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(Illustrated articles are marked with an asterisk.)

A NEW THEORY OF THE FORMATION OF DIAMONDS

The natural history of the diamond is one of the puzzles of geology, the place of its origin being until recently as great a mystery as the manner of its formation. Happily, however, the first part of the problem has been solved; the diamond has been tracked home; and though the process by which it attained its crystaline isolation remains as obscure as ever, a clue, at least, has been gained to the conditions of its development.

We need hardly remind our readers that in South Africa diamonds are found under two very dissimilar conditions: first as water-worn pebbles associated with pebbles of quartz, agates, zöolites, and the other common attendants of the diamond in other localities; second, in circumscribed pits or shafts filled with a chalky or clayey earth, more or less hardened. The famous Colesberg Kopje is a fair example of the latter sort, several of which have been discovered in the Vaal River country. In all these cases, the diamond bed is surrounded by a rim of rock dipping outward from the center, but attaining within a short distance the horizontal position characteristic of the rocky strata of the district. Inside the rim or "reef," as the miners call it, the diamonds are found at home and untraveled; outside they are absent, or occur only in layers of gravel, itacolumite, or other products of running or dashing water.

That the gems within the shaft have rested undisturbed since their formation, save by the pick and shovel of the miner, is attested by the nature of their matrix, which at Colesberg has been mined to the depth of two hundred feet without any apparent decrease in the richness of the yield, by the sharpness of the edges and angles of the crystals; and still more by the tendency of the gems thus found to check, flaw, and even explode with violence on being brought to the surface and subjected to the action of light and air. No such accidents occur to diamonds found in drifts, for the simple reason that they are the survivors of a similar process of natural selection, all their sensitive comrades having been eliminated by exposure in past ages.

Obviously, if we can decipher the geological history of these singular diamond beds, a very long step will be taken toward the solution of the question how the diamond originated.

The record begins apparently at a time when the great interior basin of South Africa, in which they occur, was the bed of a vast inland sea. The physical geography of this region reminds one of our own Utah basin. There is first a mountain ridge from 4,000 to 10,000 feet high, roughly following the line of the coast, except where it crosses the continent toward the equator, broken only by the Orange and Limpopo rivers which drain the basin. Toward the sea the descent is abrupt, often precipitous; inward, the slope is gradual, sometimes almost imperceptible, the bottom of the basin lying several thousand feet below the average crest of the rim. Everywhere throughout the interior are abundant and unmistakable proofs of the former presence of water, filling the basin as a vast inland sea, at one time the scene of great volcanic disturbance, more recently of a process of desiccation like that which turned the Sahara from a sea to a desert, or that which dried up the sea of fresh water which, but a little while ago, geologically speaking, filled the now arid Utah basin to the brim.

The period of diamond production appears to have been while the sea prevailed, their distribution in the gravels resulting from the subsequent movements of water, to which the widespread gravel beds bear witness. While the sea yet filled the basin, volcanic action was going on more or less vigorously, evolving gases, rending the overlying rock, and producing all the other well known effects of igneous disturbance. Among the minor effects we can imagine the formation of vents or crates, to be filled, when the violence was passed, by the silty deposits of the sea bed, washed in by returning water.

Here, then, we have the conditions of future Colesberg Kopjes—*minus* the diamonds.

Let us follow the process a little further. A constant product of volcanic action, we know to be carbonic acid gas, which contains the basis of the diamond combined with oxygen—a gas capable of being liquefied by the pressure of a column of water less than fourteen hundred feet high, and the ancient South African Sea was several times that depth. We know that this same gas is frequently imprisoned in the soft mud of stagnant pools, where it lies unabsorbed, escaping as bubbles when the mud is disturbed. It is not unreasonable to assume that the less energetic discharge of this gas from the heated depths below the sea bed might be stopped in the muddy filling of the vents, where, liquefied by the pressure of the superincumbent water, it might remain until deprived of its oxygen by some process of Nature's chemistry, leaving the free carbon to crystalize as the sparkling gem so eagerly sought for by the miner.

