

Research Items.

STONEHENGE.—The excavations in progress at Stonehenge have now covered the greater part of the site, only the north-western area awaiting examination. The sixth report on the results, which was presented by Col. Hawley on behalf of Mr. Newall and himself at a recent meeting of the Society of Antiquaries, deals with the south and south-west area. No objects of any importance were turned up; but a number of holes, some shallow, others reaching to a depth of 28 inches and ranging in width from 15 to 23 inches, were found. These pointed to the possible existence of a stockaded passage or long roofed building at this point, and it is conjectured that they were contemporary with the causeway at the main entrance, where similar post holes have been found. Nothing of the Stonehenge period had penetrated to the lower levels. Another causeway with pits in the ditch on each side of it was exposed. Seventy-one holes in all were discovered; but it is impossible to say what their use may have been, though they were too irregularly placed and too widely spaced to have formed a building. Further investigation has shown that the area of foreign stones must have held a much larger number than had hitherto been supposed, and they must have presented the appearance of a low wall. The discovery of a seventeenth-century glass flagon suggested that the removal of these stones had been comparatively recent.

UNITS OF MEASUREMENT IN ANCIENT EGYPT.—In *Ancient Egypt* for June, Sir Flinders Petrie puts forward and discusses a suggestion by Mr. J. Tarrell to account for the fact that the varying thicknesses of the courses of the great Pyramid tend to group around certain heights. The courses a dozen times or more start with a thick course, and dwindle until a thick course occurs again. An enormous number of blocks must have accumulated in the years of preparation. When the masons were ready to build, they shifted the quarrymen to another quarry and started sorting the blocks for each course according to size. This process was repeated from time to time, each thick course representing the beginning of a supply from a fresh source. The variations in thickness suggest the use of the cubit and double cubit, 20.6 and 41.2 inches, as the unit of a great number of the blocks, with a digit measure between, the groups being at 50, 40, 30, 32 (?), 34, 36, and 38 digits. Large exceptions point to local measures which may have survived into later times: 21.3 in. is the medieval Nilometer cubit; 22.2 in. the double foot of Syria found down to Roman times; 23.2 in. the double Roman foot, an ancient measure in Etruria; 26.3 in. the double of the northern foot (the foot of Germany and the basis of measurement in England which survives in the furlong and chain, and is important in France); 28 in. the Turkish *pih*; and 38.1 in. the Persian *arish*.

THE CRYSTALLINE STYLE.—Whereas in lamellibranchs a crystalline style is common, in gastropods it occurs in only a few genera. Mr. N. A. Mackintosh has given (*Quart. Journ. Micr. Science*, March 1925) a careful description of the style of *Crepidula*—the slipper limpet. The style, which is contained in a sac partially differentiated from the intestine, is a straight transparent rod of gelatinous consistency built up of co-axial layers surrounding a spiral core. It is composed chiefly of globulin and contains an amylolytic enzyme. The style and the style-sac resemble those of lamellibranchs so closely that they must be regarded as homologous in the two groups. A list of about two dozen gastropods is given in which

the style is known to occur, and it is suggested that the style has been lost in all but a few gastropods, or that its appearance in this group is to be explained on the principle of orthogenesis.

GELATION AND SOLUTION IN CELLS.—In his report (Year Book No. 23) on the work of the Department of Embryology of the Carnegie Institution of Washington located in Baltimore, Dr. G. L. Streeter refers among other items to the work of Mrs. G. M. Lewis on gelation and solution in cells. When a culture of embryonic tissue is washed with a saline solution to which any of the ordinary acids has been added to give it a P_H of 4.6, the cells undergo coagulation and exhibit appearances which are regarded as characteristic of cell-death. The nucleus becomes granular and acquires a bright thick membrane; in the cytoplasm the granules cease their activity, and pseudopodia are not put out. If now, before the coagulation proceeds further, the acid solution is washed off, the cells recover their normal appearance, and such a culture if returned to the incubator may live as long and remain in as good condition as the controls; in other words the gelation is reversed. Such gelation can be brought about and reversed several times in succession. The cytoplasm can be made more fluid by means of a solution of alkalis with a P_H of 8.6 to 9. The cells, instead of remaining spread out on the cover glass, begin to round off, the mitochondria change from filaments to short rods and all the granules are in dancing movement. By bathing the cultures in normal solution the process can be to some extent reversed, but the cell never spreads out again, and such a culture does not live so long as the controls. One of the most effective acids in bringing about the gelation of living cells was that obtained from sterile dead tissue, and Dr. Streeter remarks that this fact should be of importance in explaining the toxic nature of crushed or burned tissue.

