the small ones have been obtained from the eutectoid cementite. In the author's first paper it was shown that a large amount of mechanical treatment was needed in order to produce this complete spheroidisation. The macrostructure shows that the cementite vein runs close up to the edge, and the Oriental maker must have relied most upon securing the best cutting properties in the cementite particles.

High-speed tool steel, which is an alloy steel containing from 16 to 20 per cent. of tungsten and from 3 to 5 per cent. of chromium, in addition to a carbon content not exceeding 0·75 per cent., together with vanadium up to 1 per cent., also belongs to the cementitic series of steels, and its structure in the annealed condition is strikingly similar to that of Damascene steel. Spheroidised carbide particles are embedded in a sorbitic matrix. To produce the characteristic high-speed hardness such steels have to be heated to incipient melting and then rapidly cooled in a current of air. Even after this treatment a certain amount of carbide remains undissolved, and there are indications that a moderate amount of it increases the cutting properties of the tool. What is important to notice is that the makers of high-speed steel emphasise the necessity of producing a particular type of structure under the hammer, and that during this operation the massive carbides and tungstides present in the ingot are broken down and uniformly distributed through it. Accordingly the ingots are first hammered into billets, and the latter are reheated and hammered a second time. This double treatment is indispensable and must precede the heat treatment proper by thoroughly breaking up and distributing evenly the carbides and tungstides throughout the steel.

Col. Belaiew then compares not only the structures, but also the respective processes of manufacture, and points out how similar they are. Both start with a cementitic steel; both require the greatest care in breaking and evenly distributing the carbides under the hammer; in both cases the amount of mechanical work done on a given article is very large; in both cases the structure of the resulting carbides is globular or spherulitic, while the matrix is martensitic; in both cases the cutting properties of the edge depend both on the matrix and the carbides, and the author is disposed to think that the *rôle* of the latter is the more important of the two. His studies in this field have led him to the belief that the workers in Damascene steel, while very strict as regards the hammering temperatures, did not lay anything like so much stress on the subsequent heat treatment.

In Damascene steel the degree of spheroidisation is always very high. This was not an end in itself, but was attained incidentally by the numerous cautious forgings and heatings which were designed to produce the greatest ductility possible. In high-speed tool steels spheroidisation is also attained, but the author holds that insufficient stress has been laid on this point by both makers and users, and that the scientific application of the spheroidising process would help to improve the qualities of existing steels. He considers also that another inference might be drawn from the Damascene process, namely, the proper study of the macrostructure in all cases. An Oriental maker would never manufacture a steel article without having satisfied himself by studying the "watering" that the distribution of the carbide particles was the best possible and in accordance with the shape and properties of the article. Neither would he find a buyer ready to accept a sword or a tool without a proper metallographic examination of it as a whole, and to this the Oriental watering lent itself well. The author suggests, therefore, that a proper examination of the watering of high-speed steel, whether in billets or in the finished article, should prove useful. It is interesting to notice that he found a certain degree of high-speed hardness in Damascene steel itself. This point would repay investigation, for if confirmed it would prove that, at any rate in certain cases, the use of alloy steels is unnecessary, and that they could be replaced by the cheaper carbon steels.

Obituary.

DR. JULIUS HANN.

THE death of Hann, which was briefly noted in the issue of NATURE for October 13, removes from the meteorological world the most prominent figure of the past generation and the most productive of all contributors to that branch of science. Hann was born at Schloss Hans, near Linz, in Austria, on March 23, 1839, and his youth was spent in the Alps at Kirchdorf, in Kremstal, some thirty miles south of Linz. After taking his degree in mathematics and physics, he took up a professional career as teacher of those subjects in the high school of Schottenfeld, Vienna, and afterwards at Linz. At the age of twenty-nine he was appointed on the staff of the Central Anstalt für Meteorologie at Vienna, which was then under the direction of Carl Jelinek. He succeeded Jelinek as director in 1874, and continued in office until 1897, when, at the age of fifty-eight, he gave up the appointment and retired to Graz, in Styria, in order to pursue his studies in meteorology; but, finding Graz inconvenient for that purpose, he returned to Vienna in 1900, and thereafter, as professor in the university, he occupied a room in the Central Anstalt on the Hohe Warte, and continued to work there until the end of his life.

