able parts where great visibility is necessary, and this will undoubtedly be used by the automobile industry after the war is over. A high degree of visibility from all over the motor car will be worked into the new design requiring less supporting frame work, and a clear vision rooftop with sliding window will undoubtedly take the place of present designs. In fact, the motor car of the future may well be substantially all plastics.

At the present time any of the components necessary for the manufacture of plastics of all types can be made from natural gas. One of the important substances for the Bakelite type of plastic manufacture is formaldehyde, made largely from the methanol or wood alcohol by the catalytic reaction of carbon monoxide and hydrogen at high pressures. For a number of years formaldehyde and methanol have been produced from the oxidation by air of natural gas. This process can be readily expanded to produce all the formaldehyde necessary in the ever-expanding Bakelite program. The phenol or carbolic acid and cresols, etc., are also potentially available from natural gasoline.

One big field of research and development that merits discussion is carbon monoxide and hydrogen or the water gas reaction to form hydrocarbons. In the United States we have over 2.6 trillion cubic feet of natural gas yearly production. This gas contains about 90 per cent. of methane which can be converted into carbon monoxide and hydrogen by high temperatures in the presence of steam. In Germany the Fischer-Tropsch process has been developed to produce oil from carbon monoxide and hydrogen at the rate of about 15,000,000 barrels a year. The hydrocarbons produced are methane, ethane, ethylene, propane, propylene, butanes, butylenes, gasoline, gas oil and Diesel oil to solid paraffin wax. The reaction takes place in the presence of a catalyst, which may be oxides of nickel, chromium or cobalt, using temperatures of 400° F. and pressures of the order of 200 pounds.

The gasoline produced by the water gas reaction is poor in quality with about a 40 octane rating. The gasoline has to be cracked thermally or catalytically into higher octane fuel. The gasoline fraction boiling up to 300° F. contains olefins which polymerize with each other to form lubricating oil. These lubricating oils are produced commercially in Germany and some of them are high grade. The balance of the gasoline fraction, the paraffins, hexanes, heptanes, octanes may be thermally cracked under controlled conditions to make more olefins which in turn are converted into lubricating oil by polymerization. A portion of the synthetic oil is a high grade Diesel oil with octane number of over 100. The Diesel oil fraction is blended with lower grade Diesel oils to improve its quality.

Paraffin wax, which is also derived from the water gas reaction, is oxidized with air to make fatty acids. The fatty acids are reacted with potassium or sodium hydroxide, and soap is produced. The last report out of Germany is that one small cake of soap is allotted per inhabitant per month, and much of it comes from this paraffin wax. In 1938 and previous years also, conversion of paraffin wax from the water gas reaction, coal carbonization, and petroleum, was carried out forming fatty acids. In addition, these fatty acids are combined with synthetic glycerine to make fats for food. Glycerine and soap are produced (U. S.) from the splitting of fats, but the Germans are reversing the process in order to produce edible fats for food. It is not the type of fats to which we are accustomed, but it is helpful under the critical food conditions existing in Europe.

An enormous amount of research is going forward in a study of natural gas and gasoline to enhance their importance in the war effort—through solvents, plastics, high explosives, acetylene, synthetic rubber, lubricating oils and aviation gasoline. As a matter of fact, if one starts with methane gas alone, all the known synthetic products that man has produced in organic chemistry can be derived, and there are over 500,000 different ones. Any synthetic product desired can be produced at a price; the hydrocarbons are all potentially available to be converted into the manifold products that man requires in a modern world.

SCIENTIFIC EVENTS

THE GUJARAT PREHISTORIC EXPEDITION

ACCORDING to *Current Science,* Bangalore, India, a press communiqué from the director-general of archeology in India makes the following report:

The Archeological Department has recently organized an expedition for the study of the prehistory of Gujarat with the cooperation of a number of institutions and scholars. Although the department has hitherto organized systematic work on a large scale at sites belonging to the historic and prehistoric periods, particularly in Northern India, the occurrence and sequence of the earlier stone age cultures were not brought within the purview of its activities. Much interest has recently been taken in this subject, particularly since the British-American expedition led by Dr. De Terra, of Yale University, worked on

the Ice Age and connected human cultures in Northwest India and other areas. The archeological department has now in hand a bibliography of South Indian prehistory, with a view to serve as the basis of future work. The pioneers of research in India's stone age were geologists, particularly R. Bruce Foote, who, over 50 years ago, found paleolithic implements in Peninsular India so far north as Gujarat. One of the problems stated by Bruce Foote concerns the age of the paleolithic culture in the Sarbarmati valley and the gap or distance in time between that and the neolithic or later stone age culture. This has now been investigated by the Gujarat Prehistoric Expedition organized by the Archeological Survey.

