

The values of the mass of Neptune from his measures at different oppositions, and from those of Lassell and Marth and of Holden differ sensibly. The mean result from Hall's own observations is  $\frac{1}{19092}$ ; he remarks that his distances are generally smaller than those of other observers, and believes that, in order to eliminate the effect of such personal equation from the determination of the mass of a planet, the only way will be to increase the number of observers and to take a mean of their results. Hall's value approaches nearly to that found by Prof. Newcomb,  $\frac{1}{19380}$ .

On favourable nights examinations of the region about Neptune were made, but no other satellite was detected.

VARIABLE STARS (1).—The following Greenwich times of geocentric minima of Algol have been deduced from elements corrected by the later observations of Schmidt:—

|          |    | h. m. |          | h. m. |       |
|----------|----|-------|----------|-------|-------|
| November | 8  | 15 7  | December | 7     | 7 16  |
|          | 11 | 11 56 |          | 18    | 18 33 |
|          | 14 | 8 45  |          | 21    | 15 22 |
|          | 17 | 5 34  |          | 24    | 12 11 |
|          | 28 | 16 49 |          | 27    | 9 0   |
| December | 1  | 13 38 |          | 30    | 5 49  |
|          | 4  | 10 27 |          |       |       |

(2) R Leonis will now be approaching a maximum; there would appear to be indications of a sensible perturbation in the period during the last twenty years or more. (3) V Piscium, one of Argelander's supposed variables, is now favourably placed for observation; his estimates vary from 6.7 m. to 9 m.; the position of this star for 1885.0 is in R.A. 1h. 48m. 18s., Decl. + 8° 12' 9". (4) Argelander's formula of sines makes a maximum of *Mira Ceti* due on December 19, but it may probably occur earlier.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, OCTOBER 11-17

(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 October 11

Sun rises, 6h. 20m.; souths, 11h. 46m. 41' 8s.; sets, 17h. 14m.; decl. on meridian, 7° 11' S.; Sidereal Time at Sunset, 18h. 36m.

Moon (three days after New) rises, 9h. 40m.; souths, 14h. 28m.; sets, 19h. 13m.; decl. on meridian, 15° 18' S.

| Planet  | Rises |       | Souths |       | Sets  |       | Decl. on meridian |
|---------|-------|-------|--------|-------|-------|-------|-------------------|
|         | h. m. | h. m. | h. m.  | h. m. | h. m. | h. m. |                   |
| Mercury | 5 55  | 11 35 | 17 15  | 4 35  | S.    |       |                   |
| Venus   | 10 17 | 14 23 | 18 29  | 21 28 | S.    |       |                   |
| Mars    | 0 11  | 7 49  | 15 27  | 17 44 | N.    |       |                   |
| Jupiter | 3 54  | 10 16 | 16 38  | 3 38  | N.    |       |                   |
| Saturn  | 21 8* | 5 16  | 13 24  | 22 18 | N.    |       |                   |

\* Indicates that the rising is that of the preceding day.

Phenomena of Jupiter's Satellites

| Oct. | h. m. |                 | Oct. | h. m. |              |
|------|-------|-----------------|------|-------|--------------|
| 12   | 4 37  | IV. ecl. disap. | 14   | 4 50  | I. tr. egr.  |
| 13   | 4 51  | I. ecl. disap.  | 16   | 4 7   | II. tr. ing. |

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

| Oct. | h. |   |
|------|----|---|
| 11   | 12 | Venus in conjunction with and 6° 23' south of the Moon. |
| 16   | 10 | Mercury in superior conjunction with the Sun.           |
| 17   | 2  | Venus at greatest distance from the Sun.                |

GEOGRAPHICAL NOTES

ACCORDING to the report by Lieut. Wissmann on his last exploration in the Congo region, the Lower Kassai constitutes a magnificent fluvial artery, frequently of enormous breadth, and leads without obstacle into the heart of the new Congo State. Between the station of Kwamouth and the confluent of the Lulua and above the station of Luluaburg the Kassai, with a breadth of about 600 kilometres, is everywhere open for navigation. It runs through a country of wonderful fertility, presenting

alternately plains and virgin forests, and inhabited by a dense population. With about one exception the travellers have been received everywhere with eagerness by peaceable tribes, all disposed to trade. During the forty-two days employed in the voyage from Luluaburg to Kwamouth the health of the expedition was excellent. There was no loss of life, except that two natives were drowned in the rapids of the Lulua. The five white men and the 200 Negroes of the Expedition arrived all in good health at Léopoldville on July 16.

