MAN THE FIRE-MAKER

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MAN THE FIRE-MAKER

His unique evolution is largely due to his ability to turn heat to his own ends. Even before he learned to bake clay and smelt metals he used fire to change himself and the face of the earth

by Loren C. Eiseley

Man, it is well to remember, is the discoverer but not the inventor of fire. Long before this meddling little Prometheus took to experimenting with flints, then matches and finally (we hope not too finally) hydrogen bombs, fires had burned on this planet. Volcanoes had belched molten lava, lightning had struck in dry grass, winds had rubbed dead branches against each other until they burst into flame. There are evidences of fire in ancient fossil beds that lie deep below the time of man.

Man did not invent fire but he did make it one of the giant powers on the earth. He began this experiment long ago in the red morning of the human mind. Today he continues it in the midst of coruscating heat that is capable of rending the very fabric of his universe. Man's long adventure with knowledge has, to a very marked degree, been a climb up the heat ladder, for heat alone enables man to mold metals and glassware, to create his great chemical industries, to drive his swift machines. It is our intention in this article to trace man's manipulation of this force far back into its ice-age beginnings and to observe the part that fire has played in the human journey across the planet. The torch has been carried smoking through the ages of glacial advance. As we follow man on this journey, we shall learn another aspect of his nature: that he is himself a consuming fire.

At just what level in his intellectual development man mastered the art of making fire is still unknown. Neanderthal man of 50,000 years ago certainly knew the art. Traces of the use of fire have turned up in a cave of Peking man, the primitive human being of at least 250,000 years ago who had a brain only about two thirds the size of modern man's. And seven years ago Raymond Dart of Witwatersrand University announced the discovery in South Africa of *Australopithecus prometheus,* a man-ape cranium recovered from deposits which he believed showed traces of burned bone.

This startling announcement of the possible use of fire by a subhuman creature raised a considerable storm in anthropological circles. The chemical identifications purporting to indicate evidence of fire are now considered highly questionable. It has also been intimated that the evidence may represent only traces of a natural brush fire. Certainly, so long as the South African man-apes have not been clearly shown to be tool users, wide doubts about their use of fire will remain. There are later sites of tool-using human beings which do not show traces of fire.

Until there is proof to the contrary, it would seem wise to date the earliest use of fire to Peking man—*Sinanthropus.* Other human sites of the same antiquity have not yielded evidence of ash, but this is not surprising, for as a new discovery the use of fire would have taken time to diffuse from one group to another. Whether it was discovered once or several times we have no way of knowing. The fact that fire was in worldwide use at the beginning of man's civilized history enables us to infer that it is an old human culture trait—doubtless one of the earliest. Furthermore, it is likely that man used fire long before he became sophisticated enough to produce it himself.

In 1865 Sir John Lubbock, a British banker who made a hobby of popular writing on science, observed: "There can be no doubt that man originally crept over the earth's surface, little by little, year by year, just, for instance, as the weeds of Europe are now gradually but surely creeping over the surface of Australia." This remark was, in its time, a very shrewd and sensible observation. We know today, however, that there have been times when man suddenly made great strides across the face of the earth. I want to review here one of those startling expansions—a lost episode in which fire played a tremendous part. To make its outlines clear we shall have to review the human drama in three acts.

The earliest human-like animals we can discern are the man-apes of South Africa. Perhaps walking upright on two feet, this creature seems to have been roaming the East African grasslands about one million years ago. Our ancestor, "proto-man," probably emerged from the tropics and diffused over the region of warm climate in Eurasia and North Africa. He must have been dependent upon small game, insects, wild seeds and fruits. His life was hard, his search for food incessant, his numbers were small.

