cautions tuberculous patients should take, and as soon as this knowledge can be brought to the patient and his friends there will be some chance of getting these precautions adopted. There seems to be little doubt that the National Association for the Prevention of Consumption has the power to help and cooperate with similar organisations already in existence, and that it may even be of assistance to the authorities working with and under the Local Government Board, but what they are best qualified to undertake is, undoubtedly, that national educational movement to which Mr. John Burns has given his official approval.

The carrying on of this movement requires funds, large funds, and a special appeal committee has been formed, which, acting under the presidency of the Earl of Derby, is setting about to collect, in the first instance, a sum of 5000*l.* annually to be devoted to this work. That the necessary fund will be obtained can scarcely be doubted, especially as a most elaborate system of collecting small sums has been organised; moreover, those who will be most immediately benefited are already taking a very keen interest in making this scheme a success, and the committee have announced that they have already received offers of assistance from working-men's clubs and institutes affiliated to the Institute Union, and the Billposters' Association of Great Britain; whilst the post-office authorities have promised assistance, or have granted facilities which will help to form the nucleus of a fund such as could be obtained in no other way. Further, those endowed with a larger share of this world's goods have manifested an equal willingness to help, but the object is such a good one, the outlet for expenditure is so wide, and the promise of such an enormous return is so great, that if five times the sum asked for be subscribed it may be advantageously spent. The time has come when the annual loss of 50,000 or 60,000 lives from consumption—a preventable disease—is a blot on our civilisation. When we *knew not* we could not be blamed for our want of initiative and lack of energy, but now that we *know*, inaction is criminal.

RECENT PAPERS ON PETROLOGY.

UNDER this head may be included work on the minerals that build up rocks, since modern petrology depends on the understanding of the causes that have brought certain mineral constituents into association. This is true even of the fragmental rocks, where the correct appreciation of a detrital mineral may lead up to the source and the relative age of the deposit. Experimental work on minerals has, moreover, almost always a geological aim, though compounds have a way of arising artificially under conditions that seem improbable in nature.

Improvements in methods of research will be found in Mr. F. E. Wright's paper on the "Measurement of Extinction Angles in Thin Section" (*Amer. Journ. Sci.*, vol. xxvi., p. 349), where the intensity of light for different positions of a crystal-plate between crossed nicols is dealt with mathematically. The methods of observation in general use are critically discussed, and the principle of the twinned selenite plate, introduced by Sommerfeldt in 1907, is further developed by the author in his artificial quartz twin plate (p. 374). Since the eyes of observers differ in regard to their sensitiveness to certain tints, this plate may be made wedge-shaped, so that the most serviceable tint may be selected. Mr. Wright also introduces (p. 377) a bi-quartz wedge-plate. A plate of right-handed quartz, cut normal to the optic axis, is fixed side by side with a left-handed one of the same thickness. Above each is set a wedge of quartz of the opposite sign of rotary polarisation, the two wedges tapering in the same direction. Except where the wedge and the plate below it are of the same thickness, the two similar wedges will show colours of similar intensity. If a crystal-plate lies beneath the wedge-plate, and is not in a position of extinction, a difference of intensity appears in the two wedges, and a thickness can be selected that gives, by the rotation produced, the most sensitive effect to meet the case of each experiment.

Dr. J. W. Evans (Proc. Geol. Assoc., vol. xxi., p. 79) gives a useful paper for students on the systematic examination of a thin section of a crystal with an ordinary petrological microscope, in which his double quartz-wedge, described in 1905, is effectively introduced for determining the relative retardation of the rays in a section of a doubly refracting crystal.

Messrs. Allen, White, Wright, and Larsen (*Amer. Journ. Sci.*, vol. xxvii., p. 1) provide a characteristic synthetic study of diopside and its relations to calcium and magnesium metasilicates, in which the minerals produced at various temperatures are subjected to a thorough optical examination. Etch-figures are used to show minute crystallographic changes that result from dissolving one member of the metasilicate series in another, the resulting minerals being shown to be actual solid solutions (p. 39). Some of the substances produced are as yet unknown in nature, and a rhombic $MgSiO_3$ mineral arises at about 1365°, which resembles olivine in form, and which is quite distinct from enstatite (p. 30). The stable form of $MgSiO_3$ is, curiously enough, that known from meteorites only, and is styled clinoenstatite.

