valves, the whole area being greater than that of any other section of the column. Now, the question at issue is, whether by this arrangement the semilunar valves bear any less pressure because a portion of the base of the column rests upon the wall of the ventricle. That they do not may be sufficiently proved by the following considerations.

It is a generalisation from Pascal's law that "when a liquid enclosed in a vessel is submitted to an external pressure, every plane surface that we can imagine in the interior of the vessel experiences a pressure proportional to its area." As a consequence of this law, it follows, if the force impressed upon our imaginary surface represent the total force of reflux, that the pressure sustained by the whole area of the base will be considerably greater than the actual force of the column, and this increase of pressure will be proportional to the difference between the areas of the two surfaces. Also, the pressure upon the semilunar valves will be entirely independent of the pressure upon the rest of the base, and will be directly proportional to their own extent. It may be concluded, therefore, that whatever the condition of things at the base of the aorta may be, no mechanical advantage is gained thereby; indeed, if the area of the valves be equal to that of the surface we have taken, they will sustain a pressure equal to the total force of reflux of the column. Hence, by extending the area of the base over the wall of the ventricle, the only effect is to increase the total amount of pressure sustained, without at all lessening the pressure upon its original extent.

It is true that if the aortic orifice contract with the muscular substance of the ventricle, that in this way, *i.e.* by decreasing the area of the valves, a varying amount of advantage would be gained which would be greatest at the time of greatest contraction. This condition is, however, the only one that can at all favour the idea that "the reflux is most efficiently sustained by the muscular substance of the ventricle," and as this condition is doubtful, it must still seem that the main feature of Mr. Savory's theory cannot be supported. W. PERCY ASHE

Phœnician Characters in Sumatra

IN a short communication to the Anthropological Institute in December last (NATURE, vol. xi. p. 199), Phœnician characters were stated by me to be still in use in South Sumatra. As many of your readers may be glad to have more information on the subject, I write to say that the district above alluded to includes Rejang, Lemba, and Passammah, between the second and fifth parallels of south latitude. Several manuscripts, on bamboo, from this region are preserved in the library of the India Office; and a Rejang alphabet is given by Marsden in his "History of Sumatra," third edition. Some of his characters, however, appear to have been incorrectly copied. About half the Rejang letters are admitted by all the Oriental scholars to whom I have shown them to be Phœnician of the common type; others being similar to forms found in Spain and other Phœnician colonies. Most of the letters are *reversed*, a peculiarity which is explained by the fact that the Rejang writing, according to Marsden, is read from left to right, contrary to the practice of the Malays generally. The matter is of great interest, and, it is to be hoped, will be investigated by Phœnician scholars.

J. PARK HARRISON

Ring Blackbird

IN my letter in NATURE, vol. xi. p. 187, I did not refer to the Ring Ousel, for it did not occur to me that anyone would suppose that, with the apparatus of so many standard works on birds, I could fail to identify my bird, if he were a Ring Ousel, male or female. I therefore add that my bird is in no respect (save the prevailing colour) like that species of *Turdus*. It is *exactly* like a female blackbird, save that it has a white ruff, in the position of the Barbary Dove's ring, and white spot under the chin. I have never seen a Ring Ousel, or the picture of one, with those characteristics. Besides, the Ring Ousel is migratory, and would hardly be seen till the spring.

Athenæum Club, Jan. 16 C. M. INGLEBY

[Considering the time of year at which this specimen was obtained, it is more probable that it is a pied variety of the blackbird (which is far from uncommon) than a Ring Ousel. If our correspondent will forward the specimen to us, for examination, we will settle the point for him, and return it.—ED.]

OUR ASTRONOMICAL COLUMN

THE TOTAL ECLIPSE OF THE SUN ON APRIL 6.—Dr. Janssen's station for the observation of this eclipse is mentioned as probably Hué, the position of which place, as laid down on the Admiralty Chart of Cochin China, is in longitude 107° 38′ east of Greenwich, and latitude 16° 29′ north. For this point the *Nautical Almanac* elements give the following figures :—

First contact at 1h. 38m. 6, local mean time, 130° from the sun's N. point towards the west, for direct image. Totality begins at 2h. 57m. 2s., and continues 3m. 12s., the sun at an altitude of 46°.

