when Austronesian-speaking farmers entered the Philippines. The Negritos apparently adopted Austronesian languages as their own and later developed separate dialects and daughter languages, he asserts. Linguistic shifts of this magnitude suggest "periods of intimate interaction" between foragers and farmers, according to Headland.

Dietary needs helped propel the intimacy of the interaction, Headland says. Tropical rain forests are rich in game and poor in plant food. The lack of cultivated starch foods pushed the Negritos – as well as other rain-forest groups such as the central African pygmies – toward periodic exchanges with farmers and overseas traders, Headland argues.

Human populations certainly are not immune to outside influences, says Napolean A. Chagnon of the University of California, Santa Barbara, "but questions about the past can be partially addressed by studying factors such as population distribution and marriage patterns in horticultural groups." For more than 20 years Chagnon has studied the Yanomamo, South American horticulturalists who plant herbs and bananas and hunt for meat.

Headland and Reid say Chagnon overextended his theorizing when he referred to the Yanomamo in a 1983 book, *Yanomamo: The Fierce People* (Holt, Rhinehart & Winston, New York), as "our contemporary ancestors."

Nevertheless, common social patterns among a number of hunter-gatherer societies around the world, including egalitarian decision-making and communal religious practices, may shed light on behavior in earlier times, Lee says, although such analogies probably cannot extend beyond several thousand years.

Lee thinks critics such as Howell and Schrire mistakenly portray "all science as myth-making" by assuming that scientists' cultural preconceptions inevitably overwhelm careful empirical efforts to reconstruct prehistoric behavior.

Responds Schrire, "Such assertions are based more on an act of faith than on elegant research."

There is, however, an important implication about past behavior gained from insights into longstanding trade between hunter-gatherers and outside groups, says Charles A. Bishop of the State University of New York at Oswego. Evidence that Cro-Magnon clans in Europe entered into elaborate trade networks between 28,000 and 10,000 years ago suggests the majority of hunter-gatherers did likewise for the past 12,000 years, he asserts. Thus, their societies probably consisted of different social levels and were not as egalitarian as Lee and others claim.

Within the last few centuries, Bishop proposes, overexploitation of local resources and dependency on more powerful, technologically advanced neighbors have shattered traditional hunter-gatherer social systems. He maintains that anthropologists study the fallout of this process – groups with few social or political divisions, masquerading as long-isolated populations.

Whatever the truth may be, Headland says the fallout of the ongoing debate over hunter-gatherers is likely to revitalize ethnographic, archaeological and linguistic investigations. For instance, he acknowledges that his contention that most hunter-gatherers engage in commercial foraging "is a theory in need of testing." Researchers checking out his proposal will likely emphasize the ties between a variety of hunter-gatherer societies and the outside world.

The interdependence of hunter-gatherers with outsiders is not a novel notion, having been described by several prominent anthropologists in the past 70 years. But, says Headland, "Today we see the interdependence theory finally coming of age." □

*Next: The strange case of the Tasaday*

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# Solving a mystery in the sands of Mars

Results from the biology instruments that sampled and analyzed the Martian surface from the two Viking landing craft in 1976 failed to make a case for the presence of life on Mars. On the other hand, neither have scientists heretofore succeeded in completely explaining Viking's data by means of inanimate chemistry alone. Now, however, a group of researchers has proposed an answer that they say fits the data in detail, and without the need for Martian life.

In one Viking experiment, a nutrient solution labeled with carbon-14 moistened a bit of Martian "soil," causing the sample to emit gases containing the radioactive carbon in a manner suggesting metabolism. When the soil was again injected with the solution, the amount of gas in the test chamber dropped by 22 percent, and when the sample was heated to kill off any possible microorganisms, the gas production indeed stopped, suggesting life to some.

But when soil was injected with the carbon-14 nutrient solution in a second instrument, called the gas-exchange experiment, it startled Viking scientists by giving off an unexpected quantity of oxygen, which declined rapidly a few hours later. When those samples were heated, they still gave off oxygen, but less of it, suggesting the presence of a chemical oxidant that was broken down by heat.

Viking scientists concluded the experiments failed to support the idea of life on Mars, but no one managed to explain fully what chemistry might account for the surprising data.

Physical chemist Robert C. Plumb of Worcester (Mass.) Polytechnic Institute, together with three of his present and former students, set out to match the Viking results as closely as possible. They used test chambers made of the same materials as Viking's, and report in the April 20 NATURE that their goal was to reproduce quantitatively the same chemical reaction rates, the same 22 percent reduction in the amount of gases produced during the "labeled release" test, the same responses to heating, and more.

A key step in the analysis, says Plumb, resulted from research reported in 1978 by Soviet researchers who proposed that oxygen could become trapped in microscopic pores in the rocky material of the Martian surface. The pores, according to the group, could readily open if exposed to water vapor, which was provided by the nutrient solution in the gas-exchange experiment. This would trigger the abrupt release of oxygen, one of the more dramatic events in the months-long operation of the biology package.

Viking scientists had suggested that superoxides trapped on the sample might have released the oxygen, but Plumb says "superoxides are not stable in the carbon dioxide atmosphere of Mars." Instead, his group cites a 1983 Soviet report, unrelated to Viking, that ultraviolet or X-ray radiation can break down metal nitrates into an oxidizing agent called peroxonitrite (the lander instruments could not detect nitrogen). This compound can oxidize the organic compounds in the nutrient and is destroyed by heat (which would shut off the carbon dioxide production) – again reminiscent of Viking's data.

A third Viking biology instrument, designed to see whether labeled carbon dioxide might be metabolized by hypothetical Martian microorganisms, failed to show results that changed consistently with shifts in heat and humidity, Plumb says, noting another U.S. researcher's suggestion that the test was probably disturbed by the heat-driven transport of dust through the device.

Even if there are no micro-Martians, adds Plumb, future Mars-landing missions should be instrumented to detect peroxonitrite and carbonate on the planet's surface, as well as to confirm a slight alkalinity that would account for the 22 percent carbon dioxide reabsorption reported by Viking. – *J. Eberhart*