U.S. Scientists Threaten Soviet Boycott

The recent federal move to cold-shoulder the Soviets in cooperative scientific exchanges has taken on a personal dimension. Goaded by the Soviet banishment of outspoken nuclear physicist and Nobel laureate Andrei Sakharov (SN: 2/2/80, p. 67), several prominent scientific bodies in the United States threatened a personal and voluntary boycott by their members of U.S.-Soviet scientific exchanges.

The political rally behind Sakharov by scientists in this country began within a day of the Soviets' move to exile — and thereby silence — him on Jan. 22. Harsh protests by organizations such as the American Association for the Advancement of Science were cabled to Anatoly Dobrynin, the Soviet ambassador to the United States. Other groups issued strongly worded condemnations of the Soviets' gesture. Such actions marked a sharp contrast to the near apathy that met a move by President Jimmy Carter, several weeks earlier, placing an immediate ban on most government-funded cooperative exchanges with the Soviets (SN: 1/12/80, p. 23).

A Jan. 22 statement by the 4,000-member New York-based Committee of Concerned Scientists called the expulsion of Sakharov from Moscow to Gorky and the stripping away of his honors "repulsive." The statement went on to suggest that coming "as the aftermath of the Soviet incursion into Afghanistan, we are concerned that [these actions] portend a change which threatens the continuance of cultural and scientific relations between our countries." CCS cochairmen Max Gottesman and Mark Kac went on to charge, in their Jan. 25 cable to Soviet leader Leonid Brezhnev, that "punishing Dr. Sakharov for his attempts to ensure your government's respect for its human rights commitments ... is a travesty." And they added that Sakharov's detention in Gorky "will only serve to deter Western scientists from engaging in scholarly exchanges with the USSR."

The Federation of American Scientists went so far as to "adopt" Sakharov, saying his plight "deserves and requires an unprecedented defense by foreign colleagues." As the first step in his defense, FAS is asking individual member scientists to consider signing a pledge asserting that individual's intention to boycott any official bilateral scientific exchange with the Soviet government — either here or in the Soviet Union — until Sakharov is released from exile. Among initial adherents to the pledge are five Nobel prize winners and the four highest FAS officials.

FAS announced that several other organizations, including the American Physical Society, American Chemical Society and New York Academy of Sciences, had pledged to carry the adoption suggestion to their members. In justifying the campaign, the FAS asserted that "scientific support for Sakharov, through his individual adoption, is probably the only immediate strategy which cannot be credibly dismissed by the Soviets as politically motivated by hostile foreign forces."

Recognizing "the importance of having some scientists go and complain, even as others refuse to go and complain," FAS officials said individuals would be asked to consult their consciences before endorsing any boycott pledge because some exchanges — such as the swapping of reprints, diplomatic missions in search of peace and personal contacts between individual friends — should be preserved regardless of the political climate.

On Feb. 3, following a weekend in Gorky, Elena Bonner relayed a message from her husband, Sakharov, charging that local Soviet authorities had threatened further sanctions against both him and his wife if he didn't keep quiet. Despite a warning that his Jan. 23 criticisms of the Afghanistan invasion and the direction of Soviet foreign policy violated the terms of his exile, Sakharov has refused to be silenced.

When Sakharov was threatened with repression in 1973, National Academy of Sciences President Philip Handler wrote the then-president of the Soviet Academy of Sciences that "harassment or detention of Sakharov will have severe effects on the relationships between the scientific communities of the U.S. and USSR."

"That statement is as true today as it was then," said Handler last week. "This blatantly punitive act against Sakharov can only be regarded as a challenge to further cooperation and an act of deliberate ill will. What the consequences may be I cannot foresee, but I find it difficult to imagine scientific exchange continuing in the spirit we had created heretofore." □

Leg 70: Return to the Galapagos

Taken by Alvin, *composite shows top of undersea mound like those cored by Leg 70. Deep sea biota covers exterior.*

Like an out-of-the-way island suddenly "discovered" by jetsetters, the Galapagos Rift seems to be the trendy spot for researchers lately. The relatively shallow depth of the spreading center (located off the coast of Ecuador) and its unusual thermal characteristics attracted several research cruises in the early 1970s. Woods Hole Oceanographic Institution's research submarine *Alvin* took a good look in 1977 and 1979 and found spectacular undersea hot water vents and an amazing collection of animals (SN: 3/19/77, p. 182; 1/12/80, p. 29). Now, the Deep Sea Drilling Project's *Glomar Challenger* has made its second voyage to the area.

