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Prehistory and the Beginning of History

2.1 The Neolithic

The Neolithic period dates back to about 6000 years ago. It began when some groups of people adopted a new lifestyle, switching from their earlier nomadic lives hunting and gathering to land farming and animal farming.

Even before the Neolithic age, humans began to wonder about life on Earth and the stars in the sky, perhaps out of fear, but probably also out of curiosity and purely astronomical interest. The Sun was worshipped as a god from prehistoric times by early humans, but besides religion, there was also a regular observation of the stars. This was the first form of astronomy, which is very likely as old as humankind.

Through archaeological studies, early astronomical observatories have been found, such as the one at Stonehenge, situated in central southern England. It consists of a basic structure of megalithic stones set in a circle that surround more standing stones, amazingly built using only very primitive tools. Stonehenge is the best known astronomical site of Neolithic times, built around 3000 BC, most likely for the observation of the Sun (Fig. 2.1).

The construction of Stonehenge contains a clear alignment of stones, through which, at the summer and winter solstices, one can see the rising Sun at dawn and the setting Sun in the evening. This gives a spectacular view of the Sun, a scene still admired by thousands of tourists who gather at the site during the summer solstice on 21 June. It's a ritual, and for some, a real act of faith, to witness the appearance of the Sun between the geometric figures of the megalith. It's a show which continues even today, perhaps because of the many stories and legends about these mysterious megalithic structures.



Fig. 2.1 Stonehenge. This is my representation of Stonehenge on canvas, painted with acrylic colors, to which I have added a bright golden metallic glass Sun. I never been to Stonehenge, but I imagined how the Sun would appear between two megaliths on 21 June

And stories and legends do so fascinate humanity! It has been thought for some time that the Druids (Celtic priests) built Stonehenge. It was John Aubrey in 1640 who first became convinced of this story, but carbon dating has dated Stonehenge to a millennium before, between the Neolithic and the Bronze Age. The Druids were not at Stonehenge when it was built. In a scientific paper published in *Nature* in 1966, the well-known astrophysicist Fred Hoyle¹ claimed that Stonehenge had an astronomical function (Fig. 2.2).

Stonehenge was not the only Neolithic astronomical observatory of the Sun. A small bronze artifact, the “Nebra sky disk,” with a diameter of about 30 cm, has been found in the central part of Europe. It carries a very clear representation of the Sun and the Pleiades star cluster. This artifact probably has a religious meaning, like many such items from ancient cultures, but the

¹ Fred Hoyle was convinced of the extraterrestrial origin of life on our planet. With physicist Chandra Wickramasinghe and many other colleagues, he published a paper in 1978 in which he claimed that life was seeded on Earth by life-bearing comets about 4.1 billion years ago. So, this was a theory of cosmic biology, and not strictly terrestrial biology. Fossils of micro-organisms contained in meteorites of the kind continuously arriving on Earth would be the kind of thing needed to prove Hoyle’s idea. In September 2023, NASA’s mission Osiris Rex to the asteroid Bennu found traces of carbon, water, and abundant material that would be relevant to a cosmic origin for life on Earth, at least for some of its necessary ingredients, although no living organisms, not even space-resistant bacteria, are likely to be involved. So, of course, Hoyle, was not suggesting that life on Earth began with the arrival of little green men.



Fig. 2.2 Little green men. Three funny clay aliens representing Martians who have just landed in my town. Acrylic paint on canvas, and terracotta figurines

possibility of serious observation of the Sun in the sky cannot be excluded, perhaps by the priest-astronomers of the time.

Another solar observatory, this time situated in Saxony Anhalt in Germany, is the Goseck circle. It is even older than Stonehenge, and is so far the oldest solar observatory ever found. It was built by an early European culture, even before the civilizations of Mesopotamia, and before the construction of the pyramids in Egypt. Not much is known about this early culture, but we know, thanks to the radio-carbon dating, that this site was built in about 4900 BC. Archaeologists long thought that the circles were an old fortification, but further research in this area of Germany has confirmed that the remains of the structure show a clear astronomical alignment for observing the winter and summer solstices.

