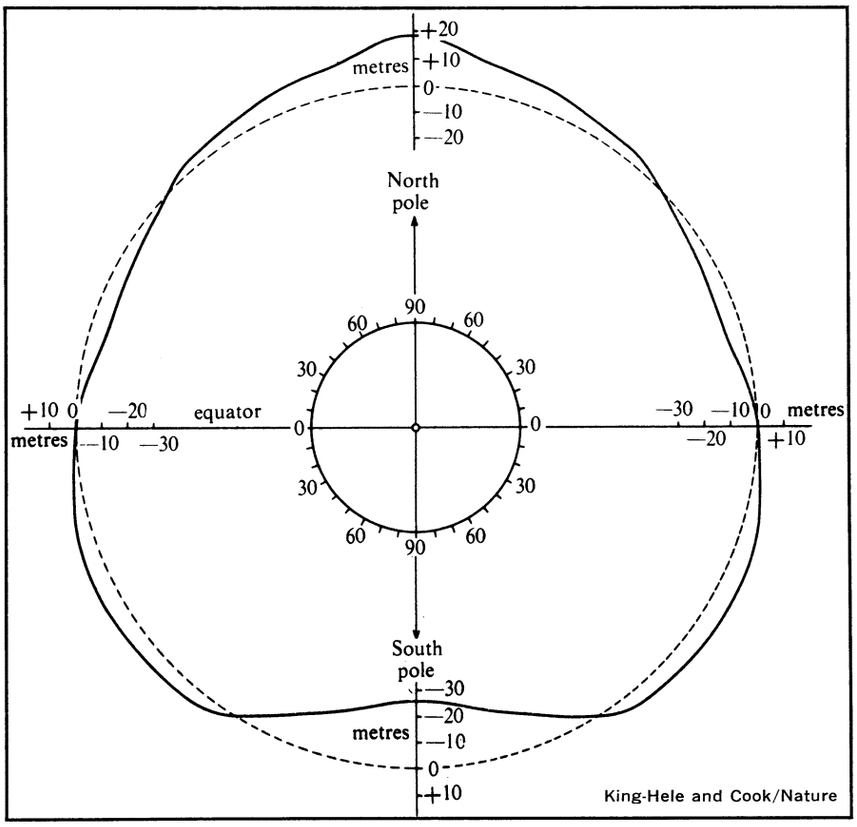
The pear-shaped earth has a larger stem

The earth is even more pear-shaped than we thought.

Soon after the launch of the first artificial satellites, analysis of their orbits led to a reshaping of the world. The earth had been known to be an oblate spheroid: It bulges at the equator and is flattened at the North and South Poles, an effect due to the rotation of the earth. But the orbits of Sputnik 2 and Vanguard 1 did not precisely conform to expectations based on that shape. They indicated that the earth was not symmetrical about the equator but had a slight pear-shaped tendency, with the stem at the North Pole. Sea level at the North Pole is about 40 meters farther from the equator than would be sea level at the South Pole (if there were a sea instead of a continent at the South Pole).

Now two English geodesists, D. G. King-Hele and G. E. Cook, have analyzed the orbits of 27 satellites and discovered that the earth is about 10 percent more pear-shaped than thought.

As mentioned, their previous data indicated that the pear-shaped tendency of the earth—the north polar radius minus the south polar radius—amounted to 40 meters. The new data agree within about 1 meter with the old values over most of the geoid—the outline of a cross section of the earth. But in the area of the North Pole there are larger differences, up to 2.3 meters, revealing, as King-Hele and Cook put it in the Nov. 9 NATURE, "the North Pole quite literally 'growing a stem,' like a pear."



The pear-shaped earth, drawn on an exaggerated scale in relation to a spheroid with a symmetrical flattening of 1/298.

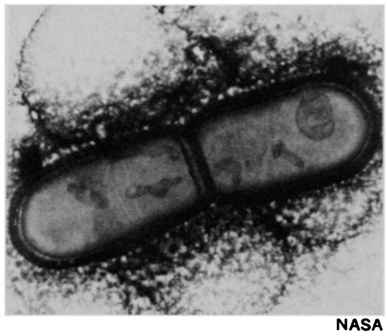
As a consequence, the pear-shaped tendency is now greater, 44.7 meters instead of 40 meters. In relation to a spheroid with a flattening of 1/298.25 (the earth's shape not counting the pear-shaped tendency), the north polar stem may be taken as 18.9 meters high, whereas the south polar depression is 25.8 meters below the spheroid. □

Bacteria thrive in Jupiter-like atmosphere

"Jupiter," says Carl Sagan, "looks like a terrific place for life."

Frigid cold, prodigious heat, crushing pressure and an uninviting atmosphere rich in such delicacies as ammonia and methane hardly sound like home sweet home, yet Sagan may not be so far out after all. Even as Pioneer 10 speeds toward its Dec. 3 flyby of the giant planet, two NASA biologists have found a group of bacteria that live their entire lives on earth under one of the supposedly most forbidding aspects of Jupiter's environment.

Gathered from several slowly seeping springs in northern California, the bacteria were thriving—and continue to do so in the laboratory—in solutions 10 times more alkaline than had previously been thought capable of supporting life. The alkalinity of Jupiter's atmosphere, probably due to ammonium hydroxide, has been cited in the past as one of the arguments against the chance of life there.



NASA

Bacterium lives in pH-11 conditions.

Bacteria from the Livermore Valley area were found in water with an alkalinity as high as pH 11.5, and are growing and reproducing in equally basic solutions of sodium hydroxide. Others, collected near the base of Mt. Shasta, can tolerate not only the alkalinity, but the presence of high concentrations of ammonia. Jupiter is likely to have 100 times the ammonia concentration favored by even these bacteria, says Kenneth A. Souza of the NASA Ames Research Center in California, but there may be transition zones where the ammonia is mixed with water or carbon dioxide.

Some of the newly found bacteria require oxygen. Others do not. They are being raised by Souza and Paul Deal, also of Ames, in gas mixtures that are supposed to simulate Jupiter's atmosphere. Composed mostly of hydrogen and helium in differing ratios, the mixtures include from 0.5 percent to 1.5 percent ammonia and as much as 20 percent methane. Methane would be a likely source of carbon for organic life on Jupiter, and the NASA biologists hope to enrich the possibility by finding methane-fixing organisms on earth.

Pioneer 10 ought to provide better estimates of the ammonia and methane concentrations on Jupiter, and may also reveal something about the vertical variations in the planet's temperature.