

Variable Stars.

Star.	R. A.		Decl.		Aug.	h. m.	
	h.	m.				h.	m.
U Cephei ...	0	52.3	81 16 N.	..	16,	20	28 <i>m</i>
R Arietis ...	2	9.7	24 32 N.	...	20,		<i>M</i>
Algol ...	3	0.8	40 31 N.	...	19,	3	48 <i>m</i>
R Comæ Berenices	11	58.5	19 25 N.	...	15,		<i>M</i>
T Ursæ Majoris ...	12	31.3	60 4 N.	...	16,		<i>M</i>
δ Libræ ...	14	54.9	8 4 S.	..	19,	21	32 <i>m</i>
U Coronæ ...	15	13.6	32 4 N.	...	16,	0	53 <i>m</i>
U Ophiuchi ...	17	10.8	1 20 N.	...	16,	2	28 <i>m</i>
							22 36 <i>m</i>
X Sagittarii...	17	40.5	27 47 S.	...	17,	21	0 <i>m</i>
U Sagittarii...	18	25.2	19 12 S.	...	18,	1	0 <i>m</i>
β Lyræ...	18	45.9	33 14 N.	...	14,	4	0 <i>M</i>
R Lyræ ...	18	51.9	43 48 N.	...	16,		<i>m</i>
η Aquilæ ...	19	46.7	0 43 N.	...	14,	2	0 <i>m</i>
δ Cephei ...	22	25.0	57 50 N.	...	20,	0	0 <i>m</i>

M signifies maximum ; *m* minimum.

Meteor-Showers.

	R. A.	Decl.	
Near γ Andromedæ ...	25	42 N.	Swift ; streaks.
,, μ Persei ...	61	49 N.	Very swift ; streaks.
,, δ Draconis ...	291	70 N.	Swift ; short.

NEW GUINEA EXPLORATION.

ON March 15 last a private exploring Expedition, commanded by Mr. Theodore Bevan, left Thursday Island for New Guinea in the steamer *Victory*, which had been placed for six weeks at Mr. Bevan's disposal by Mr. Robert Philp, the owner. Mr. Bevan's object in undertaking this expedition was to ascertain whether it was possible to reach the mountains in the interior of New Guinea by means of the Aird or other large rivers flowing into the Gulf of Papua, and to establish, if possible, friendly relations with the natives in the neighbourhood of the gulf, with the view of paving the way for future explorations.

We reprint from the *Sydney Morning Herald* of May 23 the following account of the expedition :—

The expedition has proved the existence of spacious waterways leading far into the interior of the island, the two most important—and magnificent rivers they seem to be—having been named the Douglas and the Jubilee. These discoveries may be destined to be of considerable importance to Australia, for a flourishing industrial European community may in the not very remote future settle on the banks of these waterways. Northern Queensland, from its situation, may naturally be expected to reap the greatest advantages from the opening up of New Guinea, but, directly or indirectly, the habitation of its fertile plains and valleys with pioneer settlers must prove beneficial to the metropolis of New South Wales. A comprehensive account of the expedition will be published in due course, illustrated by a chart showing the new discoveries, and by photographic views of new mountain ranges and previously unknown tribes of natives, but a brief description of some of the principal discoveries made will probably be read with interest.

Of the country in the vicinity of the Aird, very little up to the present is known, and at Thursday Island old experienced hands looked upon it as little short of madness, having regard to the supposed treacherous channels existing, and the hostility of the natives, to attempt to enter the rivers which discharge their waters into the gulf. Mr. Bevan, however, paid little regard to the grim forebodings, and the Expedition was fortunate in reaching Cape Blackwood in the month of April, at a time when the waters are invariably smooth, and when there is little reason to fear tempestuous weather. The exploring party soon set to work. Several minor streams were discovered, particulars concerning which will be given in due course, but, as already indicated, two new fresh-water rivers of magnitude were found, disembodying their waters through various mouths into the Gulf of Papua. Both these pursue a devious course amidst ranges of hills, washing the base at times of lofty mountains. The rivers are longitudinally about 60 miles distant from each other.

The first one—the Douglas—is reached by the Aird, up which the *Victory* steamed, and it became manifest that the Aird was only one of several mouths of the main stream, which was navigated for a distance of 130 miles, but which, however, in reality took the party inland only about 80 miles, by latitude, northward of Cape Blackwood. The explorers left this river through a channel marked upon the Admiralty chart as dry land, and this brought them into Deception Bay. The existence of this passage, in which there is from four to eight fathoms of water, proves Cape Blackwood to be an island. It may here be stated that for the first 30 miles up the Aird the country was found to be of deltaic formation, with alluvial islands scattered here and there ; but beyond that the main stream of the Douglas becomes a compact watercourse, flowing between rising ground on either side. The country about the delta is flat, covered with scrub, and the banks are well defined. On the higher waters of the Douglas there is a practically uninhabited forest country, which in parts could be easily cleared. Two important fresh-water tributaries to the Douglas were discovered, one of which has been named the Burns and the other the Philp. A new range of mountains observed in this vicinity was named by the leader after his uncle, Mr. Thomas Bevan, an ex-Sheriff of London.

