. The sites were covered with dirt, layered with basalt pebbles, and topping it off with four-foot-tall basalt pillars taken from a mile away. They then placed around the area large boulders and created small stone circles along the top of the platform.

What do we learn from this site?

One of the aspects of Lothagam that cannot be overlooked is the *reflection* that was necessary to plan the site. As I have described the burial site one can see how meticulously the work was done to memorialize the dead. Although we do not know which queen or king, or great person or persons initiated the monument we do know that it shows clear evidence of executive planning. Someone had to decide how large the site should be, what pebbles to place on it, how to decorate the platform, and when to start burying the dead in the site. Thus, the Lothagam site was planned, supervised, and executed by people who understood the objective of the site (Hildebrand and Grillo, 2011).

Nile Valley Complex Developments

Several civilizations such as Kush, Nubia, Meroe, Kemet, and Axum occupied the Nile Valley Complex from its origin in the upper highlands of East Africa all the way to the Mediterranean Sea. Nubia and Kemet, with various political subdivisions, were the main players in the creation of science, technology, engineering, art, and mathematics. Nubia is thought to be older than Kemet, also called Egypt, because of objects found in Sudan the modern country, containing ancient Nubia. Indeed, the Nubian incense burners are thought to suggest later royal facades for the kings of Egypt. Ta-Seti was both the neighbor and the competitor of Egypt and the two dueling cultures produced pyramids, architectural and artistic masterpieces that still stand to this day (Asante 2019; Gillings 1972).

Kemet is the most daring example of ancient African dominance in art, literature, geometry, and astronomy. It rises to the highest height in the ancient world in terms of architecture, precision, art, and mathematics. The magnificence and majesty of ancient Kemet cannot be contested. In science it was preeminent for hundreds of years; one could not think of building the pyramids without understanding mathematics and geometry. It would have been impossible to orient the temples to the sky without an appreciation and knowledge of astronomy. No ancient civilization practiced medical diagnosis before the African civilizations along the Nile River. The earliest book of medicine is the *Ebers Papyrus* and the best known and first book of mathematics is the *Rhind Papyrus*. It should seem unbelievable that scholars could teach mathematics and medicine and not mention these primary contributions by Africans![3]

Africa's early civilization has many firsts. Kemet's Imhotep is the world's first architect and the first physician. He is the first human revered as a god and worshipped as the God of Medicine. Legends have it that Djehuty and Seshat were responsible for mathematics, writing, and the calendar. What we know is that writing begins in Kemet about two hundred to four hundred years before cuneiform appeared in Mesopotamia. The earliest forms of literacy are created in Africa with thousands of manuscripts with technical instructions about everything from the construction of canals to the height and width of artistic drawings and paintings on the walls of the temples. Designs of tombs and temples are found in the sites themselves left there by the master architects and builders.

Experiments with the scepter, the *was*, the object of royal power for acoustical modulation; applying tuning forks for the purpose of cutting stone, and amplifying sound in ways to create perfectly round holes in granite using only copper tools were at the center of early research. In modern times singers have often demonstrated their abilities to break glasses with their high pitch, but in ancient times the physics of the Africans in the Nile Valley was a functional part of creative arts and architecture.

What Attracted the World to Africa?

The Hyksos came first, then the Assyrians, the Persians, the Greeks, the Romans, the Arabs, and the British. Therein lies the remarkable and hideous attempt to disappear black people from the Nile Valley, a process still going on today. But in the ancient time, all roads led to Africa. Most of the so-called great Greeks of Greece's

Golden Period had an association with black Africa. Thales, Pythagoras, Isocrates, Plato, Anaximander, and Anaxagoras, along with Democritus studied with the priests of Kemet.

Why? Because here were the first philosophers: Imhotep, Amenemhat, Amenomope, Duauf, Merikare, Amenhotep, the son of Hapu, and Akhenaten, the earliest of these had lived 2000 years before the first Greek philosopher, Thales of Miletus. What did they learn in Africa? They learned philosophy, biology, anatomy, geometry, physics, mathematics, architecture, acoustics, and astronomy.

Sungbo's Eredo

As much as we are awed by what contemporary scientists have forgotten to discuss or disclose about the foundations of STEM in Africa it is important to know that humans in Africa have been experimenting and creating in a consistent manner longer than anywhere else on the earth. However, from the thousands of years from the monumental massive structures of Inzala Y'Langa to the design and implementation of the memorial burial ground at Lothagam humans have been creating technology, art, and architecture.

By the time of construction of Sungbo's Eredo Trench built in southern Nigeria in the 9th century by the Ijebu Yoruba people West Africa had become a built region of houses, villages, and large cities making it one of the world's centers for urban life.

Yet only in recent years has Eredo and similar sites caught the attention of contemporary scholars. It has become increasingly accessible as a way to understand

the engineering genius of the African people from the 9th to 15th centuries just prior to the rampant and ravaging effects of slave-raiding, often called slave trading. Often referred to as Sungbo's Eredo in honor of the Ijebu noblewoman Oloye Bilikisu Sungbo the defensive system of trenches and walls is nearly 99 miles long (160 kilometers). Its height can reach 20 meters or 66 ft. Eredo is a ring around the ancient kingdom of Ijebu. During the time that Charlemagne ruled as emperor of the Lombards and Franks, the Ijebu, to protect their well-developed polity and to honor the royal Oloye Bilikisu started the building of the Eredo which took from 800-1000 AD.

