Research Items

Iron-working in the Bahr el Ghazal. Mr. T. C. Crawhall in *Man* for March describes the processes of iron-working and forging as practised by the Jur of the Sudanese province of Bahr el Ghazal, which are illustrated by some exhibits recently acquired by the Science Museum through Capt. J. F. Cumming, district commissioner. The ore is smelted in a clay furnace, 5 ft. high, with four clay tubes inserted in the side of the furnace near the bottom for ventilation, and a hole at the bottom of the furnace, which is sealed with clay during the period of smelting, for the extraction of the iron. There is no forced draught. The iron ore is broken into small pieces, about one inch cube, and separated into two kinds, known as the male and female elements. Both, it is believed, must be present before iron can be produced. Sixteen baskets of hardwood charcoal are used to three baskets of ore. One such charge, taking about twenty-two hours for smelting, produces only enough iron to make eight or ten spearheads. The iron collects at the bottom of the furnace and is removed by long poles pointed at the ends, pulled along the ground by native-made rope, and then quenched with water. It is then broken into small pieces for treatment at the forge. The forge is situated in a grass hut, mainly to prevent the sun from shining on the iron. Should this happen, it would be impossible to work it. Great deference is paid to the smith, and oaths sworn on his anvil, a rough piece of iron driven into a palm-tree buried in the ground, are inviolable. The charcoal is raised to the temperature necessary to soften the iron by two rows of bellows, of which the chief interest is that they exactly resemble the bellows used in ancient Egypt and shown on a drawing from a tomb at Thebes of about 1500 B.C. They are made of clay covered with goatskin, and have no valves. The nozzles, therefore, do not enter the fire, but each pair rests in a clay junction unit which has one end in the fire and the other open to the air to admit the inward draught.

Hawaiian Tradition. An interesting document has recently come into the possession of the Bernice P. Bishop Museum, Honolulu, and is edited under the title "Kepelino's Traditions of Hawaii" by Martha Warren Beckwith (Bulletin 95). The manuscript was for some years in the possession of the Roman Catholic Mission of Honolulu, for which it was composed by Kepelino, a descendant of the priestly race of Paao, born in Hawaii about 1830, and transcribed by Bishop Maigret. Although Christian influence is present, the record bears the mark of authenticity and sincerity. Of the gods it is said that three classes of gods were recognised in the history of Hawaii : the great gods, the class of spirits who were created and of men, that is the guardian spirits, and thirdly the class of things without souls. The great gods were male gods ; they had no source ; they made all things and all power was theirs. These gods made many gods to serve them and they made man and all things. In the second class there were many gods and these were subdivided into three kinds: the spirits without a body, the *aumakua* of day, and secondly the *aumakua* of night, the dead, and in the third class, district chiefs. The last are put in the class of gods because, as ruling chiefs, they had great power and also because of the *tapu* observed towards them, a thing to be dreaded. Also they had the power of life and death. They were called "gods that could be seen". They were sometimes worshipped. The *tapu* of the gods covers all men and all chiefs, while the *tapu* of the chiefs covers only the commoners with the exception of the *kahuna* and his people. The chief's *tapu* had many laws of death, such as that if one did not prostrate oneself when the chief came forth or sit when the chief's bathing water went by, or if one walked about when the chief's name was chanted, the penalty was death.

Indian Microlepidoptera. Scientific Monograph No. 2 of the Imperial Council of Agricultural Research (India) entitled "Life-Histories of Indian Microlepidoptera" has recently come to hand. In this memoir, Mr. T. Bainbrigge Fletcher, Imperial entomologist, has continued his studies of these small moths. The present contribution deals with the life-histories of a number of species belonging to the groups Alucitidæ, Tortricina and Gelechiadæ the transformations of which, in many cases, are figured on the accompanying plates. Notwithstanding their small size, certain of these insects have a very extensive geographical range and included among them are destructive species of great economic importance. Students of the groups concerned will find many hitherto unknown life-histories described. The monograph is issued by the Government Publication Branch, Calcutta (Rs. 3–4 or 5*s*. 6*d*.).

