

subsequent discussion as to the value to be attached to these remains, which, if authentic, are acknowledged to have much influence on the final settlement of the question as to who the mound-builders were.

THE use of artificial teeth is not so modern as is generally believed. *Cosmos* states that in the museum of Corneto, on the coast of Italy, there are two curious specimens of artificial teeth found in Etruscan tombs probably dating to four or five centuries before our era. These graves contained the bodies of two young girls. On the jaw of one is still to be seen two incisors fixed to their neighbours by small gold rings; in the other the rings remained, but the artificial teeth had fallen out. The teeth, carefully cut, had evidently been taken from the mouth of some large animal. The dentist's art amongst the ancients was not confined to drawing teeth, and replacing them by artificial ones, for natural teeth have been found which have evidently been treated in various ways. That this curious fact has escaped notice so long, is due to the rarity of Etruscan skeletons, the Etruscans employing cremation generally, and also to the circumstance that modern inquirers are more interested in objects of Etruscan art and industry than in the remains of their ancient owners.

WE have received from the Rev. H. H. Higgins the reprint of a paper read by him before the Literary and Philosophical Society of Liverpool on Museums of Natural History. The writer discusses the subject under four heads, to which a fifth, on the British Museum of Natural History, is added. These are Museum visitors' desiderata, arrangements and appliances. Judging from the attendance at the Liverpool Museum, he calculates that a large majority (about 780 in 1000) of the visitors are those who are not conscious of any purpose beyond a wish to see the Museum, but who fix their attention with more or less intelligence on the objects displayed. The students would number about ten to twenty, and loungers, including children, 200 in the thousand. The first desideratum in a public museum is a better treatment of the specimens which they already possess. The Museum, Mr. Higgins thinks, is a rare one, in which a donation of 100*l.* could best be spent in the purchase of fresh specimens; in almost all instances it could be better spent in making the order more intelligible and more instructive, and much of this good work might be done without spending any money. The sections on arrangements and appliances contain many interesting suggestions on these important elements in the success of a museum. A *stammbaum*, or phylogenetic scheme of the pedigree of animals and vegetables, by Prof. Herdman, of University College, Liverpool, is added to Mr. Higgins's paper.

WE have received Dr. Howden's presidential address to the Montrose Scientific and Field Club, on the "Aims of a Naturalists' Field Club," which contains much useful advice as to the methods in which the members of such societies should regulate their studies and researches. What has already been done in local natural history in the vicinity of Montrose and suggestions as to what still lies ready at hand to be done, are described in the concluding portion of the address.

Timber, a weekly journal devoted to the timber and kindred interests, is the title of a new journal, the first number of which appeared on February 28. A large portion of this periodical is occupied with trade announcements and records of sales, with a sprinkling of short articles and paragraphs on subjects connected with the uses of timber or the timber supply. The paper is intended for circulation among, and as the representative of, the numerous trades who work in timber, and does not profess to be anything else.

THE experiments in Paris by the Triboulet system of photographing all the country seen from a captive balloon by opening

the valve of a panoramic object-glass with a current sent from the ground has succeeded wonderfully well. As the operators remain on the ground a very small balloon is sufficient to carry the photographic apparatus. The impressions being taken on films can be inspected with a microscope, and are useful for military purposes.

THE additions to the Zoological Society's Gardens during the past week include a Pig-tailed Monkey (*Macacus nemestrinus* ♀) from Java, presented by Mrs. Urquhart; a Chinese Mynah (*Acridotheres cristatellus*) from China, presented by Mr. George Rowler; a Galeated Curassow (*Pauxis galeata* ♂) from Venezuela, presented by Mr. G. A. Crawley; a Chilean Sea Eagle (*Geranoaetus melanoleucus*) from Chili, presented by Mr. Richard J. Jones; a Carrion Crow (*Corvus corone*), British, presented by Mr. A. Browning Priestley; a Smooth Snake (*Coronella laevis*) from Hampshire, presented by Mr. W. H. B. Pain; a Tibetan Wild Ass, or Kiang (*Equus hemionus* ♀) from Tibet, four Sonnerat's Jungle Fowls (*Gallus sonnerati* ♂ ♂ ♀ ♀) from Southern India, deposited; a Mandarin Duck (*Aix galericulata* ♂) from China, a Dark Green Snake (*Zamenis atrovirens*), South European, purchased; two Rendall's Guinea Fowls (*Numida rendalli*) from East Africa, received in exchange; a Gigantic Salamander (*Megalobatrachus giganteus*) from Japan, two Bull Frogs (*Rana catesbiana*) from North America, received on approval; a White-fronted Lemur (*Lemur albifrons*), born in the Gardens.