The Eredo has captured the imagination of many West African historians. First written about by Peter Lloyd the site was largely publicized in science and archaeological circles; about forty years after Lloyd's publication, Eredo caught the attention of the British archaeologist Patrick Darling in 1999 who helped to bring its glory to a more popular audience.

As with the later creation of fortifications in Europe during the European Medieval Period the defensive system established by the Ijebu was meant to contain the confrontations that were happening across the political landscape. In Europe, the Reichsburg Cochem (1000 AD) and the Killyleagh Castle (1180) represented almost the entire two-hundred year length of the fortress building period in a fractious Europe. The West African fortification or *trenchification* was intended to dissuade invading raiders from entering the Ijebu territory without permission. This long ditch led to similar earthwork developments throughout the region as each kingdom sought to defend itself from the political instability among the neighbors. Important cities

such as Ife and Ilesha found such defensive systems necessary for their polity. However, this extensive system among the Yoruba did not rival the much larger system of tunnels, ditches, and walls called Iya, constructed by the Benin, an Edo speaking people.

Mathematics overview

One of the major ancient texts of the ancient Kemetic people of Africa was the *Rhind Mathematical Papyrus*. This work was first introduced into Europe by the British subject, Henry Rhind, and was secured by the British Museum upon his death. Rhind had got the manuscript, written in Africa, in 1858. The Rhind document was originally written during the reign of King A-User-Re, about 1850 B.C.E.; Ahmose made additional copies of the text around 1600 B.C.E. There are eight sections to the papyrus in which forty mathematical problems are stated and solved. The papyrus also contains four sections of nineteen geometry problems. Henry Olela in writing of the African contribution to mathematics in general and the Mathematical Papyrus in particular says, "Arithmetical problems were of a varied nature-but most solutions partook fractional and decimal processes" (Olela,1984). The Ancient Africans were, therefore, the first to discover the use of both decimal points and fractions. To this day, according to Olela, we use their method, with only slight changes.

The contemporary approach to volumes, masses, and areas is directly related to the ancient African people and their development of concepts to deal with the natural world. Besides fractions and decimal points, the early African scientists achieved their highest work in geometry as demonstrated by the construction of the pyramids and the

great temples of Karnak, Gebel Barkal, Abydos, Abu Simbel, and the Ramesseum. Later one would see the development of such structures as the Eredo Moat or Trench, the churches of Lalibela, and the hundreds of *dzimbabwes*, stone cities, located in the southern part of the continent.

Tallying

The evolution of societies in the region of the rivers and lakes in Africa meant that communities of people had to determine the meaning of *more or less* just to keep pace with their own societies. Tallying was most likely the first method of keeping a record of a herd of cows as well as the number of people in a family. This was the first form of recording numbers. Tally marks were made of stone or bone, one mark at a time until the marks represented the number sought. *Cipherization* or the use of special symbols for tallies occurred hundreds or thousands of years after tallying.

Several types of tallying were available to those young societies. The Isonghee people of Congo tallied, as early as 28,000 B.C.E., by carving notches on a fossilized baboon bone. The process is even older among the people of Swaziland where the Lebombo bone is said to be more than 40,000 years old and may be the world's oldest calculator. One can imagine the ancient African mathematical mother putting notches on a bone to record the menstrual cycle. Other methods included making marks on sticks, on the side of trees, or cave walls or writing on the ground. The methods of tallying were almost infinite. Early humans could collect stones or collect sticks or tie knots on string in an effort to keep track of what they were counting. One-to-one

correspondence was the simplest method of tallying, but some people began to use notches and marks to represent a plural of ones.

Vocalizations must have followed the incredible array of human possibilities in tallying. Words were introduced for the symbolic assortment that was developed and then the human race was off to various methods of computation and discussions about the computations. Thus, the earliest humans who confronted these glorious possibilities and the potential for intellectual debates about numbers were Africans, and likely women tallying their menstrual cycle.

The Idea of Base Numbers

Societies usually developed bases out of their particular needs. Some groups developed bases out of two or three, or five. But early Africans soon discovered that humans usually had ten fingers and consequently the most prevalent base number in antiquity was 10. As a way to systematize counting to be able to mark larger counts, the base system allowed the early societies to arrange numbers in a basic group. The most common way of doing this usually involved assigning names to number: 1, 2, 3, ...etc. until the base was recorded. In the case of base 10 or other bases, adding the previous numbers to the base in a logical fashion usually made numbers above the base. For example, the assigned names: one, two, three, four…, ten for 1, 2, 3, 4,... 10 lead us to eleven which is 10 + 1.

Although we are most familiar with base 10, we should not think of it as universally employed. Even in this century some people in the world have continued to use other bases. The Germans in the past used the base 5, quinary base, until the 1800's

(See Eves, 1964: 8).

