finds was the preliminary report of the core samples returned to earth by Luna 16 from the Sea of Fertility (see p. 65). Academician Alexander P. Vinogradov, vice president of the Soviet Academy of Sciences, told a hushed audience of some 600 scientists that the three ounces of Fertility soil was similar in composition and age (4.6 billion years old) to that brought back by Apollos 11 and 12. From this he infers a common origin for the seas. Dr. Vinogradov also concludes from the much greater coarseness of the grains in comparison with the Apollo core samples and from the fact that the Luna 16 drill hit a solid object (which he says could have been bedrock) that the Sea of Fertility's regolith was thinner than that at the Apollo 11 and 12 sites.

Another Apollo 12 find of general agreement was that of an exotic component called KREEP by some—for high content of potassium, rare earth elements and phosphorus—found in rock 13 and in other material dated about 4.5 billion years old. Although the scientists could not agree whether it came from the highlands or a crater such as Copernicus, it is believed that it could be part of the ancient crust and perhaps be the mysterious component that causes the soil to be dated 4.6 billion years old while the rocks are usually a billion years younger.

Beyond this there was little agreement.

Differences of interpretation exist about the findings from an 18-centimeter Apollo 12 core tube sample. The sample has definite striation; each layer differs in color, chemistry and grain size. "Less than one part in 1,000 or 10,000," says Dr. Edward Anders of the University of Chicago, "moved to the top." Another study revealed that the top layer of bismuth and cadmium remained at the surface for 15 million years. If the lunar soil is constantly being dug up by many small impacts, more mixing should have occurred. One explanation is that, at least in that area of the moon, the impacts are larger and less frequent. Another theory, held almost singularly by Thomas Gold of Cornell University, is of an electrostatic process on the moon which gently moves surface materials and fills holes. Some of the greatest controversy arose over data from studies of the moon's physical properties. It is generally believed that the moon was formed by accretion, although there is yet little evidence for this. It is also generally accepted that the moon is highly fractionated. And results show it is depleted in volatile elements. But there is still lively debate about whether the moon once had a hot core, where the moon's mantle begins and of what material it is composed.

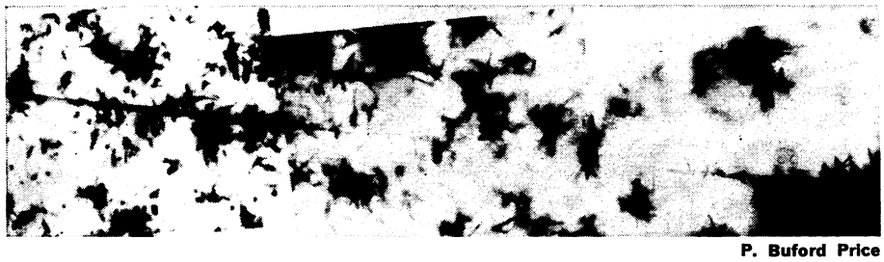
"The magnetism results from Apollo 12," says Dr. Michael Yates of Bellcomm, Inc., Washington, D.C., "seems to be supplanting the seismic results in importance since the magnetism relates to the moon as a whole." The interpretation given to the magnetic results by Dr. C. P. Sonett of the National Aeronautics and Space Administration's Ames Research Center, Moffett Field, Calif., "gives answers in direct contradiction to everyone else's," Yates says. The magnetic field in the solar wind sets up currents as it strikes the moon. From the induced currents Dr. Sonett determines something of the electrical conductivity of the moon as a function of depth. A spike or a peak in this conductivity occurs, says Dr. Sonett, at a depth of 200 kilometers. He believes that the temperature increases to that depth, and then decreases again. From this he concludes that the moon's core is relatively cool—800 to 1,000 degrees C., well below the melting point of most solids. A core that is cool now almost precludes the moon's ever having a hot core, as the cooling mechanism is impossible to explain.

"If Dr. Sonett's findings are confirmed," says Dr. Nowell Hinners, also of Bellcomm, "it is spectacular." But Dr. Sonett's cool moon contradicts other data that lead scientists to believe that the moon once had a magnetic field and thus a molten core. The spike, say the hot-mooners, could be caused by a change in material.

A tantalizing mystery was suggested from independent studies of cosmic-ray tracks found in the Apollo 12 samples. Scientists believe that the spontaneous fission of a uranium atom would leave a track about 14 microns in length. But Dr. Narenda Bhandari of the Tata Institute of Fundamental Research in Bombay, India, found a track about 18 microns in length, which he concluded was proof for the existence of transuranium elements.

