Solar physics and palaeontology

Set in stone

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An ancient forest reveals the sun's behaviour 290m years ago

EVERY 11 years or so, a new sunspot cycle begins. Sunspots are apparent blemishes in the sun's photosphere, the layer which emits its light. Though still hot (about 3,500°C), they are cooler than their surroundings (about 5,500°C) and thus appear dark by contrast. A cycle starts with spots appearing at mid-latitudes in both northern and southern hemispheres. Over time, the spot-generating areas migrate towards the equator. As they do so, the amount of light and other radiation the sun emits first increases to a maximum and then decreases to a minimum, until the spots vanish and the cycle renews.

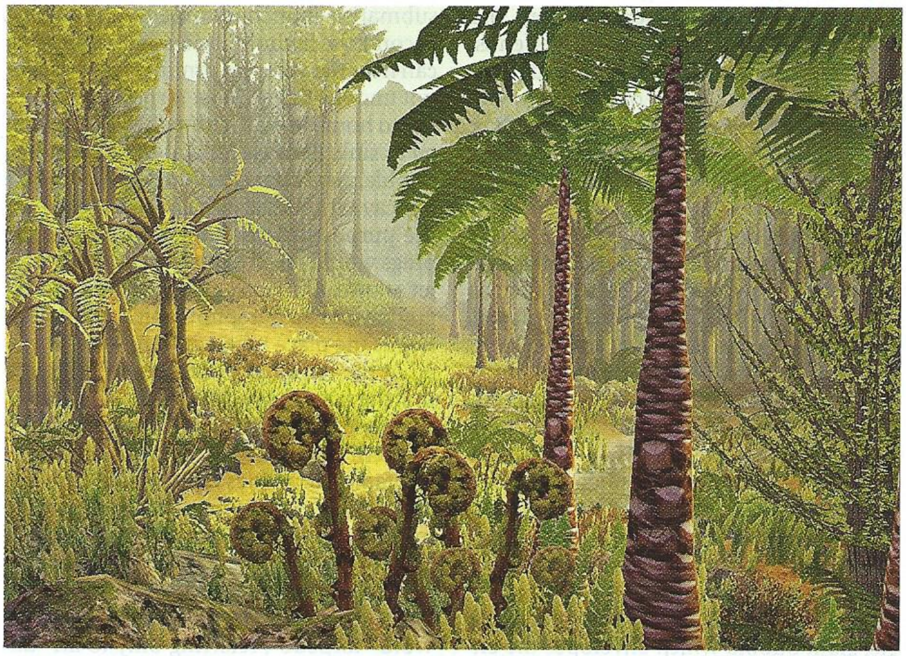
On Earth, the increased illumination of solar maxima drives photosynthesis, and thus plant growth. That permits botanists to use trees' annual growth rings to work out what sunspot activity was like hundreds, and occasionally thousands, of years ago. Determining solar activity millions of years ago, though, has not been so easy. But it is of interest to solar physicists, who wonder how far back into the past the oscillations of the sun's magnetic field that drive the cycle go, and how they might have changed over the course of time.

Now, Ludwig Luthardt and Ronny Rössler of the Natural History Museum of Chemnitz, in Germany, have cracked the problem. They have been able to apply the tree-ring method to petrified trunks from a nearby fossil forest. This forest (imagined in an artist's impression below) was buried by a volcanic eruption 290m years ago, during the Permian period. And, as they report in *Geology*, Mr Luthardt and Dr Rössler have found that the sunspot cycle was little different then from what it is now.

The Chemnitz fossil trees, mostly conifers and ferns, are particularly well preserved. Volcanic minerals seeped into them soon after the eruption and petrified them before bacteria and fungi could rot their tissues away. Mr Luthardt and Dr Rössler selected 43 of the largest specimens and looked at their growth rings.

They found 1,917 rings which were in a good enough state to be measured under a microscope. They knew that the trees had died simultaneously, giving them a baseline to work from, and so were able to compare the rings from different plants. They were stunned by how clearly they could see the cycles.

About three-quarters of their specimens showed synchronous growth peaks like those caused by modern sunspot activity. In total, the rings they measured let them study 79 years of forest growth before the eruption. During this period, the solar cycle averaged 10.6 years. That compares with 11.2 years in the modern era, although this figure conceals wide variation in the lengths of individual cycles. Within statistical limits, then, it seems that the sunspot cycle was the same in the early Permian as it is now, suggesting that the sun's magnetic oscillations were the same then as they are at present. Whether that is a coincidence has yet to be determined, but there is no reason why the method Mr Luthardt and Dr Rössler have developed should not be applied to other petrified forests, from different periods, to find out. ■



Down in the forest, something stirred