MEETING BRIEFS

Going for the Old: Ancient DNA Draws a Crowd

Approximately 170 researchers interested in reconstructing the past convened for the 2nd International Conference on Ancient DNA, held in Washington, D.C., from 7 to 9 October. While rejuvenated celluloid dinosaurs have grabbed headlines this year, these scientists were more concerned with topics such as tracing ancient human populations and understanding how DNA can survive the millennia.

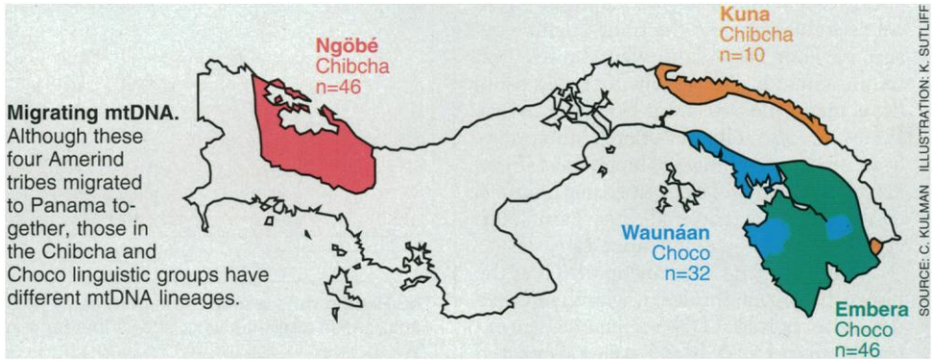
Moving Through America

The origin of the first Americans has prompted many controversial theories over the years, but in the past year or two geneticists have been adding molecular weight to one: the notion that the Americas were colonized in three waves. Although researchers differ about the dates of these migrations, the general idea is that sometime before 12,000 years ago, a group called Amerinds swept out of Asia; they were followed by another called the NaDene and then by the Eskimo-Aleuts. (The names come from present-day linguistic groupings.) Now, new genetic data on the Amerinds, presented at the meeting by Connie Kolman, a biologist at the Smithsonian Tropical Research Institute in Panama, threatens to upset this neat tripartite sequence. Kolman argued that her data on Amerind genes don't support the idea of multiple waves, although proponents of the theory are by no means giving up.

The wave theory got its start in the mid-1980s, when Stanford linguist Joseph Greenberg argued that the language differences between the three groups of American Indians were so large that they could not have developed after immigration, and that they therefore indicated the ancestors of the groups had arrived separately. Some differing dental patterns support Greenberg's idea, but a big boost came in the September issue of the *American Journal of Human Genetics*, where Antonio Torroni and Douglas Wallace from Emory University reported a mitochondrial DNA (mtDNA) analysis indicating there had been at least two waves of Indian settlers (*Science*, 15 January, p. 312).

The Emory team came to this conclusion by analyzing mtDNA samples from tribes in the Amerind and NaDene groups. The researchers found that the Amerinds had four mtDNA lineages, designated A, B, C, and D. The NaDene, in contrast, carry only the A lineage. Since the two groups are segregated by genetics as well as language, the scientists argued that the NaDene must have entered the continent separately from the Amerinds.

There is, however, an alternate interpretation of this lineage data, and Kolman has found evidence for it among two linguistically different groups of Amerinds in Panama, the Chibcha and Choco. The two groups apparently entered Panama together but split 7000 years ago, according to archeologists. What Kolman found is that the Chibcha carry only two of the four mtDNA lineages while the Choco carry all of them.



Migrating mtDNA. Although these four Amerind tribes migrated to Panama together, those in the Chibcha and Choco linguistic groups have different mtDNA lineages.

"It's very odd that two Amerind groups that are so geographically close would have different lineages, yet we're certain they came in the same migration," she says. Kolman suggests that the Chibcha may have lost mtDNA lineages, possibly as the population crashed after European contact in the 15th century. And if these Amerinds could lose lineages, so could the NaDene. Consequently, Kolman concludes that finding just one lineage in the NaDene is no reason to place them in a separate migratory group.

But Emory's Torroni says he doesn't buy this argument because time—at least the mtDNA version of it—is on his side. Within the entire NaDene A lineage, he says, "there is much less diversity than in the A lineage in any individual Amerind tribe." Less diversity in the NaDene implies they arrived later than the Amerinds, since a late arrival would give them less time to accrue mtDNA variations.

