frequently show their unfamiliarity with Nature by repeating the old objections to any admission of breaks in the record of the rocks, apparently unconscious that the present scope of geological knowledge is as limited, geographically viewed, as the range of universal history was a century ago, or that it is simply absurd to argue as though what is known of the earth's history is the whole of that history. Even if we had, duly arranged in our cabinets, every fossil the world contains, we should still fall as far short of a connected history of life as our libraries do of a history of humanity.

From the necessary conditions of the case, it is and must always be simply presumptuous to make sweeping assertions of what may or may not have been, in the absence of positive evidence. We can only assume that the unknown most probably conformed to the known in general character: that, if there is found in any region a sudden accession of vestiges of high civilization, it is more likely that a civilized people suddenly invaded that country and took possession of it, as the whites have this country, than that a peculiar civilization came suddenly into existence by direct creation. And similarly, if we find a stratum of rock suddenly (geologically speaking) filled with the remains of a higher form of life than the underlying strata showed, it is more reasonable to attribute the change to migrations, such as we have evidence of, than to creations, of which we have no evidence. And when all the evidence we have points to the evolution of higher types of civilization or of life from lower types: and since we know that, in our histories of earth and man, the unrecorded periods clearly exceed enormousiy in duration those of which we have even partial records; it is altogether more prudent to be modestly guided by the known than to give ourselves up, as the unscientific are prone to do, to wild imaginations and the traditions of those whose means of knowledge were demonstrably inferior to ours.

THE STEREOSCOPE.

We are indebted to the late Sir Charles Wheatstone for a series of investigations on binocular vision, which finally culminated in the invention of that now very popular little apparatus, the stereoscope. It was in 1823 that Wheatstone called attention to a fact until then hardly noticed, namely, that the perception of relief in objects is the result of the superposition of the images, one on each eye; but these images slightly differ from each other. The mind, guided by the experience of many years, receives in this way the impression of various distances; and Wheatstone discovered that this impression may also be given to the mind by two pictures if each is drawn so as to correspond, respectively, to the image received by each eye. In order to prove this, Wheatstone invented the stereoscope. Considered from the standpoint of pure Science (apart from its practical application for amusement, instruction, and research, and the binocular microscopes and telescopes that have grown out of it) this discovery of Wheatstone's is perhaps as interesting as any other invention of recent date, not excepting the kaleidoscope, the telephone, the pseudoscope, and the revolving mirror for measuring the velocity of light, etc. Sir David Brewster, who was erroneously supposed by many to have invented the stereoscope, used often, while insisting on the importance of this new conquest in physical science, to describe this instrument unhesitatingly as the most remarkable gift with which the study of binocular vision had been enriched.

The first stereoscope by which Wheatstone demonstrated his discovery was a reflecting stereoscope. Two vertical mirrors were placed so as to make, respectively, an angle of 45° with the axes of the eyes, and in such a position as to reflect the rays coming from the right and left into the eyes, the mirrors being joined at a middle point between the axes. Two perspective drawings, correctly made, so as to correspond with the image which the real object would make in each eye, were then so placed, at the right and left, as to cause these images in the mirrors to coincide in the act of vision, and the illusion was perfect. Wheatstone found later that he could dispense with the mirrors and simplify the apparatus by using two prisms, to which he had lenses attached so as to magnify the drawings. Brewster finally had prismatic lenses made, joined by their thinnest edges, by which small drawings, placed at the distance of, say, three inches, could be made to coincide for the vision. It should, however, be mentioned that Duboscq, of Paris, was the first to give to the stereoscope the simple practical form in which it is now seen in the trade; but its popularity did not become established until photography came to its aid, to make binocular pictures perfect in all their details.

It was at the first universal exposition, in London, in 1851, that Duboscq exhibited a stereoscope, and then for the first time the instrument became noticed by the public, although it had been known to scientists for 13 years, during which time Dr. Carpenter and others had continually, in lectures on physical sciences, exhibited the instrument and demonstrated the principles of Wheatstone's discovery. According to the statements of one manufacturer of optical instruments, a long time elapsed before the people began to appreciate the beauties of the stereoscope; and for several years no sales of any importance could be made. But at last its merits were realized, and suddenly a large demand sprung up. The stereoscope soon became in fashion; and the manufacture of the different forms of the instrument (varying in price from 50 cents to $100). the grinding of the prismatic lenses, and the production of the photographic pictures (on paper and on glass) have now become an important branch of business, in which thousands of artists and workmen are occupied.