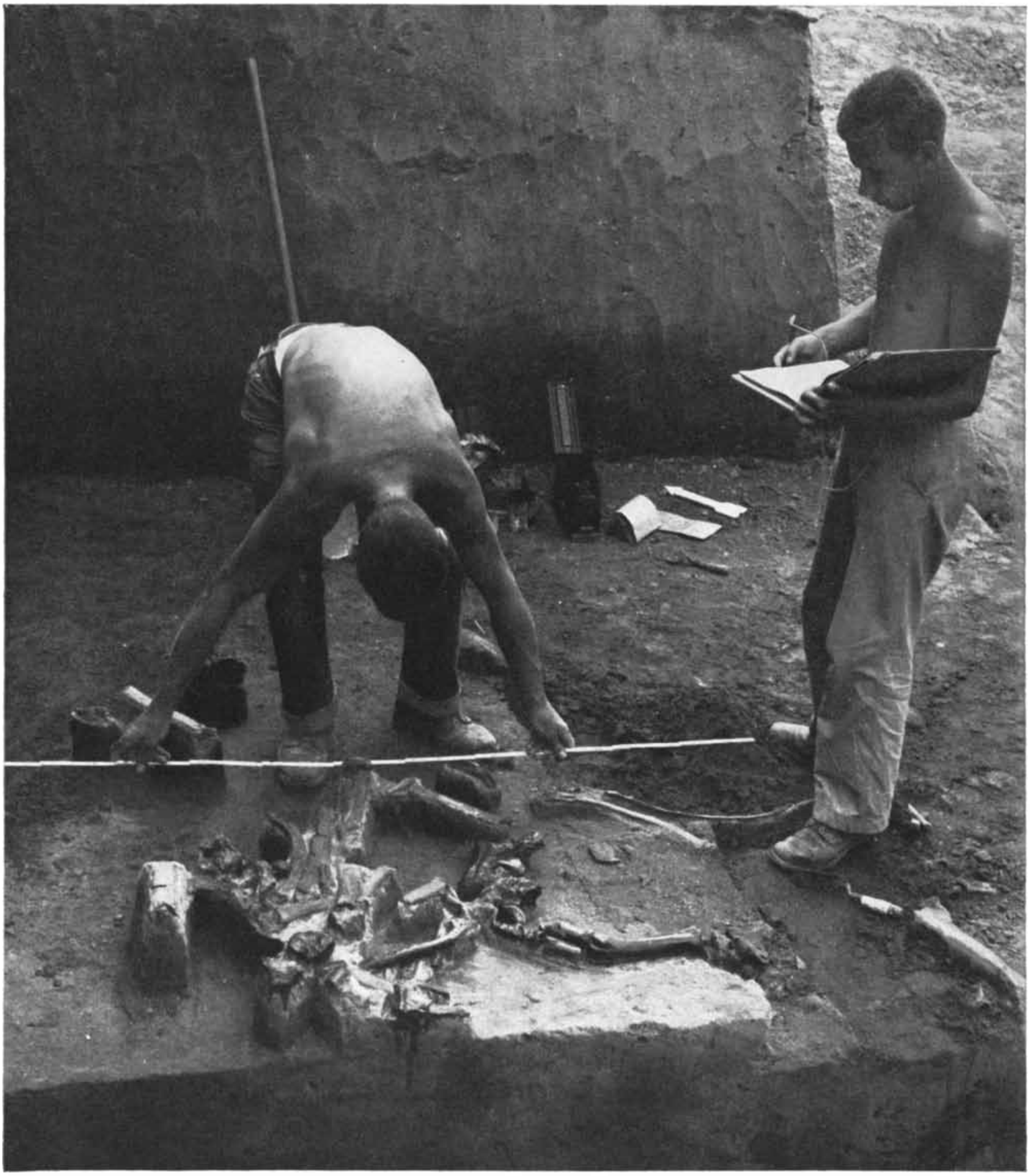
The second stage in human history is represented by the first true men. Paleoanthropic man is clearly a tool user, a worker in stone and bone, but there is still something of the isolated tinkerer and fumbler about him. His numbers are still sparse, judging from the paucity of skeletal remains. Short, stocky and powerful, he spread over the most temperate portions of the Afro-Eurasiatic land mass but never attempted the passage through the high Arctic to America. Through scores of millennia he drifted with the seasons, seemingly content with his troglodyte existence, making little serious change in his array of flint tools. It is quite clear that some of these men knew the use of fire, but many may not have.

The third act begins some 15,000 or

EVIDENCE OF FIRE made by man goes back to the Second Glacial Period. Shown here is the Red Smoke site in the Medicine Creek Reservoir area of Nebraska, where E. Mott Dávis and his colleagues have found such evidence for the later Fourth Glacial.

FIRE PIT (*lower left*) at the Red Smoke site contained charcoal, charred bone fragments and fired earth. A sample of charcoal from a slightly later fireplace above the blackboard in the rear was found by the radiocarbon method to have an age of 8,862 ± 230 years.

