

Anthracite may and does occur in sedimentary rocks of varied character, but, so far as my observation has extended, never in quantity in sandstone. In the Lower Silurian rocks anthracite occurs, both in the Old World and in the New, where no metamorphism has affected it, and where it is simply the normal result of the long continued distillation of plant tissue; but the anthracite beds which are known and mined in so many countries are the results of the metamorphism of coal-beds of one or another age, by local outbursts of trap, or the steaming and baking of the disturbed strata in mountain chains, numerous instances of which are given on a preceding page.

M. Mendeleff, in his article already referred to, misled by a want of knowledge of the geology of our oil-fields, and ascribing the petroleum to an inorganic cause, connects the production of oil in Pennsylvania and Caucasia with the neighboring mountain chains of the Alleghenies and the Caucasus; but in these localities a sufficient amount of organic matter can be found to supply a source for the petroleum, while the upheaval and loosening of the strata along lines parallel with the axes of elevation has favored the decomposition (spontaneous distillation) of the carbonaceous strata. It should be distinctly stated, also, that no igneous rocks are found in the vicinity of productive oil-wells, here or elsewhere, and there are no facts to sustain the view that petroleum is a volcanic product.

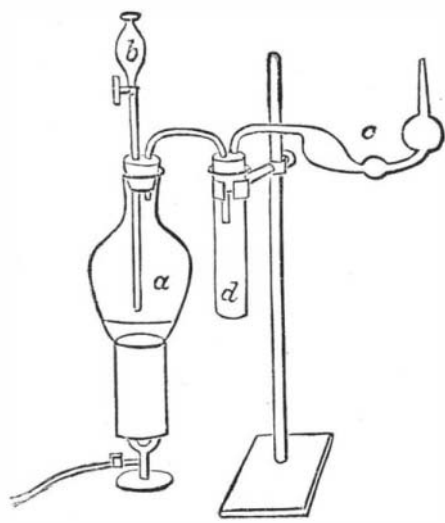
In the valley of the Mississippi, in Ohio, Illinois, and Kentucky, are great deposits of petroleum, far removed from any mountain chain or volcanic vent, and the cases which have been cited of the limited production of hydrocarbons in the vicinity of, and probably in connection with, volcanic centers may be explained by supposing that in these cases the petroleum is distilled from sedimentary strata containing organic matter by the proximity of melted rock, or steam.

Everything indicates that the distillation which has produced the greatest quantities of petroleum known was effected at a low temperature, and the constant escape of petroleum and carbureted hydrogen from the outcrops of bituminous shales, as well as the result of weathering on the shales, depriving them of all their carbon, shows that the distillation and complete elimination of the organic matter they contain may take place at the ordinary temperature.

ESTIMATION OF SULPHUR IN IRON AND STEEL.

By GEORGE CRAIG.

FOR wellnigh two years I have been estimating sulphur in iron and steel by a modification of the evolution process, which consists in passing the evolved gases through an ammoniacal solution of peroxide of hydrogen, which oxidizes the sulphureted hydrogen to sulphuric acid, which latter is estimated as usual. The *modus operandi* is as follows:



100 grains of the iron or steel are placed in the 10 oz. flask, *a*, along with $\frac{1}{2}$ oz. water; $1\frac{1}{2}$ oz. hydrochloric acid are added from the stoppered funnel, *b*, in such quantities at a time as to produce a moderate evolution of gas through the nitrogen bulb, *c*, which contains $\frac{1}{2}$ oz. (20 vols.) peroxide of hydrogen and $\frac{1}{2}$ oz. ammonia. The tube, *d*, is to condense the bulk of the hydrochloric acid which distills over during the operation. When all the acid has been added and the evolution of gas becomes sluggish, heat is applied and the liquid boiled till all action ceases. Air is blown through the apparatus for a few minutes and the contents of *c* and *d* washed into a small beaker and acidified with hydrochloric acid, boiled, barium chloride added, and the barium sulphate filtered off after standing a short time. A blank experiment must be done with each new lot of peroxide of hydrogen obtained, which always gives under 0.1 barium sulphate with me.

The whole operation is finished within two hours, the usual oxidation process occupying nearly two days; and the results obtained are invariably slightly higher than by the oxidation processes.