This, of course, is a mere hypothesis, for we know of no process by which the oxygen could be so withdrawn; but in every other respect the supposition is based on known conditions, and there is apparently no other way in which the raw material of the diamond could be so readily distributed in crystalizable condition throughout these natural diamond factories. The matrix in which the diamonds are found is unquestionably of aqueous origin; and we know, from the vegetable and other substances found enclosed by diamonds, that they could have been formed only in the presence of water. The two seem, therefore, to be contemporaneous.

It is a well known fact also that diamonds sometimes contain cavities enclosing a transparent liquid. We have seen it stated, but are not sure of the authority, that diamonds of this sort have been broken and their contents found to be carbonic acid: a fact which, if true, would add materially to this new theory of their formation.

THE EXPLORATION OF THE LIBYAN DESERT.

Nearly a year ago the staid citizens of Leipsic gathered in crowds in their streets to stare at two queer-looking wagons which were remarkable for enormous hight, and which were slowly dragged through the city *en route* for the Austrian port of Trieste. These were the water carts of the great expedition, soon to start for the exploration of the Libyan desert under the command of the intrepid German traveler, Gerard Rohlfs, of Weimar, and under the liberal patronage of the Viceroy of Egypt. From the European journals of the day, we gleaned a brief account of what the explorers proposed to accomplish, which, in the first number of our last volume, we laid before our readers, mentioning, at the same time, the departure of the caravan for the oasis of Koufra, in the center of the desert. Brief notes of progress have since appeared, but in so disconnected a form that little could be learned from them. Mr. Bayard Taylor, in a recent letter to *The Tribune*, now states that the expedition has returned, and gives an outline of its journey into the interior of the vast but little known African continent.

By New Year's eve, the party had reached the oasis of Farafrah, hitherto unvisited by any European since Cailliaud in 1819. Here they celebrated the holidays, and astonished the natives by kindling a magnesium light; and then, after a rest of three days, started on the more arduous portion of their journey. A week's travel brought them to a sudden and astonishing change in the scenery, the chronicle of which reads more like a page from the Arabian Nights than a sober scientific statement of facts. "On both sides," says the writer, "arose detached limestone rocks, increasing in hight as they advanced, and assuming the wildest forms. It was a labyrinth of lions, sphinxes, pyramids, obelisks, even semi-human statues, extending for miles. Then followed a colossal gateway of rock, the summits of which were 1,500 feet high. When this was traversed, they entered a second and still grander labyrinth, terminating in a second gateway, the towers of which overhung the cleft between them. The way then widened; the tremendous walls of rock fell apart, and the path descended toward a sandy plain. In another hour there came a fresh surprise: the final descent to the level of the oasis lay before them; the vast, mournful, sandy landscape vanished as by a miracle, and wheat fields of deepest green, dark palm groves, white walls and minarets sparkled in the light of the sinking sun."

This was the oasis of Dakhel, a large area of garden land inhabited by 17,000 people. Near the town a large number of powerful springs burst from the earth, the water being at a temperature of 110°, and carried by irrigating canals over many miles of soil. A stratum of chalk underlies the whole oasis, and, wherever pierced, there a spring rises. This water, it has been supposed, came from the Nile; but the examination of the explorers upset the theory, and proved its derivation from an independent source.

Four days' journey from this favored region brought the expedition to a poor camel pasture, destitute of water or trees, which was believed to be the supposed oasis of Zerzoora. A further march of two days to the southwest showed that no further progress could be made. Nothing but mountains of shifting sand was before it: nowhere a foothold, even for the broad-footed camel. Several attempts were made to penetrate this terrible region, but without avail; so the expedition skirted along the sand sea to the northward, seeking a crossing place. This was found in lat. 25° 11′ N., and long. 27° 40′ E., and the locality was named *Regenfeld* (rain field) on account of a steady two days' fall of rain there encountered. Steering a course by compass and astronomical observations (there was not a vestige of a trail), the explorers continued onward. The weather, it is said, became unexpectedly cold, varying from 29° to 23° Fah. in the morning; ice was formed upon vessels of water. Finally on the 20th of February, the oasis of Jupiter Ammon in Northern Libya was reached.

The journey from Dakhel to this point occupied thirty-six days, during which period not a single well was reached, although a distance of 500 miles was traversed. The iron tanks carried contained a plentiful supply of water for men and beasts during all this time. When it is considered that no other traveled route in all the Sahara has a longer space than a seven days' journey without water, the possibility of penetrating almost everywhere by the aid of Rohlf's device becomes evident.

