THE MEASUREMENT OF STELLAR DIAMETERS.—When the objective of a telescope is covered with a screen having two slits in it, the image of the object under observation takes the form of a series of fringes lying in the direction of the slits; and every one with an elementary knowledge of physics knows that this appearance is due to the interference of the beams of light traversing the instrument. Fizeau appears to have been the first to point out that the size of the fringes depends upon the angular dimensions of the luminous source producing them, and that this fact might be utilised to determine stellar diameters. The means by which Prof. Michelson has applied the principle to the measurement of the diameters of Jupiter's satellites has already been described in these columns (vol. xlv. p. 160); but the subject is so important that we give here the gist of a discussion of the theory of the matter, contributed by M. Maurice Hamy to the number of the *Bulletin Astronomique* just issued. By means of Prof. Michelson's interferential refractometer—an instrument with a life of usefulness before it—it is possible to measure diameters down to $0''{\cdot}01$, that is, to the angle which the sun would subtend if it were removed to the distance of α Centauri. In fact, there is little doubt that the diameters of stars are measurable by this means. All that is necessary theoretically is to cover the object glass of the telescope with a screen having two rectangular, parallel slits, equal and of variable width. The interference fringes produced at the focus of the instrument are made to disappear by separating the slits, and when the fringes corresponding to light of a wavelength represented by λ have vanished, the distance (l) between the centres of the slits must be measured. The exact formula which enables the diameter (ϵ) of the object under examination to be determined from these data is, according to M. Hamy,

$$\epsilon = 1''{\cdot}22\,\frac{\lambda}{l \sin 1''}$$

There are, of course, a few difficulties in the way of perfectly realising the theory, but they are being overcome, and it is not too much to say that the interferential refractometer will add very considerably to astronomical knowledge before the end of this century. It would be interesting to measure the diameters of Algol, and some of the spectroscopic binaries, and compare the results with those deduced from observations of motion in the line of sight.

THE MOON AND WEATHER.—The solitary observable effect of the moon on our atmosphere was believed by Sir J. Herschel to be exhibited in the tendency of clouds to disappear under a Full Moon. He attributed this to the heat radiated from the lunar surface. Humboldt speaks of this connection as well-known in South America, and Arago indirectly supports the theory by stating that more rain falls about the time of New Moon than at the time of Full Moon; the former period being cloudy, and the latter cloudless, according to theory. With the idea of obtaining information upon the matter, the Rev. S. J. Johnson has examined the state of the sky at moonrise and at midnight on the day of Full Moon only for the last fifteen years. His results were communicated to the Royal Astronomical Society on January 12, and they confirm the opinion now held by almost every astronomer, viz. that the Full Moon has no effect in breaking up clouds.

GEOGRAPHICAL NOTES.

MRS. BISHOP (Miss Isabella Bird) has set out *via* Canada for Korea, where she intends to spend some time studying the country, and whence she may afterwards make a journey into Manchuria.

THREE Christmas lectures to young people by Mr. Douglas W. Freshfield, were arranged by the Royal Geographical Society, and were delivered in the second week of January to an interested audience. The subject was mountain-study as a branch of geography, and the lectures were illustrated by a large collection of extremely fine photographic views of the Alps and Caucasus.

MR. H. J. MACKINDER commenced the second series of his lectures on the relation between geography and history, in pursuance of the Royal Geographical Society's Educational Scheme, on January 11, in the theatre of the Royal United Service Institution, Whitehall Yard. The lecture was introductory to the present course, which will be continued weekly, and consisted of an epitome of last year's lectures, showing that physical and geographical conditions largely determine the order of history and the movements of peoples. The remaining lectures will deal with a series of concrete examples, focussing the essential features of the relation between the geography and history of the chief countries of Europe, and especially of the British Islands.

THE *Zeitschrift* of the Berlin Geographical Society publishes an interesting paper, by Dr. Wegener, on the Chinese map of northern Tibet and the Lob-nor District, being a sheet of the official Chinese Atlas compiled by the labours of the Jesuit missionaries at the Court of Pekin, who trained and superintended Chinese surveyors. It was first published in 1718, and an enlarged edition appeared in 1863 extending over the greater part of Asia. This work still is the basis of the European maps of many parts of Tibet, and the careful index of names prepared by Herr Himly, which accompanies the report, is of extreme value, as, not content with the Chinese lettering, he has had recourse to the original Tibetan, Turki, and other native names, which he transliterates with great care.

AUGUST ARTARIA, the eminent Austrian map publisher, who has done much to maintain the character of scientific cartography, died at Vienna on December 14, 1893, aged 87.

