America, the effect of which has been to reduce prices and consequently to impose a limit upon production. Several hundred piculs of imitation Congou were shipped to London from Hiôgo in the course of last year, and are said to have been favourably received in the market, both quality and flavour being of a high order; the only question remaining to be solved as to the success of these teas is whether they "can be produced at prices low enough to enable them to compete favourably in foreign markets with China and Assam teas."

In the December part of the *Transunti* of the Royal Academy *dei Lincei* of Rome, Prof. Cossa gives an interesting account of his researches on the occurrence of the three metals cerium, didymium, and lanthanum. It appears that although these metals occur always in but minute quantities, yet their occurrence is far more frequent than is generally supposed, Prof. Cossa having been able to trace them even in bones and in the ashes of plants, not to speak of a number of minerals, such as certain apatites, Carrara marble, scheelite, &c. In Carrara marble Prof. Cossa found about two centigrammes of the mixed oxalates of cerium, lanthanum, and didymium in every kilogramme of marble; there were also traces of yttrium.

We have on our table the following works:—"The Elements of Dynamics," second edition, James Blackie (Thin, Edinburgh); "Simple Lessons in Domestic Economy," Wm. Wyley Murly; "Education as a Science," A. Bain (Kegan Paul and Co.); "The Land of Midian," 2 vols., Capt. Burton (Kegan Paul and Co.); "Reise aus den Stillen Ozean," Max Buchner (J. N. Kerns); "The Study of Rocks," Text-Books of Science, Frank Rutley (Longmans); "Dictionary of Chemistry," vol. viii. part 1, Henry Watts (Longmans); "Report of the Recorder of the Botanical Locality Record Club," West (Newman and Co.); "British Burma and its People," Capt. Forbes (Murray); "Life in Asiatic Turkey," E. J. Davis (Stanford); "Geological Survey of Victoria, Report of Progress of the Secretary of Mines" (Trübner); "The Two Voyages of the *Pandora* in 1875 and 1876," Sir Allen Young (Stanford); "Practical Geology," W. J. Harrison (W. Stewart and Co.); "Animal Physiology," Dr. A. Wilson (W. and R. Chambers); "Manual of Practical Chemistry," A. W. Blyth (Chas. Griffin and Co.); "A Ministry of Health," B. W. Richardson (Chatto and Windus); "Morphology of Vertebrate Animals," A. Macalister (Longmans and Co.); "The Colour Sense," Grant Allen (Trübner); "Fuel, its Combustion and Economy," T. Symes Prideaux (Lockwood); "The Evolution of Man," 2 vols., Ernst Haeckel (Kegan Paul and Co.); "Experimental Culture of the Opium Poppy," John Scott (Calcutta Press); "Manual of Opium Husbandry," John Scott (Calcutta Press); "Sewage Poisoning," Edward T. Blake (Hardwicke and Bogue).

The additions to the Zoological Society's Gardens during the past week include a Common Hare (*Lepus europæus*), British Isles, presented by Mrs. F. Buckland; an Impeyan Pheasant (*Lophophorus impeyanus*) from the Himalayas, two Cheer Pheasants (*Phasianus wallichii*) from North India, received in exchange; a Nuthatch (*Sitta cæsia*), British Isles, purchased; a Sambur Deer (*Cervus aristotelis*), born in the Gardens.

THE PHYSICAL NATURE OF THE SUN[1]

The question whether all points of the sun are alike, in reference to the emission of light and heat, is not yet decided. As to the distribution of heat on the sun, many investigations have already been made with a view to answering this important question. Nervander seems to have been the first to discover (from temperature observations at Paris and Innsbruck) a temperature inequality of about $\frac{1}{2}°$ R, which has moreover the period of the sun's rotation (27·25 days). Simultaneously, Dr. Buys Ballot made a similar inquiry in Utrecht. Proceeding on the supposition that a kind of h eat pole exists in the sun, and that accordingly the rotation of the sun must appear from long series of temperature determinations, he got from observations of temperature at Harlem, Zwanenburg, and Danzig, a period of 27·682 days. Since this result differs so much from that of Nervander, Buys Ballot subjected the calculations of Nervander to a thorough scrutiny, from which he concluded that that observer had "not only taken the moon for the sun, but had also mistaken the former." In his memoir Buys Ballot further showed, that to the colder side of the sun, which was presented to us on 1st January, 1846, a temperature corresponded that was, on an average, about 0·7° lower than that of the warmer side, which was presented to us on 15th January of that year. Carlini and D'Arrest got nearly the same result as Nervander. Airy, on the other hand, was unable to decide from the Greenwich observations. Since by the distinguished researches of Hornstein, Director of the observatory at Prague, and of Broun, it has been proved that the time of the sun's rotation may be deduced from variations of magnetic and barometric phenomena more accurately and from a short series (one year) of observations, and since both the period of Nervander and that of Ballot differ so much from Spoerer's and Carrington's rotation period, I submitted the Prague temperature-observations for 1876 to a closer examination, expecting a much shorter period from these than Hornstein got from magnetic and barometric obsevations, as I supposed that it would correspond to the rotation, deduced from spot observations, of the thermal equator of the sun, which, it is known, does not coincide with the true equator. I worked the observations therefore by the method given by Hornstein in the *Sitzungsberichte* of the Vienna Academy (Bd. 67), as it is peculiarly suited for such researches. I here communicate the final result. The most probable value obtained for T was 25·56 days. According to Carrington's observations, the position of the thermal equator of the sun on the foregoing supposition would have the latitude 10° to 20°, according to Spoerer's observations, the latitude 13° to 40°. As recent researches seem to show that the influence of variation of the forces of the sun is reflected in the variations of meteorological phenomena, I further investigated the wind components of the year 1870, in their relation to the rotation-time of the sun. For the east-west-components I found a period of 26·71 days. Whether from this result may be concluded a correspondence between prevalent winds in the sun, such as Spoerer has deduced from his spot-observations, will have to be decided by closer investigation.