Kolman, however, has a rejoinder. "With expanding populations, like all New World groups, it's difficult to reliably measure dates of divergence and levels of diversity," she says, because the statistical calculations for this work all assume a population in genetic equilibrium. "That's the same sort of thing that got the African Eve theory in trouble." Until these issues are resolved, it seems the idea of separate waves of migration to the Americas will continue to break against the shores of uncertainty.

Forever (in) Amber

Time and again, the best preservative for ancient DNA—and the ancient tissue that holds it—has proved to be amber. The current longevity record belongs to DNA from a weevil entombed in amber 120 million to 135 million years ago (*Nature*, 10 June, p. 536); there are myriad younger samples of DNA in amber. But no one has yet explained satisfactorily how tree resin, the raw material for amber, pulls off this feat. At the meeting, George Poinar, an entomologist at the University of California, Berkeley, trotted out what he called "a working hypothesis" to explain amber's preservative properties. Some scientists who heard him felt it was a worthy effort—"I thought Poinar did his homework," says Rob DeSalle of the American Museum of Natural History—but other researchers had a less generous appraisal.

Poinar's notion is based on his studies of resin from *Agathis australis*, a modern relative of trees that produced insect-holding amber. First, he says, the resin contains highly concentrated sugars that could pull water out of a dead insect by osmosis, since the sugar concentrations inside the corpse are much lower than those outside. The drying out would protect the insects' DNA, which degrades in contact with water. At the same time, chemicals in the resin called terpenes could enter the insect and become oxidized to aldehydes, which act as preservatives. Finally, terpenes and associated phenolic compounds could inhibit microbial activity.

But Jean Langenheim, a botanist from the University of California, Santa Cruz, who has studied the chemical ecology of resin and amber is not convinced by this scenario. In particular, she has doubts about the role of sugar, because her work shows sugar isn't usually present in resin. She does note, however, that sugar could come from tree sap if it gets mixed in with the resin.

David Grimaldi, a paleoentomologist at the American Museum of Natural History, also thinks sugars aren't part of the picture and suggests instead that sesquiterpenes, compounds present in high concentrations in resins, might be able to preserve insect tissues if they perfuse the dead insects' tissues rapidly. That's an intriguing idea, but it hasn't been tested, and so amber preservation remains an enigma.

Easter Island Originals

The genesis of the huge stone faces peering out across the Pacific isn't the only mystery on Easter Island. Another one is: Where did the first Easter Islanders come from? Most anthropologists consider Polynesians, coming from the west, to be the most likely colonists of this lonely eastern Pacific outpost, thousands of miles off the coast of Chile. But there has always been a flicker of doubt, a claim of South American ancestry fueled by controversial oral histories, claims of physical resemblances, and the trans-Pacific voyages of Thor Heyerdahl, who showed that sailing rafts like his famous *Kon-Tiki* could have made the trip from South America. Bones can also tell tales of prehistory, however, and, according to biochemist Erika Hagelberg, bones of ancient Easter Islanders contain genetic material that points unequivocally to Polynesian ancestory.

At the meeting, Hagelberg, who is at the University of Cambridge, England, reported that mitochondrial DNA sequences she extracted from Easter Island skeletons proved identical to mtDNA sequences from living Polynesians and ancient Polynesian skeletons. Hagelberg used PCR to amplify mtDNA from 12 bone samples from Easter Island archeological sites known to be several hundred years old. She then compared the sequences to sequences from bones exhumed elsewhere in Polynesia and from current Polynesians.

One mtDNA sequence in particular is a signature of Polynesian ancestry. It has three single base-pair substitutions plus a nine base-pair deletion that have not been found in the mtDNA of any other ethnic group—and it turned up in the Easter Island bones. Conversely, sequences indicating Peruvian or Chilean ancestry were absent. Unless Polynesian voyagers originally overshot Easter Island, settled on the South American coast, and then went back to settle the outpost, Hagelberg thinks the data put the notion of a South American connection to rest.