According to Eves, base 12 was used by some societies because of the lunations in a year and thus we have 12 inches in a foot, 12 ounces in the ancient, not contemporary pound; 12 hours around the clock; twelve months in a year, and the word, dozen (Eves, 1964).

The Mayans used the vegesimal scale, or number system based on 20. Other Native American groups used this scale or base that may reflect the counting of fingers and toes. Eves further says that "Celtic traces of a base 20 are found in the French *quatre-vingt* instead of *huitante*, and *quatre-vingt.dix* instead of *nonante*.... In English we have the frequently used word score" (Eves, 1964 p. 9). The ancient Babylonians used base 60. Traces of this system are found in the American use of 60 minutes for an hour and 60 seconds for a minute. Thus, the African use of various bases, especially 10 and 2, are not uncommon in the history of mathematics. Therefore, the fact that African people in various parts of the continent used different base numbers is not unusual in mathematics.

African Grouping System in Antiquity

In the simple grouping system, a number such as "b" is selected for a number base and symbols are used to reflect additives such as 1, n, b2, b3, b4, etc. Africans have employed this system effectively to express the number they wanted to express the required number of times.

Perhaps the first recorded example of such a grouping is dated around 3400 B.C. when the Nile Valley made inscriptions on stone in *ciKam*, erroneously called

hieroglyphics by the Greeks. Work on papyrus, wood and pottery was usually done in the more rapid method of writing known as hieratic, the running script, or cursive. From the hieratic form used by the priests was developed the demotic for common or ordinary use among the people. While the hieratic and demotic numeral system is not of the simple grouping type, the ciKam system is a base 10.

These symbols are 1 and the first few powers of 10.

1	a vertical staff
10	a heel bone
10 2	a scroll
10 3	a lotus flower
10 4	a pointed finger
10 5	a fish
10 6	an excited man

One could use these symbols repeatedly to express any number.

292 = 3(10 6) + 2(10) 5 + 1(10) + 2

We have written the number from left to right although the early Africans wrote it from right to left.

Numeration Systems

Numeration systems are usually written symbols or collections of number words. Thus, to speak of numeration in the African context it is necessary to remember that it may mean either of the two ideas above.

Numbers have "place value" which allow us to compute huge numbers on the basis of addition or multiplication. The common Western base system is called a decimal system because each position in a written numeral has a value ten times that of the position to the right.

Most African societies use a quinary numeration system (Zaslavsky, 1973). This means that the number five is the principal base for the construction of number words. The base is used when composing other words or to establish a language sequence. Some societies adopted ten, the decimal base, and some adopted twenty as a base. There may be several bases operating at the same time in African societies. People sometimes use one base for one particular set of functions, e.g., counting animals, and another base for exchange of goods. Thus, in currency denominations we see that the cowrie shell currency was often related to various sets of special numbers. In any case, larger numbers are always produced by operations on the basic numbers. Number words in African societies are often very explicit in giving information about the operations, e.g., "five and two," for seven; "twenty take away three", for seventeen; and "three fives", for fifteen.

Counting on the Hands

Africans have used their fingers in counting from the days of the early Kemetic people. In the first written instance we have of a human being able to count on fingers, we find an African in the *Book of the Coming Forth by Day and Going Forth by Night* engaged in this function. Actually, the story is of a deceased per-aa (pharaoh) who was trying to secure a ferry-boat to take him across a river in the lower world. The ferryman objected saying 'The mighty god on the other side of the river will say, Why Did you bring me a man who cannot number his fingers?" But the deceased per-aa showed that he was a great magician and was able to recite a rhyme, which numbered his ten fingers. This act demonstrated excellent magic. Thus, in early African history the ability to count the fingers was considered an important skill. Such knowledge opened the door for five to ten as bases.

Inasmuch as Africans organized monumental civilizations in the Nile Valley on the basis of mathematical principles, one sees the importance of counting at an early stage in human history. Throughout the vast continent of Africa where there are more than three thousand languages, one finds similarity in the number words for two, three, and four in more than seven hundred languages. In an area that includes part or most of the Sahara nations of Chad, Niger, Mauritania, Burkina Faso, Senegal, Sudan, Cameroon and most of Southern Africa, the commonality in the words for two, three, and four is striking. The same is not true for the word for "one" which may be more directly rooted in individual cultural factors rather than numeration based on economic exchange.

On the other hand, "two" is usually some variation of *li* or *di*. The word for "three" will normally be comprised of some form of *sa* or *ta*. Four is a form of the nasal consonant *ne.* For example, in Kiswahili, a language spoken by more than eighty million people, the construction for the first five words are the following:

1 one *moja*

2 two *mbili*

3 three *tatu*

4 four *nne*

5 five *tano*

Some Interesting Facts About Numbers in Africa

Base five is the system of numeration used by the Kwanyama people of Namibia and when they want to make the numbers 6, 7, 8, and 9 they add numbers to five in the following manner:

5 tano

6 tano-na-mwe

7 tano-na-vali

8 tano-na-tatu

9 tano-na-ne

The Kwanyama express the composition of five and other digits with obvious explicitness.

