

Research Items.

ESKIMO ENGRAVINGS ON WALRUS IVORY.—Three examples of Eskimo art from Alaska of a type rarely seen in Europe are described by M. L. Giroux in the *Journal de la Société des Américanistes de Paris*, N. Sér. T. 18. The objects in question are made of walrus ivory, measuring 31 cm., 33 cm., and 36 cm. in length respectively, and are engraved and painted or stained in colour with human and animal figures. Among the human figures is that of a male in European clothing. All the figures are realistic, but the animals in particular exhibit an intimate acquaintance on the part of the artist with their characteristic attitudes and habits. Although all the Eskimo of Alaska show considerable dexterity in carving wood, bone, ivory, and reindeer horn, the inhabitants of the coast from the Yukon delta to the lower Kuskokwin river are particularly noted for their artistic skill. The technical methods employed in dealing with the ivory of a walrus tooth in the days before the introduction of iron and steel implements, are of considerable interest, especially in view of the marked resemblance of the objects under consideration to palæolithic engravings. Four grooves were made in the tooth with a piece of quartz or other siliceous stone. When these had been made as deep as the form of the cutting edge of the stone implement allowed, the two pieces were flaked off either by simple pressure of the hand or by means of a wooden knife-blade-like implement, which was inserted in the groove. The central piece of ivory thus obtained was rubbed down to the required shape by a freshly broken stone. The perforation found in some of the objects was then made by a stone drill and sand, working in a slight depression previously made, and actuated by a cord or strap. The polishing was done either with a very fine-grained stone (soapstone) or by the hand used with very fine-grained sand. Lastly, another piece of ivory was employed to produce a high polish. The gravers were sharp pieces of stone, flint, quartz, schist, or soapstone, usually fixed in pieces of wood, each material requiring a special method in manufacturing the graving tool. The colours employed were black (plumbago and charcoal or gunpowder mixed with blood), red (oxide of iron or ochreous earth), yellow (ochreous earth), white (argillaceous clay), and green (oxide of copper). A dark reddish brown used for staining seal skin was obtained by macerating the inner bark of alder in urine for twenty-four hours.

AN ENDEMIC FLORA.—An unusual analysis of an endemic flora will be found by F. Lewis in the *Annals of the Royal Botanic Gardens, Peradeniya*, vol. 10, part 1. With the data given in Trimen's "Flora of Ceylon," and from his own observations as to altitude, the author has analysed the distribution of the large endemic flora in relation to its distribution at different altitudes. The result is that the greater number of endemics are to be found at the foot of the hills instead of at the highest altitudes, a conclusion which the author briefly discusses, assuming that in the more densely populated lower levels the struggle for existence is greater, and natural selection has thus operated more vigorously.

JAPANESE BOTANY.—The botanical output of Japan proceeds apace, and fortunately abstracts will be found of practically all publications in the *Japanese Journal of Botany*. A brief notice of some of the interesting papers is all that can be attempted here. Yoshiji Yoshii has published a very extensive study of the maturation of the seed of *Pharbitis Nil*. The process of maturation can be divided into a series of stages; the chemical changes, water content, etc., of the seeds were studied and also their capacity to germinate when tested at these different stages. (*Journ. of*

Faculty of Science, Tokyo, Section III. vol. 1, Part 1.). Isaburo Nagai publishes four papers upon mutations in *Oryza sativa* L. in the *Japanese Journal of Botany*, Vol. 3, No. 2; in the same journal Kametaro Ohara has a paper upon Japanese fossil conifer woods, which he has been studying at the palæobotanical institute at Berlin, and there are two cytological papers upon pollen development, that by Tetsu Sakamura and Isamu Stow, dealing with the experimental production of pollen grains with abnormal chromosome numbers in *Gagea lutea*. In the previous issue of the same journal, Ichiro Ohga has an interesting paper upon the structure of ancient but still viable fruits of the Indian Lotus. The author began these studies in Manchuria, and continued them at Tokyo and then at the Johns Hopkins University at Baltimore. These old lotus fruits occurred in a peat bed in the Pulantien Basin, in South Manchuria, and are probably at least three or four hundred years old. The retention of viability for such a long time is probably due in large part to the approximate maintenance of the water and gas content in the tissues of the embryo, due to the structure of the fruit coats and their maintenance in the undisturbed condition of the peat bed. A very full account of the life history, fertilisation and cytology of the fungus *Plasmopara Halstedii*, is given by Prof. Makoto Nishimura in the *Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo*, Vol. 17, Part I, with five plates of drawings which are well reproduced. Koki Masui has a paper upon the mycorrhizal relation of the fungus *Cantharellus floccosus*, Schw. with the roots of *Abies firma* in the *Memoirs of the College of Science, Kyoto Imperial University*, vol. 2, No. 1, 1926. It seems clear that this fungus is definitely parasitic on the tree, in many cases killing branches of the root.

