"the original raw sequencing data for as many genomes as possible".

Many markets

If the virus did jump between animals and people on several occasions, the fact that lineages A and B are linked to people who visited different markets in Wuhan suggests that multiple individual animals, of one or more species, that were carrying a progenitor of SARS-CoV-2 could have been transported across Wuhan, infecting people in at least two locations.

A study published in June found that live animals susceptible to SARS-CoV-2, such as raccoon dogs and mink, were sold in numerous markets in Wuhan (X. Xiao *et al. Sci. Rep.* **11**, 11898; 2021). Previous studies of the virus that caused severe acute respiratory syndrome (SARS) have concluded that it, too, probably jumped multiple times from animals to people (L. F. Wang and B. T. Eaton *Curr. Top. Microbiol. Immunol.* **315**, 325–344; 2007).

The latest study, if verified, would mean that the scenario of a researcher accidentally being infected in a lab, and then spreading the virus to the population at large, would have had to happen twice, says Garry. It's much more likely that the pandemic had its origins in the wildlife trade, he says.

To gather more evidence, the team behind the latest analysis now plans to run computer simulations to test how well multiple spillovers would fit with the diversity of known SARS-CoV-2 genomes.

AUSTRALIAN BUSH FIRES BELCHED OUT IMMENSE QUANTITY OF CARBON

Plankton mopped some of it up, but scientists might have to rethink the climate impact of extreme blazes.

By Smriti Mallapaty

The extreme fires that blazed across southeastern Australia in late 2019 and early 2020 released 715 million tonnes of carbon dioxide into the air — more than double the emissions previously estimated from satellite data, according to an analysis[1] published last week in *Nature*.

"That is a stupendous amount," says David Bowman, a fire ecologist at the University of Tasmania in Hobart, who adds that scientists might have to rethink the impact on global climate of extreme blazes, which have now raged not just across Australia, but across the western United States and Siberia.

It's not all bad news, however. Another paper[2] in *Nature* reports that much of this plume of carbon might have been indirectly sucked up by a gigantic phytoplankton bloom in the Southern Ocean.

ORBITAL HORIZON/COPERNICUS SENTINEL DATA 2020/GALLO IMAGES/GETTY

Sydney is encircled by huge bush fires that shroud it in smoke on 21 December 2019.

The unprecedented fires burnt across as much as 74,000 square kilometres of mostly eucalyptus, or gum, forest in southeast Australia — an area larger than Sri Lanka.

Previous estimates from global databases of wildfire emissions based on satellite data suggested that the fires released about 275 million tonnes of CO_2 during their zenith, between November 2019 and January 2020.

But the latest analysis indicates that this figure was a gross underestimate, says Ivar van der Velde, lead author of the first paper. "These models often lack the spatio-temporal detail to explain the full impact these fires have," says van der Velde, an environmental scientist at the SRON Netherlands Institute for Space Research, in Utrecht, and at the Free University of Amsterdam.

He and his team set out to get a better estimate, based on more-granular data from the tropospheric monitoring instrument TROPOMI on the European Space Agency's Sentinel-5 Precursor satellite.

TROPOMI takes daily snapshots of carbon monoxide levels in the atmospheric column beneath it. The researchers used these data to calculate a more accurate estimate of the carbon monoxide emissions from the bush fires, which they used as a proxy for calculating CO_2 emissions.

Their final figure — 715 million tonnes — is nearly 80 times the typical amount of CO_2 emitted from fires in southeast Australia during the three peak months of the summer bush-fire season.

Bowman says the figure is similar to what his team calculated from the area of forests burnt[3], but much higher than figures based on previous satellite measurements of emissions.

The key question is how these forests will recover, says Cristina Santín, a wildfire researcher at the Spanish National Research Council in Asturias. Wildfires have long been considered net-zero-carbon events, because the emissions they release are recaptured when the vegetation regrows — but if fires "threaten the recovery of the ecosystem, then we really need to worry", she says.

The second paper, also published last week, could give researchers reason to hope, however. It suggests that the emissions generated by the bush-fire crisis were nearly offset by gigantic phytoplankton blooms in the Southern Ocean, recorded over the summer of 2019–20.

The findings demonstrate how wildfires can directly influence ocean processes, says study co-author Richard Matear, a climate scientist based in Hobart with the Australian government's Commonwealth Scientific and Industrial Research Organisation. "The systems are connected."

