Research Items.

FORERUNNERS OF THE ROMANS.—Under this title Dr. D. Randall-MacIver continues in *Antiquity* for June the study of the early civilisations of Italy, which he began in the issue of that periodical for June 1927. At about 1000 B.C., that is, about the beginning of the Iron Age and two centuries before the effective coming of the Etruscans, northern and central Italy may be partitioned into five distinct spheres. The north-west is occupied by the Comacines, part of Venetia by the Atestines, the Bolognese region by the northern Villanovans, Tuscany and a part of Latium by the southern Villanovans, east of the Apennines, from Rimini to Aufidena, the Adriatic coast, and the central Apennines are held by the Picenes, including some of the Samnites and some Umbrians. The first four are related and practise cremation; but the Picenes are of wholly different origin and practise inhumation. In several parts of the country these civilisations maintained an independent existence down to the fourth century B.C. The most important contribution to the early Iron Age culture of Italy was undoubtedly that of the two Villanovan nations, and in Etruria the Etruscans owed more to them than has been appreciated. They were the pioneers in metal-working, and it was to their coppersmiths that the Etruscans owed their supremacy in the metal trade of the Mediterranean. The highest point of the Atestine culture of Venetia is between the seventh and fifth centuries. They were probably the latest of the cremating nations to settle in Italy. Originally they were closely related to the Villanovans and kept in close touch with them. The Picenes, it is suggested, are the descendants of the original neolithic population, who above all were warriors—a reef against which Villanovan and Atestine migration beat in vain.

A MAORI FEEDING FUNNEL.—In the *Museum Journal* (Philadelphia) for March, Mr. R. U. Hall describes a feeding funnel now in the University Museum which was used for administering liquid food to persons who were undergoing the process of being tattooed. It is roughly in the form of an inverted cone, distorted so that the slope of one face was longer, or developed more gradually than that of the other. Each of these two faces led to a grotesque and distorted human figure on the rim of the funnel. Most of the published examples of such funnels are almost entirely covered with the characteristic Maori scroll and spiral ornament. The present example differs in that the ornament is confined to the two faces mentioned and the side and top of the rim. It is also more slender and graceful in form, while the rim is a shelf-like projection. It shows the tool marks of the stone implement with which it was carved, and is therefore of a considerable age. It is suggested that it is the work of a talented amateur rather than a professional wood carver. The figures are male and female, and differ in their method of representation. The head of the male figure is carved on the rim of the funnel, and its body and limbs appear on the tubular portion of the vessel, being built up of a number of spirals and concentric arcs of circles. The hip ornaments represent the *rape* or buttock pattern of the body-tattoo. The place occupied by the face, being too small for a realistic representation of the tattoo pattern, is filled in with concentric arcs. The female figure, in contrast, is carved wholly on the rim, the limbs and body being distorted to fit, mainly on an undercut downward extension of the rim, so that the whole figure is contained in a lozenge-shaped space. A second difference, one following the custom of real life, is that the face is undecorated except for the woman's tattoo confined to the lips and sides of the chin.

THE GESTALT THEORY.—The May issue of *Scientia* (vol. 43; 1928) contains a discussion on the *Gestalt* theory, in which Prof. E. Rignano and Prof. Köhler attempt to interpret one another's points of view. Prof. Köhler is one of the most enthusiastic workers in this field, and he includes under the word *Gestalt* "those structures which as wholes possess specific properties and therefore can with good right be regarded as unities." Some exponents are primarily concerned with the problems of the perception of 'shape,' but others have extended it to cover most of the operations of sensory perception. This results in a certain ambiguity of expression, and considerable divergence of opinion even among the supporters of the theory, who would seem to be agreed on but one thing, namely, to oppose the associationist school of psychology. Prof. Rignano supports the older view; he has difficulty in reconciling the different usages of the word *Gestalt*, and also finds the theoretical consequences confused. Prof. Köhler answers him with a very clear exposition of his point of view. The English reader who has been familiar with the discussion in somewhat modified form in Prof. Stout's writings, and later in Prof. Spearman's, cannot avoid the feeling that the disputants are dealing with different aspects of the problem, or at least seeing it in different perspectives. There is much experimental evidence in favour of the *Gestalt* hypothesis, but 'hypothesis' would still be logically more correct than 'theory' as a description of the system.

