Earth Sciences

Upland quake: Taste of things to come?

Nothing publicizes seismic hazard better than an earthquake, as all seismologists know. True to form, the magnitude 5.5 temblor that hit Upland, Calif., 30 miles northeast of Los Angeles, on Feb. 28 has now focused attention on faults in that area that could potentially generate quakes similar in size to the Loma Prieta shock that shook northern California last October.

The Upland quake struck just south of the San Gabriel mountains on a north-south-trending fault that splits the Cucamonga fault to the east and the Sierra Madre fault to the west. Geologic evidence indicates the Cucamonga has been active during the past several thousand years, spawning earthquakes about every 600 to 700 years. Geologists don't have a firm date for the last large quake on the Cucamonga, but they think it might have occurred 600 to 700 years ago, says geologist Douglas M. Morton of the U.S. Geological Survey in Riverside, Calif.

Last month's Upland shock followed smaller quakes on the same fault in 1988 and on the Cucamonga last year. This sequence may signal that stress on the Cucamonga has reached a point where it could soon generate a large earthquake, on the order of magnitude 6.5 to 7.2, which would likely wreak major damage in this developing region. On the other hand, it may foreshadow nothing for the Cucamonga, says Morton.

Even more uncertain is the hazard from poorly defined faults to the west of the Upland temblor, many of which disappear from view beneath the sediment-filled valley. Geologists know this area must be absorbing stress caused by motion between the North American and the Pacific plates, but they don't know which faults take up the slack and whether such faults move by generating large earthquakes or instead creep without producing quakes. The recent activity offers some hope to Morton and others who have decided to examine this region in closer detail. Seismic information from the earthquake and its aftershocks may help fill in some important details about the faults in that area, he says.

New picture of California plate puzzle

As it slowly edges to the northwest, the Pacific plate moves about 48 millimeters a year relative to the North American plate. Researchers think the famous San Andreas fault absorbs a substantial fraction of that slip, on average somewhere between 30 mm to 40 mm each year. But what about the rest of the motion not absorbed by the San Andreas? While scientists five years ago thought that faults west of the San Andreas must absorb the additional slip in southern California, more recent work points to regions to the east of the San Andreas.

Roy K. Dokka and Christopher J. Travis of Louisiana State University in Baton Rouge have spent years of field work studying the faults of the Mojave Desert-Death Valley region. Their work suggests these faults have been taking up a significant amount of the plate motion, between 9 percent and 29 percent over the last several million years, they reported at a meeting of the American Association for the Advancement of Science in New Orleans last month.

This work confirms previous geodetic studies indicating that the Mojave absorbs about 6 mm per year of the slip between the North American and the Pacific, says Wayne R. Thatcher of the U.S. Geological Survey in Menlo Park, Calif.

As part of his study of Mojave faults, Dokka received help from very high sources – the Landsat satellites. John P. Ford and co-workers at the Jet Propulsion Laboratory in Pasadena, Calif., have developed an improved technique to identify faults on Landsat satellite images. This technique allowed the researchers to pinpoint several previously undocumented faults in the Mojave.

Physical Sciences

Ivan Amato reports from New York City at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Saving history through science

Those responsible for authenticating, preserving or restoring museum pieces often turn to analytical chemists for help in their efforts to save history. Restoration experts, for example, need to know the chemical identities of the pigments, binding media and other materials that past artists and artisans used originally. Museum conservators need similar information for making decisions about what solvents or finishes to use for preserving a particular piece (SN: 4/23/88, p.264).

Restorers at the J. Paul Getty Museum in Malibu, Calif., for instance, wanted to know the identity of the binding medium (a substance that holds pigments to a surface) in the paint that Bartolommeo Montagna used in his 1495 painting "The Adoration of the Magi." With researchers from the Getty Conservation Institute in Marina del Ray, Calif., chemist James M. Landry of Loyola Marymount University in Los Angeles and Margaret R. Bolton, one of his undergraduate students, analyzed a tiny sample of the painting using an instrument called an infrared (IR) microspectrometer.

The researchers embedded the sample in a plastic and then sliced it into slivers thinner than a human hair. The spectrometer shines infrared light through each sliver and monitors which wavelengths get absorbed. The resulting pattern, called an IR spectrum, identifies the chemical constituents of each slice, and thus of the painting at different depths. To help them make accurate identifications, Landry and Bolton obtained reference spectra from samples of art materials in common use at the time Montagna painted.

Landry now seeks an embedding material transparent enough for unfettered viewing of a sample through an optical microscope, yet also suited for doing chemical analyses on the same sample. To serve this double duty, the embedding material must have a composition that does not distort a sample's IR spectra. Getting as much information out of as little a sample as possible is a premium concern for art restorers and conservators who work on objects treasured by the world, Landry says.

Eastern medicine meets Western science

When practitioners of traditional Chinese medicine ask patients to stick out their tongues, the *doctors* say "Ah-ha." Relying on experience, rules of thumb and intuition, these doctors link the color, shape and surface features of their patients' tongues to specific health disorders. For example, an unusually blue tongue with a whitish, dense-looking surface, or "fur," might signal to a Chinese doctor that the person attached to the tongue suffers from emphysema, a chronic respiratory disease. Though Eastern doctors have used tongue analysis for centuries to make diagnoses, practitioners do not agree on how the technique works, notes computer scientist Yao Zhang of the ADA Research and Development Group in Beltsville, Md. Along with co-workers there and at the National Cancer Institute in Bethesda, Md., Zhang hopes to add scientific spice to the ancient art of tongue analysis.

They begin with a color image of a patient's tongue. The researchers then convert this analog image into a pattern of digits that a computer can manipulate. Using image processing techniques, they can generate tongue images that are immune to the idiosyncrasies of how different doctors observe their patients. And by generating a range of images that highlight different tongue features, the researchers hope to probe the doctors' actual diagnostic techniques, Zhang says.

Although the digital image analysis system remains in an early stage of development, Zhang says his group expects to develop the method into a computerized expert system that may help Chinese doctors to practice their art while uncovering some of the medical basis for its apparent utility.