be difficult to prove any thing except accidental coincidences among the lines of the different elements. Accurate investigation generally reveals some slight difference of wave-length or a common impurity.

Furthermore, the strength of the lines in the solar spectrum is generally very nearly the same as that in the electric arc, with only a few exceptions, as, for instance, calcium. The cases mentioned by Lockyer are generally those where he mistakes groups of lines for single lines, or even mistakes the character of the line entirely. Altogether there seems to be very little evidence of the breaking-up of the elements in the sun, as far as my experiments go.

Even after comparing the solar spectrum with all known elements, there are still many important lines not accounted for. Some of these I have accounted for by silicon, and there are probably many more. Of all known substances, this is the most difficult to bring out the lines in the visible spectrum, although it has a fine ultra-violet one. Possibly iron may account for many more, and all the elements at a higher temperature might develop more. Then, again, very rare elements, like scandium, vanadium, etc., when they have a strong spectrum, may cause strong solar lines, and thus we may look for new and even rare elements to account for very many more. Indeed, I find many lines accounted for by the rare elements in gadolinite, samarskite, and fergusonite other than yttrium, erbium, scandium, praeseodymium, neodymium, lanthanum, and cerium, which I cannot identify yet, and which may be without a name. For this reason, and to discover rare elements, I intend finally to try unknown minerals, as my process gives me an easy method of detecting any new substance or analyzing minerals however many elments they may contain.

The research is much indebted to the faithful and careful work of Mr. L. E. Jewell, who has acted as my assistant for several years. Preliminary publications of results will be made in the *University Circulars*.

Among the latest results I may mention the spectroscopic separation of yttrium into three components, and the actual separation into two. HENRY A. ROWLAND.

DUTCH BORNEO.[1]

LITTLE is known of the interior of the Island of Borneo, and therefore the information supplied by Heer S. W. Tromp in the *Tijdschrift van het Kon. Nederlandsch Aardrijkskundig Genoot.*, Deel vii. No. 4, though incomplete, is very acceptable. In 1885 he steamed up the Mahakam River to Muvara-Pahu, a village about 190 miles from the sea. Near the coast the land is flat, and is being laid out in rice-fields. It would also, in Heer Tromp's opinion, be suitable for the cultivation of sugar-cane. Farther up the river, hilly country is entered, covered with a layer of yellowish-red soil, of little value for agriculture. After eight hours' steaming from Samarinda, Heer Tromp passed the mouth of the Sebulu River, and two hours and a half later reached Naga-Beulur. Here the hills, which extend from Pelarang (a short distance below Samarinda), suddenly terminate, and the river emerges through a narrow channel from a level tract, stretching northwards probably to the frontier of Berau, which was formerly the bed of a large lake. Even now this depression is not entirely filled up. Meres and morasses of large area lie on either side of the Mahakam, and when the water is high, that is, during the greater part of the year, a large proportion of the country is submerged. The district of the Upper Mahakam is inhabited by a tribe of Dyaks, known as Bahau-Dyaks in Kutei, and elsewhere as Pari-Dyaks. Their number is estimated at 4,500. Formerly they were notorious head-hunters, and were much dreaded in the Baritu valley, but of late greater security has been established by the interference of the Sultan of Kutei.

The development of the country, however, has not been accelerated thereby, for, with the festivals held on the bringing-home of heads, has also disappeared the stimulus to industry. Large sums were formerly expended in gala-dresses for the women, of silk adorned with beads; and tobacco and rice were provided in abundance. Moreover, the Buginese dealers, as they have circulated more freely through the country, have introduced hazard and cock-fighting, with the most disastrous consequences. The steamer in which Heer Tromp travelled was unable to ascend the river beyond Muvara-Pahu, but he himself advanced some distance farther in a rowing-boat. As far as Juhalang the river is easily navigable; but beyond, the current is too strong, except when the water is abnormally low, and at Kapala-kiham a series of waterfalls practically limits the navigation.

Hence the difficulty of extending Dutch rule into Upper Kutei. Indeed, communication with Sarawak along the Seliku, one of the most important affluents of the Mahakam, which rises in the Batu-Tibang opposite the sources of one of the tributaries of the Batang-Rejang, seems to be more feasible than with the Lower Mehakam. It is also possible to reach the Upper Kayan by the Boh River, which enters the Mahakam above the first fall; but it necessitates a journey of eight days on the river, and three over uneven and stony country to the highest navigable point of the Laya, a tributary of the Kayan. In the last-mentioned river an obstruction is said to exist even more formidable than the falls on the Mahakam. This remote country is inhabited by a number of Dyak tribes, which, as well as the Bahau-Dyaks of the Malakam, the Kenyas of the Upper Kayan, and others, had their home originally near the sources of Kayan. Since such insurmountable obstacles to communication exist on the routes already discussed, Heer Tromp turns his attention to the Kapuas River on the west. He passes over the lower course of the river up to Bunut with only a few cursory remarks, as it has been already described by Professor Veth in his *Borneo's Westerafdeeling*. The town of Bunut, at the mouth of a tributary of the same name, is the capital of the last Malayan kingdom.

