nization will be the answer for more if not all civilizations.

Michael Hart of Systems and Applied Sciences Corp., in Maryland defended the positive point of view by referring to the unwarranted assumption that extraterrestrials will not be interested in colonizing and exploring. "Why should the human race be an exception?" A comment from the audience pointed out that this "exceptional" human race went only to the moon. "People may wish the money had been spent on something else," says this interlocutor. "We have talked about a mission to Mars, but so far no clearance. People who are aggressive are also stingy."

These remarks set the tone for an extended discussion. Frank Drake of the National Astronomy and Ionosphere Center at Cornell University, one of the pioneers of SETI activities, remarked "We do not do everything that's possible. The moon landings were not cost effective. Colonies may not be cost effective. How do you create the best quality of life for individuals?"

Figuring the cost of a good life from the energy consumption per head of the United States in 1974 (because it was the highest in the world), Drake concluded that it would take a good life for a million people to send one person to a star (and it would take 1,500 years). "Biology and physics conspire to make colonization impossible."

Michael Papagiannis of Boston University gave a somewhat more optimistic view. "Life has a tendency to expand to fill available space like a gas. Man is now achieving conquest of alien environments by intellect: air, water, underwater, space." Papagiannis's thesis is that a colonizing civilization would not land on planets but would build artificial colonies using alien planets only for obtaining material resources.

As to the cost effectiveness arguments, which are based on population pressure, he says he thinks we would do it not only for *lebensraum* (living space), but for reasons of glory or curiosity. If there are such colonizing civilizations, they may even have colonized our solar system and be sitting behind a screen of rocks in the asteroid belt watching us, not yet decided what to do.

If Papagiannis's hypothetical nearby aliens are not communicating for whatever reasons of their own, the others may have good technological reasons. V. L. Troitsky of the Soviet Union points out that the technical requirements for such a telescope are formidable. He calculates that an antenna capable of broadcasting a beam signal to a distance of 10,000 light-years would have to be 15,000 kilometers in radius and need a power of 2×10^{18} watts. The size is based on the temperature of the antenna not exceeding 300° K so as to preserve the integrity of the interplanetary and interstellar medium. (This represents the farthest-out environmental impact statement yet.)

If we were to sit down and do such a thing, we would have to build it at the orbit of Pluto to satisfy the size, waste requirements imposed by heat and slopover of radio frequency energy (nearer the earth it might fry us). The project would be technically possible, but who would so extend themselves to contact a civilization that might even be hostile? "It is unlikely that any civilization would try any such construction. It's doomed to fail," Troitsky says.

To all of this Von Hoerner responds with a suggestion of his own regarding what he meant by intelligent life on earth. Pointing out what the world spends on the arms race, he suggests that application of this money to space exploration and to improvements in the quality of technology, which the pessimists discount in advance, might make both communication and interstellar travel on our part possible. Provided we were willing to spend three generations on the trip, propulsion by nuclear fusion might make it.

And then we might discover we need not sophisticated radio searches but a loyal wookie, two handsome young men and a beautiful princess with a sharp tongue, not to mention a certain android with a curious resemblance to an old-fashioned jukebox. □

A sniff a day keeps pregnancy away

At the recent international Miles symposium on protein hormones, Andrew V. Schally of the Veterans Administration in New Orleans pointed out that analogs of LRH (luteinizing hormone-releasing hormone) hold great potential as new forms of birth control. If anyone was in a position to make such a prediction, it was Schally. He received a Nobel prize in medicine in 1977 for purifying, characterizing and synthesizing LRH and for other pioneering research in hypothalamic hormones (SN: 7/17/71, p. 37; 10/22/77, p. 260).

Indeed, it looks as if Schally's forecast may be coming true, according to a report in the Aug. 4 LANCET by Christer Bergquist and co-workers at University Hospital in Uppsala, Sweden. Daily sniffs of a particular LRH analog (a chemical similar but not identical to LRH) is a highly effective form of birth control for women and it causes no serious side effects, at least on a short-term basis.

LRH acts via pituitary and steroid sex hormones to trigger ovulation in women. Although scientists developed LRH analogs with an eye to using them to correct female infertility, Schally and other researchers reported last year that these analogs, paradoxically, have just the opposite effect. They switch off fertility, that is, antagonize the actions of LRH in the pituitary gland. These analogs have also been found to exert pharmacological activity via some unexpected routes of administration — the nose, the vagina and even the rectum. So Bergquist and his colleagues set up an experiment to determine whether sniffs of one potent LRH analog might prove to be an effective female contraceptive.

