Among some of the *more* remarkable spectra may be mentioned that of R. Coronæ, which, as Mr. Espin says, is one of the most puzzling in the heavens. The spectrum, he "feels pretty sure," is a double one, and that there is a displacement; at one time the spectra coincide and the star's light is continuous, and at another they are so displaced as to give the appearance of bright lines flanked with dark ones. T. Coronæ, which showed some years ago a nebular spectrum, seems to have undergone a change, as Mr. Espin says that it "is certainly not now the case."

A remark of interest is that the region bounded by the declinations $+51^\circ$ and $+56^\circ$, and R.A. 10h. 40m. and 11h. 8m. contains a large grouping of coloured stars. Out of 108 stars above 9th mag. there are seventeen which may be classed as orange-red. The region from β to ϵ Ursæ is also "very rich."

"HIMMEL UND ERDE" FOR DECEMBER.—In the current number of this journal Prof. Scheiner contributes an interesting article on the cluster in Hercules; it is accompanied both with early drawings of this fine object as viewed in the telescope, and also with the latest photograph. The last-mentioned appears, as one would suppose, as if quite another object had been photographed, so different is the result obtained. Dr. Schwahn treats in a clear manner also of a very difficult subject in an article entitled "Die Lothabweichungen und das Geoid."

A NEW VARIABLE.—In *Wolsingham Observatory Circular*, No. 38 (December 14), the Rev. T. E. Espin announces that photographs taken with the Compton telescope show that the star Espin-Birmingham 57° (R.A. 11h. 39m. 58s.; Decl. $+56^\circ 23'$), Magnitude 9.5, is variable. The star is now 8.5 mag. It has a Type III. spectrum.

GEOGRAPHICAL NOTES.

DR. F. A. COOK has communicated to the American Geographical Society of New York a scheme for the exploration of the Antarctic regions. He proposes to purchase a steam-whaler of 300 tons, equip her specially with several large boats, sledges, and an outfit similar to that used for Arctic travel, including fifty Eskimo dogs. The plan proposed is to steer south from the Falklands to Terre Louis Philippe, and enter the ice-barrier at the first convenient opening where winter quarters may be established and a landing effected. The adjoining land would be systematically explored and all possible scientific observations made. The scientific party will not exceed twelve or fourteen. Dr. Cook has had some experience in Arctic exploration with Lieutenant Peary, and Astrup, now with Peary on his second sojourn in North Greenland, has agreed to accompany him. It is proposed that the expedition should be one year in the Antarctic regions. Dr. Cook estimates the cost of his expedition at £10,000, which he hopes to raise by private subscriptions, grants from scientific societies, and by lecturing. While recognising the greater advantages to science likely to accrue from a national expedition on a large scale, such as that suggested by Dr. Murray, we would like well to see Dr. Cook's party also in the field, which is a wide one, and full of scientific possibilities.

REUTER'S Agency announces that Mr. and Mrs. Theodore Bent and their party left Aden on the 16th inst. for the seaport of Makalla, on the south coast of Arabia, whence they will proceed to the interior with the object of exploring Hadramant.

Ausland announces the sudden death, on November 21, in Yokohama, of the Austrian Consul-General, Gustav von Kreitner, who was with Count Szechenyi on his great journey in Central Asia as topographer. There his work was of the best quality, and made the results of the expedition permanently valuable to cartographers.

THE *Annales de Géographie*, a quarterly geographical paper edited by M.M. Vidal de la Blache and Marcel Dubois, which has just entered on the commencement of its third volume, has already taken the first place amongst French geographical journals for the comprehensive scope of its contents and the solid value of the contributions to geography which it publishes, as well as for the impartiality of its editorial notes. The last number is particularly good, containing a coloured map of the faunal divisions of the globe, with a discussion by Prof. J. Welsch; an able treatise on the lakes of the Jura by Dr. A.

Magnin, several excellent studies in local geography, an epitome of M. Maistre's great journey to the Shari, and an account of Mount Ararat by M. Chantre.

THE prospective formation of a "buffer-state" between Siam, Burma and China, necessitates a more complete survey of the region than has hitherto been attempted, and an Anglo-French Commission will probably undertake this work at an early date.

DR. H. R. MILL completed a course of twelve lectures on geography applied to commerce, at the London Institution, on Tuesday evening. The lectures were arranged by the Royal Geographical Society as a special educational course, designed to meet the wants of merchants and advanced school-teachers. The first six lectures took up the scientific basis of commercial geography, showing the relations of mathematical, physical, biological, anthropological, and political geography to the special subject. The remainder of the course dealt with the commercial geography of the larger divisions of the British Empire, in order to enforce the general principles in particular cases. The attendance throughout was satisfactory; and the same course was given on Friday evenings at Birmingham, under the Oxford University Extension scheme. Mr. Mackinder will commence the second course of educational lectures for the Royal Geographical Society on January 12, in the hall of the United Service Institution, Whitehall, the subject being the relation of geography to history.

