



## Geological time

### *Radiometric dating*

#### **Andrew Bell:**

So far the rocks we have looked at have all been layered sedimentary rocks, but in many ways igneous rocks are better time-keepers because they represent moments in the geological time that they've been intruded. Now this is a piece of Shap granite, beloved of geologists, and it comes from this quarry up here in Cumbria. You can see that it's made up of lots of interlocking crystals. If only we knew when these crystals formed? Well, I'll bet you're pretty frustrated that after all this, we've not once mentioned a date and absolute age of rocks. It's all been relative this and relative that. And so were many geologists for many decades until we discovered:-This is a beta counter, and it measured radiation; and there's radiation all around us coming from space. Rocks are a little more radioactive. And when we discovered they were radioactive we were able to measure the rate at which it decayed at this sort of value towards the background of this and therefore find out how long it was since the rock crystallised. And in knowing that we were at last able to find out the age of rocks and this one from Shap is 395 million years old. Happy Birthday rock!

#### **Chris Wilson:**

Mass spectrometers like this one can be used to measure incredibly small amounts of radioactive isotopes present in crystals, even single crystals. So this enables us to date the age of cooling of an igneous rock, the cooling age of a lava or even the age of an ashfall. It's even possible sometimes to determine the age of minerals that are formed in sedimentary rocks. So this information enables to put an absolute age on the succession of rocks that William Smith worked out 200 years ago.

Even more than that we can solve the ultimate question, how old is the Earth? Radiometric dating of meteorites which consists of material that fail to aggregate into planets gives the age of that event of around 4,600 million years ago. The oldest rocks which contain many clearly identifiable fossils are found in South Africa. These white and grey banded rocks are cherts: rocks composed of a variety of silica. Radiometric dating of igneous rocks associated with them indicates that they

are around 3,500 million years old. These are the fossils found within the cherts. They are bacteria. They show that life must have begun on the earth by that time. The 'chemical signatures of life', that is; organic compounds clearly derived from living matter can be found in even older rocks which date to around 3,800 million years ago.

Radiometric dating enables us to give an age to many important events in the Earth's history and chart stages in the 'evolution of life'. Sometimes we can even date the rock in which species make their first appearance, and, when they become extinct. So radiometric dating is a very important geological tool, whether used to date material incorporated into rocks millions or even billions of years ago, or material deposited on the Earth only a few thousands of years ago, where the geological and archaeological records meet.