NUTRITION OF MYCORRHIZA PLANTS.—Dr. M. C. Rayner has published the results of further research on the nutrition of *Calluna vulgaris* (*Brit. Journ. Experimental Biol.*, vol. 2, January 1925, pp. 265-292). The most striking of these is the observation of regular and well-marked digestion of the mycelial constituents in the root mycorrhiza. Digestion begins soon after the production of young roots in the spring, is carried out throughout the growing season (during which mycelial activity reaches a maximum), and continues until growth ceases in the autumn. It cannot therefore be regarded as a phenomenon of senescence. The author shows that under certain conditions the roots may be infected by the fungus, but that typical mycorrhiza may not be established. By means of a special technique it is possible to find, in early spring especially, the hyphae of invading root cells undergoing digestion before branching of the filaments can take place in the cells. This formation of suppressed mycorrhiza is regarded as highly significant, and is held by the author to explain the discordant results of previous workers. Assuming it to be correct, "the formation of mycorrhiza is a reciprocal phenomenon involving co-operation on the part of the root cells" and "represents a temporary phase of toleration on the part of the plant cell interposed between one involving immediate destruction of an entering hypha and the wholesale digestion of the mycelium which eventually takes place." It is held, in consequence, that the obligate relation in *Calluna* is associated with fungal infection and seedling development rather than with the subsequent stage of typical mycorrhiza.

formation. The cytology of digestion, the distribution of the mycelium in the shoot, experiments with cuttings, and a general discussion on the nutritive relations in *Calluna* are other subjects dealt with in the paper.

WATER ABSORPTION BY LEAVES.—J. G. Wood has recently directed attention (*Australian Journal of Experimental Biology and Medical Science*, Vol. 2, pp. 45-56, 1925) to the remarkable capacity for water absorption possessed by the relatively uncutinised leaves of species of *Atriplex*. These plants, the "salt-bushes" of Australia, are the characteristic plants over vast areas of dry plains, and as their root system is poorly developed, this power of absorbing water by means of the leaf system may be of considerable significance. It appears to be due to a remarkable accumulation of sodium chloride in the leaves of these plants. Even when growing in soil containing relatively small quantities, considerable accumulation of the salt occurs in the plant. As the result of microscopic examination of leaves placed in a solution of silver nitrate and then exposed to light, this accumulation seems to be most pronounced in the veins and in the chlorenchyma surrounding the veins.

RADIUM ORE DEPOSITS IN CENTRAL ASIA.—The presence of certain radioactive uranium minerals in Ferghana, Russian Turkestan, has been known since the beginning of this century. The centre where such deposits have been found is the Tuya-Myun copper mine, where uranium was discovered long ago. More recently that mine has been studied extensively by several Russian mineralogists, geologists, and chemists, and since 1923 the mine has been regularly exploited. Results of the work of the expeditions recently published by the Russian Academy of Sciences show that the deposits are of great practical value as a source of radium; moreover, a study of geological conditions of the Ferghana province leads to the suggestion that radium deposits are not restricted to that mine only, but are much more widely distributed along the northern slopes of the Alai and Turkestan ranges. Further investigations are being carried on by the recently founded State Radium Institute of the Academy.

THE GEOLOGY OF SOMALILAND.—Mr. R. A. Farquharson's first report on the geology and mineral resources of British Somaliland, 53 pp., 1 map, forms a valuable contribution to the geology of East Africa. The report includes a general summary of the Somaliland sequence, which has recently been described in a monograph published by the Hunterian Museum of the University of Glasgow. To the sequence already known Mr. Farquharson's most important addition is that of a series of ancient unfossiliferous slates with interbedded limestones, for which he makes the interesting suggestion that they are the northern extension of the Karagwe Series of Kenya Colony and Uganda. The local Jurassic rocks he attributes entirely to the Kimmeridgian; but in the absence of any information as to the fossils he collected, it remains uncertain whether this identification is likely to stand, or whether he obtained them only from the upper part of the Jurassic. Mr. Farquharson's conclusions as to the age of some Kainozoic rocks do not agree in some respects with those based on the collections made by Messrs. Wyllie and Smellie, and an account of the author's fossils and his geological map will be awaited with interest. The longer section of the report includes an account of the occurrence of numerous economic minerals, some of which are regarded as promising, though nothing has been so far proved of

commercial value under present conditions. In some of the specimens collected by the author, assays at the Imperial Institute record a trace of gold. The report is illustrated by a map in which, unfortunately, the place names are sometimes spelt differently from those in the text. The Las Khorai of the map is apparently Las Gori of the report. It is regrettable that a report issued at the end of April 1925 should be dated as if published in 1924.

