two oil types by looking for chrysenes: The diesel lacks these PAHs.

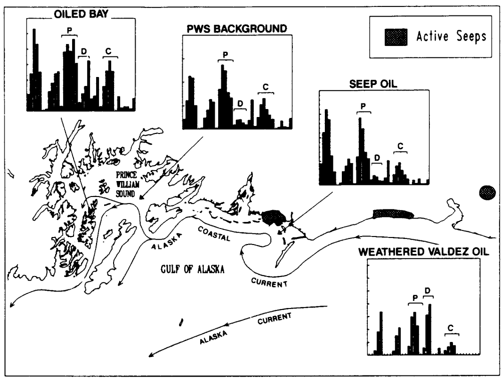
Short's own PAH fingerprinting supports Exxon's finding of background contamination with non-North Slope crude oil in deep Prince William Sound sediments — those in 40 to 100 meters of water. But his studies indicate that shallow, intertidal sediments generally remained pristine — totally free of petroleum residues — unless or until oiled by the *Exxon Valdez* spill.

And that's why at least one paper at the ASTM meeting bothered him. It attributed most of the PAHs in biological materials from one tidal area to a mix of seep oil and North Slope diesel. If one assumes such shallow areas contain a mix of diesel, seep, and *Valdez* oil, he says, then one can attribute much of any phenanthrenes and chrysenes present to seep oil, and much of the dibenzothiophene signature to diesel. This would allow you "to cover most of what you see with non-*Exxon-Valdez* oil — even if *Valdez* crude is the only [oil] present," he says. That prospect, he adds, "makes me suspicious."

Many government scientists lauded Exxon for the science reported at the ASTM meeting. Like Short, however, many also questioned how data from that research were being interpreted.

For instance, Exxon claims that "[oil] spill effects were not significant to the herring." But Evelyn D. Biggs with Alaska's Department of Fish and Game in Cordova says even Exxon's data don't support that claim. Her own histopathology studies show that "the tissues of fish in the oiled areas are more screwed up than tissues from fish in unoiled," she says.

Dennis Heinemann, a Camarillo, Calif.-based consulting seabird biologist, objects to the way Exxon's "careful," but limited, study on murres — a diving seabird — ignores conflicting findings from bigger, longer observations of those same birds (SN: 2/13/93, p.102). He compared Exxon's efforts to "looking at one tree" and then generalizing that conclusions drawn from it could "represent the whole forest." *— J. Raloff*



Adapted from Exxon/Page et al.

Shaded areas on map depict natural seeps that can contribute oil to Prince William Sound sediments. Chemical fingerprints illustrate how relative peaks of certain PAHs — phenanthrenes (P), dibenzothiophenes (D), and chrysenes (C) — differentiate Exxon Valdez *residues from seep oil.*

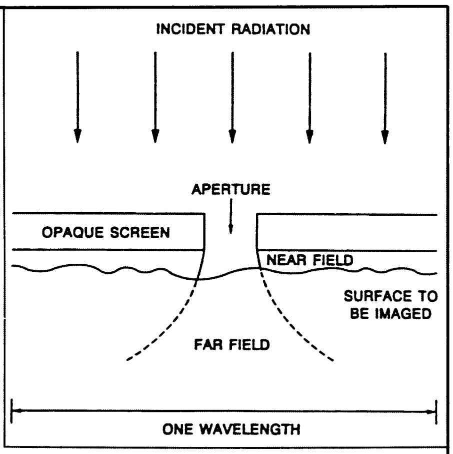
Close-up views of cells

Over the centuries, microscopists have developed many different techniques for staining biological material to highlight certain features of interest in tissue or within individual cells. The same techniques may now prove useful with a new type of optical microscope that produces sharp images of objects smaller than the wavelength of light used to illuminate the sample.

When light passes through a tiny opening, it tends to spread out, or diffract. This optical effect limits a conventional microscope's resolution. But by making the distance from the aperture to the surface being viewed much smaller than the wavelength of the illuminating light, researchers can evade the diffraction limit and generate high-resolution images of surfaces (see diagram).

Eric Betzig of AT&T Bell Laboratories in Murray Hill, N.J., and his collaborators send visible laser light through an aluminum-sheathed optical fiber tapered to a fine point 70 nanometers wide and positioned only 10 nanometers above the sample. Moving the glass fiber tip back and forth generates an image that reveals components as small as 15 nanometers across. In tests of their instrument, the researchers have obtained remarkably detailed images of the skeletal scaffolding inside a cell.

Betzig described his group's preliminary results at the Quantum Electronics and Laser Science Conference, held this week in Baltimore. □



Betzig

An illuminated aperture acts as a light source that can scan a surface to produce a high-resolution image.

Collapsing clusters lead to fullerenes

Chemists have quite successfully cooked up large quantities of fullerenes for three years now, but no one yet knows how these structures manage to emerge out of the hot carbon chaos. Why the commonly used arc-reactor-synthesis method works at all still mystifies researchers. How could atomized carbon spontaneously yield such highly ordered molecular cages?

New experimental evidence suggests that at high temperatures large carbon clusters form and then collapse into a more stable fullerene configuration.

"We've shown how carbon in a very high-energy environment reacts with itself and goes on to form fullerenes," says Michael T. Bowers of the University of California, Santa Barbara. "It's not what people — very reasonably — thought in the past."

The smallest observed fullerenes, containing 30 carbons, had appeared to come out of nowhere, Bowers says. He and his co-workers set out to discover how they form. Using a method called ion chromatography — which they developed to study carbon clusters — the team first determined what structures carbon atoms prefer to adopt.

Researchers had theorized that fullerenes assemble from sheets of pentagons and hexagons, but the group found no evidence of this. Instead, they observed that a few carbon atoms will link up linearly and that 10 carbons form monocyclic rings, 20 or more carbons form bicyclic rings, and 30 or more carbons form tricyclic rings.

In the May 6 NATURE, the California group describes how heating these large planar rings causes them to rearrange into the three-dimensional, spherical fullerenes. The rings melt down and a small carbon fragment evaporates as the atoms settle into their new arrangement.

Bowers speculates that in the searing carbon soup of an arc reactor, the 60-carbon buckyball forms preferentially because it is the most stable fullerene in the intermediate size range. Larger fullerenes may coalesce just outside the arc's hottest region, where negatively charged carbon clusters may lose electrons and grow further before melting into fullerenes.

Robert F. Curl of Rice University in Houston applauds the work for contributing to a fundamental understanding of fullerenes and for opening up theory to experimental testing. "Here's something that may bear very strongly on the formation of C_{60} and fullerenes in general," he says.

Such research may one day help chemists control the kind of fullerene they produce. Says Bowers, "Once you know the mechanism, you have a chance at tailoring molecules. Until then, people are just playing in the dark." *— K.F. Schmidt*