Messrs. Wright and Larsen also introduce us to new views on quartz (*ibid.*, p. 421). In treating of quartz as a geologic thermometer, they make use of Le Chatelier's observation in 1890 that quartz undergoes a reversible change at about 575°, as indicated by a sudden change in its expansion-coefficients, birefringence, and circular polarisation. Mügge regards the low temperature α-quartz as trapezohedral-tetartohedral, and the high temperature β-form as probably trapezohedral-hemihedral. "At ordinary temperatures all quartz is α-quartz, but if at any time in its history a particular piece of quartz has passed the inversion point and been heated above 575°, it bears ever afterward marks potentially present which on proper treatment can be made to appear" (p. 425). Quartz formed on the low temperature side, such as that of veins and geodes, shows trigonal trapezohedra, more regular twinning than the β-form (as discovered on etching), more frequent intergrowths of right- and left-handed forms, and an absence of the effects of shattering that appear in quartz cooled down from the high-temperature form. The authors verify these points by an examination of quartz from ordinary veins and from pegmatites.

M. Borisov (*Trav. Soc. imp. des. Nat. de St.-Pétersbourg*, vol. xl., p. 46) describes quartz in druses from the Government of Olonetz; the form is the rhombohedron, with a polar angle reading 85° 47′, so that we have a rare type resembling cubes. Mr. R. S. Bassler (Proc. U.S. Nat. Mus., vol. xxxv., p. 133) traces the remarkable changes by which fossils in the carboniferous limestone of Kentucky have been converted into geodes of chalcedony and quartz, and his photographs alone would claim the attention of petrologists and palæontologists alike.

Students of silicates will note the paper by Messrs. Shepherd, Rankin, and Wright (*Amer. Journ. Sci.*, vol. xxviii., p. 293), on the binary systems of alumina with silica, lime, and magnesia, in which andalusite and sillimatrite receive experimental treatment. A very useful statement is included (p. 322) as to the six phases of crystallised silica now known, the α and β forms, respectively, of quartz, tridymite, and cristobalite. Mr. Larsen (*ibid.*, p. 263) examines the refractive indices and densities of some of his artificially prepared silicates and their glasses. Incidentally, he finds that glasses rich in lime and magnesia cannot be prepared, owing to their strong tendency to produce crystals—a tendency well recognised among basic igneous rocks. Messrs. Washington and Wright (*ibid.*, vol. xxix., p. 52) discover, in a felspar from the Mediterranean islet of Linosa, a molecule corresponding to soda-anorthite, and look forward (p. 70) to naming the actual $Na_2Al_2Si_2O_8$ felspar, when forthcoming, Carnegieite. Since the felspar that they really possess is a new species, and receives the name of Anemousite, it seems quite grasping to look so far ahead, even from the very open windows of the Carnegie Institution.

Mr. F. Cornu (*Verhandl. k. k. Reichsanstalt*, 1909, p. 41), in a preliminary and slightly polemical demonstration, promises an important work on the importance of "Hydrogelen im Mineralreiche" which will need to be considered by all who deal with soils and products of decay. The author claims that our method of heating thin slices in Canada balsam removes the water from essential

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substances in the case of weathered rocks, and he here opens up a new field, which will, we hope, be promptly cultivated.

M. G. Césaro (*Bull. classe des Sci., Acad. roy. de Belgique*, 1909, p. 435) has made a comprehensive study of the mesotype group of zeolites, including a mesolite from Kenbane Head, co. Antrim (p. 447), once alleged to be galactite. The author (p. 492) ultimately concludes that galactite is a mixture of natrolite and scolezite.

A new light is thrown on nephrite by Prof. Steinmann (*Sitzungsber. niederrhein. Gesell. Nat. u. Heilkunde in Bonn*, 1908, pub. 1909, p. 1), who concludes that the Ligurian examples were originally dykes in the surrounding olivine-rocks, and had the composition of websterite or diopside-rocks. The expansion of the peridotites, due to serpentinisation, caused pressures throughout the mass, and the dykes became converted into the schistose nephrites that now remain. The brecciated and slickensided character common in serpentine-rock is aptly accounted for by this chemical expansion. "Schwellungsmetamorphose" (p. 13) is introduced as an appropriate term, and Steinmann holds that the Ligurian serpentines received their main mineral characters before the occurrence of the great movements that folded them in among the Alps.

This paper, connecting mineral changes and large rock-masses, may lead us on to igneous rocks in general. Mr. R. A. Daly (Proc. Amer. Acad. Arts and Sci., vol. xlv., 1910, p. 211) has sought to establish the average chemical compositions of igneous-rock types, and his results, largely based on Osann's collection of modern analyses, are likely to serve as standards for all who use ordinary rock-names. The number of analyses employed is shown in each case, and we are naturally left to presume that no very widely differing types are included here under the same name. A second series of averages is generously given, in which the figures are re-calculated with water omitted. Mr. Daly (p 236) urges that Rosenbusch's classification, as here emphasised, is objective and natural in a highly useful degree. Comparisons can now be easily made, by using these tables, between rocks of different grain, and the author points out that dacite is the effusive type of "granodiorite," rather than of the far less siliceous quartz-diorites of our ordinary terminology. On p. 240 we find a characteristic suggestion as to the cause of the similarity of composition of rocks of various degrees of antiquity, since "in general, differentiation in batholiths, when well advanced, restores the condition temporarily disturbed by magmatic assimilation."

