noted was 28.9 inches. The second hurricane came from the West Indies about the 24th, and reached the Banks on the 29th, only three days after the passage of the former hurricane, repeating the disasters to the fishing-vessels. Its violence was great as it continued across the Atlantic, and approached the British coasts early in September. As this storm passed up the Atlantic, very high tides were experienced on the coast, much damage being thereby inflicted on the New Jersey shore on the 29th. Very few icebergs were reported during the month.

The average temperatures were above the normal only in Florida, the Rio Grande valley, and in the middle and southern portions of the Rocky Mountain region, the departures being within a degree, except at Salt Lake City (2°). In other districts the departures ranged from 0°.1, in the eastern Gulf states, to 4°.4, in the upper Mississippi valley. Yuma, Arizona, reports a mean temperature of 91°, and a maximum of 111°. Frosts were reported from the northern states, especially at the end of the month.

Average precipitation for August, 1883.

Districts.	Average for August. Signal-service observations.		Comparison of August, 1883, with the average for several years.
	For several years.	For 1883.	
	Inches.	Inches.	Inches.
New England	4.33	1.53	2.80 deficiency.
Middle Atlantic states	4.95	3.20	1.75 deficiency.
South Atlantic states	6.43	7.51	0.72 deficiency.
Florida peninsula	7.67	5.69	1.98 deficiency.
Eastern gulf	6.33	4.39	1.94 deficiency.
Western gulf	4.27	1.62	2.65 deficiency.
Tennessee	3.92	3.51	0.41 deficiency.
Ohio valley	3.70	1.94	1.76 deficiency.
Lower lakes	2.91	2.30	0.61 deficiency.
Upper lakes	3.12	1.25	1.87 deficiency.
Extreme north-west	2.50	2.70	0.20 excess.
Upper Mississippi valley,	3.40	1.87	1.53 deficiency.
Missouri valley	2 81	2.52	0.29 deficiency.
Northern slope	1.39	1.83	0.44 excess.
Middle slope	1.42	3.65	2.23 excess.
Southern slope	2.99	1.95	1.04 deficiency.
Southern plateau	3.16	2.26	0.90 deficiency.
North Pacific coast	0.78	0.08	0.70 deficiency.
Middle Pacific coast	0.02	0.00	0.02 deficiency.
South Pacific coast	0.22	0.07	0.15 deficiency.
Mt. Washington, N.H.	7.67	6.06	1.61 deficiency.
Pike's Peak, Col.	4.81	2.22	2.59 deficiency.
Salt Lake City, Utah	0.88	0.62	0.26 deficiency.
Brownsville, Tex.	5.94	1.97	3.97 deficiency.

The rainfall record can be best shown by the above table, which shows the unusual deficiency of the month in almost every section, which especially affected the crops in the south. Remarkably heavy rains were recorded in a few instances, — 10.38 inches at Griffin, Ga., in eight hours; and 8.14 inches at Kittyhawk, N.C., in four hours. In the cotton region the rainfall was much less than in August of last year, the amount at New Orleans being 2.70 inches, against 8.38 inches a year ago.

Local storms were not numerous, but were quite severe, especially in Iowa, on the 7th and 8th. On the 21st there was a veritable tornado in Minnesota, which devastated the town of Rochester, causing a loss of over thirty lives, and much damage to property.

Seven auroral displays occurred, but none were of especial note. The following electrical phenomenon is reported from Pike's Peak: —

"The observer on the summit of Pike's Peak, Col., reported that during a sleet and thunder storm, on the evening of the 4th, the anemometer cups revolved in circles of electric light. After a flash of lightning, the light encircling the cups became dim, but would soon regain its former brilliancy. The observer states, that, by holding up his hands, electric sparks would form on the ends of his fingers, and that his hair and clothing were full of them. A peculiar crackling noise was heard about the anemometer cups; and at the corners of the office building there were continuous sparks of bright light."

Earthquake-shocks occurred at Oakland, Cal., Carson City, Nev., St. Thomas, W.I. At the last-named place a tidal wave occurred on the 27th, and at San Francisco on the 27th and 28th. Earthquake waves, whose height was one foot, and time between crests forty minutes, were recorded on the Saucelito tide-gauge. It is supposed they were caused by the earthquake in Java on the 27th.

A dense smoke, due to forest-fires in Oregon and Washington, Idaho and Montana territories, prevailed during a greater part of the month, and extended on the Pacific coast as far south as Cape Mendocino, and thence eastward to eastern Montana, Dakota, and Minnesota.

The accompanying chart exhibits the mean pressure, temperature, and wind-direction, for the month.

THE INVENTION AND SPREAD OF BRONZE.

AT the thirteenth session of the German anthropological congress, held at Trier early in August, Professor Rudolph Virchow, the president, gave an address, the substance of which we quote from the *Frankfurter zeitung* of Aug. 11.