The area chosen for this year's work is the Baroda State and parts of the Sarbarmati valley, which lies in the Vijapur Taluka and of the Narmada valley in the Sankheda region have already been surveyed. On the Sarbarmati the examination of the river bed for a length of nearly 25 miles has yielded hundreds of specimens of quartzite implements, mostly found embedded in the pebble conglomerate formation. The age of these deposits is indicated by the fact that nearly 80 feet of alluvial deposits and blown loess overlies the original river bed forming the habitat of early stone age man. This roughly indicates the age as some 50,000 years. Besides these early stone age finds, a number of microliths or tiny stone implements left by man have been recovered from the top strata of the loess hills. In the valley of the Narmada and its tributary, the Orsang, besides microlithic finds, paleolithics have also been discovered for the first time.

Thanks to the ample facilities afforded by Sir V. T. Krishnamacharya, the Dewan of Baroda, it was possible for the Archeological Department to extend this expedition to Baroda State. Two scholars especially trained in prehistory have been engaged by the department, and the Deccan College Post-Graduate and Research Institute, Poona, lent the services of its professor of ancient Indian history. The Baroda Archeological Department, the Gujarat Sahitya Sabha and the Gujarat Research Society have also cooperated. The results obtained so far have considerably advanced the scientific knowledge of early man in India, and it is hoped that if this enterprise is continued on a systematic basis the story of India's earliest inhabitants would be better known and a chapter of human endeavor in its earliest form unearthed from the fruitful banks of India's rivers.

OXYGEN MASKS FOR THE ARMY AIR FORCE

FIELD MUSEUM, Chicago, has undertaken to supervise the production of oxygen masks for the Army Air Forces. This is the result of the combined application of the scientifically accurate measuring methods used to gauge distinctive characteristics of groups of men and women, the researches of medical officers attached to the Army Air Forces, the art of the sculptor in depicting human types and efficiency in military and manufacturing methods to maintain production.

For flying in high altitudes, the pilots, bombardiers, gunners, radio operators and others require oxygen masks, and these must be accurately fitted to each man's head. In an anthropometric survey of 2,000 fliers, conducted by officers of the Aero-Medical Research Laboratory of the Army at Wright Field, Dayton, Ohio, it was found that the shapes and sizes of the heads of aviators could be reduced to seven basic composite types from among which the fliers could be properly fitted with masks. One of these head types—labeled No. 1, "the mean" type—corresponds to the fitting requirements of the majority of the fliers; the other six head types represent the extremes of contours and out-sizes in all directions. The head models give the manufacturers of masks and headgear guidance in their production of the variations required, and the quantities of each size needed, and assistance in the designing of new and improved products. An important improvement, for example, is the production of oxygen masks from plastic materials, eliminating the necessity for rubber, formerly used, leaving such rubber available for other essential purposes. The U. S. Navy and the Royal Canadian Air Force are reported to be adopting the use of the same standards, and will receive their supplies from the Army.

Sculpturing of the original master set of head models, based on the measurements furnished by aero-medical officers, was done by G. W. Borkland, president of the General Plastics Corporation, Chicago. This firm manufactures oxygen and gas masks and other equipment. After the master set had been approved by Army authorities, the problem arose of producing in quantity sets of these model heads, which have to be micrometer-accurate to meet the medical and air-safety standards.

Mr. Borkland and the Army authorities, being familiar with the work of the department of anthropology at Field Museum, decided to enlist the services of the museum laboratories and technicians. Production of accurate molds and from them of accurate plaster casts of the sets of aviators' head types is consequently now well under way at the museum.

The work of making the molds and casts has been placed in the hands of John Pletinckx and Joe B. Krstolich, sculptors on the museum staff. Twenty-eight sets, or 196 individual heads, have already been ordered, of which part have been completed. Further production on a larger scale is anticipated.