European Prehistory Gets Even Older

French researchers argue on the basis of ancient putative stone tools that human ancestors arrived in Europe as much as 2.5 million years ago; some skeptics are half persuaded

"I HAD ASSUMED THAT BREAKING the million-year barrier for the first appearance of human ancestors in Europe would be difficult," says Berkeley anthropologist F. Clark Howell. "But now I am wavering."

Until recently, Howell, like most anthropologists, went along with the conventional wisdom that human ancestors left Africa about a million years ago and first set foot in Europe some time later. Then Howell went to Paris earlier this year to take part in a gathering of archeologists and paleontologists, many of them seeking to give the convention a good jolt. He was impressed: "I think now that somewhere in the range of 1 to 1.5 million years ago there were human ancestors in Europe for sure."

Among the evidence inviting Howell—and many others—to reconsider their views was Eugène Bonifay's arresting report of simple quartz tools from the site of Saint-Eble, at the foot of Mont Coupet in south-central France. Bonifay, an archeologist at the National Center for Scientific Research in Marseilles and a co-organizer of the Paris meeting, caught people's attention so sharply because of the date he put on the artifacts: a record-breaking—for Europe—2.2 to 2.5 million years ago.

This date for the quartz fragments is fairly secure, because in the layer cake of sediments at the site the fragments are overlain by animal fossils known to be about 2 million years old and by debris from the volcano of Mont Coupet, which formed about 2 million years ago. The remaining crucial uncertainty about Bonifay's quartz fragments is whether they were made by human hand or are simply broken rocks. University of Liverpool paleontologist Alan Turner says, "Saint-Eble has flakes and what look like pebble tools of an early lithic industry. The point is, were these manufactured, or did they occur naturally?" (see box).

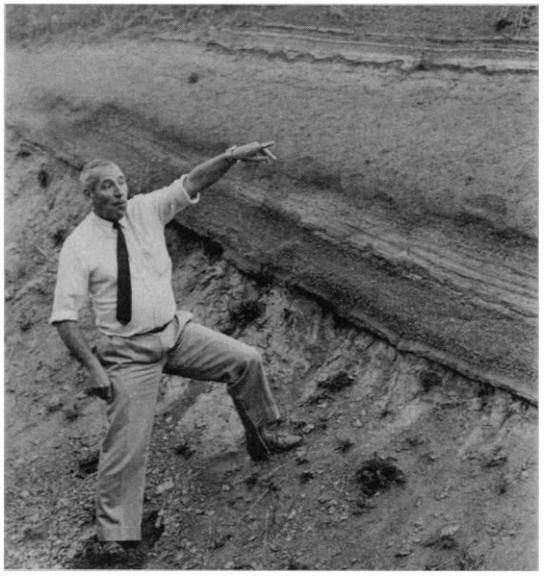
As Eric Delson of the Lehman College, City University of New York, suggests, the evidence in a case like this has to be especially good to be persuasive. "Finding something that is many times older than expected, and that will force people to change all their ideas, is not like finding yet another sidescraper in a Mousterian context. It requires exhaustive evidence. After all, you don't want to convince the fans, you want to convince the skeptics."

For many people there is still sufficient uncertainty about the claims made for the Saint-Eble artifacts that they prefer to hedge their bets. This is why Howell and others are prepared to shift the date for the entry of human ancestors into Europe from something less than 1 million years ago to something in excess of 1 million years. Going all the way to a date of 2.5 million years ago is, however, just too much to swallow at present.

But if Bonifay is correct in his conclusions about Saint-Eble, then a lot of anthropologists will have to change their views even more about a crucial period in human prehistory. "In broad terms, it is agreed that hominids migrated out of Africa between 1 and 1.5 million years ago," says Alan Turner of the University of Liverpool, speaking for the great majority of paleontologists. "There