[1] By Dr. Gruss, in the *Astronomische Nachrichten*.

THE STRUCTURE AND ORIGIN OF LIMESTONES[1]

After the obituary notices of eminent Fellows lost during the past year, who were more than usually numerous, the president confined his own special address to the consideration of the structure and origin of limestones, relying mainly on his own observations, but incorporating general facts derived from other sources. Since, in order to properly understand the nature of the various constituent fragments of which many limestones are composed, it is necessary to know the organic and mineral constitution of the various different living calcareous organisms, this question was first considered from a somewhat novel point of view, and they were regarded, not merely as living tissues, but also as mineralised organisms, much attention being paid to their special optical characters. Much attention had been also paid to their true mineral constitution, so as to ascertain in which groups the carbonate of lime exists in the form of calcite, and in which as aragonite. The results are in some cases remarkable, even in relation to biology, and are of great interest and importance in the study of limestone rocks and their included fossils, since subsequent changes depend mainly on whether the original material was calcite or aragonite. This is due to the fact that calcite is in a state of stable equilibrium, and cannot be changed to aragonite, whereas aragonite is relatively in a state of unstable equilibrium, can be changed to calcite, and usually has so changed in limestone rocks. This circumstance has given rise to a complete difference in the state of preservation of many fossils. When they were originally calcite, they may have been further consolidated, but retain their original structure and optical properties, whereas when they

[1] Abstract of Anniversary Address to the Geological Society by Mr. H. C. Sorby, F.R.S., President, communicated by the author.

were aragonite they have sometimes been completely removed by solution, and in other cases are usually changed into a mass of crystals of calcite, and have lost their original microscopical and optical characters. The general structure of various recent and fossil organisms was then considered, and it was shown how and to what extent they could be distinguished, when occurring as minute fragments in thin sections of limestones.

The various facts connected with the disintegration of shells, corals, and other organisms, are of great importance in studying limestones, since without an adequate knowledge of the manner in which they decay and fall to pieces, very inaccurate conclusions might be formed respecting the origin of calcareous deposits. The results mainly depend on original structure, and on whether they are composed of calcite or aragonite. The next questions considered were the manner in which the external form of minute fragments is preserved in limestone, and the various chemical changes occurring after deposition or consolidation; and, having thus established the general principles necessary for their accurate study, the President entered on a description of our various English limestones, in descending order.

The main object was to ascertain, as far as possible, the exact nature of the material from which each particular rock was derived. Some beds are mainly composed of definite fragments, so as to be analogous to sands, and then the true nature of the various organisms from which the fragments are derived can be ascertained, provided they were originally calcite, whereas, if they were originally aragonite, and their structure lost, very often all that can be said is that they were portions of aragonite shells or corals. Many associated beds are or were composed of fine granules, and analogous to clays. In many cases these have in all probability been derived to a great extent from aragonite organisms decayed down into small granules of calcite, and it is quite impossible to further identify the material.

The structure and origin of oolitic grains was dwelt upon at some length. Usually they are evidence of true chemical deposition. They occur in three distinct types, viz., those composed of aragonite, having a concentric structure without any radii, giving rise with polarised light to a black cross optically positive; those which are composed of calcite, having a radiate structure and giving rise to a negative black cross; and those which have recrystallised since their original formation. After describing the chief points of interest connected with the leading limestone rocks of our country, the president collected together the results into two tables, the more condensed of which may here be given.