20,000 years ago. The last great ice sheet still lies across northern Europe and North America. Roving on the open tundra and grasslands below those ice sheets is the best-fed and most varied assemblage of grass-eating animals the world has ever seen. Giant long-horned bison, the huge wild cattle of the Pleistocene, graze on both continents. Mammoth and mastodon wander about in such numbers that their bones are later to astonish the first American colonists. Suddenly, into this late paradise of game, there erupts our own species of man—*Homo sapiens*. Just where he came from we do not know. Tall, lithe, long-limbed, he is destined to overrun the continents in the blink of a geological eye. He has an excellent projectile weapon in the shape of the spear thrower. His flint work is meticulous and



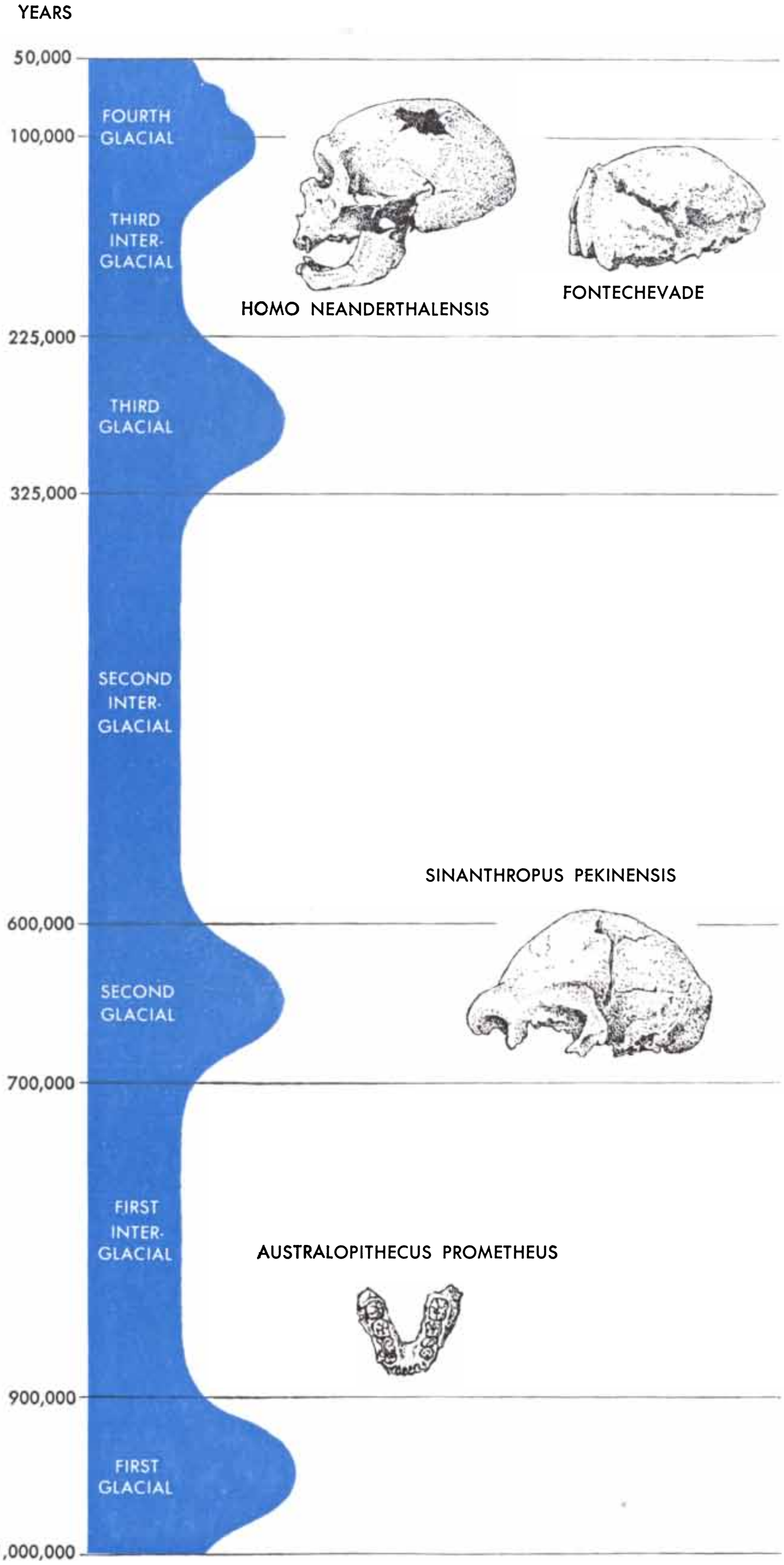
BURNED BISON BONES were found at the Red Smoke site 10 feet below the fire pit shown at the bottom of the preceding page. Near the bones lay a stone knife. Here two workers from the University of Nebraska State Museum measure the bones and map their location. The bones, which are shiny because they were protected with shellac, included ribs, vertebrae, a pelvis and most of a lower hind leg. They represent the earliest of eight levels of habitation at the site; the dated fireplace represents the latest.

