lished as a supplement to the bulletin. The Preolenna Coalfield (Bulletin 13, 1913) contains Permo-Carboniferous seams amounting in the aggregate to 6 ft. 6 in., situated under the Campbell Range some fifteen miles south-west of the north coast at Wynyard. Prospecting by diamond-bores is advised. No coal is to be expected near Wynyard (p. 71).

The Geological Survey Branch of the Department of Mines of New Zealand continues its handsome series of quarto publications. Petrographers may be disappointed with Bulletin No. 12, "The Geology of the Dun Mountain Subdivision," since the exceptionally fresh olivine-rocks of Dun Mountain have made the district famous for half a century. The bibliography on pp. 6–8 perhaps explains why little more need be written on their nature and alliances. The authors, J. M. Bell, E. Clarke, and P. Marshall, describe a new rock-species, Rodingite, on p. 31. This consists of grossularite and diallage, the percentage of silica being 40, of lime 31, and the specific gravity being as high as 3·4. The authors do not see their way towards explaining this rock either by absorption of the Maitai limestone or by differentiation in the ultrabasic mass. The main object of the present bulletin has been a review of the prospects of the associated copper ores. The mineral from which the more superficial ores are derived (p. 44) is a cupriferous pyrrhotine, containing traces of gold, silver, cobalt, and nickel. This is interestingly associated with serpentinised peridotites. The chromite in the peridotites has not been mined since 1865. Dun Mountain, a rounded mass supporting little vegetation, is figured on plate iv.

Bulletin No. 13, by P. G. Morgan, who is now director of the Survey, describes the Greymouth subdivision of North Westland, where coal-seams occur, conformably overlain by marine Eocene strata. The Pleistocene glacial gravels are worked for gold, and there is said to be a probability that the Kotuku oilfield will prove profitable on further exploration. The petroleum occurs in various Cainozoic rocks above the local Coal-Measure series, and its source is at present unknown.

Bulletin 14, by E. Clarke, is also concerned mainly with petroleum, in the New Plymouth subdivision of the Taranaki division, on the jutting promontory of the west coast of the North Island. The iron-sands that compose the Recent sand-dunes and beaches are also considered, owing to their well-known richness in magnetite and ilmenite. Bulletin 15, by J. M. Bell and C. Fraser, takes us to the Hauraki division of the North Island, where the town of Waihi, picturesquely situated, and illustrated in a folding plate, is the active centre of gold and silver mining. The ore is electrum for the most part, and the veins occur in altered Cainozoic andesites or dacites resembling the propylites of Hungary. Deposition is believed to have taken place from hot solutions, which brought up silica also, and to have been promoted by a fall of temperature near the surface (p. 179). Siliceous geyser-deposits occur in the middle of the volcanic series, and cinnabar has been found in them at Mackaytown (p. 59). The physiography of the rugged country is well described, and its irregular structure is attributed to the occurrence of epochs of denudation between those of volcanic deposition (p. 27).

R. Speight, L. Cockayne, and R. M. Laing have made an interesting study of the Mount Arrowsmith district, on the eastern slope of the Southern Alps in Canterbury (Trans. New Zealand Institute, vol. xliii., p. 315), in which the physiography described by the first named author is used by his colleagues as a basis for a report on plant-distribution. The paper, with its details of glacial sculpturing and deposition, is a good example of modern geographical inquiry into the origin of surface-forms. The rivers of Canterbury are held (p. 320) to radiate from a lost highland to the west, which has been cut away by denudation, and formed the higher part of the peneplain on which they originally flowed. G. A. J. C.

THE DEVELOPMENT AND PROPERTIES OF THE COTTON FIBRE.

THE standard accounts of the cotton fibre are curiously inaccurate. Mr. W. Scott Taggart has directed attention to some of the more glaring errors in his "Cotton Spinning" (vol. i., 1896; London: Macmillan and Co., Ltd.), as did also the present writer independently in 1905 (Khedivial Agricultural Society's Yearbook, 1905), when the cytology of the fibre was traced up to a week after the opening of the flower. Some additions to this account were outlined in my "Cotton Plant in Egypt" (London: Macmillan and Co., Ltd., 1912), and a serious attempt was then made to ascertain how and when environmental effects operated on the properties of the fibre during maturation, and also to elucidate the real nature of the infinitesimal differences which the "sixth sense" of the expert classifier of lint cotton can perceive.

(1) By pickling a complete series of bolls from flowering to maturation in 1912 we showed definitely that the first half of the maturation period is occupied in the lengthening of the lint, and in the enlargement of the capsule and seed. Thickening processes take place in the second half of the maturation period. Thus a fibre may be short, but subsequently thicken satisfactorily, or conversely. Bad weather or soil in the latter half of maturation may weaken the fibres, but cannot affect the "predetermined" length.

(2) A number of open flowers in a wide-sown pure strain were marked every day for sixty days in 1912 and allowed to ripen normally. Each sample was then combed, measured, and ginned, weighed to determine various constants, tested for breaking strain of the fibre on an automatic invention, and graded for strength; the results were examined statistically and graphically. They confirmed the developmental evidence; on shifting the breaking-strain curve backwards over thirty days' displacement, it was found to be substantially identical with the lint-length curve.

The cause of fluctuation in ginning-out-turn (ratio of lint to seed-cotton) has long been a puzzle. With this material it was traced provisionally to fluctuation in the number of lint-hairs which sprout from the seed-coat; its determination is therefore effected when the flower is about to open, which was, *a priori*, the least likely time.