MM. SCHRADER AND DE MARGERIE, whose long study of the geology of the Pyrenees is well known, have contributed to the last volume of the *Annuaire* of the French Alpine Club a concise discussion of the geographical conditions of the chain illustrated by a large-scale coloured orographical map. The denudation of the northern slope has been much more complete than that of the southern; the tertiary strata remain on the latter, but on the French side have been eroded away to form the vast fans of alluvium of the lower plain. Despite their general form, the Pyrenees are not composed of ranges running east and west, but of mountain knots and short ranges oblique to the general direction running towards E. 30° S. and then turning towards E.N.E. as a rule. The mean altitude of the chain is about 1000 metres, or say 3300 feet. Elie de Beaumont, on the assumption that the southern slope was strictly similar to the northern, made his estimate of the mean height 500 metres greater. The mass of the Pyrenees, if spread over the surface of France, would raise the level of that country by 102 metres, or 330 feet.

A NEW SULPHIDE OF CARBON.

A NEW liquid sulphide of carbon of the composition C_3S_2 has been isolated in a somewhat remarkable manner in the chemical laboratory of the university of Buda-Pesth, by Prof. von Lengyel, who contributes an account of it to the current *Berichte*. In addition to the well-known disulphide of carbon, several other substances supposed to be compounds of carbon and sulphur have from time to time been described; but as they appear to have been amorphous insoluble solids very difficult to purify, there is very little evidence of their being definite compounds. The substance now described, however, appears to be a very well characterised liquid compound of unmistakable odour and corrosive action upon the skin, and capable of being distilled under diminished pressure.

The method of preparing it was accidentally discovered during the elaboration of a number of lecture experiments illustrating the synthesis and decomposition of carbon disulphide. It was long ago pointed out by Berthelot that this familiar substance decomposes at a temperature but slightly higher than that at which its formation from its constituents occurs. Buff and von Hofmann subsequently showed that the temperature of a glowing platinum wire was ample to bring about slow dissociation of the vapour, and that the disruption of the compound occurred very rapidly indeed at the temperature of red-hot iron wire. An experiment was therefore arranged to ascertain whether rapid removal of the vapour of the synthesised compound from the heated sphere of action would largely prevent the loss by dissociation, and in order that the test should be a severe one, the rapidly moving vapour was subjected in its passage to the high temperature of the electric arc. It was during this experiment that the new sulphide of carbon was unexpectedly produced.

A little more than a hundred cubic centimetres of carbon

disulphide were placed in a flask arranged over a water bath. A large globe had been previously sealed on to the neck of the flask, through tubuli in which the carbon electrodes were inserted. To a third tubulus of the globe an upward condenser was fitted, the interior tube of which was finally bent downwards to serve as a gas delivery tube. The water bath was then heated and the carbon disulphide maintained in rapid ebullition, the electrodes were approached until the powerful current from accumulators was transmitted, and then withdrawn so as to generate the arc. The electric arc in carbon disulphide vapour under these conditions is a remarkable phenomenon; it is seamed with a dark band passing along its centre from pole to pole, and the brightest spots of the incandescent terminals are just where the band appears to touch them. The carbon disulphide was kept boiling and the arc passing for a couple of hours, during which the globe was filled with the vapour, which condensed in the condenser, and fell back into the flask. The interior of the apparatus soon commenced to blacken with liberated carbon, which collected upon the surface of the liquid, and an extraordinarily strong tear-exciting odour soon made itself evident in the neighbourhood of the apparatus. At the conclusion of the experiment the residual liquid was cherry-red in colour, and was transferred to a closed vessel containing copper turnings in order to remove the free sulphur present. After being thus left for a week it was filtered, and the carbon disulphide evaporated at a low temperature in a current of dried air, in order, if possible, to isolate the substance endowed with the powerful odour. Eventually a few cubic centimetres of a deep red liquid, the new sulphide of carbon, were left, which possessed the odour in greater intensity, a trace of the vapour producing a copious flow of tears, accompanied by violent and persistent catarrh of the eyes and mucous membrame. A drop of the liquid, moreover, at once blackened the skin.

The specific gravity of this liquid is 1·2739, so that it sinks under water, with which it does not mix. When heated it polymerises into a hard black substance. If the rise of temperature is gradual the change occurs quietly, but when rapidly heated to 100–120° the polymerisation takes place with explosive force, the interior of the vessel being covered with projected deposits of the black substance. Analyses both of the liquid and of the black solid indicate the same empirical formula, C_3S_2, and molecular weight determinations of the liquid, dissolved in benzene, by Raoult's method, agree closely with the molecular weight corresponding to that formula. The liquid can be partially distilled at 60° *in vacuo*, a small portion, however, always polymerising. The liquid, moreover, spontaneously changes in a few weeks into the more stable black solid modification. The solutions of the liquid in organic solvents likewise slowly deposit the black form.

The liquid readily ignites, burning with a luminous flame, and forming dioxides of carbon and sulphur. Caustic alkalies dissolve it, forming dark coloured solutions from which dilute acids precipitate the polymerised black compound. With alcoholic potash the action is very violent. A drop of concentrated sulphuric acid causes instant passage to the black form accompanied by a hissing noise. Nitric acid provokes an explosion and ignition, but 70 per cent. acid dissolves it completely and quietly.

