

Research Items

Culture Sequence in Nebraskan Archæology

MR. WILLIAM DUNCAN STRONG, in a survey of the archæology of Nebraska (*Smithsonian Misc. Collect.*, 94, 10) puts forward a chronological classification of the indigenous cultures of that state and of northern Colorado, in which the primary basis of division is historic, protohistoric and prehistoric. The evidence, apart from documents and European associations in the historic period, is based on the evidence from stratified sites or association with an extinct fauna or geological deposits of pre-recent date. The *Historic Period* covers the occupation by Pawnees, sedentary Sioux, Dakotas, Arapaho and Cheyennes. The Pawnees' occupation is the oldest known of these, extending back into the *Proto-historic Period* (1540-1682). This is the period of highest Pawnee cultural development. The *Prehistoric Period* (1541 back to an undefined past) in its latest phase is characterised by two main cultures, the Nebraskan and Upper Republican, which exhibit certain affinities, but at the same time appear to have maintained their integrity. The Nebraskan covers the area later occupied by the intrusive Siouan. The Upper Republican may be ancestral to the Pawnee, which would thus bridge the gap between historic and prehistoric. Stratigraphical evidence suggests that the Stern Creek culture is older than either Nebraskan or Upper Republican; but it may be an intrusive trans-Missourian culture. Of stratified sites, that at Signal Butte exhibits three phases, of which the third and last appears to be a sub-type of the Upper Republican. Phases ii and i have no pottery; but, throughout the three phases, the development of the projectile stone point, and in a lesser degree other stone implements such as the knife, can be followed in a cultural and chronological progression, which affords argument for linking Signal Butte I, though later, with the Folsom point and recent discoveries on the Lindenmeier site in northern Colorado (see p. 535 of this issue). At present, palæontological evidence is scant and the associations of implements with extinct fauna are culturally too meagre to afford ground for inference.

Stone Implements from South Australia

MR. WALTER HOWCHIN, who went to Australia in 1881 with an interest in prehistoric archæology inspired by association with Canon W. Greenwell, began to collect and study the stone implements of the extinct Adelaide tribe, which previously had been entirely neglected, in conditions which have now vanished. A paper prepared by him in 1893, but not then published in full, has now been completed and brought up to date ("The Stone Implements of the Adelaide Tribe of Aborigines now Extinct." By Walter Howchin. Gillingham and Co., Adelaide, South Australia. Pp. viii + 94. 7s. 6d.). The implements of the Adelaide tribe were found on the sand dunes of the coastal region near Adelaide and southward to the River Onkaparinga, the most prolific region being comprised within the ancient estuarine limits of the River Torrens. They occur in the recent drift, none having been found in the older formation of the sandhills. In one instance only, at Fulham, have they been found below marine deposits; but

these implements must also be described as 'recent'. All stand in a different category from the stone implements of the tableland of Central Australia, with their characteristic desert glaze and ferruginous impregnation. The material most commonly employed for the Adelaide implements is quartzite; but various other rocks were in use, including even the intractable quartz. Flint appears sparingly, some of it being of European origin, imported as ballast. For certain implements, such as 'choppers', a volcanic rock, such as basalt, was employed. Characteristic forms are knives, falling into five classes, chisels, gouges and adzes, hatchets, scrapers (of which eleven varieties are distinguished), points, graters, borers, etc., as well as a number of microlithic forms. Examples of the magical stones, which figure in aboriginal belief, some of curious form and unknown significance, are included in the collection. As a geologist, Mr. Howchin finds no evidence of a stone culture in any other than 'recent' conditions.

Life-History of the Organism of Pleuropneumonia

IN A former issue of NATURE (Feb. 24, 1934, p. 296), Dr. J. C. G. Ledingham's researches upon the causal micro-organism of pleuropneumonia of cattle were summarised. The matter has been carried a stage further by A. W. Turner (*J. Pathol. and Bacteriol.*, 41, No. 1, 1). He has studied the life-cycles and morphology of this organism in the living state by means of dark-ground observation of macro- and micro-cultures in a new fluid medium, which consists essentially of a peptic digest of ox liver and muscle, enriched with ox serum, and sterilised by filtration instead of by heat. The microbe is not filterable in the strict sense, though there is constant and early production of filter-passing forms ('conidioids'). It typically and constantly forms a relatively enormous branching mycelium, filaments of which may reach a length of 190 μ . It possesses at least five methods of reproduction, for which the term 'genethodes' is suggested. A new order Borrelomycetales to include it and the closely related organism of agalactia is proposed. The suggested terminology is *Borrelomyces* (nov. gen.) *peripneumonix*.

