The stuff of Venus: Taste-tests and turmoil

Venus had been seen (with cameras and radar), touched (by numerous probes that had landed on or crashed into its surface), heard (through detections of apparent thunder and lightning) and smelled (via samplings of its atmosphere). But until this month, the planet had never been tasted. Now the Soviet Venera 13 and 14 landing craft have taken the first two bites, drilling a pair of cubic-centimeter nibbles to find out what Venus is really made of.

The Veneras' taste-test was X-ray fluorescence spectroscopy, in which the samples were drawn into test chambers (which were then reduced from the hellish Venus environment of about 465°C and 90 atmospheres' pressure down to 30°C and 0.05 atmospheres) and irradiated with X-rays. This would stimulate the samples to give off X-rays in response, with each element producing emissions of a characteristic energy level, whose intensity would indicate the percentage of that element in the sample. (A similar technique was used by the two U.S. Viking landers on Mars.) The only previous analyses of the surface chemistry of Venus, conducted by earlier Veneras, had been gamma-ray spectroscopy, which measured the presence of radioactive uranium, potassium and thorium, but took no actual samples and could give no element-by-element accounting.

Last week, at the annual Lunar and Planetary Science Conference at the NASA Johnson Space Center in Houston (control center this week for the third flight of the space shuttle), two Soviet researchers came to present the first report in the U.S. of early results from the latest Veneras. Armed with the landers' striking photos of the surface (SN: 3/20/82, p. 197) as well as the initial X-ray findings, Valeriy Barsukov, director of the Vernadsky Institute of Geochemistry and Analytical Chemistry, and chief X-ray experimenter Yuri Surkov played to a standing-room-only crowd.

The X-ray analyses were only preliminary (see chart), with measurements of several key elements such as sulfur yet to come, but they fit readily into the growing Venus data bank, consistent with interpretations of radar measurements from the U.S. Pioneer Venus orbiter.

The Venera 13 site, scattered with dust-to-walnut-sized particles and described by Barsukov as resembling a lava flow weathered by chemical erosion, indeed shows a composition typical of a high-potassium, alkaline basalt. Apparently located in an upland region on the flank of some rolling hills (though researchers chafe at the lack of high-resolution radar data to confirm the localized topography), the site's material seems to typify the basalts found in selected parts of earth's continental crust and perhaps the uplands of the moon.

Venera 14, on the other hand, touched down on a lower elevation, where its sample revealed the sort of tholeitic basalt found in vast expanses on earth's ocean floor and the great lunar mare basins. The lander's limited field of view shows a relatively flat but fractured surface, in which, Barsukov said through a translator, it is possible to identify "no less than six different layers, different in color and therefore in composition."

Venus Surface Composition (% by weight)
Vs. Terrestrial Samples

Constituent	Venera 13	Venera 14	Terrestrial Continental Rock	Terrestrial Oceanic Basalt
MgO	10±6	8±4	0.9	7.56
Al_2O_3	16±4	18±4	14.5	16.5
SiO_2	45±3	49±4	69.2	51.4
K_2O	4±0.8	0.2±0.1	4.02	1.0
CaO	7±1.5	10±1.5	2.21	9.4
TiO_2	1.5±0.6	1.2±0.4	0.48	1.5
MnO	0.2±0.1	0.16±0.08	.08	0.26
FeO	9±3	9±2	3.86	12.24
Total	92.7%	95.56%	95.25%	99.86%

Preliminary analysis of Venera X-ray fluorescence data (other trace constituents will be added) and terrestrial comparisons, as reported by Soviet researchers.

Still being refined are measurements of constituents such as sulfur and chlorine, whose abundances, notes Harold Masursky of the U.S. Geological Survey, could shed light on the readiness of Venus basalts to be weathered by the harsh environment. On Mars, the Viking landers found such readily weathered, fine material overlying the surface that neither craft's X-ray instrument was ever able to study a solid pebble. On Venus, according to Surkov, solid rock was sampled at least by Venera 14, judging from voltage readings indicating the resistance to the drills. A high intrinsic sulfur content in the rock could also reveal much about the nature of the planet's volcanism.