CORALS AND SEDIMENTS.—Problems of sedimentation and rock formation in tropical, coral-bearing regions constitute the subject-matter for research in vol. 23 of the papers from the Department of Marine Biology of the Carnegie Institution of Washington. M. N. Bramlette, in dealing with some marine bottom samples from Pago-Pago harbour, Samoa, describes the nature of present sedimentation processes in and around the harbour. Chemical and mechanical analyses of the samples are given and discussed and, in some cases, a detailed analysis of the organic constituents has been made. Borings from the reef were also examined and, on comparison with the bottom samples, shown to be relatively richer in magnesium carbonate. A study of reef-sand from the Bahamas by M. I. Goldman is concerned chiefly with the problem of dolomitisation. The chemical composition of the sand was determined directly and also by calculation from a count of the different constituents of known composition, mainly calcareous skeletons. The difference found is taken to represent a change in chemical composition, the results in the present case indicating a relative decrease in the amount of magnesium carbonate. The results are not considered conclusive, however, and suggestions are put forward for other methods of investigation. N. R. Smith, reporting on a bacteriological examination of 'Chalky Mud' and sea water from the Bahama Banks, classifies the bacteria found and describes an experiment to show that calcite is precipitated from sea water as a result of bacterial growth when food is supplied and when the supply of calcium in solution is maintained by the addition of calcium sulphate. He states also that calcite is formed from natural sea water by the strong ammonifying vibrios found in the mud, the only addition required being organic

nutritive matter. J. A. Cushman supplies a list of some recent Foraminifera from Porto Rico with notes on their distribution. An account of some late Miocene or early Pliocene mollusca and sharks' teeth from the Fiji and Tonga Islands by W. C. Mansfield, is accompanied by a useful annotated bibliography of the geology of the Fiji Island. T. W. Vaughan and J. E. Hoffmeister describe some Miocene corals from Trinidad, mostly new species.

VORTEX DISTRIBUTION BEHIND AN AEROFOIL.—Lanchester, in his "Aerodynamics," vol. 1, indicated from general theoretical considerations that the flow in the wake of an advancing aerofoil of finite span should comprise a layer of vorticity immediately behind the trailing edge and two general circulatory motions of opposite directions of rotation, one at each tip. Broadly speaking, this prediction has stimulated investigations at Göttingen, in America, and at the National Physical Laboratory at Teddington, receiving ample verification. In Aeronautical Research Committee Report, R. and M. No. 951 (H.M. Stationery Office, 1s. net), Messrs. Fage and Simmons have subjected this theory to an accurate quantitative test and mapped out the changes which occur in the vortex distribution in the wake of an aerofoil. The result provides an experimental verification of the theoretical relation given by Lanchester, that the total strength of the vorticity leaving a semi-span of an aerofoil, as obtained by integration over the transverse plane close behind the aerofoil, is equal to the circulation around the median section, and that the distribution of vorticity is in close association with the distribution of lift along this span. At 13 chords behind the aerofoil the rolling up of the vortex band is practically complete and, within the limits of experimental error, at a distance of 0.57 chords in front of the aerofoil the flow is irrotational. The theory thus verified has undoubtedly given a new impetus to aeronautical developments.