Name of rocks.	Chief constituent fragments, &c., in descending order.
Cretaceous	Shell prisms, Foraminifera, Coccoliths.
Wealden	Freshwater aragonite mollusca, Entomostraca.
Jurassic	Chemical deposits, Aragonite mollusca and corals, Brachiopoda, Echinoderms, Shell prisms.
Permian	Original structure lost by dolomitisation.
Carboniferous ...	Encrinites, Brachiopoda, Foraminifera, Corals, and Polyozoa.
Devonian	Encrinites, Corals, and allied organisms.
Silurian	Encrinites, Corals and Polyzoa, Brachiopoda, Trilobites.
Metamorphic ...	Original structure lost, Quartz and Silicates formed *in situ*.

He concluded as follows:—

"On examining these tables, especially the more detailed ones, it will be seen how remarkably and characteristically our limestones differ from one another. There would usually be little difficulty in deciding the general age of any characteristic, somewhat coarse-grained, specimen. Though this difference must to a great extent have depended on the nature of the organisms living at each period, yet it must also have depended on the accompanying mechanical and chemical conditions of the water in which the deposits were formed. The structure of each rock was therefore dependent on two most important circumstances, and we need not be surprised to find the results so varied and characteristic. Passing upwards from the earlier rocks, we may often trace a gradual change, broken here and there by a complete contrast, which is in perfect agreement with results arrived at from a totally different class of facts. On the whole, this is perhaps the most important conclusion that we can at present draw from the subject before us. Possibly further research may teach us much more, since I am quite sure that much remains to be learned. In fact, long as I have studied these questions, and long as this address has been, I know quite enough of the facts to be convinced that it is only a sort of first attempt and rough sketch of a very wide and complex subject."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

MR. MILMAN, who for some years has acted as Assistant-Registrar, has been appointed to succeed Dr. Carpenter as Registrar of London University. It is stated that Mr. H. N. Moseley is a candidate for the Assistant-Registrarship.

MR. A. CRAIG-CHRISTIE, F.L.S., lecturer on botany, Edinburgh, is a candidate for the Chair of Botany in the University of Edinburgh.

IN a recent report by the British Consul at Hakodate, some account is given of the public buildings and other institutions of Sappora and Ishcari. Referring to the Agricultural College buildings, we are told that they consist of four distinct houses, as follows:—A two-storeyed house, comprising lecture and recitation-rooms, cabinets, and offices. A one-storeyed house, used for dormitories to accommodate from fifty to sixty students, attached to which is a similar building providing a large dining-hall, kitchen, bath-rooms, offices, and servants' quarters. In connection with this, again, is a two-storeyed building, which serves as a lecture-room and a general sitting-room and study. A two-storeyed house, which is the chemical laboratory; the ground-floor of this house is used as a general laboratory for the students, and on the second floor are the lecture and apparatus-rooms, and the rooms for collections in mineralogy, geology, and chemistry. Besides these there are several other buildings in European style, used for various scientific and industrial purposes. It is further intended to erect, at an early date, an Agricultural College, likewise two-storeyed, which will be another imposing building. Here will be zoological, mineralogical, geological, botanical, and agricultural museums, with separate halls for lectures and experiments in the above-mentioned branches. The Sapporo Agricultural College was founded by the Kaitakushi for the education and practical training of young men from all parts of the Empire, who are expected to remain in the Government service in Yesso, after graduation for a term of five years. The number of students is limited to sixty, and all their expenses while in college are defrayed by the government. Candidates for admission must be at least sixteen years of age, of sound constitution and good character. They will be examined orally and in writing in the Japanese and English languages (which they are expected to read, write, and speak correctly and fluently), arithmetic, geography, and universal history. If they succeed in this preliminary examination they will have to sign a prescribed contract with the government and furnish a satisfactory surety or guarantee. The course of instruction will occupy four years and embrace all the branches of a general education, with the study of the Japanese and English languages. Moreover, they will be thoroughly instructed in agriculture and horticulture, civil engineering, and chemistry, astronomy, botany, geology, zoology, military science and tactics, and before they leave college, in the fourth year, they will have to devote some time to political economy. As the students are destined to become practical agriculturists, including the use of hand implements and machinery, and the care and management of domestic animals, they have to work in the fields with their foreign instructor two afternoons of each week. There are at present three foreign professors or instructors, viz., one for mathematics and engineering, one for botany and chemistry, and one for agriculture, besides the native teachers, and it is expected that later will be added an instructor for military drill, and one specially for the English language, and a foreign doctor. The number of students at the time the report was written amounted to thirty, fifteen being added annually up to sixty in the fourth year of the foundation of the college, when the first batch of fifteen (the original number started with) will retire and graduate if they have completed their course of studies in a satisfactory manner, whereupon they will enter government employ. In another part of the report, speaking of the progress made by the students, the reporter says, "they are most assiduous at their studies, and it is indeed astonishing the progress they have already made. All their studies are conducted in English, and they speak and discuss in English without the slightest hesitation, making use of very good language. They also appear to enter fully into the different branches of study."