Geologic detectives track string of spills

A significant fraction of oil residue found along the beaches of Alaska's Prince William Sound does not hail from the *Exxon Valdez* accident but appears to have come from a much earlier spill, federal scientists say. Such findings will likely play a role in upcoming lawsuits over damages associated with the 1989 accident, which released 11 million gallons of crude oil into Alaskan waters.

Geochemist Keith A. Kvenvolden of the U.S. Geological Survey (USGS) in Menlo Park, Calif., and his colleagues collected samples of oily sand, oily rocks, tar balls, and solid oil mats from islands and coastal sites in the sound. To trace the source of those materials, they measured the ratio of heavy and light carbon isotopes, which provides a distinctive fingerprint, Kvenvolden says.

Eight of the samples they collected had a carbon-isotopic value of −29.3, which closely matches that of oil from the damaged supertanker. But 14 of the samples, mostly small tar balls, had unusual carbon-isotopic values that hovered around −23.8, reflecting an oil rich in heavy carbon. The isotopic evidence therefore suggests the tar balls did not come from the *Exxon Valdez,* the team reports in the September GEOLOGY.

Because the tar samples found around the sound all shared the same unusual isotopic signature, Kvenvolden's group suggests the residues came from an asphalt storage tank in the town of Valdez that ruptured during the huge 1964 earthquake in southern Alaska.

When the researchers analyzed samples of asphalt from the old facility, they found a carbon-isotopic value matching that of the tar balls. Carrying the investigation further, they traced the source of the asphalt to California, based on its unusually high ratio of heavy carbon. Only oil from the Monterey formation in California has such a fingerprint, say the researchers, who note that California supplied much of the oil to Alaska before production began in the far North.

Ian Kaplan, a consultant geochemist in Canoga Park, Calif., agrees that the heavy isotopic ratio of the tar balls is unusual. "Few oils in the world have that precise signature," he told SCIENCE NEWS.

Geochemist Greg Douglas of Battelle Ocean Sciences in Duxbury, Mass., says his research on tar balls from the beaches of Prince William Sound also suggests they did not come from the *Exxon Valdez* oil. He and his colleagues measured chemical markers within the tar balls that distinguish them from the Alaskan crude oil spilled by Exxon's vessel.

According to Kvenvolden, asphalt stands a much better chance of surviving for years than does crude oil because asphalt readily resists weathering. In fact, the USGS team concludes in its paper that "it now seems easier for us to find asphalt residues from 1964 than to find oil residues from the 1989 spill."

Statements like that could help Exxon in litigation stemming from claims of land damages caused by the *Exxon Valdez* spill. Company scientists maintain that hydrocarbons in the sound come not only from the supertanker accident but also from other sources, including natural seeps (SN: 5/8/93, p.294).

"Some claims are based on [studies showing] the presence of hydrocarbons on the shorelines. We feel those studies are very weak because they assumed that everything they detected was *Exxon Valdez* crude. They failed to recognize the possibility that there could be other oils," says geochemist A. Edward Bence with Exxon Co. USA in Houston.

Others, however, take issue with Kvenvolden's suggestion that a spill long past leaves more of a mark on the shoreline of Prince William Sound than does Exxon's oil. Ernest Piper, a project manager conducting shoreline surveys for the Alaskan Department of Environmental Conservation in Anchorage, says his team finds oil a few centimeters below the beach surface in many areas heavily fouled by the spill in 1989, although these shorelines might look clean to someone walking on them.

According to Piper, the subsurface oil that has survived so far could remain in place for many more years because much of it sits far above the high-tide mark, beyond the flushing action of waves. "It's not necessarily going to be reached other than by a really large storm, like a 25- or 50-year storm. It's probably going to stay like that for a long time," says Piper.

– R. Monastersky

Immune cells sport marijuana receptor

Once considered the seat of the spirit and the source of emotions, the spleen lost that title when physiologists demonstrated that it does little more than filter, hold, and produce white blood cells.

But maybe ancient anatomists knew something that modern scientists do not.

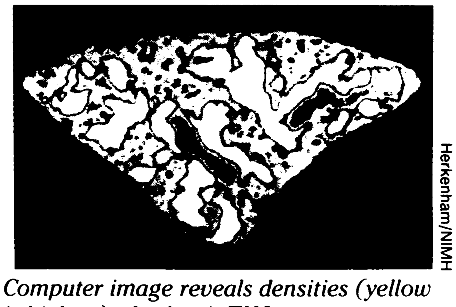
Molecular biologists searching for molecules important for the migration of white blood cells have instead stumbled upon a new type of marijuana receptor, thus far found only in the spleen. This receptor molecule readily latches on to delta-9-tetrahydrocannabinol (THC), marijuana's active ingredient, says Sean Munro of the Medical Research Council Laboratory of Molecular Biology in Cambridge, England. It also accepts the body's natural version of THC, a substance called anandamide (SN: 2/6/93, p.88).

Munro and his colleagues had been using a genetic technique called polymerase chain reaction to search through lab-grown human lymphoid cells. "We never got what we were looking for," Munro recalls.

Instead, they discovered a receptor whose genetic code has 44 percent of its sequence in common with the brain's known marijuana receptor. When the researchers inserted this genetic code into cells grown in the lab, the cells bound marijuana-like substances, though not to the same degree as the brain's cannabinoid receptor, Munro and his colleagues report in the Sept. 2 NATURE.

The researchers determined that the rat brain lacks this newly identified receptor, which is located on cells called macrophages that lie in the parts of the spleen where substances in the blood first encounter the immune system.

Another study, now accepted for publication, confirms that parts of rat spleen,



Herkenham/NIMH

Computer image reveals densities (yellow is highest) of spleen's THC receptors.

as well as lymph nodes, contain marijuana receptors, says Miles Herkenham, who, with Allison B. Lynn, surveyed tissue using tagged molecules known to link with these receptors. They work at the National Institute of Mental Health in Bethesda, Md.

The fact that this receptor differs from the one in the brain offers hope that pharmaceutical companies may one day harness THC-like substances for medical uses without having to worry about patients getting high from the treatment, says Leslie L. Iverson of Merck, Sharp and Dohme Research Laboratories in Harlow, England.

In the spleen, THC-like compounds seem to affect the ability of cells to generate a messenger molecule that helps activate white blood cells, says Norbert E. Kaminski at Michigan State University in East Lansing. Last year, Kaminski discovered a marijuana receptor in mouse spleens.

Because the spleen and brain receptors are different and because other researchers have discovered marijuana receptors in fish and sea urchins, Munro suspects that this ancient psychoactive agent ties into an ancient – and widespread – internal signaling system for organisms.

– E. Pennisi