Artificial Rain.

AFTER the magisterial words of Prof. Cleveland Abbe, as reported in your issue of December 13, 1900, it requires some courage to offer a possible instance of "artificial" rain. I was near Bolton Abbey railway station on November 26 last. The atmosphere was perfectly calm, and a thin white mist enveloped the landscape. A number of land-blasting explosions took place in some limestone quarries, perhaps a quarter of a mile away. At a very short interval after these there occurred a very little shower or sprinkling of rain, just sufficient to cause me to put up my umbrella in preparation for more. The extreme brevity of the shower, and the peculiar conditions under which it occurred, arrested my attention, and led me at once to refer it to the explosions which had just taken place.

Keighley, December 22, 1900. C. H. B. WOODD.

IN an article on artificial rain in your issue of December 13, 1900, Prof. Abbe alludes to "the popular belief that rain follows great battles," which is now often—incorrectly, as the article points out—explained by and used as an indication of some effect produced on the clouds by the explosion of the gunpowder.

It is interesting in this connection to observe that the belief about rain following battles was held many centuries before the invention of gunpowder. Plutarch, in his life of Caius Marius, writes:—"It is observed, indeed, that extraordinary rains generally fall after great battles: whether it be that some deity chooses to wash and purify the earth with water from above; or that the blood and corruption, by the moist and heavy vapours they emit, thicken the air, which is generally liable to be affected and altered by the smallest cause." (Langhorne's translation). The inference is that the belief was the result of a preconceived idea, and that the gunpowder explanation was therefore wasted on a theory which was not grounded on observation at all. M. T. TATHAM.

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PROGRESS IN METALLOGRAPHY.

THE application of micrographic analysis to the study of alloys has given to the metallurgist a new and important field of investigation, and every improvement in the established methods is worthy of attention. Some of the latest suggestions are made by M. Henri le Chatelier in the *Bulletin de la Société d'Encouragement* for September last, the most noteworthy being in connection with the final stages of polishing. It is necessary for this work that the polishing powders should be perfectly classified according to the dimensions of the particles. The method of sorting by means of levigation, described by M. Osmond, is defective, owing to the fact that the salts of lime in ordinary water cause coagulation and rapid deposition of minute particles suspended in water. Caustic lime and acids induce even more rapid settling, a fact that has proved of great commercial importance in the treatment of ore slimes by cyanide in South Africa.

To overcome this difficulty the powders are heated with nitric acid, washed thoroughly, and allowed to settle in distilled water containing 0·2 per cent. of ammonia. When treating ten grams of powder in a litre flask, nine-tenths of the liquid are siphoned off at the following intervals of time: a quarter of an hour, one hour, four hours, twenty-four hours, and eight days. The third deposit is useful in polishing hard metals such as iron, but the fifth and last deposit affords the best polishing powder. Minute care is taken to avoid any admixture of dust or dirt with these powders, which can now be bought in Paris mixed into a paste with soap, and contained in tin tubes such as are used for oil colours.

A number of materials for the manufacture of these powders have been tried. M. Le Chatelier finds that alumina prepared by calcining ammonium alum is the best, as far as speed of polishing is concerned; but oxide of chromium, obtained from the combustion of bichromate of ammonium, answers fairly well in the treatment of iron and steel, and is better than alumina for soft metals such as copper. Oxide of iron is far less advantageous than these substances, its action being very slow. The soap

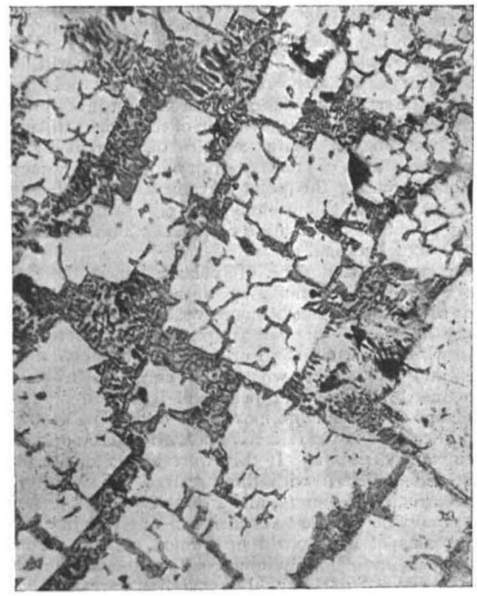

FIG. 1.—Crystals of Al_2Cu.

preparations are applied in the ordinary way to discs of wood or metal covered with skin or cloth and capable of being revolved at high velocity, the whole operation of polishing proper being carried through by their aid in five minutes.

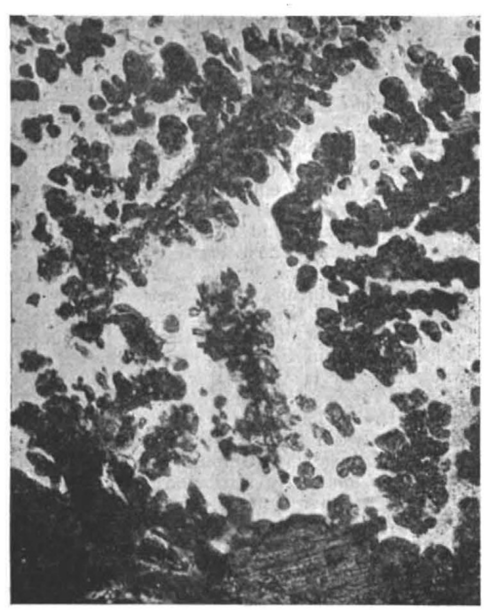

FIG. 2.—Compound near AlCu.