Mr. G. P. Merrill (*Amer. Journ. Sci.*, vol. xxvii., p. 469) concludes from averages of analyses of stony meteorites, compared with those of terrestrial rocks, that magmatic differentiation could not have produced our rocks from planetesimal material of meteoritic composition. But he does not quite touch the main question, though he goes near it (p. 470). Surely the rocks of our crust are an extremely thin film on an interior of unknown composition. A planet like the earth, when duly disrupted, would supply exceedingly little material of the kind familiar to the geologist, and a vastly preponderating mass of far more basic character. Æons might go by before a chip of the crust fell upon another planet. Moreover, have not the glassy globules found in the superficial deposits of Bohemia (Bouteillenstein and Moldavite) been claimed by a high authority as of meteoritic origin?

Mr. R. T. Chamberlin, while keeping his eye on planetesimals, has published through the Carnegie Institution a paper on "The Gases in Rocks," in which a large amount of new material is made available. In the course of experiments, most gas arises from rocks that contain the greatest proportion of ferromagnesian minerals (p. 27). The discussion of the condition of the gases that are found to exist in rocks covers ground of great interest to geologists. The author affirms, with Suess, that the water and gases of the interior (p. 69) "form an integral part in the magmas, having been vital factors in their development from the primitive planetary matter." Lavas, it is urged, originate far below the possible reach of surface-waters (p. 73), and thus bring up original water with them. On the other hand, Dr. Johnston-Lavis ("Mechanism of Volcanic Action," *Geol. Mag.*, 1909, p. 437) continues to urge that the water found in lavas is absorbed by them as they rise into the moist layers of the upper regions of the crust. Mr. R. A. Daly (*Journ. of Geology*, vol. xvi., p. 401), in a paper on the origin of augite-andesite, supports the views of Scrope and Darwin on the differentiation of an igneous magma by fractional crystallisation. His views are quoted several times, under the name of Daley, in a remarkable paper by Dr. H. I. Jensen, on the distribution, origin, and relationships of alkaline rocks (Proc. Linn. Soc. N.S.W., vol. xxxiii., p. 491). The rather dubious term "alkaline" is here used to denote "rich in combined alkalies," and the rocks discussed are those that might be conceived to originate by differentiation from a foyaite-magma. Dr. Jensen examines their distribution in space and time, and concludes that they are almost all associated with Cainozoic earth-movements. The Christiania series (p. 502) is merely known to be post-Silurian, and may therefore be Eocene. "Alkaline rocks are continental and occur in areas of normal faulting above and possibly shear below" (p. 515). They are attributed to the melting and assimilation of sediments rich in alkalies (such as were formed when our earth's surface first cooled below 100° C.), as they gradually sank under the weight of Palæozoic and Mesozoic deposits. The crustal re-adjustments of the Eocene period allowed them to be expelled within the low-pressure regions, *i.e.* the continents, towards which they had gradually flowed. There is much more in this paper than might appear from so generalised a summary. Dr. Jensen's thorough study of the types of rock with which he deals is evidenced by several papers on their occurrence in eastern Australia, published in the last two years (Linn. Soc. N.S.W. and Australasian Association for the Advancement of Science, 1908–9).

Messrs. A. Boudariat and Johnston-Lavis (*Bull. Soc. Belge de Géol.*, tome xxii., 1909, p. 103) describe the occurrence of a basalt in the volcanic cone of Tritriva in central Madagascar, which has enriched itself with abundant grains of quartz at the expense of an underlying gneiss. The quartz-grains show the aureole of augite that is so common round inclusions of quartz in basic rocks. At Tritriva the volcanic chimney that was blown through the gneiss is clearly visible, and Dr. Johnston-Lavis makes some just remarks on the analogy with the so-called quartz-basalts of other areas, and on the modification of lavas by absorption.

Mr. C. B. Travis (Proc. Liverpool Geol. Soc., vol. x., p. 311) has examined the Ordovician rhyolites of Nant Ffrancon, Carnarvonshire, and gives good reason for agreeing with Iddings and Parkinson that lithophysal cavities, such as those traceable in the large Welsh spherulites, were original features of the lavas. The view that all such cavities are due to decomposition of solid structures was abandoned, however, by its supporters so far back as 1892.