sharp. And the most aggressive carnivore the world has ever seen comes at a time made for his success: the grasslands are alive with seemingly inexhaustible herds of game.

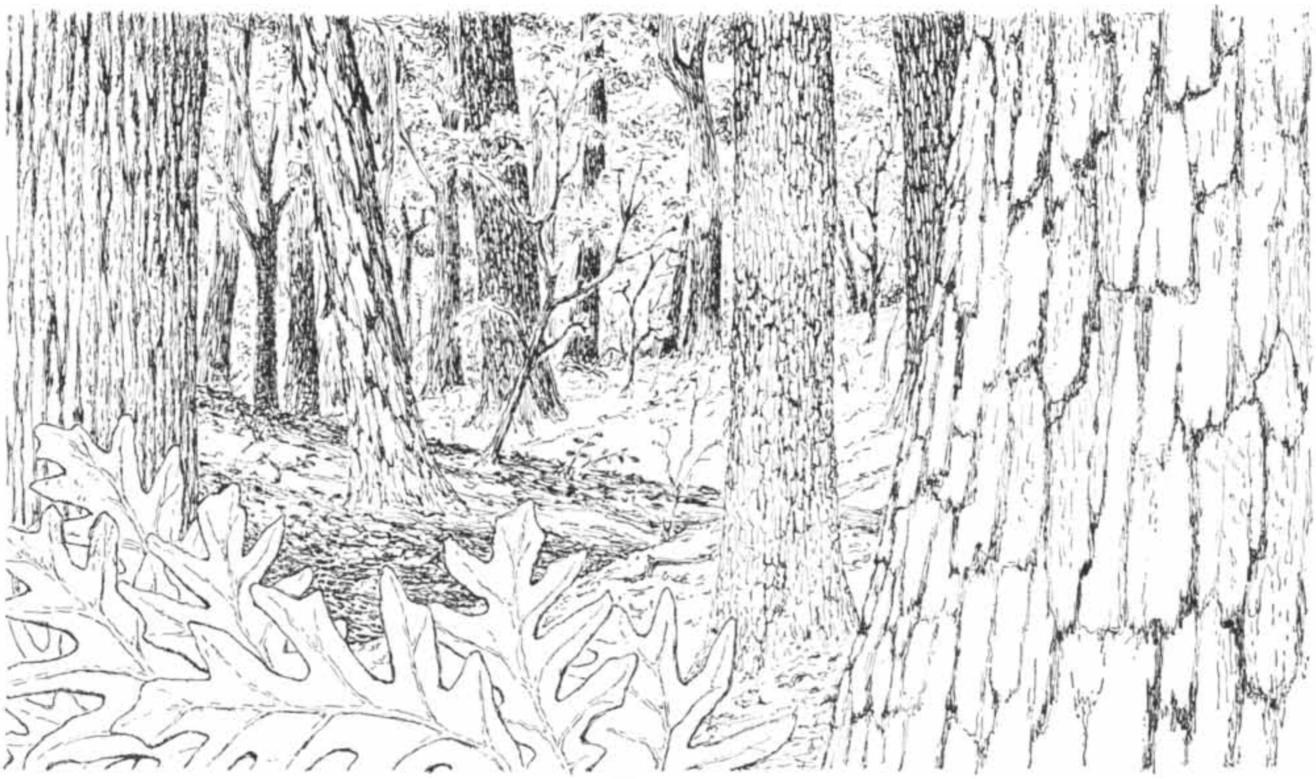
Yet fire as much as flesh was the magic that opened the way for the supremacy of *Homo sapiens*. We know that he was already the master of fire, for the track of it runs from camp to buried camp: the blackened bones of the animals he killed, mute testimony to the relentless step of man across the continents, lie in hundreds of sites in the Old and the New Worlds. Meat, more precious than the gold for which men later struggled, supplied the energy that carried man across the world. Had it not been for fire, however, all that enormous source of life would have been denied to him: he would have gone on drinking the blood from small kills, chewing wearily at uncooked bone ends or masticating the crackling bodies of grasshoppers.