In Ireland, there is another Neolithic solar observatory called Newgrange or *Sì an Bhrù* in Irish, which means “the Sun’s cave.” It is in fact a tumulus containing a burial site and an astronomical observatory. Newgrange is located about 50 km north of Dublin. On 21 December, the date of the

winter solstice, the Sun's rays enter the site to illuminate the interior of the structure. When this happens, light reaches right through to a tomb, giving a "magical" appearance to the site. Newgrange is another megalithic construction, made of huge blocks of stone, not cut, but assembled inside a tumulus of diameter 70 m and containing a corridor 17 m long. During the winter solstice, the Sun's rays enter this passageway and reach all the way to the end, where there is a block of stone decorated with spiral engravings.

Many stones in Newgrange are decorated with these spirals. According to archaeologists, they may represent symbols of divinity. We may suppose that, since they attributed particular importance to the Sun, those who built the site probably honored and worshipped it as a divinity, and they may also have had some knowledge of astronomy. Indeed, Newgrange was built with incredible astronomical competence, considering how old it is, and is one of the most important megalithic sites in Europe.

Nowadays, Newgrange is extremely well known. The site is a popular tourist destination and is open to visitors, especially at the time of the winter solstice. To make it more appealing, the organizers have artificially reproduced the effect of the Sun's rays in the passageway.² I have never had an opportunity to visit Newgrange, but I can imagine the reaction tourists must have to this artificial visualisation of the Sun's rays in the passageway. However, the real effect at the solstice must be even more astonishing.

These examples of Neolithic sites, with their solar alignments, are among the best known and most studied by archaeologists. There are many more of them in Europe, less well known than the ones I have described, but no less interesting. The need for astronomical constructions may have been connected with the rise of agriculture. The spring constellations would have been observed as a sign to begin crop planting, and the fall constellations for harvesting before the onset of winter.

Several less well known but no less important astronomical sites are found in Bulgaria. Karanova is the largest and oldest astronomical site in the region. Topchika cave has the oldest rock paintings and Magura cave also has rock paintings representing celestial phenomena, while Tangarduk Kaya is the most important cave with regard to observation of the Sun and its solstices.

During the Neolithic, astronomical observatories may have been built for practical purposes, such as crop planting and harvesting, as previously mentioned, but also for religious and astronomical reasons. Engravings and

² Tourism is probably a good thing for economic reasons, but not so good for the preservation of historical sites. Too many people visit these vulnerable archaeological sites, many with little or no respect toward them. Newgrange limits the numbers of tourists, but personally I feel that adding the artificial effects of the Sun's rays was not really necessary.

paintings in caves are clear testimonials to how much our ancestors may have understood astronomy. Martin Sweatman at the Edinburgh School of Engineering has done studies of prehistoric art. In his view, these people had an advanced knowledge of the sky. He declares with some conviction that the people concerned were intellectually hardly any different from us today. Quite a bold affirmation from a scholar in this area! Regarding cave paintings around Europe, there have been interesting studies by archaeologists at the Universities of Kent and Edinburgh. It has been suggested that animal paintings in caves may actually be symbols of constellations, and not simply depictions of people's daily lives.

Well, I asked an astronomer friend for his opinion on these recent studies by the archaeologists. This is his comment:

I am an astronomer, but I was stupefied on viewing the stars in a truly dark sky on a clear moonless night in the Sierra mountains of California. I can only guess that the early people, who always experienced such dark skies, were just as familiar with the stars as we are today.

His comment makes perfect sense to me, and I find it quite possible that animal paintings in caves may in fact have been representations of constellations, as claimed in the recent studies at the University of Kent and Edinburgh. As I mentioned in my previous book "Close Encounters of Art and Physics" published by Springer 2019, the rock paintings in caves, according to my interpretation, were probably not just artistic expressions by early humans, but a tool for describing their curiosity about and interest in Nature. Animals were very present and important in the lives of prehistoric humans, so it may be that cavemen looking at the stars imagined they saw animals. It is a fact that the meaning and interpretation of the sky can vary from era to era and culture to culture. At the same time, but in a different hemisphere, Native American peoples were also making drawings on cave walls, and on one particular rock, we can clearly see representations of the Sun and stars.

