

Research Items.

PROGRESS AND DECAY IN CIVILISATIONS.—A suggestive application of anthropological theory to the problems of history and sociology is made by Mr. Christopher Dawson in an attempt to account for the phenomena of progress and decay in ancient and modern civilisations which appears in the January number of the *Sociological Review*. He adopts the view to which the late Dr. Rivers was led by his observation in Melanesia, that the introduction of new racial or cultural elements is essential to progress, and suggests further that the cycle of approximately ten centuries, which has been observed in cases where such an introduction has taken place, may represent the period which elapses before the stimulus is completely exhausted. On the other hand, Hellenic and Roman culture both perished when apparently at the height of their power. This arose from the neglect and extinction of the fundamental cultural type. Rome, which was essentially an agrarian state, became commercial and urban and exhausted itself in attempting to live by war and plunder.

PLEISTOCENE DEPOSITS OF THE PORTSMOUTH DISTRICT.—In "The Pleistocene Deposits of the Portsmouth District and their Relation to Man," Dr. L. S. Palmer and Lt.-Col. J. H. Cooke (*Proc. Geol. Assn.*, vol. xxxiv.) give the results of their examination of between forty and fifty exposures in the 15, 50, and 100 feet terraces which rise in the Portsmouth district from the sea northward. Coombe-rock is found in some form or other in all levels. This ancient name for the rubble which is found in the main Brighton valley was adopted by Clement Reid in 1887 for similar deposits elsewhere, and is generally used now for a heterogeneous series of deposits comparable in variety with the clay-with-flints of the higher parts of the chalk downs. The authors give five distinct types of deposit as exhibited in the terraces; namely, alluvium, brick-earth, coombe-rock or rubble-head, stratified river-gravel or raised beach pebbles, sands (æolian and fluvial). Sections are given of a number of exposures, and Mr. A. S. Kennard and Mr. B. B. Woodward add a useful appendix on the mollusca of Portfield, near Chichester. The paper contains much of interest relating to the flint implements of the district. Acheulian forms occur more abundantly than any other type. The authors are of opinion that the evidence that they have accumulated justifies them in coupling Acheulian man with the Riss-Würm interglacial epoch, Mousterian man with the Würm, Aurignacian man with the Achen recession of the northern ice, and Neolithic man with the submerged forests, this arrangement being confirmed both by geological deposit and fossil content.

THE PEARL ORGAN OF THE GOLDFISH.—Mr. T. Tozawa (*Annal. Zool. Jap.*, vol. x., No. 6, pp. 253-263) gives an account of an experimental study of the so-called pearl organs of the goldfish. These organs appear as small white conical warts, in the male only, on the operculum, and on the rays of the dorsal, pectoral, and anal fins. They increase in numbers and size with the age of the fish up to six years, after which there is a decline. They appear during the breeding season from March to September, are most numerous in April, and are periodically shed and reformed at the same spots after an interval of from three to ten days. Their formation is due to a thickening of an area of epidermal cells, the result of hypertrophy, over which the pearl organ itself is formed by cornification of the superficial cells. The

author performed several castration experiments and as a result concludes that the cornification process is greatly influenced by the substances (hormones?) produced from the testis, absence or decrease of which suppresses or retards pearl organ formation.

MOLLUSCA DAMAGING BRICKWORK.—Dr. Annandale (*Jour. Asiat. Soc. Bengal, N.S.*, vol. xviii., No. 10, 1922, p. 555) records the interesting fact that the Pholad, *Martesia fluminalis*, was found to be the cause of injury to the brickwork at the entrance to one of the dry docks at Calcutta. The molluscs had only been able to attack those parts of the wall at which the glaze on the bricks had been worn away or abraded, and had fortunately all been killed off after penetrating to a depth of about half an inch. Dr. Annandale is of opinion that these molluscs would ultimately have destroyed all the brickwork, and believes that the larvæ were assisted in getting a hold in the first place by the inequalities produced on the surface of the bricks by the falling out of small pieces of cinder incorporated in their substance, thereby exposing a small unglazed area. The species usually bores in wood or sandstone. The burrows made by the borers were rapidly inhabited by other lamellibranchs, for which they formed suitable shelter, the presence of the latter helping in the destruction already started by the Pholad.

