LEEDS ASTRONOMICAL SOCIETY.—The Journal and Transactions of this society for the year 1916 has been received. The number of members was fifty-two, and in view of the prevailing conditions, an average attendance of fourteen may be taken as an indication that the meetings continued to be interesting and helpful. Numerous observations of interest are recorded, and among the contributed papers, one by the Rev. I. Carr-Gregg on "The Invisible Universe," and another on "Sir William Herschel," by Miss C. A. Barbour, call for special mention. The editor is Mr. C. T. Whitmell, who has also made numerous contributions.

WAVE-LENGTHS OF HELIUM LINES.

ON account of its great intensity and the convenient distribution of the lines, the spectrum of helium furnishes a valuable source of standard wave-lengths in spectroscopic and optical work. A new series of determinations of the wave-lengths of the brighter lines which has been made by Mr. P. W. Merrill at the U.S. Bureau of Standards, Washington (*Astrophysical Journal*, vol. xlvi., p. 357, December, 1917), will therefore be generally welcomed. The highest possible precision has been aimed at, and as lines belonging to all the six series which constitute the spectrum of helium were included in the measurements, the new wave-lengths will also provide valuable data for computations of theoretical interest.

An interferometer of the Fabry and Perot type was used, and nine of the lines were compared directly with the fundamental standard—the red line of cadmium—by photographing the helium and cadmium spectra simultaneously on the same plate. Other wave-lengths were then determined from photographs of the helium spectrum alone. The adopted values for the twenty-one lines measured are given in the appended table, which also includes the values given by previous observers. The values given by Lord Rayleigh (two sets) and Eversheim were derived from interferometer observations, but those by Runge and Paschen were determined in the more usual way from grating photographs; the latter have been corrected from Rowland's scale to the international scale in order to make them directly comparable with the other values.

Wave-lengths of Helium Lines (in I.A.).

Bureau of Standards	Rayleigh *a*	Rayleigh *b*	Eversheim	Runge and Paschen
2945·104				106
3187·743				701
3613·641				641
3705·003				007
3819·606				605
3888·646				638
3964·727				727
4026·189				192
4120·812				821
4143·759				766
4387·928				934
4437·549				549
4471·477	(478)	480	493	475
4713·143	(171)	142	154	074
4921·929	925	928	922	919
5015·675	680	678	683	556
5047·736				641
5875·618	616	623	639	650
6678·149	144	147	151	14
7065·188	189	197	207	22
7281·349				53

In the case of double lines the wave-lengths are those of the stronger components. From the general agreement of individual determinations it is considered probable that the error is in no case so much as 0·003 A., and that in most cases the errors are smaller than that amount. It is shown that the Kayser and Runge formula for spectral series, based upon three consecutive lines, will not reproduce accurately even the next member in any one of the six helium series.

THE CORAL-REEF PROBLEM.

FROM time to time recent work on the topography of coral-reefs has been referred to in NATURE, and the existence of submarine platforms from which atolls and encircling reefs rise has been very generally demonstrated. Prof. R. A. Daly regards these platforms as wave-cut plains, produced from coral banks and volcanic isles when the level of oceanic waters was lowered by ice-accumulation in Glacial times. The melting of the ice caused a general submergence of the platforms and of the adjacent coasts, giving rise to drowned valleys and all the features that have been attributed to a subsidence of the ocean-floor. The existing coral-reefs are thus for him post-Glacial, and grew up on the submerged platforms when warmer conditions were renewed.