TRITRICHOMONAS FECALIS.—This was found by L. R. Cleveland (*Amer. Jour. Hygiene*, vol. 8, No. 2; 1928) in human fæces which had been in tap water from 15 to 25 days. It could not be demonstrated in the fæces before they were placed in water, but by heating one-half of a stool and placing it in water while the other half not heated was placed in sterile tap water in a sterile jar, it was shown that the organism was in the fæces, for in five experiments it was never obtained from the heated portion of the stools but invariably from the unheated portion. Heating of the fæces did not render them unsuitable for the growth of the Trichomonas, because it grew in them when added from other cultures. It has been maintained for three years in fæces placed in tap water, and will grow in any fluid which supports bacterial growth. It will ingest red blood cells, yeasts, and starch grains, but cannot live on red blood cells without bacteria. When grown anærobically in pure cultures of certain bacteria, the Trichomonas becomes exceedingly abundant. Multiple fission was constantly taking place, and it was found possible to induce this at will by crowding the organisms—this is the first record of multiple fission in a human trichomonad. Examples with from three to at least one hundred nuclei were observed. Trichomonads of many animals were placed in fæces diluted with tap-water, but none grew except *Tritrichomonas augusta* from the frog. *T. fecalis* is less than half the size of *T. augusta*, and differs from the latter in having no granules in the axostyle or in the cytoplasm.

PHOTOSYNTHESIS OF DIATOM CULTURES IN THE SEA.—Continuing their excellent work based in the Millport Marine Station, Miss S. M. Marshall and Mr. A. P. Orr report on experiments carried out with cultures of diatoms contained in glass bottles suspended in the sea (*Jour. Mar. Biol. Assoc.*, **15**, 1;

1928). A persistent culture of *Coscinosira polychorda* was used. The bottles containing the cultures were suspended at various depths, some exposed to light, others covered. The 'compensation point,' at which the amount of oxygen produced by photosynthesis is balanced by the amount used in respiration, was found to lie at a depth of 20-30 metres in summer. In winter it is close to the surface in coastal water. The optimum position for photosynthesis is never at the surface, even in winter, but some metres down. The experimental results are carefully considered in relation to the similar work of Gaarder and Gran and the authors' own researches in Loch Striven, and add much to our knowledge of this fundamental question.

NITRATE IN THE SEA.—H. W. Harvey continues (in *Jour. Mar. Biol. Assoc.*, **15**, 1; 1928) his interesting studies on the occurrence and seasonal variation in the English Channel of this important limiting factor in plant production in the sea. He confirms his previous conclusion that the nitrates are almost entirely utilised by phyto-plankton in the summer and are re-formed in early autumn. Regeneration takes place in the deeper layers, but the exact mechanism is not yet known. The interesting observation is made that the effect of land drainage on the quantity of nitrate is apparent for only a few miles from shore, and most of the nitrate entering Plymouth Sound in river and estuarine waters is used up by plants before it reaches open sea, at least in summer.

PLANT GENETICS.—Crosses have been studied by Dr. R. J. Chittenden (*Jour. of Genetics*, vol. 19, No. 3) of a number of *Primula* species, Vesicales section, including *P. Juliæ*, *P. acaulis*, *P. elatior*, and *P. officinalis*. All have as chromosome number $n=11$. Their hybrids are very fertile, with highly regular reduction divisions. The *Godetia* species studied fall into two groups: (A), including *G. amœna* and *G. Whitnegi* ($n=7$), intercross, but the hybrids are highly sterile; (B), containing *G. Bottœ* ($n=9$), *G. tenella* ($n=16$), and *G. lepida* ($n=26$). *G. Bottœ* will cross with *G. tenella* and the latter with *G. lepida*, but the hybrids are sterile. Groups (A) and (B) will not intercross. Six species of *Nemophila* ($n=9$) were also studied. Although four of the species are closely allied, they all refuse to intercross. Nevertheless, from a study of their variations, conclusions are reached regarding their probable genetic composition. In the genus *Phacelia* four species were examined ($n=11$). Two of the species were sterile with all the others, but the other two (*P. Parryi* and *P. Whitlavia*) may belong to the same species. Numerous parallel variations were found in the various genera. Thus in *Primula*, the pin and thrum types are present in all these species. Mauve and white flowers occur in two of the species of *Godetia*. Two species of *Nemophila* have a spotted and a uniform corolla colour, while in *Phacelia* two species have white and purple varieties. These variety characters show the same relations of dominance or recessiveness in different species of the same genus, for example, thrum being always dominant to pin, and the semi-glabrous condition of *P. Juliæ* dominant to the hairy condition in other species. A curious case is the occurrence of plants heterozygous for an inhibitor of a character which is not found in the species but is present in related species.

