Homo naledi may be two million years old (give or take)

November 30 2015, by Francis Thackeray

Professor Lee Berger from the University of the Witwatersrand holding the skull of Homo Naledi. Credit: EPA/Shiraaz Mohamed

There has been global interest in the announcement of new fossils from a

cave called Rising Star in the Cradle of Humankind World Heritage Site in South Africa.

These fossils were recently reported by Lee Berger and his team, who described the discovery of more than 1500 fossils as representing a new species of the genus Homo. It has been called Homo naledi, associated with a name for star in the Sesotho language.

But the age of Homo naledi is not yet known with certainty. The new species has not yet been dated. Unsuccessful attempts had been made by Paul Dirks and members of the Rising Star team to obtain an age. They used techniques applied previously to date a range of fossils. These included Australopithecus africanus, such as the famous "Mrs Ples" skull, as more than two million years old, and fossils of Paranthropus robustus and Homo erectus.

In a new paper in the *South African Journal of Science* I suggest that Homo naledi lived two million years ago (plus or minus 500,000 years). If shown to be correct, this will help to place Homo naledi in the family tree of human relatives.

The variance is based on the fact that the earliest date for Homo rudolfensis is about 2.5 million years, and the date for certain African Homo erectus samples is about 1.5 million years.

Although different, Homo naledi is most similar to fossils attributed to Homo habilis (about 1.8 million years old), and to a lesser extent to fossils of Homo rudolfensis and Homo erectus.

Taken together I am suggesting that Homo naledi is in the order of two million years old, with upper and lower limits of about 1.5 and 2.5 million years respectively.

Why is dating so important

Estimating the age of fossils is important because it allows palaeoanthropologists the opportunity to try to draw up a family tree. It shows the evolutionary relationships of distant relatives.

Some of the fossil species can be considered to represent possible ancestors of our own species, Homo sapiens, while other species such as Paranthropus robustus can be considered to be evolutionary "dead ends".

The big question being asked is: where does Homo naledi fit in the evolutionary tree?

It had a small brain of about 500 cubic centimetres in volume. This makes it similar to fossils of Australopithecus. On the other hand, bones of parts of the skeleton, especially the foot, indicate that this species was in some respect remarkably like Homo.

Dating such enigmatic fossils is crucial for an understanding of evolutionary relationships of Homo naledi, compared to more than ten other species which are recognised by palaeontologists.

My approach has been to assess the degree of similarity or dissimilarity between skulls. This can help to assess the age and affinities of fossils.

Quantifying degrees of similarity between fossils

Recognising that the new fossils have features of both Australopithecus and Homo, we need to know how old they are. One way of addressing this is to use a technique that I have previously described, based on measurements of skulls.

Statistics are calculated by taking one set of measurements for specimen A, plotted against the corresponding measurements of specimen B. When A and B are the same species, the values for the two specimens are typically distributed along a straight line, with little scatter around that linear pattern.

When measurements of two specimens (C and D) of different species are plotted against each other, there is a high degree of scatter. The degree of scatter around the line can be quantified using a statistic that I have called log sem, based on a standard mathematical technique that is known as least squares linear regression.

Remarkably, a pattern has been found for comparisons of modern skulls of the same species, whether these are of mammals, birds or reptiles. The mean log sem value for comparisons of pairs of modern species has central tendency around a particular number with a value of -1.61 (plus or minus 0.1), which I have regarded as an approximation of a biological species constant called T.

How does this help to date Homo naledi

Comparisons have been made between the skull measurements of Homo naledi and those of more than ten other recognised species.

It is possible to say that Homo naledi is indeed different because in all cases the log sem statistics for such comparisons is significantly greater than -1.61.

But what is exciting is the fact that of all such comparisons, Homo naledi is most similar to skulls attributed to Homo habilis known to date to about 1.8 million years, and to some extent to other fossils attributed to Homo rudolfensis between about two and 2.5 million years ago.

To a smaller extent Homo naledi is similar to fossil skulls of Homo erectus between about 1.5 and 1.8 million years ago. Using these results, based on comparisons of skulls, I suggest that Homo naledi is two million years old, plus or minus 500,000 years.

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