Medieval Astronomy: Stories in the Sky

a class by Yaroslava Solovei (Nadya Neklioudova)

It is often said that we are made of star-dust. And scientifically speaking, it's true - the oxygen in our lungs, the carbon in our bodies, calcium in our bones, iron in our blood – these and other essential elements were created inside stars before Earth was even born. So, it could be said that all of us, all humans throughout the ages, share a connection with the stars – and through that, a connection with each other, throughout our history.

In recent years, an article came out that really stuck in my mind – about the how the story of Orion the Hunter, and the Pleiades, the Seven Sisters, might actually be one of the oldest human stories in the world:

"Look carefully tonight at the Pleiades star cluster, and you will probably count six stars. So why do we say there are seven of them? Many cultures around the world refer to the Pleiades as "seven sisters", and also tell quite similar stories about them."

"In Greek mythology, the Pleiades were the seven daughters of the Titan Atlas. He was forced to hold up the sky for eternity, and was therefore unable to protect his daughters. To save the sisters from the hunter Orion, Zeus transformed them into stars. But the story says one sister fell in love with a mortal and went into hiding, which is why we only see six stars."

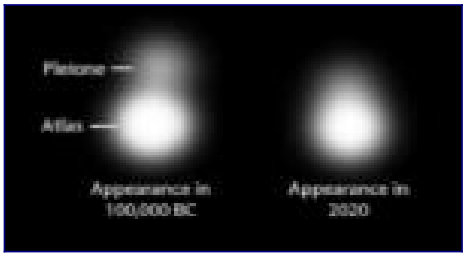
"A similar story is found among Aboriginal groups across Australia. In many Australian Aboriginal cultures, the Pleiades are a group of young girls, and are often associated with sacred women's ceremonies and stories. The Pleiades are also important as an element of Aboriginal (and Maori) calendars, and for several groups their first rising at dawn marks the start of winter."

"In Greek mythology Orion is a hunter. This constellation is also often a hunter in Aboriginal cultures, or a group of lusty young men. People in central Australia regarded Orion as a "hunter of women", and specifically of the women in the Pleiades. Many Aboriginal stories say the boys, or man, in Orion are chasing the seven sisters – and one of the sisters has died, or is hiding, or is too young, or has been abducted, so again only six are visible."

"Similar "lost Pleiad" stories are found in European, African, Asian, Indonesian, Native American and Aboriginal Australian cultures. Many cultures regard the cluster as having seven stars, but acknowledge only six are normally visible, and then have a story to explain why."

"If we take what we know about the movement of the stars and rewind 100,000 years, Pleione was further from Atlas and would have been easily visible to the naked eye. So 100,000 years ago, most people really would have seen seven stars in the cluster."

"A simulation showing hows the stars Atlas and Pleione would have appeared to a normal human eye today and in 100,000 BC."

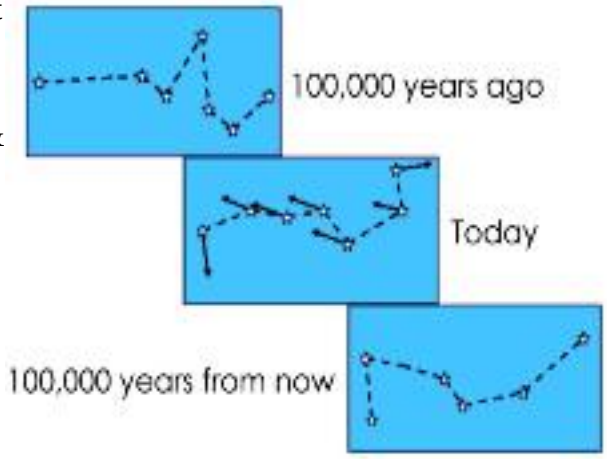


"We believe this movement of the stars can help to explain two puzzles: the similarity of Greek and Aboriginal stories about these stars, and the fact so many cultures call the cluster "seven sisters" even though we only see six stars today."

"Is it possible the stories of the Seven Sisters and Orion are so old our ancestors were telling these stories to each other around campfires in Africa, 100,000 years ago? Could this be the oldest story in the world?"

https://theconversation.com/the-worlds-oldest-story-astronomers-say-global-myths-about-seven-sisters-stars-may-reach-back-100-000-years-151568

Another similar story exists about the Northern constellation of Ursa Major, which today looks like a very strange long-tailed bear on old star maps. Bears usually have very short tails, so stories were created to account for this oddity. The Greeks said that Zeus threw the bears (his lover Callisto, and their son Arcus) into the sky by swinging them by their tails, thus stretching them out. Long before Greek influence, Slavic people called this constellation The Bear as well. Several tribes of Native American people also call this constellation the Great Bear, but what the Greeks saw as a long tail, they saw as three birds, or three bear-hunters – with the middle hunter carrying a pot for cooking the bear! (This is Mizar & Alcor, a famous double star).



