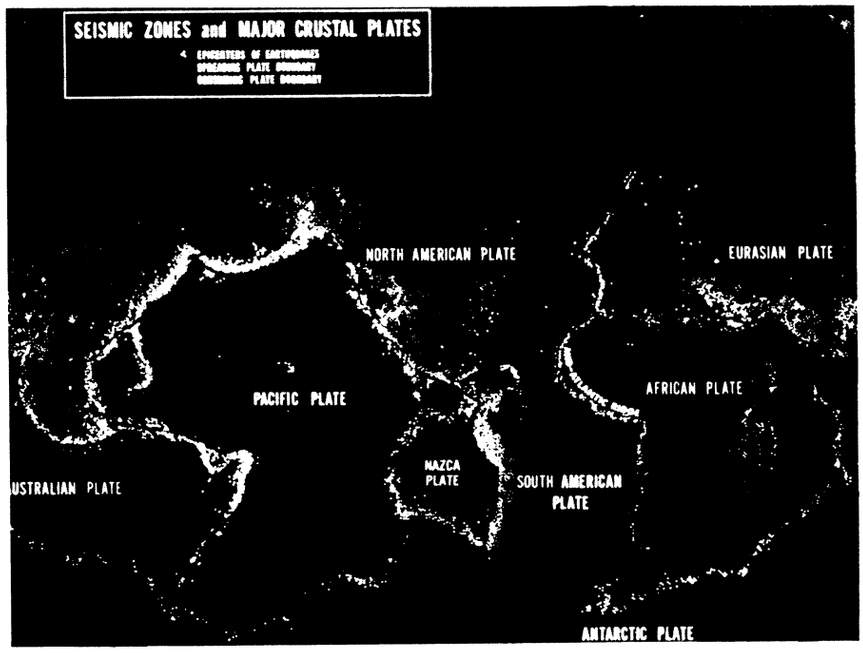
A multination project to study the restless earth

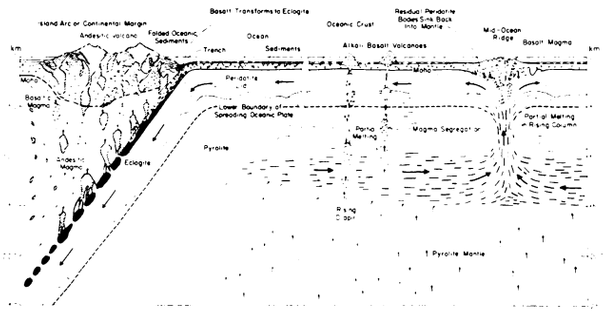
The earth is restless. It keeps rearranging its crust. Most of the motion is slow and imperceptible, but sometimes the changes are sharp and destructive. Despite decades and centuries of human interest in the dynamics of the earth's crust, especially the more violent manifestations such as earthquakes and volcanic eruptions, until recently geophysicists did not have anything like a general theory of what was going on.

Now they do. It is called plate tectonics, and they like it so well that they are using it as the focus for an international geodynamics project in which 52 countries are taking part. The overall life span of the project runs from 1971 to 1979, but the first three years were spent in planning. Now the data gathering is about to begin, and the National Academy of Sciences has signalized the moment by issuing a report this week outlining what American geophysicists hope to accomplish as their part of the project. The report, *U.S. Program for the Geodynamics Project, Scope and Objectives*, is being formally presented to H. Guyford Stever, director of the National Science Foundation, who is the nearest thing left to a Presidential science adviser.

Plate tectonics is the theory that the earth's surface is made up of a number of plates that move horizontally in relation to each other. A generalization of the older hypothesis of continental drift, plate tectonics sees the mid-ocean ridges as places where material wells up from below the earth's mantle. From these lines the plates move outward. At other extremities, the material of one plate slides under another and its material gradually returns to the lower depths. There are also boundaries, exemplified by the boundary between the North American and Pacific plates, which runs along the California coast, where plates seem to be sliding horizontally past each other.