THE PETROLOGY OF SAMOA.—Prof. R. A. Daly has written a very valuable account of the geology of Tutuila and the smaller American islands of the Samoan Group for Publication No. 340 of the Carnegie Institution of Washington. The average basalt of Tutuila is almost identical with that of Hawaii and with the average plateau basalt of the world. This close resemblance of the oceanic and continental basalts is strongly suggestive of a nearly uniform substratum below the heterogeneous crust. The alkali-trachytes and other intermediate rocks, occurring in Tutuila mainly as volcanic necks and dykes, are regarded as differentiates of ordinary basalt. The cause of the differentiation is, however, recognised to be still an unsolved problem, though the common eruptive sequence—basalt, trachyte, basalt—found in very many volcanic centres, receives a suggestive explanation. One of the domes of Tutuila is built up in part of quartz-trachyte similar to that of Ascension Island. It is remarkable as one of the rare examples of a lava in the open-Pacific area containing primary quartz, and unique in being farther removed from a visible continental border than any other case yet described. It suggests to Daly that the submerged edge of Australasia may really extend as far to the east as Samoa. The lithification of beach sands is another problem which is fully discussed. The view is adopted that the formation and distribution of the "beach rock," as the firmly cemented sand is termed, are controlled by the action of the more violent storms. These are known to pile up calcareous sands over the normal beaches, and in their new position bacterial decomposition of the organic matter associated with the displaced shelf sands tends to precipitate calcium carbonate sufficiently to fix the grains. Further precipitation from the saturated tropical sea water then completes the process of cementation. Ordinary clean beach sands are not cemented because they are kept in incessant movement by wave-action.

THE RAYLEIGH SEISMIC WAVE.—Part 5 of Vol. 2 of the *Japanese Journal of Astronomy and Geophysics* contains a memoir of 93 pages by Mr. H. Nakano of the Central Meteorological Observatory, Tokyo, on the properties of the wave propagated along the surface of the earth due to some seismic disturbance in the interior. He finds that the wave does not make its appearance at the surface at a point immediately above the focus, but at distances from that point which depend on whether the originating disturbance is of the dilatational or distortional type. Its amplitude when it first appears at the surface is small and it does not attain its full value until the wave has travelled a distance along the surface which is large compared with the depth of the focus. The retardation of phase at each point of the surface is the same as it would be if the disturbance originated at the point on the surface over the source at the instant it actually originated at the source. The author hopes by a study of the laws of propagation in a laminated earth and comparison with observations to arrive at more definite conclusions as to the structure of the interior of the earth.

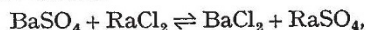
SURVEYS IN TIBET.—In the annual reports of parties and officers, 1921–22, which is published as a supplementary volume to the general report of the Survey of India for that year, there is a brief record, accompanied by a map, of the late Sir H. H. Hayden's surveys in Tibet in 1922. Sir H. H. Hayden, who was accompanied by an Indian surveyor, travelled through the central and south-eastern parts of the country to report on certain mineral-bearing areas for the Tibetan government. His routes lay between Lhasa and the great lakes of Tangra, Kyaring, Ziling, and Nam. Altogether some 36,000 square miles were mapped on a quarter-inch scale, of which only some 4000 miles had been previously surveyed: the remainder was known only from rough route surveys of the native Indian explorers Kishen Singh and Nain Singh, and the tracks of the few European travellers who had previously succeeded in penetrating this region.

BINARY ALLOYS OF ANTIMONY AND BISMUTH.—The equilibrium diagram of the binary alloys of antimony and bismuth has been already studied by several investigators. The results, however, do not agree well with one another, and a re-determination of the diagram has been carried out by Otani at the Research Institute, Sendai (Report No. 91). He has determined the liquidus and solidus by measurements of electrical resistance. With regard to the former, he measured the difference in potential between two fixed points in the specimen, both in the liquid and solid states. The current passed through the specimen for the measurement of the potential fall was 1.5 amperes, and the electrodes dipped into molten alloys were iron wires about 0.8 mm. thick. The rate of heating and cooling was about 1 degree per minute. The liquidus curve is found to be smooth and convex upwards. In the case of the determination of the solidus, the alloys were tested in the form of rods 5 mm. thick and 9 cm. long. These rods were made by casting the alloys in an iron mould and afterwards annealing them just below their solidus for a sufficiently long period to obtain a homogeneous structure. This was confirmed by microscopical examination. The temperature-resistance curves obtained on heating show that the solidus also is a smooth curve, which is concave upwards. The crystallisation interval in the case of the 50:50 alloy is nearly 200° C. This, of course, diminishes on either side. Thus the form of the liquidus and of the solidus in this system belongs to the ordinary type of solid solution where all points of the liquidus lie between those of the pure metals.

