Astronomy of Ancient Cultures

The science of archaeoastronomy combines the fields of astronomy and archaeology with the goal of uncovering clues to the importance of astronomy in ancient cultures. The pages below focus on a variety of early civilizations, but regardless of their differences, it is apparent that these cultures had one thing in common: astronomy was a backbone of their social, political, and religious systems. Astronomy is considered to be the most ancient science, although until recently it was not conducted as science for curiosity's sake or for the furthering of human knowledge. Instead, the study of the sky was a vital part of the theological foundation of early civilizations. The sky's obvious effects on Earth led to the view of an intense connection between celestial events and human affairs. The first question we must ask when we begin to study archaeoastronomy is: why did the ancients bother? The most obvious explanation derives from the fact that the sky is a dynamic and ever-changing scene. Due to the changing positions of the Sun, Moon, planets, stars, and other astronomical objects, astronomy probably began as a natural curiosity. Eventually, over a few generations patterns were noted in the sky, and the people began to assign a mythical value to certain patterns. The cyclical occurrence of the Sun, constellations, and to a lesser extent the planets, gave the impression of a cosmic order. Everyday observations, such as the rising and setting of the Sun, and seasonal observations, such as the summer and winter solstices, were carefully noted and often coincided with festivals. Astronomical events like eclipses and supernovae were often hailed as religious signs. Archaeoastronomy is a fascinating field which gives an immense insight into the mindsets of ancient cultures. The reference page below contains a listing of some of the best books and articles on the subject, as well as a list of interesting websites dealing with archaeoastronomy.

The astronomy practiced by Native Americans is impossible to summarize in one explanation, since the tribes had such diverse traditions and legends. The impressive aspect of their astronomy lies in the fact that many of the tribes were hunters and gatherers. This contrasts sharply with the other ancient cultures studied here, which developed the practice of astronomy after becoming equipped with the technology of agriculture.

Ancient Astronomy of the North American Indians

The Anasazi of Chaco Canyon, New Mexico

The Anasazi were a mysterious people who lived in Arizona and New Mexico about a thousand years ago. They built high cliff dwellings, the ruins of which remain today. Little is known about their way of life, but several tantalizing clues were left in the form of cave art. A recently discovered site called Penasco Blanco shows a depiction on a cave wall of what must be a supernova explosion (see picture below). The relative orientations of the crescent moon and the star make it very likely that this is a recording of the supernova which created the Crab Nebula in 1054 A.D. This supernova, which would have been about five times brighter than Venus for about three weeks, was also recorded by Chinese astronomers. Another very interesting site is called the Anasazi sun dagger. It is a spiral design traced into a cave wall, and during midsummer, midwinter, and the equinoxes it is perfectly bisected or surrounded by daggers of sunlight which enter the specially placed windows. The Anasazi also built a solar observatory called Hovenweep Castle at Four Corners. All of this evidence points to the fact that the Anasazi were quite experienced sky-watchers, as are their probable descendents, the Pueblo Indians.

The Pueblo Indians of New Mexico

Studying the astronomical practices of the Pueblo gives us a glimpse into the astronomy of ancient groups such as the Anasazi. The Pueblo Indians lived in a society completely dominated by a strict religious order. Timing ceremonies was vital to them, and they devised a type of knotted cord that allowed them to keep track of the solar cycles. Summer solstice was a particularly important time for them: an individual known as the sun priest would watch for the summer solstice through a notch in the wall of a 'sun tower'. At the proper time, the sun priest would warn the people, speaking words which were thought to come directly from the sun.

Big Horn Medicine Wheel, Wyoming

The Big Horn Medicine Wheel is a mysterious stone marking which was placed at the summit of a 10,000 foot mountain between 200-400 years ago, probably by the Cheyenne Indians (see photo below). It has a diameter of 90 feet, with 28 spokes that radiate outward and apparently stand for the number of days in a month. Although the orientation has been debated, it seems that the medicine wheel marks both the rising and setting sun on the summer solstice. Other stones in the arrangement mark the rising of the bright stars Aldebaran, Rigel, and Sirius. Other medicine wheels have also been found to have astronomical orientations, such as one at Moose Mountain in Canada, which was probably built between 100-500 A.D.

