the action of the more refractive rays of the spectrum, had been demonstrated and studied by the highest chemical investigator of the time, who had died in 1786. Cirillo's observations are, however, worth recording, because they were connected in his mind with the action of sunlight in causing movements and irritability in vegetable organs.

Other workers in those days were investigating in Italy the chemical action of light; and their experiments, like those of Cirillo, are also generally forgotten. In 1782, Alessandro Barca, in Padua, studied the effect of solar rays in accelerating the decomposition of phlogisticated alkali, or yellow prussiate, in the presence of acetic acid.[1] In 1794, Anton Maria Vassalli, in Turin, in comparing the action of solar and of artificial light, showed that the latter darkens silver salts, causes chlorotic leaves to become green, rouses the sleeping leaves of the sensitive plant, and acts generally in the same manner, although with less intensity, as the light of the sun. Vassalli observed a diminution in weight in the silver chloride darkened by light; he also experimented upon the effect of moonlight upon this salt, and upon vegetation.[2]

The "Discorsi Accademici" of Cirillo, in which are the two remarkable essays, "Del moto e della irritabilità dei vegetabili" and "La cagione della vita," were first published in 1789, and re-edited in 1799. This second edition was the last scientific labour of Cirillo, for in that same year he was overwhelmed in the political storms that swept over Naples. All the writings of Cirillo glow with warm philanthropy and patriotism, and we see in them a constant protest against the prejudices and superstitions then so high in authority in the Neapolitan kingdom. After the cowardly flight of King Ferdinand from Naples in December 1798, leaving the city a prey to royalist anarchy, Cirillo joined with the patriots who favoured the entrance of the French into Naples and the establishment of the Parthenopæan Republic. Pressed by the insistance of his friends, Cirillo accepted the presidency of the legislative body, but during the brief period of his political power he occupied himself mainly in alleviating the growing misery of the people; above all, Cirillo remained the philanthropist and the physician rather than the politician. The Republic lasted a few months, sinking finally in the struggle with the brigand hordes of the Holy Faith, that through pillage and bloodshed Cardinal Ruffo led from Calabria to Naples. Cirillo was among the many who capitulated in the Castles of Naples, on condition of a free passage to a French port. The sorrowful history of what followed is well known, of how the capitulation was ruthlessly broken when Castles and prisoners were secured. All those who had held office under the Republic, or had any direct connection with its government, were condemned to death for high treason. From June 29, 1799, to September 1800, execution followed execution, until in Naples alone ninety-nine of the foremost men were put to death, besides the many—it is said 300—executed in the provinces. Domenico Cirillo was hanged on the same day as Mario Pagano and the poet Ignazio Ciaja. "For the death of these men all the city mourned," wrote Marinelli, a diarist of the time. Another botanist, Abate Nicola Pacifico, an old man of seventy, companion and fellow-worker of Cirillo, shared his fate on August 20, on the same day when the gifted Eleonora Fonseca Pimentel was delivered to the hangman.

Cirillo's house was pillaged by the mob, and his collections and books, among which was the herbarium of Imperato, were burned or dispersed. "Let the idle and ignorant know that love of humanity, zeal for science, and faithfulness to duty can only be quenched in me with my life"—thus wrote Cirillo in the days of his prosperity, little dreaming of the distant purport of his words. Nobly indeed, when oppression and ignorance prevailed, in the days of suffering and agony, Cirillo to the very last kept faith to duty and to Fatherland.

ITALO GIGLIOLI.

METALLIFEROUS DEPOSITS.

A COURSE of four Cantor Lectures delivered before the Society of Arts by Mr. Bennett H. Brough, on the nature and yield of metalliferous deposits, has just been published. Descriptions are given of the principal ore deposits of the world, and the statistics of production appended furnish a clear idea of the condition of the mining industry at the present time. The subject is of great importance from a commercial point of view, as will be evident from a moment's consideration of the enormous value of mineral resources. In the United Kingdom alone, the value of the minerals raised in one year has approached 80,000,000*l.*; and the vast sums representing the British capital invested in mines in all parts of the world will be readily appreciated. Last year, the number of new mining companies registered in Great Britain was 559, with a united nominal capital of 71,687,366*l.* Of these companies, 281, with a nominal capital of 37,037,057*l.*, were formed to mine and explore in British colonies and dependencies, and 157, with a nominal capital of 24,049,502*l.*, to mine in foreign countries. During the present century the mining industry has made remarkable strides. Some indication of the progress made, even during the past ten years, is afforded by a comparison of the world's output of metals in 1889 and in 1898. In round numbers, the production of the principal metals was as follows:—