A NEW PROCESS FOR THE PREPARATION OF ETHERS.

A NEW and advantageous general process for the preparation of ethers (alkyl oxides), including the most important from a technical point of view, ethyl ether, is described by Prof. Kraft, of Heidelberg, in the current *Berichte*. In the course of an investigation of the aromatic derivatives of sulphuric acid, it was observed that there is a complete analogy between the behaviour of sulphovinic acid and its homologues on the one hand, and the alkyl esters of aromatic sulphonic acids on the other, towards alcohols at moderately elevated temperatures. It was found, in fact, that the conclusions arrived at by Prof. Williamson in the year 1851, with regard to the processes involved in the formation of ethers from the esters of sulphuric acid, are equally applicable to the alkyl esters of the sulphonic acids. For these latter substances decompose in a precisely similar manner to the alkyl sulphuric acids upon warming with alcohols, an ether being the product of the reaction. Thus, for instance, the reactions between alcohol and ethyl sulphuric acid, and between alcohol and the ethyl ester of benzene sulphonic acid, run exactly parallel, as will be apparent from the equations representing them—

This new class of reactions of the sulphonic acids appears likely to prove of more than merely theoretical interest, for on account of the great stability of these aromatic substances, they are capable of converting far larger relative quantities of alcohol into ether when the reaction is made continuous than the alkyl derivatives of sulphuric acid. Although sulphuric acid is so cheap, and the manufacturing process of continuous etherification has been rendered as perfect perhaps as is possible, still oil of vitriol is unfortunately prone to decomposition in contact with a readily oxidisable substance such as alcohol, becoming reduced to sulphur dioxide which is lost in the gaseous state. Moreover, the powerful affinity of oil of vitriol for water, which is one of the products in the first stage of the reaction, brings about such a dilution after treatment with a considerable quantity of alcohol, that it is no longer capable of performing its function in the process of etherification, which latter must of necessity be arrested in order that the acid may be replaced. Now, the sulphonic acids of the aromatic series, such as benzene sulphonic acid, $\text{C}_6\text{H}_5.\text{SO}_2.\text{OH}$, are so stable at the temperature of reaction with alcohol, that the latter is only etherified, and not in the slightest degree oxidised, doubtless owing to the fact that the hydroxyl group present in sulphovinic acid is replaced by the less mobile radicle of the benzene nucleus. Further, the water which gradually accumulates is not retained by the sulphonic acid, but passes over largely with the ether, from which it separates as a distinct layer in the receiver.

This mode of preparation of ethyl ether and its homologues from alcohols by means of sulphonic acids may therefore be very advantageously substituted for the ordinary process now in use. It may be carried on in a perfectly continuous manner, employing the same quantity of the sulphonic acid for weeks, in open vessels and upon any scale. There would appear to be practically no limit to the amount of alcohol which any definite amount of sulphonic acid is capable of converting into ether. Prof. Krafft has actually followed the process with benzene sulphonic acid until one hundred times its weight of alcohol had been so converted, and the residual sulphonic acid appeared as capable of bringing about the reaction, and as free from products of decomposition, as at first.

The reaction in the case of benzene sulphonic acid can readily be proved to occur in the two stages indicated in the following equations:—

For if the process is arrested at any time and the liquid in the distilling vessel is poured, when cool, into water, the ethyl ether of benzene sulphonic acid, $\text{C}_6\text{H}_5\cdot\text{SO}_2\cdot\text{OC}_2\text{H}_5$, immediately separates in the form of a difficultly soluble heavy oil, which after separation is found to boil at 156° under 15 m.m. pressure, which temperature has previously been given by other observers as the boiling-point of the compound.

The benzene sulphonic acid may be replaced by benzene disulphonic acid, para-toluene sulphonic acid, β -naphthalene sulphonic acid, or any stable sulphonic acid or its esters.

As a laboratory or lecture experiment this new process of etherification may be easily carried out in the following manner:—The sulphonic acid, about 80–120 grams in quantity, is conveniently placed in a strong glass tube, 25–30 centimetres high and 5 centimetres wide, closed at one end. The open end is stoppered with a well-fitting ordinary cork bored with three holes, through one of which a thermometer is inserted, through another the tube leading to the condenser, and through the third the stem of a dropping funnel. The benzene sulphonic acid is first melted and then heated to about $135\text{--}145^\circ$ with the thermometer in the liquid. Alcohol is then allowed to emerge into the hot liquid from the dropping funnel, whose stem is made to end in a fine opening only about an inch from the bottom of the reaction cylinder. The supply of alcohol is maintained constant at a convenient rate from a reservoir whose delivery tube passes air-tight through a cork in the neck of the dropping funnel. The two layers of ether and water then rapidly collect in the cooled receiver into which the tube of the condenser passes.

