Cherokee preparations for war, on the other hand, salt taboos resulted in impaired judgment and a tendency to rash behavior—qualities that, when added to an adrenalin boost, would help create a "formidable warrior." Similarly, in initiation rites intended to weed out the weak, sodium deprivation could push endurance to the limit. Neumann recounts a report of Carolina Sioux boys' "hellish cries and howling" during one such rite.

"Consciously or not," Neumann concludes, salt taboos developed because of concrete "advantages for the population as a whole": preservation of health or creation of culturally desirable physical and emotional conditions.

SCIENCE & TECHNOLOGY

Ozone and the Origins of Life

"The Evolutionary Role of Atmospheric Ozone" by A. J. Blake and J. H. Carver, in *Journal of the Atmospheric Sciences* (May 1977), American Meteorological Society, 45 Beacon St., Boston, Mass. 02108.

What source of energy triggered the chemical reactions leading to the evolution of life on earth 3 billion years ago?

Scientists frequently assume that the earth's primitive atmosphere, which contained as little as one-thousandth the current amount of oxygen (O_2), contained correspondingly little ozone (O_3), a gas that absorbs the sun's ultraviolet radiation. In the absence of such an ozone "screen" (which developed later), scientists believe that ultraviolet radiation could have penetrated the atmosphere with sufficient intensity to spark the synthesis of organic molecules.

But the authors, physicists at the University of Adelaide, Australia, contend that such calculations based on models of the earth's primitive atmosphere may be in error. Oxygen and ozone levels, while related, are not directly proportional. Photochemical reactions between water vapor, carbon dioxide, methane, and especially nitrogen also have a significant effect on ozone production. The authors conclude that even with an atmosphere containing only one-thousandth the current oxygen level, the earth would have had an effective ozone screen—thereby ruling out ultraviolet radiation on earth as the energy source responsible for organic synthesis.

The authors suggest two alternate explanations: (1) Electrical discharges within the atmosphere may have supplied the needed energy, or (2) chemical synthesis might have taken place outside the earth's environment. Modern radio astronomers have detected organic molecules in dark, nebular regions of space. Such complex molecules of extraterrestrial origin may have accumulated on the earth's surface as a result of intense meteor showers during the first eon of the planet's history.

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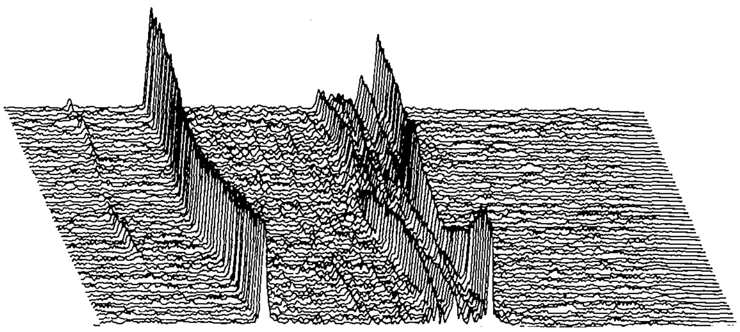

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Pulses of sound passed through ocean currents are distorted by temperature, pressure, and other variables. The resulting "arrival structure" of a sound wave can thus be used to determine conditions along its path.

The Sinews of the Sea

"Acoustic Probing of Ocean Dynamics" by Robert P. Porter, in *Oceanus* (Spring 1977), Woods Hole Oceanographic Institution, Woods Hole, Mass. 02543.

The swirl of ocean waters over much of the earth's surface can determine the weather in New England and the anchovy catch off Peru. But most techniques for tracing currents, eddies, and other ocean phenomena are either too expensive (survey ships) or too superficial (satellite photographs) to reveal the workings of a large tract of water over a long period of time.

With the help of acoustic probing, however, researchers can begin to grasp the dynamics of ocean behavior. Sound can travel great distances through water, writes Porter, an associate scientist at Woods Hole Oceanographic Institution, but its speed will vary with such factors as temperature, pressure, depth, current, and salinity. (As an eddy crosses a transmission path, for example, the intensity of a sound wave can vary by a factor of 10.)

Acoustic probing can be conducted over vast areas—up to 100 km from small, untethered sound emitters suspended in the sea. Pulses can be tracked from widely scattered sites. In one experiment, each pulse of sound emitted from a projector arrived at the receiver in two pulse groups, one 30 milliseconds after the other, in defiance of basic ray acoustics (see figure above). The "arrival structure" resulting from the influence of "ocean variables"—which can disperse, retard, and otherwise distort sound waves—is an implicit record of conditions along the sound's path.

If scientists can "sort out" the relationship between sound and ocean, it will be possible to measure temperature, speed, and countless other critical characteristics of, say, the Gulf Stream by simply passing a sound wave through it and analyzing the arrival structure.