In a summary of his views in *Scientia* (vol. xxii., p. 188, 1917) Daly points out that flat, reefless banks occur "in every ocean, inside and outside the tropical belt . . . covered with 45 to 100 metres of water." He urges that the inner walls of reefs are not well graded to the floors of the lagoons, and that the upper wall thus indicates a rise of water-level (whether we attribute it to flooding or subsidence) since the formation of the level inner floor. He believes that this floor is part of the platform, and is not due to infilling, though it is not clear why he should demand "millions of years" for such deposition within the wall (compare also his paper on "A New Test of the Subsidence Theory of Coral Reefs," Proc. Nat. Acad. Sci., vol. ii., p. 664, 1916). He holds that "the mean depths of water above the flat floors of wide lagoons are nearly equal to the mean depths found on reefless banks," and that there is a close similarity of depth in the greater lagoons throughout the reef areas of the Pacific and Indian Oceans. Daly regards the reefs as "peripheral growths on wave-cut platforms," those nearer the centres of the platforms having been extinguished by mud and sand swept over the shoals.

On the other hand, Prof. W. M. Davis, in a series of critical papers, based on a recent visit to the Pacific isles, has greatly strengthened the Darwinian view. Thanks largely to his reasoning, even those who cannot find evidence for a general subsidence of ocean-floors are inclined to invoke block-faulting to explain the drowning of certain areas. Davis ("A Shaler Memorial Study of Coral Reefs," *Amer. Journ. Sci.*, vol. xl., p. 223, 1915) urges that if the lagoon floor is part of a wave-eroded plain from which the reefs rise, the sea would have cut cliffs in the surviving volcanic isles, the tops of which should appear as truncations of the spurs that bound the subsequently drowned valleys. Such cliffs occur in Tahiti ("Clift Islands in the Coral Seas," Proc. Nat. Acad. Sci., vol. ii., p. 284, 1916), but are very exceptional features. Davis regards them as emphasising the general absence of cliffs, even if they "are the work of abrasion during the lowered sea-stands of the Glacial period" ("Problems Associated with the Study of Coral-Reefs," *Sci. Monthly*, vol. ii., p. 564).

Davis, in his three papers in the *Scientific Monthly* (1915) and elsewhere, lays stress on the mature forms of the valleys in the reef-encircled isles as indications of their antiquity. These valleys cannot have been

deepened and widened to their present condition during the relatively short epoch of glacially lowered sea-level. The embayed shores, first used by J. D. Dana as a confirmation of Darwin's subsidence-theory, have none of the characters of recently dissected land. Another point firmly brought forward is the unconformity between the reefs and the floor from which they have grown upward. That floor may be seen, for instance, beneath elevated fringing reefs in the New Hebrides. It has, at some epoch, been subject, not to marine planing, but to subaerial denudation. At Havannah harbour in Efate it must have stood above the sea before the corals grew. The joint evidence of the drowned valleys with their mature forms and of the unconformity of the reefs on an old land-surface points very strongly in favour of Darwin's views. Efate and Oahu in the Hawaiian Islands furnish instances of oscillatory movements, and some authors have held these to be incompatible with a broad system of subsidence. Davis justly styles this objection as "the most singular of all." Finally, the inequality of the depths to which drowning has taken place in adjacent regions is a powerful argument against ascribing the submergence to an increase of water in the sea. Davis, with characteristic width of outlook, believes that "some combination of regional subsidence with Glacial changes of sea-level—or with changes of sea-level caused by movements of the sea-bottom—is worthy of careful consideration as being probably nearer the truth than either process taken alone." But his reasoned conclusion is that subsidence has played by far the greater part.

In a still more recent paper Davis deals with the Queensland platform ("The Great Barrier Reef of Australia," *Amer. Journ. Sci.*, vol. xliv., p. 339, 1917), which he believes to be due in large measure to coral-reef agencies, which produced a mature reef-plain before the subsidence occurred that gave rise to the present barrier reef and the embayment of the coast.

GRENVILLE A. J. COLE.

A BACTERIAL DISEASE OF CITRUS.

DR. ETHEL DOIDGE, mycologist to the Department of Agriculture of the Union of South Africa, who is becoming well known for her researches into the bacterial diseases of plants, is to be congratulated on the excellent piece of work which is described in detail in an article on "A Bacterial Spot of Citrus."[1] At a time when research in phytopathology is largely at a standstill, it is refreshing to read of such ably conducted scientific investigations in our Colonies as these are.

