tron stars that radiate X-rays from their surfaces, X-rays generated by thermal processes as ordinary stars radiate light. They figured that some of the older pulsars might be hot enough to do it.

They observed four likely candidates, and found what they believe are such X-rays in two cases. One of these was, in Helfand's phrase, "a great bonus." It coincides with the third binary pulsar. The newly found system is 20 times as close to us as the first binary pulsar, about 1,000 light-years away. Optical pictures show two candidates for the pulsar's companion, a red star and a blue one. If the neutron star is not producing the observed X-rays, says Helfand, either of these may be: the red star in its corona, the blue one on its surface. In a few weeks they hope to be able to choose. Meanwhile the radioastronomers will be refining their position determination from an accuracy of a few minutes of arc to a few seconds of arc. Then the identification of radio pulsar, X-ray source and red or blue star may be definite. □

Body weight and breast cancer survival

Overweight breast cancer patients do not survive as long as do those of average weight. This finding, made by N.F. Boyd of Toronto's Princess Margaret Hospital and colleagues, was reported this week in Washington at the meeting of the American Federation for Clinical Research.

In a ten-year study, Boyd and his coworkers followed the progress of 700 Toronto breast cancer patients. They found that 60 percent of patients weighing less than 140 pounds survived at least five years after surgery, but only 49 percent of those weighing more than 140 pounds survived that long; and that 50 percent of patients weighing less than 140 pounds survived at least 10 years, while only 39 percent of those weighing more than 140 pounds survived that long.

Why would weighing more than over 140 pounds be detrimental to survival from breast cancer? Boyd isn't sure, but he points out that most of the subjects were simply overweight, not just of large body stature. This suggests that body fat may encourage breast cancer, and women who consume high-fat diets have been found to be more likely to get breast cancer in the first place than are women who do not eat such diets (SN: 6/23/79, p. 414). Fat in the diet, or body fat, might possibly switch on excess production of sex hormones which could be involved in triggering breast cancer. Other studies have shown that when overweight premenopausal breast cancer patients had their ovaries (a major source of the hormone estrogen) destroyed, they survived on the average as long as lean premenopausal breast cancer patients. □

High pressure tactics reveal earth interior

Researchers at the Carnegie Institution of Washington are literally squeezing information from the earth. What they've found may revise prevailing theories about the formation of the earth's interior.

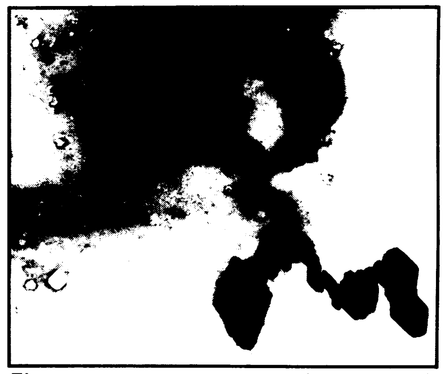
Using a "diamond anvil"—a device that squeezes samples between two diamonds — Peter M. Bell and Ho-Kwang Mao have been able to recreate pressures up to 1.7 million times that on the earth's surface and, using lasers, temperatures up to 3,000°C—conditions similar to those well within the earth's core (SN: 3/10/79, p. 156). Their recent experiments, reported last week at the Carnegie Institution, suggest that the earth's core may not be composed of iron and nickel, as assumed from studies of meteorites, but possibly of iron and oxygen. Moreover, the results may explain how iron dissociated from other minerals during the early stages of the earth's formation and sank to form the core.

Though the earth's core is believed to consist of iron, studies based on the earth's orbit and rotation and the behavior of earthquake shock waves as they pass through the core indicate that it is less dense than pure iron, Bell explained. Based on the composition of meteorites, a less dense iron-nickel alloy core has been favored. But earlier studies by Mao using the high pressure device showed that under the necessary pressures, nickel makes iron more, not less, dense. So the search continued for a lighter partner for iron.

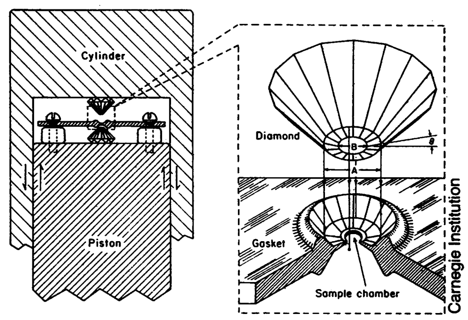
As part of the search, Bell and Mao subjected samples of synthetic basaltic rock — composed of iron, magnesium, potassium, calcium and silicon — to increasing pressures and temperatures. At a pressure 200,000 times that on the earth's surface (200 kilobars), which is equivalent to a depth of about 650 kilometers, they found that nearly all the synthetic basalt forms perovskite — very dense, very stable, diamond-shaped silicate crystals. The important outcast from this structural change is iron, says Bell. Only about 20 percent of the iron enters a perovskite structure, while the remainder forms a mineral called magnesiowüstite, composed of oxides of magnesium and iron.

Interestingly, the depth equivalent at which this chemical transformation occurs is the point within the deep mantle where seismic waves abruptly increase. The pressure-induced change to very dense perovskite may be the cause of this previously unexplained seismic discontinuity, the researchers suggest.

Further increasing the pressure and temperature, the researchers found that the perovskite and magnesiowüstite mixture remains stable to a depth equivalent to 1,600 kilometers. At that point, the iron



Electron microscope image shows crystals with perovskite structure at 200 kbars.



Cross section of diamond-anvil cell. Inset: expanded view of pressure face.

oxides and magnesium oxides begin to separate, Bell says. A complex reaction involving simultaneous oxidation and reduction then occurs, he says, and iron, mixed with very little oxygen, precipitates as a metal. When these reactions occurred in the early earth's interior, according to Bell and Mao, the dense iron sank to the earth's center; oxygen carried to that depth became metallic and lessened the density of the core. The lighter magnesium oxide released from magnesiowüstite rose to the deep mantle, they suggest, reacted with perovskite to remove iron and continued the core-building cycle.

These results, Bell says, bear on several theories about the earth's interior. One current debate questions whether all or only part of the earth's mantle circulates; Bell and Mao's findings suggest that only the upper layer of the mantle churns beneath the crust. "At very high pressure," Bell says, "thermal expansion [the suggested cause of the circulation] declines, so that we can't have convection in the deep mantle." Their findings also support the recent hypothesis of a deep, undifferentiated layer within the mantle (SN: 12/1/79, p. 372). That layer probably exists below the point demarcated by the seismic discontinuity, Bell said at a press conference, and may be composed of perovskite mixed with rare earth elements. In addition, Bell says, the results explain how, if the earth were formed by the accretion of meteorite-like material, it evolved a uniform structure. "The big question in the study of planets," he said, "has been to understand how iron pulls away from magnesium to form the core." □