Basins Hasten Brewing of Oil

An unexpected prize of research expeditions to seafloor vents along the East Pacific Rise three years ago was petroleum (SN: 2/13/82, p. 103). Hydrocarbons formed in mineralized mounds when hot basalts under the spreading centers quickly cooked blankets of organic sediments. Now another team of scientists has discovered a similar accumulation of rapidly heated hydrocarbons, but in a very different tectonic setting: the King George Basin of Bransfield Strait in western Antarctica. There, the subduction, or downward plunge, of the Drake Plate into the South Shetland trench is thought to be causing underground intrusions of lava beneath the basin, in a process called back-arc volcanism.

"This finding expands the spectrum of hydrocarbon formation processes," says Erwin Suess at Oregon State University in Corvallis, who happened on the discovery with Michael Whiticar and Herbert Wehner at the Federal Institute for Geosciences and Resources in Hannover, West Germany. The researchers were studying the geochemical, sedimentological and tectonic processes of the basin.

The finding is also the first demonstration that thermally formed hydrocarbons are being produced in Antarctica. No petroleum reservoirs have ever been unearthed in Antarctica, primarily because the Antarctic Treaty prohibits commercial oil exploration. Yet the presence of hydrocarbons is not surprising; the oceanic waters that circle the continent are some of the most fertile in the world, leaving Antarctica's coastal basins rich in the organic material from which oil is made. The researchers stress, however, that the newly found hydrocarbons will almost assuredly *not* lead to large petroleum deposits with commercial potential.

One of the first steps in determining whether a commercially viable petroleum deposit is underfoot is to find out how the hydrocarbons were created. Oil companies are rarely interested in methane and other gases produced by biological processes. Instead, they search for hydrocarbons made with the geologic recipe that calls for slow heating of organic matter deep down in the crust for millions of years, yielding heavy oils that house more energy per volume than do gases.

As discussed in the March 7 NATURE, carbon-13 and sulfate measurements of sediment cores taken a year ago by Suess's group aboard the West German research ship *Polarstern* rule out biological processes as a source of the King George Basin hydrocarbons, in favor of a thermal origin. But the chemical tests also showed that the hydrocarbons had not been warmly aged for very long.

"The volcanism cooks up the organic material to make petroleum before its time," says Suess. This petroleum could have commercial value if there were enough of it. But Suess believes that there is very little oil in the basin, because lava intrudes over a very small region, perhaps only 10 meters or so in diameter.

While oil companies may be disappointed, the scientists are not. Both the East Pacific Rise and Antarctic finds may help geologists better understand the conditions needed to produce oil at the crust's surface. And Suess suspects that there may be hydrothermal activity associated with the King George Basin, just as there are hydrothermal vents along the East Pacific Rise—even though the causes of volcanic activity at the two sites are very different. According to Suess, this idea is supported by recent chemical studies conducted by others at Oregon State, indicating that water is circulating through the basin sediments. In the future Suess would like to search for vents and possible vent communities such as those found at the East Pacific Rise. "All attention has been directed towards mid-oceanic ridges," he says. "And no one is looking at back-arc volcanism, which may have many of the same effects."

Meanwhile, work has been progressing at the East Pacific Rise. Peter Lonsdale, one of the researchers who originally discovered the hydrocarbons near the hydrothermal vents in the Gulf of California's Guaymas Basin, says he and his coworkers have subsequently used the submersible *Alvin* there to study in much greater detail the composition and distribution of different hydrocarbons as a function of water temperature and distance from the vents. Lonsdale's group is now in the process of publishing its findings.

In addition, Lonsdale, Ray Merewether and Mark S. Olsson, all of Scripps Institution of Oceanography in La Jolla, Calif., report in the March 10 JOURNAL OF GEOPHYSICAL RESEARCH the discovery of another source of hydrocarbons in the Guaymas Basin: plumes of hydrocarbons rising hundreds of meters above the 2-kilometer-deep seafloor from seeps along faults in the continental margin. According to Lonsdale, the plumes, detected with up-looking and side-scan sonar, are the deepest ever found.

Since most of the plumes do not originate at the vents, they contain hydrocarbons (mostly methane, the researchers suspect) produced in lower temperature processes than the petroleum formed in sediments near the vents. However, Lonsdale notes that the high temperatures of the spreading center may still have contributed to the maturation of the hydrocarbons in the plumes.

Lonsdale says the recent discovery in Guaymas Basin may be of interest to scientists trying to estimate the amount of hydrocarbons that invade the ocean from natural sources, as opposed to human-made pollutants. And since hydrocarbon plumes and seeps are often used by oil companies as guideposts to underlying petroleum reservoirs, the Guaymas plumes might eventually prove commercially useful. But the most important aspect of the Guaymas Basin, he says, is that it is a natural laboratory for studying the formation of hydrocarbons. *—S. Weisburd*

Gene-code variety

In this heyday of genetic engineering, scientists take great advantage of the uniformity of the DNA code. A human cell's gene, for example, once put in the proper context, can be effectively translated by the decoding equipment of a bacterium. But the genes of one group of organisms, single-celled animals called ciliates, are not translated well by the cellular machinery of other organisms. Now scientists report "the surprising finding" that the genetic coding of these simple animals actually departs from the so-called "universal" code. The only coding variations previously discovered are in genes of subcellular structures, the mitochondria (SN: 9/15/79, p. 185).

Stuart Horowitz and Martin A. Gorovsky of the University of Rochester in New York determined the nucleotide (DNA subunit) sequence of two genes in the nuclei of the ciliate *Tetrahymena thermophila*. In the standard code, the sequence TAA is a "stop" signal, terminating the translation of a gene. But in these *Tetrahymena* genes, TAA corresponds to the amino acid glutamine.

Two groups of scientists report in the March 14 NATURE analyses of genes of another ciliate, *Paramecium*. Francois Caron and Eric Meyer of the National Center of Scientific Research in Gif-sur-Yvette, France, find that both TAA and TAG, which normally terminate gene translation, are scattered through the genes. Analysis of a specific *Paramecium* gene by J. R. Preer Jr. and colleagues at Indiana University in Bloomington indicates that TAA and TAG code for glutamine. In addition, work in West Germany indicates that TAA encodes glutamine in several genes in another ciliate, *Stylonychia*. In all these ciliates, only one of the usual stop codons, UGA, appears to act as a termination signal.

Under most conditions, any genetic change involving termination signals is likely to be lethal to an organism. A major puzzle now is how the variation in the genetic code of ciliates could have arisen during evolution. *—J. A. Miller*