Plotting breaking-strains against "strength" as determined in hand-pulling by an expert (Mr. H. C. Thomas, of Alexandria), the two were found to be completely independent; the expert unconsciously integrates breaking-strain with sectional area; samples of the same pure strain with respective breaking-strains of 12 grams and 2 grams were both graded as "SS" in a scale of seven grades. This leads on to a new definition of "fineness" in cotton fibre; it is not due primarily to differences in fibre-diameter, but to differences in the thickness of the lint cell-wall. "Weakness" of a sample is thus mainly irregularity in breaking-strain.

Determinations of fibre-weight with a micro-balance showed incidentally that an ordinary seed of Egyptian cotton bears about 10,000 fibres, and that weight is closely related to breaking-strain. The spinning into yarn introduces fresh complications, with which we have not dealt.

It should be obvious to those familiar with the sub-

ject that the discovery of this phenomenon of predetermination has shattered almost all accepted beliefs about the fibre of cotton, and has at the same time coordinated the old data afresh into a straightforward story. The practical applicability of the results is slight, since every boll passes through a different life-history, on account of the continuous fruiting of the plant.

In 1913 a series of daily pickings was made from a group of pure-strain plants growing in field-crop conditions, over a period of ninety days, with parallel records of flowering, etc. The examination of these having been delayed by unavoidable circumstances, the present note has been prepared. It should be noted that this last material is unique in the history of long-staple cotton.

These results were obtained incidentally during my tenure of the post of botanist to the Khedivial Agricultural Society, and to the Egyptian Government at the Giza Cotton Experiment Station, 1904–13.

W. LAWRENCE BALLS.

NEW ZEALAND SURVEY.[1]

THE report before us gives a full account of the work of the Department of Lands and Survey, New Zealand, for the year ending March 31, 1913. As in previous years, not only surveying, but also the direction of the magnetic observatory falls within its purview. Most of the work dealt with in the report has been undertaken in connection with cadastral requirements, and the higher grade work, which is termed "standard" survey, is in great request in town and suburban holdings, where land that could probably have been purchased sixty or seventy years ago for a mere trifle is now reported as having a value of 1200*l.* a foot. Under such conditions work of the highest precision is essential, but the new secondary triangulation is as yet available for a small part of the country only. This triangulation is the equivalent of second order triangulation, since the triangular error is kept below 6″, and is usually considerably less. This is as much as can be expected from the instrument used, a 10-in. vernier theodolite, and the Conference of Surveyors-General supported the New Zealand Survey in the opinion that a modern instrument of higher class was indispensable. A standard bar of nickel-steel 10 links long has been obtained from the Société Genevoise, Geneva, as well as a comparator from the Cambridge Instrument Company for use with it. Both of these have been examined and verified at the National Physical Laboratory. Four bases, from 5·2 to 11·5 miles in length, have been measured since 1909, but only two are as yet part of the finally accepted triangulation.

In the magnetic observatory a new set of Eschenhagen-Toepfer magnetographs were received at the end of 1912, and were installed at Amberley, thirty-four miles north of Christchurch.

Considerable assistance was given to the officers and scientific staff of the British Antarctic (*Terra Nova*) expedition, who took magnetic observations and determinations of gravity as controls to the work carried out in the Antarctic. The report also publishes ten seismograms of those recorded during the year by the Milne seismograph. Maps showing the progress of the work and extracts from Conference of the Surveyors-General of the Commonwealth of Australia, which was held at Melbourne in May, 1912, complete a report which is of much interest, and contains a record of much valuable work. H. G. L.

[1] Report on the Survey Operations for the Year 1912–13. Department of Lands and Survey, New Zealand. By James Mackenzie, Surveyor General Pp. 77+6 maps+5 diagrams. (Wellington, 1913.)

THE ENCOURAGEMENT OF RESEARCH BY THE CARNEGIE INSTITUTION OF WASHINGTON.

THE Year Book for 1913 of the Carnegie Institution of Washington is now available. The information provided in its 336 pages shows convincingly that there has been no relaxation of effort on the part of the trustees of the institution to administer wisely the funds placed at their disposal for the encouragement of scientific research, and that the results arrived at by the men of science who have received assistance are as promising and as full of interest as in previous years.

The following list shows the amounts of the grants made for the present year and the purposes to which they are being devoted :—

	£
Administration	10,000
Publication	12,000
Division of Publications	2,000
Departments of Research	137,929
Anthropology	4,000
Embryology	5,380
Minor Grants	18,980
Index Medicus	2,500
Insurance Fund	5,000
Reserve Fund	50,000
Exhibit at Panama-Pacific International Exposition	2,000
	£249,789

The next table shows the departments of scientific investigation to which the larger grants were made by the trustees for the financial year 1912-13, and the amounts allotted from these grants by the executive committee during the year :—

	£
Department of Botanical Research ...	7,601
Department of Experimental Evolution	19,028
Geophysical Laboratory	15,600
Department of Historical Research ...	5,920
Department of Marine Biology ...	6,378
Department of Meridian Astrometry...	5,036
Nutrition Laboratory	9,310
Division of Publications (office expenses	1,800
Solar Observatory	33,126
Department of Terrestrial Magnetism	42,053
Researches in Anthropology	1,400
Researches in Embryology	3,000
	£150,252

The following extracts from the *résumé* of the investigations of the year included in the report of the president of the institution, Dr. R. S. Woodward, will give some indication of the work which has been initiated and encouraged :—

All the departments of research of the institution are now well-defined organisations, each of them independent of and more or less isolated from the others, and each of them devoted to a field which, while in some cases related to, does not encroach upon, the fields of others. Each of them possesses a degree of autonomy which calls for a corresponding degree of freedom in the character of their annual reports and accounts of progress.

Studies of the Salton Sea, carried on during the past seven years by the department of botanical research in collaboration with a number of contributing specialists, have been brought together during the year in a volume now in the press under the title "The Salton Sea : A Study of the Geography, the Geology, the Floristics, and the Ecology of a Desert Basin."