A recent application of the spectroscope, especially useful for the student of Science, consists in the reproduction of drawings of geometrical figures, illustrating the various forms used in the study of stereometry, such as the projection of solids in descriptive geometry and spherical trigonometry, and especially in crystalography. In the latter science, it may be made especially useful, as, in this way, not only the crystals themselves, but also the forms resulting from the interpenetration of two crystals, may be explained better than can be done in any other way. The relation of various systems of crystalization, the transition of one form into another, the relation of the nucleus to exterior forms, the directions of cleavage, the position of axes of crystalization, the laws of double refraction, and various other more or less intricate subjects may thus be made simple to the average understanding: and these studies may awaken some interest in this important subject, and simplify it to those who cannot afford to buy the expensive and bulky models of crystals. A number of stereoscopic pictures may thus be made equivalent to a collection of models costing as many dollars as the pictures cost cents.

ARTIFICIAL BUTTER.

There has been for some time past a prevalent impression that, if the manufacture of artificial butter has not died out, at least no product of this description is now industrially made which has any standing in the market, or which cannot, by any one, be properly distinguished from the genuine article. It is true that the public, both in this country and more especially in England, has had placed before it in the newspapers more records of failures in artificial butter making than of the successful efforts therein; and these, together with the popular prejudice which exists against the material, are sufficient, perhaps, to account for the general impression referred to. The facts, however, we are assured by competent authority, are altogether against any such conclusion, for quite recently no less than fifty artificial butter factories were counted in this city; and large quantities of artificial butter are sold in the market by wholesale dealers, or are purchased direct from the manufactories by large retailers, and offered to the customer as genuine butter. There is, of course, a duplicity in this business which is reprehensible; but if people cannot distinguish the made from the natural product, and if the former is, as reported by Professor Chandler, actually more healthful than the average cow butter sold, it would be difficult to prove any damages save to the moral sense to all, and to the over-qualmish prejudices of a part, of the community.

It will be seen furthermore that, the above being the case, the problem of succesfully producing the imitation product has been solved, and in that we may recognize an important step in scientific progress, which it is worth while to consider briefly in the light of previous efforts. As the successful process is based mainly on the invention of Hippolyte Mège, patented in this country in December 1873, the previous patents, obtained by Bradley in 1871, and by Peyrouse in the same year, as well as that taken out by Paraf in April, 1873 (which last is charged to be a piracy of Mège's ideas) need not be referred to. The best points of Mège's invention are found combined in the reissue of his patents, dated May 12, 1874, and among them these two essential and important operations, namely, the extracsion of the oil from the fat, at a low temperature, and the conversion of the oil, by churning with milk, into butter. The caul fat, being washed, is hashed, melted in a water bath at 125° Fah., and, after becoming separated from the membrane, is allowed to solidify. It is then pressed, and the oil treated in different ways according as the resulting product is intended for immediate or future use. It will suffice here to say that the product thus obtained has a grain, and seemingly has no resemblance to genuine butter save in color. With reference to the many other patents issued since the date of Mège's, it may be said that, as a rule, the common defects, of grain, lack of savor, and inferior keeping quality, are present in all; and the products may more fairly be described as chemically prepared tallow than as butter.

The above statements are made on the authority of Dr. Henry A. Mott, E. M., a promising young chemist of this city, who for some years back has been engaged in investigating the subject we are here examining. His researches have included the actual manufacture and testing of the various compounds patented; and their result is found in the present, or "true," as he terms it, process for producing artificial butter. To Dr. Mott belongs the credit of this discovery, although the ownership of his process is in the hands of others; and its salient feature is that he produces, not tallow disguised as butter, but butter itself. This will be seen at once from the fact that chemical analysis of cream butter gives water 12·29. and solids 87·71 parts per 100: of artificial butter, water 12·005, solids 87·995. The amount of casein in the artificial product, the detailed analysis shows to be a little higher than in the natural butter (0·745 to 0·19) but not sufficient to make any difference. Comparing the fats proves that there is a very small amount of butyrin in the artificial product, and herein lies the chief disparity: which amounts to an absolute virtue, because, while sufficient butyrin exists to afford the necessary odor and flavor to the artificial product, there is not enough contained to render the butter rancid by decomposition.