Culture of Snail's Tissue. J. Brontë Gatenby and E. S. Duthie have recorded (*J. Roy. Micr. Soc.*, **52**, pt. 4 ; 1932) observations on the histology of the wall of the pulmonary cavity in *Helix aspersa*. They describe the normal regeneration of the wall after cutting in the living snail, and give a preliminary account of the behaviour of small pieces of the wall when cultivated in hanging drops of the snail's blood. In the process of normal regeneration no mitotic divisions were seen, while figures suggestive of amitosis were extremely common. In no case have the authors seen mitoses in the cultures where cell multiplication is rapidly taking place, but even a few minutes after the tissue has been placed in blood, and put under the microscope, constriction and separation of cells by the amitotic method has been observed. It is concluded therefore that in culture and in normal regeneration, and probably also in normal growth, the cells of the snail multiply by amitosis. The paper is illustrated by thirteen figures. (See also NATURE, **130**, 668, Oct. 22, 1932.)

Fluorescence in Ryegrasses. Rapid developments are taking place in the application of Gentner's screened ultra-violet light test for *multiflorum* characters in *Lolium*. The use of the test has passed into routine practice in a number of seed-testing and herbage research stations and new directions in which it is of service are multiplying. In view of the somewhat expensive nature of mercury vapour and other ultra-violet ray lamps, it is satisfactory to find that filtered daylight may be successfully employed. Linehan and Mercer record (*Proc. Internat. Seed Testing Assoc.*, **4**, No. 2 ; 1932) efficient performance of a Dutch instrument for daylight use. A similar instrument of British manufacture is now available. In a recent communication to the Editor, Messrs.

E. W. Hullett and J. W. Calder, of Canterbury Agricultural College, New Zealand, point out that evidently only the longer wave part of the ultra-violet light spectrum is necessary, since ordinary laboratory glass does not markedly reduce the intensity of the fluorescence. These authors report success with several types of ultra-violet ray generator and with daylight passed through a Wood's filter. The fundamental physiological causes of the fluorescence phenomenon remain obscure, and merit biochemical and physical research in view of their probable importance to plant physiology generally. It is interesting to note, however (Linehan and Mercer, NATURE, 131, 202, Feb. 11, 1933), that despite apparent complexity of these causes, fluorescence behaves, in hybridisation, as a simple Mendelian dominant.

Migration of Oil and Natural Gas. Most geologies of petroleum devote considerable space to problems of oil migration within the earth's crust in an attempt to explain how it is that petroleum makes its way into the reservoirs from which it is at the present time produced. Ever since the inception of theories of origin and accumulation of oil, attempts have been made to explain the forces which have caused the movement of the oil through the earth's crust and it must be admitted that there has been a good deal of uninspiring repetition of old theories without regard for the results of experimental work or for the records of field technology now available from well-understood oilfields throughout the world. The study of migration has been made a special one by Prof. V. C. Illing for some years past. His paper before the Institution of Petroleum Technologists on March 7 showed clearly that he is not satisfied with mere repetition of theories. Apart from giving results of experimental work carried on for some years past at the Royal School of Mines, he emphasised that migration is bound to be a twofold process: a primary movement of oil and gas from source rocks to reservoir rocks and a secondary movement of segregation within these rocks and thus the ultimate distribution of oil and gas as pools. Primary migration is ascribed to compaction aided by internal or external sources of pressure, in which phase the oil originates. Secondary migration implies separation of gas, oil and water within the coarse rocks, sometimes due to static buoyancy but probably in the main due to flotation in mobile fluids. Such previously accepted theories as buoyancy, capillarity or hydraulic currents as being responsible, are, the author contends, inadequate, and even Munn's theory fails to explain the retention of oil in coarser rocks.