NEMATODE PARASITES OF PLANTS.—Part 4 of the collected papers issued from the Department of Helminthology of the London School of Tropical Medicine contains reprints of fourteen papers by workers in that Department. Several of these communications have been already noticed in these columns, and reference can now be made only to two others. Dr. T. Goodey gives an account of his observations on quiescence and revivescence in the nematodes *Tylenchus tritici* and *T. dipsaci*. When wheat galls caused by *Tylenchus tritici* are soaked for some hours in water they swell and finally liberate thousands of the larvæ of this nematode in the first stage of development. Such larvæ, if alive, are capable of movement and are thus able to infect germinating wheat plants when galls are sown along with healthy seed. The statement originally made by Baker (1771) that the larvæ are capable of resuming their activity after having been dormant for a period of twenty-seven years has been repeated by later writers. Dr. Goodey gives evidence which shows that larvæ may retain the power of revivescence for a period of about nine years. Dr. Goodey contributes a useful review of the members of the nematode genus *Aphelenchus* which cause disease in cultivated plants. The structural details and biology of each species and the disease due to it are dealt with, and the suggestion is made that some form of heat-treatment of infective soils is likely to give the best results, comparatively low temperatures being lethal to the parasites.

SOUTHERN HEMISPHERE METEOROLOGICAL CORRELATIONS.—The correlations subsisting in the Southern Hemisphere between the weather elements of South America and the Antarctic have been the subject of many papers by Mr. R. C. Mossman, the most recent of which, on "Indian Monsoon Rainfall in relation to South American Weather, 1875-1914," constitutes vol. xxiii., Part VI., of the *Memoirs of the Indian Meteorological Department*. A detailed comparison is made for each of the forty years between the departures from the normal of pressure, temperature, and rainfall at various places in South America,

including the South Orkneys, and the corresponding departures of Indian Monsoon rainfall, with the view of throwing further light on the relationship previously discovered, namely, that years of high pressure in the Argentine and Chile, with much ice off South America, correspond with years of good rainfall in India. It is also known that there is a high positive correlation between winter temperature at the South Orkneys and rainfall in the Argentine after an interval of 3 to 4 years, and an equally marked negative correlation after an interval of $2\frac{1}{2}$ years. From this pair of correlations it is concluded that if it becomes possible to correlate the simultaneous rainfall and pressure conditions in South America, a long warning should be available of a year of very deficient Monsoon rainfall. The chief difficulty about the seasonal correlation method is that we have hitherto found only a few of the correlations which must exist, but as more of them are found and co-ordinated with others, the physical mechanism underlying them will become clearer and the problem of seasonal forecasting increasingly tractable.

COMMERCIAL SYNTHESIS OF METHYL ALCOHOL.—The synthesis of methyl alcohol from carbon monoxide and hydrogen, which has been carried out on a small scale in scientific laboratories, is now performed on a very large technical scale by the Badische Anilin and Sodafabrik at Ludwigshafen. To promote this reaction the two gases are mixed under high pressure and at a high temperature in the presence of a catalyst, the process being similar to the synthesis of ammonia from nitrogen and hydrogen. The Leuna Works, near Merseburg, manufactures at present sufficient methyl alcohol for German requirements, and the works are in a position to meet the technical consumption of other industrial countries. Closely connected with this process is the manufacture of formaldehyde, which at present is being used in large quantities for the making of artificial resins. As the direct synthesis of formaldehyde is difficult, methyl alcohol is first made and then oxidised to formaldehyde by conveying the vapour over red-hot copper.

