under its eastern declivity, were overwhelmed with their unfortunate occupants, to the number of fifty or sixty, and, to quote the words of an epitaph in St. George's Churchyard descriptive of the event-

"The wind and sea its fury broke,
The wondrous works of God bespoke:
Man's dwellings levelled with the ground,
When some were killed and some drowned."

The grandfather of my informant fared worse still, for he, poor man, "was killed fust and drownded aterwards." I mention Leland's report in order to suggest that since his time the inroads of the sea and rivers must have reached flint-bearing strata more prolific than any before attacked.

The supply of flints at the present day is greater than the loss caused by attrition, and so the Chesil Bank is very gradually creeping up to the height it had acquired at the date of the "Outrage," when the ridge was equally steep on either side, and the present eastern expanse of pebbles had no existence.
Weymouth, April 2
Thos. B. Gi

THOS. B. GROVES

Flowering of the Hazel

ALTHOUGH in the vast majority of cases the male and female flowers of the hazel, as stated by Mr. Bennett in NATURE, vol. xi. p. 466, mature simultaneously on the same bush, with, I think, rather some tendency to begin the shedding of pollen I think, rather some tenuency to begin the shedding of policies before the expansion of the neighbouring stigmas; yet I have seen very striking exceptions to this rule, in the same sense as have been formerly recorded in NATURE. Thus, on March 5, 1874, I was astonished to find in a neighbouring copes a row of hazel bushes with beautifully expanded stigmas, their male catkins being still in a very undeveloped condition, and other bushes, very near those, had long lost their stigmas—the buds unfolding —while the male flowers were still shedding their pollen. Probably this exceptional "proterogyny" of the hazel is peculiar to individual bushes, and it is to be desired that such bushes may be observed in succeeding years.

Dr. H. Müller, in his admirable work on fertilisation of flowers by insects, states that he once observed many honey-bees collecting the pollen of the hazel, "but none of them ever sat down on a female flower." However, one can scarcely avoid connecting, in a Darwinian sense, the brilliant red colour of the stigmas with the occasional dichogamy and with the bees, often seen collecting the pollen of this shrub, at a season when there is scarcely any other pollen within their reach.

Frankfort-on-the-Maine, April 26 F. D. WETTERHAN

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1715, MAY 3.—The circumstances of this eclipse, the last in which totality was witnessed in London, and of which Halley gave so full and interesting an account to the Royal Society, are very closely represented by the following elements, wherein the Greenwich corrections to the principal lunar motions have been incorporated with Leverrier's Tables of the

Conjunction in R.A. May 2, at 21h. 52m. 31'7s. G.M.T.

		V / //
R.A	 	
Moon's hourly motion in R.A.	 	38 29.8
Sun's	 	2 23.3
Moon's declination	 	16 16 30'4 N.
Sun's ,,	 	15 32 15.7 N.
Moon's hourly motion in Decl.	 	8 12·3 N.
Sun's ,, ,,	 	0 44.5 N.
Sun's ,, Moon's horizontal parallax	 	61 4.9 8.8
Sun's ,,	 • • •	~ ~
Moon's true semidiameter	 	16 38.7
Sun's	 • • •	12 21.3

The sidereal time at Greenwich mean noon, May 2, was 2h. 39m. 0'7s., and the equation of time 3m. 23s. additive to mean time. Hence the middle of general eclipse occurred at 21h. 36m. 46s.; the central line commenced in long. 46° 54′ W. and lat. 31° 58′ N., and ended in long. 129° 39′ E. and lat 54° 30′ N., and the middle of totality took place with the sun on the meridian in long. 31° 1′ E. and lat. 62° 21′ N., or on Lake Ladoga.

If we calculate directly from the above elements for the superstance of the superstance of the superstance.

If we calculate directly from the above elements for the

position of St. Paul's, we find totality commenced in the metropolis at 9h. 5m. 58s. A.M. on May 3, and ended at 9h. 9m. 19s., so that the computed duration is 3m. 21s. Halley observed the eclipse from the house of the Royal Society in Crane Court, Fleet Street: he made the duration of totality 3m. 23s., and the middle at 9h. 7m. 22s. mean time; and De Louville, of the French Academy of Sciences, who came over to observe the eclipse, and was with Halley at the time, found the duration of total darkness 3m. 22s., or only one second less than was noted by the latter. The calculation is therefore within 2 secs. as regards continuance of total eclipse, and only 17 secs. later than the observed time of middle, an agreement which has not often been exceeded in predictions of recent phenomena. Again, if by equations of reduction founded upon this direct calculation for St. Paul's, we deduce the circumstances for Greenwich, there results 9h. 6m. 27s. mean time for beginning of totality, and 9h. 9m. 39s. for ending, or a duration of 3m. 12s., which is in exact accordance with Flamsteed's observations.