The oasis of Jupiter Ammon was found to have a depression of 100 feet below the Mediterranean level. From this point the expedition went to the great oasis of Kharjeh, 100 miles south and east, where photographs of the Egyptian temples were made. The inscriptions on these ancient monuments, it is said, give the names of eight Libyan rulers which have never hitherto been found recorded.

By April 15, the expedition had returned to Cairo, after traversing 1,700 miles of desert, two thirds of which distance was before totally unexplored. The oasis of Kufrah was not reached, nor is it believed that the same exists; and even if it did, the vast sand sea would prevent its practical connection with Egypt.

The results of the labors of the expedition are, in detail, said to be rich in scientific discovery. In general, however, the problem sought to be solved has only been negatively answered; that is, it is proved that the Libyan desert is absolutely uninhabitable, and cannot be explored without the most careful preparation, and good luck added thereto.

CAN YOU SWIM?

We do not mean: Can you swim for fun, or for sanitary refreshment; but can you swim for your life, with your boots on?

Swimming as an accomplishment is common; we should like to say common enough, but that would not be true so long as there remains a single individual who cannot swim at all, and unhappily such individuals are numerous. We can say, however, that swimming as an accomplishment is common compared with the art of swimming as a safeguard against drowning.

This is a distinction with a difference. There are multitudes, who are quite at home in the water in Nature's costume or with a light bathing dress on, especially when they know how far it is to the bottom and how far to the shore, who would go to the bottom with discouraging haste if suddenly pitched overboard in a strange place with their usual clothing on. The conditions are entirely different from those of ordinary swimming; and to one unaccustomed to the feeling and effect of clothing in water, the difference is very apt to nullify for the moment all his experience as a swimmer. The consequence is a sudden loss of self-control, which too often results disastrously, whereupon the friends of the victim marvel that such a good swimmer should drown so easily.

An accident of this sort occurred but a few days ago. The victim was the master of an excursion steamer, a good swimmer, his numerous friends say; yet when he found himself in the water unprepared for swimming, he acted as wildly as one wholly unable to swim. With all his swimming, he had probably never been in the water before in full dress; and the confusion of mind which ensued, when he found his limbs muffled with clothing, his buoyancy reduced, and all the usual conditions of swimming changed, kept him from making good use of the knowledge he possessed. So he tired himself and strangled himself with frantic struggles, and went to the bottom before a boat could reach him, though it was near enough to have saved one who could not swim at all, had he been cool enough to keep perfectly still.

The moral is plain. With all your swimming practice, don't neglect to accustom yourself to conditions such as you will be pretty sure to find yourself in should you ever have occasion to swim for your life. When you can keep yourself afloat with heavy boots on, when you can tumble out of a boat in ordinary dress and strip in the water, and not waste your strength in suicidal attempts to overcome the resistance of clothing that cannot be removed, then you can safely answer in the affirmative the question: Can you swim?

There is a forceful proverb about teaching old dogs new tricks. We do not imagine that many adults will act upon

the suggestion we have made. But the boys will, if they have half a chance. And we would urge upon parents the propriety of allowing their sons to vary their watery sports in the way we have described. They cannot put their old clothes to better use. We can say from personal experience that the boys will like the fun, and that they will never regret the saving knowledge they will gain by it.

Of course we would not exclude the girls from such knowledge, if circumstances are at all favorable. At least let them learn to make the most of the temporary advantage their clothing offers for buoyancy, and also how to relieve themselves of entangling skirts in case of emergency.

PROFESSOR HUXLEY AND HARVARD.

The rumor that the Faculty of Harvard University are endeavoring to secure Professor Huxley as the successor of Agassiz is making, it appears, quite a breeze among the English scholars. The *Academy*, one of the ablest literary periodicals, hopes there is no truth in the statement, and asks, "are the English universities so rich in really eminent professors, and so poor in money, that they can or must allow Professor Huxley to go to America to find leisure to work? . . . The universities are so rich that they could beggar the whole world. Will they allow themselves to be beggared by Harvard?"