We cannot be sure whether, in the Neolithic and Bronze ages, people had any real knowledge of astronomy, but they were certainly observing the sky, and through their observations, they would have developed myths and legends about the creation of the world. The Sun in particular has been seen as the most important, and indeed life-giving celestial object, and it was therefore often worshipped as a God. In many ancient cultures, myths and legends would have been ways to communicate, and also to explain the very workings of the world. And the most successful tool available would surely have been the visual arts, paintings in particular, and small artifacts.

2.2 The Bronze Age

2.2.1 Ancient Mesopotamia

Mesopotamia is recognized as the site of some of the world's earliest human settlements and civilizations, dating from the early paleolithic until the era of late antiquity. The region known as Mesopotamia is situated in a valley between two rivers, the Tigris and the Euphrates. It has seen some of the most ancient cultures, and has been labeled by historians "the cradle of humanity." Its inhabitants include the Assyrians and Babylonians, and prior to them, in the late fourth millennium BC, the Sumerians, who were among the first to use cuneiform writing. This attempt at written communication was originally representational. For example, a house would be drawn in order to refer to a house. However, this system was eventually found to be rather inconvenient and evolved to use more abstract symbols and concepts. Cuneiform writing became more phonetic, denoting sounds, and semantic, denoting concepts. It is through the many tablets that have been found that we have learned about their culture and those of their successors.

The Assyrians and Babylonians, for example, are known to have been keen observers of the stars and constellations, and they may well have been the first true astronomers in human history. They lived in the same valley of Mesopotamia, with the Assyrians in the north and the Babylonians in the south, and they shared the same cuneiform writing and the same religious beliefs, inherited from the earlier civilizations of Sumerians and Akkadians. The Babylonian dynasty reigned for about 300 years in the area that is now Iraq.

Hammurabi was the best remembered king of that dynasty, known especially for the oldest known code of law, the Code of Hammurabi. This code is the most complete collection of laws ever written in ancient times. It contains 282 laws, including economic provisions, family law, criminal law, and civil law. And most famously of all, it led to the expression "an eye for an eye, a tooth for a tooth," which meant that forgiveness was not on the agenda! Serious punishment was inflicted on those who did not obey the law. The Assyrians were aggressive warriors. They conquered the lands of Mesopotamia and also the lands we now call Turkey.

During the time they ruled Babylon, the Assyrians created the first library in ancient history, containing thousands of clay tablets, on which they described their science, religion, and Mesopotamian legends in cuneiform writing. But besides writing, we also know how important it was for them to portray visual images relating to religion, war, and legend. Anyone who

has had the chance to visit the British Museum in London will never forget the marvelous, and truly enormous, stone figures created at the time of the Assyrians and Babylonians.

Art always had importance as a means of communication in ancient societies, since the majority of the population could not read or write, and indeed, in many early cultures, writing had not yet been invented. Art, in religion as in war, had the role of glorifying gods and kings. It was the most important tool, and maybe the only tool, for communicating with the illiterate population of the time, and this was also true for the Assyrians and Babylonians.

In religion, the cult of the Sun was particularly important for the Babylonians, and one of the priest's roles was to study the Sun and the stars. The Babylonians also believed that the stars could influence their lives, and that by observing and studying the constellations, the future could be read. They created the twelve signs of the zodiac and the first concepts of astrology, imagining the stars as making up mythological figures in the sky. They divided the year into twelve months, assigning each one a figurative zodiac sign. According to the Babylonian priests, the Sun appears in a different constellation each month. By studying the positions of the celestial bodies, they claimed to be able to interpret our lives.

The modern zodiac signs are the same as the ones created by the Babylonians during the late fifth century BC. Many centuries have passed since then, and amazingly enough, astrology is still alive and well. But today, we don't need the ancient Babylonian priests to interpret our future by observing the constellations. Nowadays, we can easily get informed about our astrological horoscope by reading newspapers and magazines, or watching TV. But by looking at the stars, Mesopotamian priest-astrologers did not only read and interpret people's lives here on Earth. They also studied the sky using scientific methods, such as mathematics. In fact, they were probably the ones who invented the concept of zero, or at least, the absence of number.