The petrology of sedimentary rocks still attracts few workers. Dr. Woolacott (Univ. Durham Phil. Soc., Memoir i., 1909) describes a brecciated magnesian limestone in a paper illustrated by views of the rock as it occurs in the open field. Experiment (p. 5) leads to an estimate of the thrust concerned as having generated a pressure of 300 tons to the square foot. Mr. G. Linck, so well known for his researches on chemically deposited limestones, contributes a lucid paper on these rocks to the *Naturwissenschaftliche Wochenschrift*, 1909, p. 689. The Canadian Mining Institute publishes (Journ., vol. xii., 1909) a general paper by Mr. E. Coste on petroleums and coals, strongly supporting the "solfataric" view of the origin of petroleum. Mr. A. J. Cox (*Philippine Journ. Sci.*, vol. iii., p. 301) investigates the Philippine coals as fuels, and concludes that they may compete successfully with those of Australia. This subject is also dealt with by Mr. W. D. Smith ("Mineral Resources of the Philippine Islands," Bureau of Science of Manila, 1909). Barytes is so frequent as a cementing material in rocks that Dr. Trener's discussion of its origin in mineral waters rising from below is of general petrological interest (*Jahrb. k.k. Reichsanstalt*, Bd. lviii., p. 439).

As regards the petrography of special areas, we may note the excellent "Introduction to Petrography and the Collections of Rocks" published by the Royal Scottish Museum, Edinburgh (1909, price 1*d.*). Emphasis is here

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laid on Scottish examples. Dr. W. F. Hume, in his "Notes on the Petrography of Egypt" (*Geol. Mag.*, 1908, p. 500) gives a concise sketch that ought to be reprinted for the use of travellers. Mr. F. Kretschmer (*Jahrb. k.k. Reichsanstalt*, Bd. lviii., p. 527) describes the "Kalk-silikatfelse" near Mährisch-Schönberg in the Sudetic, and shows them to have become mineralised by the granite of the chain, while (p. 571) certain dyke-like pyroxene-pegmatites have arisen from the absorption of limestone into the invading igneous material. Dr. Hinterlechner and Mr. C. von John, in an elaborate paper on the eruptive rocks of the Bohemian Eisengebirge (*ibid.*, Bd. lix., p. 127), show that the alteration of the sediments into crystalline schists is not here dependent on the amount of dynamic influence. Where pressure has been least, the crystallisation is most marked, and is due to the intrusion of a mass that was once regarded as a primitive core. This, the earliest granite of the area, is later than Lower Silurian sediments, and Dr. Hinterlechner believes that it was intruded after the folding of the district. Since Devonian beds are here involved, this red gneiss may be of Upper Devonian or Carboniferous age. A paper of this kind emphasises the fact that in true petrology the laboratory merely subserves the work done in the open field.

G. A. J. C.

REPORTS ON CLIMATES.

THE results of the meteorological observations at the principal stations in the system of the Deutsche Seewarte for the five-year period 1901–5, and for the ten-year period 1896–1905, recently published, complete the series of these valuable statistics for the thirty years 1876–1905. They include the mean monthly, seasonal, and annual values, and extremes or other data relating to the various elements, deduced from observations generally made three times daily, and in practically the same form as in previous instalments. The heights of some of the barometers above sea-level have changed from time to time, but in order to permit easier comparison of one period with another, this inconvenience has been minimised by reducing the observations to agree with the levels given in previous publications. Otherwise, as usual in the case of barometrical observations at climatological stations, the readings are not reduced to sea-level.

The meteorology of Peru is discussed by Dr. J. Hann in the *Sitzungsberichte* of the Vienna Academy of November 4, 1909. The observations of the various stations on which the discussion is based have been published in the Annals of the Harvard College Observatory, to which we have previously referred; the tables were carefully prepared for publication under the direction of Prof. S. J. Bailey, of Arequipa, and are mostly printed *in extenso*, with mean values, but without discussion. In the present work Dr. Hann has submitted the results of the various elements to minute investigation by the laborious process of harmonic analysis. This brings out many interesting points; we propose here only to make a few general remarks on the most important station, on the summit of the Misti (lat. 16° 16′ S., long. 71° 25′ W.), at the great elevation of 5850 metres above sea-level. Dr. Hann points out that the agreement of the daily range of the barometer with that of the highest stations in Europe and America is very noteworthy; the principal maximum occurs between noon and 1h. p.m., and the minimum about 5h. a.m. The mean annual temperature (1893–5) was −7·8° C.; January, −6·0°; May, June, and August, −9·7°. The thermometer, even on very fine days, rarely rose above freezing point. Above 4600 metres, only snow or hail was observed; a certain amount of snow remains during nearly the whole year, but a few clear days suffice to clear off the greater part of a heavy snowfall.