We donot agree with our contemporary in its intimation that money would be the mainspring of Professor Huxley's action, should he consent to occupy Agassiz' vacant chair. The work of such men is not to be measured in pecuniary compensation, nor does it belong to any country, but to the entire world. We greatly mistake the spirit of our great modern investigators if, should they determine that they could accomplish greater ends and achieve greater triumphs in the cause of Science by changing their abodes to the remotest corner of the earth, either a feeling of patriotism or a desire to make money would deter them from accepting the duty. Professor Huxley's decision, we venture to say, will be based on the question of where he can do the most good, not on the matter of pecuniary gains.

DISASTROUS FLOODS.

The two heavy floods which have recently occurred at Eureka, Nev., and Pittsburgh, Pa., have been so terribly destructive to life and property that they may be fairly classed among the extraordinary calamities of the year. They are besidephenomenal in their nature, one being due to a greatly overcharged cloud breaking against a lofty range of mountains, and the other to the meeting of two vast masses of vapor which united in a deluge which is described as resembling the descent of a torrent. Both storms appear to have been local in destructive effect, although heavy rains and freshets have taken place over Ohio, Indiana, and Kentucky, and have everywhere caused damage.

The report of the Nevada deluge states that, within ten minutes after the beginning of the rain, Eureka was flooded. The water poured through the streets for half an hour, tearing up houses and uprooting trees, damaging property in the end to the extent of $100,000, and killing twenty people.

In Pittsburgh, the destruction was much more extensive. From the descriptions given of the rising of the storm, two great black clouds appeared at opposite points of the compass and slowly approached each other. Blinding flashes of lightning shot between them as they neared, until the gradually narrowing space appeared a mass of fire. The meeting was heralded by a terrible thunderclap, followed by a few heavy rain drops, and then down poured the deluge with fearful fury. Pittsburgh lies at the junction of two rivers, and its suburbs, built on the hillsides and valleys adjoining the streams, are traversed by gulches and natural water courses, which form channels for the rain to run off. Several ravines empty into Butcher's Run Valley, about two miles north of the center of Alleghany City, along which numbers of houses had been erected. Here the damage began, and the flood rushed down the bed provided for it by Nature, sweeping away everything in its path. In other valleys deluges appeared, working like disaster, and small streams suddenly became roaring torrents. Over one run, two new iron bridges and five wooden ones were carried off. Large salt works, refineries, and factories were destroyed, and barges and vessels in the rivers were torn from their fastenings and swept away. The total loss of life is placed at 219 persons, and a rough estimate places the pecuniary loss at $3,000,000.

Both floods, besides being owing to the phenomenal circumstances mentioned, were also greatly due to the situation of the towns, Eureka, at the foot of the mountains, receiving the deluge pouring down their sides; and Pittsburgh, also in a valley surrounded by high land, lay in the path of the torrents which naturally sought to empty into the rivers.

TIDES IN THE GULF OF MEXICO.

A correspondent asks us whether it be true that at Pensacola, Florida, there is but one daily tide, and inquires whether, if such be the fact, how it is that at Havana, Key West, and other points in proximity, the tides take place twice a day in the ordinary manner.

Professor Bache, in his coast survey reports, mentions that the tides of the United States are divisible into three distinct classes. Those on the Atlantic coast are of the ordinary type, ebbing and flowing twice in twenty-four hours, and having but moderate differences in hight between two successive high or low waters, one occurring before and the other after noon. Those on the Pacific coast also ebb and flow twice in twenty-four hours, but the morning and evening tides vary considerably in hight. The intervals also between successive high and low waters may be very unequal. The irregularities are due to the moon's declination, as, when the moon travels to the north of the equator, the vertex of the tide wave follows her, giving the highest point of one tide in the northern, and the highest point of the opposite tide in the southern, hemisphere. Hence,when the moon is in northern declination, the tide at any place in the northern hemisphere caused by her upper transit will be higher than that caused by her lower transit. This variation in the hights is called the diurnal irregularity, and has a period of one lunar day.