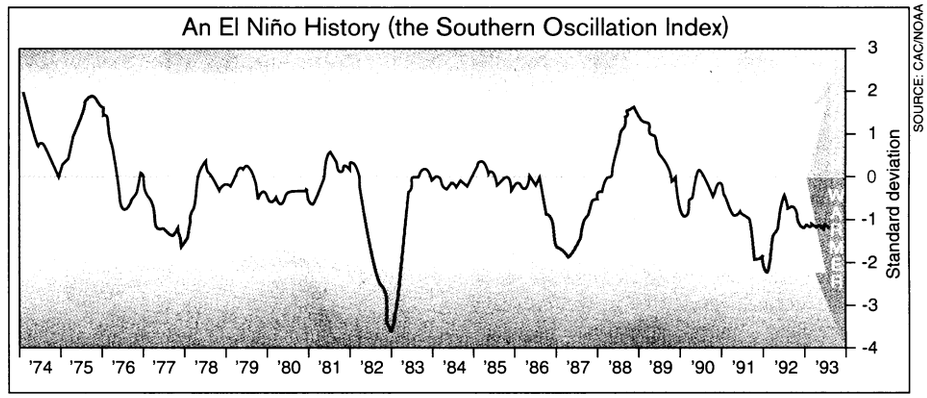
Other researchers concur. "If the mtDNA says Easter Island was populated by Polynesians, I believe it," says the Smithsonian's Connie Kolman. Now if PCR could produce mtDNA from those stone faces, the island might become even less mysterious.

–Joshua Fischman

CLIMATE

El Niño Metamorphosis Throws Forecasters

A year ago, climate forecasters were feeling pretty confident about their ability to forecast El Niño, the pool of anomalously warm water that forms every few years in the tropical Pacific and throws a monkey wrench into global weather patterns. By relying on computer models that reproduce the interplay of the tropical ocean and atmosphere, along with statistical analyses, they had successfully predicted the two El Niños since 1986, which brought in their wake a global retinue of droughts and floods. But the events of last winter dealt that growing confidence a blow: Most forecasters failed to predict the El Niño that popped up. And this winter promises to be equally unsettling for forecasters.



The Pacific runs a fever. The barometric pressure difference between Darwin, Australia, and Tahiti, which tracks El Niño, shows that for 4 years the system has been stuck "on."

Predictions issued over the past few weeks run the gamut from another El Niño to the first colder-than-normal tropical Pacific in 4 years. Since the predictions fall on both sides of the El Niño question, half of them are going to be wrong whatever happens. And it's not that the computer programs have started to malfunction. Instead, it seems that, unnoticed until this year, nature has changed the rules in a way forecasters can't fathom. Instead of spawning an El Niño for a year or so every 3 to 7 years, then giving way to relative cold, the El Niño system seems locked in the "on" mode.

"This has been a remarkable 4-year period," says climatologist Chester Ropelewski of the U.S. Weather Service's Climate Analysis Center (CAC) in Camp Springs, Maryland. "This is really unprecedented in the climate record. Clearly, we don't understand all that's going on here."

That uncertainty contrasts with the attitude last year, when most forecasters were fairly confident that there was no El Niño in the cards. After all, the previous winter's El Niño "looked like it was all over in August '92," notes Ropelewski. Tropical waters from South America to the central Pacific had cooled to normal temperatures, the weakened easterly winds that had let warm waters slosh in from the western Pacific were blowing strongly again, and even the warm water's source region in the western Pacific was cooling.

The forecast models did the obvious. To the CAC's statistically based model, which comes up with a prediction by comparing recent patterns of atmospheric pressure and sea surface temperatures with the historical record, last year's pattern looked like a classic El Niño termination. The most highly regarded of the models that simulate the interplay of ocean and atmosphere, developed by Mark Cane and Stephen Zebiak of Columbia University's Lamont-Doherty Earth Observatory, also discerned no signs that warm water would appear a third time. Only the CAC's second model, a newly installed coupled ocean-atmosphere model, was right about the El Niño that developed a few months later. Says Ants Leetmaa of the CAC, "We were either very skillful or it was beginner's luck."

Luck may be what it takes to forecast El Niño in these uncertain times. Looking over the century-long historical record, Ropelewski notes only one similar period of sustained warmth in the tropical Pacific—a shorter episode lasting from 1939 to 1941. What could have kept surface water temperatures up for so long this time around is anybody's guess. Vernon Kousky of the CAC does offer some possibilities: the increasing greenhouse effect of human emissions, the climatic ef-