

## Ancient people sparked die-offs down under

When early humans first landed in Australia, some 50,000 years ago, they torched the landscape and killed off an arkful of fantastic beasts, including carnivorous kangaroos, marsupial lions, car-sized tortoises, and 25-foot-long lizards. Such is the scenario proposed by a team of geologists who have dated the extinction and find that it corresponds to the arrival of people on that continent.

The new study is changing researchers' views of the toll that ancient people exacted on the world around them.

The crisis in Australia killed off some 60 species, including all large land animals—called the megafauna. Paleontologists have discussed this extinction for more than a century, arguing whether people or climate changes deserve the blame. The debate stalled, though, because researchers did not know precisely when the animals disappeared.

The new study is “the most impressive arsenal of dating techniques to be

brought to bear on this subject so far,” says geologist Gifford H. Miller of the University of Colorado at Boulder, who teamed up with U.S. and Australian colleagues to pinpoint the extinction. “We used four different methods, and they're all saying essentially the same thing.”

In their study, described in the Jan. 8 *SCIENCE*, the researchers focused on an extinct flightless bird named *Genyornis newtoni*, which stood about 5 feet tall and weighed twice as much as a modern Australian emu. Many millennia ago, windswept sands buried fragments of eggshells from *Genyornis* and ancient emus, preserving a biological remnant suitable for dating.

Miller and his coworkers analyzed the amino acids locked within the shells. During life, almost all organisms incorporate into their tissue only amino acids with a left-handed geometry. After death, those molecules slowly transform into a roughly equal mix of left- and right-handed

forms. By measuring the ratio of the forms in the preserved eggshells, the researchers assessed the samples' ages.

Miller's team also used carbon-14 dating and a similar technique that relies on the radioactive decay of uranium atoms. A fourth method gauged the legacy of ebbing radioactivity in quartz grains, thereby dating the sand in which the eggshells were found.

The combination of these techniques indicates that *Genyornis* went extinct between 45,000 and 55,000 years ago, the scientists report. That time, they say, corresponds to the best estimate for when people first reached Australia from Indonesia. It does not match any span of severe climate change in Australia, says Miller.

This circumstantial evidence may not be enough to convict humans yet, says Timothy F. Flannery of Harvard University. Scientists do not know, for instance, whether the *Genyornis* extinctions coincide with the disappearance of the other Australian megafauna.

Nevertheless, the eggshell data “represent a serious challenge to the proponents of climatically caused megafaunal extinction,” says Flannery in a commentary accompanying the *SCIENCE* report.

Miller's group proposes that people killed off the Australian megafauna indirectly, by altering the vegetation. Evidence for this view comes from the mixture of carbon atoms in the fossil eggshells. It suggests that *Genyornis* ate only shrubs and trees, whereas emus had a more varied appetite that also included grasses. Because emus survived and *Genyornis* died out, Miller's team theorizes that people disrupted the native Australian vegetation, perhaps by setting fires, a practice still common among Aborigines.

Previous studies have suggested that the frequency of fires increased dramatically in Australia at the same time that humans reached the continent, says fire historian Stephen J. Pyne of Arizona State University in Tempe.

The new Australian data could rekindle debate about a later bout of megafaunal extinctions that swept North America at the end of the ice age, around 11,000 years ago. Paul S. Martin of the University of Arizona in Tucson proposed in the 1950s that the continent's large mammals succumbed to human hunters arriving from Siberia. Many researchers, however, have rejected this overkill hypothesis and favored climate change as the cause of the extinctions.

The fire theory for Australia and other new hypotheses have caused Martin to change his mind. “I see a reason to back away from the overkill [idea] as the only effective model,” he says. In addition to hunting, people would have wreaked havoc by disrupting the ecosystem and introducing novel diseases to the New World, all of which could have sparked the extinctions, he says. —R. Monastersky

## This year, resolve to fidget more

Anyone embarking on a New Year's diet knows the inherent unfairness of weight gain and loss: Some people just don't put on weight, even when they eat a lot. Researchers studying metabolism are now surprised to find that people appear to fidget more when they overeat, burning off some excess calories—and people who stay lean despite over-indulging appear to fidget the most.

To gauge why some people gain weight easily, researchers at the Mayo Clinic in Rochester, Minn., tracked 12 men and 4 women, none of whom was obese, for 10 weeks. During the first 2 weeks, the researchers measured the participants' base metabolism rate and caloric needs. Then, each participant went on a diet with 1,000 extra calories per day—roughly a 35 percent boost, equivalent to two double cheeseburgers.

Researchers checked to see that all meals were eaten and even probed the participants' garbage to make sure they weren't skipping dessert.

The participants wore pedometers to measure activity such as walking or stair climbing. A urine test revealed how many calories their bodies were burning.

With these data, researchers were able to apportion how much energy was burned by exercise or base metabolism. The rest must have been burned by “fidgeting”—movements not recorded by the pedometers, such as posture adjustments or desk work, says study coauthor Michael D. Jensen.

While some participants gained 16 pounds, others added only 3, the researchers report in the Jan. 8 *SCIENCE*. All

study participants burned more calories than usual, consistent with other studies of people who are overfed. Since metabolism and exercise didn't account for the change, the researchers fingered fidgeting.

Previous research has hinted at a role for genes in weight gain. A Canadian study of identical twins in 1990 showed that when fed extra calories, some sets of twins gained more than other sets, but the weights of each pair changed in tandem.

Although that research took base metabolism into account, it hadn't measured fidgeting. “That was really the inspiration for this study,” Jensen says.

Why some people fidget more than others remains unclear. Not fidgeting might have had survival value in the past, says Elliot Danforth Jr. of the University of Vermont in Burlington. Lackadaisical babies would have survived famines by conserving calories. Since modern people evolved from survivors, most people today don't fidget away extra pounds, he suggests.

Not everyone agrees that fidgeting accounts for the excess calories being burned. Jules Hirsch and his colleagues at Rockefeller University in New York City have used radar to track people's movements and found no correlation between fidgeting and energy consumption. Hirsch says that among overfed people, some just use more calories than others to do the same things.

Eric Ravussin of Eli Lilly and Co. in Indianapolis counters that exercise tests in the new study showed that the weight gains were not related to movement efficiencies of the participants. —N. Seppa