In the Malinke languages of Mali, Guinea, and Burkina Faso, the word for "nine", *kononto,* literally means "the one of the bell," which is usually accepted as a reference to the nine months of pregnancy. As has been pointed out above, several languages use secondary bases. Where five is the principal base, ten or twenty may be a secondary base coming into play when it is necessary for counting. For example, among the languages of East and Southern Africa, base ten is often secondary to five. What this means is that the higher numbers proceed on the basis of tens. An example cited by Claudia Zaslavsky is:

100 tsikumi

1000 lukumi

10000 kakumi

In this case *kumi* is the word for ten that is repeated in the higher numbers. Although these words were originally applied to cowrie shells they are not limited to cowrie currency.

The languages of West Africa can also use base twenty as a secondary standard for counting. In those cases, ten is an independent word and may be designated as "two fives" or "two hands". Twenty is usually expressed as "person complete" in a literal

meaning of the entire number of human digits on both the hands and the feet. The Malinke word *dibi* means “mattress” that is shared by a man and a woman with forty digits.

Thus, among the Yoruba, Dyola, Nalu, Nuba, Efik, Balante, Vai, and Dru the five-twenty system is in widespread use. The Ibo people express the square of twenty as *nnu*, 400. The square of 400 is *nnu khuru nnu*, 400 meets 400, equals 160,000.

Numbers /Words of West Africa

Ibo	**Hausa**	**Yoruba**
I otu	1 daya	1 okan
2 abuo	2 biyu	2 eji
3 ato	3 uku	3 eta
4 ano	4 hudu	4 erin
5 ise	5 biyar	5 arun
6 isii	6 shida	6 efa
7 asaa	7 bakwai	7 eje
8 asato	8 takwas	8 ejo
9 itoolu	9 tara	9 esan
10 iri	10 goma	10 ewa
11 iri na otu	11 goma sha daya	11 ewa laa okan
20 ohu	20 ashirin	20 ogun

Number/Words of Southern Africa

Zulu	**Sotho**	**Lingala**
1 nye	1 ngwe	1 moko
1 bili	2 pedi	2 mibale
3 thathu	3 thavo	3 misatu
4 ne	4 nne	4 minei
5 hlanu	5 hlano	5 mitanu
6 isithupa	6 tselela	6 motoba
7 isikhombisa	7 supa	7 nsambo
8 isishiyagalombili	8 robeli	8 mwambe
9 isishiyagalunye	9 robong	9 libwa
10 ishumi	10 leshome	10 zomi
11 ishumi nanye	11 leshome lemotso mong	11 zomi ma moko
20 ngamashumi amabili	20 mashome a mabeli	20 ntuku mibale

African people have had written systems though not necessarily alphabetic writing systems for a long time. Most of the major African cultures used a form of hieroglyphics to express concepts, ideas, and time. Therefore, the concept of numbers, the use of words for numbers, and the counting of objects have existed in Africa for thousands of years (Zaslavsky, 1973; Asante, 2019). Evidence of productive art appears

all over the continent and is especially rich in Namibia, Chad, and Algeria. The Tassili site in Algeria and Ennedi site in Chad are international treasures. In fact, rock paintings of thousands of years have demonstrated that information, communication, and symbolism were early creations of *Homo sapiens* in Africa.

African Geometry and Greek Adaptations

Many reputable scholars now admit that the Greeks learned most of their early philosophy from the Africans (James, 1954; Diop, 1974 Bernal, l988). What is not so readily known is that there are four major propositions in mathematics that found their way from Africa to Greece (Petrie, l926).

Proposition One

The square of the hypotenuse of a right-angled
triangle is equal to the sum of the squares on
the side containing the right angle.

Such knowledge by the ancient Africans made it possible for them to solve some of the problems of the pyramid construction. They knew, for example, that possible combinations, in definite ratios, of the square of 3 and 4 which when totaled made 5. One could then construct a right-angled triangle with sides of 3, 4, and 5.

Proposition Two

The three angles of a triangle are together equal
to two right angles.

The ancient Africans were able to arrive at this conclusion mathematically although they were also capable of seeing that the three angles of an equilateral triangle are together equal to two right angles.

Proposition Three

The diameter of any circle bisects that circle.

The value given to *pi* by the ancient Africans was 3.13/18. Indeed, they calculated that if a diameter is divided into 9 units, the circle drawn around the diameter was equal to the square on a line with 8 units. Although this is less accurate than the contemporary calculation that puts pi at 3.14159, the ancient Africans were able to work with this calculation of ratio of the circumference to the diameter of a circle.

Proposition Four

If two straight lines cut one another, they make the vertical angles equal to one another.

The work of the ancient Africans can be seen and proved in almost all modern geometry textbooks. Much of what has been called discovery by Greeks rightly belongs to the ancient Africans. The Kemites of Sais, the science center of the ancient world, were able to calculate the distance a ship was from land and the height of pyramids.

The Greeks, particularly Herodotus, Strabo, and Diodorus, said that the ancient Africans had invented geometry. Forced from the earliest of times to solve geometrical problems, the Classical Africans of the Nile Valley gave considerable attention to the

problems of geometry. They knew how to evaluate the areas of rectangles and cylinders; they knew how to obtain precision of the areas of circles; and they understood how to analyze the triangle. All mathematical and geometrical problems proceed by trial and error as an aspect of reason. Herodotus says that the Greeks brought geometry from Egypt to their own country.