GEOGRAPHICAL NOTES

MR. WADA, of the Japanese Legation in Berlin, recently laid before the Geographical Society there certain maps produced by the Geological Survey of Japan, which represent the work up to the present of that establishment. It was founded in 1879, and was organised by Dr. Naumann, a German geologist. It consists of topographical, geological, and agromonomical sections, and of a technical and chemical laboratory. The maps prepared by the department for the Geological Congress of Berlin this year were:—(1) An oroplastic map, on a scale of 1 : 860,000, showing the general position and form of the Japanese archipelago, the coasts, ranges of mountains, as well as the depths of the ocean off the coast. (2) A magnetic map. During the preliminary topographical survey magnetic variations were investigated by the help of a portable magnetometer. Magnetic investigations are of extraordinary interest in Japan. The maps show that the variations are frequently very different in kind, the numerous volcanoes causing great irregularity. (3) A geological map constructed from the preliminary surveys of Dr. Naumann and native geologists. This is based on a topographical map, which is not reliable in detail; but it shows the knowledge attained so far of the geological structure of Japan. From this it appears that all the formations are met with in that country, the Palæozoic being universal. Next to these in extent comes granite. A complete report on this subject is to be made by the head of the Survey to the Congress. The topographers have worked now for about four years, and the area surveyed is more than eighty geographical miles square. The completion of the maps for the whole country will take another eight years. The detailed geological survey has reached about the same extent as the topographical survey, but none of the sheets of the map have yet been published, although they exist in manuscript down to the 38th parallel, with the exception of *Yezo*. The maps, as well as the text, appear in Japanese and English, and the Survey publishes also annual reports, eight of which have already appeared, but only in Japanese. Another map, also prepared for the Congress, is one of the volcanoes, the ages being distinguished by colours. An important portion of the work of the Survey is the study of soils. According to Mr. Wada, a volcanic tufa, consisting for the most part of decomposed silicates, forms a large part of the numerous uncultivated plains at the foot of the mountains. An accurate knowledge of this will be of much value to agriculture. Japanese soils in general are stated to be poor in chalk. This subject will also be dealt with by the head of the Agromonomical Section before the forthcoming Congress.

THE last *Bulletin de la Société de Géographie* (1^{er} Trimestre, 1885), contains a paper by M. de Mailly-Chalon on a journey in Manchuria. With two countrymen he left Peking for Newchwang, and thence passing to the east of Moukden, through Kirin to Ninguta, where the party turned to the south-east along the Tiumen, towards the ocean, and reached Vladivostock. The journey the whole way was along the Korean frontier. Leaving Vladivostock the travellers crossed Siberia to Tomsk, from which they went to Samarkand. From this point the story of the journey is taken up by another member of the party, Baron Benoist-Méchin, whose paper on the journey across Turkestan succeeds M. Mailly-Chalon's. This journey led them from Samarkand through Karshi, to Bokhara, thence to the Amou-Darya at Charjui. They followed the river then down to Petro-Alexandrovsk, whence they deviated to Khiva. From the latter town they retraced their steps up the river, and from Kurgan-Chin started across the Kara-Kum to Merv, and so to Sarakhs and Persian territory at Meshed. The journey, here barely indicated, lasted two years, *i.e.* from the departure from Japan for Peking to the arrival in Teheran. M. Rabot writes on Nordenskjöld's expedition to Greenland, the paper being compiled from the Professor's reports to Mr. Oscar Dickson, published in the *Journal* of the Swedish Society of Anthropology and Geography. M. Charles Huber brings to an end his long journeys in Central Arabia, between 1878 and 1882, to which we have adverted in noticing previous numbers of the *Bulletin*.

At the meeting of the Paris Geographical Society on the 7th inst., M. Giraud was received with great distinction, and detailed his recent travels in Africa. The explorer has received the gold medal of the Society and the Cross of the Legion of Honour.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, APRIL 19-25

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on April 19

Sun rises, 4h. 57m.; souths, 11h. 59m. 0'7s.; sets, 19h. 1m.; decl. on meridian, 11° 20' N.; Sidereal Time at Sunset, 8h. 53m.

Moon (at First Quarter on April 21) rises, 8h. 10m.; souths, 16h. 4m.; sets, 23h. 58m.; decl. on meridian, 18° 14' N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian
Mercury ...	5 4 ...	12 44 ...	20 24 ...	18 2 N.
Venus ...	4 57 ...	11 45 ...	18 34 ...	8 47 N.
Mars ...	4 36 ...	11 7 ...	17 38 ...	5 21 N.
Jupiter ...	12 45 ...	20 2 ...	3 19* ...	14 3 N.
Saturn ...	7 22 ...	15 28 ...	23 34 ...	22 3 N.

* Indicates that the setting is that of the following day.

