in most bowerbird species, observes Presgraves. Instead of the usual soft calling, "these guys scream their heads off," Presgraves says. Males rush at the bowers that shelter a female, often crashing into the wall. They pick up the snail shells or bleached sheep vertebrae that they have scattered by the hundreds around the clearing and toss them much farther than other bowerbirds, up to a meter away. "It looks like a temper tantrum," Presgraves notes.

The females seem extremely choosy, usually just flying away after the show. Only a small percentage of the males in a population manage to mate. To see what pleases the females, Borgia and Presgraves videotaped the action at 13 undisturbed bowers for a season. Comparing successful male displays with flops, they report, "Females preferred males with the most intense displays."

The next season, the researchers removed one wall from each of 12 bowers. In 22 of 26 courtships, the birds kept the remaining wall between them during the majority of the display, even when the investigators repositioned it. When males did move to where no barrier separated them from a female, displays were more muted, with significantly less body shuddering, long calling, and decoration flinging, say the researchers.

They argue that their findings support the idea that the species' unusual bower orientation and male shenanigans "represent a coevolved suite of changes that allow males to give higher-intensity displays."

Another bowerbird observer, Stephen Pruett-Jones of the University of Chicago, says he's fascinated by the new details of the little-known spotted species. However, he sees several interpretations. Male aggression did not have to drive evolution of the bower, he says. "It could be the reverse: Male aggression in displays evolved in response to bower structure."

Aggression is nothing unusual in bird courtship, observes Anders P. Møller of Pierre and Marie Curie University in Paris. Male mallards, for example, get so rough during aquatic sex that they drown some of their partners. He notes, "Lots of aspects of sexual behavior are actually outcomes of sexual conflict." —*S. Milius*

High-pressure water triggers tremors

Tiny droplets of water may seem too inconsequential to break rock, but three Yale University geologists now say that water trapped far below Earth's surface can set off earthquakes.

Deep underground, heat and pressure expel water from the crystals of certain minerals, transforming one structure into another. "The classical view of metamorphism is that fluid is released very slowly and continuously in teeny, tiny amounts over millions of years," says Jay J. Ague, a coauthor of the report appearing in the Nov. 15 GEOPHYSICAL RESEARCH LETTERS. "What we show is that once one of these [transformations] gets going, a lot of water can be released over decades or hundred-year timescales."

If water is squeezed that quickly out of crystals 10 to 20 kilometers below the surface, it soon fills pores in the rock and is left with nowhere to go, Ague says. When its pressure overcomes the weight of the overlying rocks, the water blasts some escape routes. Cracking rocks already under immense strain in a fault zone is a good way to start an earthquake, he points out.

Ague and his colleagues Jeffrey Park and Danny M. Rye wondered whether this process could trigger mysterious earthquakes such as Loma Prieta. That 1989 California quake started nearly 18 km underground, deeper than seismologists thought possible along the San Andreas Fault. Most tremors there occur in the top 12 km of the crust as opposite sides of the fault slip past each other. Deeper rocks are so hot that strain does not tend to build up: Like Silly Putty, they flow when pushed slowly but snap if stretched abruptly.

In the Yale team's proposed mechanism, water would strain the rocks so rapidly that they would break even at that depth. "The [Loma Prieta] trigger was at the very deepest place possible, which makes the idea worth entertaining," says Kevin P. Furlong of Pennsylvania State University in State College. Still, he asks whether water can be released rapidly enough to break rock that is pliable enough to flow.

Water might diffuse peacefully through the rock if it were released gradually as the minerals converted from one type to another. The Yale scientists' analysis, however, indicates that rock being heated holds water beyond the equilibrium temperature for the mineral transformation and then releases it quickly. They modeled reactions in which the mineral serpentine loses its water to become olivine. Overstepping the critical temperature by as little as 5°C can generate enough pressure to shatter the rocks, Park observes.

Ague admits there's more work to be done. "There are hundreds of reactions that can take place, so we've really only scratched the surface," he says.

If the researchers' theory proves right, its implications don't stop after a single rumble. "If the fault seals up after an earthquake, the reactions keep going and fluid pressure builds up again," Ague says, "so this process could happen over and over." —*S. Simpson*

TNT-sensing plastic exposes land mines

Placed in the heart of a lightweight, portable device, a new polymer that sniffs out trinitrotoluene, or TNT, could help in the search for millions of unexploded land mines buried around the world.

Designed by Timothy M. Swager and his colleagues at the Massachusetts Institute of Technology, the polymer can detect TNT concentrations of less than a few parts per billion, making it one of the most sensitive materials of its kind. The polymer glows when exposed to light and indicates the presence of TNT through a decrease in this fluorescence.

An estimated 100 million land mines lie buried in fields, forests, and villages worldwide, presenting a deadly hazard for those who live and work in those areas (SN: 3/28/98, p. 202). Most land mines use TNT as their explosive and leak small amounts into the soil and the air above.

A prototype device can detect these TNT traces. It shines a light onto the sensitive polymer and indicates on a display when TNT molecules, diffusing into the polymer, make its fluorescence dim.

The polymer is extremely sensitive because it soaks up TNT vapor "like a sponge" and its intrinsic electronic properties amplify the signal that TNT triggers, Swager says.

The material absorbs photons of light, which produce bundles of energy, called excitons, that travel throughout the polymer. In the absence of TNT, the excitons eventually release their energy and emit photons, leading to the observed fluorescence. TNT molecules deactivate the excitons, releasing the excess energy as heat instead of fluorescence. Just a few TNT molecules can deactivate many excitons, so small concentrations of TNT cause a large decrease in the intensity of emitted light.

Swager and his coworker Jye-Shane Yang reported their latest findings on Nov. 11 in the online version of the JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.

David R. Walt of Tufts University in Medford, Mass., has been developing sensors for finding old mines and has tested the polymer. "It's better than any other materials we've examined for [TNT-like] compounds," he says.

The prototype device, made by Nomadics of Stillwater, Okla., "looks like an oversized TV remote," Swager says.

Preliminary tests in a simulated minefield showed that the device and polymer both need improvement before they can be used in a real de-mining situation, he adds. The researchers missed some mines in their test, and an overlooked mine can be disastrous. "You cannot miss," Swager says. "It's OK to have false positives, but you cannot miss." —*C. Wu*