Textual Examples

Indeed, in the matter of calculating the area of the triangle, the ancient Africans had written:

Examples of reckoning a triangle of land. You are told a triangle of height (merry) ten rods has a base of four rods. What is its area? Do it thus: Take

half of 4 (2) to form its rectangle. Multiply 10 to 2 to obtain its area: Do it thus:

140011,000

1/220022,000

(Answer) Its area is 2,000 cubits (2 kha) = 20 setats.

(*Rhind Papyrus*, prob. 51).

The ancient Africans were just as capable in the area of the circle. Therefore, we read in the *Rhind Papyrus*:

Method for calculating the areas of a circular piece of

group of a diameter of nine rods. What is its area?

Subtract the ninth part of the diameter leaving 8

parts. Then multiply 8 by 8 times which will give you 64.

Hence, its area is six kha and four setats.

(*Rhind Papyrus*, prob. 50)

What we are able to see is that the ancients used a method which was essentially the squaring of eight-ninths of the diameter. This method gives *pi* = 3.2605. In fact, the value of *pi* obtained by the Africans in this way was a much stronger approximation than the value of 3 used by the ancient Eastern people (Chace, l979). There is no indication that *pi* was calculated by Western people prior to the Greeks doing so around the 6th century B.C.E.

The Moscow Papyrus

Alongside the *Rhind Papyrus* the only other extant mathematical papyrus from ancient Africa is the one that is located in the Moscow Museum, it is usually called the Moscow Papyrus. It is important for pointing to two significant achievements of the early Africans. Unquestionably, the discoveries made in geometry at the earliest time add to much of what we know and do today. Take the idea of the volume of a pyramid, for example, with the top cut off along a plane parallel to the base occupies a portion of the papyrus. The Kemetic geometers examined this problem in some detail. Where "a" is the side of the base, "b" the upper edge, and "h", the height, the formula correctly given in the papyrus is: volume, or V, = h/3 (a2 + ab + b2). What is remarkable about this formula is that the ancient Africans did not simply explain the discovery of a rule for the volume of a pyramid by deducing from the weighing of model pyramids and prisms but had more rational heuristic or justificatory procedures (Boyer, 1968).

Another problem in the *Moscow Papyrus* that is equally as telling in terms of the skill of the ancient Africans is the correct formula for a hemisphere. The scribe asked for the area of a hemispheric shaped basket or diameter 4 1/2 and found the area correctly as equal to the area of two large circles or twice the area of the base of the hemisphere. The formula was: 2(8/9)2 (4 1/2)2.

Contributions in Kemet after Conquest

The Assyrians fell upon Africa at Kemet and conquered the great city of Mennefer in 667 BCE. They left after a short while in 663 and then the Persians invaded 138 years later in 525 BCE, further taking what they could from the African classical civilizations and meandered around in the affairs of Kemet for nearly two hundred years, 193 to be precise, making no meaningful contribution to this ancient culture. The Macedonian and Greek invasion of Kemet in the autumn of 332 B.C.E. visited destruction on many of the institutions of the classical land. Indeed, the fact that Greeks had already, since the time of Homer, before the Assyrian invasion, started to come to Africa for education, meant that much of what the ancient Africans knew would be a part of the learning of the Macedonian and Greek conquerors. Alexander was able to defeat the Persians without a major battle.

Thales had come to Kemet to study geometry in the 7th century; Pythagoras had followed him and learned various theories and theorems in Kemet and visited Mesopotamia and found a school in Crotona in what is now Italy; Democritus of Abdera had spent time in Kemet and spoke of the rope stretchers of Egypt. The city of Alexandria founded at Rhacotis and enlarged by the Greeks became the mathematical

center of the world displacing the ancient city of Sais. Many Egyptian mathematicians wrote in Greek after the Greeks forced their language on the ruling classes. Since Greek was the language of the conquerors for nearly three hundred years, we find that many Egyptian scholars began to use the language. The fact that Africans in South Africa often used Afrikaans for mathematics under the white regime did not make them Boers, neither were the Africans in Alexandria made Greeks by their use of the Greek language. Sarton (1959:9) maintains that there were too few Greek immigrants to have a significant impact on the fundamental forces of African life.

African Mathematical Personalities

Euclid of Alexandria, one of the most important mathematicians of the era, spent his entire life in Africa (Raju, 2017). Euclid was an African who influenced not only Greece, but his geometry became the basic lessons of many European universities before Leonardo Fibonacci brought African numerals from Africa. Sarton accused Europeans of fabricating the pictures of mathematicians. We see this in many situations in mathematics. Writers try to claim even those who were born in Africa as blond and fair European mathematicians when we know that this is highly improbable. Euclid's chief work is his *Elements* that contain 13 books and some 465 propositions. In our opinion the reason his work dominated the teaching of geometry for 2000 years is because of this organization. The deductive method of proof which he perfected added new theorems and allowed mathematicians to be much more rigorous.

