How Chemical Fossils help us understand past greenhouse climates - and future ones

Professor Richard Pancost

According to Professor Pancost, there are many aspects of the future climate that we can predict with a fair degree of certainty, but others are much less certain. One of the reasons we can have this qualified confidence in forecasts is the work of geochemists who use chemical signatures in rocks to characterise past environments. This is rarely less than tricky, and involves the most sophisticated of modern high-tech chemical analysis, but with enough independent indicators providing a consistent picture, scientists can correct for confounding effects and obtain estimates of, for example, atmospheric carbon dioxide, oxygen levels, temperature, humidity, and so on. It is not hard to see the correlation between historic carbon dioxide levels and contemporary temperatures, just by plotting graphs, but one can go much further and run our climate forecasting models over historical periods. By and large this gives a great deal of confidence that they are broadly correct - though a significant current concern is that the northern polar regions are warming rather faster than predicted for reasons not fully understood.

The devil, however, is in the detail. A warming climate may even sound attractive to people living in cold northern latitudes, but if rainfall patterns change, by the end of this century there may be hundreds of millions of people trying to grow the wrong crops in places that will no longer sustain the same population levels. The real impacts of climate change are always local, but the current models are only reliable when used to predict global averages. We cannot reliably predict whether Europe will be wetter or drier, or whether the rice-growing areas of South East Asia will have enough water in future (though, in general, there are reasons to think that wet areas will get wetter and dry areas drier). At present, the only advice one can give to governments is that the future is almost certain to be different compared to the past.

Scare stories about climate change may no longer figure prominently in our media, but it has not gone away. There will be major impacts in the lifetime of our children and grandchildren - but we do not yet know what they will be.