Morphology of the Wheat Joint-worm Gall

THE morphology of the stem galls produced on wheat by the chalcid wasp *Harmolita tritici* forms the subject of a paper by Messrs. W. J. Phillips and F. F. Dicke (*J. Agric. Res.*, 50, No. 4; 1935). It appears that the female insect selects for oviposition the upper side of a node, in tissue that will later form an internode. The ovipositor is inserted slightly below the meristematic region, at the union of a leaf base with the stem. The egg is actually deposited in or near the phloem of the vascular bundle. The gall tissue arises partly from the phloem, but mainly from the parenchyma. There is no pith cavity in the part of the internode within the gall area, this section of the internode being filled with gall cells. Practically all the vascular tissue is destroyed in this region, and this inhibits the normal functions of the plant. The entire galled region lignifies and becomes hard by the time the larvæ are fully grown. The gall stimulus seems to be the products of larval

metabolism together with, perhaps, mechanical irritation. Unhatched eggs remain inert, a fact which strongly indicates that no stimulating substance is injected into the tissues at the time of oviposition to initiate gall-formation. The absence of the insect over the immense wheat area of Kansas and western Missouri seems to be due to the fact that the meristematic zone at the node of the wheat in this region is too tough and hard for oviposition. It is suggested that by fertilisation, or otherwise, the growth of the wheat might be brought to a stage unsuitable for the insect at the normal time of attack.

Refrigerated Gas Storage of Apples

LEAFLET No. 6 on Food Investigation, by Drs. Franklin Kidd and Cyril West, issued by the Department of Scientific and Industrial Research, 1935, shows how completely scientific investigation has now established suitable conditions for winter storage of the apple crop. It is now clear that if both the atmosphere surrounding the apples and the temperature are controlled, very adequate storage conditions can be provided when certain precautions are taken. Control of the atmosphere enables the oxygen supply to be cut down, and the carbon dioxide supply, released by the respiration of the apples, to be maintained at a suitable level. Whilst the slower respiration doubles the lifetime of the apples in store, the carbon dioxide has further influence in retaining the original green colour and hardness of the fruit. The temperature of the store is cooled as rapidly as possible to about 40° F. and kept about this level—too high for the development of the low-temperature breakdown conditions which so frequently follow when the fruit is released from stores at freezing temperatures. One of the most significant lessons learnt in recent years is the influence of the volatile products released from ripening fruit in producing further and deleterious changes in the fruit. They are controlled largely by their absorption by wrapping the fruit in paper soaked in mineral oil; it is also now clear that varieties with different ripening periods should be stored separately, as these substances are released in greatest quantity just as the apples begin to ripen. Practical details as to the construction and management of gas storage containers are given in this very concise publication.

Problems of Cacao Cultivation

1935 marks the close of the five year Cacao Research Scheme which has been carried out at the Imperial College of Tropical Agriculture, Trinidad, and a summarised account of the present situation has been published by Sir Geoffrey Evans in *Tropical Agriculture*, 12. The work, financed jointly by the producers and manufacturers themselves, was launched as the first organised attack on the botanical and soil problems that arise in the cultivation of the crop. The aim of the botanical researches has been defined as "the collection of information necessary for improvement of both yield and quality", a uniformity of production, at least locally, being specially desirable. Improved yield will then justify intensive cultivation, which in its turn will be limited to the more productive areas. Selection and propagation studies have, therefore, been the chief lines of work, the development of good methods of vegetative propagation being of particular importance as only by this means can uniformity be obtained, cacao-subject to cross-pollination. As regards

chemical and ecological researches, systematic studies of 'good' and 'bad' cacao soils have been made and detailed surveys of soils in representative cacao-growing districts carried out. From such investigations, it is now possible to state whether or not a particular soil will prove suitable for profitable cacao production, fluctuations in soil and atmospheric moisture being a factor of some importance. Further, manurial studies have shown that both the quantity and quality of the product may be greatly improved by the addition of suitable fertilisers. For a more detailed account of the scientific side of the work, reference should be made to the four annual reports on cacao research already issued and obtainable on application to the editor, *Tropical Agriculture*, Imperial College of Tropical Agriculture, Trinidad, B.W.I.

