

The Cult of the Sun.

AT a meeting of the Royal Anthropological Institute on Nov. 5, Mrs. Zelia Nuttall read a paper on "The Cult of the Sun at the Zenith in Ancient America".

Attention was first directed to the important fact that all the ancient centres of civilisation in America are situated within the tropical zone. In this the sun passes through the zenith of each latitude twice a year at noon, excepting at the tropical lines, which it approaches very slowly, and passes through the zenith at noon for 10 or 12 consecutive days at the solstices, appearing to linger there before slowly moving away.

When the sun passes the zenith, vertical objects, of course, cast no shadow. The high temperature caused by the vertical rays over a particular area causes an indraught producing an ascending current carrying up the warm moist air which, condensed in the higher regions of the atmosphere, falls as rain. It is a law of Nature that, subject to modifications according to situation near sea or mountain ranges, the rainy season of any place begins almost, if not immediately, after the sun has reached its zenith.

Authentic, documentary, and historical evidence presented establishes that throughout tropical America this phenomenon was observed by means of gnomons ranging from staffs, high poles, plain or carved columns and stelæ, conical structures and altars, and finally temples situated on high sub-structures. The ancient sun priests dated the commencement of the year from the moment the gnomon cast no shadow, and the phenomenon was interpreted as a 'descent' of the sun, to which prayers were addressed for rain which, of course, were effective.

A number of peculiar structures with vertical shafts have been found in temples, and also below ground, and it is obvious that such would have afforded a perfect means of registering not only the sun at the zenith, when its rays would fall into the chamber,

but also the culmination of the moon and other celestial bodies, in particular of the Pleiades in November, which heralded the dry season and gave the signal for the lighting of the bonfires which were kept burning day and night in the temple courtyards for public convenience during the dry and cold season.

The native representations in painting and sculpture show the sun god descending head-foremost in human form, or as a bird or a combination of both, associated with the serpent, the symbol of rain. A head in a solar disc or a winged head were also employed as symbols, and the sun god armed, seated in the centre of a solar disc, is another common form.

Mention was made of the interesting fact that, at Mrs. Nuttall's suggestion, the observation of the shadowless pole has been officially revived as a school festival in Mexico as an educational factor and a link with the past. This year, for the first time since 1519, it was celebrated in a public square, witnessed by thousands of school children, some of whom danced and sang in the Aztec language in native costume to the accompaniment of drums and flutes of ancient form.

In conclusion, it was pointed out that the northernmost great ruins in Mexico, those of the Guinada in the State of Zacatecas, are situated on the Tropic of Cancer, where the sun would appear to make a prolonged annual visit, and that in precisely the same latitude in Africa lie the ruins of Kalahshu, and not far to the south of Der, the ancient name of which was "the city of the sun". The ruins of Zimbabwe are within three degrees of latitude to the north of the Tropic of Capricorn, and their conical structure and a chamber with a vertical shaft appear to testify that in the Old, as in the New World, the inhabitants of the intertropical region observed and celebrated the passage of the sun through the zenith which was followed by rain.

The Storage of Food.

THE Report of the Food Investigation Board for 1928¹ again reveals the wide scope of the researches on the preservation and storage of food carried out under its auspices. During the year, Sir William Hardy retired from the chairmanship and was succeeded by Sir Joseph Broodbank; and Dr. F. F. Blackman and Dr. J. B. Orr succeeded Sir Richard Threlfall and the late Prof. T. B. Wood as members. The extension of the Low Temperature Research Station at Cambridge was well advanced at the end of the year, and the new fruit storage research station at East Malling had been commenced: it was also decided to set up a fish research station at Aberdeen. On the other hand, work on fish by-products was discontinued.

CONDITIONING OF BEEF.

An important research on the changes undergone by beef during storage and its effects upon the palatability and flavour of the meat has been carried out by T. Moran and E. C. Smith and published as a special report to the Board.² The following general procedure is recommended: after killing, the carcase

should be carefully dressed and cooled for 1-2 days at 31°-33° F.; the meat is then hung as sides or quarters at 36°-38° F. for 10-12 days and finally stored for the 24 hours before sale at room temperature or at 40°-45° F. It is also necessary to rest the animal before slaughter if good quality meat is to be obtained.

The first change after death is the onset of rigor mortis, which consists of a gelation of the muscle plasma, causing hardening and loss of irritability, and a production of acid which causes contraction of the muscle, increase in opacity, and later the breakdown of the protein gel. In experiments on the rate of cooling of carcasses, it was found that the temperature in the muscles increased for the first few hours after death, partly due to the conversion of glycogen into lactic acid and partly due to the changes in the physical state of the proteins. The later stage of resolution of rigor is relatively slow: it is brought about by autolysis, by the acidity of the tissues, and by bacterial action, and can be controlled to a considerable extent by the conditions of storage.

In following the changes in detail, it is necessary to consider separately each tissue of which the meat is composed. The state of the superficial connective tissue is largely responsible for the appearance of the meat: it readily takes up 80-100 per cent of its weight of water, and becomes white and opaque; this may occur from excessive swabbing on cleaning the carcase or from sweating on removal from cold store. On

¹ Department of Scientific and Industrial Research. Report of the Food Investigation Board for the year 1928. Pp. vi+110. (London: H.M. Stationery Office, 1929.) 3s. 6d. net.

² Department of Scientific and Industrial Research: Food Investigation. Special Report No. 36: Post-mortem Changes in Animal Tissues—The Conditioning or Ripening of Beef. By T. Moran and E. C. Smith. Pp. vii+64+8 plates. (London: H.M. Stationery Office, 1929.) 2s. net.

drying, the tissue loses its excess water and becomes translucent again; but if frozen whilst swollen, the fibres become broken up and disorganised.