Twenty-seven regularly menstruating women, ages 21 through 37 years, volunteered for the study. They took LRH daily by nasal spray for three to six months, for a total of 89 treatment months. Ovulation was inhibited in all but two of the 89 treatment months, and these two were due to initial technical problems with the nasal spray, not to LRH analog inefficacy. None of the subjects became pregnant or developed serious side effects while using the spray. After they discontinued the spray, their ovulatory and menstrual cycles returned.

Still to be answered is whether long-term use of the analog is free from serious side effects. However, the Uppsala scientists foresee that it will present fewer problems than do steroid sex hormone-based oral contraceptives. "A lot of women who can't use the birth control pills for one reason or another will be able to use the spray instead," Bergquist anticipates. Meanwhile, women in the study have found LRH analog nasal spray a highly convenient means of contraception and would like to keep using it.

DSDP: Confusion in the ooze

Things are never as simple as they seem. No sooner had the scientists from Leg 66 of the Deep Sea Drilling Project (SN: 7/28/79, p. 71) toasted to their success on confirming a simple model of converging tectonic plates than the team from Leg 67 hauled on board evidence that makes things decidedly more complicated.

To recap: The "accretionary wedge model" says that when an oceanic plate, for example, slides beneath a continental plate, the sediments carried along on top of it are scraped off and plastered against the continental plate. Proof of the pudding for this model would be a reversed age sequence of sediments at the plate junction; the oldest sediments should be nearest the continent and the youngest, just having been scraped off, should be nearest the trench that forms at the junction. Leg 66 triumphantly pulled up the plum — a series of drill cores taken off the coast of Mexico near Acapulco — that appeared to show just that. Leg 67's results, however, seem to muddy the picture somewhat.

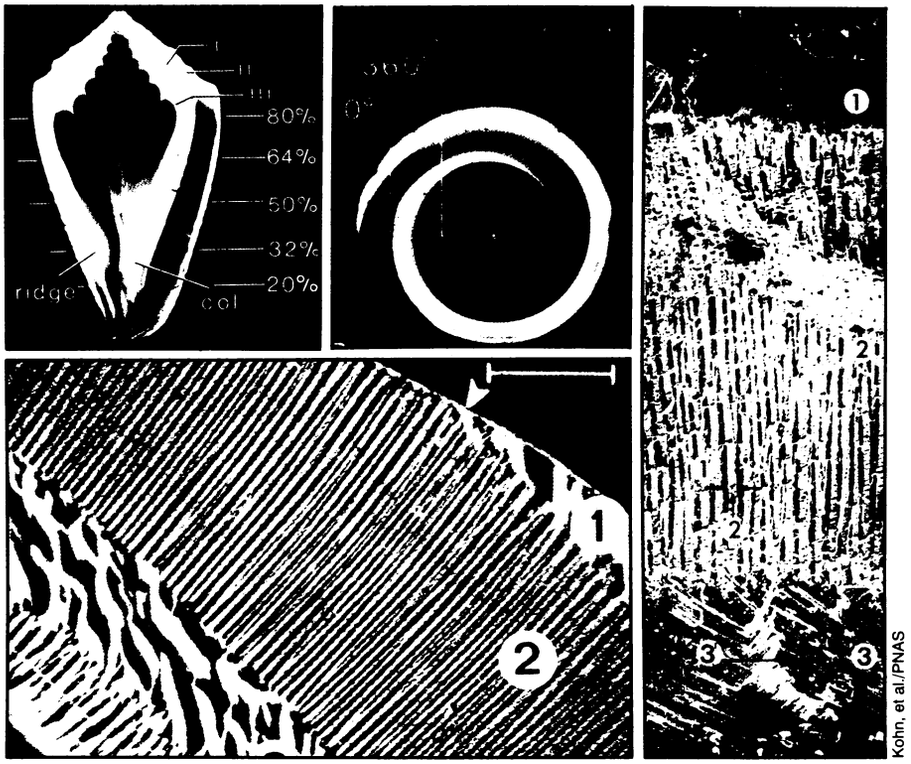
Like the previous leg, Leg 67 was exploring the junction where the oceanic Cocos Plate, which carries part of the crust of the Pacific Ocean, slides under the Caribbean Plate. According to co-chief scientist Ro-

land von Huene of the U.S. Geological Survey in Menlo Park, Calif., Leg 67's cores, which were taken just off the Pacific coast of Guatemala, showed Cretaceous rock — 70 million years old — just 3 kilometers from the trench. The sediments now being carried into the trench are as old as Early Miocene (20 million years old) and are separated by only a few hundred meters from the older rocks. That distance, says von Huene, is not enough room for 70 million years' worth of sediments; the Cretaceous rocks, if the accretionary model holds, should be much farther landward from the junction.

