elements of low atomic weight observed by Millikan. It will be seen that the linear relation between the square root of the frequency of corresponding lines and the atomic number which holds for the higher atomic numbers breaks down in this region. In fact, while there is a general tendency for the corresponding frequencies to increase with increasing atomic numbers, one is no longer an approximately continuous function of the other. The vertical spacing between the points ⊗ and ⊡ for any one element is an indication of the extension of the relevant spectrum. It will be seen that this extension varies in an irregular manner in the sequence of elements from lithium to oxygen. The points shown for lithium are those for the well-known red line 6708 Å and the end, 2299 Å, of the series to which it belongs. No lithium lines were found in the ultra-violet beyond 2299 Å in the region in which the vacuum grating is effective; so that if the allocation of these spectra, for the intervening elements up to aluminium, to the L X-ray series of the respective elements is correct, this series is the L series of lithium. This forms very convincing evidence of the essential similarity of X-ray and visible spectra.

(*To be continued.*)

The Natives of Australia.[1]

By SIDNEY H. RAY.

IN the National Museum of Victoria at Melbourne a special gallery has been devoted to a fairly representative collection of objects connected with the daily life of the Australian aborigines. A very instructive and well illustrated account of the exhibits has been written by Sir Baldwin Spencer, and this gives, in a wonderfully succinct form, what are practically short comparative essays on the arts and crafts of the natives.

There seems to be very little doubt that the first inhabitants of Australia were frizzly-haired people of the old Stone Age, using unground axes, chipped stone knives, and scrapers without handles. They had no knowledge of boats or house-building. Part of this population, cut off by a subsidence which now forms Bass Straits, survived in Tasmania until modern times, but on contact with Europeans became exterminated. In the Museum these people are represented by masks of two males and one female and by a cast from the skeleton of Truganini, the last of the Tasmanians. There is also a collection of their stone implements.

On the mainland the primitive population was supplanted by people in a higher grade of development whose origin is still a matter for discussion These people are remarkably uniform throughout the continent. The average height is about 5 ft. 6 in.; the skin a dark chocolate colour and never really black; the head long, the hair wavy, not woolly or frizzly like that of the Tasmanian, Papuan, or Negro. The people are nomadic, living in tribes which have distinctive names, and roam within certain clearly defined limits. They have no villages but only camps or clusters of rude shelters. One of the Museum cases contains a representation of a native camp, Fig. 1. This shows the *mia-mia* or shelter made of bark from gum trees resting on the windward side of a rough framework and forming a sort of lean-to. The man and woman are supposed to be returning from a hunting expedition The woman carries in her hand her digging stick, and on her back a young child secured in its position by the skin cloak. The latter is usually of opossum skins, sewn together with sinews often taken from a kangaroo's tail. The head of the clothed man is decorated with a string forehead band in which are stuck feathers of the black cockatoo. But generally the men wear no clothing. The man in the foreground is making fire with a drill. In connexion with the camp, the *toas* or posts set up by South Australian tribes on departure as a guide to new-comers (see NATURE, February 12, 1920, p. 643) do not appear to be represented in the Victorian collection.