Fire shortens the digestive process. It breaks down tough masses of flesh into food that the human stomach can easily assimilate. Fire made the difference that enabled man to expand his numbers rapidly and to press on from hunting to more advanced cultures. Yet we take fire so much for granted that this first great upswing in human numbers, this first real gain in the seizure of vast quantities of free energy, has to a remarkable degree eluded our attention.

With fire primitive man did more than cook his meat. He extended the pasture for grazing herds. A considerable school of thought, represented by such men as the geographer Carl Sauer and the anthropologist Omer Stewart, believes that the early use of fire by the aborigines of the New World greatly expanded the grassland areas. Stewart says: "The number of tribes reported using fire leads one to the conclusion that burning of vegetation was a universal culture pattern among the Indians of the U. S. Furthermore, the amount of burning leads to the deduction that nearly all vegetation in America at the time of discovery and exploration was what ecologists would call fire vegetation. That is to say, fire was a major factor, along with soil, moisture, temperature, wind, animals, etc., in determining the types of plants occurring in any region. It follows then, that the vegetation of the Great Plains was a fire vegetation." In short, the so-called primeval wilderness which awed our forefathers had already felt the fire of the Indian



FOSSIL FIRE-MAKERS are located in time. At the left is an approximate scale of years. The colored band beside it indicates the advance and retreat of the ice in the glacial and interglacial periods. The early modern man of Fontèchevade made fire, as did Neanderthal man. *Sinanthropus* probably made fire, and it is possible that *Australopithecus* did.



PRE-FIRE VEGETATION in Pennsylvania is reconstructed from an early description. The four closest trees are a tulip (*left*), a shagbark hickory (*second from left*), a sugar maple (*third*) and a white oak (*fourth*). In the foreground are white oak leaves.

hunter. Here, as in many other regions, man's fire altered the ecology of the earth.

It had its effect not only on the flora but also on the fauna. Of the great herds of grazing animals that flourished in America in the last Ice Age, not a single trace remains—the American elephants, camels, long-horned bison are all gone. Not all of them were struck down by the hunters' weapons. Sauer argues that a major explanation of the extinction of the great American mammals may be fire. He says that the aborigines used fire drives to stampede game, and he contends that this weapon would have worked with peculiar effectiveness to exterminate such lumbering creatures as the mammoth. I have stood in a gully in western Kansas and seen outlined in the earth the fragmented black bones of scores of bison who had perished in what was probably a man-made conflagration. If, at the end of Pleistocene times, vast ecological changes occurred, if climates shifted, if lakes dried and in other places forests sprang up, and if, in this uncertain and unsteady time, man came with flint and fire upon the animal world about him, he may well have triggered a catastrophic decline and extinction. Five thousand years of man and his smoking weapon rolling down the wind may have finished the story for many a slow-witted animal species. In the great scale of geological time this act of destruction amounts to but one brief hunt.

Man, as I have said, is himself a flame. He has burned through the animal world and appropriated its vast stores of protein for his own. When the great herds failed over many areas, he had to devise new ways to feed his increase or drop back himself into a precarious balance with nature. Here and there on the world's margins there have survived into modern times men who were forced into just such local adjustments. Simple hunters and collectors of small game in impoverished areas, they maintain themselves with difficulty. Their numbers remain the same through generations. Their economy permits no bursts of energy beyond what is necessary for the simple age-old struggle with nature. Perhaps, as we view the looming shadow of atomic disaster, this way of life takes on a certain dignity today.

Nevertheless there is no road back; the primitive way is no longer our way. We are the inheritors of an aggressive culture which, when the great herds disappeared, turned to agriculture. Here again the magic of fire fed the great human wave and built up man's numbers and civilization.