Several explanations could account for the unpredicted position of the Cretaceous sediments, von Huene notes. If no active subduction has taken place, for example, the rocks may have remained near where they were first deposited. Alternatively, the rock could have been transferred northeastward by the oceanic plate to the continental plate or slid from the upslope of the trench after deposition. Regardless of the explanation, says von Huene, their results "question the mechanism proposed in the simple [accretionary] model." The simple scraping-butter-off-a-knife theory may hold for the area explored by the earlier venture — which recovered only much younger, 5- to 10-million-year-old rocks — but a different or more complex model may be needed to explain the Leg 67 results. At the very least, he says, the results indicate that "two different mechanisms may be working in the same area." The only way to resolve the conflict, say the researchers, is more drilling, and preferably at that same convergence zone. That opportunity may be long coming: The *Challenger* is moving to the Atlantic this fall to drill there.

One thing the two voyages did agree on — but a surprise to Leg 67 — was the presence of gas hydrates, which are ice-like combinations of gas, usually methane, and water that form at the low temperature and high pressure found in the sea floor. Gas hydrates can usually be detected by seismic reflection profiling of seafloor sediments, and are most often found in glassy sands such as those off the Mexican coast. They are an unexplored source of natural gas — several oil companies believe thay may be an economically feasible resource — but like other gas under pressure, they can cause problems in drilling. Leg 66 had expected to find the icy gas — it was the first time the DSDP has recovered gas hydrates —but the pre-voyage seismic records for Leg 67 indicated no such substances in the mudstones off Guatemala. University of Oklahoma's William Harrison, the on board chemist, said "it took some convincing" to persuade the team of their presence. The total volume of gas in that region must be large, he said; a 20-cubic-centimeter sample of sediment, thawed for 6 minutes, yielded 172 pounds per square inch of methane. □

Mollusk remodels as shell grows



Kohn, et al./PNAS

The Conus *shell grows by spiraling its outer lip around a vertical axis. A cross section (top center) of the shell just below the spire shows thickened outer whorl and thinned inner whorls (scale bar=5mm). The several layers of a whorl have their crystal architecture oriented almost perpendicularly, as indicated by the scanning electron micrograph (right) and by the light micrograph (bottom left, scale bar=0.5mm). Dissolution proceeds along an inner whorl (bottom left). Arrowhead indicates the disappearance of layer one.*

In the face of predation by shell-crushing animals 65 million years ago, mollusks evolved thicker and thicker shells. But a thick shell introduces problems, such as great weight and little space for the shell's inhabitant (especially for those that must swallow large, intact prey). The *Conus* mollusks seem to have solved such problems with a flexible approach to their inner space. While they extend and thicken the outermost whorl of their shells, they dissolve and remodel the inner turns.

The interior renovations of these animals, which are encased in cone-shaped shells topped with low spires, have been investigated by zoologists at the University of Washington. Alan J. Kohn, Elizabeth R. Myers and V.R. Meenakshi report in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that about 25 percent of the shell material secreted by Hawaiian *Conus lividus* is later dissolved. The dissolution provides about 65 percent of the mollusk's living space between adjacent shell whorls. The inner walls, which no longer have protective value, thin to 35 to 50 microns, but do not completely dissolve.

In contrast to the cone portion where each whorl covers the proceeding one, in the spire each shell whorl remains exposed, and the scientists find that shell dissolution does not occur in the spire region. In addition, the space between whorls is filled to make a solid, thick spire.

Each whorl of shell is composed of several layers. The mollusk's body wall (mantle) on the right side secretes the growing edge of the shell. Kohn and colleagues observe that approximately 10° from this outer lip, the strong, thick second layer of shell is added. The third layer begins 30° to 50° from the lip and the fourth (found only at the spire end of the shell) begins 90° from the growing edge. For extra strength, the interwoven architecture of each layer has primary axes generally oriented perpendicularly to those of the adjacent layers.

Microscopy shows that the shell material is dissolved smoothly, layer one first, beginning at about 380° near the top of the cone (and further inward nearer to the bottom). From the anatomy of animals removed from their shells, Kohn and collaborators suggest that the mantle on the animal's left side dissolves the shell of an inner whorl as the mantle on the right side adds to the outer turn. They point out, "If thinning of the penultimate whorl did not keep pace with thickening of the last whorl, the narrow aperture of the shell would be nearly occluded." □