

Doubters and Deryagin

Anomalous water, polywater and now water II are the names given to a strange substance that appears when water vapor condenses in minute capillary tubes (SN: 3/21, p. 287). The substance has a viscosity between that of molasses and that of heavy motor oil. It is denser than ordinary water, and it does not freeze.

Water II was first reported in 1962 by a Russian chemist, Dr. N. N. Fedyaikin. It has been a bone of controversy ever since. Some of the chemists who have worked with it say it is an unusual molecular form of water, a polymer made of water molecules; some say it is a mixture or compound of impurities leached from the capillary surface by the condensing water vapor; many will not commit themselves.

The arguments got an airing last week at Lehigh University in Bethlehem, Pa., at a symposium during the meeting of the American Chemical Society's Division of Colloid and Surface Chemistry.

Very much a proponent of an unusual form of water is Dr. Boris V. Deryagin of the Institute of Surface Chemistry of the Soviet Academy of Sciences. He reported at Bethlehem that he had distilled a column of water II, heated the vapor to 800 degrees C. and recondensed it. The recondensed water II showed the same characteristics as before evaporation, and he takes this as evidence for an unusual molecular form of water that is highly stable.

Dr. Deryagin contends that experiments with highly pure equipment show that the properties exhibited by anomalous water cannot be attributed to impurities. When questioners point out that others get the opposite result, he replies, "I can't be responsible for results that are bad and not by us." He insists that if other experiments were as clean as his, they would get the same result. If impurities are present in the equipment, he says, they will turn up in the anomalous water. American experimenters concede that their experiments are not as clean as Dr. Deryagin's.

On the negative side is Dr. Dennis L. Rousseau of Bell Telephone Laboratories at Murray Hill, N.J., who concludes, "I do not believe there is sufficient evidence to justify a polymer of water."

As a test for the existence of the polymer he made anomalous water with heavy water or deuterium oxide. A polymer of deuterium oxide should have a different structure from the polymer of hydrogen oxide, he says.

And because of the structural difference, a polymer of deuterium oxide should absorb infrared frequencies other than those absorbed by a polymer of hydrogen oxide. But the infrared absorption by samples of anomalous water and anomalous heavy water turn out the same, he says. This would indicate that whatever is there is not a water polymer.

Further support for the impurity argument is provided by Dr. Robert Davis of Purdue University. Dr. Davis, who worked with Dr. Rousseau and Dr. Robert Board of Hewlett Packard, used an analytical technique called electron spectroscopic chemical analysis to determine that 15 samples of anomalous water were composed mainly of sodium, potassium, sulfate, nitrate, chloride, carbonate, borates and silicates. The impurities came out to be more than 95 percent of the samples.

Another negative judgment is entered by a group from the University of Bristol in England, Drs. D. H. Everett, J. M. Haynes and P. J. McElroy. They conclude that the thermal properties of anomalous water are all consistent with those of a solution of ordinary water and silica gels that could have been formed by water reacting with the tube surface. After this, says Dr. McElroy, "we wonder about some of the other unusual properties of anomalous water that are used to define it."

BIOSPACE STUDIES

Man the experimenter

Among the unknowns associated with space travel, the most crucial have to do with man himself and the space environment's biological effects on him. Many physical responses to this weightless state can and have been measured, such as blood-cell anomalies and bodily weight and bone-density losses.

Whereas space scientists do not claim to understand completely all of the causes of these phenomena, the fact that astronauts recover with no apparent long-term effects has led the space agency to proceed confidently with longer space flights.

One phenomenon about which they are less confident, however, is the penetration of human cells by high-energy particles of high atomic number (SN: 5/30, p. 523).

It is generally accepted that when these HZE particles penetrate human tissue they damage the cells; nonregenerative cells, such as those of the central nervous system, are destroyed. The major handicap in getting factual



Lehigh Univ.

Deryagin: Clean experiments needed.

A major problem in determining the properties unequivocally is that samples of anomalous water are small, a few micrograms or milligrams. Experimenters tend to make their own, and sometimes disagree on whether a colleague has been using genuine material.

Says one of the men who introduced the word polywater, Dr. Ellis Lippincott of the University of Maryland, "If credibility is to be maintained, we must come up with a sample that you can show people and that will have definite properties." And Dr. Robert R. Stromberg of the National Bureau of Standards sums up: "With the evidence we had, we started out believing that water forms a polymer. New evidence casts serious doubt." □

data concerning the phenomenon is that these particles are unique to the space environment and can be produced on earth only by a special type of accelerator, which at best would not be available for human tissue studies for five years.

In lieu of experiments with this kind of machine, or actual space research, scientists have flown animals in balloon flights to the top of the earth's atmosphere, where HZE particles are present; but the incident rate at those altitudes is only one-sixth of that of free space outside of the earth's magnetic field.

Several such experiments were flown in the early 1960's. One carried black mice to the top of the atmosphere. As a result of the flight the mice produced gray hairs, consistent with one theory that galactic-ray particles inactivate melanin-producing cells in hair follicles.

In 1962 monkeys were flown in a similar experiment, although the purpose of the flight was not at that time