The track of the shadow across this country will be pretty correctly given by the following figures:-

	North Limit.	Central Line.	South Limit.
Long.	Lat.	Lat.	Lat.
4° Ŵ.	52° 19′ 6	50° 37′8	48° 59′ •7
3	52 48 0	51 6°0	49 27 8
2	53 16 2	51 34 1	49 55 8
IW.	53 44 '2	52 2 1	50 23 7
0	54 12 1	52 29.9	50 51.6
ı E.	54 39.8	52 57 6	51 19 4

Halley concluded that the south limit passed over Cranbrook, in Kent, where "the sun was extinguished but for a moment:" our elements indicate a duration of only seven seconds, and therefore the limits must be assigned with considerable precision as well as the track of central eclipse. At Northampton, close to this track, the error of calculation is again only two seconds. At Plymouth it was supposed that the totality continued 4m. 30s., but it does not appear to have lasted more than about 4m. 6s. in any part of England, and the longest duration would fall on the Norfolk coast, about midway between Cromer and Wells.

Should any reader be desirous of further examining Halley's table of the circumstances of totality, printed in the Philosophical Transactions, 1715, the following equations of reduction will assist him :-

Cos. $w = 45^{\circ}4600 - [1^{\circ}75533] \sin l + [1^{\circ}41097] \cos l \cos (L - 91^{\circ}28^{\circ}9)$ t = 21h. 33m. $25^{\circ}9 + [2^{\circ}08660] \sin u + [3^{\circ}36371] \sin l - [3^{\circ}86117] \cos l \cos (L + 43^{\circ}21^{\circ}4)$

Here L, the longitude from Greenwich, is to be taken, positive if east, negative if west; l is the geocentric latitude, and t represents Greenwich mean time; the quantities within square brackets are logarithms.

In a future column we shall give particulars of the total solar eclipse of 1724, May 22, founded upon elements similarly derived. This phenomenon has an especial interest, as having been the last in which totality was observable in any part of England, and the subject of the description given by Dr. Stukeley in his "Itinerarium Curiosorum."

THE TRANSIT OF VENUS, 1631, DECEMBER 7.—It is known that Gassendi at Paris watched attentively during several days, despite of interruption from stormy weather, for the transit of Venus, which Kepler, on the completion of the Rudolphine Tables, had predicted for the 6th of December, 1631, and that his observations were unsuccessful, the first view of the planet upon the sun's disc being reserved for our illustrious countryman Horrox eight years subsequently. Gassendi was able to watch the sun occasionally on the 6th and during the whole morning of the 7th, and it now appears that he very narrowly missed being the first observer of the rare phenomenon of a transit of Venus. We have before us elements of the transit of 1631, carefully deduced from Leverrier's Tables of Sun and Planet. As regards the

centre of the earth, the first external contact occurred on December 6, at 15h. 47 8m. Greenwich mean time, at 35 from the north point of the sun's disc towards E. for direct image, and the last external contact at 18h. 26.8m. about 4° towards W. At Paris the final contact took place at 18h. 50.3m. local mean time, but the sun did not rise till 19h. 39m.; the planet therefore had left his disc less than fifty minutes before he was on the horizon of Paris.

ARCTIC GEOLOGY*

Vardo Island, † at the end of a long promontory in the polar basin, is described by Mr. Campbell, of Islay, ‡ as consisting of metamorphic slates, dipping at 45°, and striking with the hollows and ridges north and south, ground into shape by ice, but since submerged and waveworn; drifts packed and rolled by the sea are left in a grass-grown raised beach at 60 feet, a peat-covered beach at 100 feet, and rolled stones occur on the summit level of the island, 220 feet above the sea, resting on red sandstones, with fossil markings in concentric rings. At 30 feet above the sea occurred a "storm beach," with large and sub-angular stones, sweeping in a crescent round the bay, the fortress of Vardö, and the church of Vadsö. He describes it as built on coral sand, and refers to the warm equatorial current affecting the climate in the polar basin to lat. 80° in Spitzbergen, and to long. 66° E. in Novaya Zemlya, which enables a Iuxuriant vegetation to live on the shore at Yeredik, about 70° N., in spite of the winter's darkness.

The most northern island of Novaya Zemlya has been called Castanjeno by Capt. Mack, from the "Mimosa beans" or chestnuts found there, which tropical brown nuts in Spitzbergen reach 20° E.; § but Mr. Lamont considers the large quantities of drift wood found on that coast to be derived from pines (Abies excelsa) that have grown on the banks of the large Siberian rivers; || and states that when wood occurs inland it is associated with bones of whales. He therefore does not agree with Lord Dufferin that it is brought to Spitzbergen by the Gulf Stream, ¶ which Mr. Lamont states has no influence north and east of Black Point and the Thousand Isles, even during June, July, and August, while during the winter months ice-laden currents sweep round Spitzbergen on both sides from the north, and bear back the equatorial current, and envelop

the entire island with a wall of ice.