Man's first chemical experiment involving the use of heat was to make foods digestible. He had cooked his meat; now he used fire to crack his grain. In the process of adopting the agricultural way of life he made his second chemical experiment with heat: baking pottery. Ceramics may have sprung in part from the need for storage vessels to protect harvested grain from the incursions of rats and mice and moisture. At any rate the potter's art spread with the revolutionary shift in food production in early Neolithic times.

People who have only played with mud pies or made little sun-dried vessels of clay are apt to think of ceramics as a simple art. Actually it is not. The sun-dried vessels of our childhood experiments would melt in the first rain that struck them. To produce true pottery one must destroy the elasticity of clay through a chemical process which can only be induced by subjecting the clay to an intense baking at a temperature of at least 400 or 500 degrees centigrade. The baking drives out the so-called water of constitution from the aluminum silicate in the clay. Thereafter the clay will no longer dissolve in water; a truly fired vessel will survive in the ground for centuries. This is why pottery is so important to the archaeologist. It is impervious to the decay that overtakes

FIRE VEGETATION in an area deliberately burned over by the Indians is similarly reconstructed from an early account. The forest has been replaced by grassland. The three trees are young oaks. In the foreground are grassland plants such as strawberry.

many other substances, and, since it was manufactured in quantity, it may tell tales of the past when other clues fail us.

Pottery can be hardened in an open campfire, but the results can never be so excellent as in a kiln. At some point the early potter must have learned that he could concentrate and conserve heat by covering his fire—perhaps making it in a hole or trench. From this it was a step to the true closed kiln, in which there was a lower chamber for the fire and an upper one for the pottery. Most of the earthenware of simple cultures was fired at temperatures around 500 degrees centigrade, but really thorough firing demands temperatures in the neighborhood of 900 degrees.

After man had learned to change the chemical nature of clay, he began to use fire to transform other raw materials—ores into metals, for instance. One measure of civilization is the number of materials manipulated. The savage contents himself with a few raw materials which can be shaped without the application of high temperatures. Civilized man uses fire to extract, alter or synthesize a multitude of substances.

By the time metals came into extended use, the precious flame no longer burned in the open campfire, radiating its heat away into the dark or flickering on the bronzed faces of the hunters. Instead it roared in confined furnaces and was fed oxygen through crude bellows. One of the by-products of more intensified experiments with heat was glass—the strange, impassive substance which, in the form of the chemist's flask, the astronomer's telescope, the biologist's microscope and the mirror, has contributed so vastly to our knowledge of ourselves and the universe.

We hear a good deal about the "Iron Age," or age of metals, as a great jump forward in man's history; actually the metals themselves played a comparatively small part in the rise of the first great civilizations. While men learned to use bronze, which demands little more heat than is necessary to produce good ceramics, and later iron for tools and ornaments, the use of metal did not make a really massive change in civilization for well over 1,500 years. It was what Leslie White of the University of Michigan calls the "Fuel Revolution" that brought the metals into their own. Coal, oil and gas, new sources of energy, combined with the invention of the steam and combustion engines, ushered in the new age. It was not metals as tools, but metals combined with heat in new furnaces and power machinery that took human society off its thousand-year plateau and made possible another enormous upswing in human numbers, with all the social repercussions.

Today the flames grow hotter in the furnaces. Man has come far up the heat ladder. The creature that crept furred through the glitter of blue glacial nights lives surrounded by the hiss of steam, the roar of engines and the bubbling of vats. Like a long-armed crab, he manipulates the tongs in dangerous atomic furnaces. In asbestos suits he plunges into the flaming debris of hideous accidents. With intricate heat-measuring instruments he investigates the secrets of the stars, and he is already searching for heat-resistant alloys that will enable him to hurl himself into space.

How far will he go? Three hundred years of the scientific method have built the great sky-touching buildings and nourished the incalculable fertility of the human species. But man is also *Homo duplex,* as they knew in the darker ages. He partakes of evil and of good, of God and of man. Both struggle in him perpetually. And he is himself a flame—a great, roaring, wasteful furnace devouring irreplaceable substances of the earth. Before this century is out either *Homo duplex* will have learned that knowledge without greatness of spirit is not enough for man, or there will remain only his calcined cities and the little charcoal of his bones.