ENCKE'S COMET will no doubt be within reach as the moon withdraws from the early evening sky. The positions subjoined are reduced to 8h. Greenwich time from the ephemeris of Dr. von Asten, of Pulkova, published by the Academy of Sciences of St. Petersburg :—

	R.A.	N.P.D.	DISTANCE.
	h. m. s.	° ′	
1875—Jan. 24	23 23 31	85 40·6	1·989
,, 25	— 24 53	85 32·9	
,, 26	— 26 16	85 25·0	
,, 27	— 27 40	85 17·0	
,, 28	— 29 6	85 8·8	1·977
,, 29	— 30 33	85 0·4	
,, 30	— 32 2	84 51·9	
,, 31	— 33 31	84 43·3	
Feb. 1	— 35 2	84 34·5	1·961
,, 2	— 36 34	84 25·5	
,, 3	— 38 8	84 16·4	
,, 4	— 39 43	84 7·1	
,, 5	23 41 20	83 57·6	1·940

Mr. Otto Struve writes that Dr. von Asten's calculations show the last three revolutions of this comet can be perfectly represented by a uniform mean motion, without the hypothesis of a resisting medium, and even with greater precision than all the previous observed returns with that hypothesis. At the same time, during more than one revolution, something like acceleration has been indicated, and nearly to the same amount as Encke had supposed. This was the case between 1862 and 1865. Again, in other revolutions, as between 1845 and 1848, the acceleration has been subjected to very considerable changes. In the actual state of his researches Dr. von Asten is inclined to conclude that the existence of a resisting medium is not proved by the motion of Encke's comet, and that the observed acceleration in several returns ought to be attributed to the action of other forces; for instance, repulsive power produced by the approach of the comet to the sun, the effect of which might vary considerably, according to the conditions in which the return to perihelion takes place. A short paper by Dr. von Asten on this interesting subject is in the press.

WINNECKE'S COMET OF SHORT PERIOD, last visible in 1869, will also be observable in the morning sky from about the next new moon. The ephemeris calculated by Prof. Oppölzer of Vienna will be found in No. 2,016 of the *Astronomische Nachrichten*. This comet will propably be faint, while it remains visible at the present return. It arrives at perihelion on March 12, and at its least distance from the earth on February 15. It is Comet 1819 (3), and Oppölzer thinks he has identified it with one of the imperfectly observed comets in 1808. The elements which have been determined for 1875 show that the comet now makes a very close approach to the orbit of Jupiter; indeed, in heliocentric longitude 109° 25′, the distance between the two orbits is less than 0·06 of the earth's mean distance from the sun; this point is passed rather less than two years before perihelion passage. So far as can be judged at present, the comet will not be liable to great perturbation from the attraction of Jupiter till the year 1907, when it is possible a complete

change of elements may take place; this, however, of course depends upon the amount of change which the actual mean motion may undergo, from the successive smaller perturbations of the next thirty years.

BORRELLY'S COMET OF DECEMBER 6.—Thus far it does not appear that any orbit of the last comet discovered at Marseilles has been published. The following elements, founded on observations between Dec. 7 and 26, received from M. Stephan, Director of that Observatory, may therefore possess some interest:—Perihelion passage, Oct. 19, 1874, at 4h. 36m. Greenwich time; ascending node, 282° 12′ 49″; distance of perihelion from node, counted on the orbit in the direction of motion, 15° 23′ 34″; inclination, 80° 56′ 28″; distance in perihelion, 0·49665; motion, retrograde. These elements bear no close resemblance to those of any previously computed comet.

*ON A PROBABLE CAUSE OF THE CHANGE OF THE COURSE OF THE AMÚ DARYA FROM THE CASPIAN TO THE ARAL**

IF the central regions of Asia are really, as is surmised, the localities where the youth of the human race was passed, agriculture, aided by irrigation, has probably been practised from the earliest ages on the banks of the Oxus.

The description, in Herodotus, of the plain in Asia through which a mighty river called Aces ran and watered the lands of five nations inhabiting its banks, may possibly not apply to the Oxus valley, though the Chorasmians are specified as one of the five nations. But the passage clearly describes the distribution of the waters of the Aces for the purposes of cultivation, and it may with reason be inferred that the art of irrigation was in vogue in the Kharesmian oasis some two thousand years ago. However this may be, the Chinese traveller Hiouen-thsang speaks of Khiva, in the seventh century of our era, as forming but a narrow band on both banks of the Oxus; a description which does not admit of a doubt that the waters of the river were then employed in watering the land.

At the present day the Khanate of Khiva, as is well known, owes its fertility to the numerous canals of irrigation derived from the Amú, between Pitnak and Nukus. The heads of these artificial canals are kept open during the part of the year included between the months of May and November, and thus allow the summer or flood waters of the river, which pass into them, to be distributed over the land of the Khanate. As the volumes and velocities of the streams entering the several canals are less than that of the flood of the Amú, a deposition of silt, carried in suspension by the waters, takes place in these canals. For this, among other reasons, their heads are closed during the winter and early spring months, so as to allow of their running dry, and the deposited silt being then cleared, by manual labour, from their beds.