In fact, the stars of this constellation have their own noticeable proper motions, and 100,000 years ago when the story originated, the outlines of this constellation looked decidedly more bear-shaped. Just like the Pleiades – as humanity travelled across the planet over thousands of years, the stories changed as the stars crept slowly across our sky.

https://astrolab.awh.durham.ac.uk/one_lab/pm_intr.html

Here in the Southern Hemisphere, we are lucky to have some of the oral traditions and stories from Aboriginal First Nations cultures. Australia is and was a harsh land to live in, the Earth's driest inhabited continent (not counting Antarctica!), and the people who first arrived here had to have paid very close attention indeed to the natural world around them. Sharing information and passing it on to the next generations in the form of stories was crucial to their survival – and scientists today are only just realising what a treasure trove of scientific observation First Nations stories are.

For example, in Western culture we credit Isaac Newton with explaining the rise and fall of tides – in 1687, Newton explained that ocean tides result from the gravitational pull of the Sun and Moon on the oceans of the Earth. Even Galileo, who discovered a lot of things about our place in the Universe, and who was the first to study and describe the surface of the Moon having mountains and craters, did not believe the tides had anything to do with the Moon! He likened the ebb and flow of tides to the sloshing of water in a container, thinking that it was due to acceleration and deceleration caused by Earth's movement.

Aboriginal astronomers, however, had it figured out thousands of years earlier. In the oral traditions of the Yolngu people of Arnhem land in northern Australia – when the tides are high, water fills the Moon as it rises. As the water runs out of the Moon, the tides fall, leaving the Moon empty. Then the tide rises once more, refilling the Moon. So, although the mechanics are a little different, the Yolngu people obviously had an excellent understanding of the motions of the Moon, and its connection to the tides.

In Maori mythology of New Zealand, a story about Rona and Marama (the moon) says that Marama gave Rona the power to control the tides. Another link between the Moon and the tides – which of course, a seafaring people would have had to understand very well.

Celestial Creatures

In the famous Lascaux Caves in France, there are cave paintings from approximately 20,000 years ago representing animals and their life cycles – some of these depictions seem to refer to seasonal breeding times of animals, and perhaps their migration patterns. Of particular interest is an image of a bull, with a few dots placed over its head:

As you can see when compared to a star map – these dots and their location have more than a passing resemblance to the Pleiades star cluster! The Hyades star cluster, together with bright star Aldebaran, make up the head and horns of the Bull in the Taurus constellation. Though stars do move over thousands of years – these ones, being a cluster, would likely still have looked triangular and bull-like 20,000 years ago (even without Aldebaran, which isn't part of the cluster). If we further consider that the big round dot to the left of the bull's horns in the cave might represent the Sun (or the Moon) which travels along the ecliptic plane – then what we have in the Lascaux Cave may well be a beautiful astronomical observation! Because how else would ancient people pass on relevant knowledge about animals, their breeding and migration cycles, if not by paying attention to the cycles of the natural world, and making connections to the cycles of stars that appear at particular times of the year? Could Taurus be the first animal that early humans recognised in the sky?

Many names of stars and constellations, especially those visible from the Northern Hemisphere, have names from Greek and Roman mythology – Perseus, Hercules, Andromeda, etc. Many stars were named by Middle-Eastern astronomers – for example Rigel means "foot" (of the Giant, Orion) and various stars named Deneb and Denebola (Deneb means "tail" - several sky creatures have tails). We also have stars with Latin names – Capella means "she-goat", and Mira means "wonderful".

Sometimes the mythology gets in the way of actually understanding why certain star patterns were named the way they were, as more often these names actually originated in day-to-day lives of ancient people. Multiple names from multiple cultures might confuse or frustrate an astronomer – but they make a historian very happy, as they teach us about what different cultures thought was important in their lives, important enough to place into the sky.

Today there are 88 widely-accepted constellations in astronomy, but the Ancient Greeks and Romans knew only 48 of those, because that's what they could see in their sky. The Romans translated the Greek names into Latin, and not all Greek names were original either – some were likely borrowed or altered from Ancient Egyptians, Phoenicians or Babylonians.