Unlike *Alvin,* Leg 70 concentrated on less sensational, though no less important, features of the Galapagos region called hydrothermal mounds. Located about 20 kilometers south of the spreading center and its hot water vents, the mounds are quite different in formation and much less active than the vents. But both features appear to be part of the little-understood system that cools and changes newly formed ocean crust by the circulation of water beneath the sea floor.

In 1977, DSDP's Leg 54 attempted to get to the inner workings of that plumbing system by coring the mounds, but had relatively little success. The recently completed Leg 70, which was led by Richard Von Herzen of Woods Hole Oceanographic Institution and Jose Honnorez of the University of Miami, was better prepared. With an acoustic locator attached to the drill string for the first time and armed

with the newly developed Hydraulic Piston Corer (HPC) (SN: 2/10/79, p. 86), Leg 70 was easily able to locate and take undisturbed core samples from the soft mounds 9,000 feet below.

According to Von Herzen, the core samples show layers of hydrothermally altered materials, such as manganese oxide and an iron-rich green clay, alternating with normal ocean sediments. The total thickness of the alternating layers is about the same — 30 meters — as that of the purely ocean sediments on the sea floor adjacent to the mounds. This suggests, Von Herzen says, that the ocean sediments falling on the mounds may be dissolved by the hydrothermal material. Temperatures within the mounds ranged from 59° to 68° F, compared with the ambient sea water temperature of 36° F. Along with evidence from pore water samples, the measurements suggest that water circulating through the mounds moves very slowly — "about tens of centimeters per year."

Together, the data seem to paint a picture of the mounds as breaks or leaks in the otherwise impermeable pipes of a beneath-the-crust plumbing system. The 5-meter to 20-meter-high mounds form in depressions in the sea floor, says Von Herzen, where faults may allow circulating water to surface. The very slow movement of the water keeps the minerals within the mounds instead of spewing them onto the sea floor. David Williams, Von Herzen and co-workers suggest in the Dec. 10 JOURNAL OF GEOPHYSICAL RESEARCH that such mounds build from the inside out. The alternating layers suggest that the mounds are not "on" continuously but that they last for thousands of years, unlike the short-lived, violent activity of the hot vents at the spreading center. Further analysis of the distinct layers preserved in the HPC samples may pin down the timing of the active episodes, Von Herzen says.

Leg 70 also tended to leftovers from Leg 69. Guided by a sonic beacon on the sea floor, Leg 70 re-entered and deepened a hole in what researchers aboard Leg 69 described as a rock formation perfectly sealed from penetration by water (SN: 12/15/79, p. 413). Based on temperature measurements, the earlier researchers had found that the drill hole was sucking water at a rate of 40 gallons per minute, which indicated a low pressure area. According to Von Herzen, water is still being pulled into the formation and temperatures at the bottom of the now 561-meter hole — one of the deepest in the ocean floor — measure about 232°F. The significance of the formation is, however, unclear. Roger N. Anderson of Lamont Doherty Geological Observatory, who was aboard Leg 69, believes the formation to be a fossilized low pressure area formed by an unusual combination of heat and geology. Von Herzen suggests that the drill hole has tapped into an active circulation pattern where low pressure is created by water moving through the crust. □

CESR in the province of bottomonium

Quantum chromodynamics is the theory of what holds everything together. There are physicists who don't think much of QCD as it is called, but there is no really thoroughly worked out alternative theory, so either the center holds on this basis or there will have to be lots of new work done. To see if it holds, experiments look for predicted phenomena.