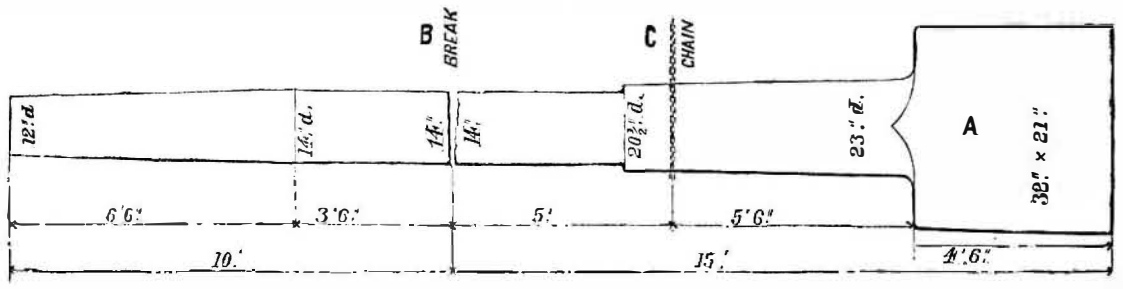
The effect of this phenomenon is to materially modify the tides, more especially on the Pacific coast and in the Gulf of Mexico. In the latter, however, the tides vary greatly according to locality. On the coast of Florida, from Cape Florida around to St. George's Island,near Cape San Blas,the tides are of theordinary kind,with a large diurnal inequality. From St. George's Island, in Appalachicola Bay, to Derniére Island, they happen but once a day, that is ebbing and flowing once in 24 hours. At Calcasieu entrance,the double tides reappear,and exist for some days about the period of the moon's greatest declination. The tides are double at Galveston. At Aransas and Brazos Santiago, the single day tides are at perfectly marked as at Pensacola. The probable cause of these discrepancies is the formation of the islands and entrances. If the tides arrive at the same place by two different channels, and one of them is retarded six hours behind the other by traveling a longer route or through shallower water, the semi diurnal tides will be destroyed through interference of the waves, the high water of one being opposed to the low water of the other; the diurnal inequality will, however, not be destroyed, but merely modified in hight and time, leaving a single tide in the lunar day outstanding, which is small in amount. This is doubtless the case at Pensacola, where the mean tide is but one foot, and the extremes of rise and fall one and a half feet and four tenths of a foot.

In this connection, we may add that to the difference in tides of the Atlantic and Pacific oceans is due the erroneous idea that the level of the latter body of water is the higher. At Panama the tides rise over twenty feet, while at Aspinwall about as many inches is the limit. The mean tide, however, of both oceans is the same.

FRACTURE BY LONG-CONTINUED JARRING.

In one of the articles recently published in the SCIENTIFIC AMERICAN, the well known fact, that a long continued succession of even moderate shocks, or jarring, sometimes produces rupture in even large masses of iron, was illustrated by the account of the breaking of one end of a very large shaft at the Morgan Iron Works, while the other end was under the hammer. We are now indebted to the same authority for the account of a similar incident, which occurred at the West Point Foundery some months ago.

In forging masses of iron of such shape that they are difficult to handle, it is usual to weld to them a porter bar, by which they can be moved about conveniently until they are nearly finished, when the bar is cut off and laid aside until again required for a similar purpose. The same bar is often kept in use many years.



The above sketch represents a porter bar thus used at the West Point Foundery, as nearly as can be ascertained, about twenty years. The large mass of iron, A, measuring, in section, two feet eight inches by one foot nine inches, and four feet and a half long, weighing over four tuns, could not well be handled on account of its weight and its awkward shape. This porter bar was therefore welded on it, as shown in the sketch. The whole mass was then slung by the chain, in which it was nearly balanced when the point of support came at C, ten feet from the larger end and fifteen feet from the smaller end. While the hammer was at work upon the forging, the bar suddenly broke at a point ten feet from the smaller end, B.

The appearance of the fracture is described as highly crystaline and a clean break. The piece thus broken off weighed, probably, a tun and a half. The force which, applied at the extremity, would have been required to break it off by a steady pressure, would have been at least twelve tuns. The cause of this remarkable accident is, as has already been explained, the gradual separation of particles by successive shocks, each of which forces them a minute distance beyond the limit of elasticity. This action continually repeated must, sooner or later, produce rupture. although the effect of each shock is quite imperceptible to the senses. The most singular and least understood phenomenon is the structure of the metal at the surface of fracture. It is by no means well established that what are described as crystals are true crystals, or even that wrought iron can have a crystaline structure under any circumstances, as a crystal has usually, if not invariably, definite axes and facets, making fixed angles with each other, and the crystal, as a whole, is without a semblance of ductility. This phenomenon is not an uncommon one; but it is not yet well understood, and demands careful investigation by the use of the best known appliances and the application of scientific methods. The subject is one of great importance. The breakage of railroad axles in this manner has probably sacrificed many lives and much valuable property.