	1889. Tons.	1898. Tons.	Value of output in 1898. £
Pig-iron ...	26,000,000 ...	36,000,000 ...	100,000,000
Gold	182 ...	430 ...	57,500,000
Silver	3,900 ...	6,000 ...	24,000,000
Copper... ...	266,000 ...	431,000 ...	21,750,000
Lead	549,000 ...	770,000 ...	10,000,000
Zinc	335,000 ...	468,000 ...	9,950,000
Tin	55,000 ...	77,000 ...	8,000,000
Antimony ...	11,000 ...	28,000 ...	1,100,000
Mercury ...	3,838 ...	4,100 ...	815,000
Nickel	1,830 ...	6,200 ..	725,000
Aluminium ...	70 ...	4,000 ...	440,000

The simplest classification of the ore deposits from which these vast outputs have been obtained, divides them into (1) beds, (2) veins, and (3) masses. This classification has proved well adapted for practical use. The more elaborate systems of classification that have from time to time been proposed are fully discussed, the classifications dealt with being those of Agricola (1555), Burat (1855), B. von Cotta (1853), Grimm (1869), J. A. Phillips (1884), A. von Groddeck (1878), F. Pošepný (1880), Sir A. Geikie (1882), H. S. Monroe (1892), H. F. Kemp (1892), H. Louis (1896), H. Hoefer (1897) and G. Gürich (1899). The last-named investigator uses the mode of concentration as the basis of classification. The concentration may take place with or without a change in the state of aggregation. In the former case the passage into the solid state is from a state of vapour, from a molten state, or from a state of aqueous solution. Consequently the following classes of ore deposits are distinguished:—

I. Sublimation deposits: (*a*) syngenetic, in which the sublimation of the vapours takes place simultaneously with the solidification and within a solidifying magma, *e.g.* tin ore deposits; (*b*) epigenetic, in which crusts are formed coating fissures; (*c*) metagenetic, in which the constituents of a rock are dissolved by pneumatolysis and replaced by metallic substances.

II. Magmatic, or solidifying deposits: (*a*) syngenetic, representing the usual form of magmatic deposit as described by Vogt; (*b*) epigenetic, only imaginable if an apophysis of a magma within the enclosing rock consists of a metallic band; (*c*) metagenetic, hardly imaginable.

III. Precipitation deposits: (*a*) syngenetic, in which the chemical precipitation takes place simultaneously with the sedimentation, the deposit being formed simultaneously with the surrounding rock, *e.g.* seams, beds; (*b*) diagenetic, in which the concentration takes place in the muddy floor of a lake, *e.g.* concretionary nodules of clay iron ore; (*c*) epigenetic, in which the deposit is formed subsequently to the surrounding rock, *e.g.* veins, cave fillings; (*d*) metagenetic, in which the soluble constituents of a rock are dissolved, transported, and the metallic substance precipitated, the deposit being formed subsequently to the enclosing rock, but growing at the expense of the latter.

IV. Separation deposits: (*a*) residual deposits formed by chemical concentration, a soluble rock constituent, *e.g.* lime, being carried away, and a metallic substance, *e.g.* brown iron ore, remaining unaltered; (*b*) detrital deposits formed by mechanical concentration, *e.g.* dry placers, alluvial deposits.

In view of the apparent impossibility of definitely determining the genesis of a given deposit, it may be questioned how far it is advisable to adopt a genetic classification. Probably, however, by employing that system of classification, an observer would be induced to make a more thorough examination than if he were

[1] Alessandro Barca, "Sulla Scomposizione dell' alcali flogisticato" (Opusc. Scelti vii. 1783).

[2] Anton M. Vassalli, "Parallelo della Luce Solare e di quella della combustione" (Opusc. Scelti xvii. 1794, p. 106).

required merely to define the deposit by its outward form. Any efforts to introduce improvements in mining must, however, subordinate theory to practical requirements.

In consequence of the difference of form in beds, veins and masses, various methods of working have to be employed. Underground mining is not necessary with all ore deposits. The iron ore beds of Northampton, for example, and the alluvial beds of river gravel containing gold are worked open-cast.