THE current number of *Petermann's Mittheilungen* contains the conclusion of M. Thoroddsen's paper on a lava desert in the interior of Iceland. It supplies certain geographical and scientific observations of the writers, such as the superficial dimensions, height, &c., hydrography, climate, geology, volcanoes, glaciers, botany, and zoology of the interior of Iceland. Herr Hasenstain describes, with a large map, Bohndorff's journeys in Central Africa between 1874 and 1883. The usual geographical information for the month, and account of the literature concludes the number.

THE most interesting contribution, however, to *Petermann* this month is a short prefatory sketch on the history of the great geographical house of Perthes of Gotha, September 11 being the centenary of its foundation. In 1801 the first geographical work was published by Perthes, and in 1809 he published a large atlas by Prof. Heusinger. Under the second proprietor, Wilhelm Perthes, who was head of the establishment between 1816 and 1853, the publications of the house assumed their geographical and cartographical character. In 1817 appeared the first edition of Stieler's Atlas, consisting of fifty maps, and between 1823 and 1831 a supplement of twenty-five more was added. This Atlas has now for nearly seventy years been the principal work published by the house of Perthes. It has been kept up to date, and the number of the maps, which in 1862 was 84, grew in 1871 to 90, and in 1879 to 95. The total number of maps, old and new, amounts to 197. Besides Stieler, Berghans (1797-1884), Spruner and Sydow supported Perthes. In 1832 Berghans's great atlas of the extra-European countries appeared. It was a financial failure, but it carried the name of the house abroad, and laid the foundation of its world-wide fame. In 1838 the publication of the same author's Physical Atlas in 93 maps was completed. Between 1837 and 1852 Spruner's Historical-geographical Atlas appeared, and was followed by various editions. Wilhelm Perthes died in 1853, and Bernhardt Perthes reigned in his stead for only four years, leaving a posthumous son, the present Justus Perthes. Petermann, who died in 1878, commenced his celebrated *Mittheilungen* in 1855. The publications of the house since that date are well-known to all geographers; Behm's "Geographical Year-Book," and Behm and Wagner's "Population of the Globe," are works of world-wide celebrity.

ON Friday last, after an absence of nearly three years, the Danish exploration expedition to the east coast of Greenland, under Lieutenants Holm and Garde, returned to Copenhagen in the ship *Constance* from Godthaab. We have from time to time given particulars of the progress of this expedition, the chief object of which was to penetrate as far north along the east coast as possible, and to attempt to reach certain native settlements known to exist between latitudes 65° and 66° N. The expedition has fulfilled all expectations, besides the collection of a valuable scientific material, Lieut. Holm having wintered in lat. 65°-66°, the highest point reached being lat. 66° 08' N., the northernmost ever reached by Europeans. Lieut. Holm is stated to have made some very valuable geographical and ethnographical discoveries, having spent last winter among East Greenlanders never before visited by Europeans. He has named the stretch of coast explored, King Christian IX.'s Land.

A WRITER who has travelled widely through Tonquin and Southern China describes, in a recent number of the *République Française*, the route from Lao-Kai, on the Red River, to Meng-tze in Yunnan. Premising that the river from the mouth to Lao-Kai, on the Tonquin border, is tolerably well known, he refers to the various routes for getting into South-Western China, but is far from enthusiastic about any of them, although he thinks that France in Tonquin has as much chance of getting the China trade as any of her rivals in the south. The writer then describes the route along the river from Lao-Kai to Manhao, the head of the Red River navigation. From this point the road to the plateau of Yunnan is said to be mountainous and

difficult in the extreme. The article is of special value at the present moment, when the question of trade routes into South-Western China has assumed so much prominence.