Neolithic Astronomy in Britain

Perhaps the most mysterious ancient astronomy is that practiced by the neolithic people of Britain and Western Europe. Beginning around 3000 B.C. the people of this region began accumulating giant stones called megaliths and placing them in specific shapes with special orientations. The most famous example of this is Stonehenge, a site on a plain in southern England (see picture below). This monumental feat was begun five thousand years ago, and was continually reconstructed and added on to for two thousand years. The large stones weigh about 30 tons each, and were probably dragged by oxen from a site 20 miles away, while the central volcanic stones come from Wales, over 130 miles away. The astronomical orientations of these stones are generally without question, although archaeoastronomers believe in different levels of the people's scientific capability. What makes Neolithic astronomy more mysterious is the fact that only the monuments remain; the people had no writing system at that time with which to record their motivations.

At Stonehenge, astronomical alignments are hard to judge because stones were placed next to each other sometimes hundreds of years apart. However, it is commonly accepted that Stonehenge recorded the rising and setting positions of the Sun and Moon at the height of each season. In addition, the oldest stone at the site, called the Heel Stone, was placed at the entry to Stonehenge in such a position that sighting it from the center of the monument points directly to the summer solstice. It has also been suggested that the outer series of holes could have acted as a computer to predict lunar eclipses. This use is the most advanced stage of neolithic astronomy, and is still debated among archaeoastronomers. The picture below shows a schematic of the astronomical orientations at Stonehenge.

Studies of other neolithic sites throughout Britain and France show that many sites have a mathematical significance as well. At the Avebury stone ring, 17 miles north of Stonehenge, the common neolithic unit of distance, called the megalithic yard, is highlighted. The circumferences of the circles of stones are significant: 25 or 50 megalithic yards (a megalithic yard is 2.71 feet). Many of the circles have diameters of 4, 8, 12, 16, or 32 megalithic yards. In an effort to achieve a value of pi which was an integral number, some of the circles are flattened at the top. It is also evident that these people were aware of the geometric relation that we call Pythagorean's theorem for a right triangle. Several shapes are constructed based on an interweaving of circles and right triangles. Some of the stones could be used as sights to distant mountain ranges, where astronomical events could be pin-pointed.

Arab and Islamic Astronomy

During the period when Western civilization was experiencing the dark ages, between 700-1200 A.D., an Islamic empire stretched from Central Asia to southern Europe. Scholarly learning was highly prized by the people, and they contributed greatly to science and mathematics. Many classical Greek and Roman works were translated into Arabic, and scientists expanded on the ideas. For instance, Ptolemy's model of an earth-centered universe formed the basis of Arab and Islamic astronomy, but several Islamic astronomers made observations and calculations which were considerably more accurate than Ptolemy's. Perhaps the most fascinating aspect of Islamic astronomy is the fact that it built on the sciences of two great cultures, the Greek and the Indian. Blending and expanding these offen different ideas led to a new science which later profoundly influenced Western scientific exploration beginning in the Renaissance.

Purposes of Islamic Astronomy

Perhaps the most vital reason that the Muslims studied the sky in so much detail was for the purpose of time-keeping. The Islamic religion requires believers to pray five times a day at specified positions of the sun. Astronomical time-keeping was the most accurate way to determine when to pray, and was also used to pin-point religious festivals. The Muslim holy book, the Koran, makes frequent reference to astronomical patterns visible in the sky, and is a major source of the traditions associated with Islamic astronomy.Another important religious use for astronomy was for the determination of latitude and longitude. Using the stars, particularly the pole star, as guides, several tables were compiled which calculated the latitude and longitude of important cities in the Islamic world. Using this information, Muslims could be assured that they were praying in the direction of Mecca, as specified in the Koran.Aside from religious uses, astronomy was used as a tool for navigation. The astrolabe, an instrument which calculated the positions of certain stars in order to determine direction, was invented by the Greeks and adopted and perfected by the Arabs (see picture below).The sextant was developed by the Arabs to be a more sophisticated version of the astrolabe. This piece of technology ultimately became the cornerstone of navigation for European exploration.

Great Islamic Astronomers

Science was considered the ultimate scholarly pursuit in the Islamic world, and it was strongly supported by the nobility. Most scientists worked in the courts of regional leaders, and were financially rewarded for their achievements. In 830, the Khalifah, al-Ma'muun, founded Bayt-al-Hikman, the 'House of Wisdom', as a central gathering place for scholars to translate texts from Greek and Persian into Arabic. These texts formed the basis of Islamic scientific knowledge.One of the greatest Islamic astronomers was al-Khwarizmi (Abu Ja'far Muhammad ibn Musa Al-Khwarizmi), who lived in the 9th century and was the inventor of algebra. He developed this mathematical device completely in words, not mathematical expressions, but based the system on the Indian numbers borrowed by the Arabs (what we today call Arabic numerals). His work was translated into Latin hundreds of years later, and served as the European introduction to