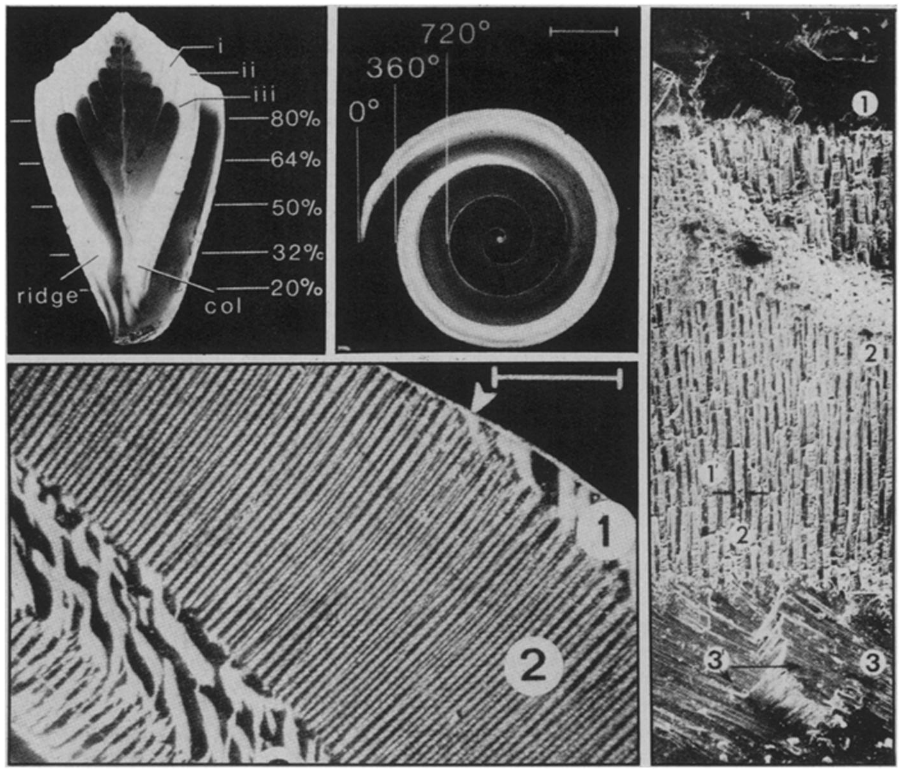
land von Huene of the U.S. Geological Survey in Menlo Park, Calif., Leg 67's cores, which were taken just off the Pacific coast of Guatemala, showed Cretaceous rock — 70 million years old — just 3 kilometers from the trench. The sediments now being carried into the trench are as old as Early Miocene (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



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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." □