Until lately I have always added excess of chlorate of potash to the residue left in *a*, evaporated it nearly to dryness, diluted, filtered, and added chloride of barium to the diluted filtrate, but only once have I obtained a trace of precipitate after standing 48 hours, and the pig-iron in that case contained 8 per cent. of silicon, so that all the sulphur is evolved during the process. It has been objected to the evolution process that when the iron contains copper all the sulphur is not evolved, but theoretically it ought to be evolved whether copper is present or not; and to test the point I fused 3 lb. of ordinary Scotch pig-iron with some copper for half an hour in a Fletcher's gas furnace. No copper could be detected in the iron by mere observation with a microscope, but it gave on analysis 0.225 per cent. of copper, and on estimating the sulphur in it by the above process and by oxidation with chlorate of potash and hydrochloric acid, using 100 grains in each case, and performing blank experiments, I found:

By peroxide of hydrogen process..... 0.0357 per cent.
By oxidation (KClO_3 and HCl) process, 0.0362 "

so that even in highly cupriferous pig-iron all the sulphur is evolved on treatment with strong hydrochloric acid.—*Chem. News.*

THE AIR IN RELATION TO HEALTH.*

By Prof. C. F. CHANDLER.

It is only about one hundred years since the first important facts were discovered which threw light upon the chemistry of atmosphere. It was in 1774 that Dr. Priestley, in London, and Scheele, in Sweden, discovered the vital constituents of the atmosphere—the oxygen gas which supports life. The inert gas, nitrogen, had been discovered a year or two before. When we examine our atmosphere, we find it is composed of oxygen and nitrogen. The nitrogen constitutes no less than 80 per cent. of the atmosphere; the remaining 20 per cent. consists of oxygen, so that the atmosphere consists almost entirely of these two gases, odorless and colorless and invisible. The atmosphere is, however, never free from moisture; a certain amount of aqueous vapor is always present. The quantity can hardly be stated, as it varies from day to day and month to month; it depends upon the temperature and other conditions. Then we have the gas commonly called carbonic acid in extremely minute quantities, about one part in 2,500, or four one-hundredths of one per cent. A small quantity of ammonia and a small quantity of ozone are also present.

Besides these gases which have been enumerated, and which play an important part in supporting life in both the kingdoms of nature, we find a great many solids. Every housewife knows how dust settles upon everything about the house. This dust has recently been the subject of most active study, and it proves to be quite as important as the vital oxygen that actually supports life. When we examine this dust—and it falls everywhere, not only in the city streets, but upon the tops of mountains, upon the deck of the ocean steamer, and the Arctic snow—we find some of it does not belong to the earth, and, as it is not terrestrial, we call it cosmical. And when it falls in large pieces we call it a meteorite or shooting star. When the Challenger crossed the Atlantic, and soundings were made in the deep sea, in the mud that was brought up and examined there were found various little particles that were not terrestrial. They were dust particles that were dropped into the atmosphere of the earth from outer space. Then we have terrestrial dust, and we divide that into mineral and organic. The mineral consists chiefly of clay, sand, and, near the ocean, salt. Then we have organic matter. Some of this is dead leaves which have been ground to powder. Animal matter has also become dry and reduced to powder, and we actually find the remains of animals and plants floating upon the atmosphere, especially in the city. Examinations of the dust which had collected upon the basement and higher windows of a Fifth Avenue residence showed that the dust upon the basement floor was chiefly composed of sand. And the higher up I went, the smaller proportion of sand and a larger proportion of animal matter, so that the dust that blows into our faces is largely decomposing animal substance.

But we have a living matter in the atmosphere. We often notice in the summer, after a rain, that the ground is yellow. On gathering up the yellow powder and examining it under the microscope, we find that it consists of pollen. The pollen of rag weed and other plants is supposed to be the cause of hay fever. But we also have something far more important in the germs of certain classes of vegetation. The effects are familiar. If food is put away, it becomes mouldy. This mould is a peculiar kind of vegetation which is called a fungus, and the plants fungi. In order for this mould to develop on a certain temperature and a certain degree of moisture are necessary. Our food, we say, decays. Now, what we call decay is really the growth of these fungi. Animal and vegetable substances which these fungi seize upon are destroyed. All ordinary fermentations and putrefactions are due to mould fungi, yeast plants, or bacteria, and liquids undergoing these processes carry these fungi and their germs wherever they go. The refuse of the city pollutes the air. You have only to pass along any street to find more or less rubbish. That furnishes the nidus for the growth and development of these germs, and until we adopt better methods of getting rid of that refuse, we never shall have the air of this city in the condition that it should be.