These rapid changes of direction of currents, with accompanying marked alteration of climate, appear to bear a close analogy to those which must have obtained in South Britain when the alternating beds of boulderclay and sands and gravels were being deposited, clay with scratched stones during the colder intervals, and sands during the warmer episodes, when the waves were fretting coasts unprotected by ice.

Icebergs appear to have ground the surface of the rudely columnar trap-rocks of the Thousand Islands, which are covered with countless smoothed and rounded boulders of the local trap, and of red granite derived from the centre of Spitzbergen, forty miles distant.

In one of the cluster of islands off the coast at Black Point is a channel 100 yards long, three or four feet wide, and four deep, running N.E. and S.W., excavated in the boulders, which Mr. Lamont believes to have been produced by the passage of an iceberg, when the land stood lower than at present. The power of bergs to groove and scoop out hollows has been denied, and it is to be hoped that the

* Continued from p. 494.
† In the following notes on Spitzbergen and other neighbouring islands, only those points have been touched on as have a direct bearing on the geology of the area already described.

1 Quar. Jour. Geol Soc., vol. xxx. p. 455; 1874.
5 "Frost and Fire," by J. F. Campbell, vol. i. p. 483.

" "Seasons with the Sea Horses." London, 1861.
" "Letters from High Latitudes." (London.)

officers of the Arctic Expedition will have opportunities of ascertaining what the usual character of the bottom portion of a berg is, how far it is capable of grooving rocks and excavating hollows in soft sea beds, with or without coming to rest.

Separated from the great glacier of Deeva Bay by two miles of sea covered with fast ice, is a terminal moraine of mud, $3\frac{1}{2}$ miles long, 200 to 400 yards broad, and 20 to 30 feet high, on the top of which grow Arctic plants. Observations as to what extent glaciers can extend into the sea, and push moraines before them without breaking off into bergs, would have great interest, for in this instance the sea must have been deeper during the maximum size of the glacier than now, as bones of whales occur at heights of more than forty feet above the present sea-level.

One of the three large glaciers that protrude into the sea between Black Point and Ryk-Yse Islands has a sea front of thirty miles, sweeping in three great arcs, five miles beyond the coast line, terminating in a precipitous wall from 20 to 100 feet in height, from which bergs are constantly tumbling into the sea, carrying stone and large quantities of clay and stones seawards. The position of the melting area of such bergs as these, and con-sequent deposition of erratic material, is a point of great interest in attempting to unravel the British glacial phenomena.

Prof. Wyville Thomson, dredging on the edge of the southern ice pack, brought up fine sand and greyish mud, with small pebbles of quartz, felspar, and small fragments of mica-slate, gneiss, and granite, derived from the melting of icebergs found in lat. 65° or 64° S., which represents their melting area, while further south in 200 to 250 fathoms of water, in which they first commence to float, land débris is much rarer; at the surface of the water in the melting area, Globigerina and diatoms are numerous, but do not form a deposit at the bottom, owing to the deposition of silt obliterating them.

Recent Elevation of Spitzbergen.—From the observations of Mr. Lamont it may be inferred that during the past 400 years Spitzbergen has been rising at the rate of

thirteen feet per century.

Bear Island (lat. 74° 30' N.)—From the plants and specimens collected by Professors Nordenskjöld and Malmgren, the following classification of the rocks of the island has been established *:-

MILLSTONE GRIT.—Siliceous schists.

MOUNTAIN LIMESTONE STAGE.—Productus limestone, spirifer limestone with gypsum, resting on Cyathophyl-tum-bearing limestone and dolerite, possibly the equivalent of the Carboniferous shale with Cyathophyllum of the south of Ireland.

URSA STAGE of O. Heer.—Sandstones, with shale and coal-seams. All the beds contain plants.

DEVONIAN.—Russian Island limestone, red shale.

The Russian Island limestone, which spreads over so large an area in Spitzbergen, contains no determinable fossils, and, like the shales beneath it, is of doubtful geological age, probably, as suggested by Nordenskjöld, belonging to the Devonian. No true coal measures are present

either in Spitzbergen or Bear Island.
The "Ursa Stage" Prof. Heer correlates with the Kiltorkan beds in Ireland, the Greywacke of the Vosges and southern Black Forest, and the Spirifera Vernewiti shales of Aix, and the sandstones of Parry and Melville Islands in the Arctic Archipelago; and from the marked absence of Devonian and coal-measures species, regards the stage as of Lower Carboniferous age, the base of which he considered to be beneath the yellow sandstones; but Sir Charles Lyell, from the fact that these sandstones at Dura Den, in Fife, and in the co. Cork, contain the exclusively Devonian fish Asterolepis and Glyptolepis, believed these deposits to be Devonian, which

^{*} Quar. Journ. Geol. Soc., vol. xxviii. p. 161. (Read Nov. 9, 1868.)