So, how did these primordial astronomers portray the Sun visually and culturally? And what kind of myths and legends did they create regarding our star? For the Babylonians, the Sun was at the heart of a religious cult, as well as being an astronomical object they could study in the sky. The Sun was a god! Shamash was the Sun god for the Sumerians, and subsequently also for the Assyrians and Babylonians. They imagined Shamash traveling across the sky every morning, opening the gates in the east and entering the gates in the west at the end of the day. In-between, his voyage continued in the underworld, whereupon night appeared on Earth. Sometimes, during Shamash's voyage



Fig. 2.3 The Mesopotamian Sun god. Shamash was the powerful Sun god of Mesopotamia. I have represented him by a terracotta figure, painted in acrylic gold, with a radiant crown and wings also painted in gold

in the underworld, he could be attacked by demons, causing a temporary obscuration of the Sun which we call a solar eclipse!

The journeys of Shamash explained the cycle of day and night. By an empirical observation, the Assyrians and Babylonians could have better explained the obvious change between day and night, but imagination played a powerful role in this ancient population, and it was important for their beliefs to invent myths and legends. The symbol of the Sun god Shamash was a disk with sunrays, sometimes represented with wings, and later, after the invention of the wheel by the Sumerians in the fourth millennium BC, on a chariot, sitting on a throne and holding the two symbols of his power: a solar disk and a royal scepter. It was believed that Shamash could see everything in the world. As Sun god, he was always present in the sky, whether it was sunny or cloudy, and because he could see everything and all the time, he was worshipped as the divine judge (Fig. 2.3).

2.2.2 Bronze Age Egypt

Ancient Egypt was a civilization in the Nile valley in northeast Africa. Upper and lower Egypt were unified into a vast kingdom from around 3100 BC until the conquest by Alexander the Great in 332 BC. The pharaoh was leader

of the state and the religion, and considered to be the divine intermediary between the gods and the population.

The Egyptians had a prodigious imagination for myths, legends, demons, and gods. Ra was the Sun god, the most important in Egyptian religion and culture, the creator of everything, from the Universe to humanity itself, the one that gave life on Earth through the warmth of his rays. Ra traveled on a golden boat across the Blue Nile during the day, and lit up the world of the dead at night. Ra could have encounters during his voyage through the underworld, in particular, with a demon, the snake Apep, which could attack the Sun god's boat, temporarily obscuring the Sun. Nowadays, of course, we call this phenomenon a solar eclipse. In all ancient cultures, the fascination with and fear of this celestial phenomenon inspired myths and legends created by the feeling of mystery that surrounds the unknown (Fig. 2.4).

But what is the real nature of a solar eclipse? Hugh Hudson, astrophysicist at the University of Glasgow, Scotland, says: "A solar eclipse is simply the shadow cast by the Moon. It is a rare phenomenon because the motions of the Sun and the Moon have to align exactly with the observer on the Earth; the full shadow (total eclipse) is typically no more than a few hundred kilometers across. This shadow races across the Earth along a different path each time, roughly twice a year, but only those lucky people within the path of totality get to enjoy the spectacular appearance of the solar corona, and only briefly."

So that's it! The mysterious phenomenon of the temporary occultation of the Sun. Not demons or evil serpents from the underworld, but a natural motion of the Moon in front of the Sun.

Doctor Hudson also points out the spectacular beauty of the solar corona during a total eclipse. The Sun's corona is the outermost part of the Sun's



Fig. 2.4 Solar eclipse. Visual representation of a temporary obscuration of the Sun, depicted with acrylic paint on canvas

atmosphere. We cannot usually see it because we are blinded by the Sun's bright surface. Without a special instrument, the corona can only be viewed during total solar eclipses. At a temperature of about 1 million kelvin, the corona is hotter than the surface of the Sun, but strangely less bright, and despite many years of observation, it is still considered something of a mystery. An enduring problem in astrophysics.