One of the most constant sources of the pollution of the air in inhabited localities is the decomposition that takes place in the ground. Refuse of every kind gets into it. Our sewers are leaky, and putrefaction is constantly going on. The soil down to the limit of the ground water contains a large amount of air. This air, when the atmospheric pressure in the house is diminished, is drawn in with such organic impurities as it contains. A cement floor in the cellar is not a protection against this entrance of the ground air, for the cement is porous to the passage of air, but a remedy may be found by laying on the cement a covering of coal tar pitch, in which bricks are set on edge, the spaces between the bricks are filled with the melted pitch, and the bricks then covered with coal tar pitch. When the house is building, the foundation walls should also be similarly coated, outside as well as inside. Such a cellar floor was considered to be absolutely impervious to ground air and moisture. The lecturer had recently laid this floor in his own house with the greatest success. The atmosphere of the entire house is improved, and the expense is very moderate. Another source of the contamination of the air of houses is the heating apparatus. Stoves and furnaces, however well constructed at first, will, from the contraction and expansion of the metal, soon allow the escape of coal gas, and this danger is greatly increased by the use of dampers in the stove-pipe. When, to regulate the fire, the damper in the pipe is closed, the gases, having their passage to the chimney cut off, will escape through any cracks or openings in the stove into the room. Prof. Chandler, having kept a record of accidents from this cause, had accumulated a formidable list of suffocations due to the use of the damper. The danger was now somewhat lessened by providing dampers with perforations in the center, which allowed the gases to escape when the damper was closed. As regards the maintenance of pure air in houses, the preference was given to the open fire-place. The hot-air furnace deriving a supply of pure air from out of doors was, when properly constructed, a very satisfactory method of heating, but in city houses the mistake was often made of carrying the cold air duct of the furnace to the front of the house, where it was exposed to the dust of the streets. It should be taken from the rear end of the house, and carried some distance above the surface of the yard. It was an excellent expedient to insert in the cold air duct a wire screen to hold a layer of cotton to retain the floating impurities which might enter the air-box. This could be removed from time to time, and the cotton replaced. Steam heating has been objected to by many for reasons in no wise due to the apparatus, but to neglect in the use of it. The complaint

of closeness where steam is used is due to the fact that a room containing a steam radiator can be heated with every door and window closed, and no fresh air admitted, while with stoves and open fire-places a certain quantity of fresh air must be admitted to maintain the fire. Where radiators are used, the ventilation of the rooms should, therefore, be looked after. Again, the complaint that steam apparatus has an unpleasant odor is due to the fact that the radiators are allowed to become covered with dust, which is cooked, and gives rise to the smells complained of. The radiator should be from time to time cleaned. When these precautions are taken, no means of heating is more satisfactory than steam.

Sewer gas is another source of contamination; this is a very indefinite term, to which formerly many false and exaggerated properties of causing specific diseases were attributed. It is now, however, recognized to mean simply the air of sewers, generally not differing very greatly from common air, containing a certain proportion of marsh gas, carbonic acid, and sulphureted hydrogen, etc. No one of these gases, however, is capable of producing the diseases attributed to sewer gas. Careful research has shown that it is the sewage itself, containing germs of specific disease, which is added to the air in the sewer by the breaking of bubbles of gas on its surface, which is the cause of the diseases associated with sewers.

An intimate connection is believed to exist between the germs of sewer air and diphtheria, and probably also between sewer air and scarlet fever. This sewer gas is to be excluded from our houses by proper systems of plumbing, and to such an extent have these now been perfected, that there is no objection to having plumbing fixtures in all parts of the house. This opinion has lately been objected to in the *Popular Science Monthly*, as it was at a meeting of the Academy of Medicine last spring, but on wholly insufficient grounds.