Among these 48 constellations, 25 are named for animals, 14 for people, and only 9 for inanimate objects.

The names of celestial animals varied as much as the cultures that named them.

Lupus the Wolf was a large carnivore – also a Panther or a Leopard, a Beast to ancient Babylonians and “Therion” to the Greeks (Medieval Latin “Fera” meaning “Beast”). The ancient sky bestiary also included a Hare (Lepus, not to be confused with Lupus), Leo the Lion, Large and Small Bears (Ursa Major and Minor), Corvus the Crow, and Cygnus the Swan (just a Bird or Chicken to the Greeks, and a Turtle to the Chinese). There was Aquila the Eagle, Cetus the Whale (depicted as a whale by people who saw whales on a regular basis, or as a fearsome sea-monster by those who didn’t), the Dolphin, Pisces the Fishes, Scorpio, Cancer the Crab, The Serpent, and to top it all off, the Hydra.

Quite a few constellations are named for domesticated animals – Equuleus the Little Horse, Pegasus the Big Horse (originally just a regular horse in Ptolemy’s “Almagest” - the mythical wings came later), Taurus the Bull, Aries the Ram, Big Dog and Small Dog (Orion’s hunting dogs of course), and Capricorn too. Capricorn started off as just a Goat, or Baby-Goat in the Middle East. Later astronomers decided that this was none other than Amalthea, the goat who fed baby Zeus with her milk – and the layering of mythology that gave Pegasus the Horse his wings, later gave the Capricorn a strange fish-tailed-goat depiction.

Over time, the stories grew more and more elaborate. Pegasus the Horse got wings and a tie-in to the story of Perseus, who slew the Medusa and rescued the princess Andromeda from the sea monster Cetus. Princess Andromeda was the daughter of Cepheus and Casseiopeia, whose constellations are also nearby. The star Algol, the brightest star in Perseus, represents the head of the Medusa in Greek mythology - it was called Horus in Egyptian mythology, and "Satan’s Head” in Hebrew.

Aside from mythical heroic figures, many of the people-shaped constellations are named for people being simply human. Gemini are twin brothers, Virgo is a young woman, Orion and Sagittarius are hunters, Ophiuchus is the Greek Serpent-Bearer (or Arabic snake-charmer), Boötes is a herdsman, Auriga a charioteer, and Aquarius was associated with the annual flood of the Nile in Egypt. The vessel with the water is often depicted as being more important – the Romans called Aquarius the Amphora, and al-Biruni describes it in his star catalogue from 1030 AD as a Bucket.

Only one actual historical person, or rather that person’s hair, has been immortalised in the skies. Coma Berenices is named for Queen Berenice II of Egypt, who in 246 BCE sacrificed her hair to the goddess Aphrodite to ensure the safe return of her husband, King Ptolemy III, from battle. This interesting fact gives us an exact date for the creation of this constellation. Before that, it was considered to be a tuft of fur in the constellation of Leo.

These human-shaped constellations were recognised as such long before they acquired names from Greek mythology. Look at the constellations of Gemini or Orion – the brain draws human stick-figures instantly. These oldest constellations represent humans in general, doing things in the sky that us earthly humans could relate to – only later did they acquire specific, larger-than-life associations with characters from particular myths.

The Milky Way

The names associated with the Milky Way deserve a special mention, though there are too many to name them all. Its milky appearance inspired the Ancient Greeks to tell the story of how Zeus decided to let the infant Hercules suckle on his divine wife Hera's milk when she was asleep, an act which would endow the baby with godlike qualities. When Hera woke up and realized that she was breastfeeding an unknown infant, she pushed him away and the spurting milk became the Milky Way (and by extension, gave its name to galaxies in general – "gala" meaning "milk" in Greek.) The Greeks saw spilt milk in the sky before they created the myth in order to explain it, and they actually called it "The Milky Circle".

It was not until Galileo looked at the Milky Way through a telescope, that it became obvious that it was actually made of millions of stars – until the year 1610, people had no idea what the Milky Way even was. They could only guess – some thought it was actual clouds among the stars, or a reflection of sunlight, or gases escaping from the Earth at night, or even a line of glue that holds celestial hemispheres together. Around 2,500 years ago Pythagoras had the right idea about it, and so did Persian astronomer al-Biruni, but it could not be proven until Galileo's time, and people still debated it for decades afterwards.