Hann's chief and most continuous occupation was the editing of the *Meteorologische Zeitschrift*, which, in conjunction with Jelinek, he started on May 1, 1866, as the *Zeitschrift der Oesterreichischen*

Gesellschaft für Meteorologie. From 1877 to 1885 he was sole editor of that journal, and when, in the latter year, it was combined with the *Zeitschrift der Deutschen Meteorologischen Gesellschaft,* under the title which it now bears, Prof. W. Köppen, of the Seewarte, Hamburg, became his collaborator, and in 1892 Dr. G. Hellmann, of Berlin. More recently Dr. R. Süring, of Potsdam, shared the editorial duties, and at the beginning of this year Felix Exner, the present director of the Central Anstalt, relieved Hann, whose strength was failing. From its beginning the *Zeitschrift* has been recognised as the leading meteorological journal of the world, and as indispensable for any library in which the science of meteorology is represented.

Hann was one of the secretaries of the original international assembly of meteorologists at Leipzig in 1872, a member of the International Meteorological Committee from 1878 to 1898, and president d'honneur of the international conference at Innsbruck in 1905.

He was not only an exemplary editor of the *Zeitschrift,* but also an indefatigable contributor. Every number contained articles from his pen. No subject of meteorological interest escaped his notice. He was instrumental in obtaining for the journal all the data for out-of-the-way places that he could hear about. He moved, for example, our Meteorological Council to publish the results of the observations at the stations of the Royal Engineers and Army Medical Department which had been established through the influence of General Sabine, and more recently he always searched the blue-books of our scattered Colonies for information that would otherwise have been practically inaccessible to meteorologists. The whole world was his parish, and he took great care of it.

By May 1, 1906, Hann had been editor of the *Zeitschrift* for forty years, and the epoch was marked by the publication of a special volume of contributions made by his friends, pupils, and colleagues. It is known as the "Hann Band." It was edited by Dr. Hellmann, of the Prussian Institute, his colleague as editor of the *Zeitschrift,* and Prof. J. M. Pernter, Hann's successor as director of the Central Anstalt in Vienna.

In the spring of 1919 Hann's eightieth birthday was celebrated, and the opportunity was again taken to mark appreciation of his services by the collection of a fund to be placed at the disposal of the Vienna Academy for the encouragement of the study to which he had so assiduously and successfully devoted his life. By that time the disastrous effects of the war upon the finances of Austria had become realised, and Hann, in common with many other Austrian men of science, suffered lamentable privations, under which his health suffered, though he maintained his industry and assiduity. He died in Vienna on October 1.

Hann was a most voluminous author. Vienna was a great centre for the study of Erd-kunde, and the school of meteorology and geophysics, which owed much of its inspiration to Hann, is probably without a parallel in the world. The recital of his work by the Royal Meteorological Society at the award of the Symons medal in 1904 refers to 121 titles in the Royal Society catalogue and the following comprehensive books: Astronomical geography, meteorology, and oceanography in "Allgemeine Erd-kunde," published in 1881 by himself conjointly with Profs. Hochstetter and Pokorny; in 1883, "Handbuch der Klimatologie," which has now reached three editions, and is recognised everywhere as the standard work on that subject; in 1887, "Atlas der Meteorologie," forming part 3 of Berghaus's "Physikalischer Atlas"; and, lastly, in 1901, the "Lehrbuch der Meteorologie," "the most thorough treatise in all branches of the science," an indispensable work of reference for all meteorologists, which also has now passed into its third edition.

The amount of information contained in these works is extraordinary, and the method of presenting it equally remarkable, so much so that Hann's name is a household word wherever meteorology is discussed, and his position as the leading meteorologist of the world is unchallenged. While everything passed under his notice as editor of the *Zeitschrift,* he had a genius for seeing the bearing and noting the scientific connection of the various contributions of authors writing from many points of view. It is to Hann perhaps more than to anyone else that we owe the advances which have been made in recent years from a heterogeneous collection of meteorological erections towards a meteorological edifice on ordered scientific lines.

It is not practicable, within the limits of this notice, to make any enumeration of his own contributions to the science; his books are the best guides. From the first, mountain observations were among his favourites, and from that point of view he was the first to discover that a cyclone is in reality a cold creature. His studies in climatology led him also from the first to insist on the need for precision in the evaluation of mean daily temperature, and in recent years he wrote important papers on the subject with reference especially to the temperatures of tropical countries.

Hann was, indeed, the chancellor of the realm of meteorology. "It is said that the chief notary or scribe of the Roman Emperor was called chancellor either because he was entrusted with the power of obliterating, *cancelling*, or crossing out such expressions . . . as seemed to him to be at variance with the laws or otherwise erroneous; or, more probably, because he sat *intra cancellos,* within the lattice-work or railings which were erected to protect the Emperor from the crowding of the people." As one reads this definition of what a chancellor was and did, we may well think of Hann, indefatigably occupied in the seclusion of his room in the Hohe Warte of the Imperial City of Vienna, protected from the crowding of

official duties, yet in continuous touch with the whole meteorological world, wasting no time over controversy, keen to appreciate the scientific laws and scrupulous impartially to place everything that complied therewith at the service of the whole scientific world.