A valuable paper on the climate of the Lower Guinea coast and hinterland, by Dr. R. Sieglerschmidt, appears in vol. xxiii., part i., of *Mitteilungen aus den deutschen Schutzgebieten*; it is the more important from the fact that, with the exception of a short discussion of the rainfall of the Cameroons by Fitzner in 1907, no general paper on the climate of that district has been published for some years. Among the earlier papers may be specially mentioned the results of the Loango expedition (published in 1878), observations at Vivi and other places by Freiherr v. Danckelman (1884), and the reports by Lancaster and Meuleman on the climate of the Lower Congo (1897). Dr. Sieglerschmidt's article deals exhaustively with each of the meteorological elements, and the general results confirm those given by Dr. Hann in his "Klimatologie," that the air-pressure on the Lower Guinea coast has a single yearly range, and that the yearly means decrease from south to north, while the temperature (reduced to sea-level) increases considerably towards the interior, except in the extreme north. Rainfall increases along the coast from almost complete rainlessness to that of the second wettest district of the globe. The oceanic air-current, which from June to September (or October) extends from the north of Angola to the Cameroons far into the interior, has a great influence on the yearly range of temperature, rainfall, &c., while in the hinterland of the north and south districts the yearly range is determined by the alternation of summer warmth and winter cold of higher latitudes.

The climate of Berlin, part ii., air-temperature, by Prof. G. Hellmann (with the assistance of Messrs. G. v. Elsner and G. Schwalbe), forms part No. 6, vol. iii., of the *Abhandlungen* of the Royal Prussian Meteorological Institute. In this valuable and laborious investigation the observations are dealt with in great detail and for various periods from the year 1701. In the following table we quote the maximum and minimum readings for 1830–1907, and the mean monthly and yearly values for 1822–1907, in centigrade degrees:—

	Jan.	Feb.	March	April	May	June
Mean max. ...	1·4	3·3	7·0	12·9	18·5	22·5
Mean min. ...	−3·2	−2·0	0·2	4·3	8·8	12·8
True mean ...	−1·1	0·5	3·4	8·6	13·6	17·5
	July	August	Sept.	Oct.	Nov.	Dec.
Mean max. ...	23·8	22·8	19·0	12·9	6·3	2·7
Mean min. ...	14·3	13·9	10·5	6·4	1·6	−1·4
True mean ...	18·9	18·1	14·6	9·5	3·9	0·7

Yearly mean, 9·0; absolute maximum, 37·0 (July 20, 1865); absolute minimum, −25·0 (January 29, 1830, January 22, 1850).

The author points out that the earlier period was somewhat colder than the later; this was noticeable in all the winter months, especially in January, while greater heat in summer, especially in May and August, was observed, but he considers that it would be premature to assume that a permanent change of climate has taken place. The principal anomalies in the yearly range are the cold periods in the middle of February and June, and the warm periods near the end of September and middle of December. The cold spell of May 11–13, popularly known as the days of the Ice Saints, is not specially noticeable. The chief cause of these anomalies in the annual range of temperature is the distribution of air-pressure in Eurasia, especially the position of the barometric maximum.

A comprehensive discussion of the rainfall of northern Spain and Portugal, by Dr. W. Semmelhack, is contained in *Aus dem Archiv der Deutschen Seewarte* (1910, No. 2). It deals with many aspects of the subject, including horizontal and vertical distribution of amount and frequency, isohyets and tabular means of years and seasons, thunderstorms, &c., embracing a period extending from 1861 to 1900. The rainfall is affected chiefly by conditions of pressure over the Atlantic, Mediterranean, and the Continent, and its yearly distribution is therefore subject to considerable fluctuation. To give details would require much space, but a rough idea may be gained from the fact that about 4 per cent. of the area in question receives an amount not exceeding 12 inches; 53 per cent., approximately 12–27½ inches; 17 per cent., 27½–39½ inches; 23 per cent., 39½–59 inches; 3 per cent., more than this amount. The extreme values are 9·6 inches at Palencia (Old Castile) and 113 inches at Sierra d'Estrella. The monthly extreme values vary very greatly; the highest are met with on the N., N.W., and W. coasts. In March, 1886, 48·7 inches were recorded at Sierra d'Estrella, but in the dry districts of the central plateau the greatest monthly amounts are little above 6 inches; rainless months occur at times at nearly all the stations.

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