Dr. Mott's process of manufacture is as follows: The fat, after being weighed, is thoroughly and repeatedly washed in tepid and cold water. It is then disintegrated in a meat hasher, and forced through a fine sieve. Next, it is placed in the melting tank, which is surrounded by water at 116° Fah., and there kept until the temperature of the fat reaches 124° Fah. During this process the material is constantly stirred. After the scrap has settled, the clear yellow oil is drained off in cans, and left for from 12 to 24 hours in a room at 70° Fah. to granulate. The refined fat is now packed in cloth into small packages, about 8 inches long by 1½ inches thick by 4 inches wide, and these are placed on metal plates, and piled one above another in a press. Gradual pressure is applied, when the oil is driven out, and cakes of pure white stearin left. The oil, being cooled to 70° Fah., is next churned with sour milk, annatto. and soda, 100 lbs. of oil being used to 15 or 20 lbs. of milk, 3 ozs. of annatto solution, and ¾ oz. of bicarbonate of soda. The mixture is agitated for ten or fifteen minutes, and then led into a tub of pounded ice, with which it is thoroughly mingled. This process completely removes the grain. After the ice melts, the solidified oil is crumbled, and 30 lbs. of it are introduced in a churn with 25 lbs. of churned sour milk. Here it takes up a percentage of the milk, as well as the butter flavor and odor. Lastly, the butter is worked and salted in the usual way, and is packed in firkins, etc., for the market.

Hon. X. A. Willard, President of the New York State Dairymen's Association, an able butter expert, admits his surprise at the flavor, and declares the butter the best yet made. The cost of manufacture is about 13 cents a pound, the selling price 25 cents to wholesale dealers; so that, so far as the saving is concerned, there is very little, over the cost of genuine butter. The economy, however, would doubtless become manifest were the people willing to accept the material for what it is, and thus enable the industry to become established on a broader foundation.

Dr. Mott's report on artificial butter, recently read before the Chemical Society of this city, contains complete details of his processes, together with a review of those previously patented, besides full chemical analyses, complete estimates, and plans for a factory capable of producing 500 lbs. of butter daily, and drawings of apparatus, etc. This valuable paper, too lengthy for these columns, appears in full in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 48 and 49, current volume.

THE SALT BLUFFS OF VIRGIN RIVER, NEVADA.

The mineral wealth of Nevada is by no means confined, as many may suppose, to Big Bonanzas and similar stores of precious metal hid within its seemingly barren mountains. In many places its sterile plains—the beds of recently evaporated seas—are underlaid with extensive strata of cruder though possibly not less important commodities, among which common salt is certainly not the least valuable.

Perhaps the most important of the formations of this character are the vast deposits of rock salt along the valley of the Rio Virgin, in the southeastern corner of the State. Their discovery is quite recent. Lieutenant Wheeler, in charge of the survey of the region west of the 100th meridian, first visited their neighborhood in 1869, and again two years later, at which time the only indication of their presence appears to have been a curious natural well, which Mr. G. K. Gilbert describes and figured in his report on the geology of those parts. It lies near the confluence of the Rio Virgin and the Colorado, in a smooth gravelly plain sloping gradually toward the latter, and presents a round, craterlike opening nearly three hundred feet across at the top. The sides are of unconsolidated *detritus* horizontally bedded, the upper thirty-five feet being of half-sorted gravel and sand, and the lower fifteen feet of saline sand showing a slight efflorescence. At fifty feet below the land surface is a water level about a hundred and twenty feet across, and below the water the slope of the bottom can be seen continuous with the bank for fifteen or twenty feet. The water is too salt for drinking. There is no sign that the well ever overflowed, the water is not thermal, and no marks of geyser action are to be seen. Mr. Gilbert suggests that the well might have been opened by the solution of a salt deposit, which is extremely probable in view of the vast extension of saline strata along the river valley.

A correspondent of the San Francisco *Chronicle*, who lately made a special visit to the salt quarries now being opened up at various points from six to twenty miles above the Colorado, reports that the rock salt occurs in "mountains," and is quarried like marble or granite. The salt mountains begin about six miles from the mouth of the Rio Virgin and extend along its valley a distance of thirty miles. For the first six miles or so, the salt rock appears like common coarse gray granite, and is said to contain 92 per cent of pure salt.

The quarries here lie along the east side of the river and within half a mile of the river bank. On the western side, twenty miles up, the salt is as white as snow on the surface but beautifully transparent within. The blocks of salt thrown out by blasting look like cakes of clear ice, so crystalline that fine print can be read through several inches of it.

The Rio Virgin is a muddy turbulent stream about a hundred feet wide and very shallow. Where it joins the Colorado, the latter is perhaps seven hundred and fifty feet wide and from ten to fifty feet deep at low water. The head of navigation is at Collville, twenty-five miles below, but small barges of a few tuns burden are towed up to the mouth of the Virgin for cargoes of salt for supplying the mines of El Dorado cañon and elsewhere. The Virgin joins the Colorado at a point six hundred miles above its mouth, and about fifty miles below the outlet of the Grand Cañon. The region about the salt mines is altogether barren and desolate.

PAINTING the surface with ink soon relieves the pain of a small superficial burn.