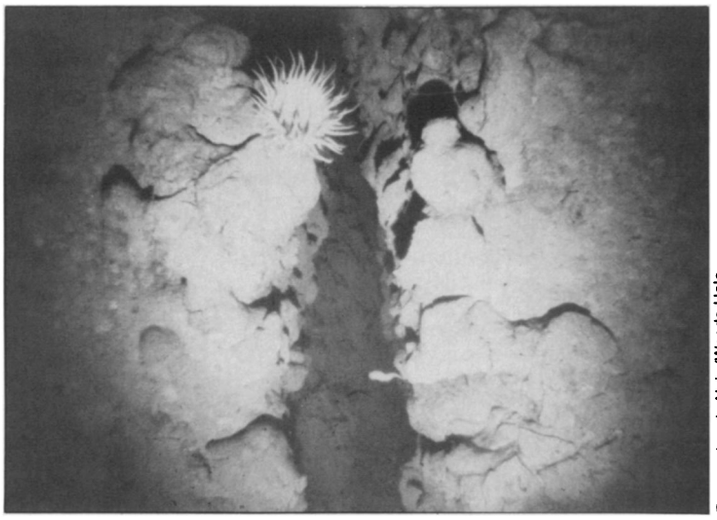
Deep drilling in the Galapagos Rift



Warmed by subsurface magma, water percolates up through spreading Galapagos Rift.

Research sub Alvin/Woods Hole

The Galapagos Rift, on the Pacific Ocean floor, is one of the splits along which the huge plates of the earth's crust are gradually pulling apart, as new crustal material is forced up from below. In 1972, scientists discovered that just south of the rift lies a series of strange bumps on the seafloor, ranging from perhaps 3 to 20 meters in height in an active geothermal region. Early this year, the Woods Hole Oceanographic Institution's research sub Alvin visited the mounds (SN: 3/19/77, p. 182) and gathered evidence that they are composed of hydrothermal sediments, rich in iron and manganese and located over sites where hot water is being vented upward from the ocean crust.

Now the Deep Sea Drilling Project's ship, the Glomar Challenger, has sent its diamond-tipped bits into the mounds themselves, yielding core samples from four separate sites in the mound area as well as a fifth site about 160 kilometers to the north. The expedition, DSDP Leg 54, was the project's first Pacific foray in three years.

The mound targets were on the youngest oceanic crust ever drilled by the DSDP, no older than 610,000 years. The samples, which included both sediments and volcanic rocks, suggest that the hydrothermal activity in the area has been going on for at least 400,000 years of that time.

The mound drilling was among "the most challenging and daring in the history of the project," according to an official of the Scripps Institution of Oceanography, which manages the DSDP. The thin sediments made it difficult to stabilize the drill bit for its entry into solid rock, and the mounds themselves are so small that they were virtually invisible to the ship's usual echo sounder, requiring use of the "downhole" scanning system (previously only used to reenter existing holes) to position the bits.

The mound exploration is deemed important in part because of their relationship to hydrothermal activity. Similar hydrothermal regions on land are often related to ore deposits of "economic grade," and the DSDP data may aide understanding of how such significant deposits form.

Leg 54 researchers also took samples from seven sites in the region of the East Pacific Rise, one of the fastest-separating of the world's crustal-plate boundaries. The samples were taken from an area where two plates are moving apart at nearly 10 centimeters per year. □

Night glasses for safer highway driving

No spectacles will allow a person to see in the dark. But researchers claim that special prescription glasses can improve vision in very dim light and that such improvement is desperately needed for night highway driving.

Approximately three-fourths of people with perfectly normal vision in daylight become near-sighted in dim light, according to the research of Herschel W. Leibowitz at Pennsylvania State University and D. Alfred Owens now at the Massachusetts Institute of Technology. This twilight or night myopia was recognized in the 18th century by English astronomer Nevil Maskelyne, but the basis of the defect has been in dispute.

Recently Leibowitz and Owens related night myopia to dark focus, where the eyes focus when there is nothing to see. Investigators had long assumed eyes focus in total darkness at infinity. But using a new technique Leibowitz and Owens directly measured that focal distance and found it varies remarkably among individuals.

The technical trick is to measure the "relaxed" focal distance without providing a new focus for the eyes. Owens built a laser optometer which reflects a speckle pattern of laser light off a rotating cylinder.

A half-second flash of the laser light is too short to alter the eyes' focus. If they happen to be focused at the distance of the cylinder, the speckle pattern will appear stationary. If the focus is nearer or further, the pattern will seem to move in the same or opposite direction as the cylinder.

In complete darkness, people focus at distances of 1 foot to 10 feet, with an average focal length being approximately 2 feet, Leibowitz and Owens find. When the researchers reduce the illumination of a simulated road sign, a subject's point of focus shifts gradually from the appropriate target distance toward the dark focus. Under night driving conditions, the focus was approximately halfway between the two points. Therefore, the shorter a person's dark focus, the greater the night myopia.

A short dark focus also correlates with two other types of near-sightedness. Pilots in clouds or drivers in heavy fog experience empty-field myopia, sometimes called sky or space myopia. Instrument myopia troubles people using microscopes and other optical instruments with small viewing apertures. The researchers demonstrate that night, empty-field and instrument myopias all reflect the tendency of the eyes to relax toward the individual's dark focus when there is limited visual stimulation.

The implications of night myopia for highway driving are grim. Most subjects tested focus at a point no more than six feet away when driving at night. More distant objects will all be somewhat blurred. Yet drivers generally do not reduce their speed at night.

Leibowitz and Owens propose in the July 29 SCIENCE that this incautious behavior results because other aspects of vision are not noticeably reduced at night. Driving demands continuous attention to orientation and motion, which are monitored by the periphery of the retina. This perception is relatively independent of the amount of light. In contrast, the identification of specific forms, which is seriously deficient under low illumination, is required less frequently in night driving. This function of the central retina is crucial, as the form may be a pedestrian, cyclist or disabled car.

The researchers suggest special prescription glasses as a novel solution, in addition to continued efforts to better illuminate roads. With glasses made to correct for night myopia in nine college-age subjects, acuity improved by as much as 25 percent under simulated and real night driving conditions. "At highway speeds this added margin of visibility could weigh heavily in the interest of accident prevention," the researchers say. Because the laser optometer is a simple device that may be constructed for a few hundred dollars, Owens and Leibowitz propose that drivers eventually be screened for night as well as daytime visual performance. □