In Sanskrit, the Milky Way was called "the Divine Way". The Vikings called it "Odin's Way". The Chinese, Japanese and Vietnamese called it "Sky River", "River of Heaven" or "Silver River". These watery names exist in Indonesian, Equatorial African, and Australian Aboriginal cultures, and some Native American languages. But naming it after a road, path, or trail dominates in most languages around the world, and the variety of these names reflects their cultural significance.

A huge swath of Africa through the Middle East to Mongolia calls it "Haymaker's Way", "Godfather's Straw" or "Route of Scattered Straw" – you can easily picture this in a dry climate. Scandinavian and other northern cultures call it "Winter Street", "Path of Snow" and "Skiing Path". Imagine skiing across the sky! Others associated this celestial road surface with dust (Incas), ash (Dakota people of North America), golden sprinkles (San bushmen), sand (Germans), flour (Hungarians and some Native Americans), white clay (South Americans), and even sheep. The name "Birds' Path" is used in several Uralic and Turkic languages and in the Baltic languages - these peoples observed that birds follow the course of the galaxy during their migration period. There are other evocative animal names - Hawaiians call the Milky Way "Fish Jumping in Shadows", people in Thailand call it "The Road of the White Elephant", and an Irish legend tells of the "Way of the White Cow".

Though the name "Milky Way" actually comes to us from Rome, the Romans had their own name for it also - "via caeli regia", "the Ruler's Way". Many places in Europe took the phrase "all roads lead to Rome" literally, and called our galaxy "The Road to Rome" because pilgrims followed it when traveling. In Spanish and Portuguese, it's *Camino de Santiago* - "The Road to Santiago", in England "St James' Way", and in Russia and Ukraine "Way of Moses" or "God's Way".

Hungarians called it "The Warrior's Way", with the stars as sparks from their warriors' horse-shoes. Another Scandinavian name is "The Way of Souls", presumably to Valhalla. The Moldavian and Romanian name is "The Road of Slaves", to remember the people lost to the Mongolian Horde – similar names exist in Russian regions, "Batu Khan's Way" or "Mamai's Way". In this way, people hoped the sky would remember the people they lost.

People saw more mundane, everyday things in the Milky Way as well – some Slavic people saw a "Belt", Syrians saw a "Long Ribbon", and Ptolemy in Egypt saw simply a "Ribbon". Babylonians saw a "Golden Ribbon", Yakutians saw a "Celestial Rope" and Mongolians saw a "Sky Seam". Some thought the sky was held together by glue, others envisioned it to be a column or supporting structure, or a spine or backbone.

Again we realise how intimately connected everyday people's lives were to the night sky, and which worries, beliefs, everyday things and impressions of Nature they assigned to something they couldn't understand until the invention of the telescope.

Folk Astronomy

All human cultures mark the passing of time by the differences we observe around us. How we mark those differences depended on where you lived. In the Northern latitudes, where time for sowing seeds and growing food was strictly limited by the short Northern summer, the solar calendar was most important – whereas among the nomadic people of Arabia, the lunar calendar made more sense, as their seasonal changes were less significant.

Astronomy gave people something that could be measured - the stars, Moon, Sun, and planets all had reliable cycles, and charting these cycles helped people to understand the world around them, to create calendars for their society to function. We all know Stonehenge was an important monument, aligned to the Midsummer sunrise and to the Midwinter sunset. Monuments aligned with the Sun have stayed reliable for thousands of years - however, ancient Egyptian temples that were built with an alignment to particular stars, no longer work the same way due to precession of equinoxes, or basically the Earth's wobble. The Temple at Luxor was built with no less than 4 stellar alignments in mind – and it, as well as several other star-aligned temples at Karnak, show signs of alterations over the centuries, to keep up with the stars' precessional changes. The rising of Sirius no longer announces the seasonal flooding of the Nile to Egyptians, for the same reason (and not just because the Nile now has a dam in it).

Speaking of Sirius, Claudius Caesar Germanicus wrote in the 1st century AD, "When it lies near the sun's rays, summer blazes [hence the dog days of summer]; ... when it rises it affects crops in two very different ways: the healthy it strengthens, but those with shrivelled foliage or feeble roots, it kills. There is no star the farmer likes more or hates more."

Farming was inseparable from Astronomy. Knowing the movement of stars and the Sun through the year gave every farmer priceless information – even if the only thing the average farmer had to work with was noticing where exactly the sun or a certain star rises or sets against the landmarks of his town. For example when the sun rose above the spire of the local church, the farmer knew what crops to plant – or to harvest, when in autumn the Sun returned to the same location. Russian Orthodox religious tradition has Saint's days sprinkled all throughout the year, making it even easier to remember agricultural occasions as particular Saints were associated with specific crops, harvests or events.