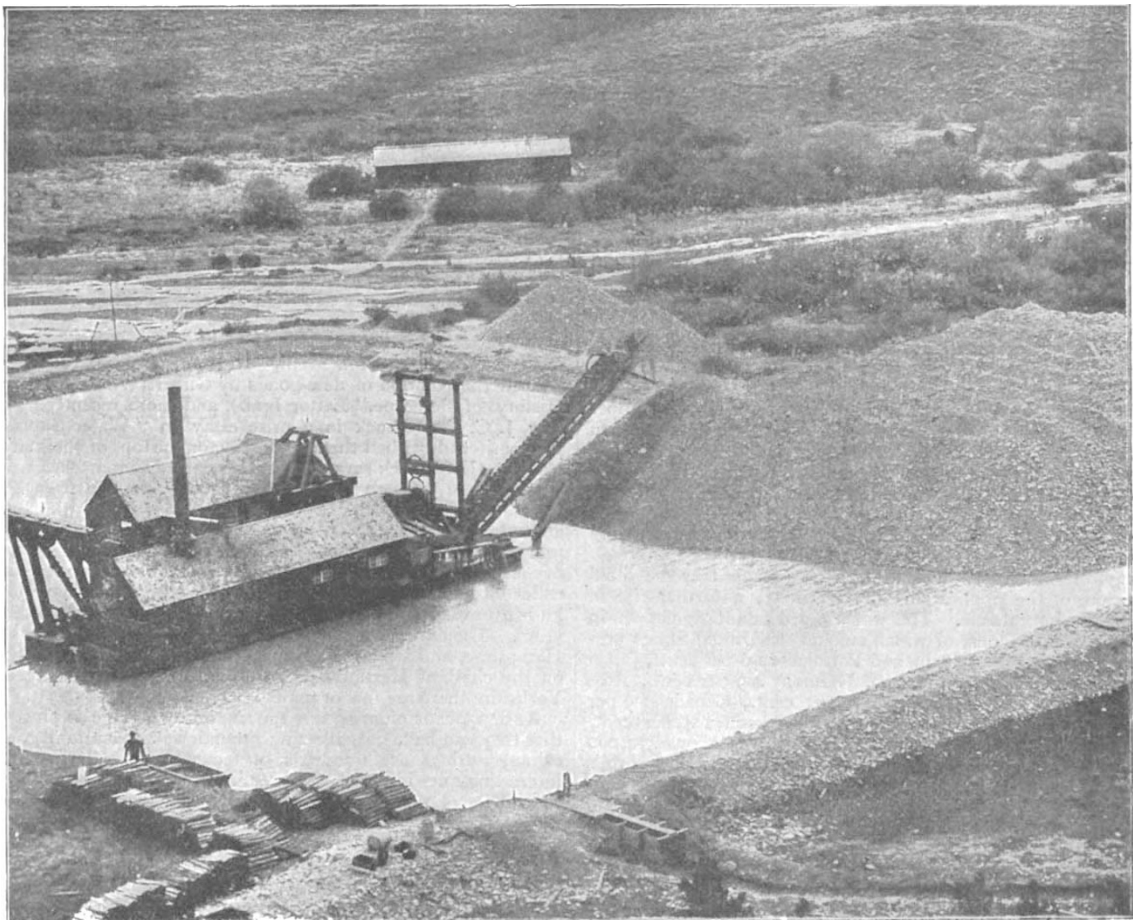

FIG. 1.—Gold Dredge at work excavating auriferous Gravel 45 feet below the Water Surface.

Of late years very successful results have been obtained by extracting auriferous gravels from the beds of rivers by dredges. The practice of dredging originated and has been brought to its present state of perfection on the Clutha river, in the province of Otago, New Zealand. Ground containing only a grain or a grain and a half of gold per cubic yard can now be worked at a profit. The remarkable yield of a dredge working at Cromwell, on the Clutha river, which cost 5,000*l*. to build and launch, and obtained more than that amount of gold within seven weeks after starting, shows how quickly the capital sunk in the industry has, in some instances, been returned. Experience in Montana, United States, shows that with a bucket-dredge 98 per cent. of the gold in the gravel is extracted. The cost of dredging when steam is employed is 4½*d*. per cubic yard, and when electricity is employed for power 2¼*d*. per cubic yard. The practice of dredging is coming into increasing use in New Zealand, Canada, California, Montana, the Republic of Colombia, and elsewhere. It represents an important advance in the working of alluvial deposits, and if the yields of gold in the future are not likely to be so sensational, they will probably be more regular than they have been in the past. The accompanying illustration (Fig. 1) shows the latest type of gold dredge made by the Risdon Iron-works of San Francisco. As represented, it is excavating auriferous gravel 45 feet below the water, and stacking it 24 feet above.