In beginning the president remarked, that, in the choice of Trier as the place of assembly for this year's congress, it was considered that the city and its surroundings were especially suited by their situation for the solution of the often-broached question of Celts. The speaker then reviewed in a general

way the present condition of anthropological research, paying especial attention to the first appearance of bronze in Europe. The question, when did the metal first come into use in our part of the world, is certainly one of the most important which anthropological science has to consider, and in order to provide the necessary material for its solution, wherever individual investigators or scientific societies are active, the territorial relations should be first examined, and, without drawing general conclusions, the localities or the strata in which the discoveries are made should be determined; for, however many investigations have already been undertaken in this branch of anthropology, the boundary where the stone age ceases and the metal age begins has not yet been definitely decided for any locality. A difficulty which arises in answering the question, does this or that settlement, this or that discovery, belong to the stone or bronze age, must not be passed in silence, since neglect of it has frequently led to mistakes. The difficulty is, that at one time, when metal was already common, stone implements were used both by poorer people, who were not able to obtain the expensive tools, and for ritualistic purposes. A circumstance which next comes into consideration, and which renders difficult in no little degree the determination of the epoch to which certain discoveries belong, is that the river-sand, silt, etc., in which the objects were found, often change their positions.

Passing to a general consideration of the bronze age, the speaker said that the answer to the question, where did the invention of this alloy originate, is one of the most important problems for anthropological research. There are two widely differing views on this subject: 1°, that of investigators who assume that bronze was invented at different times and in different places, independently of each other; and, 2°, that of those who assert that the invention was made at one place, and thence the use of the metal spread. In opposition to the first-mentioned assumption, is the fact that the bronze objects scattered over many regions show in their composition a considerable agreement, and, almost without exception, are composed of a mixture of nine parts copper and one part tin, as are by far the majority of those which are found in the countries lying between the Caucasus and Portugal. Even if the moisture of the earth and atmospheric influences affect the various components of the alloy in various ways, and a part of the copper is destroyed or altered, the bronze objects, as a whole, are affected in the same way; and the appearance of a very similar composition, in regions far removed from each other, points with convincing force to the conclusion that the invention of this mixture was made in one place, and its use was thence spread. Further, as to how bronze was introduced into Europe, we find also various opinions not very harmonious with each other. Some investigators naturally claim that it was through the Phoenicians, of whom we know that in ancient time they carried on a trade extending over the whole Mediterranean, and that while Cyprus, one of the chief centres for copper ore, — from this island copper (Latin, *cuprum*) received its name, — lay in their immediate neighborhood, they passed in their voyages the Pillars of Hercules, and visited the 'tin-island' (Great Britain). From the Phoenician trade-stations on the coast of the Mediterranean, among which the Massilian colony (Marseilles) played an important part, trade-roads into the interior were probably built. Many investigators suppose the spread of bronze was through commercial activity. Whether this view is true, is not easy to determine; since trade-settlements, which, as a rule, exert no, or at most only a transient, influence over the majority of the colonies and customs with which they come in contact, as soon as they cease to exist, can seldom be traced. The speaker, in his researches in Sicily, where, as is well known, the Carthaginians, also a people of Phoenician origin, were for a long time settled, could find no traces which indicated this settlement. Further, it is also well known that the trade supremacy which Pisa on the Mediterranean, and Genoa on the Black Sea, once exercised, has left on the coasts bordering these seas no traces worth mentioning. But, supposing that bronze was scattered by the commerce of the Phoenicians, it by no means proves that they were the inventors of this alloy. The speaker, on the whole, was much more inclined, with reservation of his decision, to place this invention farther to the east, in central Asia.

Besides the view just mentioned, which considers the commercial activity of the Phoenicians as the agent by which that advance in culture signalized by the use of metal implements was brought about, there is a theory lately advanced by Hochstetter, which deserves mention because it completely abandons the views formerly held. Hochstetter bases his assumptions on the discoveries in the graves at Hallstadt (first described by Sacken), and on certain discoveries at Watsch (Carniola), which show an interesting similarity to the former.[1] From these data, Hochstetter traces the identity of bronze manufacture in Hallstadt and upper Italy, and comes to the conclusion that this manufacture originated with the Aryans, and that the use of bronze for weapons and vessels had been common among this people a long time before the Aryan races wandered from their Asiatic home to Europe; while, at the same time, he denies the Etruscan origin of the findings at Hallstadt, Watsch, and Este, and assumes that the bronzes found in Italy, so far as they were not brought there by the Aryans inhabiting Italy, were imported from Greece.

