

## Symbols in the Stone Age

Archaeologists have long agreed that the artwork of the later ice age in Europe (a period extending from roughly 10,000 to 37,000 years ago) cannot be considered art for art's sake. Although many of the drawings and carvings that have been discovered are of a high artistic caliber, particularly in southern France and northwestern Spain, it is obvious they were not intended merely for aesthetic contemplation. Many of the celebrated French cave paintings, for example, were executed on walls to the rear of the caves where there is very little light; often they were drawn directly on top of earlier pictures, without regard to the resulting artistic composition.

Since the animals portrayed were often the prey of ice age hunters, the traditional theory has held the images to be elements of a hunting ritual. The theory, says Dr. Elwyn Simons, a paleontologist at Yale University, was that "The artwork represents some kind of hunting magic." A more recent theory interprets the images in terms of sexual symbolism.

**These interpretations** are too limited, says Alexander Marshack, an archaeological researcher with the Peabody Museum of Archeology and Ethnology. Having spent the past six years in a microscopic re-examination of ice age artifacts, Marshack believes there is a great deal more than just hunting, fertility or sexual references to be seen.

Marshack argues, in research to be published in France and Italy this spring, that ice age art reveals a consistent and complex pattern of symbolic and notational meaning, the earliest complex system of symbols yet found. The symbolism, Marshack says, indicates a far greater development of intellectual skills and a more precise observation of the natural world than archaeological theory has thought possible for ice age man.

Because formal writing began alongside agriculture, which did not develop until thousands of years after the end of the ice age, archaeologists have not looked for complex systems of symbol-making in early prehistoric culture. "Nobody has examined the whole body of ice age artifacts with a strict analytic methodology before," Marshack points out.

As an example of ice age symbolism, Marshack has analyzed a reindeer-antler baton discovered in France in 1885 and dated at roughly 12,000 years of age. Somewhat over a foot long, with a hole bored at one end, the baton is carved with images includ-



*Marshack finds unexpected pattern.*

ing plants, fish and mammals.

"Most of the images are carved with incredible realism," Marshack says, "but the important thing is that all the images have a spring and summer reference." There is a male salmon of the spawning season, for instance, and three plants at different stages of growth. One is a young spring shoot, one a branch in full leaf and one a flower. "Other images are as precisely seasonal," Marshack notes, "and the different creatures come from different realms in the hunters' territory." The baton also contains an ibex head marked by an X. "Other ibex heads, and other animals, are symbolically marked in ice age art," he says.

Previous studies of the baton without the help of a microscope had overlooked many details. Some of the plants had been labeled harpoons, and most of the smaller images were considered indecipherable.

Marshack speculates that the images on the baton are part of an ice age system of symbol-making, and a complementary mythology, designed to explain the seasonal reappearance of plants and animals. But the baton and its symbolic representations are only one small part of an intricate system of notation, he claims. "There are hundreds of other aspects. The tradition of symbolism is very complex."

**Most archaeologists** and anthropologists in the United States have not yet seen Marshack's data, the bulk of which is to be published in this country in the fall. Even so, his findings are attracting attention. Dr. Simons, who has not seen the research, finds the outline of Marshack's theory "plausible and very interesting." And Dr. Clark Howell, an anthropologist at the University of Chicago who is acquainted with the evidence, agrees the theory is highly significant and adds, "I think he has pretty well proved his case."

## Road is cleared for FDA

Ever since 1962 when Congress passed the Kefauver-Harris amendments empowering the Food and Drug Administration to demand proof of efficacy as well as safety of drugs on the market, the FDA's authority to apply its power retroactively has been challenged. At issue was not so much its authority to act at all but its right to insist that older drugs meet the same high standards of proof that apply to compounds approved since 1962.

**A landmark case** just decided in Ohio says that it has that right. If the decision stands through the Supreme Court, the floodgates to swift and extensive FDA action will open.

The Ohio contest challenged FDA's power to ban from the market Panalba, a combination antibiotic that brings the Upjohn Company of Kalamazoo, Mich., \$1.5 million a year in sales (SN: 7/5, p. 6). But its ramifications reach far beyond Panalba itself, extending to all combination antibiotics and to other compounds accused of being unsafe, ineffective or both.

Backed by a review conducted by the National Academy of Sciences, the FDA contended that Panalba, a fixed combination of tetracycline and novobiocin, is ineffective and that, because of dangers associated with its novobiocin component, is unsafe.

Over Upjohn's objections, the Court of Appeals in Cincinnati ruled that because of the threat to health, the drug agency was justified in its attempt to remove Panalba without granting the company a lengthy prior hearing.

According to a spokesman for the Pharmaceutical Manufacturers Association, which represents most of the major drug houses in the United States, PMA is particularly unhappy with this decision because it significantly fortifies FDA's power to act first and talk later.

Further, the three-man panel of judges upheld FDA's authority to apply the same criteria to pre- and post-1962 drugs. The FDA, under the amendments, must demand "substantial evidence" of safety and efficacy. In a regulation promulgated Sept. 19, the agency spelled out the conditions of substantial evidence it had been imposing since 1962. A drug, it said, must be evaluated in controlled clinical trials, employing a reasonable number of patients whose disease state is clearly defined. The compound must be compared to a placebo—or in some cases, an active drug—in double-blind studies. Only occasionally, FDA said, would it accept the kind of historical data—clinical experience and general acceptance in

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the medical profession—on which Upjohn sought to rely.

Because controlled studies did not become routine until a few years ago, most drug houses do not have, and have not subsequently obtained, this type of data to support older products. They were hoping that in evaluating a drug's efficacy, FDA would accept the more generalized historical evidence. FDA would not, and the court says it does not have to.