The Gulf of Papua has been explored up to Orokolo, and to the westward of that village are what appear to be fine rivers, but these were reported by the natives to be separate mouths of one river, and the natives' report has been confirmed by Mr. Bevan, who, proceeding up a sixth large channel to the west of Bald Head, came upon the main river, which fed the delta and cut inland at right angles into the five other rivers. There was a heavy break on each bar of the first five openings, probably due to south-east weather on the Queensland coast, but a smooth-water passage was found into the sixth opening. The time at the disposal of the party was too limited to enable them to survey each opening of the river, so a westerly course was pursued, and the *Victory* steamed up a large channel running in a northerly direction from Bald Head to the point of its confluence with other waters. A week was spent in examining the rivers coming in from the north-west, but although high land was seen it could not be reached by any branch in that direction. The easterly passages were next tried, and a channel was found running easterly and north-easterly, almost at right angles, into two other streams. Taking the branch running inland, they proceeded a few miles further, and found it led into two other streams, one going inland and the other with a current towards the sea as before. Yet again did they meet two other streams, and still steaming up the one leading inland, they, on going 5 miles further, came upon another, and this time the last arm leading seaward. Here they found themselves on a fresh-water river nearly half a mile wide, with a steady current flowing towards the sea. A magnificent panorama of rising country was now opened up. Range over range of hills stretched into the distance, capped by some towering blue mountain peaks, and so clear was the atmosphere that even the high mountains, which must have been leagues away, seemed close at hand. They were all clad with trees, and upon the face of them could easily be distinguished the water-gullies, brightly illuminated by the glistening rays of the sun. The river was navigated 110 miles from Bald Head, or about 50 miles in latitude from Orokolo, its chief trend being in an easterly and north easterly direction, although the course was unusually serpentine. In honour of Her Majesty's having completed the fiftieth year of her reign, this river, probably the finest in British New Guinea, has been named the Jubilee. The ranges into which the waters carried the little steamer, drawing 9 feet of water, were named the Albert Victor.

Very little trouble was experienced with the natives during the expedition. Only once was the party attacked, and that was when going up the Aird—about 20 miles from its mouth—probably by the same tribe that attacked Capt. Blackwood forty-two years ago. The hostile blacks fired several flights of arrows, some of which fell harmlessly by the vessel's side, but they dispersed at the sound of the steamer's whistle, and after a few shots had been fired wide ; neither the attacking nor attacked sustaining the slightest hurt. Through this untoward circumstance Mr. Bevan was unable to obtain the name of the tribe. Another tribe, who evinced their peaceful intentions by carrying green bows in their canoes, were found inhabiting the country behind Aird's Hill. A third tribe was met with 48 miles inland, as the crow flies, from Cape Blackwood, and these

called themselves the Tumu. At the confluence of the Douglas River with Deception Bay, a fourth, the Moko tribe, was found. The Kiwa Pori tribe, the fifth met with, were ascertained to be the inhabitants of the country close to Bald Head, in the Papuan Gulf. The Birumu tribe were seen about 16 miles north-west of Bald Head, and the Evorra, the seventh and last tribe, were found about the same distance north-east from Bald Head. With all, except of course the first, friendly relations were established. Mr. Bevan's previous experience of New Guinea natives and knowledge of some of their habits and dialects were exceedingly serviceable to him; and with the exercise of a little patience he was enabled to inspire them with the fullest confidence. Several natives were induced to go on board the steamer, and were photographed. Only three of the tribes could be spoken of as large, the one possessing the greatest numerical strength being the Kiwa Pori, which numbered from 400 to 500 men. The result of Mr. Bevan's observations is that the country is practically uninhabited except along the coast. No natives were seen on the Jubilee River beyond 25 miles from the coast-line.

The best of the land—and fine rich soil it is—appeared to lie between the head of the deltas of both rivers and the foot of the hills, where it looked exceedingly fertile, and covered in places with a palm scrub which could be readily cleared. Sago, tobacco, bananas, bread-fruit, and sugar-cane were found to be indigenous. As already stated, the country about the deltas is alluvial and flat, and then in turn come sandstone, limestone, and ironstone, as well as the stratified rocks which mark the earlier geological periods. Mr. Bevan hopes, at no distant date, to be able to complete the work of which this preliminary expedition he has now made is but the precursor. In the animal, vegetable, and mineral kingdoms, there is a splendid field for men of science. About eighty ornithological specimens have been obtained by the party, and a few snakes, lizards, and fishes, which will be examined at the Australian Museum. A large and varied ethnological collection has also been obtained by Mr. Bevan in exchange for trade from the tribes with whom he established friendly intercourse. Some of the prominent features in the landscape have been named after Mr. Richard Wynne, Mr. F. E. Joseph, Dr. Ramsay, Messrs. Harrie Wood, C. S. Wilkinson, E. Fosbery, and other well-known Sydney citizens.