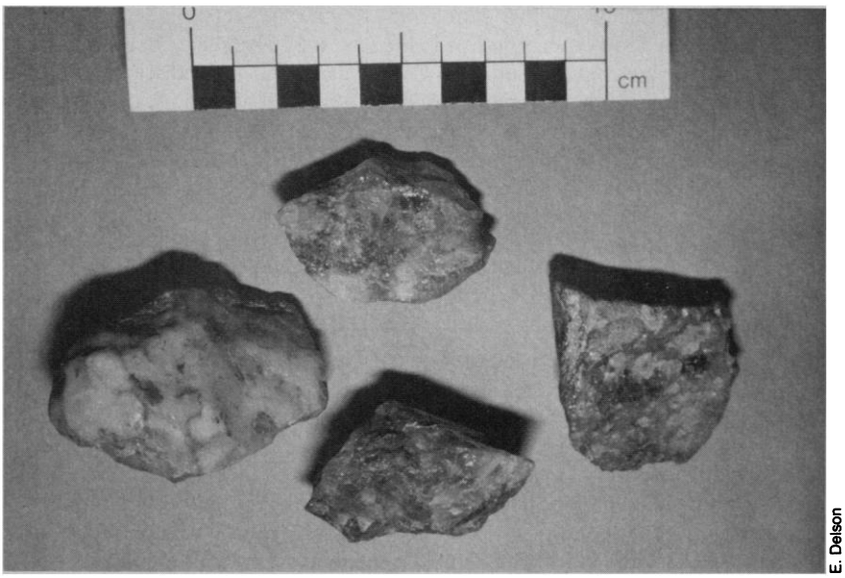
Lewin Leaving

After 9 years on the news staff, Roger Lewin is departing *Science* to devote full-time to book-writing and other free-lance activities. His first project will be a new book to be coauthored with Richard Leakey. Lewin not only by-lined the many articles for which readers will remember him, but also edited the Research News section for 8 years.



S. Ackerman

Roadside geology. *Eugène Bonifay explains the stratigraphy of the Saint-Eble site.*



E. Delson

Ancient tools or just rocks? *At 2.5 million years old, these four putative tools from the site of Saint-Eble would revolutionize European prehistory.*

have been previous claims of earlier dates, particularly in Asia, but these have been disproved. And up to now people have been unwilling to believe anything earlier than 1 million years in Europe." A single, confirmed European site well in excess of that date would undercut this consensus: hence the potential importance of Saint-Eble.

The traditional view of the human lineage has portrayed a succession of three species. First is *Homo habilis*, which evolved in Africa by about 2 million years ago and never strayed outside the continent; next is the peripatetic *H. erectus*, which also appeared first in Africa, about 1.6 million years ago, and some populations of which migrated to other parts of the Old World by about 1 million years ago. Most recent is *H. sapiens*, initially appearing about half a million years ago as a variously defined stage often called archaic *H. sapiens* and being succeeded in turn by modern *H. sapiens* within the last 200,000 years.

According to this view, the only hominid species to have made it out of Africa are *H. erectus* and various forms of *H. sapiens*. But if migrations had occurred more than 2 million years ago, as Bonifay's new evidence implies, then the species involved would probably be *H. habilis*. Yves Coppens of the Collège de France is more than prepared to accept the new thinking: he even calls for expanding the term "human" to include *H. habilis* (traditionally viewed as prehuman) and considers that this evolutionary phase "would correspond well to the creator of those first tools found in Europe."

Says Howell: "Coppens is very bold and often right. In eastern Africa, *H. habilis* appears very suddenly in the fossil record and disappears suddenly from it as well. This could make sense if there was some sort of migration from the African continent toward Europe." In Howell's view, however, there is no convincing evidence yet for *H. erectus*, let alone *H. habilis*, in Europe.

This goes to the heart of the problem of early prehistory in Europe. "It's important to remember that everything older than half a million years is an *inference* of human occupation, based on the identification of tools rather than fossils," says Delson. "To date, no European hominid fossils older than 500,000 to 600,000 years have been established to everyone's satisfaction." In this sense, Bonifay's claim of pushing back the evidence of human habitation in Europe follows the usual line: it is based on putative stone tools, not fossils.

The few fossils that have been found in earlier sites have generated more disagreement than consensus. Howell's view that "I see no solid evidence for *H. erectus* [fossils] in Europe" receives support from some colleagues, particularly in the United States and Britain, but is opposed on grounds of logic by some continental Europeans. Says Jean-Marie Cordy of the University of Liège, "I think everyone agrees that there are sites of occupation in Europe with an age of at least 1 million years, perhaps 1.5 million. We don't have human remains from sites of that age, but we have the evidence in the form of artifacts, and I don't see how hominids of 1 million years ago can be anything other than *H. erectus*—even if it's an evolved form of *H. erectus*."

Other Europeans disagree with Howell on the grounds of the fossils themselves. For instance, a 400,000-year-old fossil skull from Arago Cave in the French Pyrenees is identified by its excavators, Henri and Marie-Antoinette de Lumley, as *H. erectus*. But there are many like Howell who argue that the specimen is some kind of archaic *H. sapiens*. The famous Petralona skull, of Greece, is in a similar paleontological limbo. Excavated almost 30 years ago, this skull remains an enigma because of its mixture of primitive and advanced features. "The face resembles *H. sapiens neanderthalensis*, but the back of the skull looks like *H. erectus*," says Louis de Bonis of the University of Poitiers.