Occultations of Stars by the Moon

April	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	
20 ...	λ Geminorum ...	3½ ...	22 59 ...	23 20 ...	187 232
22 ...	B.A.C. 3122 ...	6½ ...	21 4 ...	22 4 ...	127 255
23 ...	π Leonis ...	5 ...	18 46 ...	19 42 ...	14 290
24 ...	δ Leonis ...	5 ...	23 7 ...	23 58 ...	135 238

Phenomena of Jupiter's Satellites

April	h. m.	April	h. m.
20 ...	I 12 I. tr. ing.	22 ...	2 24 III. occ. disap.
	22 19 I. occ. disap.		20 14 I. ecl. reap.
21 ...	I 45 I. ecl. reap.	23 ...	2 28 II. occ. disap.
	19 39 I. tr. ing.	24 ...	20 34 II. tr. ing.
	21 59 I. tr. egr.		23 30 II. tr. egr.
		25 ...	19 55 III. tr. egr.

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

April	h.	Phenomenon
19 ...	1 ...	Saturn in conjunction with and 4° 1' north of the Moon.
22 ...	3 ...	Jupiter stationary.
23 ...	19 ...	Jupiter in conjunction with and 4° 37' north of the Moon.

ON A REMARKABLE PHENOMENON OF CRYSTALLINE REFLECTION¹

Introduction.

IN a letter to me, dated March 29, 1854, the late Dr. W. Bird Herepath enclosed for me some iridescent crystals of chlorate of potash, which he thought were worth my examination. He noticed the intense brilliancy of the colour of the reflected light, the change of tint with the angle of incidence, and the apparent absence of polarisation in the colour seen by reflection.

The crystals were thin and fragile, and rather small. I did not see how the colour was produced, but I took for granted that it must be by some internal reflection, or possibly oblique refraction, at the surfaces of the crystalline plates that the light was polarised and analysed, being modified between polarisation and analysis by passage across the crystalline plate, the normal to which I supposed must be sufficiently near to one of the optic axes to allow colours to be shown, which would require no great proximity, as the plates were very thin. To make out precisely how the colours were produced seemed to promise a very troublesome investigation on account of the thinness and smallness of the crystals: and, supposing that the issue of the investigation would be merely to show in what precise way the phenomenon was brought about by the operation of well-known causes, I did not feel disposed to engage in it, and so the matter dropped.

But more than a year ago Prof. E. J. Mills, F.R.S., was so good as to send me a fine collection of splendidly coloured crystals of the salt of considerable size, several of the plates having an area of a square inch or more, and all of them being thick enough to handle without difficulty. In the course of his letter mentioning the despatch of the crystals, Prof. Mills writes: "They [the coloured crystals] are, I am told, very pure chemically, containing at most 0.1 per cent. foreign matter. They are rarely observed—one or two perhaps now and then in a large crystallisation. . . I have several times noticed that small potassic chlorate crystals, when rapidly forming from a strong solution, show what I suppose to be interference colours; but the fully formed crystals do not show them."

Some time later I was put into communication with Mr. Stanford, of the North British Chemical Works, Glasgow, from which establishment the crystals sent me by Prof. Mills had come. Mr. Stanford obligingly sent me a further supply of these interesting crystals, and was so kind as to offer to try any experiment that I might suggest as to their formation.

On viewing through a direct-vision spectroscope the colours of the crystals which I had just received from Prof. Mills, the first glance at the spectrum showed me that there must be something very strange and unusual about the phenomenon, and determined me to endeavour to make out the cause of the production of these colours. The result of my examination is described in the present paper.

Section I.—*Preliminary Physical Examination.*—1. It will be necessary to premise that chlorate of potash belongs to the oblique system of crystallisation. The fundamental form may be taken as an oblique prism on a rhombic base, the plane bisecting the obtuse dihedral angle of the prism being the plane of symmetry. Rammelsberg denotes the sides of the prism by P, and the base by C, and gives for the inclinations of the faces PP = 104° 22' and CP = 105° 35'. The face C, which is perpendicular to the plane of symmetry, is so placed as to bring three obtuse plane angles together at two opposite corners of the parallelepiped. The salt usually forms flat, rhombic or hexagonal plates parallel to the C plane, the edges of the rhombus being parallel to the intersections of the P faces by the C plane, and the hexagons being formed from the rhombic plates by truncating the acute angles by faces parallel to the intersection of the C plane by the plane of symmetry.

The plane angles of the rhombic plates, calculated from the numbers given by Rammelsberg, are 100° 56' and 79° 4', while the hexagonal plates present end-angles of 100° 56' and four side-angles of 129° 32'. These angles are sufficiently different to allow in most cases the principal plane of a plate, or even of a fragment of a plate, to be determined at once by inspection. But in any case of doubt it may readily be found without breaking the crystal by examining it in polarised light. There are

¹ Paper read at the Royal Society on March 19 by Prof. G. G. Stokes, M.A., Sec. R.S., Lucasian Professor of Mathematics in the University of Cambridge.