One reported at the recent meeting of the American Physical Society in Chicago is a confirmation of the existence of the particle with the unwieldy name upsilon-double-prime. This was done by experimenters at the Cornell Electron Storage Rings (CESR) in what appears to be a winning cast of dice in what could be called the "onium" sweepstakes. According to QCD the subatomic particles of physics are built out of six different varieties or "flavors" of quarks. When the fourth of these postulated flavors (designated charm) was discovered five years ago, it exhibited the ability to form what is called charmonium, a particle made of a charm quark and a charm antiquark. Charmonium comes in a spectrum of states (called psi, psi-prime, psi-double-prime, etc.) that differ from one another in mass. How the charmonium states change into one another, resemble one another and differ from one another is extremely important for an understanding of the characteristic called charm and of the chromodynamic force that holds these structures together.

In 1977 the fifth quark, called bottom, was discovered, and in being discovered it manifested itself as bottomonium, otherwise known as the upsilon particles. The discoverers, who worked at the Fermi National Accelerator Laboratory, found clear evidence of the upsilon and the upsilon-prime at 9.4 and 10.0 billion electron-volts (9.4 and 10.0 GeV) respectively and an indication of a third at 10.3 GeV. The DORIS colliding beam facility at Hamburg confirmed the first two. Now CESR has found "a beautifully clear indication of the third state, upsilon-double-prime," says Karl Berkelman of Cornell, thus confirming its existence.

It was a fortunate thing in that CESR was designed to operate optimally in just the energy range where bottomonium can be made before anyone knew what the mass of bottomonium would be. One of the big weaknesses of the theory is that it does not specify the masses of the particles it predicts, so nobody is sure what the masses will be until the particles are found.

The optimal operating range around 10 GeV was chosen for CESR, because it is halfway between those of the first generation of electron-positron colliding beams (SPEAR, DORIS, etc.) and those of the second generation (PETRA, PEP). CESR was built rather quickly because tunnels did not need to be excavated to hold the rings that store the electrons and positrons before they collide to make all these new particles. The rings were put into the existing tunnel of the Cornell Electron Synchrotron.

CESR began experimental operations in the fall of 1979. By then, of course, physicists were well aware of the mass range where bottomonium was to be found, and that became the opening campaign. The detector is called CLEO. That is not an acronym for anything, Berkelman says. "It's just a name we thought went well with CESR."

Berkelman stresses the precision and clarity of the CESR results. With an exact picture of the bottomonium spectrum, study can proceed to the ways in which the flavor called bottom behaves and how it responds to the chromodynamic force. Comparisons with charmonium will be drawn. One of the important things to be sure of is that the chromodynamic force relates to different flavors of quark in the same way. If it doesn't there will be a tremendous scramble to redo the theory. With three well-defined levels of the bottomonium spectrum the CESR physicists feel the omens for being able to do such studies are good.

And there may be more. There are indications that bottomonium may be divided into more than three parts. Berkelman speaks of a hint of a fourth bottomonium state. Beyond bottomonium Berkelman suggests that CESR may be working in a good range to find bottom mesons, structures in which a bottom quark is united to an antiquark of another flavor. Here bottom would manifest itself unmasked by antibottom. This is an aspect of that famous search for bare bottom that has caused so much witticism. Witticism aside, the discovery of bare bottom is one of the things that are fundamental to QCD as the theorists perceive it. □

DNA rules take effect

Revised guidelines for research involving recombinant DNA were published in the Jan. 29 Federal Register. The guidelines lower the physical safety requirements for conducting most experiments using the common laboratory bacteria *Escherichia coli* K-12 and eliminate the requirement that such experiments be registered with the National Institutes of Health. Those experiments, however, are not exempt from the guidelines, as the Recombinant DNA Advisory Committee recommended (SN: 9/29/79, p. 214). Director of NIH Donald S. Fredrickson proposed the revised guidelines Nov. 30 (SN: 12/8/79, p. 389). Bernard Talbot of NIH says that the public comments received overwhelmingly endorsed the proposed guidelines. □