In addition to Euclid, there were other Africans who made contributions while living in the shadow of conquest. Eratostenes of Cyrene (b. in 194 BCE) in present day Libya was an African who wrote in Greek (Boyer, 1968). He was the first person to measure the circumference of the earth accurately. His method was intricate. He measured the shadow cast by the sun in Alexandria the same day that the sun shone down a deep well in Aswan (Syene) about 500 miles to the South. The shadow showed an angle of 1/50 of a circle from a direct zenith overhead. He knew that there were 360 degrees in a circle, and he multiplied 486 miles times 360/7 which gave him 25,000. This compares very favorably with the modern calculation of 24,830 miles. This is an error of only .7 of 1%.

Menelaus of Alexandria (b. in 70 AD) laid the foundations for studying spheres. Indeed, we can say that spherical trigonometry began with the African mathematician Menelaus. He used his method to study astronomy.

A man with the popular name, **Claudius Ptolemy** of Alexandria followed Menelaus in the field of astronomy living between 100 and 170 CE. His book is called the *Almagest.* Most scholars consider this work to be astronomy, but he was a major ancient trigonometrist. Ptolemy developed formulas for sines and cosines of the sum and differences of two angles and half angles. His tables, which he used for astronomy, remained in use for 1000 years. Some writers believed that he improved on the calculation of *pi* which the early Kemetic people had already established with greater accuracy than anyone else. Ptolemy's calculation was a value of 377/120, pi at 3.14167

(Boyer, 1968). We should remember that although the name Ptolemy comes from Alexander's general who ruled Egypt immediately after the Greek conquest by the time of this Ptolemy of Alexandria nearly fifteen generations had passed and he was Egyptian in every sense of the word, not Greek. It is no different than finding Africans today with names like Richard, Charles, Raymond, and Thomas, although these names are remnants of conquest.

Heron of Alexandria (born in 10 CE) lived during the same period and is credited with inventing 100 machines and writing mathematical books. We credit him with laying the foundation for cybernetics an robotics. Percival Edwards in 1883 is credited with the vending machine, but Heron invented the vending machine that dispensed soap and water nearly 1800 years before. Heron is often compared with **Diophantus** of Alexandria (b. 201-286) as practical rather than theoretical mathematician. Diophantus is called the father of algebra. In fact, some Eurocentric writers assume that they had to be Africans because they did practical work! This assumes that Africans could not do both, theoretical and practical mathematics. Whatever the ultimate merits of their work, which is given credit for inspiring some Europeans, both Heron and Diophantus were African mathematicians working in the Greek language. To be clear, their work was all on the African continent. They worked in a tradition that had been prepared by the earlier African scientists who had inspired the Greeks to come to Africa.

Hypatia, (b. 355-d. 415 CE) a brilliant African woman algebraist, held the chair of philosophy at Alexandria, long after the Greeks had been defeated in Egypt by the Romans, until she was murdered by Christian fanatics in 415 C.E. They literally tore

her apart. Hypatia was born in Egypt and was the daughter of an Egyptian, Theon; all of her work was done on the African continent influenced by the history of science and culture in the Nile Valley. There could not be any Alexandria without the Wasetian base. Some twentieth century drawings of Hypatia depict a white European with Nordic features!

Mathematics and Islam in Africa

The rise of the Muslim religion in the 7th century C.E. in Eastern and later Western Africa meant that Islam would have an impact on the thinking of Africa. Furthermore, it meant that African mathematicians, already given to working out problems within their own environment in relationship to iron, mining, agriculture, and architecture, would have the added notions that came with the integration of the indigenous cultures with Arabic culture, thereby benefiting both cultures. African Muslims introduced African numerals into Europe to replace the Roman numerals that were so difficult to handle with large numbers. However, it was not until later when the work of Fibonacci succeeded in gaining some acceptance that the less cumbersome numerals won a foothold in Europe. Europeans introduced laws to prevent the use of the numerals that came after the Muslims had conquered Egypt. In fact, the word "algebra" is derived from the name of the famous Islamic text, *Al-Jabr Wa 'L Muqabalah*. Indeed, the word "algorithm", a mathematical procedure, is taken from the name of the author of the text; he was called Al-Khwarizmi (Al-Daffa, 1977). This 8th century scholar's work laid the basis for much of modern practical mathematics. There is much speculation that although the work was done in Africa and Asia, namely in Baghdad, the inventor of algebra ad algorithm could have been African or Persian. The

records are not clear on this fact.

However, we do know that the African calculator, Al-Hasib Abu-Kamil Shiya ibn Aslam ibn Muhammad al-Hasib Al-misri, who lived from 850 C.E. TO 930 C.E., influenced many mathematicians including Leonardo of Pisa (Fibonacci) who found great inspiration in the work of the African mathematicians (Al-Daffa, 1977). Abu-Kamil Shiya is one of the most important African mathematicians in terms of his direct influence on other mathematicians. Three hundred years after his death, Fibonacci found his works to be significant enough to copy them wholesale and distribute them to Europeans. Fibonacci said that he wrote his book based on all that he studied in Egypt and other countries and left nothing out in order that "the Latin people should no longer be deprived of it" (Carrucio, 1964).