Research at the Bose Research Institute

PAPERS recording the biological and physical researches, under the direction of Sir J. C. Bose, at the Bose Research Institute, Calcutta, have recently been published collectively ("Transactions of the Bose Research Institute, Calcutta", 9, 1933-34: Biological and Physical Researches. Edited by Sir Jagadis Chunder Bose. London, New York and Toronto: Longmans, Green and Co., Ltd., 1935. 18s. net). Further work on the physiology of *Mimosa pudica* has been carried out, during which the effect of flowering on diverse internal activities, especially of that of the pulvinus, were examined. The appearance of the inflorescence induces a depression in the moto-excitability of the pulvinus. This investigation, together with others, such as a study of variation in longitudinal and diametric growth in *Helianthus*, and the determination of the actual moment when germination commences inside a seed, together with the measurement of the rate of growth of the embryonic radicle, makes use of the continuous automatic record method which is so closely associated with the Bose Research Institute. By automatically recording the rate of oxygen consumed during respiration, a respirograph devised at the Institute is claimed to be very accurate and sensitive. This apparatus is fully described and illustrated. An investigation has been carried out on the physico-chemical and physiological nature of fat-soluble vitamins of *Cicer arietinum*, a pulse commonly used throughout India as an article of diet. The oil of certain varieties approaches cod liver oil in vitamin efficiency. Other researches at the Institute during the year under review include an anthropological study of the primitive Oraons of the Ramhi district, the continuous emission spectra of the hydrogen halides, and the flame spectrum of HCl.

Geology of Ceylon

So little has been published about the geology of Ceylon, that a monograph on the subject, accompanied by an excellent geological map, by J. S. Coates, who until recently was Government mineralogist of the Island, is particularly welcome (*Ceylon J. Sci.*, B, 19, 101-187; 1935). In order of age the formations described are as follows: Bintenne Gneisses are specially developed in the low country of the south-east. Khondalite series of granular quartzites and other metamorphic rocks, including garnet-sillimanite schists, form the central mountain system of the Island. Charnockites are extensively developed as sills in the Khondalite series and also occupy the whole of the south-western part of the

Island. There they are associated with garnetiferous leptynites that are regarded as sheared portions of charnockitic rocks. In the north and north-west a later series of Wannai Gneisses and granulites occur. The younger Pegmatites are of two types: a white variety (Balangoda group) remarkable for its variety of accessory minerals, including zircon and radioactive minerals; and a red variety poor in these accessories. Dykes of dolerite, peridotite and pyroxene-scapolite rocks also occur. Nine-tenths of the Island are occupied by the above crystalline rocks. The remaining deposits include the Jurassic Tabbowa Series; Miocene and related Tertiary beds; and Pleistocene and Recent coastal deposits and river alluvium, the last of which include the gem gravels for which Ceylon is famous. Gem-corundum has been traced only to the white pegmatites which are also the source of beryl, chrysoberyl, topaz, tourmaline and zircon. Moonstone occurs in bands of a sheared quartz-felspar rock probably related to the pegmatites.

