Paleontology

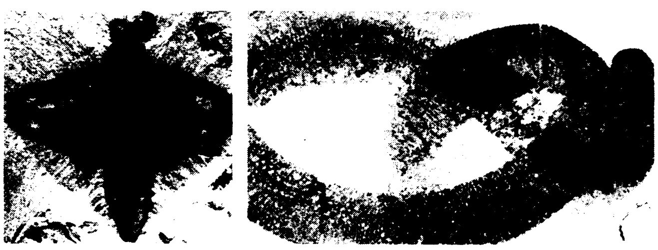
Traces of soft-bodied beasties

If you're a soft-bodied animal, chances are you won't leave a fossil legacy. The fossil record is made up mostly of shells, bones and other hard parts that are able to withstand decay and weathering long enough to become immortalized as fossils. This leaves paleontologists with a rather narrow view of the diversity and evolution of past life. So when scientists uncover fossils of the soft body parts — as some did recently in a quarry near Milwaukee — it's an event to write home about.

Donald Mikulic of the Illinois State Geological Survey in Champaign and co-workers report in the May 10 SCIENCE on the discovery of 15 different types of soft-bodied animals dating back 430 million years to the Silurian period. The Wisconsin find is important because it partially fills the gap between two previous major discoveries of fossilized soft animals: one dating from the middle Cambrian (about 530 million years ago) and the other from the Lower Devonian (about 400 million years ago).

Among the rather bizarre-looking creatures unveiled by Mikulic's group are worms with multiple-lensed compound eyes and two arthropods (invertebrates having jointed limbs and segmented covering) with limbs that look well adapted for snatching prey — suggesting that these arthropods, unlike most other Silurian animals found before, were predatory. There is also a worm with a sucker disk, making it perhaps the earliest leech. "Leeches have only been found in the Jurassic in Germany," says Mikulic. "So this occurrence extends the range of leeches back over 200 million years."

The scientists also discovered a fossil of what may be the oldest uniramian (a type of arthropod that includes centipedes)—a possible candidate for the marine ancestor of terrestrial forms that show up some 30 million years later. Also included in the assemblage is the earliest, best preserved xiphosure (an animal that remotely resembles a horseshoe crab) and an arthropod that doesn't appear to be related to anything ever described before.


Mikulic/SCIENCE
Unknown arthropod *Earliest leech?*

An important find is a 1-centimeter-long conodont animal, the oldest and fourth example ever found. Conodonts—usually 1- to 3-millimeter-long fossils that look like, but are not necessarily, relics of teeth — have puzzled paleontologists for over a century because alone they cannot be linked to any known animal phyla. Only recently have three arrays of conodonts been discovered in Scotland in conjunction with three whole fossilized animals. The Wisconsin find confirms these earlier discoveries.

Conspicuously absent from the Wisconsin assemblage are mollusks, corals, echinoderms and shelly animals that usually flood the Silurian record. "This means that there was something different about either the bottom conditions or the water chemistry itself that excluded those organisms from living in that particular spot," says Mikulic. This environment was also probably responsible for the unusual preservation of the soft-bodied animals. Mikulic suggests, for example, that the bottom waters lacked oxygen. This anoxic environment would have kept out not only the shelly animals, but also aerobic bacteria, which would have decomposed any soft animals that happened to float into the region. The lack of such bacteria would have given the soft animals a shot at being buried and fossilized.

Physical Sciences

From a meeting of the Acoustical Society of America in Austin, Tex.

The squeal of chalk

Nothing wakes up dozing students like the shriek of chalk sticking and slipping across a blackboard, and few sounds pain machinists more than the squeal of metal against stone during honing. It was the apparent similarity of these sounds that led Herbert L. Kuntz and Robert D. Bruce of Hoover Keith & Bruce, Inc., in Houston to study chalk squeal as a way of understanding and reducing the piercing noise generated during honing.

When an incorrectly held piece of chalk is drawn across a blackboard, the chalk at first sticks to the surface. Suddenly, when it crumbles, the chalk slips and vibrates, producing a squeal. As the vibrations die down and chalk dust rolls out of the way, friction between the chalk and the board increases until the chalk sticks once again, and the cycle is repeated.

Kuntz and Bruce found that the frequencies at which sound is radiated from squealing chalk depend on where, at what angle and how tightly a piece of chalk is held, as well as its length. For example, if the chalk is held just above the contact point and perpendicular to the board, the radiated frequencies are higher than if the chalk is held at a 45-degree angle. In the first case, vibrations are generated along the length of the chalk. In the second case, the chalk vibrates by bending.

The researchers found that although the blackboard itself produces very little sound, a stiff, smooth board permits chalk to radiate louder sounds than a pliant, rough board. A lump of putty atop the chalk reduces the squeal substantially.

Water music by laser

The light from a laser can generate sound by heating the medium through which it travels. A laser beam directed into water, for example, heats up the illuminated column of water, which expands slightly. If the laser's intensity oscillates, the water undergoes periodic expansions and contractions, producing an underwater sound wave.

"Laser-induced sound has been observed experimentally," says Yves H. Berthelot of the University of Texas in Austin, "but unfortunately the efficiency of this type of sound generation . . . is extremely low. We would need a laser of several thousands of megawatts to produce any decent music underwater."

Nevertheless, because this method allows underwater sound generation without actually having a physical device in the water and may lead to a new type of sonar, several researchers are now looking for ways of improving its efficiency. Recently, Berthelot showed that if a laser beam scans a water surface at the speed of sound in water, virtually all of the sound emitted by the source, though initially spread out over time, is received simultaneously. This drastically increases the sound level.

Tapping a violin's vibrations

"For years, we've dreamed of being able to see and to understand exactly how a violin moves," says violin maker and researcher Carleen M. Hutchins of the Catgut Acoustical Society in Montclair, N.J. Now, computer-based techniques like "modal analysis" are bringing this goal closer.

In his experiments, Kenneth D. Marshall of the BFGoodrich Research and Development Center in Brecksville, Ohio, using a miniature hammer that measures force, lightly taps the surface of a violin at more than 200 locations to excite its natural vibrations. An accelerometer attached to the violin's top plate measures its motion, and a computer compiles the data.

Recently, Marshall used this technique to get a "first look" at how the presence of a musician alters the vibrational behavior of a violin. The results show that a violin vibrates less strongly when held by the player than when suspended by rubber bands (a method used in the past for studying violin sounds). "At times the difference can be enormous," he says.