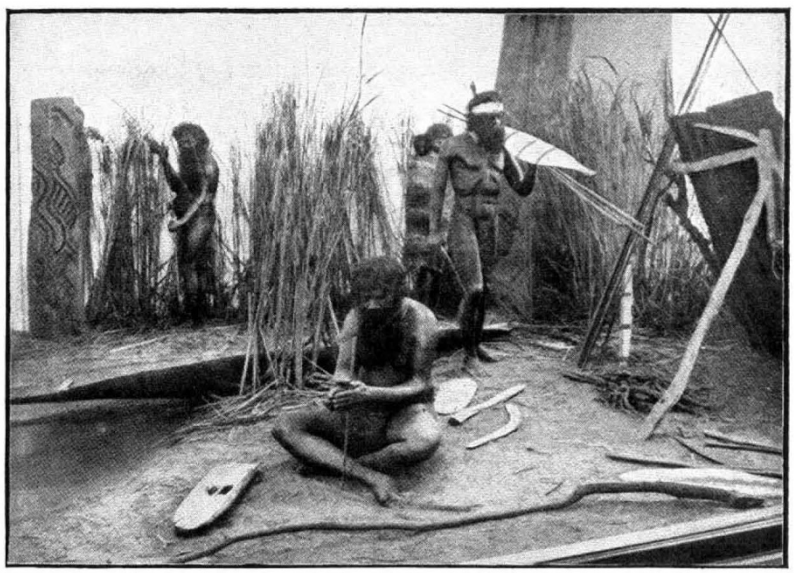

FIG. 1.—Native camp scene.

The languages used differ so much that natives of one tribe cannot understand the speech of their neighbours, and though in some regions, owing to the absence of mountains and rivers, tribes may be closely associated and a few words understood, there is even between these very little community in actual speech. In the Northern Territory the languages appear entirely different in grammatical structure from those in South, West, or East Australia, and approach in character

[1] "Guide to the Australian Ethnological Collection" exhibited in the National Museum of Victoria. By Sir Baldwin Spencer. 142 pp. Third Edition. Illustrated by 33 Plates. Melbourne: Albert J. Mullett, Government Printer, 1922.

the Papuan tongues of New Guinea. Throughout the Australian continent gesture language is very highly developed and forms a ready means of communication when words fail.

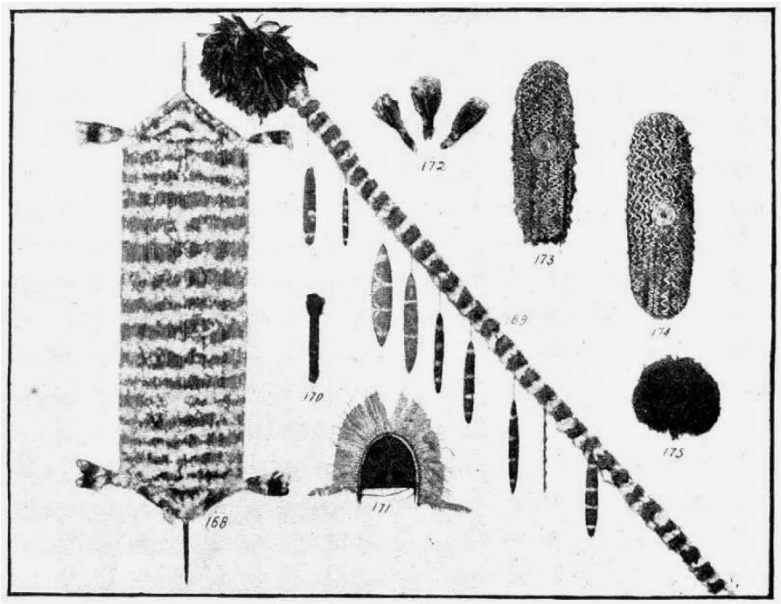

FIG. 2.—Ceremonial objects.

Much has been written about Australian tribes. Most of them have a very definite organisation and are divided into at least two main divisions (sometimes four or eight). Men of one group must marry women of the other, the children belonging sometimes to the father's division, sometimes to the mother's. Relationship names refer to the members of the group. Thus a man uses the term "father" not only for his real father but for all his father's brothers. His "mother" is any of the women whom his father might have lawfully married, and his "brothers" are not only his blood brothers but also his father's brother's sons.

Another social system which is greatly developed among the Australian aborigines is based on the *totems*. As defined by Sir J. G. Frazer, a totem is "a class of material objects which a savage regards with superstitious respect, believing that there exists between him and every member of the class an intimate and altogether special relation." In Australia the totem is an animal or plant, and the native describes himself as a kangaroo, snake, or gum-tree man as the case may be. Some tribes perform ceremonies to increase the totem animal or plant, while in others men may not eat or injure their totem. Sometimes the tribal organisation is based on the totems, sometimes it is sexual, and the women have different totems from the men. Often the totem regulates marriage.