Mathematics in Contemporary Africa

Many Western writers have attributed African mathematical concepts to everyone but Africans. Actually, just about all groups have been credited with African accomplishments: Europeans, Arabs, Indians, Mesopotamians, and even space aliens have been cited as building the pyramids, creating geometry, erecting Great Zimbabwe, and so forth.

The use of mathematics in Africa predates that on any other continent. Furthermore, the development of mathematics in parts of Africa outside of the Nile Valley occurred about the same time as they did in other parts of the world. Therefore, the African kingdoms of the savannah, Ghana, Mali, and Songhai, had their great people of mathematics. Many Arabs contributed to the spread of the Ancient African wisdom

in mathematics. They traversed many regions carrying the knowledge they gathered from Africans in the Nile Valley to various regions of the world. Indeed, Islamic science developed within the framework of the Arab intellectual middlemen borrowing many ideas from the people among whom they spread the Islamic faith. As the Persians, Greeks and Romans had spread African religious ideas, such as the worship of Isis (Auset), so the Arabs took the spread of African science to different parts of the world. Original ideas of Arab intellectuals were often mixed with the ideas of the indigenous people among whom they lived and traveled. The flourishing of Islamic knowledge and science occurred after 639 CE when Cairo was established by General El As who had come to the area two years earlier. The expansion of Arab knowledge on the basis of the African foundation was a gift to the world. They did not find Africa devoid of science, mathematics, geometry, astronomy, and medicine; they bent the creative base of these sciences to the creation of new avenues for study and practice. What is often missing is the accrediting of the contributions and achievements of the previous culture and civilization.

Into Europe with Numerals

Leonardo Fibonacci, the most talented European mathematician of the medieval era introduced what he thought were Hindu-Arabic numerals into Western Europe in 1202. It took three hundred years for this system to take root in Europe. The rules of computation were unknown in Europe at this time (Zaslavsky, 1973:27A). What was passed down as computations were nothing more than arithmetic and bits of Euclidean geometry, translated from Greek to Arabic and from Arabic to Latin. According to

Zaslavsky the subject of computational rules was viewed with skepticism and suspicion by the established institutions. Thus, among the crimes for which the Spanish Inquisition later gave the death sentence was the possession of Arabic manuscripts and the study of mathematics (Zaslavsky, 1973: 274). Most Europeans considered the study of numbers to be magical and mathematicians were obviously heretics.

African developments in mathematics have not been the same everywhere. This is a fact on every continent and is certainly not a minimizing of the cultural and social achievements of societies that have shown enormous technical progress. However, it is generally accepted that the civilizations of the West African kingdoms reached high points of intellectual achievement that became the envy of the world. In fact, Leo Africanus wrote "Here are a great store of doctors, judges, priests and other learned men, that are bountifully maintained at the king's cost and charges. And hither are brought divers manuscripts of written books out of Barbary, which are sold for more money than any other merchandise." Furthermore, in the book *Tarikh es-Soudan*, the history of the Sudan, are these lines from a biography of al-Hajj Ahmed Baba, who was "a lawyer, lexicographer, grammarian, prosodist, and scholar. He occupied himself with the sciences all his life….At his death he left about seven hundred volumes of his own writing" (Hodgin, 1960: 91). Ahmad Baba had been vice-chancellor of the University of Sankore until the capture of Timbuktu by the Moroccans. Also associates from two other Malian universities studied and practiced the sciences at Sidi Yahya University and Djinguereber University. The Sudanese kingdoms had clerks and scribes, much like the ancient kingdoms of the Nile Valley from which they took much, copied manuscripts, calculated goods, particularly animals, and oversaw land. Many books

written by these scribes and scholars have never been translated into European languages. Termites destroyed others of the original books, but some were lost by military invasions, and by political instability. There have been international efforts to preserve the hundreds of manuscripts written in African languages using Arabic script that have been found in safe houses, archives, and tombs, in Timbuktu.

In 1700 in the present Nigerian city of Katsina there lived a scholar by the name of Muhammad ibn Muhammad who was renowned for his mathematical scholarship. He was a teacher of astronomy, number theory, geometry, and the mystic arts associated with numerology. His mentor was Muhammad Alwali of Bagirmi, a village close to Lake Chad. Alwali was himself quite a scholar and author, writing texts on astronomy, divinations, and magic. Unfortunately, none of those texts survive. (Zaslavsky, 1973: 276).

Losing Names Often Means Losing History

The participation of African scholars in Spain, Iraq, and Turkey during the reign of Islamic kingdoms is unquestioned. Since all Islamic Africans have Arabic names they often get lost in the acknowledgements of their contributions. It is much like someone looking at a citation by an American named George Washington Carver and assuming that the person is of European origin because of the name when in fact the person may be African in origin. One author identifies this kind of phenomenon with the fact that Nicolaus Mercator, the mapmaker, was really a Flemish person named Niklaus Kauffman, the surname being Latin for “merchant.” (Zaslavsky, 1973: 276).

