drive matter outward. Over millions of years such highly active centers could have generated clouds of tenuous matter stretching for long distances.

If such expelled matter emits radio, it has to do so extremely weakly. Otherwise it would not have avoided detection until now. The 23 central objects selected have been very popular objects of radio observation. For nobody to have noticed anything, the extended nearby sources should radiate with less than 5 percent of the integrated flux of the compact quasar or galactic center. That would make the extended sources extremely difficult to distinguish from background noise. Therefore the choice of the sensitive, 100-meter Effelsberg antenna.

The five astronomers managed to devise an observing technique for this telescope that has a range of 37 decibels between the faintest and the strongest signal it can measure. It is the first time, they say, that such a wide dynamic range has been achieved on a radiotelescope. With this range they could hope to encompass and distinguish both the bright images of the quasars and galactic centers and the weak emissions they hoped to detect nearby. They used the system to survey the 23 sources and their neighborhoods up to several minutes of arc away at a wavelength of 11 centimeters.

Each of the 23 objects chosen for study has an axis that can be determined on a scale shorter than one minute of arc by considering its shape, the direction of most of its energetic activity, etc. The search was for weak neighbor sources, two or more, on or near each of these 23 axes and lying between a few and several minutes from the main object. Chance would give the expectation of one such association in 23 tries. In fact, four were found. This is still not significantly above chance, but it becomes meaningful if one considers which sources the four are.

The four sources with weak neighbors all belong to the class designated D2 by G. K. Miley in his classification scheme. That is, on the miniature scale of less than a minute or so they have a "core and jet" structure, a roundish main object with a jet to one side. In all four of these cases the weak neighbor sources lie on the axis defined by the jet. Furthermore, the strongest of the neighbors is in each case closest to the core and on the side of the jet. (If the weak sources are expelled material, the newest and least burned out of them ought to be nearest the source.) No physical connections are evident, but this much is "compelling evidence," Reich and collaborators conclude.

The spans of these systems run from 3 to 24 megaparsecs. From that Reich and collaborators estimate that the centers have been active for more than 10 million, possibly up to a billion years. To have resisted precession effects and kept their axes straight for that long they must be very massive objects. □

Mt. St. Helens: Part two . . .

Our story thus far: Mount St. Helens, a youngster amid the ancient peaks of the Cascade range, rumbled from a 123-year sleep March 27 (SN: 4/5/80, p. 213). Loosing dozens of moderate-sized quakes and spitting steam, ash and chunks of rock and ice, it has titillated tourists, unnerved natives and gripped geologists with its ever-changing, unpredictable ways.

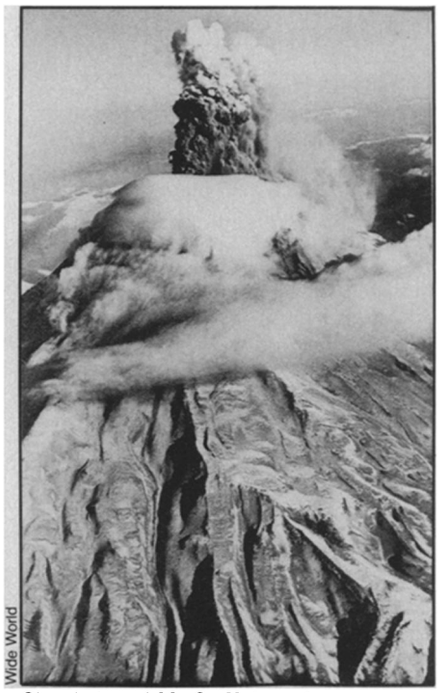
Last week, the volcano added a new piece to its repertoire: harmonic tremors. The tremors, which are low-level, long-lasting, rhythmic movements as opposed to the sharper bursts that mark earthquakes, are always associated with the movement of magma, say researchers, and may indicate an increased likelihood of a lava eruption. Though harmonic tremors "are usually only seen actually during eruptions," says University of Washington's Steve Malone, they do occur without eruptions. The first burst of continuous tremors occurred from 7:25 to 7:30 pm PST April 1, and they have since continued intermittently and irregularly. The longest event, lasting 28 minutes, occurred April 6.

The tremors may have occurred before April 1, says Malone, but been masked by the thousands of small earthquakes. "We don't really understand why [the tremors] are caused," said Malone in an interview. "It's possible the magma has to reach a certain volume or velocity to set up the resonance."

As harmonic tremors took center stage, most of the volcano's other activities settled down. Since April 1, says Malone, the volcano has averaged 79 earthquakes greater than Richter magnitude 3.0 per day, with only four per day greater than 4.0. At its worst two weeks ago, Mt. St. Helens rapped out eight quakes per day that were greater than magnitude 4.0. Researchers report no signs of magma-induced inflation or swelling of the volcano; previous measurements of swelling near Spirit Lake were incorrect, said U.S. Geological Survey's Donal R. Mullineaux. Steam and ash eruptions have declined in frequency and height, a USGS spokesman said, allowing airborne scientists a closer look at the activity. In addition to the instruments recording the volcano's underground behavior, scientists hope to use an emission spectrometer to analyze the blue flame frequently seen within the crater. The flame is believed to be caused by the release of gases from the volcano, and the content of the flame may reveal its source. A high sulfur content, for example, may indicate a high temperature source such as magma, says geologist Dave Johnston.

Signals that the volcano might be building to a magmatic finale will come in one of two ways, says Malone: a sudden increase in earthquakes and steam-ash explosions or a sudden, ominous silence. In the meantime, with geologists, seismometers and computers running full tilt, "we're watching everything for anything," he says. "The amount of data we've gotten in two weeks is equivalent to what we've gotten in the last 10 years. And we're learning so much we don't even know what we're learning."

Tune in again next week. □



Cloud-ringed Mt. St. Helens throws steam, ash and ice chunks from its 1,700-foot-wide, 500-foot-deep crater April 3.

Oldest fossils found

The oldest fossil imprints of life — 3.5 billion years old — have been found in sedimentary rocks from Australia, according to an international team of researchers at the University of California at Los Angeles.

Modified by a stream of qualifiers as the "oldest, undisputed morphological evidence" of life, the find is about 400 million years older than similarly undisputed fossils from South Africa. Algae-like structures that might be fossils were previously found in 3.5-billion-year-old rocks (SN: 10/15/77, p. 245), but they are not as "confidently interpretable" as the Australian fossils, says researcher Malcolm R. Walter.

The "cabbage-sized object" — about 24 by 16 by 16 inches — is actually an imprint of an ancient mat of algal or bacterial cells rather than a "biochemical fossil" or trace of organic molecules believed to be the remains of ancient cells. Such biochemical fossils were believed to have been detected in 3.8-billion-year-old rocks (SN: 9/15/79, p. 183) but are now interpreted as "fluid inclusions," or bubbles, and not of biological origin, says Walter. □