

► Spring, Maryland, receives substantial user fees from the pharmaceutical industry that fund an estimated two-thirds of its drug-review process. Although the FDA has put 45% of its staff on leave and will cut back on food-safety programmes, user fees might keep its drug-review pipeline open — albeit operating more slowly than normal, says Timothy Coté, founder of Coté Orphan Consulting in Silver Spring and a former director of the FDA's Office of Orphan Products Development.

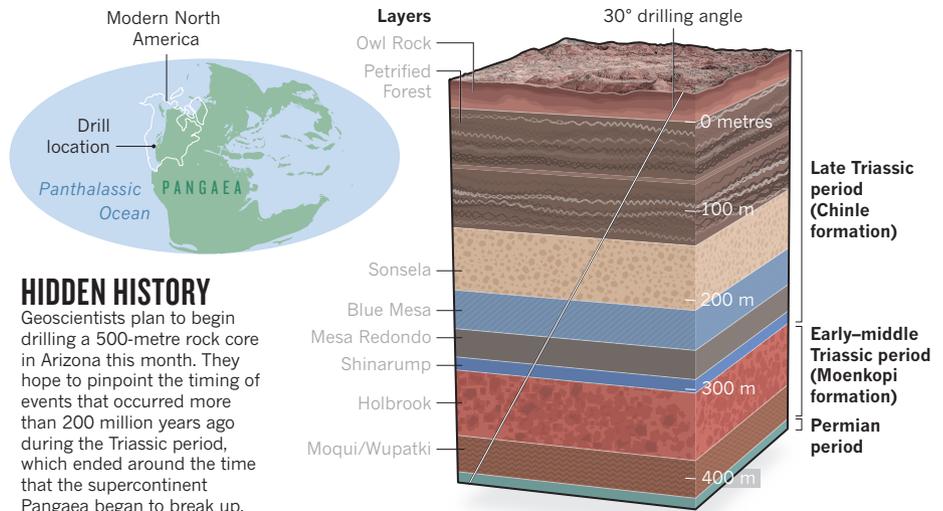
But a lingering shutdown would have knock-on effects. For instance, if the NSF misses one or two weekly payments to the National Radio Astronomy Observatory in Charlottesville, Virginia, the facility would be forced to close, disrupting long-term research, says facility director Tony Beasley.

At NASA, one casualty could be the Mars Atmosphere and Volatile Evolution (MAVEN) mission, which until 1 October was being prepared at Cape Canaveral in Florida for an 18 November launch. MAVEN's principal investigator, Bruce Jakosky of the University of Colorado Boulder, says that his team can accommodate a brief work stoppage. But if MAVEN, which will study the Martian atmosphere, misses its three-week launch window, it will be delayed until 2016, when Mars and Earth will again be favourably positioned in their orbits. Under NASA's contingency plans, operational missions, such as work on board the International Space Station, will continue.

Meanwhile, the shutdown forced the Centers for Disease Control and Prevention in Atlanta, Georgia, to halt its tracking of influenza cases just when the US flu season normally begins. The agency will also cut back on surveillance of emerging infectious diseases such as the Middle East respiratory syndrome coronavirus, says spokeswoman Barbara Reynolds. The Environmental Protection Agency has retained some staff to look after its environmental-health and security functions and to care for animals being used in studies.

Predicting when and how the shutdown might end is difficult. The last such event, in early 1996, continued for a record 21 days, although shutdowns have historically been much shorter. The latest dispute is rooted in attempts by the Republican-controlled House of Representatives to withhold funding for the health-care reform programme championed by President Barack Obama. The Democrat-controlled Senate has repeatedly rejected the House manoeuvres, with little sign that the two bodies are willing to compromise. ■

Additional reporting by Erika Check Hayden, Heidi Ledford, Brendan Maher, Maryn McKenna, Jeff Tollefson, Alexandra Witze and Sarah Zhang.



HIDDEN HISTORY

Geoscientists plan to begin drilling a 500-metre rock core in Arizona this month. They hope to pinpoint the timing of events that occurred more than 200 million years ago during the Triassic period, which ended around the time that the supercontinent Pangaea began to break up.

GEOSCIENCE

Geologists take drill to Triassic park

Arizona rock core to yield coherent picture of turbulent period.

BY ALEXANDRA WITZE

Tourists flock to Petrified Forest National Park in Arizona to marvel at great glittering logs of petrified wood. But geologists hope to flock there this month in search of something less visible and more scientifically significant: a core obtained by drilling half a kilometre into rock more than 200 million years old.

Drillers will spend several weeks boring through layers of rock that house the fossils of tiny early dinosaurs and giant crocodile-like phytosaurs, as well as the leaves and pollen of an entire fossilized ecosystem. The goal of the US\$970,000 drilling project is to stitch together a complete picture of most of the middle and late Triassic period, a turbulent interval that saw both a mass-extinction event and the emergence of dinosaurs. Geoscientists hope to use the decay of radioactive uranium in layers of volcanic ash in the core to precisely date events between about 205 million and 235 million years ago, just before the supercontinent Pangaea began to break apart.

“It’s a unique opportunity to put together a coherent time framework for a critical part of the Triassic,” says John Geissman, a geologist at the University of Texas at Dallas and one of the project’s leaders. “Sure, we have other continental Triassic records, but the Petrified Forest area is pretty darn good when it comes to details.”

The Petrified Forest effort has been years in the making. It is a follow-up to a project in which a Triassic core was drilled from New Jersey’s

Newark sediment basin between 1990 and 1993 (ref. 1). That project aimed to tease out changes in the amount of sediment that was deposited as Earth went through cyclical shifts in the shape of its orbital path around the Sun. “If we can show that the Newark timescale is correct, we can empirically calibrate the Solar System’s behaviour,” says Paul Olsen, a geologist at the Lamont-Doherty Earth Observatory in Palisades, New York, and a member of the project team. “That’s probably the most exciting aspect for me.”