The theory can explain the apparent motion in the positions of continents, mountain building at plate boundaries, volcanism at boundaries and elsewhere, the presence of ocean trenches at plate boundaries and seismic activities at boundaries. But there are things the theory cannot explain, and the scientists involved in planning the geodynamics project stress that these instances are also of high importance in the study. They include such things as vertical motions in the middle of plates and mountain building and seismicity at points far from plate boundaries. Plate tectonics can explain the Pacific Coast Range; it has difficulty with the Rockies. It can account for California earthquakes but not earthquakes in Missouri or the St. Lawrence valley.





The earth's crustal plates as they are now known (above). A schematic of the phenomena plate tectonics explains (right).

The American part of the program consists largely of studies to be undertaken within the United States or in cooperation with Western Hemisphere neighbors, for example a study of stress accumulation and dissipation along the California plate margin or a detailed study of the Nazca Plate, a small plate off the west coast of South America. Most of the detail work is already going on. The plans do not ask for large new expenditures though they do call for some increases. The main point of the project is to provide central coordination and a general frame of reference for the integration of a multitude of studies. □

Drug shows promise in counteracting Herpes virus

Herpes viruses are definitely known to cause cold sores. They have also been implicated in mononucleosis (SN: 12/2/72, p. 362), and in some human cancers (SN: 11/25/72, p. 345). Although some nonprescription drugs relieve the symptoms of cold sores, no drug has been proven to kill Herpes viruses.

Now such a drug is looming on the scene, Abbott Laboratory microbiologists reported last week at a meeting of the American Society for Microbiology in Washington.

The drug is phosphonoacetic acid. Its role was discovered during routine drug screening. It is simple in chemical makeup, consisting of phosphoric acid and acetic acid. It is somewhat of an oddity in that it does not exist in nature.

Skin-infection tests in mice and eye-infection tests in rabbits are standard laboratory pocedures for evaluating the effectiveness of drugs against Herpes viruses. When mice are infected with Herpes, not just their skin becomes diseased. Their central nervous systems nearly always become infected as well, and within a few days they become paralyzed and die. When rabbits are infected with Herpes, their eyes become diseased. Occasionally they too get the virus in their central nervous systems, become paralyzed and die. So when Abbott scientists tested the effects of phosphonoacetic acid on mice and rabbits, they looked for not just remission of skin or eye disease, but

for animal survival. The drug produced both results in mice. In rabbits, it cleared up the eyes but did not always counteract central nervous system infection, reports R. R. Bower.

The drug has also been shown definitely in tissue culture tests to act on the virus, says J.C.-H. Mao. The drug inhibits the viruses' DNA polymerases. These are the enzymes that the viruses need to get their genes replicated in host cells. Yet the drug does not hurt host cells' DNA polymerases. "Thus," says Mao, "the acid has an excellent selectivity between viruses and human cells."

Abbott scientists are now awaiting the outcome of toxicity tests with the acid. If it proves safe, more animal tests, and ultimately clinical tests, are in the offing. Says Bower: "I think it is too early to tell about anything having to do with cancer. We can't go that far out on a limb. But if the drug proves safe, well naturally, there will be a lot of interest in trying it against various conditions." □

A powerful pulse of laser light: Step toward fusion

One spur to the development of more powerful lasers is the possibility of using them in projects seeking to gain electric power from controlled thermonuclear fusion. The idea is to use laser light to evaporate, ionize and implosively compress a solid fuel pellet and thus trigger nuclear fusions. To get to that point requires lasers much more powerful than any now in operation.

Now the Sandia Laboratories in Albuquerque have announced a new laser that appears to be a significant step on the way. It is a hydrogen fluoride laser that has produced a pulse of 228 joules of energy and 55 nanoseconds duration, which is a power output of about 4 billion watts. This output is about 45 times that previously confirmed for a laser using hydrogen fluoride.

It is one of the most powerful pulses ever produced by any gas laser and compares favorably with the neodymium-glass lasers that are generally considered much more powerful than gas lasers. The feat also proves the efficacy of using electron beams to energize lasers. It seems that this promises to be the best way to energize the extremely powerful lasers of the future.