As a consequence of the court ruling, if FDA questions the efficacy of a marketed drug, the manufacturer must go out and produce the necessary data if it can.

FDA, at present, declines to say how it plans to implement the court decision, but when the last roadblock is knocked down, it is expected to act against some 90 combination antibiotics, as well as other drugs that the NAS review found to be deficient.

A spokesman for Upjohn says company lawyers have yet to decide what their next move will be. The appeals court gave the company until March 9 to seek a stay before the Supreme Court. □

#### POLLUTION STANDARDS

### Planning Philadelphia's air

Air quality standards for the three-state Philadelphia Air Quality Control Region were approved March 2 by the Health, Education and Welfare Department's Air Pollution Control Administration, the first such regional approval under the 1967 amendments to the Clean Air Act.

**The region**—which includes parts of Pennsylvania, New Jersey and Delaware—must submit implementation plans, including emission standards and enforcement procedures, by May 11. The air quality standards define ambient air goals, but the emission standards will apply to actual emissions from industrial plants and other air polluters, and thus will be the means by which the region hopes to meet its goals.

Air quality standards—and the emission standards that will follow—apply to sulfur oxides and particulates, the only two pollutants for which HEW has issued criteria under the 1967 amendments. Although the three states have joined together in the Air Quality Region, the standards approved by HEW differ for each state. All fall within the HEW criteria calling for a maximum of 80 micrograms of particulates and 115 micrograms of sulfur oxides per cubic meter. Delaware's standards are the most stringent.

Reductions as high as 70 percent for sulfur oxides and 56 percent for particulates will be achieved if the goals are met. □

#### LUNAR QUARANTINE

### A puzzle of toxicity

Scientists studying the samples of lunar soil returned from the moon by Apollo 11 and 12 are united in unambiguously emphasizing that they contain no evidence of life forms or precursors of life forms.

Yet a puzzle of another kind with implications for back contamination has arisen. Soil from Apollo 11 core tube samples has had a toxic effect on earth bacteria. This information, which Dr. Gerald Taylor, a scientist at the Manned Spacecraft Center, describes as preliminary, was known to members of the Lunar Quarantine Review Committee of the National Academy of Sciences' Space Science Board. It was one reason among several for a recommendation that full quarantine procedures be continued through the Apollo 13 flight in April.

After receiving the committee's report last weekend the National Aeronautics and Space Administration decided to abide by the recommendation. The NASA decision was announced formally in Washington Monday without reference to the toxicity evidence. The quarantine decision, says Chester M. Lee, Apollo 13 mission director, was "based solely upon the fact that a segment of the scientific community considers the hilly upland site to constitute a new lunar environment in comparison with Apollo 11 and 12."

The evidence of toxicity emerged when the NASA scientists in Houston subjected three types of bacteria to four types of lunar soil samples. The bacteria grew in three, but died when subjected to the fourth—the Apollo 11 core tube soil sample.

**The bacteria** chosen for the test represented a cross-section of terrestrial organisms: *Azotobacter vinelandii*, a common soil bacteria; *Staphylococcus aureus*, which caused a rash on the Apollo 12 crew, and *Pseudomonas aeruginosa*, a common laboratory bacteria.

The four soil types exposed consisted of two groups of randomly collected surface soil and two core tube samples, one from each mission.

The scientists have not determined what is responsible for the toxicity. They are repeating the experiments with fresh material from Apollo 11 and 12 core tube samples. "We are involved in a complicated process of extracting the soil in an attempt to isolate the toxic agent," says Dr. Taylor.

Since the source of the toxicity is still unknown, Dr. Taylor believes the decision to continue the quarantine for the next flight is a prudent and necessary precaution.

The decision conflicted with a recommendation in January by the Interagency Committee on Back Contamination (ICBC) to drop quarantine restrictions. Later in January, the planetary biology committee, a subcommittee of NASA's Space Science Applications Steering Committee, strongly opposed the ICBC recommendation. Dr. Richard S. Young, steering committee chairman, explained that in question were several "observed biological responses to lunar soil still unexplained.

"Although most likely these responses do not represent a terrible hazard to the earth," he said, his committee felt more investigation was needed.

"Although lunar geologists assure us that the Apollo 11 and 12 soil samples are representative of 95 percent of total lunar soil, that is not enough," says Dr. Young. "We can't be assured until the selenologists are 99.999 percent sure."

During Apollo 13 three 10-foot holes will be drilled into the lunar regolith at the Fra Mauro highland landing site. Two holes are for temperature probes to measure the flow of heat to the surface. The third is to obtain an eight-foot core sample. The Apollo 11 core tube sample was only one foot in depth, but the astronauts had difficulty driving the core tube into the regolith. The sample may have been the "native moon itself" rather than a mixture of native soil and meteoritic material, Dr. Taylor suggests.

Selenologists agree that the surface soil, sterilized by radiation and temperature changes, is devoid of life on the moon, although plants grown in moon soil flourished on earth. Dr. Taylor's question was whether deeper protected soil could support life. The toxicity of the Apollo 11 core sample could mean that the deeper one digs the more toxic the soil becomes, but Dr. Taylor concedes that so little is known that the opposite could also be true.

Nothing is yet known for sure about the native moon soil, stresses Dr. Young. Scientists opposing quarantine have claimed that soil from deep within the lunar regolith has been studied on the surface. Dr. Young points out that they really don't know yet the depths of the mixing process.

Dr. Allan H. Brown, chairman of the final NAS review committee, stated before the final decision that his board would "vote one way or the other for good scientific reasons—and not give up quarantine because it is expensive or because the astronauts do not like it," or because it delays delivery of lunar sample material. □