The effort, funded by the US National Science Foundation and the International Continental Scientific Drilling Program, might also help to resolve a simmering dispute. Comparisons of the Newark data with data from Triassic rocks in the Mediterranean have led some researchers to suggest radically revising the period’s history. This reworking would lead to one subdivision — the Norian stage — taking up nearly half of the entire Triassic period, drastically changing dates of key evolutionary events, including the emergence of certain dinosaurs.

The idea of a ‘long Norian’ remains fiercely controversial², and the Petrified Forest core would need to capture a sufficient record to settle the debate. But the rocks have plenty of chronological gaps, owing to weathering or abrupt geological events. Because of surface erosion, for example, the core will not capture the very end of the Triassic around 200 million years ago, when a mass extinction swept across the planet, killing many dinosaurian relatives. The core will instead start in rocks dating to around 205 million years ago, in layers known as

the Chinle formation (see 'Hidden history'). It will travel, with several breaks in time, through the Moenkopi formation and stop in rocks about 235 million years old. The record then skips tens of millions of years into rocks from the Permian period that preceded the Triassic.

"We know parts will be missing," says Geissman. But getting a nearly complete record for much of the Triassic, in such well-studied rock layers, is bound to offer a trove of information.

Geologists have explored the Petrified Forest area since the 1850s, most recently for its rich array of Triassic fossils. Since 2004, for instance, several skeletons have been unearthed of an extinct crocodile-like animal called *Revueltosaurus*, previously known only from its teeth. Early dinosaurs such as the dog-sized *Coelophysis* also roamed there, and radiometric dating has shown how these dinosaurs were related to those in other parts of the Americas³.

Spectacular, fossil-bearing rocks sprawl almost everywhere in the park, says Bill Parker, Petrified Forest's palaeontologist. The challenge is tying separate discoveries into a coherent, well-dated story. Many surface rocks are weathered so badly that they distort fossil relationships and make radiometric dating all but impossible. "It's not like the Grand Canyon, where you can just hike down and see all the rocks in their proper order," says Parker. "A core eliminates all of that problem, when you get one single section all the way down." Drilling in US national parks is allowed at the discretion of the park superintendent. Petrified Forest is unusual in calling itself a science park and in having Parker on staff as a full-time palaeontologist.

The big question for researchers is when drilling can begin. The team had hoped to start on 8 October, but that plan is now in doubt. Petrified Forest National Park, along with the rest of the US government, shut down on 1 October. The park will not reopen until Congress agrees on a plan to keep the government funded. If delayed too long, drilling may have to be rescheduled for next spring.

Ultimately, if the project's science findings are strong, it will pave the way for further studies of the Triassic's buried history. The team already has its eye on other cores that it could drill. ■

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POLICY

Overhauls set scientists on edge

Australian government axes carbon tax and designated science minister, but says it will not cut research funding.

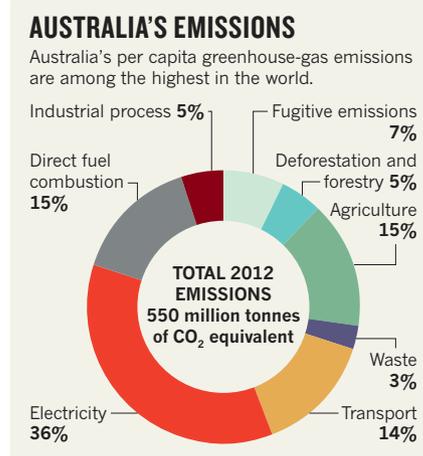
BY CHERYL JONES

Changes made by Australia's newly elected conservative government, sworn in on 18 September, are unnerving scientists. Prime Minister Tony Abbott was quick to renew his pre-election pledge to axe the country's carbon-pricing scheme, and the Coalition administration has begun to kill off some of the main government agencies tasked with tackling climate change. Abbott opted not to appoint a single minister for science, deciding instead to spread responsibility for it over several ministries, including industry and education.

It is a tricky time for people working in carbon policy in Australia, and scientists are worried that research into global warming is under threat. David Karoly, an atmospheric scientist at the University of Melbourne, says that it is unclear whether funding for climate-change studies, including those conducted by the Bureau of Meteorology and Australia's national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), will be held at current levels.

University research may also be vulnerable. "There are fears about the funding of climate-change research, particularly on mitigation," says Karoly.

Australia is a world leader in climate-change research. As one of the world's biggest emitters of greenhouse gases per capita (see 'Australia's emissions'), its scientists have been a big part of the Intergovernmental Panel on Climate Change. Overall, the country has a high scientific output (see 'Punching above its weight'). But some fear that this work may be in jeopardy. The



government has already closed the country's Climate Commission, a public-education body, although plans are afoot to revive it as a private entity. And the government wants to close the Climate Change Authority, which provides advice on emissions reductions, says Karoly, a member of the authority's board.

The Clean Energy Finance Corporation, or 'green bank', a Aus\$10-billion (US\$9.4-billion), 5-year programme established by the former administration to provide loans for the commercialization and deployment of clean-energy technologies, is also under threat.

Responsibility for carbon policy will form part of the environment portfolio, held by minister Greg Hunt. Until now, the centrepiece of the policy was the carbon 'tax' introduced in 2012 by the Labor government, with support from the Greens. The price was not strictly a tax, but, rather, was a permit system that functioned similarly to a tax, and was ▶

SOURCE: AUSTRALIAN DEPT OF CLIMATE CHANGE AND ENERGY EFFICIENCY



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