The fat becomes rancid on prolonged storage: the change can be followed by estimating the increase in free acids and the decrease in the iodine number. The state of the fat determines the period of storage, since the slightest taint of rancidity is undesirable, and this develops whilst the lean part of the meat is still improving in flavour.

Little alteration occurs in the proteins during storage after the resolution of rigor: in a short period of hanging, autolysis is negligible, there is no increase in the water which can be expressed from the muscle, and, except on exposed surfaces where methæmoglobin may be found, no change in the pigment.

As regards the carbohydrates, the effective changes are over within 3 days of slaughter: the lactic acid reaches its maximum of about 0.8 per cent and then remains unaltered throughout storage.

With ordinary cleanliness, bacterial contamination of the carcase is only slight, and experiment showed that increase in the bacterial content of meat hung for 17 days at 41° F. is negligible.

The experiments on the palatability of the stored beef were carried out at the Household Arts Department, King's College for Women, London, and at Messrs. J. Lyons and Co.'s laboratories. They showed that conditioning effects a marked improvement in palatability, particularly in respect of tenderness, but also of juiciness and texture, without any change in flavour. The improvement is more marked with coarse than with prime joints. A few experiments also indicated that freezing beef has no marked deleterious effect on its palatability.

Apart from the scientific aspects of the improvement of the meat supply, the demand of the public for good meat is an important factor to be considered, and it is to be hoped that the experimental grading and marking scheme for home-killed beef³ will stimulate this demand by giving purchasers confidence that they can obtain exactly what they require.

FRUIT AND VEGETABLES.

The chemical changes occurring in apples stored at 12° and 1° C. have been further studied by D. Haynes and H. K. Archbold. The rate of loss of respirable

³ Home-killed Beef: Experimental Grading and Marking Scheme. Ministry of Agriculture and Fisheries. Marketing Leaflet, Nos. 13 and 13a.

material, sugar, acid, and residue (cell wall material) per unit of nitrogen (protoplasm) has been found to be characteristic of the variety. Storage life may be roughly divided into three periods: in the first, the starch is hydrolysed with a concomitant rise in sugar; in the second, at 1° C., the total sugar and sucrose decrease, but the reducing sugar rises slowly to a maximum; in other words, the rate of inversion of sucrose is greater than the rate of consumption of its products; in the third, at 1° C., internal breakdown has set in and the rate of loss of sugar is increased; at this point the sucrose has all been inverted and the stable reducing sugars stored in the vacuole are oxidised. Throughout, acid is lost, the rate in the first and third periods being faster than in the second. At 12° C. internal breakdown does not occur but is replaced by senescence, which is observed at an earlier period of storage life and is characterised by very similar changes in the constituents of the fruit.

Fungal invasion of stored apples has been studied by A. S. Horne: a close relationship between the chemical composition of the fruit and susceptibility to invasion has been found; thus decrease in the amount of acid is associated with an increase in the rate of invasion. The relationship between growth of fungi and the environment, especially the humidity, has also been studied by R. G. Tomkins.

The possibility of the cold storage of vegetables has been investigated by J. Barker: the commoner vegetables can be stored for a few weeks at 45° or 33° F. The lower temperature is the more satisfactory, except for potatoes, which sweeten near the freezing-point. Even lower temperatures, 26° and 29° F., at which partial freezing occurs, are satisfactory for cabbages, cauliflowers, or sprouts, but not for tomatoes, cucumbers, or lettuces. Preliminary experiments on the rate of deterioration after removal from cold store indicated that 33° F. was more suitable than 45° F., except for tomatoes.

These excerpts must suffice to indicate the nature of some of the work which has been carried out under the direction of the Board. Among other subjects dealt with are corrosion of metal food-containers, with the production of hydrogen and perforation of the can, the transport of butter in insulated vans, and the freezing of fish on board the trawler so that it can be kept for a longer time and landed in a fresher condition. The report also refers to work on the control of temperature and humidity and on methods of refrigeration.

Nickel in Engineering.

IN a lecture on "Nickel and its Uses in Engineering", delivered before the Junior Institution of Engineers on Nov. 15, Mr. W. T. Griffiths stated that, prior to the War, 65 per cent of the world's production of nickel was utilised in the manufacture of nickel steel for armament purposes; after the Armistice, production dropped to the level of the years 1890-91.

New uses for nickel have now increased the consumption to as high a figure as any attained during the War. A considerable portion of the output is used, on account of its high melting-point, in the radio electrical industry for parts of wireless valves; it is also used for the electrodes of sparking plugs. In chemical engineering much use is made of it on account of its ability to withstand alkaline reagents. In mechanical engineering it is largely used by means of electro deposition for building up worn parts of mechanisms, but its principal uses are found when alloyed with other metals; for example, in steels it increases toughness, and in conjunction with heat treatment much improves the homogeneity of castings;

in case-hardened articles it increases the penetration of the hardening material, and in many cases eliminates a preliminary heating and quenching; in conjunction with chromium and molybdenum, large forgings can be made as the elastic limit of the material is much improved. In Canada, nickel alloy steel is used in casting the bar framing of locomotives and even in boiler parts including plates, firebox and tubes being made of an alloy steel containing 2 per cent of nickel, thus enabling the boiler pressure to be increased by some 37 per cent without increasing the weight of the engine.

When alloyed with iron, nickel has the property when present to the extent of about 25 per cent of destroying the magnetic properties of iron, but a higher percentage of nickel restores these properties, and the Western Electric Co. of America has established that after heat treatment of high content nickel-iron alloys, the magnetic qualities are 10-13 times better than the best soft iron; it also has much effect in diminishing the hysteresis loss. These properties are