northern Bushmen into two groups—that of the Kaukau of southern Damaraland and that of the Ngami, which would include the click-using peoples as far north as the Kwando River. Between the two groups there is very considerable linguistic difference, though there exist equally undeniable affinities. In Herr Seiner's photographs, however, only two examples of so-called Bushmen are recognisable as such, the remainder (though their language was "Bush") are obviously true negroes, and must be the result of hybrids ancient and modern with the true negro stock, as exemplified by the recent Bantu invaders (Bechuana and Zambezian) and the Berg-Damàra. Seiner classifies the Zambezians as "Bantu," and the Bechuana as a class apart. There is no justification for this distinction. The Bechuana tribes are just as much "Bantu" in languages as the Zambezians, though some of them have obviously absorbed a good deal of Bushman blood during the last twelve or fifteen hundred years.

The descriptions and beautiful pictures of the Kilimanjaro glaciers (in parts ii. and iii. of Band xxii.) are of the highest interest; so also are the equally careful, illustrated reports on the "volcanelli" (if one may coin a word to describe the lesser craters which break out on the mass of a huge volcano) of the Cameroons. This article, by Dr. Otto Mann, describes the renewed activities of the Cameroons volcanic mass in 1909. H. H. JOHNSTON.

CORDITE.

THE recent discussion in Parliament on our supplies of cordite and our productive capacity for this type of smokeless powder has naturally directed public attention to these important questions. The production of a smokeless powder was ever the dream of the military strategist, and with the discovery of gun-cotton the conclusion was hastily arrived at that the ideal propellant was found, only to be rudely dissipated by numerous serious disasters. Gun-cotton for many years resisted all attempts to render its combustion sufficiently under control for it to be adopted as a propellant, yet to-day it is the basis of the smokeless powders of all nations. Its early failures were entirely due to the retention in the nitrated cotton of the physical characters of the parent cotton, for even after reduction to an extremely fine state of division during the process of manufacture, the fibrous nature of the cotton persisted. Success has only been attained by the destruction of this fibre, and the smokeless powders of all nations may be classed either as simple gelatinised gun-cottons in which soluble nitrocelluloses have been gelatinised by treatment with an ether-alcohol mixture, or as nitrocellulose-nitroglycerine colloids, in which the nitrocellulose employed may be of the soluble variety, as in ballistite, or the insoluble (true gun-cotton), as in the case of cordite.

The introduction of blasting gelatin by Nobel (1875), consisting of some 90 per cent. nitroglycerine with 10 per cent. of soluble nitrated cotton in a gelatinised form, was the first step towards the production of powders of the cordite type. The high percentage of nitroglycerine rendered blasting gelatin unsuitable for use in guns, but by incorporating the two constituents in equal quantities, Nobel gave to the world the first successful smokeless powder of this class, ballistite. Cordite was the outcome of the work of a committee presided over by the late Sir Frederick Abel, and was patented a year later than ballistite, in 1889. The essential difference between ballistite and cordite is that whilst the former contains soluble nitrocelluloses, cordite contains the insoluble or tri-nitrocellulose. This change in the character of the nitrocellulose employed entailed the introduction of acetone in the manufacture of cordite. Soluble nitrocotton and nitroglycerine can be thoroughly incorporated under proper conditions in the presence of water without the aid of any solvent, but the ingredients of cordite can only become perfectly incorporated in the presence of a mutual solvent. It is essential that the solvent shall be sufficiently volatile to permit of its removal at reasonably low temperatures from the finished powder, and acetone, which boils at 56° C., fulfils all the conditions best.

It is important to note that nitroglycerine is the only explosive containing an excess of oxygen, all nitrocelluloses being theoretically deficient in this element to give complete combustion of carbon to carbon dioxide and hydrogen to water. There are therefore admirable theoretical grounds for the incorporation of these two explosives with each other. The total change in physical characters of both nitroglycerine and nitrocellulose brought about entirely alters the character of their explosion; singly, both constituents are beyond control once combustion is started; gelatinised together, combustion is regularly progressive throughout the mass, an essential condition for a propellant.

