

Australian fossil: The dawn of life?

In the beginning there were bacteria; the major question has been when was the beginning? Until recently, the date established for the first life forms was 2.3 billion years ago. Then, the discovery of fossil imprints in sedimentary rocks pushed the date back to 3.5 billion years (SN: 4/12/80, p. 229). Now UCLA paleobiologist J. William Schopf reports the first direct identification of the actual bacterial cells that produced the ancient imprints. The chainlike fossils, magnified 2,100 times, represent at least five types of microbial forms of life, according to Schopf (arrows point to bacteria cell walls). They were contained in fragments unearthed from a desolate region of northwest Australia by UCLA and Australian scientists. The fossils "demonstrate that the surface of the earth was habitable some three and a half billion years ago, and that it was populated by numerous types of relatively advanced bacterium-like forms of life," Schopf says. Less conclusive evidence of life in 3.8-billion-year-old rocks from Greenland was previously reported (SN: 9/15/79, p. 229), but those findings have been challenged as representing remnants of "fluid inclusions," or bubbles, that were not of biological origins.



J. William Schopf/UCLA

Sex hormone overrides upbringing

Maria was a trim little girl. Now, as Mario, he is a strapping young man. And Isabel put on men's clothes at 12 to become the muscular, masculine Chi-chi. Rather than being recipients of incredibly successful sex-change operations, these teenagers are victims of a rare genetic defect, a biological trick. It makes male babies appear female and has resulted in more than a dozen being raised as girls until the undeniable events of puberty.

These instances of sex-change at puberty are evidence that gender identity is not inalterably fixed in the young child. Julianne Imperato-McGinley of Cornell University Medical College told the meeting in Washington of the Endocrine Society. She has studied three isolated and inbred villages in Santo Domingo in which 38 people have been identified with the genetic defect. Of 18 who were raised unambiguously as girls, in a society with clearly segregated sex roles, 17 changed during puberty to male identities, male occupations and male sexual activity. Imperato-McGinley says that the area even has slang Spanish terms that she translates as "penis-at-12" and "first woman, then man."

The biological basis for the sex confusion is lack of the enzyme that converts the male hormone testosterone to another form called dihydrotestosterone. That second hormone is required prenatally to form the male external genitalia (SN:

3/29/80, p. 198). At puberty, however, testosterone itself causes the major changes. So the male children, mistaken for females, begin to add muscle and notice their voices deepening. The penis (previously thought to be a clitoris) lengthens to 4 to 6 centimeters. Although sexually potent, most of the men are infertile because the prenatal deficiency leaves the urethra in the wrong position.

The girls who later changed to men began to suspect a difference between the ages of 7 and 10. On the average there was a five-year lag from the first doubt to the complete change in gender role. Imperato-McGinley interviewed the parents and neighbors of those children. She says they reacted to the change with amazement, confusion and finally acceptance. One mother even said, "We were proud."

Imperato-McGinley cautions that the seemingly easy acceptance of a sex change must be viewed in the perspective of the Dominican society where there is clearly an advantage to being male. Now people in that area detect affected children at birth by close examination of the genitals and raise them as boys.

In another isolated community, in New Guinea, two children with that genetic defect caused a tribal dilemma because the sexes are segregated at birth and reared separately. When two "girls" turned out to be boys, the leaders after deliberation decided to rush them through all the male

pubertal rites and initiate them as men.

In the United States, Imperato-McGinley has tracked down 15 cases of the genetic defect. In seven cases, all who were raised outside the country, the children had changed identity from female to male. The eight children born in the United States, however, were regarded as hermaphrodites during early medical examinations and were surgically castrated. All are now in their late teens, consider themselves female and five have serious psychological problems. Imperato-McGinley says it is not clear if these adolescents can make it as women.

Normally the hormones act in concert with the child's rearing to establish gender identity, Imperato-McGinley says. When the rearing gender differs from the hormonal gender, a biological override seems to go into effect. In other types of hermaphroditism, she says, there is no male hormonal thrust, so the rearing as a female is the predominant force. □

Erring chip signals 'Russians are coming'

On June 3 and again on June 6, nearly 150 B-52 bomber crews revved their engines in preparation for signals to take off. Those signals never came. It is now believed that a small, malfunctioning integrated circuit — computer chip — is responsible for generating false warnings that Soviet intercontinental ballistic missiles had been fired at the United States.

It took a mere three minutes — albeit frantic ones — before crosschecks with data from radar and satellite sensors confirmed that the initial warnings were erroneous. Results of an investigation by the North American Air Defense Command (NORAD) suggest that the faulty signals were generated by a chip in NORAD's communications multiplexer. The multiplexer converts information exiting NORAD's main computer into a form suitable for transmission over a communications line. At the same time it adds information that will enable receiving stations — such as the National Military Command Center in the Pentagon and the Strategic Air Command Center in Omaha — to identify and interpret the message.