Photoconductive Effect in Carborundum Crystals. In a communication to the Editor, Prof. Kamienski, of the Institute of Physical Chemistry and Electro-Chemistry, Jagellonian University, Cracow, has observed that some carborundum crystals exhibit a photoconductive effect. A Lindemann electrometer connected across a xylol-alcohol resistance in series with the crystal and a small battery were used to investigate the phenomenon. In a typical case the crystal had an area of 2·5 sq. mm., the xylol-alcohol resistance was of rather less than one tenth the resistance of the crystal in the dark, and a 4-volt battery was used. A small lamp carrying 0·25 amp. at 2·5 volts was used: when it was 1 cm. from the crystal the electrometer indicated 2·2 volts, at 5 cm. it indicated 0·7 volt, and at 10 cm. it indicated 0·4 volt. In contrast with selenium cells, these crystals give very steady and reproducible results. Prof. Kamienski states that the inertia is low; when the crystal is illuminated, the electrometer needle shows immediately a deflection nearly as great as the ultimate equilibrium value, which is attained in 2–4 minutes. Some crystals show a different photo-sensitivity according to the direction the current is flowing; others have an almost equal sensitivity for both directions. Messrs. Adam Hilger Ltd. have carried out experiments on one of these crystals and have confirmed these results. They also found that the range of sensitivity of the crystal was about 3000–5500 A., and that it was most sensitive to light of wave-length about 4000 A.

Photographic Sensitisers for the Infra-Red. In the *Journal of the Chemical Society* for February, Miss N. I. Fisher and Miss F. M. Hamer publish an account of the syntheses of several tricarbocyanines. These dyes are photographic sensitisers for the infra-red between 7000 A. and 10000 A.

New Lens of High Rapidity for Cinematography. Messrs. Carl Zeiss of Jena have placed upon the market a new cinematograph camera lens with an aperture of *F* 0·85. The lens is known as the 'R-Biotar'. It has already proved very successful in providing an X-ray cinematograph record of the pulsating organs of the body. Actually, of course, the fluorescence image produced on a screen was photographed; the great rapidity of the new lens makes this work much more satisfactory than was previously possible. We are informed that the price of the lens in Great Britain is about £48.

Electrostatic Production of High Voltages. Van de Graaf, Compton and Van Atta, working at the Massachusetts Institute of Technology, have developed a very direct method for the production of high direct current potentials (*Phys. Rev.*, Feb. 1). Electric charges are sprayed by point discharge on to the surface of a moving insulating belt which carries them into the interior of a large insulating sphere. The charges are removed from the belt by a point-collector system inside the sphere and the latter becomes charged to a high potential. The charge conveyed by the belt is limited by the electrostatic intensity in the air at the surface of the belt, and the maximum potential is limited by leakage and discharge from the sphere. In a model generator with a pair of 24-inch spheres 25 microamperes was obtained at about 1,500 kilovolts, and this generator was simple and cheap to construct. A very large generator is now being constructed with 15-foot spheres supported on 24-foot towers of shellac insulating compound, inside which the belts are to run. Each of the two spheres will form a laboratory room and a discharge tube will be supported between the two spheres. Simultaneously with the development of the high voltage generator, a discharge tube has been evolved consisting of an insulating fibre (shellac compound) tube with flat metal ends. The electric field around the cylinder is made uniform by providing a spiral indian-ink leak round the outside of the tube. About 300 kv. was applied to a tube of this type without puncture, the voltage being limited by discharge and the current capacity of the electrostatic generator.

Viscosity of Aqueous Solutions. Grinnell Jones and S. K. Talley (*J. Amer. Chem. Soc.*, Feb.) describe some very accurate experiments on the viscosities of

aqueous solutions of six salts and also sucrose and urea at 25°. The Ostwald type viscometer was of quartz, internally ground and polished, and the transit of the meniscus was timed automatically by means of a photoelectric cell. The viscosities confirm the prediction made by Jones and Dole on the basis of the Debye theory of interionic attraction that all salts will increase the viscosity of water if measured at sufficiently low concentration. This is the case even for those salts which produce a diminution in viscosity at higher concentrations, including potassium chloride, chlorate and nitrate, ammonium chloride and cæsium nitrate. The viscosity-concentration curves for these salts go through a minimum. Jones and Dole had shown that the fluidity of a salt solution should be related to the concentration by an equation of the form $\varphi = 1 + A\sqrt{c} + Bc$, where A and B are constants. A should be negative for all electrolytes but zero for non-electrolytes, whilst B may be either positive or negative. This equation, based on the Debye-Hückel theory, is found to hold, and the results also confirm the equation of Falkenhagen and Vernon, in which the value of the constant A is calculated in terms of the mobilities of the two ions. In the case of the two non-electrolytes, the square root term was absent, as it should be when no ions are present in the solution.