A word is necessary with regard to the climate, which is described as by no means unhealthy. The temperature varied from 72° F. at daybreak to about 86° in the shade at noon. The party returned to Thursday Island within the time stipulated by the owners of the *Victory*, in excellent health, and with unimpaired physique. The cost of the expedition was from £500 to £600, but from this a considerable sum, represented by the value of the collections, must be deducted. In response to Mr. Bevan's application, the Government have placed at his disposal a competent draftsman to aid him in making up his plottings.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE Institution of Mechanical Engineers held their summer meeting last week, at Edinburgh, under the presidency of Mr. E. H. Carbutt. The meetings were held in the Library Hall of the University, the members being received by the Marquis of Tweeddale, the chairman, Sir William Muir, Principal of the University, and other members of the Reception Committee. The two papers first read on Tuesday related to the Forth Bridge and the machinery employed in its construction. Both papers we reprint to-day. The discussion on the first of them referred mainly to the subjects of expansion and contraction under variations of temperature and to wind-pressure, and in reply the author of the paper, Mr. E. M. Wood, explained that 1½ inches per 100 feet was allowed for expansion, or double the amount usually thought sufficient; whilst, as regards the wind-pressure, the highest registered had been 35¼ lbs. per square foot, whilst 56 lbs. was allowed for. All the speakers who discussed the paper of Mr. Arrol, the contractor for the bridge, referred in high terms to the skill and ingenuity exhibited throughout. Later on in the day the members made an excursion to the Forth Bridge, Mr. Arrol and the heads of the various departments at the works acting as guides. A striking feature was the com-

parative noiselessness with which the work was carried on, owing to the successful use of hydraulic power in riveting.

We regret to learn that on the day of the visit to the bridge two men had lost their lives owing, it is believed, to the staging on which they were employed giving way; this raises the number that have been killed at the Forth Bridge works to six during the last two months, the number of men employed averaging between 3000 and 4000.

The third paper read was by Mr. F. J. Rowan, on electro-magnetic machine tools, which were invented by him to overcome the difficulties of riveting by hand; they perform their work in a very complete way. The conditions of the work itself involve the separation of the riveting portion of the apparatus from the bolster or holder-up, whilst the riveting process requires that the two portions of the machine should be rigidly held together. This is effected by magnets so arranged on opposite sides of the plating with their poles of unlike denomination facing each other, that they are drawn towards each other, thus pressing the plates together, and insuring the proper condition for riveting. The riveting itself is effected by an electric motor, which by means of gearing and a cam, lifts the hammer against a spring, the amount of compression imparted to the spring in lifting being regulated by hand.

The first paper read on Wednesday was descriptive of the electric light on the Isle of May, by Mr. D. A. Stevenson. The machinery, boilers, and engines, are placed near the base of the island, and close to the water-supply, as it was found that the saving which would be effected by not having to convey fuel to the top of the island, or to pump up water, would compensate for the loss of energy due to the resistance of extra length of the electric conductor. The electric generators are two De Meritens alternate-current machines, each weighing 4½ tons. The induction arrangement of each machine consists of five sets of twelve permanent magnets, sixty in all, each magnet being made up of eight steel plates. The armature, 2 feet 6 inches in diameter, is composed of five rings with twenty-four bobbins on each, arranged in groups of four in tension and six in quantity, and makes 600 revolutions per minute. With the circuit open, each machine develops an electromotive force of 80 volts, with the circuit closed through an arc 40 volts. An average current of 220 amperes is developed, thus yielding 8800 watts of electrical energy, or 11·7 horse-power in the external circuit. In the dioptric arrangement constructed by Messrs. Chance to the author's design, the condensing principle has been carried further than in any apparatus previously constructed. The principle consists in darkening certain sectors by diverting the light from them and throwing it into the adjoining sectors so as to reinforce their light. The author agreed with the conclusion arrived at by the Trinity House that taking first cost and annual maintenance into account, electricity should only be used for important landfall-lights; where, however, the most powerful light was desired, independently of cost, the electric arc had no rival. Some interesting observations have been carried on for the last five months which prove the electric light to be the most penetrating of all lights in all states of weather. Every night at twelve o'clock the light-keepers at St. Abbs Head, twenty-two miles distant, where there is a first-order flashing light, and one of the most powerful oil-lights in the service, observe the Isle of May light; whilst the keepers there observe the St. Abbs Light. The result of these observations has been that the Isle of May light has been seen one-third more frequently than the other. The paper was discussed by Sir James Douglas and several other speakers. A paper was read on the construction of the Tay Viaduct, by Mr. F. S. Kelsey, the resident engineer. This bridge is two miles long, and has taken five years to construct, having been opened for traffic on June 20 last. A paper on the dredging of the lower estuary of the Clyde, by Mr. C. A. Stevenson, was read. Both these papers, which were fully discussed, are of technical rather than scientific interest.

In the evening a *conversazione* was given by the Lord Provost, magistrates, and Council of the city in the Museum of Science and Art. Sir William Thomson gave a very exhaustive lecture on waves, concluding with an important suggestion. It seemed to him that inasmuch as wave resistance depends almost entirely on surface action, it might be diminished relatively very much by giving a great deal of body below the water-line. High speeds of 18 or 20 knots might thus be obtained. By making ships like the old French ships, swelling out below the water-line, there would be a large additional displacement and carrying power, and little addition to wave disturbance.