Several affluents enter the main stream before the next town of any importance, Putus-Sibow, is reached. Here the Dyaks carry on a considerable trade with the Malay dealers, bartering the products of their forests against copper utensils, salt, tobacco, linen, crockery, etc. In 1888 Heer Tromp ascended this river, the Kapuas, in a steamer as far as the mouth of the Mendalam, a distance of 400 miles from the sea. It will be seen at once that it possesses a great advantage over the Mahakam, on which navigation is possible only for a distance of 250 miles.

Moreover, the Mendalam can be ascended by steamer, and Heer Tromp continued his journey in a boat up the Kapuas itself as far as Lunsa. Hajji Achmet, a native clerk, ascended the Bongan River, which enters the Kapuas at Lunsa, and its affluent the Bulet, to a point whence, he heard, the Seputan, a tributary of the Kaso, which flows into the Mahakam, could be reached in a day's march. This appears probable, for nowhere in this country are elevations of any great height to be seen. The Taman-Dyaks, who dwell on the Upper Kapuas, are more civilized than the Bahaus or the Kayans. Their women wear tasteful sarongs ornamented with beads and shells, and do not tattoo themselves, like the Kayan women.

[1] From the Scottish Geographical Magazine for February, 1891.

EDUCATION IN GERMANY.[1]

THE resolutions arrived at by the Conference on School Reform in Berlin may be summed up as follows: —

(1) Only two kinds of high schools are to survive, — gymnasia and non-Latin or non-classical schools (oberrealschulen and höhere bürgerschulen). A common lower school for gymnasia and non-Latin schools, so warmly advocated by many, is considered undesirable. The change from the one school to the other will be facilitated in every possible manner.

(2) The over-pressure, which is one of the most crying evils at the present time, is to be greatly reduced. A diminution of the hours devoted to Latin and Greek is considered possible, without any risk to the supremacy of classics. The Latin essay is to be abolished, as well as the Greek translation in the written examination for remove into the prima. German is to become the chief subject of instruction. Contemporary history is to be more thoroughly studied, without, however, adding to the hours assigned to history.

[1] From the London Journal of Education.

(3) Especial stress is laid on the fact that home tasks are not to be increased; that the bulk of the work should be performed in school; and that, with this object in view, an alteration in the present method of teaching is absolutely necessary.

(4) For the teacher, more thorough pedagogic education and a higher social status are insisted on.

(5) Teachers should not be specialists, but form masters, and should realize their responsibility for the physical as well as the intellectual development of their pupils. Greater attention should be paid to the health of the boys, and to the demands of hygiene in the schools.

(6) The final school examination (which serves as entrance examination to the university) should be regarded as the "remove" examination out of the oberprima, and consequently should be restricted to work done in this class. The Latin essay is henceforth to be abolished, and the examination in other respects made considerably easier.

In order to meet the probable growing demand for höhere bürgerschulen and realschulen, the conference passed a number of resolutions the most important of which were that gymnasia or realgymnasia, where only a small proportion of the pupils pass into the upper classes, should be turned into realschulen; that in towns where there are several gymnasia or realgymnasia, if possible, one of these should be turned into a realschule. In the establishment of new schools, preference is to be given to realschulen, but at the same time the interests of the minority of the inhabitants of small towns without gymnasia are to be considered by having Latin instruction given where desired in the three lowest classes, so that pupils who are intended for a gymnasium may be prepared for it without leaving their homes at too early an age.

The salaries of the teachers in the realschulen are to be on the same scale as those in the gymnasia.

It is thought likely that the demand for realschulen will increase, now that a leaving-certificate from a realschule qualifies for all the lower government posts, and for the one year's military service. There is to be a special examination for this privilege in the gymnasia at the end of the year in the unter secunda.

