Abstractions

LAST AUTHOR

Baker's yeast, or *Saccharomyces cerevisiae,* has been used in cooking and brewing for centuries, and more recently has also proved a valuable asset in molecular- and cell-biology research. However, the genomes of this species' many strains had never been compared on a large scale. Leonid Kruglyak, a geneticist at Princeton University in New Jersey, and his colleagues set out to do this, both to provide information on genetic variation in this microorganism and to learn about the evolutionary relationships among different strains. Using DNA microarrays, the team uncovered almost 1.9 million single-letter variations — known as single nucleotide polymorphisms — in the DNA code among the genomes of 63 strains. On page 342, their study of yeasts from around the globe reveals that *S. cerevisiae* is a diverse, highly adaptable species. Kruglyak tells *Nature* more.

How did you gather the different strains?

We requested samples from researchers and repositories around the world and received more than 100 strains. For the strains to be useful, they had to be able to produce spores that could mate with other strains. Some strains couldn't make spores, so we ended up with 63 that were usable.

Did you find genetic similarities between strains from different geographical areas?

Yes. Vineyard strains from many parts of Europe, as well as North America and Africa, are very similar, which is no accident — clearly these strains have been transferred across continents by people. One strain we studied is classified as coming from a vineyard in Russia, but doesn't look like any other wine strain we looked at. So either they're making wine from a strain unrelated to that being used by everyone else, or it was simply misclassified.

How adaptable is *S. cerevisiae*?

Very. We found that strains isolated from human patients are diverse. Several looked like vineyard strains, three bore some similarity to those used in making beer and bread, and some didn't resemble any other strains. We interpret this to mean that there isn't a particular subgroup that has specialized to colonize human tissues. Instead, whatever strain happens to be in the environment can probably make the transition.

Does this finding have implications for human health?

There have been reports of patients being infected with strains that are sold as probiotic nutritional supplements. This suggests that taking yeast as a supplement may not be a good idea for people with compromised immune systems. ■

MAKING THE PAPER

Tim Naish & Ross Powell

Extracting ice sheet's past reveals what a warmer future might hold.

Tim Naish (left) and Ross Powell.

One of the greatest fears about climate change is that the Antarctic and Greenland ice sheets could melt, bringing with them a devastating rise in sea levels. But because of their locations, the most at-risk regions are some of the least accessible to study. Flanked by expansive floating ice shelves and largely buried below sea level, the West Antarctic ice sheet (WAIS) is thought to be highly vulnerable to global warming. If the WAIS alone melted, this might raise sea levels by 4–5 metres worldwide.

Climate scientists are keen to find out what the WAIS looked like during the early Pliocene epoch, 3 million–5 million years ago, when Earth's average surface temperatures and atmospheric carbon dioxide levels were similar to those predicted for the coming centuries. But records of the ice sheet's past were lacking, in part because glaciations often scotch the evidence of previous environmental change.

In an attempt to capture a chronological record of past ice-sheet oscillations, a team of 57 scientists from institutions in five countries set out to drill through one of the floating ice shelves and 850 metres of water to retrieve a sediment core from the sea bed. Led by Tim Naish, a palaeoclimatologist at the Antarctic Research Centre at Victoria University of Wellington in New Zealand, and Ross Powell, a sedimentologist at Northern Illinois University in DeKalb, the team has extracted a 1,285-metre rock core from beneath the Ross Ice Shelf, which abuts the WAIS.

The top 600 metres of the core, covering the past 5 million years, revealed drastic shifts in the WAIS — from grounded ice or ice shelves to open waters, and back to ice (see page 322). The authors show that these cycles were influenced by the tilt of Earth's axis, which shifts between 22.1° and 24.5° over an approximately 40,000-year period. This shifting of the polar regions towards and away from the Sun influences Earth's ice ages.

"The dramatic contrasts between the sediments showed us that the ice sheet fluctuated quite dramatically during the early Pliocene."

"At elevated atmospheric carbon dioxide levels the associated global warming seems to amplify the effect of Earth's tilt on the stability of the ice sheet," says Naish. The core reveals the risk that climate change projected for this century could lead to the eventual loss of a significant portion of land-based Antarctic ice.

Obtaining such a geologically rich core was a formidable exercise. The team set up on the northwestern corner of the Ross Ice Shelf, over a basin that was protected from the major glacial advances that can disturb the geological record. The 85-metre-thick slab of ice rose and fell with the tides, and drifted westwards by about half a metre a day. Drilling delays left the scientists ice-bound and bored. Naish and Powell distracted them with field trips and social events. After three weeks, the drilling team triumphed, finally guiding the drill bit through the ice shelf and water to their target on the sea floor — an area just 9 metres in diameter. "It was a bit like guiding a piece of wet spaghetti through the water," says Naish.

The team drilled day and night in 12-hour shifts for three months. Every day, stretches of core 30–40 metres long were transported to the Crary Science and Engineering Center at McMurdo Station, where they were split, described and sampled by sedimentologists. Data-hungry scientists gathered each morning to examine the previous day's haul.

Examining the chunks of core was like stepping back in time through Antarctic environmental change. Layers of coarse sediments representing very cold glacial environments with expanding ice were interspersed with green, diatom-rich sediments indicative of warmer, productive, ice-free oceans full of plankton and algae.

"The dramatic contrasts between the sediments showed us that the WAIS fluctuated quite dramatically during the early Pliocene, responding to periods of warming and cooling," says Powell. In all, the team dated 38 sedimentary cycles, the bulk of which linked the extent of the ice sheet to Earth's axial tilt.

The core's geological record also shows good agreement with an ice-sheet model published in a related paper by team members David Pollard and Robert DeConto (see page 329). They find that, as the world warmed, the Ross Ice Shelf melted from beneath, leading to partial or complete collapse of the WAIS. "We were trying to talk about the WAIS from one tiny point," says Powell. "Pollard and DeConto's model gives us a broader perspective about how important ocean temperatures are in controlling what the ice sheet does." ■

See also News & Views, page 295.

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