Regarding the solar eclipse, Dr Hudson and colleagues have had a fascinating idea, or as he calls it, "a brilliant idea": eclipse-chasing. For the next very long eclipse in 2024, they would like to record the sound stream from different sites as the shadow reveals the corona to those watching. They are also hoping to put the sound track on the Web. I find this communication idea brilliant indeed. In his words, "One would not believe the gasps and shouts (and profanity) when people see the naked corona suddenly revealed!" Personally, I would love to be one of the people who gasp and shout when the naked corona is revealed!

But, getting back to the religion of Ancient Egypt, Ra was not the only name given to the Sun god, for they worshipped the Sun under several names. These include the falcon-headed Ra-Horakhty, Amun-Ra, and Ra-Aten (Fig. 2.5).

One pharaoh, Akhenaten, is particularly closely associated with Sun worship. He is remembered as the pharaoh who changed religion from polytheism to monotheism. Historians described him as heretic, fanatic, and somehow mad, but also as mysterious, enigmatic, and revolutionary.

He was the first in ancient culture who dared to change a religion. Then, only one God had the power over everything on Earth and over the whole Universe. The change imposed by Akhenaten to a monotheistic worship of the Sun was not widely accepted by the all-powerful priests, nor indeed by the illiterate and superstitious population. Of course, there was a reason for making this choice, and it was not inspired by theological illumination. Through this change, only the pharaoh Akhenaten could communicate with the Sun's disk, without any interference from the many other gods (Fig. 2.6).

The Sun was worshipped as a life-giver, so anything or anybody touched by the Sun's rays was blessed. And there is truth in this ancient belief. In a sense, the vegetation on planet Earth is indeed blessed by the touch of the Sun's rays. We call this phenomenon photosynthesis, a process by which plants use sunlight to store chemical energy in the form of glucose (a sugar), taking in carbon and water from the air and soil and releasing oxygen as a byproduct. Almost all life on Earth depends on this chemical process. By eating plants, herbivores obtain energy, and then carnivores and omnivores like humans obtain energy by eating herbivores. The Egyptians' ancient belief that the

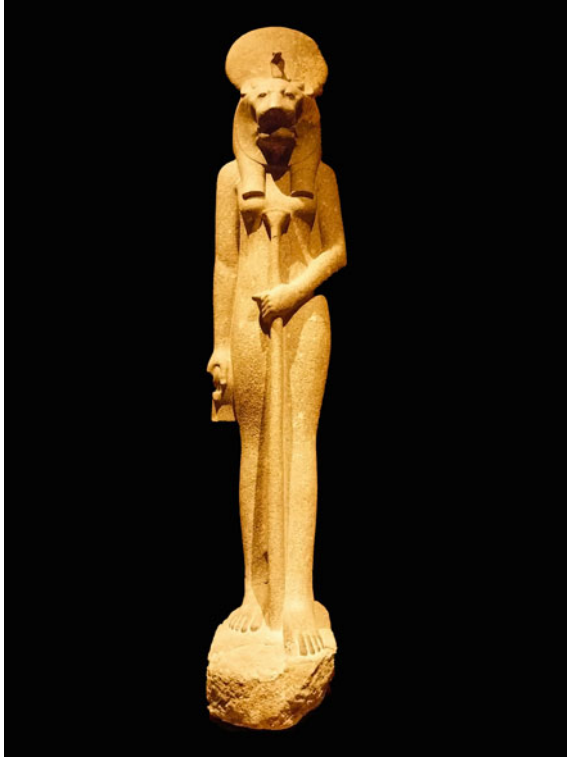


Fig. 2.5 Sun goddess with lion's head and the symbol of the Sun disk. Egyptian Museum in Turin, Italy. Photo by the author

Sun's rays bless whatever they touch can thus be compared with the process of photosynthesis. It converts the Sun's energy to the chemical energy which has sustained living systems on our planet for billions of years. So, in a way, we can agree with the Egyptians' ancient cult of the Sun. Everything and everyone the Sun's rays touch receives a blessing!