Oxidation and the Lubricating Properties of Oil. In a paper in the *Proceedings of the Royal Society* for February, R. O. King describes experiments on lubrication by oil in a state of strong oxidation. A blended mineral oil was circulated through a journal bearing, the temperature of the bearing was artificially raised by a gas-burner, and the the oxidation of the oil was promoted by blowing air through the hot oil. It was found that as the trial of a sample of oil proceeded, the viscosity increased slightly, but the bearing friction at high temperatures decreased and the temperature of seizing was pushed up to very high values. In one case, for example, the coefficient of friction had the very low value of 0·00045 with the bearing running at about 250°. The lubrication of a bearing of this kind under ordinary conditions is of the 'fluid friction' type, but the friction observed under the oxidation conditions is too low to be explained in this way, and the author suggests that the 'oxidation lubrication' is of a quite different type in which activated molecules formed in the initial stages of oxidation become attached to the surfaces and build up a boundary layer. The conditions are then something like those of 'boundary lubrication' described by Hardy but the special nature of the activated molecular film permits a surface of very free slip to be formed.

Astronomical Topics

Astronomical Notes for April. Mercury is in elongation as a morning star on April 20, but is not well placed for northern observers. Jupiter and Mars continue to be well placed, in Leo. Mars is stationary on April 13, not far from Regulus; after this it will approach Jupiter until the evening of June 4, when they are only 15′ apart. Neptune is also in Leo. Venus and Uranus are too near the sun for observation; the former becomes an evening star on April 21, but will not be easily observable until June.

An occultation of Regulus is visible in the southern portion of England on the evening of April 6; the northern limit runs roughly from Liverpool to Dover. Many observers are making expeditions to the limiting line, in the hope of locating this with precision. At Greenwich, disappearance occurs at 8.57 p.m., and reappearance at 9.10 p.m., 24° east of the north point. The smallest instrument will suffice for the observation. Other disappearances of faint stars occur in London on April 1 at 10.10 p.m., on April 29 at 10.42 p.m. and on April 30 at 11.30 p.m. Minima of Algol occur on April 1 at 11.40 p.m. and on April 4 at 8.30 p.m.

Comet Pons-Winnecke should be visible with moderate instruments at the end of April and in May. Search ephemerides are given in B.A.A. Handbook for 1933.

Summer time begins on the morning of April 9, a week earlier than usual, owing to the third Sunday being Easter. Summer time is not used in these notes, and should not be used for astronomical records. After April 9, the times given here need to be increased by one hour to give the summer time.

The Minor Planet Amor. This is the interesting planet discovered by M. Delporte at Uccle a year ago, when it approached the earth within ten million miles. It was observed for nearly three months; *Astronomische Nachrichten* No. 5936 contains a careful discussion of its orbit by Dr. A. Kahrstedt of the Berlin Rechen-Institut.

Epoch 1932 April 6.0 Greenwich Time; mean anomaly 0·45458°; arc from node to perihelion 25·24671°, node 171·13239°, inclination 11·93816°, eccentricity 0·4358886, mean daily motion 1329·6154″, semi-major-axis 1·9239201, period 974·718 days. It is pointed out that the period is to that of the earth as 8 to 3, so that 8 years bring about a recurrence of favourable conditions. Search ephemerides are given for the spring months of 1916 and 1924, in the hope that a re-examination of plates exposed then may disclose some images of the planet; these would be of great use in improving the orbit determination, and facilitating the recovery of the planet. Its motion when near the earth is so rapid that the long trails on plates might have been taken for those of meteors.

Since the least distance of this planet is only two thirds of that of Eros, it may be used for determining the solar parallax and the mass of the moon, as soon as its orbit is accurately known.

Measures of Double Stars at the Union Observatory, Johannesburg. Bulletin 241 of the Astronomical Institute of the Netherlands contains further instalments of the systematic survey of the southern heavens for double stars, which is being carried out by W. H. van den Bos with the 26-inch refractor at the Union Observatory. Accurate measures are given for 158 stars; a considerably longer list contains estimates of positions and magnitudes; in about half the stars of the first list the separation is less than 1″, and several are so small as 0·1″. In four cases, closer companions of previously known pairs have been detected. The primaries are nearly all in the Bonn or Cape Durchmusterung, their reference numbers in these being given.