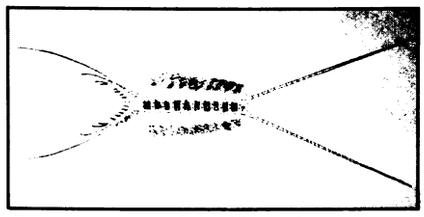
Evolutionary oddball surfaces in Greenland

Paleontologists prospecting in remote northern Greenland have discovered the remains of a bizarre creature dating from immediately after the evolutionary explosion that filled the seas with the first complex animals. Shaped a bit like a spiny postage stamp, this exquisitely preserved fossil may help make sense out of the menagerie of strange animals created during that critical evolutionary stage at the beginning of Earth's Cambrian period.

Discovered on an expedition led by John S. Peel of the Geological Survey of Greenland and Simon Conway Morris of the University of Cambridge in England, the ancient creature bears the unofficial name Grasper, for a pair of appendages sticking out in front. Paleontologists have collected 50 or so partial skeletons of the animal, but they have found only one complete specimen. In a stroke of luck, the researchers discovered one half of the complete specimen in 1989 and then found the matching half when they returned to the same site in 1991.

"We knew Grasper was something different and very special," says Peel, recalling the initial find. But scientists did not begin studying the animal until after the discovery of its second half. In Chicago last week, at the Fifth North American Paleontological Convention, Graham E. Budd of Cambridge described the preliminary results of his work on the fossil.

Grasper and the other creatures found at the Greenland site provide a glimpse of life roughly 540 million years ago, soon after the "Cambrian explosion," an evolutionary burst that created the major existing divisions of animal life. During Precambrian time, which makes up some 87 percent of Earth's history, animal life evolved simple, coral-like and jellyfish-like forms about as complicated in shape as a dinner plate. These forms persisted for tens of millions of years, only to be replaced over a very short span by the appearance of the first complex animals in the early Cambrian. Paleontologists have found spectacularly preserved fossils of early Cambrian animals at three sites: the Burgess Shale in western Canada, Chengjiang in southwestern China and Sirius Passet in northern Greenland.



Reconstruction of the 14-centimeter-long creature called Grasper shows gill-like flaps along the sides. Striations and bumps appear on the back.

At all three sites, rocks have preserved a number of bizarre animals that do not readily fit into any phylum defined by modern organisms. Budd has found several strange features on Grasper. Most obvious are the long spines protruding from the front and rear of the body; these do not appear on any other known Cambrian animal, Budd says. In addition, Grasper has gill-like flaps along its sides—a feature seen in only one other Cambrian animal, a weirdo called *Opabinia* that resembles a swimming vacuum cleaner.

But Grasper also has characteristics that may link it to some of its contemporaries. "The animal is bizarre; there's no doubt about it," says Budd. "But it's also important to look at the things that it appears to share in common with other animals, because that's the way you can try to classify it. It's quite easy to get bamboozled by the really bizarre aspects."

He points to several parts of Grasper's anatomy shared by animals called lobopods—worm-like creatures with legs that look as though they have been inflated with a bicycle pump. Ancient lobopods and their modern counterparts, in the phylum Onychophora, intrigue scientists because they may represent a link between two extremely successful phyla, Annelida (segmented worms) and Arthropoda.

Budd notes that Grasper has striations running across its back along with a double row of bumps — both features found on Cambrian lobopods. The remarkable preservation of this animal also allowed Budd to study its internal musculature, where he found signs of circular muscles resembling those of modern onychophores. Furthermore, indentations on the fossil's underside suggest that it had stubby legs, a characteristic of Cambrian lobopods.

Yet Grasper's unique characteristics prevent it from fitting squarely into the lobopod group. Budd speculates that Grasper may be a lobopod that sported arthropod features such as gills. Other scientists say they hesitate to judge Budd's preliminary analyses because they have not yet had a chance to exam-

Making big galaxies by merging smaller ones

Astronomers have gathered fresh evidence that millions of mini-galaxies merged to form today's collection of spiral and elliptical galaxies — including, perhaps, our own Milky Way.

The first hints of this cosmological drama came late last year, when astronomer Lennox L. Cowie and his colleagues at the University of Hawaii in Honolulu reported a baffling result: New infrared maps indicated that the vast majority of galaxies that existed when the universe was half its current age were small, amorphous blobs (SN: 11/16/91, p.312). Those galaxies lacked the familiar spiral or elliptical shape of galaxies common in the present-day universe.

Few of the small galaxies appear to reside within 60 million light-years of the Milky Way. Thus, Cowie speculated that clusters of the small galaxies may have served as seeds for today's elliptical and spiral galaxies, merging in the recent past to form these bigger galaxies. Alternatively, he noted, the tiny galaxies may have simply faded from view or even self-destructed as the universe grew older.

New observations by Cowie's team, made in the last six months with the Canada-France-Hawaii telescope atop Mauna Kea, strongly support the merger scenario, he says. Cowie reported the results this week in Paris at an astronomy workshop.

The findings show that as an observer views regions of space more than 2 billion light-years from Earth — the same as looking back in time — the number of small galaxies increases. Moreover, the number of spirals and ellipticals declines correspondingly. Peering into the past, it appears that "the population of large galaxies is replaced by the smaller ones," says Cowie. If a movie of the history of the universe were run in reverse, "it's clear that the large, present-day galaxies break up into smaller galaxies," he adds.

Cowie says it would take 10 to 100 of the small galaxies to form a single spiral. That may pose a problem, he notes, since current models indicate that the merger of so many mini-galaxies would form a fatter disk than spiral galaxies, such as the Milky Way, actually have. He suggests that theorists need to develop more detailed simulations of the motion of stars and gas in interacting galaxies.

"It's a tricky business once [a galaxy] is absorbed and gets mixed into the rest of a group of galaxies," Cowie notes.

Preliminary observations with the Hubble Space Telescope seem to support Cowie's merger notion. Richard E. Griffiths and Kavan U. Ratnatunga of the Space Telescope Science Institute in Baltimore and their colleagues used Hubble to resolve the shapes of a small sample of galaxies believed to lie between 3 billion and 10 billion light-years from Earth. The team found that more than half the roughly 300 galaxies in their survey were small and amorphous, and some appeared to be merging.

Though a definitive interpretation will require many more years of observations, Ratnatunga says the early data hint that small galaxies were the building blocks for today's galaxies. Griffiths reported the results last week at a Hubble workshop in Sardinia, Italy. — *R. Cowen*