Basaltic uplands, basaltic lowlands — yet there may well be a third major surface component, says Masursky, that has never been sampled. Gamma-ray measurements from Venera 8, back in 1972, were at least consistent with the presence of granite, he says, but there were no X-ray data to say for certain. Two more Venera landers, however, have been announced by Soviet officials for 1986 (to be dropped off by flyby craft that will then head for comet Halley), and those are expected to carry both gamma-ray and X-ray instruments. The constraints of the Halley-bound flybys limit the range of accessible landing sites, but well within reach, Masursky says, should be the vast Venus highland known as Aphrodite, where ancient impacts may have punched through overlying basalt to reveal granite beneath.

Picking such a site would be aided by a Venus-orbiter with high-resolution radar, and although no such U.S. mission is likely before 1988 if then, there are hints of a possible Soviet version.

Radar maps from the Pioneer Venus orbiter were provided by U.S. scientists to help Soviet researchers select the landing sites for Veneras 13 and 14, and such cooperative exchanges of planetary experience have taken place to varying degrees over the years. Much of this activity is arranged between individual scientists and their institutions in the two blocs, but since 1972 there has also been a formal agreement approving official, government-authorized working groups and symposia on planetary subjects.

Last Dec. 29, President Reagan announced as part of a group of sanctions in response to Soviet involvement in Poland that the space-science pact and several others would not be renewed when they expire. The space agreement runs out May 24, and even a U.S.-Soviet meeting formerly planned to have taken place several days before the expiration is now expected to be cancelled. "If it were to go forward," says a State Department official, "it would really be inconsistent with the whole idea."

A number of U.S. planetary scientists have been upset about the decision to let the agreement lapse, and their discontent could be heard last week around the meeting rooms and hallways of the Houston conference. Following the Soviet Venera report on Thursday morning, for example, session co-chairman Roger Phillips introduced Eugene H. Levy, chairman of the National Academy of Sciences' Committee on Planetary and Lunar Exploration. The NAS is instrumental in expediting activities such as are carried out under the space-science agreement that is about to lapse, so Levy is directly affected by the agreement's demise. His prepared remarks were presented as a mere congratulatory statement on the Soviets' success, but a much stronger message could be inferred between the lines.

He called the double Venera mission a "beautifully executed scientific project," a phrase pointedly at odds with the view that such exercises are conducted primarily as publicity. "The Soviet planetary exploration program," he said, "is an example

of what can be accomplished by a steady and consistent commitment to important scientific goals." The "steady and consistent" part, many U.S. space scientists feel, has been a sorely lacking aspect of the U.S. planetary program, whose progress is sometimes perceived as a succession of individual battles for separate funding needs. Calling attention to the declining role of the U.S. in planetary research, he said, "I know that we all look forward to the advances in human knowledge that soon will be appearing in Soviet scientific journals...." The Venera accomplishment, he said, suggesting a strong reference to concerns about the potential losses if the U.S. loses its position of space leadership, "has surely aroused the admiration of people all over the world." His words were spoken to Barsukov and Surkov. His message was for Washington.

Other planetologists feel, however, that individual contacts rather than formal agreements still provide the bulk of their scientific exchange, and such one-to-one links are likely to continue. "I could not see a situation," says the State Department source, "where the U.S. government would try to restrict personal contacts."

—J. Eberhart

Rad damage of polymers

At the bottom of a water-filled, stainless-steel-lined pit, various construction materials used in nuclear power plant buildings recently were exposed to a cobalt-60 radiation source. The experiments — conducted by Ken Gillen and Roger Clough of Sandia National Laboratories in Albuquerque, N.M.—indicate that long-term, low-level doses of gamma radiation degrade the materials faster than do equal doses doled out at a higher rate over a shorter period of time.

The findings have implications for determining the lifetime of certain polymers used in nuclear reactor structures. Traditionally, age testing of these materials has emphasized total radiation dose—not dose rate. A typical age test, for example, involves exposing polymers to 40 Megarads—a radiation dose about equal to that expected during a plant's 40-year design life—over a period of several days.

The Sandia tests, on the other hand, involved administering lower doses over a longer period of time to more closely simulate the nuclear power plant environment. In one test, polyvinylchloride — which is used for cable jacketing — was shown to degrade three to four times faster at the lower-level, longer-term dose rate. Similar results were observed using polyethylene, a cable insulation material.

