ine the new find. After viewing Budd's presentation last week, Desmond Collins of the Royal Ontario Museum in Toronto says he thinks Grasper looks more like an arthropod than a lobopod. Others don't know what to make of the beast.

The labels may seem of minor consequence, but the ultimate classification of the Cambrian oddballs will shape how scientists view patterns of animal evolution. If these creatures cannot fit into existing phyla, then the early seas held a great many more phyla than are recognized today.

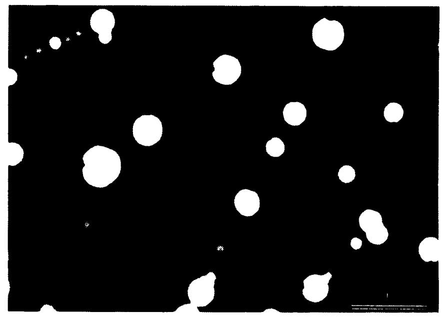
In *Wonderful Life: The Burgess Shale and the Nature of History* (1989, Norton), paleontologist Stephen J. Gould of Harvard University argues that the Cambrian explosion created a great variety of fundamentally distinct body plans, most of which later disappeared, leaving the relatively few phyla found today. But a number of other scientists challenge that theory, saying that the number of phyla has remained relatively steady. Moreover, recent work has found homes for some of the most bizarre of the Cambrian animals, suggesting they do not represent unique phyla (SN: 5/18/91, p.310).

If Grasper is related to the lobopods, it may help scientists link other Cambrian oddballs, such as *Opabinia,* to existing phyla. Possessing characteristics of several phyla, the oddballs may represent intermediate forms that provide clues about how different body plans arose. Judging from Grasper's affinities with both lobopods and arthropods, Budd speculates that the arthropods may have developed from early gilled lobopods.

In the early Cambrian, he says, evolutionary forces apparently had great freedom to mix and match aspects of different phyla within a single organism. But soon after that period, the basic body plans emerged and the phyla grew distinct. "So the next challenge is to work out why it is that those changes could happen then, but don't appear to happen now," says Budd. — *R. Monastersky*

Speeding the spread of helium bubbles

Irradiation can have a deleterious effect on metals in a nuclear fission or fusion reactor. Alpha particles captured by aluminum, for example, readily pick up electrons to form helium atoms, which collect into gas bubbles that grow, migrate and coalesce. Such bubbles weaken the material and sometimes initiate crack formation.



Van Siclen *et al.*

This electron micrograph, taken after the sample was slowly cooled to room temperature, shows small indium particles attached to the surfaces of helium bubbles embedded in aluminum.

Now researchers have discovered that at sufficiently high temperatures, helium bubbles diffuse at least 100 times faster through solid aluminum containing traces of lead or indium than through pure aluminum. This suggests that these "impurity" atoms may partially coat a bubble's surface to form a thin liquid layer, which somehow facilitates a bubble's movements through the surrounding array of aluminum atoms.

Clinton DeW. Van Siclen and Richard N. Wright of the Idaho National Engineering Laboratory in Idaho Falls describe their results in the June 29 PHYSICAL REVIEW LETTERS.

The researchers initially came upon this effect when impurities accidentally contaminated an aluminum sample during the course of another experiment. They videotaped the behavior of helium bubbles in thin films of irradiated aluminum alloyed with either lead or indium after heating the samples for several minutes to temperatures ranging from 723 to 743 kelvins — higher than the melting points of lead and indium but lower than that of aluminum.

"It was really striking to actually watch the bubbles diffuse," Van Siclen says. Measurements confirmed that the presence of trace amounts of lead and indium greatly increases the rate of bubble diffusion.

These findings add to the list of factors nuclear engineers must consider in selecting materials for reactors. They also suggest a novel means of enhancing the diffusion of atoms within materials when that seems desirable. — *I. Peterson*

Hints of a chlorine-cancer connection

The chlorine added to drinking water in the United States has produced dramatic reductions in water-borne diseases such as typhoid fever. Yet this chemical's role as a public health hero may be tarnished if hints of a link with cancer prove true.

A new statistical analysis indicates that people who drink chlorinated water run a 21 percent greater risk of bladder cancer and a 38 percent greater risk of rectal cancer than people who drink water with little or no chlorine. There is no proof that chlorine itself actually causes cancer; however, investigators think something in chlorinated water may act as a carcinogen.

"I am quite convinced, based on this study, that there is an association between cancer and chlorinated water," says Robert D. Morris of the Medical College of Wisconsin in Milwaukee, who directed the new study. Previous investigations showed no clear link between chlorinated drinking water and bladder or rectal cancer, but those efforts may have lacked the statistical power to find a connection, Morris says.

He and his colleagues turned to a formidable statistical method called meta-analysis. They began their inquiry by using a computer to comb the medical literature for studies on chlorinated water and cancer. Their search turned up 22 studies, but only 10 met certain quality standards. In these 10 studies, for example, investigators had determined whether subjects consumed chlorinated water and then used that information to define control groups. Some of the 10 studies indicated that people drinking chlorinated water had an elevated risk of cancer; others showed no excess risk.

Meta-analysis enabled Morris' group to pool the data from the 10 studies, far surpassing the statistical power of any single study. The analysis turned up a significantly increased risk of developing rectal and bladder cancer for people who drank chlorinated water — a risk that went up as the dose increased. In the July AMERICAN JOURNAL OF PUBLIC HEALTH, the researchers suggest that at least 4,200 cases of bladder cancer and 6,500 cases of rectal cancer in the United States each year may trace to consumption of chlorinated water.

Animal studies have suggested that chlorine forms cancer-causing by-products when it interacts with organic compounds in water. Morris speculates that the rectum and bladder, which act as holding tanks for concentrated human waste, may be especially vulnerable to such chemicals.

"We recognize that there could be an association between exposure to chlorination by-products and cancer," says Fred S. Hauchman at the Environmental Protection Agency's health effects lab in Research Triangle Park, N.C.

However, he and Morris emphasize that the public health benefits of clean water far outweigh the potential health risks of chlorination. At the same time, researchers continue to study other methods of disinfecting water, including a process called chloramination, which adds both chlorine and ammonia to water. Chloramination may prove safer than simple chlorination because it yields fewer dangerous by-products, Morris says. — *K.A. Fackelmann*

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