Social organisations and ceremonies are controlled by men whose age, fighting power, or skill in magic make them prominent; but there are no chiefs. The passage from youth to manhood is marked by submission to painful rites of initiation. The knowledge of the sacred or secret ceremonies connected with initiation is forbidden to women and children under severe penalties. Many of the sacred objects connected with these ceremonies, and with the totems, are prominent in the Victorian collection (Fig. 2). They comprise *churinga* (sacred stones and sticks associated with the totems), wands, slabs, and decorations used at initiation.

No Australian weapons are made of metal. Bows and arrows are unknown. Spears are sharpened wooden sticks with barbs attached or cut near the point. Sir Baldwin Spencer describes twelve main types. In some places they are tipped with bone, flaked stone, or spines from the echidna or the sting-ray. The spear is launched by a spear-thrower. This is a stick with a point at one end which fits into a hole in the spear-shaft and gives leverage and accuracy of aim. Spear thrusts are warded off by shields, which are often highly decorated. Clubs of various forms are also used. The most distinctive Australian weapon is the boomerang. This was apparently not used by the Tasmanians. It is a curved throwing weapon varying in size and use, and most of the eastern and southern coastal tribes make a "return" boomerang which when thrown comes back to the thrower.

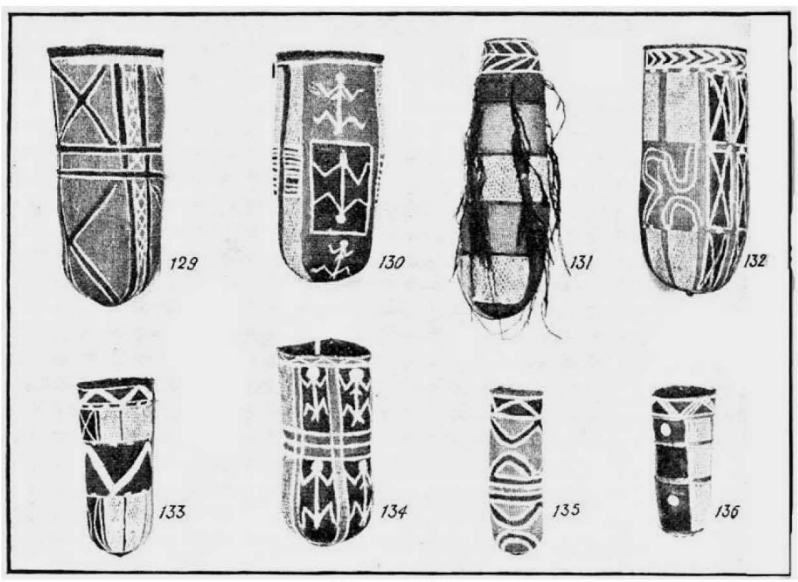

FIG. 3.—Baskets.

The weapons and implements exhibited have been arranged so as to show their development in various parts of Australia. Thus one of the cases shows transition from an ordinary throwing-stick to a boomerang

and thence to a large double-handed sword-like weapon. Another case shows a transition from a stick to various shapes of knobbed clubs. Two of the latter from Queensland with teeth in the swollen part are suggestive of the "pine-apple" clubs of New Guinea.

The stone implements in the Museum are of special interest. Sir Baldwin Spencer points out that there is no essential difference in type throughout Australia, neither is there any evidence of distinct stages of culture which might be called eolithic, palæolithic, or neolithic. Stone implements which, if discovered in Europe, would be assigned to these stages are found in use in the same camp and district at the present time. The cutting edges of knives and other implements are produced by flaking or chipping, or by grinding and polishing suitably shaped pebbles or cut lumps of stone. Spear-heads and knives are hafted with resin. Spear-heads made of glass, used since the advent of the white man instead of quartzite, are shown in one of the cases. The finely serrated edges are produced by pressure of a kangaroo bone broken and ground into a gouge-like form.