### THE BRITISH ASSOCIATION

#### SECTION C—GEOLOGY

*Some Results of a Detailed Survey of the Old Coast-Lines near Trondhjem, Norway*, by Hugh Miller, F.G.S., H.M. Geological Survey.—During a short visit to Norway in October, 1884, it appeared to the author that the best way to help to a solution of the vexed questions connected with the coast-terracing of Norway was to execute a careful survey of a few square miles of some suitable coast-region upon a sufficiently large scale. The neighbourhood of Trondhjem is remarkably well suited to this purpose. The map employed was partly a municipal chart on the scale of 1-10,000, and partly an enlargement of the Ordnance map. The limit of all the terraces and marine deposits is the famous "strand line" west of the town, a double range of old coast-cliff cut in the rock of the mountain-side. Its upper line is 580 feet above the sea, and answers to the "marine limit" over Norway generally. Numbers of level terrace-lines have been incised—chiefly in greenish clays, like brick-clays—all along the arable slopes east of the town between this rock-terrace and the sea. Above the Bay of Leangen, two miles east of town and river, and far beyond all erosive influence of the latter, thirty of these lines were mapped one above another in the first 300 feet of ascent, a distance of one and a half mile. Many of these are small but extremely distinct, the earthy clays being well suited to retain sharp impressions of successive sea-margins, which these unequivocally are. The present coast-line, neatly etched out by the waves in Trondhjem and Leangen Bays, is the key to these tiers of older ones. It also resembles them in having made little or no impression where the coast becomes rocky, the lines of incision in both cases stopping short at once when they reach the harder material. The old coast-lines are most numerous in well-sheltered positions. Thus a single pair of large terraces in an exposed situation east from Christiansten, where they face the open water of the fjord and the prevalent north-westerly storms, is represented in the recess above Leangen Bay by ten or twelve. The same fact is brought out on rising from this recess to the higher and more exposed ground. Thus, while thirty-three or thirty-four terraces are mapped below 350 feet (approximate) elevation, only nine or ten appear between that level and the rock-terraces of the upper marine limit, the numerical average height of the terraces thus rising by more than a half. In recesses of the coast further east, but beyond the map, these upper terraces seem to be preserved in considerably greater numbers. The number actually mapped was forty-three, or, with the two rock-terraces, forty-five. The largest number of terraces hitherto described at any one place in Norway seems to have been eighteen. Some of the general conclusions of the author are as follows:—(1) These terraces are all post-glacial, *i.e.* formed since the rock-glaciation of the district. This is confirmed by the condition of the high coast-cliff, which has been cut in ice-rounded rock, but is not itself glaciated. It appears, however, from the fauna of the raised shell-banks of the country (as worked out by Sars and Kjerulf), in which recent shells do not rise above 380 feet, that the seas of the upper levels were still glacial; and, though the Trondhjem fjord was free from land-ice, other deeper fjords and higher coasts may still have had glaciers coming into conflict with the sea, and producing the glaciated rock-terraces described by Sexe. All the evidence obtained discountenances Sexe's view that these rock-terraces were cut out by glaciers, as well as Carl Petersen's that they were rasped out by floating ice coasting the shores. On the clay terraces coast-ice has left no more sign of its presence than the winter freezing of our British rivers leaves upon our river-terraces. (2) If the country was upraised by a succession of elevatory jerks, as supposed by most geologists from Keilhau downwards, most of these would seem to have been small—much smaller, at least, than is supposed by Kjerulf. It is improbable that even Leangen Bay was secluded enough to contain a record of all the original coast-lines. The longer pauses and greater storms may have effaced an unknown number by a process of excision exemplified in all its stages by the map. It is hard to say, in fact, where the subdivision would end if all were preserved. The smaller terraces remind the eye