Satellite and radar sensors deployed to monitor missile launches and flights were supposedly the source of data generating the ground alerts on June 3 and 6. But those warnings were recognized as mistakes when direct readouts of the sensors at military command centers — which had also received the attack warnings — failed to register any sign of missiles, according to Assistant Secretary of Defense for Communications, Command, Control and Intelligence Gerald P. Dinneeh at a June 17 news briefing.

The 46-cent part that failed was about

the size of a dime. Replacing it will correct the problem, but to improve the error-detection and correction capability of the entire system, design changes are now under development. Until they are in place, communications traffic is being re-routed to and from NORAD's main computer. In addition, an independent review team of computer experts is analyzing the June incidents to verify NORAD's diagnosis as accurate and complete.

The affected computer system was only recently installed to replace aging and obsolescent equipment. Though declared operational, the system was still undergoing tests at the time of the malfunction.

Another false alert occurred last November 9. Unlike the current pair, it involved human error when a test tape of a missile attack was inadvertently inserted. □

A blow to acid rain

In a move seen by many as the first concrete governmental step toward dealing with the problem of acid rain, the Environmental Protection Agency last week ordered two controversial Ohio power plants to cut their sulfur dioxide output by 100,000 tons per year. The Eastlake and Avon Lake coal-burning facilities, owned by Cleveland Electric Illuminating Co., have become a symbol in the battle between environmentalists and coal interests over the issue of acid rain.

Sulfur dioxide, as well as other compounds produced by the burning of fossil fuels such as coal, can combine with water vapor and form weakly acidic rains that have been shown to damage lakes and possibly crops (SN: 2/2/80, p. 76; 2/16/80, p. 106). The sulfur and nitrogen oxides produced by the heavy concentration of power plants in the Ohio Valley and blown to the east by prevailing winds have, according to recent studies, caused a steady increase in the acidity of rain falling in the eastern United States (SN: 3/29/80, p. 199). The Eastlake and Avon Lake plants became a test case for controlling sulfur dioxide emissions when President Jimmy Carter announced last June that the pollution limit at the plants would be relaxed because the Ohio coal industry — which produces high-sulfur coal — would suffer if the plants were required to burn out-of-state, low-sulfur coal.

Saying that the new restrictions would result in only "minor labor dislocations" at Avon Lake and "minimal disruptions" at Eastlake, the EPA set the limits at 5.64 pounds of sulfur dioxide per million British Thermal Units (Btus) of heat emitted at Eastlake and 4.10 pounds per million Btus at Avon Lake. Previous limits allowed 6.58 pounds per million Btus, and 6.09 pounds per million Btus, respectively. The new restrictions were arrived at by using a different computer model of the regional sources and movements of pollutants. □

Magsat down; magnetic field declining

Preliminary results from the just-downed Magsat—for Magnetic Field Satellite—confirm a previously detected decrease in the intensity of the earth's magnetic field, NASA scientists said last week. But it is not clear, they cautioned, if the measured decline is a normal fluctuation of the field, or indicates that the field is approaching a periodic reversal.

Magsat was launched into a polar orbit Oct. 30, 1979 (SN: 11/10/79, p. 327) and re-entered earth's atmosphere over the Norwegian Sea at 3:20 p.m. (EDT) June 11, gleaning nearly 2 months' more data than initially expected. Like its predecessors, the three poGO's (for Polar Orbiting Geophysical Observatory, SN: 5/24/75, p. 341), Magsat measured the earth's main magnetic field as well as the fine-scale magnetic anomalies present in the crust. Unlike poGO, Magsat's magnetometers were able to discern the direction as well as the magnitude of the main field and to get a higher resolution view of the crustal anomalies.

Measurements of the main field, when plugged into a computer model, show that the overall intensity of the field is declining at a rate of 26 nanoteslas per year, according to Gilbert Mead, a member of the project team at Goddard Space Flight Center. (A nanotesla is a measurement of magnetic flux density, or magnetic induc-

tion, and is abbreviated nT.) This decrease — a rate of decline of less than 1 percent per decade — is consistent with a trend noted more than 20 years ago, says Mead, although larger than the 10 to 20 nT per year decline between 1940 and 1960.

If the rate of decline were to continue steadily — and Mead stressed that the researchers cannot determine if it will — the field strength would reach zero in 1,200 years. In that event, according to current theory, the magnetic field would be likely to rebuild with a polarity opposite to that of the present, so that compass needles that now point north would point south. From measurements of the magnetic field preserved in ancient lava flows, the earth's field is known to reverse approximately every 500,000 to 1 million years; the last major reversal occurred about 700,000 years ago. Little is known about the effects of field reversals, although some research has linked them to mass extinctions of species due to an influx of ultraviolet or cosmic radiation (SN: 3/27/76, p. 205). Moreover, little is known about what may cause the field — which is created by churning in the earth's molten core — to decline in strength. "All we've been able to do is observe the phenomena," says Mead. "We can't predict if these changes are likely to cause reversals or are the normal fluctuations due to changes in the core." □

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