Fire is produced by drill or saw. A piece of hard wood is either rapidly rotated or worked up and down in a groove upon a softer piece, the powder worn away being ignited by the heat of the friction.

Bowls are hollowed from blocks of wood, partly by gouging, partly by burning. Baskets are plaited from grass-stalks, rushes, thin pliant twigs, or split cane. Sometimes they are open, sometimes close enough to contain honey or water. The close baskets are often decorated, as in those from Northern Territory shown in Fig. 3.

String in some places is made of human hair, but in others the possession of the hair of a person gives its possessor power to work harm upon the man from whom it has been cut. String is also made of vegetable fibre, sinew, and fur. Personal ornaments are made of fur, feathers, wood, bone, or shell.

Native art is well represented in the Museum collection. It consists of rude drawings of animals and plants and geometric designs drawn with yellow or red ochre, white pipeclay, and charcoal, or incised drawings with the sharp-edged tooth of an opossum or a flake of flint.

Among the descriptions of the exhibits Sir Baldwin Spencer has given many notes on their use. He has provided a most instructive and useful guide, which cannot fail to interest the student and stimulate the study of Australian ethnography.

Long-Distance Radio Telephony.

THE successful transmission of speech from New York to London, which took place in the early hours of the morning of January 15, shows that the difficulties of long-distance radio telephony are being overcome. The main difficulties are due to absorption of the radio-waves and the muffling of the sounds produced by extraneous noises due to atmospheric disturbances. By carrying out the experiment at night, when the absorptive effects are a minimum, and during the winter months, when the atmospheric disturbances are least, the chances were all in favour of a successful issue. During the first half-hour of the two hours' test, however, the cracklings due to the atmospheric disturbances were plainly audible. Since January 1 measurements have been made daily at the New Southgate Works of the Western Electric Co., Ltd., of the intensity of the signals and of the atmospherics respectively. The results for the first fortnight show that the amplitude of the disturbance due to the atmospherics was less than ten per cent. of the average amplitude of the signals for fourteen hours out of the twenty-four. At this period of the year it is only from 1 P.M. to 11 P.M. Greenwich time that transatlantic telephony is unsatisfactory. When the measurements have been carried out systematically for a year, it will be possible to estimate with fair accuracy the cost of a radio transmission system of satisfactory quality.

It has been found that although the Austin formula gives the daylight strength of radio signals with high accuracy for hundreds of miles over the sea, yet when the distances are measured by thousands of miles it cannot be used. The night values of the signals when the circumstances are favourable can be accurately calculated, as the damping effects are then negligibly small. In the recent test a small frame aerial was used, for the constants of such an aerial can be readily calculated. As there were sixty listeners, each with a head set, considerable amplification had to be employed, and so the test was a specially severe one. Amateurs in this country have occasionally picked up both speech and music sent out by the American broadcasting stations. These, however, are "freak" receptions due to several favourable conditions occurring simultaneously. For commercial radio telephony, communication must be possible at definite times of the day under practically all atmospheric conditions.

In the test the total distance traversed by the speech was first 70 miles by telephone cable from New York to Long Island, where there is a radio station with an antenna 1½ miles long, supported by towers 450 feet high. About sixty kilowatts had to be supplied to this aerial. A notable economy of power was effected by suppressing the carrier wave between the radio-transmitting and the radio-receiving station, a distance of about 3000 miles. It has to be remembered that the speech could have been sent out with practically equal clearness from any point on the vast long-distance telephone network of the United States.

There can now be no reasonable doubt that trans-atlantic telephony is possible during a large fraction of the year, and it is quite probable that the result of the tests now being made at New Southgate will demonstrate that radio telephony between Europe and America will be feasible on a commercial basis. This will doubtless have important results on the world's future. It is to be hoped that rapid communication will prevent many of those misunderstandings which too frequently arise between nations.