Another reform is the putting of gymnasia and realschulen on an equal footing with regard to the right of study for all degrees in the university and technical high schools (these are of the nature of technico-scientific universities). The only condition for realschule students is the completion of their leaving-certificate by certificates of their proficiency in classics, while gymnasium students must obtain certificates of proficiency in drawing and mathematics. Moreover, the school authorities have the right to excuse good pupils from the gymnasium or realschule this supplementary examination; also every candidate who has passed the final examination of a nine-class high-school shall be admitted to all state examinations, if, during his term of study, he passes the necessary special examination which he has omitted during his school career. It is these reforms which are really the most important, for they make it possible to carry out the proposed changes without injuring the interests of many classes.

The committee for the carrying-out of the reforms resolved upon in the conference held its first meeting in Berlin on Jan. 6. The committee consists of Geheimrath Hinzpeter as chairman; Dr. Schrador, curator of the Halle University, as vice-chairman; Dr. Fiedler of Breslau; Dr. Graf of Elberfeld; Dr. Kropatscheck of Berlin; Dr. Schlee, director of the Realgymnasium of Altona; and Dr. Uhlhorn of Hannover. The members of the Council for Education are not on the reform committee, but several of them are appointed to draw up the report. The committee agreed as to the reforms necessary for raising the social standing of the teacher, and on the conditions for the right to one year's military service. The next general meeting is to be held in February, and meanwhile the work of reform is to be furthered by private consultations.

Reforms have already been initiated in Würtemburg gymnasia. They are divided into ten classes, of which Class I. is the lowest. The chief alteration is that Latin is to be begun in Class II. instead of Class I., in which the average age is eight. In the lowest class the time is to be spent in mastering reading, writing, and the elements of arithmetic; also Greek is to be begun in the fifth instead of the fourth, the average age of which is eleven. Then the time devoted to classics is to be curtailed in all classes, so that from the second to the sixth not more than ten hours, from the seventh to the tenth not more than eight hours, are given to classics in the week. This means a reduction from 102 hours to 82 hours in all the classes reckoned together. The number of school-hours is not to be diminished, but the time saved is to be given to other subjects. German is to have 28 hours as against 26, French 18 instead of 16, mathematics 39 instead of 37, physiography 16 instead of 10, and obligatory drawing in Classes IV. to VI. 7 hours, whereas before no time was devoted to this subject.

The chief feature of the reform programme is the emphasis laid on making grammar the handmaid of literature, on mastering the text, and gaining a knowledge of grammar by study of it rather than making grammar an aim in itself. The official publications point out the fact that these alterations are comparatively insignificant, and that the Würtemberg educational authorities consider the time not yet ripe for extensive reforms, more especially as the resolutions passed by the Berlin School Conference really tend to make the gymnasia of Prussia more nearly resemble those of Würtemburg. For instance: the gymnasium in Würtemberg has no Latin essay, and the division of secondary schools into gymnasia and non-classical realschulen is already carried out.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Discovery of Fish-Remains in Lower Silurian Rocks.

AT a meeting of the Biological Society of Washington on Feb. 7, 1891, Mr. Charles D. Walcott of the United States Geological Survey announced the discovery of vertebrate life in the Lower Silurian (Ordovician) strata. He stated that "the remains were found in a sandstone resting on the pre-paleozoic rocks of the eastern front of the Rocky Mountains, near Cañon City, Col. They consist of an immense number of separate plates of placoganoid fishes and many fragments of the calcified covering of the notochord, of a form provisionally referred to the *Elasmobranchii*. The accompanying invertebrate fauna has the facies of the Trenton fauna of New York and the Mississippi valley. It extends upward into the superjacent limestone and at an horizon 180 feet above the fish-beds. Seventeen out of thirty-three species that have been distinguished are identical with species occurring in the Trenton limestone of Wisconsin and New York.

"Great interest centres about this discovery from the fact that we now have some of the ancestors of the great group of placoderm fishes which appear so suddenly at the close of the Upper Silurian and in the lower portion of the Devonian groups. It also carries the vertebrate fauna far back into the Silurian, and indicates that the differentiation between the invertebrate and vertebrate types probably occurred in Cambrian time."

Mr. Walcott is preparing a full description of the stratigraphic section, mode of occurrence, and character of the invertebrate and vertebrate faunas, for presentation at the meeting of the Geological Society of America in August, 1891. L. A.

Washington, Feb. 10.

Was Lake Iroquois an Arm of the Sea?

IN *Science* recently Professor Davis stated several reasons leading to the belief that the Iroquois beach was formed by a lake instead of being formed by the sea, as held by Professor Spencer. It is possible that both theories are partly right, and that there was once a lake overflowing the divide at Rome, while later the basin of Lake Ontario or its eastern portion was occupied by the sea. It is not my present purpose to enter into a general discussion of the question, but to call attention to a class of deposits