EARTH SCIENCES

Susan West reports from Toronto, Ontario, at the spring meeting of the American Geophysical Union

Pet seismologists

Snakes crawl out of hibernation, dogs run in circles, rats swarm the streets in daylight—all before an earthquake strikes, according to Chinese seismologists. In an effort to move such reports from the realm of anecdote to fact, SRI International of Stanford, Calif., under contract to the U.S. Geological Survey, has organized "Project Earthquake Watch."

Now in its third year, the project has 1,250 volunteer observers in three areas—north of Los Angeles, near Hollister and San Jose and in northern California where the San Andreas fault swings into the Pacific Ocean. The researchers hope that by using existing populations of a variety of animals in their natural states and by keeping long-term daily observations, they will be able to determine what animals are most sensitive and just what they are sensitive to — changes in electromagnetic fields, low-frequency sounds or the smell of gases escaping from the earth, for example. "In this way, we may be able to design better instruments to pick up these changes," says SRI's William Kautz.

The volunteers must be at least 18 years old, have several animals and be around those animals most of the day, says Kautz. They are required to call the project headquarters daily with an evaluation of their animals' behavior based on a predetermined scale, to keep a daily log and to make weekly reports. What constitutes unusual behavior is up to the volunteer, say the researchers, but includes "unexpected, prolonged vocalizations," restlessness, attempts to escape confinement, hiding and refusal to enter a building. Only reports entered before a quake are included in the analysis, and factors such as the distance between the observer and the quake epicenter are considered.

So far, however, the network has scored no great successes. In the year since all 1,250 observers have been on line, six earthquakes of magnitude 5 or greater have struck in California, but only two touched on the fringes of the animal-watching network, says Kautz. The results from those two are "inconclusive, though suggestive and encouraging." "We are still waiting for the right earthquake to come along," he says, "but we are encouraged that the use of volunteers will be very helpful."

Magnetic dolphins . . .

Dolphins, like pigeons, seem to know just where they're going. Pigeons, it has recently been suggested, get their bearings from bits of magnetic material in their heads (SN: 5/24/80, p. 326). Might dolphins have a similar internal compass?

J. Zoeger of Los Angeles Harbor College and J.R. Dunn and Michael Fuller of the University of California in Santa Barbara wanted to find out. Using sensitive magnetometers in the UCSB rock magnetism laboratory, they examined 1-inch cross section samples from the heads of five dolphins that had been stranded and died. In at least two they scored: In tissue from an area between the roof of the skull and a septum in the posterior portion of the brain, they measured a magnetic moment of 2×10^{-5} gauss per cubic centimeter—20 times stronger than that of the earth's field and 100 times the "noise" level of the instrument. When the scientists took a closer look, they found that the material shows the thermal properties of magnetite—a strongly magnetic, iron-containing mineral—and that it is not a contaminant. Under the microscope, the sample was found to contain many opaque particles — which Fuller says could be the sought-after magnetic bits — that have diameters of several microns. As to what those bits may mean in terms of dolphins' navigation abilities, Fuller tends to the side of caution: "All we have found is that some dolphins have some magnetic material in their heads. We don't know why it's there." If it is there for navigation, however, he suggests it may be possible to wire fishermen's nets so that the animals can avoid capture.

and bees

Bees follow a magnetic compass, too. And Joseph Kirschvink of Princeton University suggests that their compass might tell geologists about the strength of the ancient geomagnetic field. Bees show the clearest link between magnetic effects and behavior, Kirschvink says, and therefore make the best candidates for such studies. For example, previous work showed that when bees are exposed to very strong magnetic fields, their sense breaks down and magnetic-related behavior — such as their communicative "dance"—becomes erratic. The field strength at that break point is about 5 gauss, Kirschvink says. He suggests that this upper limit may have developed through natural selection—those bees able to function when the earth's field reached that strength survived. If so, with some complicated genetics, he proposes that it may be possible to determine when that strength existed.

Rise and fall of the northwest

If folks in Seattle are getting a sinking feeling, it's because they are—sinking, that is. According to John Adams of Energy, Mines and Resources in Ottawa, Canada, and Robert Reilinger and James Ni of Cornell University, the coastal ranges of Oregon and Washington are currently rising at a rate of about 2 millimeters per year. That means that Astoria, Ore., and Neah Bay, Wash., appear to be rising relative to sea level and Seattle seems to be sinking. The researchers base their findings on tide gauge measurements, leveling surveys and on an examination of land terraces formed by wave action. Their results indicate that the coast is not only being raised but also tilted landward and that the movement began about seven million years ago. The cause for all this is quite simple: The Juan de Fuca plate, a small oceanic plate off the Oregon and Washington coasts, is forcing its way beneath the North American plate at that point, and something — namely the coastal ranges — has to give.

Flashy research

Like a monument to some god of science fiction, the CN Tower rises 1,815 feet above Toronto, Ontario. Billed as the world's tallest free-standing structure, it houses broadcasting and communication equipment as well as the obligatory revolving restaurant and a disco. But it is also the world's tallest lightning rod and as such provides an opportunity for a joint government-university research project on lightning. Ultimately, explains T.R. McComb of the National Research Council of Canada, such research will aid lightning-resistant design of tall buildings, which often suffer electrical and communications systems damage from lightning.

Because researchers are primarily interested in lightning currents, says McComb, two current-measuring shunts were installed at two different levels in the tower along with a current measuring coil just under the tower's fiberglass skin and a videotape system to record lightning flashes. Such devices allow the researchers to measure the rate at which the current rises, which is the factor that most affects vulnerable power systems. In addition, lightning takes a long time to travel the length of the tower to the ground, so that the scientists can examine the current in the primary flash without interference from ground reflection, McComb explains.

The program is still in its infancy, McComb says, and the researchers hope to continue their observations for 10 or 11 years. In the past eight months, 31 flashes and their current measurements have been recorded to the tower, he said, but some puzzling observations—such as a zero electric field in the midst of a large flash — need to be explained.