The Sandia laser begins as a 40-inch-long Lucite tube that contains a ten-to-one mixture of sulfur hexafluoride and ethane at slightly less than atmospheric pressure. A beam of accelerated electrons is sent lengthwise down the tube. The electrons cause a chemical reaction by colliding with the sulfur hexafluorine molecules and detaching fluorine atoms. The fluorine atoms are highly reactive. They detach hydrogen atoms from the ethane molecules and thus form hydrogen fluoride. The hydrogen fluoride comes out of the reaction in a highly excited state, and as it decays to its ground state, it gives off energy which is the laser light. The light is in the infrared part of the spectrum, the majority of it in the wavelength range between 2.65 and 2.95 microns.

The principal investigators are R. A. Gerber and E. L. Patterson. R. J. Jensen and L. S. Blair of the Los Alamos Scientific Laboratory collaborated in earlier work on the system.

Even when the present laser is improved by putting mirrors on the ends to make an optical resonator and increasing the electron beam energy to scale its output up to a possible 1,000 joules, it is not likely to be used for fuel-pellet irradiation. The beam is not coherent, the pulse is too long and the wavelength is too long, among other difficulties.

Yet gas lasers are attractive for fusion applications, one reason being their high efficiency in converting excitation energy to laser energy compared with other classes of lasers. From the hydrogen-fluoride laser the Sandia physicists hope to learn lessons applicable to others as they look toward lasers in the 1,000- to 10,000-joule range believed advantageous for fusion applications. □

Soviets will land on Mars

In late summer when the Soviet Union mounted its impressive four-spacecraft expedition to Mars—Mars 4, 5, 6 and 7—Western officials assumed at least one or more of the vehicles would land on the planet. This week, Roald Sagdeyev, the new head of Moscow's Space Research Institute, made it public: The Mars' caravan includes flybys, orbiters and landers.

According to the new chief, one spacecraft will try to land to test the physical properties of the soil and surface rocks and transmit television pictures back to earth. It will also take measurements of the Martian atmosphere and magnetic and gravitational fields and try to determine the thermal characteristics of Mars.

No mention was made of life-detecting experiments. Some U.S. biologists feel the Soviets don't yet have that capability.

Silent Alabama autumn: A tale of two pesticides

Pesticides strike again. This time the victims are several thousand bass, shad, catfish, carp and other fish in Weiss Lake, Ala., and an unknown number of birds and small wildlife in the area. The villain, a highly toxic mixture of two insecticides—endrin and methyl parathion—has been applied in heavy doses to this year's disappointing cotton crop in Cherokee County in northeastern Alabama.

Alabama's Department of Agriculture and Industry and the Fish and Game Division of the Conservation Department have investigated the animal kill. Both reports concur on the cause of the deaths but disagree over the damage done.

Rain fell heavily in August in Cherokee County and prompted farmers to spray their cotton crops several times more than usual. The pesticides were not allowed enough time to dry between rainfalls. In addition, the storms produced excessive runoffs. In many instances, the runoffs had not far to flow as it has been the habit of area farmers to plant their cotton crop right up to the Weiss Lake shoreline.

The Alabama Department of Agriculture maintains that the only loss to pesticides is a fish loss in Weiss Lake and in streams that flow into it. "We have not noticed any absence of birds or wildlife in the area," says John Kirkpatrick, director of the Department of Agriculture and Chemistry. But Charles D. Kelley, head of the Fish and Game Division, says residents in Cherokee County have found fish floating on top of ponds, dead song birds, dead turtles and a lack of squirrels and other wildlife.

With the recent ban on DDT, many cropdusters are using endrin. The pesticide is more toxic than DDT. Endrin is a chlorinated hydrocarbon, which means that it has a long-lived residue and tends to increase its intensity as it builds up within an organism. Its toxicity varies greatly for humans, but it is most deadly to fish.

Methyl parathion is an organic phosphate. It is less persistent than a chlorinated hydrocarbon—it breaks down rapidly. But it is far more dangerous to humans than endrin.

Kirkpatrick told SCIENCE NEWS preventive measures are being proposed to prevent this sort of tragedy from reoccurring.

"Farmers have been growing their crops too near the water. The first step may be to set up buffer zones between the crops and the shoreline. Secondly, we need to further educate the farmer in pesticide usage." □