NEW SOURCE OF DIAMONDS IN SOUTH AFRICA.—In addition to the kimberlite pipes and derived gravels which constitute the source of most of the South African diamonds, the Witwatersrand bankets and the Upper Triassic Forest Sandstone are also known to be diamondiferous. A further occurrence in the chert beds of the Dolomite series (Transvaal System) has now been recorded by David Draper in the *Trans. Geol. Soc. S. Africa*, vol. 30, pp. 57-68; 1928. Following the marine transgression which led to the deposition of the great Dolomite series, a temporary regression of the sea made possible the formation of breccias and conglomerates from the newly exposed cherts and dolomites. At this time the diamonds were introduced from an adjoining elevated land surface, just as at the present time in Brazil and Borneo diamonds are being transported to lagoons and shore-lines where coral reefs are in process of formation. The productive fields are in the Lichtenburg and Ventersdorp districts in the south-western Transvaal, and their importance may be realised from the output for November 1926, which amounted to above 120,000 carats, valued at more than half a million sterling. Corundum occurs in the concentrates, suggesting that the ultimate source may have lain in the north-eastern Transvaal, where possibly it has been since obliterated by the intrusion of the great Bushveld complex.

THE UPPER ATMOSPHERE.—*Die Naturwissenschaften* for May 4 contains an interesting summary of our present knowledge of the upper layers of the earth's atmosphere, in an article (with brief bibliography) by J. Bartels. The sources of information touched on are very varied—meteors, luminous high clouds, auroræ, ozone, long-distance propagation of sound, terrestrial magnetic variations, and radio propagation; the extent to which the temperature, density, pressure, composition, and ionisation of the upper layers can be considered known is indicated.

THIN METALLIC FILMS.—In a recent issue (No. 8) of the *Annalen der Physik*, E. Rupp has described a neat method for preparing extremely thin foil. A small piece of metal is put in a tungsten boat in a vacuum furnace, and after preliminary purification *in situ*, part of it is distilled on to a highly polished rock salt plate. Heating is arrested when a sufficient quantity has been deposited, and the rock salt then transferred to a salt solution, where it dissolves and leaves the metal floating in the liquid, from which it can be lifted on a frame. Layers as thin as 10^{-6} cm., free from holes, can be prepared and handled in this way, and have been used for studying the diffraction of slow electrons by the Debye–Scherrer X-ray method, in a modified Ramsauer apparatus.

PHOSPHORESCENCE.—Prof. R. W. Pohl has given a valuable summary of some of the electrical and optical properties of phosphorescent crystals in the issue of *Die Naturwissenschaften* for June 15. The outstanding new result which he mentions is that their resistance for electron currents is proportional to the absolute temperature, a fact of particular significance since the same law holds for metals, where it has required the wave-mechanics for its explanation. One gathers from Prof. Pohl's article that the importance of these phosphors from the chemical and crystallographic point of view lies in their optical behaviour being that of a mixed crystal, and since the component responsible for the after-emission of radiation is present in vanishingly small quantity, its absorption spectrum and natural ultra-violet frequencies can thus be found with it in a dilute solid solution in an almost transparent matrix, instead of in a thin film of the pure substance that can only be prepared with some difficulty. It is an interesting point that measurement of the internal photoelectric current of a phosphor still provides the most direct proof of the rule that one electron is liberated for each radiant quantum absorbed.

ELECTRIC SPARKS.—The three experimental papers on the form and structure of electric sparks, by T.

Terada and U. Nakaya, published in volume 8 of the *Scientific Papers of the Institute of Physical and Chemical Research, Tokyo*, are instructive to scientific workers and will be useful to magneto manufacturers. The authors point out that our present knowledge of the form and structure of sparks is not much greater than in the days of Franklin and Lichtenberg. For example, the spark between the electrodes of a Wimshurst machine, instead of taking the shortest path, takes an irregular, bow-shaped curve with a right-angled bend on it. They give pictures of many zigzag sparks and point out the analogy with the 'discharge canal' in Lichtenberg's figures. Their most important results are in connexion with the straight and smooth type of spark sometimes observed. They found that this could always be secured by making a definite leak of electricity from the positive electrode. This was most readily secured by attaching a needle point to the positive electrode, from which a brush discharge takes place. This kind of spark they call a 'three-part' spark. Apparently the same spark is produced whether the needle is at a distance of 30 cm. or at a distance of 150 cm. from the spark. They conclude that the effect is neither directly due to the ions emitted from the point nor to any other kind of radiation which it may emit. If there is leakage on the negative lead, the three-part spark, or the 'fat spark' as it is called sometimes by magneto manufacturers, is not produced. It is advisable, therefore, to protect the negative lead with ebonite tubing. When an air blast is directed to the positive end of the three-part spark, its path makes a large curve at this end. When it is directed to the middle part of the spark nothing happens. When it is directed to the negative end, the number of sparks is greatly diminished and sometimes they stop altogether. If the voltage is increased, the air blast being applied to the negative end, the spark takes the zigzag form. Earthing the positive electrode produces the same effect as attaching a needle point to it.