MATHEMATICS IN AMERICA.—In his presidential address, reprinted in *Science* of January 4, to Section A of the American Association, in December 1923, Prof. G. A. Miller gave an account of the development of mathematics in America during the last seventy-five years. When the Association was founded in 1848 various European mathematicians then living had produced work which outranked the best American contributions to mathematical knowledge up to that time. Neither did Americans take any active part in the development of the science, which was proceeding rapidly in Europe, during the next 30 years. A stimulus to progress was given by the enthusiasm of Prof. J. J. Sylvester, whose first course of lectures on the Galois theory of equations, at Johns Hopkins University in 1882, was responsible for inaugurating American activity in this field and in group theory. Other fields in which American mathematicians have rendered outstanding service to world progress in the last forty years are postulates and the calculus of variations. But the greatest mathematical monuments which America has raised during the period under consideration are its series of periodicals, beginning with the *American Journal of Mathematics* in 1878. The actual mathematical advances made by Americans during the last 75 years are conspicuous but not satisfying. American mathematicians have not yet attained as high a relative standing as that already belonging to some other sections of the American Association, such as the astronomers and geologists.

LOW VOLTAGE ARC IN HELIUM.—The production of an arc, at voltages lower than the ionisation voltage, has been explained by supposing that the voltage employed imparts a velocity to the electrons, which enables them to "excite" the atoms of the gas with which they collide, and a second electron striking an excited atom is then able to ionise it. According to Franck, the normal parhelium is changed into metastable orthohelium by inelastic collision with an electron, the kinetic energy of which is due to a "fall" through 19.77 volts; the next inelastic collision is at 20.55 volts and, according to Lyman, gives the line 600.5 Å. Compton, Lilly, and Ölmstead have, however, maintained the helium arc down to 8 volts, and although Miss A. C. Davies has explained this by assuming that, when the arc is started at 20 volts, a certain number of excited atoms are produced, which remain unaltered when the arc burns below this voltage, this does not agree with Kannenstine's value for the life of the metastable helium atom, which is 0.0024 sec. Messrs. R. Bär, M. von Laue and E. Mayer, in the *Zeitschrift für Physik*, Dec. 17, 1923, describe experiments which show that the continuation of the arc in helium at voltages lower than 20 is caused by electrical oscillations, due to self-induction in the circuit. The vibration frequency of these oscillations cannot be calculated, using Thomson's formula, from the conditions in the external circuit, but depends also on the conditions in the tube in which the arc is formed. Under different conditions the frequency was found to vary between 3×10^4 and 3×10^5 vibrations per second, while the maximum voltage was in all cases higher than 20 volts, and may reach 22 or even 27 volts, when the arc is being maintained by a 16-volt battery through a suitable inductance.

ELECTRICITY IN MINES.—Prof. W. M. Thornton read an interesting paper on researches on the safe use of electricity in coal mines to the Institution of Electrical Engineers on January 31. The author has investigated for many years the limiting electrical conditions under which ignition of coal dust and fire damp may occur and he obtains some definite conclusions. Alternating current is always far safer than direct current so far as lighting is concerned. Many accidents occur from poor lighting at the working surface face. By means of specially constructed generators, giving a current with a frequency of 150 at 200 volts, satisfactory lighting could be provided while the numerical value of the current would have to exceed 23 amperes before the spark made on breaking the circuit would cause an explosion. On the other hand, with direct currents an explosion would occur at half an ampere. The great colliery disaster at Lenghenydd in South Wales in 1913, when the death-roll was 439, the greatest on record, directed attention to the sparks produced in signalling bells as a possible source of explosion. The sparks from signalling bells can now be made inert in various ways and one or other of these methods is compulsory. Prof. Thornton showed to the meeting his safety lamps in action. They gave an alarm signal when the mixture of gas and air approached a dangerous value. One of the difficulties in applying electricity to mining is the provision of an efficient earth underground with which all exposed pieces of metal in the circuit or motors must be connected so as to prevent the risk of shock to the miners. The author uses an earth plate in the shape of a hollow cone with its vertex pointing downwards. The cone is embedded in the earth and sufficient water is admitted to fill it. Periodical tests are made of the earth resistance and when it is too high more water is poured on the ground above it. The device is simple and effective.