Petralona's problems don't end there,

When Is a Rock an Artifact?

Where does nature stop and technology begin? This is the question confronting archeologists who seek to identify very early stone fragments as tools. Says Jean-Marie Cordy of the University of Liège: "Before talking about tools we must talk about artifacts, which is a much broader category. The problem is that the further back in the past you go, the more primitive the toolmaking technique is. And the more primitive the technique, the more an artifact is going to resemble something formed by natural forces and not by a human at all."

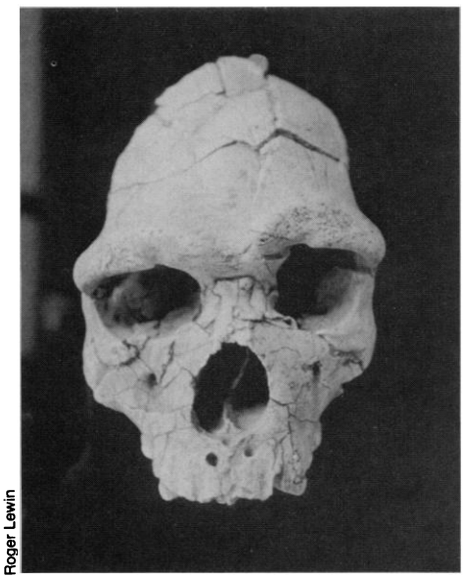
That is why, when archeologists and paleontologists gathered at the NATO Advanced Research Workshop in Paris, France, last April, most had trouble convincing themselves that they could accept new evidence suggesting habitation by human ancestors of the European continent as early as 2.5 million years ago. After viewing scores of line drawings and photographs, participants in the workshop remained divided as to what they had seen. Simple pebble tools can look just like broken stones, for example, because in effect this is what they are; and there are many ways in which even experts can be fooled. Gerhard Bosinski of the University of Cologne pointed out that volcanoes can produce "tephrafacts," objects that look remarkably like the flakes, cores, and pebble tools formed by early humans but in fact are naturally occurring stone that has fractured during a volcanic explosion.

Ideally, all postulated tools would be examined by, say, scanning electron microscopy for traces of the marks left by cutting, scraping, or other use. However, artifacts can vary enormously in their state of preservation, and sometimes what is well preserved in the eyes of a prehistorian may be useless to a specialist in scanning electron microscopy.

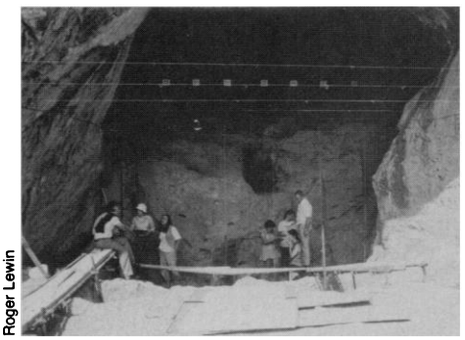
Faced with this conundrum, Jean-Michel Geneste of the Ministry of Culture in Bordeaux recommended more comparison among putative artifacts from many sites, so that some kind of identifiable pattern may be discerned for true artifacts. "The sites to be preferred are those with an identifiable fauna and other means of dating, as well as lithic technology," he said. Eric Delson of Lehman College, City University of New York, added that "there are five criteria that a site must meet before you can claim to have established the presence of humans. These are clear dating; artifacts that are unmistakably made by human intention; a faunal context; traces of fire or other human activity, apart from the artifacts; and human remains."

So far, none of the European sites now under scrutiny has passed the full test. In fact, very rarely in the world's prehistorical record do all the elements needed for study come together at one site.

Perhaps best poised for acceptance into the general prehistorical record is Soleihac in southeast France. Situated on an ancient lakeshore, Soleihac has been confidently dated to 930,000 before present by paleomagnetic as well as other techniques. "The fauna and the climatological data are also in accord for this date," says Eugène Bonifay of the National Center for Scientific Research in Marseilles. The site contains numerous stone tools. In addition, Bonifay claims for Soleihac the distinction of "the oldest dwelling structures now known in Europe." ■ **S.A.**



Roger Lewin



Roger Lewin

Qui est-ce? *The Arago fossil face (top), recovered from a cave site in the Pyrenees (bottom), is said by some to be* Homo erectus *and by others to be a form of* Homo sapiens.

however. "It's difficult to assign a date to this specimen because we don't know exactly which layer it was found in," de Bonis continues. "The date you come up with depends on the method of dating used, as well as on the level of the deposit you think is appropriate." Estimates range from 600,000 to less than 200,000 years old.