Against these conclusions, surprising by their novelty, Virchow asserts, that in case the Aryans, in their wanderings to the west, had taken bronze with them, we must expect to find traces of its use on the highways, which they presumably followed in their

[1] A situla dug up at Watsch exhibits the same decoration as those found at Hallstadt, and contains, among other things, a representation of warriors, who are equipped with four different kinds of helmets, such as may be reconstructed from the discoveries at Hallstadt. Objects corresponding to the Watsch bronzes were found also in Este (North Italy).

advance ; for example, in the valley of the Donau. Especially in regard to the Caucasus, his investigations in the region convinced him that no people already sufficiently civilized to employ metals could have passed over this range; and, on account of the geographical relations, we must assume that the Aryan peoples first divided in central Asia, and separated widely along the northern coast of the Aral and Caspian seas, and then proceeded through modern Russia, where the characteristic bronzes are not found, or westward through Asia Minor. Once in Greece, it is highly probable that Italy was their next step. A fact brought forward by Hochstetter in support of his theory — viz., the lack of ribbed bronzes, Mestea dicordoni — has proved a mistake. A point of attack is presented by the same investigator, in his assertion that the discoveries at Hallstadt do not date back of the second millenary before the Christian era, and immediately preceded the Roman civilization; and that, at the time of the subjugation of Noricum by Rome, the manufacture of bronze already existed.

At the close of his address, Virchow merely touched upon other anthropological questions, and pointed out that philology and archeology alone were not in condition to relieve the darkness which still concealed the invention and spread of bronze; and that somatic anthropology, i.e., the investigation of the physical constitution of the peoples under consideration, as seen from the bones preserved to us, may here have a final word to say, and may, perhaps, answer the important question, whether the cultivation of central Europe is to be traced to the influence of two different families, or to only one, the Aryan.

THE VEGETATION OF THE CARBONIFEROUS AGE.[1]

MUCH of the second decade of my life was spent in the practical pursuit of geology in the field ; and throughout most of that period I enjoyed almost daily intercourse with William Smith, the father of English geology. But, in later years, circumstances restricted my studies to the paleontological side of the science : hence I was anxious that the council of the British association should place in this chair some one more familiar than myself with the later developments of geographical geology. But my friend, Professor Bonney, failing to recognize the force of my objections, intimated to me that I might render some service to the association by placing before you a sketch of the present state of our knowledge of the vegetation of the carboniferous age.

This being a subject respecting which I have formed some definite opinions, I am going to act upon the suggestion. To some this may savor of 'shop-talk;' but such is often the only talk which a man can indulge in intelligently: and to close his mouth on his special themes may compel him either to talk nonsense or to be silent.

Whilst undertaking this task, I am alive to the difficulties which surround it, especially those arising from the wide differences of opinion amongst paleobotanists on some fundamental points. On some of the most important of these there is a substantial agreement between the English and German paleontologists. The dissentients are chiefly, though not entirely, to be found amongst those of France, who have, in my humble opinion, been unduly influenced by what is in itself a noble motive ; viz., a strong reverence for the views of their illustrious teacher, the late Adolphe Brongniart. Such a tendency speaks well for their hearts; though it may, in these days of rapid scientific progress, seriously mislead their heads. I shall, however, endeavor to put before you faithfully the views entertained by my distinguished French friends, M. Renault, M. Grand-Eury, and the Marquis of Saporta, giving, at the same time, what I deem to be good reasons for not agreeing with them. I believe that many of our disagreements arise from geological differences between the French carboniferous strata and those in our own islands. There are some important types of carboniferous plants that appear to be much better represented amongst us than in France: hence we have, I believe, more abundant material than the French paleontologists possess, for arriving at sound conclusions respecting these plants. We have rich sources, supplying specimens in which the internal organization is preserved, in eastern Lancashire and western Yorkshire, Arran, Burntisland, and other scattered localities: France has equally rich localities at Autun and at St. Etienne. But some important difference exists between these localities. The French objects are preserved in an impracticable siliceous matrix, extremely troublesome to work, except in specimens of small size: ours, on the other hand, are chiefly embedded in a calcareous material, which, whilst it preserves the objects in an exquisite manner, does not prevent our dissecting examples of considerable magnitude. But, besides this, we are much richer in huge Lepidodendroid and Sigillarian trees, with their Stigmarian roots, than the French are : hence we have a vast mass of material illustrating the history of these types of vegetation, in which they seem to be seriously deficient. This fact alone appears to me sufficient to account for many of the wide differences of opinion that exist between us, respecting these trees. My second difficulty springs out of the imperfect state of our knowledge of the subject. One prominent cause of this imperfection lies in the state in which our specimens are found. They are not only too frequently fragmentary, but most of those fragments only present the external forms of the objects. Now, mere external forms of fossil plants are somewhat like similarities of sound in the comparative study of languages: they are too often unsafe guides. On the other hand, microscopic internal organizations in the former subjects are like grammatical indentities in the latter one: they indicate deep affinities that promise to guide the student safely to philosophical

[1] Opening address before the section of geology of the British association for the advancement of science. By Prof. W. C. WILLIAMSON, LL.D., F.R.S., president of the section. From advance sheets kindly furnished by the editor of *Nature*.