I am not aware that even a rough estimate has ever been made of the quantity of water thus diverted from the Amú, and passing into these canals, during the period of the yearly floods. It is clear, however, that the physical phenomena of the river must be sensibly affected by the abstraction of so large a body of water from its stream, and I will, therefore, make some attempt to arrive at an approximation to the truth on this head, though the data at my disposition are insufficient, and the conditions of the problem are such as render it difficult to attain to any great precision.

The land under cultivation in the Khanate is generally estimated at about two millions of acres; if we assume that the whole of this cultivation requires the constant use of water, about 40,000 cubic feet per second must be taken by the several canals from the river. It is perhaps true that many of the crops do not require more than partial irrigation, but, on the other hand, the population of about 400,000 souls, and the cattle of the Khanate, are entirely dependent on the river for their water supply. The excess, therefore, assigned for irrigation may be considered as absorbed by the people and by the cattle, and the estimate of 40,000 cubic feet per second may be allowed to stand for the present.

* Presented to the Imperial Geographical Society of Russia, December 4, 1874; read at the monthly meeting of the Society, December 16, 1874.

A very rough calculation, founded on the scanty data to be found in General Ivanien's pamphlet on Khiva, and made by me some four months ago, gave 30,000 cubic feet per second as the quantity of water diverted from the Amú by the irrigation canals. It is to be remarked, however, that the few dimensions given of these canals are merely founded on hearsay evidence, and are not the result of actual careful observation, and they refer, moreover, to the state of things which existed forty years ago. No correct estimate can be expected to be deduced from such confessedly general and incomplete information. It results, then, that the first estimate of 40,000 cubic feet per second, founded on the known necessities of the land and its population, is probably nearer the truth than the second, which I derived from a perusal of General Ivanien's interesting pamphlet.

It has already been said that the heads of the canals remain open during the flood season of the Amú; the quantity of water, consequently, entering the canals, depends upon the height of the summer floods of the river, and will be greater as the level of the flood is higher, and will be less as that level is lower. But since a supply of about 40,000 cubic feet per second is a matter of actual necessity to the lives of the population of the Khanate, it is clear that the levels of the canal beds, at their heads, must be so adjusted as to provide for the entry of 40,000 cubic feet per second, even should the level of the Amú flood be an exceptionally low one. It results, therefore, that in all years, except that of an exceptionally low flood, a much greater quantity of water than what is actually required for irrigation and for consumption by the population and by the cattle is diverted from the Amú, and passes by the irrigation canals of Khiva. Ivanien mentions that the excess of water passing by the canals during high floods is allowed to flow into lakes and into the Doudon, Kunya Daryalik, and other old dry beds of the Amú, which thus act as safety-valves to the embankments and works belonging to the irrigated tract. The conclusion which may be drawn from the foregoing is, that in most years there is a very great waste of water arising from the imperfect system of irrigation employed in Khiva. It is needless to enlarge on the magnitude of such an evil in a locality where water is an absolute necessity to prevent the advance of the surrounding desert. With a scientific system of irrigation, it is probable that an acreage of land equal to that at present cultivated on the banks of the Amú might be reclaimed from the desert, by precisely the same expenditure of water which now takes place.

The following table, which I have ventured to compile from the measurements and observations of the Amú Darya made by the officers of the expedition sent in 1874, under the auspices of the Imperial Russian Geographical Society, will enable some idea to be formed of the waste of water which took place on several dates between the 23rd of June and the 10th of September of the year in question. The table shows, in cubic feet per second, the total discharge of the river, the portion of that discharge diverted by the irrigation canals, and the remainder which passed Nukus. I must, however, remark that the quantities shown should be regarded as an approximation only to the truth.

Date. New Style.	Volume of River.	Volume passing Nukus.	Volume entering Canals.
23rd June ...	101,000	47,800	53,200
29th „ ...	97,900	46,300	51,600
11th July ...	139,800	66,200	73,600
17th „ ...	122,600	58,000	64,600
3rd August ...	142,800	67,600	75,200
15th „ ...	120,700	57,200	63,500
25th „ ...	106,000	50,200	55,800
10th September...	93,100	44,100	49,000
Average per diem	122,200	59,600	62,600

These figures show that in lieu of 40,000 cubic feet per second, which is the water supply estimated to be sufficient for the wants of the Khanate, the irrigation canals, between the 23rd of June and the 10th of September, 1874, diverted, on an average, 62,600 cubic feet per second from the Amú Darya, or ten-nineteenths of the whole volume of the river.

Information does not yet exist which would allow more than a guess to be made of the volume of the low-water discharge of the Amú, but from what has been already stated, it follows that at Nukus there is a very much less difference between the