He and his colleagues found that, during the fires, vast black plumes of smoke, rich in nutrients, were swept thousands of kilometres away over the ocean. Within days, these aerosols had infused the waters with much-needed iron, nourishing phytoplankton, which sucked up carbon equivalent to as much as 95% of the emissions from the fires.

The ocean achieves "an amazing sleight of hand — like a magician", says Bowman.

1. van der Velde, I. R. *et al. Nature* https://doi.org/10.1038/s41586-021-03712-y (2021).
2. Tang, W. *et al. Nature* https://doi.org/10.1038/s41586-021-03805-8 (2021).
3. Bowman, D. M. J. S., Williamson, G. J., Price, O. F., Ndalila, M. N. & Bradstock, R. A. *Plant Cell Environ.* https://doi.org/10.1111/pce.13916 (2020).

NEW DARK ENERGY COULD SOLVE UNIVERSE EXPANSION MYSTERY

Traces of primordial form of the substance hint at why the cosmos is expanding faster than expected.

By Davide Castelvecchi

Cosmologists have found signs that a second type of dark energy — the ubiquitous but enigmatic substance that is pushing the Universe's expansion to accelerate — might have existed in the first 300,000 years after the Big Bang.

Two separate studies — both posted on the arXiv preprint server[1,2] — have detected a tentative first trace of this 'early dark energy' in data collected between 2013 and 2016 by the Atacama Cosmology Telescope (ACT) in Chile. If the findings are confirmed, they could help to solve a long-standing conundrum surrounding data about the early Universe, which seem to be incompatible with the rate of cosmic expansion measured today. But the data are preliminary and don't show definitively whether this form of dark energy really existed.

"There are a number of reasons to be careful to take this as a discovery of new physics," says Silvia Galli, a cosmologist at the Paris Institute of Astrophysics.

The authors of both preprints — one posted by the ACT team, and the other by an independent group — say that further observations from the ACT and another observatory, the South Pole Telescope in Antarctica, could provide a more stringent test. "If the early Universe really did feature early dark energy, then we should see a strong signal," says Colin Hill, a co-author of the ACT team's paper[1] who is a cosmologist at Columbia University in New York City.

Mapping the CMB

Both the ACT and the South Pole Telescope are designed to map the cosmic microwave background (CMB), primordial radiation sometimes described as the afterglow of the Big Bang. The CMB is one of the pillars of cosmologists' understanding of the Universe. By mapping subtle variations in the CMB across the sky, researchers have found compelling evidence for the 'standard model of cosmology'. This model describes the evolution of a Universe containing three primary ingredients: dark energy; dark matter, which is the primary cause of the formation of galaxies; and ordinary matter, which accounts for less than 5% of the Universe's total mass and energy.

Current state-of-the-art CMB maps were provided by the European Space Agency's Planck mission, which was active between 2009 and 2013. Calculations based on Planck data predict — assuming that the standard model of cosmology is correct — exactly how fast the Universe should be expanding now. But for the past decade or so, increasingly accurate measurements of that expansion, based on observations of supernova explosions and other techniques, have found it to be 5–10% faster[3].

Theorists have suggested a plethora of modifications to the standard model that could explain this difference. Two years ago, cosmologist Marc Kamionkowski at Johns Hopkins University in Baltimore, Maryland, and his collaborators suggested an extra ingredient for the standard model[4]. Their 'early dark energy' would be a sort of fluid that permeated the Universe before withering away within a few hundred thousand years of the Big Bang.

Early dark energy would not have been strong enough to cause an accelerated expansion, as 'ordinary' dark energy is currently doing. But it would have caused the plasma that emerged from the Big Bang to cool down faster than it would have otherwise. This would affect how CMB data should be interpreted — especially when it comes to measurements of the age of the Universe and its rate of expansion that are based on how far sound waves were able to travel in the plasma before it cooled into gas.

The two latest studies find that the ACT's map of the CMB's polarization fits better with a model that includes early dark energy than with the standard one. Interpreting the CMB on the basis of the early dark energy model and ACT data would mean that the Universe is now 12.4 billion years old, about 11% younger than the 13.8 billion years calculated using the standard model. Correspondingly, the current expansion would be about 5% faster than the standard model predicts — closer to what astronomers calculate today.

Hill says that he was previously sceptical about early dark energy, and that his team's

GIULIO ERCOLANI/ALAMY

The Atacama Cosmology Telescope in Chile.