of the incised lines and little planes engraved on the sandbanks bordering the rivers after a flood, in which case there is no periodicity in the subsidence of the waters. (3) The preservation or excision of the terraces thus seems to depend as much upon local circumstances—exposure to storms, resistance of coast-line, &c.—as upon anything else. It is impossible at present to predicate which of them shall in any given place remain. Whether elevation by jerks, therefore, be postulated or not, all hope of correlating these terraces throughout the country must be deferred until their heights have been accurately determined by level. The measurements hitherto made, not even excepting those of Profs. Kjerulf and Mohn, are probably inadequate for the purpose. This observation seems to apply also to the terraces graven in rock. In their aneroid measurements of the upper strand-line at Trondhjem these observers differ by 55 feet. (5) On entering the mouth of the Trondhjem Valley the terraces come under an influence other than that of the sea-waves. The valley was worked out, in deposits partly levelled out by the sea, according to the laws of river-terracing under the accelerating influences of a falling sea-level. The processes of automatic river-terracing are beautifully exemplified within the district mapped in the deep lobe-shaped curve of the river just before it enters the sea. The terraces have been added one after another to the point of the lobe of land thus surrounded, which is known as *Öen*.

*The Glacial Deposits of Montrose*, by Dr. J. C. Howden.—These consist, in order of age—(1) a marine clay containing fossils of a purely Arctic type, apparently the bottom of a deep sea. Above this is seen the estuarine clay, beneath which, however, are often found deposits of peat. Over the estuarine clay is a bed of stratified sand, and above that a dense non-fossiliferous Carse Clay, varying in thickness from 4 to 6 feet. The sequence of these deposits was held by the author to indicate interglacial periods.

*Irish Metamorphic Rocks*, by G. H. Kinahan, M.R.I.A.—This paper is an epitome of what is known as to the age of the Irish Metamorphic rocks.

*Barium Sulphate as a Cementing Material in Sandstone*, by Prof. Frank Clowes, D.Sc.—The author described the "Hemlock stone" and other similar blocks of Lower Keuper sandstone in the neighbourhood of Nottingham. They stand out in hard masses from the more easily denuded sandstone around them. Analysis has shown that the cementing material of the upper part is barium sulphate. This being practically insoluble withstands denudation and protects the lower part from waste, this lower part being mainly cemented by calcareous matter. Bischof has proved the occurrence of barium sulphate as a cementing material in some foreign sandstones, but the fact is probably new in Britain.

*On Deep Borings at Chatham. A Contribution to the Deep seated Geology of the London Basin*, by W. Whitaker, B.A., F.G.S., Assoc. Inst. C.E.—A few years ago the Admiralty made a boring in the Chatham Dockyard extension, to the depth of 903½ feet, just reaching the Lower Greensand, and in 1883-84 followed this by another boring near by. After passing through 27 feet of Alluvium and Tertiary beds, 682 of chalk, and 193 feet of Gault, the Lower Greensand was again reached; but, on continuing the boring, was found to be only 41 feet thick, when it was succeeded by a stiff clay, which, from its fossils, is found to be Oxford clay, a formation not before known to occur in Kent. At its outcrop, about seven miles to the south, the Lower Greensand is 200 feet thick, and is succeeded, a little further south, by the Weald Clay, there 600 feet thick. Not only, however, has this 600 feet of clay wholly disappeared, but also the whole of the next underlying set of deposits, the Hastings beds, which crop out everywhere from beneath the Weald Clay, and are also some hundreds of feet thick. More than this, the Purbeck Beds, which underlie the Hastings Beds near Battle, are absent, and also the Portlandian, Kimmeridge Clay, Corallian, &c.; beds which have been proved above the Oxford Clay in the sub-Wealden Boring, to the great thickness of over 1600 feet. We are therefore faced with a great northerly thinning of the beds below the Gault, a fact agreeing in the main with the evidence given of late years by various deep wells in and near London. Three other deep borings have been made or are being made near Chatham, all of which have passed through the Chalk into the Gault, and one has gained a supply from the sand beneath. The practical bearing of the Chatham section is, however, to enforce the danger of counting on getting large supplies of water in the London Basin