The agricultural calendar is well described in in this English rhyme from the 15th century:

January – By this fire I warm my hands
February – And with my spade I delve my lands.
March – Here I set my things to spring,
April – And here I hear the birds sing.
May – I am light as a bird on a bough,
June – And I weed my corn well enough.
July – With my scythe my meadow I mow,
August – And here I shear my corn full low.
September – With my flail I earn my bread,
October – And here I sow my wheat so red.
November – At Martinmas I kill my swine,
December – And at Christmas I drink red wine.

This is folk astronomy – not an exact science, but the beginnings of it, based on observations of Nature. One of the simplest scientific devices was the sundial, or simply, a stick (gnomon) casting shadows on the ground. The lengths of shadows at different times of the year were written down in "The Work of Farming" - a manual of agriculture from the days of the Roman Empire, still widely known and distributed in the Medieval world. Palladius was a high-ranking Roman in the 5th century AD, who owned farms in Italy and Sardinia and wrote about what he knew. His manual goes through the farming calendar with advice of when to plant and harvest, where to buy bees, and why ceramic pipes were better than lead. At the end of each month, Palladius gave the lengths of shadows for each hour of the day, pointing

out that the months come in symmetrical pairs: “August matches May by the comparable course of the Sun.” The measured lengths range from 2 feet at noon in June or July, to 29 feet in the last hour of the day in December. He listed 12 sun-lit hours for every day, summer and winter – this meant that the length of one hour varied through the course of the year. You could have 12 very long hours in a summer’s day, followed by 12 very short hours at night – and vice versa in winter, the dark winter nights dragging on through 12 long hours. These “unequal hours” were invented in Egypt, used by Jesus, and were still common in Medieval Europe.

It was only when mechanical clocks were invented around 1300 that it became far easier to measure time in equal segments, without reference to the seasons.

And speaking of calendars, Medieval calendars could get pretty complicated. The “Kalends” was the term for the start of the month – similar to how the “Ides” is the middle of the month. The system of numbers we’re familiar with today are actually Hindu-Arabic numerals. They originated in India in the 6th or 7th century and were introduced to Europe through the writings of Middle-Eastern mathematicians, especially al-Khwarizmi and al-Kindi, about the 12th century. (Side note: the name “al-Khwarizmi” is where we derive the word “algorithm” from.)

Before that, Roman numerals were widely used, and before that, our system of 60 seconds in a minute, 60 minutes in an hour, and 24 hours in a day goes back to the Babylonians, who in turn got it from the ancient Sumerians.

There was another system of counting that was widely used in history – counting on your fingers! No, not like “this little piggy went to market, this little piggy stayed home”… if you were at a noisy market, or in a quiet monastery, you might use finger-counting to get your message across. Finger-counting could be done not just up to 10, but up to 9,999!

Seb Falk has a great video demonstration:
https://www.sebfalk.com/post/medieval-finger-counting-on-the-bbc

The Science of Astronomy

John Gower, a friend of Chaucer, wrote:
“The Science of Astronomy
I thinke for to specify
Withoute which, to telle plain,
All other science is in vain”.

Astronomy in the Middle Ages was a cornerstone of many other sciences, and religions actually understood and supported this. Astronomy was one of the few sciences that relied on precise observations, measurements, geometry and mathematics – a beautiful way of understanding the world around you. An understanding of astronomy meant that calendars could be created for religious celebrations, and for Christianity especially, this knowledge of science was a way to understand the work of God. The book of Nature and the Book of Scripture were said to go hand in hand. While Europe had priests and monks who studied Nature and the sciences as a way of understanding and interpreting God’s creation, Sultans in the Middle East competed by whose university was better, and what great minds they could attract. Science and knowledge flourished and developed in the Islamic world during the Islamic Golden Age, around the 8th-13th centuries. Universities were established in Europe as well – Oxford, Cambridge... Quite often monks were required to attend a University, their time there funded by the Church. This may only have been 1 in 20 monks, only the best and the brightest, that would be sent to a University such as Oxford – but they could learn and then bring that knowledge back to their abbeys and monasteries. In this way, religion actually contributed to furthering the causes of science and human understanding the world. We commonly call it the “Dark Ages” – but this couldn’t be further from the truth. A lot of thinking, learning and discovery went on - with wonderful astronomical instruments that were also invented, refined and perfected during this time.

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