For examining and photographing the polished and etched specimens under the microscope, M. Le Chatelier proposes the use of monochromatic light such as that derived from an electric arc in mercury vapour, with suitable screens between the source of light and the object to be illuminated; but it appears doubtful whether enough light can be easily obtained in this way for very high magnifications.

With regard to the selection of the specimens to be examined, it is well known that much time is wasted when working out a complete series of alloys of two metals. It is necessary to prepare, polish and etch a series of specimens, many of which will present no features of interest when examined under the microscope. M. Le Chatelier proposes to shorten the search for typical alloys by melting together two superimposed layers, each consisting of a pure metal, the lighter one being on the top. If no alloys are formed of greater density than the heavier metal, and the crucible is allowed to cool undisturbed, a culot can be obtained which, on being sawn through vertically, shows a complete gradation from one pure metal to the other, passing through the whole series of alloys, which can then be studied in one specimen. In this way he prepared a number of series, the three illustrations (Figs. 1, 2 and 3) being from

FIG. 3.—Crystals of $AlCu_3$.

photographs of different parts of a single specimen showing the aluminium-copper series. Fig. 1 shows crystals of Al_2Cu; Fig. 2, crystals of a compound of undetermined composition which is not far from that expressed by the formula AlCu; Fig. 3 shows crystals of the compound $AlCu_3$. It would seem that the exact percentage of any particular part of a specimen prepared in this way must be a matter of uncertainty, but there is no doubt that, in the hands of M. Le Chatelier, the method has already yielded some interesting results.

T. K. ROSE.

SOME RECENT ADVANCES IN GENERAL GEOLOGY.

AMONG the recent researches on organic remains none are of greater geological interest and importance than those relating to the Radiolaria. The tiny siliceous structures which belong to this Order of Protozoa have long been recognised in our formations, but the part they have played in building up portions of the stony structure of the earth has not until lately been realised. The most striking evidence was that brought forward by Prof. Edgeworth David and Mr. E. F. Pittman (*Quart. Journ. Geol. Soc.*, vol. lv. p. 16, 1899). They describe a great series of siliceous limestones, jaspers and claystones, with interstratified coral limestones and plant-beds, and submarine tuffs, the whole attaining a thickness of over 9000 feet, and extending over many hundred square miles in New South Wales. In the bulk of these rocks Radiolaria are present at the rate of about one million to the cubic inch, and among the forms Dr. G. J. Hinde has recognised twenty-nine genera and fifty-three species. Taken as a whole, the deposits are fine-grained, and bear evidence of having been laid down in clear sea-water, beyond reach of any but the finest sediment. They do not indicate any very considerable depth of water; but they tell of a vast lapse of time, and of conditions which prevented the dispersal over the area of coarse detritus. What exactly were these conditions it remains for future research to discover. In this country, in Devonshire and Cornwall, the occurrence of radiolarian cherts, both of Ordovician and Carboniferous ages, has been made known through the observations of Dr. Hinde, Mr. Howard Fox and Mr. Teall. The more prominent of these rocks are found in the Lower Carboniferous formation of Coddon Hill near Barnstaple, where the chert-beds have long been known, although their organic origin was not until recently discovered. The freedom of the beds from mechanically-formed detritus has led to the supposition that these strata were deposited in deep water and at some distance from the coast, although the associated strata above and below the chert-beds do not lend support to the hypothesis. The fact is that at the present time the only extensive radiolarian deposits known to be in process of accumulation are in the deeper oceanic regions.

Radiolaria, while entirely marine, are widely distributed, and they can exist at various depths in deep and shallow seas. It may be surmised, therefore, that in shallower areas coral-reefs may have acted as barriers to the dispersal of terrestrial *débris*. Hence in our explanations of the physical conditions of the past we must be guided by the general characters of the sedimentary strata in which bands and beds of radiolarian chert occur, rather than by the evidence of the chert itself. There is, however, little doubt, from the wide distribution of these lowly forms of life, that they may prove of considerable importance in the identification of horizons, although, as might be expected from their present geographical and bathymetrical ranges, some specific types have been of long geological duration.

In the coast ranges in California, and again in Borneo, such radiolarian rocks of Jurassic, or possibly Lower Cretaceous age occur, and it is noteworthy that Dr. Rüst has remarked that "the differences in the Radiolaria from these two rock-divisions are not very striking." (See Hinde's "Description of Fossil Radiolaria from Central Borneo," 1899.)

The question whether the Wealden strata which are essentially freshwater should be grouped as Jurassic rather than Cretaceous has been raised by geologists in the New as well as in the Old World, who have argued that the Wealden plants, fishes and reptiles are Jurassic rather than Cretaceous in character. There has never been any question in this country that the Purbeck and Wealden Beds are intimately connected both stratigraphically and palæontologically, and it has been held by some geologists that locally the Wealden Beds and Lower Greensand bear also evidence of continuous deposition. The subject was lately discussed by Mr. G. W. Lamplugh (Brit. Assoc., Bradford, 1900), who points out that in Dorset, Hampshire and Surrey there is evidence of the close stratigraphical connection between Wealden and Lower Greensand, that part of the