Adding to the superheavy element excitement was a find by Dr. P. Buford Price of the University of California at Berkeley of a track 50 times as long as that reported by the Indians. This track, he believes, may contain the first real evidence of the hypothesized magnetic monopoles (SN: 8/29/70, p. 183). "If they do exist," says Dr. Price, "the moon's surface, which has been exposed for billions of years, would be a logical place to find one."

What does all this mean? "The speculation this year is more restrained than last year," says Dr. Robin Brett of NASA's Manned Spacecraft Center in Houston. "This is a sign we are zeroing in; we are starting to do real science." □



P. Buford Price

Long particle track is claimed to be possible evidence of a magnetic monopole.

POLYWATER POOH-POOHED

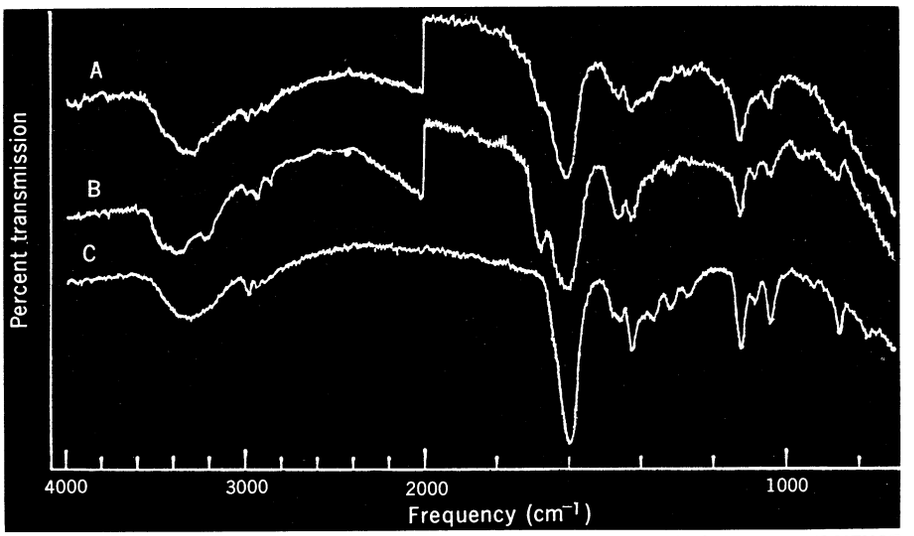
By the sweat of their brow

Polywater, or anomalous water, has provoked a continuing controversy among chemists. It is hard enough to believe that water can assume a form as viscous as molasses and have an atomic weight several times that of an ordinary molecule of water. Straining credibility even more are the facts that the anomalous water appears only in capillary tubes of a few microns diameter and that the largest samples obtained are measured in micrograms.

Nevertheless when Dr. Boris V. Deryagin, director of the Institute for Surface Chemistry of the Soviet Academy of Sciences, announced the discovery of the substance by one of his colleagues, N. N. Fedyakin, specialists in colloid and surface chemistry paid attention (SN: 12/21/68, p. 615). For awhile those who believed in anomalous water had the floor, and studies based on infrared and Raman spectroscopy indicated that anomalous water had the structure of a polymer made of water molecules (SN: 3/21/70, p. 287).

From the beginning, however, there were doubters, and as proponents of polywater failed more and more to agree on the structure of the substance and in their attempts to produce convincingly large quantities of it, the doubters began to have their innings. In the Soviet Union doubts were loudly expressed at a confrontation that the Soviet Academy of Sciences arranged between Dr. Deryagin and other interested academicians (SN: 10/3/70, p. 286).

In the West a more or less negative attitude appeared at the 44th National Colloid Symposium at Bethlehem, Pa., last June (SN: 7/4/70, p. 6). Lately a series of reports in three different journals fires a few more salvos from the negative side. Whether these will finally sink polywater will probably depend on the faith of proponents; from the



D. L. Rousseau/SCIENCE

Similar infrared spectra for (a) polywater, (b) sweat and (c) sodium lactate.

first the whole question has had more of the appearance of an ideological or religious debate than a scientific one.

A few of the first Western scientists who responded to Dr. Deryagin's announcement by beginning studies of anomalous water, B. A. Pethica, W. K. Thompson and W. T. Pike of Unilever Ltd. in Port Sunlight, England, contend in the Jan. 4 NATURE PHYSICAL SCIENCES that whatever anomalous water is, it is not polywater. In experiments with anomalous water removed from the tubes in which it appears, they could not obtain the infrared absorption spectrum on which was based the determination that anomalous water is a polymer. They conclude: "Until conclusive evidence to the contrary is obtained the possibility still exists that it is a gel or solution of silicates or other materials."