The black polymeric modification is readily soluble in caustic alkalies, but acids reprecipitate it unchanged. When heated it undergoes a remarkable change, sulphur subliming, and a gas, inflammable and containing sulphur, but not carbon disulphide, is liberated, the nature of which is reserved for a further communication.

The liquid sulphide combines readily with six atoms of bromine, with evolution of heat. The substance is readily isolated when bromine is dropped into a solution of C_3S_2 in chloroform, as it is insoluble in that solvent. Strangely enough this compound, $C_3S_2Br_6$, is endowed with a pleasant aromatic odour, two substances of frightful odours thus uniting to form an agreeably odoriferous compound, a striking example of the effect of chemical combination. A. E. TUTTON.

DR. GREGORY'S JOURNEY TO MT. KENIA.

AT the meeting of the Royal Geographical Society on Monday evening, Dr. J. W. Gregory read a paper, of which the following is a full abstract:—

It has long been known that the lakes of Equatorial Africa are developed on two types, first those which have low shores and are rounded in shape, and second those which have high, steep shores and are long and narrow. The lakes of the latter group, moreover, are distributed on a definite plan, occurring at intervals along lines of depression across the country. The chief of these runs from Lake Nyasa through a large series of lakes, including Natron, Nawasha, Baringo and Basso Narok (Lake Rudolf); from the last of these the line of depression runs through Abyssinia into the Red Sea, which continues the same type of geographical structure for 18° to the north; thence it can be followed up the Gulf of Akaba to the Dead Sea and Jordan Valley. It seems not unlikely that the whole of this great line is due to one common earth movement of no very great age, for the traditions of the natives around Tanganyika, of the Somalis and Arabs, and of the destruction of Sodom and Gomorrah may have reference to it. It was the interest which these problems excited that led to Dr. Gregory's desire to visit the district, as he was recently enabled to do, by the permission of the Trustees of the British Museum. He started with a large expedition, intended to explore this "Rift Valley" in the neighbourhood of Lake Rudolf, which landed at Lamu, and thence started up the Tana Valley, where it unfortunately collapsed. On his return to Mombasa Dr. Gregory himself organised a small caravan of forty Zanzibaris, and travelled to the highest part of the "Rift Valley" between Nawasha and Baringo, examining its structure and natural history. The most risky part of the journey was crossing the high plateau of Leikipia, which has only twice before been traversed, by Teleki and Höhnel in 1887, and by the German Emin Relief Expedition under Dr. Peters in 1889–1890. Mr. Joseph Thomson reached its western side, but had to abandon his camp and escape under cover of night. The expedition crossed Leikipia by a new route, and traversing the plateau which is marked as the site of the "Aberdare Mountains," reached Northern Kikuyu without trouble, except for want of food. The natives at first refused to sell any, as some white men who had visited a neighbouring district had seized food without payment, shot the elders, and carried off the young men as porters. After much "shauri" the natives were satisfied as to the peaceful object of the expedition, the right of blood-brotherhood was celebrated, and food obtained. The party then turned north, to the western foot of Mount Kenia. Most of the men were left in the camp while Dr. Gregory and twelve men started for the central peak. Three days were spent cutting away through the dense forest and bamboo jungle on the lower slope. Owing to the damp, mist, and cold, this work was very severe on the Zanzibaris. On the fourth day they emerged on to the Alpine pasturages, only to be caught in a furious blizzard of snow and hail, which necessitated camping for the night on a frozen peat bog. Next day a tent was carried higher up, as a base for reconnoitring excursions. The most important of the peaks on the south slope was ascended, and named Mount Höhnel, after the Austrian explorer. Five glaciers and eight lakes were discovered, as well as an interesting flora and fauna. A small shelter-tent was taken to near the end of the largest glacier, in readiness for an ascent of the central peak. A snow-slip during a severe storm in the night nearly buried this, and did cover all the food. The ascent had therefore to be attempted after a night's exposure to a severe storm, and without food. The main glacier, which was named after the late Prof. Carvell Lewis, was explored, and the *névé* field at its head crossed to the main south *arête*. After ascending this for some distance it became badly corniced, the risks of further progress were too serious to be encountered alone, and after reaching the height of a little over 17,000 feet it was necessary to return. In a subsequent attempt on the west *arête*, Dr. Gregory was caught in a severe snowstorm, which rendered the route followed in the ascent impassable, and might have entailed serious consequences. He was then recalled to attend to his men, many of whom were suffering severely from the cold and altitude, and an immediate descent to Leikipia was necessary; he had, however, achieved the five purposes for which he visited the mountain.

During the return to the coast much new ground was covered with some interesting topographical results; but except for securing a passage across Kikuyu, by curing the chief of toothache, this part of the journey presented little of general interest.

In conclusion, some of the scientific results of the expedition were summarised, though it was said to be too early to do this properly. Among the more interesting results was the discovery of the former greater extension of the glaciers of Mount