

How old is the Earth?

Geological time – the early years

The Earth has been the subject of study for thousands of years, the first records being by Greek Philosophers. Some of the earliest ideas about geological time and the age of the Earth were by Aristotle (384-322 BC), who recognized that shells found along the sea shore were similar to those found fossilised in rock exposures on land. He came to the conclusion that, not only were fossils once living creatures, but at times the land must have been under the sea and that the changes must have taken place over a long period of time.

Later, religious chronology became a common method of estimating the Earth's age. The Hindu belief was that the Earth is involved in an eternal cycle of creation and destruction and that each 'Day of Brahma' lasted for 4.32 billion years. Jewish doctrines indicated that the Earth was created on 7th October 3761 BC and, using biblical chronology, the early Christian, St. Augustine of Hippo (354-430 AD), estimated that the Earth was created in the year 5500 BC.

During the Middle Ages, religious dogma stifled scientific reason and at times banned it— Galileo Galilei (1564- 1642), for example, was imprisoned for suggesting that the Earth orbited the sun. Early European scientists trying to calculate the age of the Earth did so in terms of religious doctrine. Calculations were based on the assumption that humans (Adam and Eve) were created within the first week of the Earth's creation, so that the history of mankind was the same as the history of the Earth. The German scientist Johannes Kepler (1571-1630), for example, calculated that the Earth was created in the year 3993 BC and Isaac Newton, (1642-1727) believed it to be 3998 BC, but two people famous for dating the age of the Earth were James Ussher and John Lightfoot.

John Lightfoot (1602-1675) wrote *A Few and New Observations upon the Book of Genesis* in 1642, in which he concluded that "Man [was] created by the Trinity about the third hour of the day, or nine of the clock in the morning". Two years later (1644) he published *The Harmony of the Four Evangelists: Among Themselves and With the Old Testament* in which he stated that that the world was created at the September equinox, 3928 BC. In other words, Lightfoot considered that the Earth was completed on Sunday 12th September 3928 BC and that human beings were created on Friday, September 17, 3928 BC, at 9 o'clock in the morning.

James Ussher (1581-1656), Archbishop of Armagh, Primate of All Ireland, and Vice-Chancellor of Trinity College, Dublin, wrote his chronology, *Annales veteris testamenti a prima mundi origine deducti (The Annals of the Old Testament, Deduced from the First Origin of the World)* in 1650. Based on the Bible and Middle Eastern and Mediterranean histories, he calculated that the creation of the Earth was completed at sunset of the 22nd October 4004 BC so that the first day of creation was on Sunday 23rd. Ussher's chronology was accepted as the true date for the Creation and dominated theological and scientific thinking for over a hundred years.

It was not until the 18th century that these calculations were questioned and more importantly, in a scientific way, supported by observations, measurements and carefully designed laboratory experiments. For example, In about 1715, Edmund Halley suggested that seas had originally been fresh water, but over a long period of time rivers had carried dissolved salt into the oceans and that was the reason why they were salty. He concluded that the Earth could not be as young as a few thousand years, as Ussher suggested, because the oceans would still be nearly fresh, but it could not be extremely ancient, otherwise the oceans would have become saturated with salt. Later, George-Louis Leclerc, Comte de Buffon (1707-1788) believed the Earth to be ancient and tried to prove this experimentally. Assuming that the interior was made of iron, he heated ten iron balls ranging in size from half an inch to 5 inches (1.3 cm to 12.5 cm) in diameter and measured the rate of cooling. His results were used to calculate the rate of cooling of the much larger Earth and he estimated its age to be about 75,000 years.

So by the start of the 19th century, scientists were again arguing for an ancient Earth, but still nobody had discovered a way of calculating its age with any accuracy.