CATHODE SPUTTERING.—In the *Ann. der. Phys.*, No. 15, p. 672, 1926, A. von Hippel describes a new method for the investigation of cathode sputtering, and he shows that sputtered metal particles consist, at any rate to a very large extent, of uncharged atoms. In his experiments a cadmium cathode was usually employed, but experiments were also carried out with silver and zinc cathodes. The particles emitted from the cathode collide with ions and electrons, and if they were atoms they would emit their resonance lines. Thus, if the resonance lines of the cathode material are observed close to the plate, which lies outside the dark space, on which the sputtered particles are deposited, then we have evidence of the atomic nature of the particles. Clear proof of this was obtained, however, by comparing the intensity of the cadmium 3261 line with the intensity of the mercury 2537 line, when the vapour pressure of the mercury inside the sputtering chamber was known. From these observations the vapour pressure of the sputtered particles was calculated, and the value thus obtained agreed, within the limits of experimental error, with the value obtained from calculations based on a knowledge of the thickness of the sputtered film and on the assumption that the particles were atoms. Incidentally it was found that sputtered cadmium absorbed mercury vapour very rapidly.

AGE-HARDENING OF ALUMINIUM ALLOYS.—It has been shown that the alloys of aluminium with manganese and silicon possess the property of age-hardening after quenching from a high temperature, and also that alloys of aluminium with copper show age-hardening to a lesser degree. In the first part of a paper by Kathleen E. Bingham read at the Liège

meeting of the Institute of Metals on September 3, and entitled "The Constitution and Age-hardening of some Ternary and Quaternary Alloys of Aluminium containing Nickel," it is shown that the ternary alloys of aluminium with copper and nickel do not possess this property of age-hardening in any appreciable degree. This suggests that the addition of nickel to the alloys of aluminium with copper suppresses the phenomenon of age-hardening. This is explained by the constitution of the alloys, since the property of hardening depends on the precipitation of one or more of the constituents, and it has been shown that with 2 per cent. of nickel and about 6 per cent. of copper there is no CuAl_2 present, either at 500° C. or on cooling slowly to 200° C.; *i.e.* 2 per cent. of nickel increases the solubility of CuAl_2 in these alloys at both high and low temperatures. Finally, it is shown that the addition of 1 per cent. manganese to the alloys of aluminium with copper and nickel causes the precipitation of a large amount of magnesium silicide on cooling from 500° C. to 200° C., and also affects slightly the solubility of CuAl_2 and NiAl_3 . In the series containing 4 per cent. copper, 2 per cent. nickel, and 1.5 per cent. magnesium, marked age-hardening takes place, and it is suggested that it is due chiefly to the precipitation of magnesium silicide, since it has been seen that any due to the CuAl_2 is very slight. One per cent. magnesium is already in excess of the amount required for the formation of the compound Mg_2Si , as there is only about 0.13 per cent. silicon in the aluminium used.

TESTING ON HARDENED STEEL.—The testing of high carbon tool steel has hitherto been carried out almost entirely in the form of actual machine tests on tools made from the steel. Axel Lundgren, in a paper read at the Stockholm meeting of the Iron and Steel Institute describes a simpler test. The type of test adopted was a bend test, carried out in a machine specially designed for this work. Steels with more than 1 per cent. of carbon annealed in such a manner that the cementite was in a fine-grained form, show, after subsequent hardening and tempering, a higher bend strength and a higher resistance to impact than specimens which, before hardening, have been so annealed that coarse-grained cementite has developed. An annealing which yields a cementite in a spheroidised condition will, after hardening, yield a steel consistently tougher than will a treatment which resulted in the cementite appearing in the form of a network, and this despite the fact that the cementite has afterwards disappeared. Steel with the highest percentage of carbon, 1.3 per cent., shows, after hardening and tempering, a higher bend strength than do lower carbon steels. Annealing so as to produce a fine-grained cementite results, when the steel is hardened and tempered, in the production of a higher bend strength than is obtained from an unannealed steel. The steels quenched at too high a temperature and then tempered at a temperature of 150° to 200° C. show a reduced bending strength, particularly when the tempering temperature is lower. So far as hardness is concerned, the steel with 1.3 per cent. of carbon is slightly harder after heat treatment than the 0.9 per cent. carbon steel. The difference is not great, but with lower carbon contents a rapid decrease in hardness is recorded. Similarly, a slightly greater hardness has been observed in the specimens which were not annealed before hardening, than from those which had been annealed. The influence of the rate of cooling upon the ultimate bending stress, after tempering, has been tested with a tempering temperature of 300° C. In this connexion it has been found that in the case of very rapid cooling in benzene, a much lower bending strength was obtained, than in the case of a less rapid cooling in air.