How old is the Earth really?

THE AGE OF THE EARTH- 1850-1900

The age of the Earth has been the subject of conjecture ever since the time of the Greek philosophers over 2000 years ago. In the Middle Ages, calculations were based on religious and historical documents to give an age of about 5000 to 6000 years, but in the 18th century, scientific methods started to be used. George-Louis Leclerc, Comte de Buffon (1707-1788), for example, measured the rate of cooling of small metal balls and used the results to calculate that the Earth was about 75,000 years old. But it was in the second half of the 19th century that scientific observation and experimentation came of age. Three methods were being used at that time to calculate the age of the Earth.

In 1862, William Thomson better known as Baron Kelvin of Largs (1824-1907), assumed that the Earth was originally molten and, based on cooling by conduction and radiation, calculated that the earth required about 98 million years to cool, although towards the end of is life, he revised this to 20-40 million years.

In 1898 John Joly reconsidered some ideas that had originally been suggested by Edmund Halley almost 200 years before. The assumption was that the seas had originally been fresh water, but because rivers carried dissolved salt into the oceans, over a long period of time the oceans would get more salty. Although Edmund Halley did not attempt any calculations, John Joly measured the amount of salt being carried into the sea and used this theory to calculate the Earth was about 80-90 million years old, but he later revised this to 100 million years.

The third idea was that if the total thickness of the sedimentary record and the average rate of sedimentation could be measured, then the age of the Earth could be calculated. The problem was how to take measurements- different geologists calculated the thickness of sedimentary rocks to be between 25,000 and 150,000 m and there were several ideas about the average sedimentation rate, although the favoured rate was about 0.3 m per 1000 years. Of course, using different thicknesses and sedimentation rates resulted in a wide range of ages, but the maximum age of the Earth, using this method, was about 500 million years.

But then, in the last few years of the 19th century, a tool was discovered that would revolutionise the science. In 1896 Henri Becquerel observed that photographic plates that he had stored in light-proof boxes, were damaged when left for some time next to uranium salts, as if exposed to light. He deduced that uranium salts were emitting unseen rays. Becquerel had discovered radioactivity.

Two years later, Pierre and Marie Curie discovered radium and then Pierre Curie discovered that radioactive decay produced heat. This discovery proved that the calculations of George-Louis Leclerc and Lord Kelvin could not be accurate because these scientist had assumed that heat was always being lost; they did not know that heat could also be created.

During the first few years of the 20th century, experimentation by Ernest Rutherford and Bertram Borden Boltwood found that radioactive decay of a particular element, took place at a constant rate. This meant that by measuring how much one element had decayed into another, then this could be used to measure the age of minerals and rocks. For the first time scientists had a reliable geological clock to calculate the age of the Earth.

As the new century dawned, so did modern geochronology.