The citrus "spot" is a disease of economic importance in the citrus orchards of the Western Province of the Cape, and attacks not only the fruit, but also the leaf and the branch of the tree. The fruit is disfigured and ultimately destroyed, while the attacks on the tissues of the stem cause very commonly gummosis in the spring.

The cause of the disease was ascertained to be a species of Bacillus new to science, *B. citrimaculans*, A comparative table is given of the characters of this and the two organisms known to attack the citrus in America, viz. *Bacterium citriputeale* and *Pseudomonas citri*. The description of *B. citrimaculans* given by the author, together with its full "group number," may be held up as a model to be followed by workers in this field. The opinion is expressed that very probably the organism is a soil bacillus, which first invaded rotting fruits lying on the ground, and has now taken on a parasitic habit. The organism loses its virulence rather rapidly when cultivated on artificial media. The most frequent method of infection is through wounds, and the author considers the possibility of stomatal infection an open question at present. While preventive measures are not discussed, it is pointed out that any improvement in the sanitation of the affected orchards would doubtless prove beneficial. Since it was found that the organism is very sensitive to copper sulphate, it is suggested that spraying with Bordeaux mixture should be tried. E. S. S.

[1] *Annals of Applied Biology*, vol. iii., January, 1917, pp. 53-81, with 10 plates.

THE FLORA OF THE SOMME BATTLEFIELD.[1]

THE ground over which the Battle of the Somme was fought in the late summer and autumn of 1916 rises gradually towards Bapaume, and at the same time is gently undulating, with some well-marked branching valleys initiating the drainage system of the area. Before the war the land was for the most part under cultivation, but on the highest levels there were large areas of woodland, such as High Wood and Delville Wood, now shattered and destroyed.

During last winter and spring all this country was a dreary waste of mud and water, the shell-holes being so well puddled that the water has remained in them, and even in the height of the summer there were innumerable ponds, more or less permanent, in every direction.[2]

The underlying rock is everywhere chalk with a covering of loam of varying thickness. As a result of the bombardment the old surface soil has been scattered and the chalk partially exposed. One effect of the shelling, however, has been to disintegrate the underlying chalk and produce a weathering effect which has been accentuated by the winter rains, snow, and frost. A general mixing of chalk, subsoil, and scattered top soil and also a rounding of the sharp edges have taken place, so that instead of the new surface soil being sterile, the shelling and weathering have "cultivated" the land. That this is so is proved by the appearance of the Somme battlefield during the past summer.

Looking over the devastated country from the Bapaume Road, one saw only a vast expanse of weeds of cultivation which so completely covered the ground and dominated the landscape that all appeared to be a level surface. In July poppies predominated, and the sheet of colour, as far as the eye could see, was superb; a blaze of scarlet unbroken by tree or hedgerow. Here and there long stretches of chamomile (*Matricaria chamomilla*, L.) broke into the prevailing red and monopolised some acres, and large patches of yellow charlock were also conspicuous, but in the general effect no other plants were noticeable, though a closer inspection revealed the presence of most of the common weeds of cultivation, a list of which is given below.

Charlock not only occurred in broad patches, but was also fairly uniformly distributed, though masked by the taller poppies. Numerous small patches were, however, conspicuous, and these usually marked the more recently dug graves of men buried where they had fallen. No more moving sight can be imagined than this great expanse of open country gorgeous in its display of colour, dotted over with the half-hidden white crosses of the dead.

In all the woods where the fighting was most severe not a tree is left alive, and the trunks which still stand

[1] Abridged from an article by Capt. A. W. Hill, Assistant Director, Royal Botanic Gardens, Kew, in the *Kew Bulletin of Miscellaneous Information*, Nos. 9 and 10, 1917, by permission of the Controller of H.M. Stationery Office.

[2] For a description of the battlefield shortly after the fighting Mr. John Masefield's recently published book, "The Old Front Line" (Wm. Heinemann), should be read.