Positive evidence of such a solution is reported in the Jan. 15 SCIENCE by Drs. R. E. Davis of Purdue University, Dennis L. Rousseau of Bell Telephone Laboratories and R. D. Board of the Hewlett-Packard Co. of Palo Alto, Calif. This is a detailed and extended presentation of preliminary results that Dr. Davis reported at the colloid symposium.

The evidence rests on investigation of anomalous water by electron spectroscopy for chemical analysis (ESCA), a technique similar to the photoelectric effect except that it uses X-rays instead of the more usual visible light to dislodge electrons from the sample under study.

The numbers of electrons with different amounts of energy that the sample gives off serve to identify chemical species in the sample. It is a particularly good method, the authors say, for qualitative analysis of small samples.

Because reports on different samples of anomalous water have varied widely, the investigators used two independent samples, one prepared at Purdue, the other at Bell Labs in Murray Hill, N.J. The result is that both samples showed high concentrations of sodium, potassium, sulfate, chloride, nitrate, borates, silicates and carbon-oxygen compounds, but very little water. On this ground they suggest that it is highly unlikely that a polymer of water has been discovered.

Writing by himself in the same issue of SCIENCE, Dr. Rousseau points out that the infrared spectrum of polywater closely resembles that of sodium lactate, the primary constituent of sweat. He suggests that human sweat may contaminate the samples, agreeing with the Russian investigator V. L. Tal'rose, who had found phospholipids and other organic substances in some of Dr. Deryagin's samples. Dr. Rousseau points out that an aerosol cloud of sweat vapors surrounds human beings much like the cloud that surrounds the character Pigpen in the Peanuts comic strip.

Finally a professor of dentistry at the University of Michigan at Ann Arbor suggests that the reason such concentrated solutions occur is that when water and other liquids condense in isolated minute capillaries, their corrosive power is greatly enhanced.

Dr. William J. O'Brien, in three papers in SURFACE SCIENCE, bases his argument on the 1928 finding of Dr. J. L. Shereshefsky of Johns Hopkins University that liquids condensed in capillaries have abnormally high surface tensions. Dr. O'Brien suggests that this prevents them from leaving atom-sized holes in their structure as they do when they condense under other conditions. Instead, they fill the holes with atoms taken from the surface on which they condense. This gives them a dissolving power that can be many times what they normally have, he says. □

IN THE UNITED STATES

An end to DDT, maybe . . .

Environmental Protection Administrator William D. Ruckelshaus last week announced cancellation of all uses of DDT in the United States.

Environmentalists viewed the move as a sign, at least, that Ruckelshaus is more on their side than officials of the U.S. Department of Agriculture, which earlier had appealed the cancellation as ordered by a Federal judge at the behest of conservation groups. Pesticide regulation moved from Agriculture to the Environmental Protection Agency in December when EPA was formed.

But the action by no means assures the immediate end of the use of DDT in the United States. The cancellation cannot take effect until chemical companies and others get their licks in during months of appeal procedures.

And even if DDT use ceases in the United States, underdeveloped countries still rely heavily on the chemical in disease control and agricultural production. If, as many scientists believe, DDT contamination, particularly of the oceans, is a worldwide phenomenon, then use in the underdeveloped countries will continue to affect the whole world. It was with this in mind that last summer's Study of Critical Environmental Problems (SN: 10/31/70, p. 344) recommended that advanced nations might even subsidize underdeveloped nations so the latter can use more expensive, but less environmentally harmful, substitutes for DDT.

DDT was earlier canceled for a number of uses by USDA, and the major remaining use for the chemical in the United States is against cotton pests. USDA scientists are working on biological controls and other alternative to use against the cotton pests. □

CROSS-FLORIDA LINK

. . . and an end to a canal

"To prevent a past mistake from causing permanent damage," President Nixon this week halted construction by the Army Corps of Engineers of the Cross-Florida Barge Canal. Twenty-six miles of the canal had already been built at a cost of $50 million; an additional $180 million would have been required to complete it.

The President based his action on a recommendation of his Council on Environmental Quality, which said the canal would have destroyed the Oklawaha River, "a uniquely beautiful semitropical stream." A Federal judge had ordered a temporary injunction against canal construction last week as a result of a suit brought by the Environmental Defense Fund. □