In Ancient Egypt, myths, legends, and religion were always connected to the creation of the world. Ma'at was the goddess of creation and also of truth, justice, cosmic balance, and order. And above all, she was the daughter of the supreme god, the Sun. Justice, order, and laws were given by the gods to humankind at the moment of creation, which means she was a very important deity. In paintings, Ma'at was represented as a woman, seated or standing, with an ostrich feather on her head.

The Sun god himself was worshipped under different names according to the Sun's position on the horizon or in the sky. Khepri was the morning Sun, Ra-Harakhty the Sun at the zenith, the most powerful one, and Atum the evening Sun, the oldest and wisest. The Sun god was represented everywhere,



Fig. 2.6 Pharaoh Akhenaten. Terracotta figurine with golden sunrays

in drawings on papyrus and paintings on grave walls, but also in the architecture of monumental pyramids, sphinxes, and temples, and sculptures from large figures to small clay figurines. He was literally everywhere. During the reign of Akhenaten, the Sun god could only be honored and worshipped indirectly through the pharaoh, who alone had the power to communicate with the supreme God.

The impressive monumental art works of ancient Egypt have been admired throughout antiquity right up to our own time, as has the work of artisans, who played an important role in Ancient Egyptian society. Jewelry-making

provides a good example. Body adornment has been a feature of human vanity since the people of prehistoric times. However, the Egyptians, in particular, were masters in the craft of jewelry-making. Artifacts have been found mostly in tombs, some of them going back as far as 4500 BC. It was very common for Egyptians to wear jewelry, from the youngest child to the oldest priest, from the poorest peasants to royalty and the elite. Some types of jewelry were worn during life, others were made for burial. Indeed, it seems that Egyptians were always buried with adornments.

Jewelry was made to be decorative but also to serve a purpose. These crafts have been documented by images in tombs illustrating different techniques. For example, painted scenes have been found of men drilling beads, while others string them together. Notably, glass beads were often used in necklaces.³

The artistic style in Ancient Egypt changed very little over time. In fact, the word “art” is absent from their hieroglyphic language, while art itself was very present. Artwork was functional, bound to religion and ideology, and idealized in its form, involving a particularly unrealistic vision of the world. Symbolism played a prevalent role in establishing the sense of order. Animals were represented as symbolic figures, and colors were also used to symbolize different things. For example, blue was a sign of fertility and birth, and also symbolized the water of the Nile. Blue and green were associated with vegetation and were symbols of vitality. Turquoise was used for funerary equipment, black as a symbol of the afterlife, gold as the main symbol of divinity, and perhaps most importantly, red, orange, and yellow as symbols of the Sun.

A change came in the arts during the reign of Pharaoh Akhenaten. It is known as Amarna art, named after the city founded by the pharaoh himself. The monotheistic worship of only one god, the Sun, reflected a major change of culture and style. Figures began to show a kind of movement that was absent before this period, with overlapping images creating an illusion of motion. The culture changed after Akhenaten’s death, returning to the polytheistic religion. Akhenaten reigned in Egypt for only seventeen years, and probably died in 1334 BC, whereupon his name and face were completely removed from all paintings and monumental representations. Apparently, it was commonplace in Egypt to denigrate public figures. Akhenaten was not loved by his people. He was completely forgotten for centuries following his death, until the nineteenth century, at which point, through many archaeological excavations, the past existence of Akhenaten was brought back into

³ Being a glass artist myself, I often make glass beads. I find it interesting that this craft fascinated ancient peoples like the Egyptians, and that it has been around in human history for so many centuries.



Fig. 2.7 Hieroglyphic text at the Egyptian Museum in Turin. No sign of any written text about Akhenaten. Photo by the author

public view. But note that, despite Akhenaten's "Damnatio memoriae",⁴ the Sun god still remained the major divinity in ancient Egypt (Fig. 2.7).

⁴ I recently visited the Egyptian Museum in Turin, Italy. I was curious about the Pharaoh Akhenaten and, among the many tombs, sculptures, and hieroglyphic texts, hoped to find something mentioning the importance of Akhenaten's life. Well, it turns out that the "damnatio memoriae" was indeed borne out!