African American Mathematicians

The first African in the United States to be recognized as a mathematician was Benjamin Banneker, born in 1731 in Maryland. He exhibited unusual talent with no formal training and is credited with inventing the first clock in North America (Asante, 2013). In addition, Banneker published his own almanac which corrected Benjamin Franklin's and was commissioned to help plan Washington, D.C. Benjamin Franklin, who was Secretary of State, sent a copy of *Banneker's Almanac* to Condorcet in Paris to illustrate the potential of Africans in America in the sciences. These achievements are even more important since during the time of Banneker's life in the United States, the white leaders who ran the country did not think Africans were capable of mathematics. This was so despite the fact, as we have seen, that so much of what we now know came directly from Africa. Banneker died in 1806 having become one of the most recognized scientists in early America (Asante, 2013).

There were other Africans equally as capable as Banneker but due to the conditions of enslavement were prevented from making their own researches. Even after Africans were emancipated in 1865 and could freely participate in academic endeavors the white associations of mathematics segregated African Americans. Indeed, the many potential African American mathematicians were dissuaded from entering the field because of the intense racism expressed in the mathematical

Association of American and the American Mathematical Society. The struggle to open mathematics associations to African Americans continued well into the 20th century.

The first doctorate in pure mathematical granted to an African American man**,** Elbert Frank Cox, was made by Cornell University in 1925. Yale University and the University of Michigan granted African American women the doctorate in pure mathematics in 1949. Evelyn Boyd Glanville received her doctorate from Yale while Marjorie Lee Browne was honored with her degree from Michigan. These women mathematicians were the forerunners to the women who would serve admirably as mathematicians in the American Space Program.

J. Ernest Wilkins received his Ph.D from the University of Chicago in 1942 when he was 19 years old. Wilkins was the only African American to work on the Manhattan Atomic Project. David Blackwell who became the first African American admitted into the National Academy of Science received his doctorate from the University of Illinois about the same time as Wilkins was graduating from Chicago.

The African American mathematicians like other Africans in America received harsh treatment from the society and their peers. In fact, at professional meetings where they gathered to read mathematical papers, the African American scientists would have to read the Green Book to find private homes that would rent rooms to them because of the segregation of the hotels. Few white mathematicians ever came to their defense to demand that they be allowed as professionals to register into the hotels like white scientists. Nevertheless, sufficient numbers of African Americans continued to study mathematics so that now numerous scientific advances in America have been credited

to African Americans. The National Aeronautical and Space Administration awarded the Space Act Award to David R. Hedgeley, mathematician, for a breakthrough in computer graphics that allows a wide variety of computers to show an image in 3-dimensional forms. Referred to as the Hedgeley Solution, the process is very reliable and applicable to complex 3-dimensional scenes.

In the diaspora, African Brazilians, African Caribbean people, and African Americans continue to establish themselves in the field of mathematics.

Mathematics is an old science that finds much of its inspiration and foundation in the classical civilizations of Africa. We have yet to explore the range of materials in Ethiopia, Sudan, and other areas of Africa, but we know enough to say that all people have contributed to the advancement of mathematics as a science. Africans made the first original contributions to science as far as we know from history, others followed with amazing success, such as the translations and disseminations of ancient knowledge by the Muslims, and since the 17th century the Europeans have been making their contributions. This does not mean that others have not continued to make contributions, but it reminds us that all human traditions are significant and necessary. In addition, Arabs, Turks, Iranians, Chinese, and Japanese have made remarkable contributions to the human pool of mathematical knowledge. Never should it be assumed again that the African contribution is insignificant or non-existent when it comes to STEM.

But our aim cannot be science to dominate the world, to pollute the oceans, to destroy the atmosphere; our grandest ideas must be about uplifting the downtrodden,

creating avenues for collective advancement, and demonstrating that our genius is for peaceful transformations of our lives.

Today we have scores of breakthrough scientists who are exploring all the boundaries of science. John Passmore, a genius at science and entrepreneurship, has established Latimer, named for the African American scientist who contributed to the invention of the lightbulb and the telephone. Passmore's ambition is like ours, to explore ways to have our scientists recognized for their contributions. He is interested in large language models for storing and using information to make changes in the world. It is important that continental African scientists continue to combine their work with that of Africans in the diaspora in the interest of making the world better.

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[1] Keeping the "races" separated and maintaining white domination meant that the historians of apartheid used every discipline to underscore the asserted superiority of the white races. Therefore, they commonly used archaeology, biology, and even theology to push the notion that whites were not only different, but intellectually superior to Africans. Erasing Africans from South Africa became a principal objective of education in apartheid South Africa. The idea was to create a land without people before the whites came. Of course, the idea was vigorously promoted but the attempt was futile given the wide range of human contributions found in the country.

[2]

The association of Hat-Heru (Hathor) with cattle has been demonstrated numerous times in the writings of Africologists and Egytologists.

[3] The conspiracy of silence about Africa's contributions to world history was what inspired Cheikh Anta Diop, Theophile Obenga, Chancellor Williams, Yosef ben Jochannon, and indeed, some European writers such as Basil Davidson and Martin Bernal, to condemn the racist nature of Western scholarship.