Earth Science

Watching a continent splinter

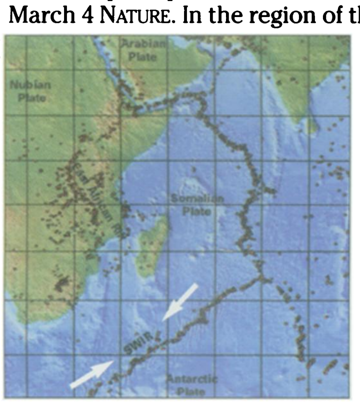
Ancient human ancestors inhabited some of the rawest land on Earth, amid the East African Rift Valley. There, two sections of the planet's skin are pulling apart like a fresh wound. For years, geoscientists have wondered why this gash disappears south of Mozambique. Two researchers now have an answer.

The East African rift marks the boundary between two tectonic plates: the Nubian plate to the west and the Somalian plate to the east. A general rule of plate tectonics is that such rifts must hook up to other plate boundaries, but researchers have had trouble tracing the connection of the East African rift. South of Mozambique, there are no earthquakes or other signs of disturbance like those seen along the rift to the north.

Dezhi Chu of Exxon Production Research Co. and Richard G. Gordon of Rice University, both in Houston, tracked the continuation of the East African rift by studying ocean rocks. Between Africa and Antarctica, there is a rift in the seafloor where the crust spreads apart and new rock is born. In the process, the two African plates inch away from Antarctica.

Using Antarctica as a signpost, Chu and Gordon discerned the motion between the Nubian and Somalian plates. Instead of pulling straight apart, the two plates rotate like scissors blades around a pivot point east of South Africa, the two report in the March 4 NATURE. In the region of the East African rift, far north of the pivot point, the two plates are separating by 6 millimeters a year. Just south of the pivot point, the two plates are crushing together at a rate of only 2 mm per year, so slowly that they don't often produce large earthquakes.

NATURE



Quakes in East Africa (red dots) mark where the Nubian tectonic plate and the Somalian plate are diverging. White arrows show where the two plates are crunching together.

By understanding the motion, or kinematics, of these two plates, geoscientists will have more success in resolving how all Earth's plates behave. "It solves, in a sense, this 30-year mystery of how the East African rift fits in kinematically in the plate-tectonic scheme," says Gordon. —*R.M.*

Pinning L.A. quakes down to a fault

Seismologists hunting for faults in Los Angeles have always seemed like fishers surveying a well-stocked lake: Both groups know that their quarry hides beneath the surface in large numbers, but neither can say exactly where the prey lurks.

Until now. A pair of researchers has just reeled in a major catch by pinpointing the location of one of these elusive faults.

The concealed cracks beneath Los Angeles are called blind-thrust faults because they remain out of sight, covered over by thick layers of surface sediments. In an earthquake, these thrust faults serve as giant ramps, with one wedge of crust riding up another. Seismologists tuned into the dangers of blind thrusts during the 1987 Whittier Narrows earthquake, a magnitude 6.0 tremor that struck directly beneath metropolitan Los Angeles but never broke the surface. Although the blind thrust faults are far smaller than the San Andreas Fault, they pose a major hazard because of their proximity to the city.

By studying the topography throughout Los Angeles, geologists have been able to infer the general locations of some of these blind thrusts. In the new study, John H. Shaw of Harvard University and Peter M. Shearer of the Scripps Institute of Oceanography in La Jolla, Calif., probed deeper by gaining access to tightly held data collected by oil companies. To ferret out petroleum, such firms have scanned the hidden geology of Los Angeles by vibrating the ground with explosions and other means.

Shaw and Shearer discovered a large fault, which they named the Puente Hills thrust, running 40 kilometers in an east-west direction underneath the city. The plane of the fault dips down to the north at an angle of 27° to the horizontal, and the structure appears to be broken into three distinct segments, they report in the March 5 SCIENCE. When Shaw and Shearer reanalyzed data from the Whittier Narrows earthquake, they found that the location of the quake precisely matched the position of the Puente Hills thrust.

Each of the newly identified fault segments could produce a magnitude 6.5 jolt, say the researchers. If the segments broke together, they could trigger an earthquake of magnitude 7.0, which would carry 30 times the energy of the Whittier Narrows shock.

"This study is a vast leap forward in understanding blind-thrust faults," says geologist James F. Dolan of the University of Southern California in Los Angeles. The new discovery, however, should not heighten the concern of jittery Angelinos because geologists knew that a blind thrust must have been down there, says Dolan. "This doesn't change our overall perception of the seismic hazard facing L.A." —*R.M.*

1998: Warmest year of past millennium

The current millennium is ending not with a bang but a boil. A study of climate reaching back to the time of William the Conqueror indicates that recent temperatures are the highest of the past 1,000 years.

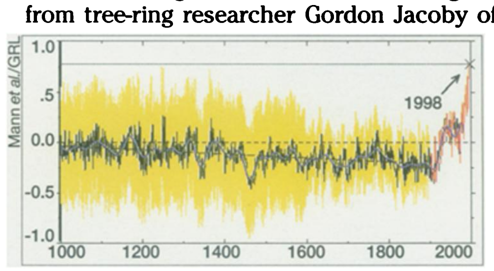
The new analysis, published in the March 15 GEOPHYSICAL RESEARCH LETTERS, combines information recorded in tree rings and glacial ice. Michael E. Mann of the University of Massachusetts at Amherst and his colleagues calibrated these natural thermometers against modern instruments, which enabled them to make a Northern Hemisphere temperature reconstruction of unprecedented length.

In a previous analysis of the past 6 centuries, the team had found no decade warmer than the 1990s (SN: 5/9/98, p. 303). Still, some scientists had wondered about earlier times. In the first 3 centuries of the millennium, a time known as the medieval warm period, Europe was notably balmy. This span may now require a different name. While the North Atlantic basked in warmth, the high temperatures did not spread across the Northern Hemisphere, according to the new report.

Although there are large uncertainties in the temperature estimates for the earliest part of the record, the current warmth is unprecedented, says Mann. "The numbers for 1998 are so unusual. They push it up to the ballpark of 99 percent certainty that 1998 is the warmest year in the reconstruction," says Mann. It's also very likely that the 1990s are the warmest decade of this millennium, he adds.

Such strong statements, however, get a cool reception from tree-ring researcher Gordon Jacoby of Lamont-Doherty Earth Observatory in Palisades, N.Y. "There's so much uncertainty in the chronology," says Jacoby. He calls the study "a good first effort, but there's a lot more work to be done." —*R.M.*

Mann et al./GRL



Black line charts temperatures relative to millennial average. Yellow denotes range of potential error in the measurements.