EARLY MATHEMATICS IN SCOTLAND.—A paper of only forty pages naturally gives room for no more than a very rapid sketch of its subject; but within these limits Prof. G. A. Gibson, in a "Sketch of the History of Mathematics in Scotland to the end of the 18th Century" (*Proceedings of the Edinburgh Mathematical Society*, vol. 1, pts. 1 and 2, 1927–28), has given useful references to the work of men who are famous for original discoveries, or for their ability and success as teachers, or both. He deals with John Napier (1550–1617), James Gregory (1638–1675) and his nephew David Gregory (1661–1708), Robert Simson (1687–1768), James Stirling (1692–1720), Colin Maclaurin (1698–1746), Matthew Stewart (1717–1785), John Playfair (1748–1819), and Sir John Leslie (1766–1832). We are also given some interesting particulars of the state of mathematical studies in the schools and universities of Scotland at various dates. In Scotland, as in England, mathematics (arithmetic, geometry, and algebra) was not taken as a subject of education in schools until the latter half of the seventeenth century. In the universities, up to the time of the Reformation, the course included the "Sphere" (presumably the famous thirteenth-century work by Sacrobosco) and the "Physics," "De Caelo," "De Ortu et Interitu" and "Meteorologica" of Aristotle, but the mathematical subjects consisted of nothing more than arithmetic and very elementary geometry. Definite mention of arithmetic as a school subject begins in 1628. Only with the establishment from 1760 onwards of a new type of school more advanced than the grammar school and called by the name of "Academy" does a programme of higher mathematics appear in the curriculum extending, beyond plane and spherical geometry, to such things as the theory of equations, the differential calculus, statics, dynamics, hydrostatics, and optics, and it is not probable that this programme was at first carried out in the schools with any degree of thoroughness.

SPECIFIC HEATS OF SALT SOLUTIONS.—At room temperature, electrolytic solutions have an abnormally small heat capacity, and a mathematical theory to account for this has been advanced by Zwicky. He showed that in the vicinity of each ion a very high pressure could be set up due to the attraction exerted by the ionic field upon the dipoles of the water molecules. At room temperature, increase of pressure decreases the heat capacity of water, and hence an electrolytic solution should have a low specific heat. With rise of temperature, the heat capacity of compressed water increases, and therefore salt solutions should behave similarly. An attempt to test this theory experimentally is being made by F. T. Gucker, who describes some preliminary results in the *Journal of the American Chemical Society* for April. He employs an adiabatic twin calorimeter apparatus, with which, it is claimed, the specific heats of solutions may be found with an accuracy of 0·05 per cent. The results with potassium nitrate and chloride solutions do not uphold the above theory, although, as Zwicky has pointed out, the hydration of the ions may mask the effect of increase of pressure.

THE 'UNSATURATED HYDROCARBONS' IN THE GASES FROM THE CARBONISATION OF COAL.—In technical terminology the 'unsaturated hydrocarbons' in fuel gases are those which are absorbed by bromine or by concentrated sulphuric acid, and recent suggestions for their commercial utilisation has made it desirable to obtain a more detailed knowledge of the composition of these constituents. A convenient method for the determination of the unsaturated gaseous compounds present in coal gas is described by A. B. Manning, J. G. King, and F. S. Sinnatt in *Technical Paper No. 19* of the Fuel Research Section of the Department of Scientific and Industrial Research (London: H.M. Stationery Office). After the removal of the liquid constituents of the gas the unsaturated substances are separated as the bromine compounds, which are fractioned and the original hydrocarbons regenerated by the action of a zinc-copper couple. The resulting gas is analysed by treatment with strong sulphuric acid and combustion over copper oxide. The paper contains a detailed account of the apparatus used and some of the results obtained with gases from both low and high temperature carbonisation of coal.

CARBON MONOXIDE FROM GAS FIRES.—The Joint Research Committee of the Institution of Gas Engineers and the University of Leeds has issued its seventeenth Report, which records further study of the products of combustion of typical gas appliances, and in particular the evolution of carbon monoxide in the flue gases from gas fires. For this purpose a very refined modification of the iodine pentoxide method was employed, and indeed necessary, to detect and measure the small quantity of carbon monoxide passing from a modern gas fire. This reached 30 parts per 10,000 of gas burned in such a fire when properly regulated. The actual concentration in the flue gases is, however, much less—it may be so little as one two hundred and fiftieth of this owing to the dilution of the flue gases, which varies from case to case. Small as this is, in view of the volume of gas burned in such appliances, the usual practice of fixing them to efficient flues is considered to be advisable.