The gradual increase in the world's annual production of gold is shown in the accompanying diagram (Fig. 2).

The value of the world's gold production in 1898 was 57,500,000*l*., of which the Transvaal produced 27·6 per cent., Australasia 22·5 per cent., the United States 22·1 per cent., Russia 8·8 per cent., Canada 4·8 per cent., Mexico 3 per cent., India 2·7 per cent., and China 2·1 per cent. Thus the Transvaal, Australasia, and the United States together produced 72 per cent. of the total. The production last year was even greater, amounting probably to 62,700,000*l*., notwithstanding

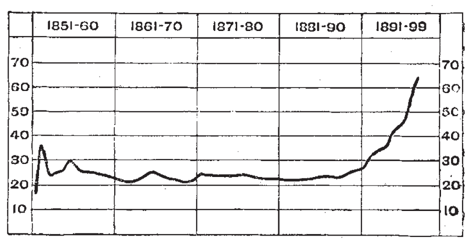

FIG. 2.—World's gold production (in millions of pounds).

the interruption in Transvaal mining. From the present condition and prospects of the more important mines in Africa, Australasia, the United States, Canada and other countries, it seems that there are no signs of falling off in the world's gold production. In the case of silver, of which the world in 1898 produced 165,000,000 ounces, Mexico produced 34·4 per cént., the United States 33 per cent., and Australasia 7·3 per cent. Less than half the world's supply was obtained from silver ores. The remainder was obtained from the metallurgical treatment of other ores in which silver was an accessory constituent. Since those ores would continue to be mined for the other metals they contained, a steady supply of silver was assured, whilst a slight rise in the price of silver would enable many deposits of true silver ores now untouched to be worked.

In a paper read before the Society of Arts in 1854, Mr. J. K. Blackwell stated that the world's production of pig iron then amounted to 6,000,000 tons. Of that quantity the United Kingdom produced 50 per cent., France 12·5 per cent., the United States 12·5 per cent., and Germany 6·6 per cent. In 1898 the world's production had risen to 35,741,000 tons, of which the United States produced 32·7 per cent., the United Kingdom 24·1 per cent., Germany 20·6 per cent., and France 7·1 per cent. The relative position of the different countries from a mining point of view is better shown by the statistics of iron ore production. The world's production in 1898 was 73,670,000 tons, of which the United States produced 26·2 per cent., Germany 21·6 per cent., the United Kingdom 19·3 per cent., Spain 9·7 per cent., France 6·2 per cent., Russia 5·6 per cent., Austria-Hungary 4·5 per cent., and Sweden 3·1 per cent. The more important iron ore deposits now worked are at the mines of Lake Superior, Bilbao, Southern Spain, the Ural, Styria, Dannemora, Grängesberg and Gellivare.

With regard to copper, the rapid decadence of British copper mining was owing to copper in the Cornish mines having given place to tin as greater depths were reached, and to these great depths and the quantity of water encountered rendering competition with the American and Spanish deposits impossible. There are, however, large areas unexplored, and many mines worth re-opening should the price of copper rise, and should the disadvantages experienced in Great Britain make themselves felt abroad. Owing to the increased demand for copper caused by the rapid extension of the applications of electricity, a further rise in price is not improbable. The world's production of copper in 1898 was 424,126 tons, of which amount the United States produced 55·1 per cent., Spain and Portugal 12·6 per cent., Japan 5·9 per cent., Chili 5·8 per cent., Germany 4·9 per cent., Australasia 4·2 per cent., Mexico 2·5 per cent., Canada 1·9 per cent., Cape Colony 1·6 per cent., and Russia 1·4 per cent. Last year the world's copper production was about 474,000 tons. The Anaconda Mine produced 11 per cent. of the world's output, and among other important copper mines are those in Arizona, in the Lake Superior district, in the South of Spain (Rio Tinto and Tharsis), and Portugal (San Domingos), in South America, in Japan; at Mansfeld, and at the Rammelsberg, in Germany; at Falun, in Sweden; and in Australasia (Mount Lyell, Tasmania; Moonta and Walleroo, South Australia; and Great Cobar, New South Wales).

CONFERENCE OF DELEGATES OF CORRESPONDING SOCIETIES OF THE BRITISH ASSOCIATION.

THE first meeting of the Conference took place at Bradford on Thursday, September 6.