Ionisation of the Upper Atmosphere

E. V. APPLETON and R. Naismith (*Proc. Roy. Soc.*, A, July) have published the results of a long, systematic investigation of the reflection of wireless waves in the ionosphere. The method employed is to vary the frequency of a wave sent upwards, and to plot automatically the delay time of the reflected wave observed at vertical incidence against the frequency. At critical frequencies, the wave breaks through a lower reflecting layer and is reflected at a higher one, and the critical frequency for a given layer is connected with the maximum electron concentration in the layer by a formula which is now well established. The investigation was mainly concerned with daytime conditions, which are more complicated than those observed at night, for instead of the simple E and F regions of ionisation there is frequently an intermediate region E_2 lying above E_1 and a region F_1 lying below the main F_2 . The F_1 region is prominent only in summer. The seasonal variations of the noon values of ionisation in regions E and F_1 agree with a theoretical calculation based on the assumption that direct solar radiation is the ionising agent and recombination of ions the predominant dissipative process. The diurnal and seasonal variations of region F_2 are quite different, the critical frequency for summer noon being slightly less than for winter noon. The authors reject the conclusion of some of the American workers, that critical-frequency determinations do not give a true measure of the electron concentration; and explain their results on the assumption of a high molecular temperature for the upper atmosphere at summer noon. This causes a reduction in the electron concentration. The temperature required is of the order of 1,200° K., and could be due to molecular dissociation, or to collisions of excited molecules. The anomalies connected with region E are less fully considered, but examples are given of a special type of region E condition, common in summer, in which a thin stratum is formed which reflects strongly at both upper and lower surfaces, and which may give good reflection and hence very favourable transmission conditions for quite short waves.

Interaction of Neutrons with Matter

T. BJERGE and C. H. Westcott (*Proc. Roy. Soc.*, A, July) have investigated the production of 'slow' neutrons by the passage of neutrons through hydrogen-

containing substances. Their main experiment consisted in surrounding a radioactive neutron source with cylindrical vessels of water of varying diameter, and measuring the artificial radioactivity induced in a specimen placed outside the vessel. The curves show a maximum effect for a thickness of water of about 10 cm., and further experiments show that the 'fast' neutrons coming from the source are reduced to half-value in about 7 cm. of water while the 'slow' ones only have a half-value distance of about 1.6 cm. The scattering cross-section of several atomic nuclei for 'slow' neutrons was estimated ($3 \cdot 10^{-23}$ cm.² for hydrogen, 3×10^{-24} cm.² for carbon and oxygen). The cross-section for absorption varies very much from element to element—it is about 4×10^{-25} cm.² for oxygen and 1.2×10^{-21} cm.² for boron. J. R. Dunning, G. B. Pegrum, G. A. Fink and D. P. Mitchell (*Phys. Rev.*, Aug. 1) have also studied these neutrons. Their results agree approximately with Bjerger and Westcott in giving a halving-distance in water for fast neutrons from a radon-beryllium source of about 8 cm., and a maximum production of slow neutrons by spheres of 10 cm. radius. These workers have also studied the production of slow neutrons in heavy water, and they find that it is about 5.5 times less effective than ordinary water. They conclude that there is a smaller probability of interaction between a neutron and a deuteron than between a neutron and proton, and this is borne out by absorption experiments. The collision cross-section of a number of elements was measured for fast and for slow neutrons—the former shows a fairly regular increase with atomic number, while the latter varies violently from element to element, and attains a value 3×10^{-20} cm.² for cadmium. The high absorption of cadmium for slow neutrons was found to be nearly exponential when measured with a parallel beam, and was also found to be a true absorption associated with very little scattering.

Structure of Keratin

ASTBURY and his co-workers have shown that the molecular structure of keratin is such that the 'extended' form β -keratin consists of flat grids of atomic chains bound together by side chains. A number of such grids piled on one another form the β -keratin crystallites, and a characteristic spacing of about $4\frac{1}{2}$ Å., found from the X-ray photographs of keratin structure, is supposed to represent the distance between the grids, while a spacing of $9\frac{1}{2}$ Å. represents the distance between main chains in the plane of the grid. In the normal unstretched α -keratin, the main chains are regularly folded in planes perpendicular to the grid. In a recent paper (W. T. Astbury and W. A. Sisson, *Proc. Roy. Soc.*, A, July 1), this view receives rather direct confirmation. Specimens of horns and hair were squeezed laterally in the presence of steam. The α -keratin was first changed to the β -form and the β -keratin crystallites then took up a definite orientation, X-ray examination now revealing directly that the $4\frac{1}{2}$ Å. spacing and $9\frac{1}{2}$ Å. spacing were respectively normal and parallel to the flat surface of the squeezed specimens. The sharpness of the X-ray diffraction spots shows that the keratin grids are not very wide, but that many of them are piled on top of one another to form the β -keratin crystallite. The end of the paper contains a short discussion of the evolution of fibrous proteins, and speculates on the condensation of these from the globular protein structures.