The earlier form of cordite consisted of nitroglycerine, 68 per cent.; nitrocellulose, 37 per cent.; vaseline, 5 per cent. It was soon found that serious erosion took place in the guns, and Sir Andrew Noble showed this to be due to the rapid motion of the gaseous products at very high temperature. Since the temperature is a function of the nitroglycerine content, combustion to carbon dioxide taking place to greater extent with its accompanying higher calorific intensity, it followed that reduction of the nitroglycerine would lower the temperature of the products and lessen the erosion. This led to the introduction of modified (M.D.) cordite of the following composition:—Nitroglycerine, 30 per cent.; nitrocellulose, 65 per cent.; vaseline, 5 per cent.—practically a reversal of the former proportions of the chief ingredients. The introduction of the vaseline was made to overcome metallic fouling in the gun, arising from surfaces of metal in practically a clean condition rubbing against each other as the projectile moved outward. The vaseline decomposition products provided just the slight lubrication needed. It has performed another important office, little thought of on its introduction, in acting as a "stabiliser" in the cordite.

In the manufacture of cordite, the gun-cotton employed is thoroughly dried at a temperature of 40° C., and is then mixed by hand with the proper proportion of nitroglycerine, the mixture being finally passed through a sieve. The "paste" obtained is transferred to an incorporating machine of an exactly similar type to that employed in a machine bakery, except that temperature control is arranged for, and there worked into a thorough dough with the requisite quantity of acetone. The first kneading occupies about three and a half hours; then the vaseline is added and a further kneading for a similar period takes place. "Cordite dough," in which every trace of the fibrous character of the gun-cotton has disappeared, results, and this dough is then shaped into the finished threads, cords, or rods by pressure through suitable dies. As the thinner makes pass from the press they are wound on drums, thicker qualities being cut into suitable lengths as they pass out on an endless band. The acetone remaining must now be removed by drying in suitable rooms at a temperature of 110° F. The removal of solvent from the larger sizes of all smokeless powders offers considerable difficulty owing to their horny nature; the odour of acetone is readily detected in freshly ground cordite after long storage.

Naturally the detection of products which may indicate decomposition actually occurring or likely to occur is important, and for this purpose Abel's heat test, first introduced for gun-cotton about 1875, is employed for cordite. The test depends on the liberation of iodine from potassium iodide by the action of nitrogen peroxide, the principal decomposition gas. The ground explosive is heated to 180° F. in a tube, and the time noted for discoloration of the test paper to a certain standard tint. The question at once suggests itself, Does the test show decomposition products which were present in the explosive, or have they resulted from heating during the test, or both conditions acting together? Very divergent opinions are held as to the value of the Abel test as an indication of the stability or "life" of gelatinised explosives. Certainly a powder giving a bad test must be regarded with suspicion, but it is obviously not an easy matter to fix a time limit for a test which is subject to adverse criticism.

One of the most important considerations with any explosive is its stability. The question naturally arises, Is the molecular arrangement in such substances as nitrocellulose and nitroglycerine stable under ordinary conditions of temperature? Their explosive properties depend entirely on molecular rearrangement, which is practically instantaneous when detonation occurs. Certainly slow decomposition occurs in most nitro-compounds of the explosive class at temperatures not greatly above the normal with the production of oxides of nitrogen, and it has been shown that these oxides act catalytically on the explosive; in other words, their effect becomes cumulative and may lead to ignition. In order to avoid this catalytic action, "stabilisers" have been introduced in many explosives, substances capable of absorbing these nitrogen compounds. As already mentioned, the vaseline in cordite appears to perform this useful function.

THE SHEFFIELD MEETING OF THE BRITISH ASSOCIATION.

