

Early Copper and Bronze in South Africa.

TWO papers dealing with the primitive working of copper in South Africa, which were presented to Section H at the South Africa meeting of the British Association, are printed in full in vol. 26 of the *South African Journal of Science*. The late Dr. P. A. Wagner and Mr. Hugh S. Gordon deal with material obtained from ancient smelters on the farm Blauwbank, No. 435, in the Waterberg district of the Transvaal, from which it was deduced that the ancient metallurgists had deliberately set out to make bronze. Further, as the original ingot found on the site some years ago and the prills of bronze here dealt with contain nickel and arsenic in notable amounts, it has been suggested that investigation might throw light on the date of these workings in view of the fact that ancient bronze from Egypt and Mesopotamia contains nickel, and yet no very ancient site is known which could have produced the ore required to make a nickeliferous bronze.

Further investigations have established the existence at Blauwbank of no fewer than forty smelting sites, two different types of furnaces, and at least four different types of slag, proving that tin, iron, copper, and bronze were smelted there. Chemical analysis of eleven of the supposed bronze prills and brods prove that some of them are of fairly pure copper, others of arsenical copper and copper spice, while only two contain enough tin to bring them within the definition of true bronze, and these are so rich in arsenic that the application of the term is scarcely warranted. Nearly all contain some percentage of nickel. The analysis of a bronze bangle from Zimbabwe also contains nickel. As other bronzes from Zimbabwe and a piece of bronze from Rooiberg, found by Dr. Frobenius, also contain nickel, it is possible that further investigations may show a connexion between Blauwbank and Rhodesia, especially as no ancient tin-workings are known in Southern Rhodesia.

On the other hand, Mr. G. H. Stanley in a paper on "Primitive Metallurgy in South Africa", while admitting that the specimens he has examined point to a deliberate admixture of tin and copper, holds that the copper ingots are of recent native origin. The specimens from Zimbabwe which were examined were in part from the Rhodesia Museum, Bulawayo, in part specimens submitted by Miss Caton-Thompson from her excavations at Zimbabwe and other ruins of Rhodesia. The museum specimens from Zimbabwe itself were typical tin bronzes approximating so closely to the 90:10 ratio that in all probability they were made by melting together previously smelted copper and tin. No nickel was found in any, though there were traces of cobalt. The metal was of excellent quality and obviously produced by skilled smelters from very fine ores. Of the specimens from other sites, a slug from Renders Ruin was almost pure copper, while a bangle from Niekerk Ruins, Inyanga, contained less tin and more arsenic than the rest. A spear-head from Dhlo-Dhlo was of intermediate position, but with neither nickel nor cobalt in detectable quantities.

Miss Caton-Thompson's specimens—small objects, bangles and the like—exhibited a peculiar blue-green patina which suggested enamel. It was, however, easily removable by dilute hydrochloric acid, leaving a very roughly corroded surface. A bangle gave the analysis copper 87.43, tin 12.3, iron 0.08, nickel nil, cobalt faint trace. A spherical pellet 1.4 cm. in diameter showed copper 98.87, tin 0.8, bismuth 0.01, nickel nil, cobalt nil. Other bangles gave an analysis of copper 89.57, tin 10.5, and a piece of thin bronze plating gave approximately the same.

Excepting a brass, the only specimen to show a notable content of nickel was a specimen from Chiwona, an irregular flattened lump of metal weighing about 110 gm., evidently a smelting product. The analysis was copper 96.3, arsenic 1.78, tin trace, iron 0.42, nickel 1.2, cobalt slight trace.

Mr. Stanley maintains that the presence of nickel is exceptional rather than characteristic. Nickel is quite a common accompaniment of copper in ores of the latter, but unless its presence is commercially important, it is not usually determined or reported. The analyses of ancient copper objects from Sumeria published by Prof. Desch show only four with nickel exceeding 0.25 per cent, the richest being 3.3. Copper and bronze objects of ancient Egyptian and Babylonian origin seldom show the presence of nickel beyond what might be considered an ordinary impurity. In regard to the possibility of South Africa having been the source of ancient bronzes showing traces of nickel, he holds that such ores might have been obtained from a number of other centres, such as the Caucasus or Asia Minor, where a number of ancient workings are known, and others are probably still undiscovered.

University and Educational Intelligence.

CAMBRIDGE.—The Ministry of Agriculture and Fisheries has offered to make a grant not exceeding £8500 in aid of the provision of additional laboratory accommodation at the field station of the Department of Animal Pathology in the University.

The Appointments Committee of the Faculty of Economics and Politics has appointed E. A. G. Robinson, of Corpus Christi College, to be University lecturer in the faculty.

The Council of the Senate has recommended the establishment of a temporary professorship of colloidal physics for three years, and that the professorship be held in the first instance by Dr. E. K. Rideal, of Trinity Hall.

It is proposed to confer the honorary degree of doctor of science on Prof. A. Einstein, Prof. M. Planck, and Sir John Rose Bradford.

At a special congregation of the Senate on May 17, the Right Hon. Stanley Baldwin was elected Chancellor of the University in succession to Lord Balfour, who died on Mar. 19.

LEEDS.—The Corbet-Woodall scholarship in gas engineering, value £60 a year, and tenable for three and possibly four years, is being offered for competition. Applications must reach the Clerk to the Senate, the University, Leeds, by June 2.

LONDON.—Presentation Day at the University was on May 14, the ceremony taking place in the Albert Hall. The new Chancellor, Lord Beauchamp, who presided for the first time, referred in his charge to the new graduates to the re-constitution of the University under the Act of 1926. In the course of next year, he said, it might be expected that the foundation stone would be laid of the buildings on the Bloomsbury site, into which the University would enter in its centenary year (1936). Another important development to which the Chancellor specially referred was the provision of a hall of residence for students. The new Principal, Dr. E. Deller, in his Report, also referred to the re-constitution. "There are still some matters outstanding—the revision and (it is hoped) the simplification of our regulations, and the delegation of powers are examples—but satisfactory progress is being made." The total number of candidates for