The process lends itself equally well to the preparation of mixed ethers. For instance, if a mixture of methyl and propyl alcohol are allowed to pass through a layer of a sulphonic acid, β -naphthalene sulphonic acid was used in the actual experiment made, at a temperature of $122\text{--}126^\circ$, the product consists largely of methyl propyl ether. This mixed ether, which has previously been found so difficult to obtain, and which is important as being isomeric with ethyl ether, can readily be obtained pure by fractional distillation of the product, when it is found to boil constantly at 37° . Similarly, di-methyl and di-propyl ether may be readily prepared from the corresponding alcohols. Isobutyl ether may also be obtained with ease from isobutyl alcohol by use of a sulphonic acid, a reaction which it has hitherto not been found possible to carry out by means of sulphuric acid.

A. E. TUTTON.

THE PROGRESS OF TECHNICAL EDUCATION.

SINCE the passing of the Technical Instruction Acts in 1889 and 1891, authorising County Councils to devote the funds accruing under the local taxation (Customs and Excise Act, 1890) to educational purposes, considerable progress has been made both as regards the number of authorities who have availed themselves of the provisions of the Act, and also in respect to the proper disposal of the funds. From the last report of the National Association for the Promotion of Technical and Secondary Education it appears that out of a total of 126 local authorities in England and Wales, 114 are now giving the whole, and twelve are giving part of the grant to educational

purposes, and, estimating the total amount distributed at £750,000, no less than £604,000 is spent to this end. These figures show that the work of technical instruction is firmly established, and it only needs to be organised and consolidated to become a very important factor in our educational system.

It seems desirable, now that the scheme has had sufficient time to crystallise into shape, to put on record some of the experiences of Technical Instruction Committees, as set forth in reports to various County Councils. By this means it is possible to give an idea of the developments which are most likely to end in good results. No attempt is made in the following to discuss all the reports, for such a course would be beyond the limits of this paper. A few reports have been selected, and from them extracts have been taken which are likely to be of use for future procedure.

For convenience we begin with the northern counties. The Northumberland Committee reports that—"The average attendance at the science classes was not quite as satisfactory as might have been anticipated. It is notable, moreover, that the centres where the attendance was smallest were not always situated in sparsely populated districts. On the contrary, in more than one fairly populated district, where educational work of a similar character has been carried on for some years, and where a general and ready appreciation of the advantages offered might reasonably be expected, the results were disappointing. In several instances the teachers experienced difficulty on account of the lack or diversity of the previous training of the students, and it is to be hoped that the more general establishment of night schools and continuation classes will, in the course of time, prepare the ground for the work of the special technical instructors."

In thus expressing the need for more schools to prepare the ground for technical instruction, the committee shows its good sense. Elementary science is the best foundation of a technical education, and to attempt to infuse a knowledge of technicalities into the minds of the young mechanics of this country without such a preliminary grounding, is to court failure. The action of the Department of Science and Art, in withdrawing grants for second-class certificates, was taken in order to force the Technical Instruction Committees to provide the necessary elementary instruction. Unfortunately, however, some committees have not yet realised their duty in this matter, so between them and the Department many classes in elementary science have fallen to the ground.

One of the greatest needs experienced by Northumberland is for a good secondary school. To quote the report:—"The facilities for secondary education in Northumberland are in certain parts of the county entirely absent, and where they do exist appear to be in many cases inadequate, inefficiently equipped, and having no relation to the established agencies for elementary and higher education. In the south-west of the county there is no secondary school of any description, and the lad who gains a scholarship has no choice between Newcastle and Carlisle. . . . Of the schools of a secondary character already in existence in the county, in only one or two cases is there any attempt to provide systematic instruction in science, and in no case is there, outside Newcastle, laboratory accommodation for practical work in chemistry or physics."

This is a very regrettable state of things, and much progress cannot be made until it is altered. A good secondary school should be established at every large centre of population. There are, however, numerous large districts not so favoured. For example, the Technical Instruction Committee of the West Riding of Yorkshire, which is without doubt doing as good work as any committee in the country, reports that in the Todmorden district, with a population of over forty thousand, the nearest available secondary schools are at Halifax, more than twelve miles away, and there are many districts in other counties far worse off. Clearly a portion of the sums now spent in the railway fares of holders of scholarships would be better expended in the establishment of secondary schools in the required districts, or by increasing the scholarships to the amount necessary to cover the cost of maintenance of the scholar at a residential college. The payment of the West Riding Committee for railway fares during the year covered by the last report amounted to nearly £4000, of which about £3000 was expended under the scholarship scheme. This money would be better spent in subsidising local technical schools, and the committee intends in the future to follow such a course as far as possible.