FOR the last few months the various committees dealing with the local arrangements for the meeting of the association have been hard at work and the general outlines are settled. The hardest task, perhaps, has fallen to the lot of the hospitality committee in finding accommodation for the large number of visitors expected, the city being notorious for its small hotel accommodation. A first list of hotels and lodgings is now ready, and members should lose no time in engaging rooms. To meet the expected demand, the committee has arranged for the two training colleges' hostels for women to receive members, the larger one for gentlemen, with a limited number of married people in an annexe, and the University Hostel for single ladies. The list may be obtained from the secretary of the hospitality committee, Mr. J. Wortley, George Street, Sheffield.

The reception-room will be at the Cutlers' Hall. Here, in addition to the various rooms and offices usually associated with the reception-room, will be a large luncheon-room, giving, close at hand, sufficient accommodation to prevent the pressure and overcrowding so prevalent in many previous meetings. The Cutlers' Hall is conveniently situated in the centre of the city, close to the tram termini, and the various section rooms are grouped round it, all within a radius of 400 yards, with the exception of that of physiology, which, for evident reasons, is better placed in the University. The president's address, and the popular lectures by Prof. Stirling (types of animal movement), Mr. Hogarth (new discoveries about the Hittites), and Mr. C. T. Heycock (the Saturday evening lecture to operatives), will be given in the Victoria Hall.

The first evening reception will be at the Town Hall, by the Lord Mayor and Countess Fitzwilliam. The Weston Park is to be the central scene of the second on Tuesday, September 6, at which about 4,000 guests are expected. The University lies along the east side of this park, and the Mappin Art Gallery is in it on the west. Advantage has been taken of this to have a combined reception by the University and the local committee. The Chancellor and the Duchess of Norfolk will receive one category of guests at the University, and the Earl and Countess Fitzwilliam another in the Art Gallery, but the two will really form a combined conversazione, with an evening garden-party in the park. One of the features of the latter will be a military tattoo with torches after dark. Afternoon garden-parties for the whole association will be given by the Lord Mayor at his seat at Wentworth, and by the local committee in the Botanical Gardens, whilst a number of smaller garden-parties will be given on other days. Arrangements have been made for visits to more than twenty works, covering the chief staple trades of the city. In the University also the various furnaces in the metallurgical department will be run on different days to illustrate that feature in the University curriculum.

Saturday, September 3, will be devoted to excursions to the Derwent Waterworks, to Chatsworth, Welbeck, and Clumber, where members will be entertained respectively by the Dukes of Devonshire, Portland, and Newcastle, also to Haddon, Roche Abbey, and Bolsover Castle. The neighbourhood is so rich in picturesque scenes that there will be ample scope for members to arrange private excursions, such as to the Peak Caverns, the limestone dales, Buxton, Matlock, Wingfield Manor, or even further afield, to York, Lincoln, or Newark Castle, and Southwell Minster.

A local handbook of 500 pages has been compiled under the editorship of Dr. Porter, with the assistance of a large number of local experts, containing a large amount of interesting matter, scientific, historic, and local. During the meeting the University will hold a congregation for the purpose of conferring honorary degrees on the president and other eminent scientific men attending the meeting.

PROVISIONAL PROGRAMMES OF SECTIONS.

SECTION A (MATHEMATICAL AND PHYSICAL SCIENCE).—The address of the president (Prof. E. W. Hobson) will be delivered at 10 a.m. on Thursday, September 1. Two discussions are under arrangement. On Monday, September 5, there will be a joint discussion with Section G on the principles of mechanical flight, to be opened by Prof. G. H. Bryan; and on Tuesday, September 6, Dr. C. Chree will open one on atmospheric electricity. The section will meet with Sections G and B on Friday, September 2, to participate in the discussion on the report of the gaseous explosions committee, and in papers to follow dealing with combustion. Several papers have been already promised to the section, but the programme is still incomplete.

SECTION B (CHEMISTRY).—The feature of the programme is the joint discussions with other sections. These are:—Friday, September 2, with Sections A and G: Subjects of general interest; in particular, combustion. Monday morning, September 5, with Sections I and K: Respiration; afternoon, with Section L: The neglect of science by commerce and industry. Reports will be presented by Prof. W. A. Bone, on combustion; Dr. J. V. Eyre, on solubility.