The objectors all insist that a trap will allow sewer gas to pass through it, and the experiments made at the Academy of Medicine showed that sulphureted hydrogen gas, etc., would so pass. The advocates of the trap have never denied that the water seal would absorb gases on one side and give them off on the other, but they do deny that, in the conditions existing in good plumbing, such gases will be given off in quantities to do any damage, and they confidently assert that the germ which is the dangerous element will not pass the seal at all. Pumpelly investigated the matter for the National Board of Health, and in no instance was he able to make the germ pass the seal of the trap. It is now proposed to set up against the weight of this scientific testimony the results of an investigator in Chicago, whose work was at once appropriated as an advertisement by stock jobbing disinfectant companies in a manner which raises a suspicion that the investigation was made in their interest. He described tersely the essentials of good plumbing, the necessity of a trap on the house drain, the ventilation of the soil-pipe, and the ventilation of the trap against siphonage. Of the first, he said that it offered protection to each householder against the entrance into his house of the germs of a contagious disease which passed into the common sewer from the house of a neighbor. Were the trap dispensed with, the contagion in the sewer would have free entrance into the houses connecting with it.

Prof. Chandler, in conclusion, alluded to the cordial relations now existing between the Board of Health and the majority of the master plumbers of the city. He said that for himself his opinion of the craft had greatly risen during his intimate connection with plumbers the last two years. He thought the majority of the jobs now done in the city are well executed. He believed that the Board of Health had not been obliged to proceed against more than eight master plumbers since the new law went into force. He called upon the Association to adopt a "code of ethics," which should define what an honest plumber can do and cannot do, and he illustrated his meaning by citing an extraordinary case of fraudulent workmanship which had been recently reported to him. His remarks on this point were greeted with frequent outbursts of applause.

THE PLANTAIN AS A STYPTIC.

THE following abstract of a paper read by Dr. Quinlan at the recent British Pharmaceutical Congress, may prove of interest to medical readers in this country, where the plant mentioned is a common weed:

"About a year ago Dr. Quinlan had seen the chewed leaves of the *Plantago lanceolata* successfully used to stop a dangerous hemorrhage from leech bites in a situation where pressure could not be employed. He had searched out the literature of the subject, and found that, although this herb is highly spoken of by Culpepper and other old writers as a styptic, and alluded to as such in the plays of Shakespeare, its employment seems to have died out. Professor Quinlan described the suitable varieties of plantain, and exhibited preparations which had been made for him by Dr. J. Evans, of Dublin, State apothecary. They dried leaves and powdered leaves, conserved with glycerine, for external use; the juice preserved by alcohol, as also by glycerine, for internal use; and a green extract. He gave an account of the chemistry of the juice, from which it appeared that it was not a member of the tannin series; and also described its physiological effect in causing a tendency to stasis in the capillaries of the tail of a goldfish, examined with a microscopic power of 400 X. He regarded its styptic power as partly mechanical and partly physiological. The juice, in large doses, he had found useful in internal hemorrhages. The knowledge of the properties of this plant he thought would be useful in cases of emergency, because it could be obtained in any field and by the most un instructed persons."

BACTERIA.

BACTERIA, whether significant of disease or decline of health, are found more or less numerous in everything we eat and drink. The germs or spores of many kinds, known as *termo*, *lineola*, *tenuis*, *spirillum*, *vibriones*, etc., exist in almost infinite numbers; some of the smallest are too small to be seen by the highest powers, which, being lodged in all vegetable and animal substances, spring into life and develop very rapidly under favorable circumstances. They develop most rapidly when decomposition commences, and seem to indicate the degree or activity of that decomposition, also hastening the same. They are found most numerous in the feces, and usually fully developed in the fresh evacuations of persons of all ages. They may be seen plainly under a thin glass with high powers with strong or clear light, when the material is much diluted with water.

These bacteria appear almost as numerous, yet more slowly, in urine, either upon exposure to air or when freshly evacuated, when the general health of the individual is declining, or any tendency to decomposition. A diagnosis can

* Abstract of a lecture before the Master Plumbers' Association, New York, Nov. 2, 1882.