THE CURRENTS IN SUPRACONDUCTORS.—Supplement No. 50 of Communications from the Physical Laboratory of the University of Leyden contains a report by Prof. Kamerlingh Onnes of the results of the experiments on the mutual action of the electric currents in two supraconductors in the neighbourhood of each other. In one case the two supraconductors are concentric rings of lead in liquid helium with their axes horizontal and the inner ring supported by a long vertical fibre provided with a torsion head. The currents having been produced in the rings by the diminution of a magnetic field along their axes, the inner ring is rotated about 30° out of the plane of the outer by means of the torsion head. The rotation of the inner ring is observed by means of a mirror attached to it and is found to be invariable to within less than 1 part in 1000 for 6 hours. When the inner ring is replaced by a spherical shell also of lead and the experiment repeated, the torsional couple necessary to rotate the sphere is only one-third that for the ring. The author concludes that the paths of the electrons amongst the molecules of matter are fixed and unaffected by any transverse magnetic field.

DOMESTIC GRATES.—Technological Paper No. 13 of the Fuel Research Board is an account of the investigation of the relation between the design of a domestic grate and the heat radiated by it into the room, carried out by Dr. Margaret Fishenden under the auspices of the Manchester Air Pollution Advisory Board. The measurements show conclusively that diminution of the depth of a grate from front to back increases the heat radiated into the room per pound of coal consumed. Ease of maintenance of the fire limits this diminution in most cases to a minimum of four inches. The bars of the grate should be as slender as possible, and the grate should be visible from as large an area of the floor of the room as possible. Conduction losses through the back of the grate should be minimised by the use of firebrick instead of iron. The throat of the flue should be adjustable in area so as to permit regulation of the flow of air through the room, and an adjustable air inlet beneath the fire should be provided for the regulation of the speed of combustion of the coal.

PRECIPITATION OF RADIUM SULPHATE.—Sulphate ions will precipitate radium in the presence of a large excess of barium even though the solubility product of radium sulphate is not exceeded. H. A. Doerner and W. M. Hoskins have investigated this phenomenon and publish their results in the *Journal of the American Chemical Society* for March. At equilibrium, the reversible reaction



gives a distribution of radium and barium represented by the equation

$$\text{Ra}''(\text{final}) \times \text{Ba}''(\text{initial}) = K \times \text{Ra}'(\text{initial}) \times \text{Ba}'(\text{final}),$$

which is mathematically deduced from the principle that the radium-barium ratio of the precipitate ("crystal surface") is proportional to the radium-barium ratio of the solution. This equation is confirmed experimentally, K , obtained by several methods, being 1.8. The equilibrium is largely influenced by crystal growth. The possible application of the theoretical equations to adsorption, fractional crystallisation, etc., is discussed.

SOLID SOLUTIONS OF WATER AND OXYGEN.—The attention of chemists so far has been centred chiefly on compounds subject to the law of multiple proportions, but, according to N. S. Kurnakov (*Annales de l'Institut d'analyse physico-chimique de l'Académie de Science de Russie*, vol. 2, liv. 2, 1924), we must admit that this type of change is merely a particular case of a more general case—the constant change of the solid phase. Attention is directed chiefly to the ferrous compounds with a variable amount of oxygen and water in such substances as mica, tourmaline, hornblende, and also phosphorus salts. For these substances, the absorption of different amounts of oxygen does not affect the structure of the crystal, but creates continuous variations of colour and optical properties. The greyish-black, bluish-green, and blue colour of such substances is remarkable as being doubtlessly connected with the amount of absorbed oxygen. A very characteristic example is the mineral vivianite, which is a hydrated phosphorus oxide of iron, which may also be produced synthetically. In the early stages of their formation the crystals are nearly colourless, but become more blue as oxygen is absorbed, without changing their structure, and remaining quite homogeneous. The amount of water in vivianite crystals is also variable; the latter depends on the formation of solid solutions of water, and is very common among numerous classes of chemical compounds.