The Sandia tests show that polymer damage, mostly embrittlement, occurs when radiation exposure causes chemical bonds to break, which in turn leads to oxidation — the combination of a substance with oxygen. □

Hypothalamic hormones and cancer

The hypothalamus was found during the late 1960s and early 1970s to be the brain and body's executive hormonal switchboard; Roger C.L. Guillemin of the Salk Institute in LaJolla, Calif., and Andrew V. Schally of the Veterans Administration Hospital in New Orleans shared a Nobel Prize for the discovery (SN: 10/22/77, p. 260). Since then the isolation, sequencing and synthesis of hypothalamic hormones and the design of analogues of, and antagonists to, them has opened a radically new approach to birth control, with one analogue ultimately reaching clinical trials (SN: 5/24/80, p. 331). And now hypothalamic hormone analogues look as if they can counter some hormone-sensitive cancers — notably hormone-sensitive prostate cancer — Schally and his colleagues report in the March Proceedings of the National Academy of Sciences.

Luteinizing hormone-releasing hormone (LHRH) is a hypothalamic hormone that controls sex hormones in both men and women (SN: 8/12/72, p. 108). Superactive LHRH analogues (compounds similar in structure to LHRH) increase levels of the male hormone testosterone, stimulate the testes, stimulate libido and influence other sex-hormone related functions. Paradoxically, however, large doses of these analogues do just the opposite. So Schally and his co-workers tried to learn whether such doses might make testosterone-dependent prostate cancer regress in animals. They found that it does.

Then they attempted to see whether such doses can do the same for testosterone-dependent prostate cancer in humans, which constitutes about a half of all cases of human prostate cancer. Over periods of six weeks to a year they gave large doses of superactive LHRH analogues to six patients with localized prostate cancer and to four patients whose prostate cancer had already metastasized. The patients agreed to this experimental treatment since estrogen, a treatment for local prostate cancer that cannot be surgically treated and for metastasized prostate cancer, had not helped one of them and was contraindicated for the rest of them because of their medical histories. (Castration is another treatment for metastasized prostate cancer.)

The treatments brought about tumor regression and clinical improvement — such as better urinary flow and a decrease in bone pain due to cancer metastasis—in nine out of 10 patients. (The tenth patient's cancer was found to be hormone-insensitive.) Schally and his colleagues conclude, "...Long-term administration of LHRH analogues could become an alternative to surgical castration and estrogen therapy for the treatment of hormone-dependent prostate carcinoma."

However, the analogues were not without some undesirable side effects of their own, notably a decrease in libido and erectile potency. And as Avery Sanberg, a prostate cancer scientist at Roswell Park Memorial Institute in Buffalo, told Science News, what Schally and his group are doing, essentially, "is changing the hormonal milieu. But it remains to be seen whether that effect is any better than what therapy in the past has given....Nobody has ever cured prostate cancer with hormonal therapy." William Scott of the Johns Hopkins Medical Institutions agrees: "I think we have gone about as far as one can go with hormonal therapy. I think any other hormonal manipulation is just a variation on the theme." *—J.A. Treichel*

Measles eradication as world-wide goal

Although still regarded in some countries as just part of growing up, measles infections take a heavy world toll. Each year 1.5 million children die of the disease and its complications, which include pneumonia and brain inflammation. The incidence of complications and death is highest in developing countries where there is malnutrition and high risk of concurrent infections.

At a meeting in Washington, physicians from 21 countries concluded that worldwide eradication of measles is possible, probably within 20 years. An effective vaccine is available, but major challenges are expected in financing immunization programs in developing countries and in motivating some of the developed countries, such as France and the United Kingdom, to participate.

The United States is cited as the best example of a measles eradication program. Currently, more than 96 percent of children entering school have proof of immunity. The annual incidence of measles here has dropped from 336.3 cases per 100,000 population in the 1950s (before the vaccine came into use in 1963) to 1.3 cases per 100,000 population in 1981. So far in 1982, a record low of only 130 cases has been reported, says Alan R. Hinman of the U.S. Centers for Disease Control. He and colleagues predict in the March 19 Journal of the American Medical Association that by October 1982 indigenous measles will have been eliminated in the United States, although approximately 500 cases per year will occur due to importation of measles with occasional, limited transmission. Other countries making progress toward extensive immunization of children include Canada, China, Czechoslovakia, Costa Rica, Cuba and Chile. □