Could it be definitely ascertained what amount of deformation carries those particles which are most strained beyond their limit of elasticity, and could rules and formulæ be obtained which should express the existing relation in such cases, between the resisting power of the material and the forces of impact and inertia which thus attack it, a most valuable addition to our knowledge would be made. At present we can only adopt, as a general principle, the rule to make parts, exposed to shock, of such form as will distribute resistance as uniformly as possible throughout the piece, and to adopt every practical method of reducing the violence and frequency of shocks and jars. The most elastic materials are best fitted to withstand this kind of stress.

ENGLISH FOOD ADULTERATION.

The English Adulteration Act imposes a fine for the selling of any adulterated article as pure; and also provides that any mixed materials, such as mustard, cocoa, etc., shall be designated by a label setting forth the fact. A large number of dealers have attacked this law, stigmatizing it as unfair and coercive, and a parliamentary committee is now inquiring into its workings. The evidence thus far adduced is not only interesting in itself, as showing the many falsifications of the commonest articles of food, but is of especial importance to American dealers, inasmuch as it is stated that it is a common practice for the owner of a spurious article on the other side of the Atlantic, on finding that it is in danger of seizure under the law, to lose no time in getting it aboard a steamer for New York. In this way, it appears, from the statements of the New York *Herald's* London correspondent, that shipments of spurious teas, adulterated wines and spirits, and fraudulent packages of Roman cements, together with a number of other commodities, all more or less adulterated, find their way to our markets.

Tea is doctored in order to improve its appearance, increase its bulk, and add to its weight. For the two last mentioned purposes, finely ground quartz and iron or steel filings are employed. Catechu gum, an astringent substance, is also used, but the favorite ingredient seems to be "lie" tea, or old tea leaves once used and then worked over. This is mixed with low grades of new tea, and placed in cylinders under steam, together with a quantity of carbonate of magnesia, Dutch pink, and Prussian blue. The adulteration with "lie" tea is usually done in China before export, but the "facing," as the coloring is termed, is performed by people in England who become skilled in the fraud as a business. The dealers face the tea to render it b ack or green, according to the desires of customers. Out of 170,000,000 pounds of the commodity annually consumed in England, it is asserted that one fifth, or about 35,000,000 pounds, is open to suspicion.

British wines, according to the testimony of several analysts, are largely adulterated with potato spirit; sherry is doctored with sulphuric ether, and to other liquors fusel oil and French treacle or brandy, which is often nothing more than beet root spirit colored and flavored. Beer is now comparatively pure, and the main adulteration is simply water.

In butter, often as much as forty per cent of water is found; patents have recently been obtained for a compound called "butterine;" and two other artificial mixtures, known as "Australian" and "Dutch" butter, have appeared in the markets. The Australian stuff is bone fat extracted by steaming refuse bones. It sells for fifteen cents per pound, and smells horribly. Dutch butter is a mixture of genuine butter and American lard. There is, beside, a French butter, compounded of drippings and kitchen stuff colored with annatto.

Corn flour, a material largely used for food for children, is described as generally worthless and unhealthy. Thirty-three out of seven thousand grains, a pound, one analyst states as the proportion of nutritious matter contained, where there should be at least eight or nine hundred grains. The article is nothing more than starch, a fact proved by the circumstance that a dog fed upon it died of starvation.

Other well known adulterations in bread and milk are noted; but as these commodities do not come under the head of possible exports, allusion to them is unnecessary.

J. H. says: "Please call the attention of your numerous readers to the great danger of buying cheap cans, for fruit, vegetables, etc., as a mixture of lead and tin is used for their manufacture (instead of the bright tin),by unprincipled manufacturers."

IT is only by the thorough study of details and their mastery, that one can hope to attain eminence or position in any profession.—*Graham Smith.*