Fully occupied in the enjoyment of his work, he was too busy for journeys that would separate him from it. Since 1898 he has not often been seen outside Vienna or his summer resort. He leaves a widow, a son, and two daughters to mourn his loss, which calls forth the assured sympathy of colleagues and friends in all parts of the world.

Hann received many distinctions. He was "Hofrat" in 1891, and subsequently was ennobled with the prefix "von"; but he made little display of the distinction. He had also the Ehrenzeichen für Kunst und Wissenschaft, and was a Knight of the Prussian Order "Pour le Mérite," a member of the Academy of Vienna, and honorary or foreign member of foreign academies and societies in all parts of the world. He was the recipient of the Buys Ballot medal, the Symons medal, and many other recognitions of his pre-eminent services. NAPIER SHAW.

BENJAMIN HARRISON.

THE late Benjamin Harrison was born on December 14, 1837, at Ightham, Kent, where his family had resided for several generations. Educated locally, he had the good fortune to be trained by two schoolmasters interested in science and archæology, and thus the natural trend of his mind was greatly stimulated. On leaving school at the age of fifteen he entered his father's shop, and after his father's death carried on the business of grocer until a few years ago. He passed peacefully away on October 1 after a few days' illness in the house in which he was born. He was married twice, his first wife dying in 1877, and his second wife (for many years an invalid) surviving him only a week. He leaves one son and two daughters.

In early life Harrison was a keen botanist and an enthusiastic collector of fossils and flint implements, and he soon got in touch with such well-known workers as the late Lord Avebury, F. C. J. Spurrell, and Roach Smith. In 1870 he met the late Sir Joseph Prestwich, who, perceiving the importance of his discoveries, encouraged him in many ways. As a result of Harrison's field work, Prestwich, in 1889, published his well-known paper on the Palæoliths of Ightham (Quart. Journ. Geol. Soc., vol. 45, pp. 270–294), followed in 1891 by the Darenth paper (*op. cit.*, vol. 47, pp. 120–160), and in 1892 by the paper on the plateau implements (Journ. Anthrop. Inst., vol. 21, pp. 246–262), Prestwich claiming for these rudely chipped flints a much greater antiquity than the Palæoliths. This was the beginning of the great "Eolithic" controversy which has not yet received its final solution, and it would appear as though there will always be two opinions respecting "Eoliths." Henceforward Harrison's spare time was spent in accumulating evidence in support of the "Eoliths" and in elucidating other prehistoric problems, whilst his house became a Mecca for all students.

Harrison's name will always be associated with "Eoliths," but it was his evidence that enabled Prestwich to establish the "hill group" of Palæoliths whilst the excavations carried on by Harrison at the rock shelters at Oldbury yielded many late Palæoliths which are now regarded as St. Acheul II. Harrison published but little, yet no one was more willing to assist others with his knowledge. An extremely well-read man, his ready wit, kindness of heart, and cheerful disposition endeared him to a large circle of friends, who now mourn the loss of "old Ben." In 1895 he was awarded the Lyell fund by the Geological Society, and in later life he was the recipient of a Civil List pension. Harrison was one of those humble workers for science who, in the face of great difficulties, rise superior to their surroundings by strength of character and industry, and leave an imperishable name behind.

Notes.

AT a meeting of the Optical Society held on Thursday, October 13, the resolution passed early in 1915 suspending certain members, subjects of countries then at war with Great Britain, was revoked.

THE Thomas Hawksley lecture of the Institution of Mechanical Engineers for the present year is to be delivered at the institution on Friday, November 4, at 6 o'clock, by Dr. H. S. Hele-Shaw, who will take as his subject "Power Transmission by Oil."

AT the opening of the annual meeting of the Société de Chimie industrielle on October 10 the Dumas medal of the society and an illuminated address were presented by M. Dior, Minister of Commerce, to Sir William J. Pope.

"EARLY Relations of Egypt, Babylonia, and Syria" is the subject of a lecture to be delivered by Mr. Percy E. Newberry on Thursday, October 27, at 8.30 p.m., at the rooms of the Royal Society, Burlington House. This lecture is the first of a series on Egypt to be arranged by the Egypt Exploration Society. Tickets and further details can be obtained from the Secretary, 13 Tavistock Square, W.C.1.

THE programme for the session 1921–22 of the Institute of Metals contains, in addition to announcements of general meetings of the institute, the first list of meetings of the newly-formed London Local Section. There are now in existence local sections in Birmingham, Sheffield, Glasgow, and London, and