With both age and identity in dispute for many of the earliest European fossils, it's not surprising that researchers turn to stone tools to follow the trail of hominid history. Specialists from a dozen countries gathered at the Paris meeting to discuss archeological sites ranging from Israel to the Iberian peninsula. "Our goal was to bring together the paleontologists, the archeologists, and the prehistorians and to draw up an inventory of the oldest sites, to shed some light on the first appearance of humans in Europe," says Bonifay.

The Massif Central of France was not the only European region with claims of early human occupation. One site, Senèze, an ancient riverbank in the Haut-Loire, contains crude pebble tools: "rare, but incontestably of human origin," says Bonifay. The tools are dated to 2 million years ago. And Spain, Italy, Germany, Czechoslovakia, Romania, and Turkey also have candidate sites that would overturn the idea of a relatively recent arrival in the continent.

But Howell argues that these sites are in "the wrong places." If human ancestors really were in western and central Europe 2 million years ago, he reasons, it should be possible to find fossil and archeological traces of them even earlier in Turkey, Bulgaria, Romania, and Hungary. "I feel sure they arrived in Europe from the south and east," says Howell. "But so far, most of the early sites we're finding are in the northern Mediterranean. We're not yet able to track hominid dispersal into Europe."

Nevertheless, the consensus at the meeting in Paris was that the continent may have been occupied much earlier than most researchers had previously been prepared to accept. Putative artifact sites in the Massif Central, for example, have now been provisionally dated to 1.3, 1.5, and over 2 million years ago. And some participants in the conference were able to inspect them firsthand, on a field trip arranged by Bonifay.

Says Turner, "What Bonifay has done is open the debate and force people to go and look for themselves. It's important that people get together and examine the evidence on the ground. It was a very useful meeting in this sense." ■ SANDRA ACKERMAN

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Rifkin Tries to Stop Galileo Launch

On 28 September, activist Jeremy Rifkin and two antinuclear groups asked the U.S. District Court in Washington, D.C., for an injunction against the National Aeronautics and Space Administration's (NASA's) attempt to launch the Galileo spacecraft to Jupiter aboard the space shuttle Atlantis, an event now scheduled for 12 October.

The plaintiffs include the Christic Institute, a Washington-based public interest law firm; the Florida Coalition for Peace and Justice, a statewide activist group; and Rifkin's own Foundation on Economic Trends. As *Science* went to press, their hearing date was scheduled for 10 October.

The groups allege that the launch poses an unacceptable risk to the public because of Galileo's two Radioisotope Thermoelectric Generators, which are designed to provide the spacecraft with power from the radioactive decay heat of some 20 kilograms of plutonium oxide. They assert that a Challenger-like explosion could disperse the plutonium, which is a potent carcinogen when it lodges in the lungs or bones, and thus render large areas of Florida uninhabitable.

Nonsense, says Dudley G. McConnell, the NASA official in charge of the environmental impact statement on the Galileo launch. The number that Rifkin quotes for the probability of plutonium release, 1 chance in 430, "is no number that we recognize." If risk is defined as the consequences of an accident times the probability of its happening, he says, "then the average individual risk of cancer mortality [in any given accident scenario] is *never* more than 1 in 100 million."

Not surprisingly, however, Rifkin and company aren't buying it. "We are saying that NASA's final environmental impact statement is grossly inadequate," says Rifkin. The injunction suit charges that the agency has deliberately used overoptimistic risk assessments and, moreover, has refused to consider alternative power sources.

Not true, McConnnell replies. NASA did two independent risk analyses, one by the space shuttle office and one by the new safety office that was set up in the aftermath of Challenger. Neither found any significant risk. Simultaneously, still another analysis was carried out by the Interagency Nuclear Safety Review Panel. And with few exceptions, mostly due to differences in modeling assumptions, its findings were consistent with those of the other studies.

NASA argues, moreover, that there is no alternative power source for Galileo. If the spacecraft were equipped with solar arrays adequate for the faint sunlight near Jupiter it would weigh an extra 500 kilograms, too much for any U.S. launch vehicle to get it there. Besides, the solar cells would quickly fry in the giant planet's radiation belts.

Still, NASA is taking the injunction threat very seriously. Since Galileo's launch window lasts only from 12 October to 21 November, a long legal battle could force a delay in the mission until the next opportunity in May 1991, at a cost measured in the hundreds of millions of dollars. Lawyers at NASA and at the Justice Department have already been briefed.

Says NASA spokesman Charles Redmond, "We have great concern that a project that has suffered nearly a decade of delay be subjected to another delay. Is that in the best interest of the country?"

■ M. MITCHELL WALDROP