The report of the Committee, a copy of which was in the hands of every delegate present, was taken as read. The chairman then remarked that the chief subject for discussion that day consisted of the following resolutions, which had been brought forward by the Yorkshire Naturalists' Union:—

(1) That the Conference of Delegates be allowed to meet on the first day of the British Association meeting, and make their own arrangements for subsequent meetings and order of business.

(2) That it is desirable, in order to make the discussions of the Conference of Delegates more useful to the local societies, that they should have the power of deciding the subjects for discussion at the meetings of the Conference, and it is suggested, therefore, that a circular be sent by the Committee every year to each of the corresponding societies asking them to send a list of subjects for discussion (not more than two or three) at the forthcoming meetings. The Committee then to send to the corresponding societies a schedule containing the titles of all the subjects proposed for discussion, asking each society to mark such of these subjects as it deems most desirable to discuss at the Conference meetings. On receipt of this information the Committee will then arrange the list of subjects in order of precedence as indicated by the support given to each subject by the societies; and a copy of this should be sent to the delegates or Societies as an agenda paper before the first meeting of the delegates.

After a long discussion, it was resolved that the meetings of the Conference be held on Thursday and Tuesday, as heretofore.

Copyright.—Mr. Walton Brown remarked that some time ago Lord Monkswell had introduced a Bill into Parliament dealing with copyright, but so far as scientific societies were concerned the Bill ignored some important points. There was no provision that a society should have any copyright in the publication of its own transactions. He believed that societies could claim copyright if they paid their contributors. He thought that the Conference should ask the Corresponding Societies Committee to take steps to have an amendment proposed recognising the copyright of scientific societies in their publications.

Prof. Henry Louis pointed out that the British Association expressly disclaimed copyright for themselves; and the Rev. J. O. Bevan urged that a special case should be prepared and submitted to counsel for a legal opinion. Mr. Walton Brown's views were unanimously accepted by the meeting, which then adjourned.

At the second meeting of the Conference an address on dew-ponds was given by Prof. Miall. In the first place, Prof. Miall noticed the mention of dew-ponds by Gilbert White ("Natural History of Selborne," Letter lxxi.), and more recently by the Rev. J. C. Clutterbuck in a prize essay on "Water Supply." Both writers described them as existing on the tops of chalk hills, and Mr. Clutterbuck says that at the selected spot an excavation is made from 30 to 40 feet or more in diameter, and from 4 to 6 feet deep. The bottom is covered with clay mixed with lime, and a layer of broken chalk is placed over the clay with lime to prevent injury to this impermeable lining. Water is then introduced by artificial means. If there is a fall of snow this is collected and piled in the pond. Ponds so made have been known never to become dry during periods of twenty or thirty years. They are most common on the chalk hills of Sussex and Hampshire, and are also found in Berkshire and Wiltshire. But on the chalk of Hertfordshire, Bedfordshire, Lincolnshire and Yorkshire there are few or none.

As dew-ponds often occupy the summit of a ridge so precisely that they can have no collecting ground worth mentioning, and as any springs are hundreds of feet below, it becomes an interesting question why they retain more or less water when the low-level ponds of the same district have become dry, though they supply water for large flocks of sheep.

Prof. Miall then reviewed the evidence bearing upon the question whether these ponds are mainly dew-ponds or rain-ponds, and quoted the experience of Mr. Clement Reid, who found that at the end of a long drought the best dew-ponds were sheltered on the south-west side by an overhanging tree, or the hollow was sufficiently deep for the south bank to cut off much of the sun. The depth or shallowness of the water did not appear to make so great a difference as might be expected.

It was, however, evident that many additional observations were necessary before this question could be settled. It was desirable that the temperature of the water of the pond at various depths, as taken hourly through a summer night, should be noted, and that many other thermometrical observations should be made. He concluded by asking that residents in the south-eastern counties would investigate the matter.

Mr. Clement Reid had been working for some years in a country where dew-ponds were abundant, but did not think they were formed in the scientific manner pretended by their makers. In times of drought some dried up and others did not, the fittest surviving. Farmers were continually making new ones, and sometimes, by accident, hit on a satisfactory site It was unfortunate that they were almost entirely without meteorological observations on the high ground where dew-ponds might be seen.

Mr. Hopkinson noted the difficulty of ascertaining the amount of water contributed to the pond by dew. A distinction must be drawn between dew and mist. There were scarcely any rain gauges on the high ground where dew-ponds existed, though probably more rain fell there than in the valleys. He did not know of any dew-ponds in Hertfordshire. Mr. J. Brown and Mr. W. Gray stated that there were no dew-ponds in Ire-