THE PLAN OF CREATION.

A LECTURE BY PROFESSOR AGASSIZ.

[Reported for the Scientific American.]

After a few preliminary remarks the lecturer said. The animal life of our globe shows that it has been formed with the design of bringing forth man as its last and highest creation. The history of the earth during those inconceivable periods of time before the human race was created has been traced by the united labors of astronomers and geologists.

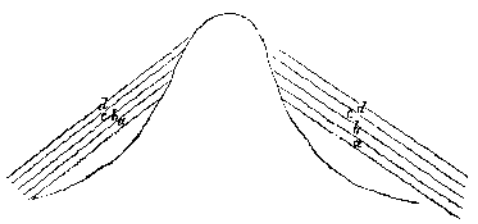
By the theory of Laplace, which is now generally accepted, it is supposed that the solar system once existed as a nebula, a vast distended flat mass of fiery particles of matter, revolving upon its axis. As it cooled it contracted, and threw off rings upon its outer edge, like the rings of Saturn. These were then drawn together into globes of molten matter

Between the time at which the astronomical history ends and that at which the geological begins, there is a period which has not been examined, because there is no man competent to undertake the investigation. As frequently happens in science, we must wait for another generation to be educated for this work; for, learning the art of investigation is the labor of a lifetime.

Geology finds the earth in a state of igneous fusion. In examining the rocks of the earth we find that they consist of two classes. Those of one class are formed in layers like the leaves of a book, while those of the other class are simple masses without stratification.

The stratified rocks were formed by being deposited at the bottoms of seas and lakes. Let me present some of the evidence by which this fact is known. All except the very oldest of the stratified rocks are filled with animal remains—especially with shells. Now we find these shells always lying upon their broad surfaces. If a shell falls through water and rests upon the bottom, it will not rest upon its edge, but upon its side; and the fact that the shells contained in the rocks always have their broad surfaces parallel with the planes of stratification is one of the proofs that these rocks were deposited in water. Many of these rocks now lie in a slanting position upon the slopes of mountains, but as we find the shells which they contain with their broad surfaces parallel with the planes of stratification we have no doubt that these rocks were formed and hardened in a horizontal position.

The stratified beds have been raised into a slanting position by the rocks from below being pushed up through them. This diagram may represent a mountain. The



central mass is of unstratified rock, with the stratified rocks lying upon its sloping sides in this manner. We know that these rocks have been raised in this manner, not merely from the broad surface of the shells being parallel with the planes of stratification, but also from the fact that we find the same kinds of rock lying one upon another in the same order on both sides of the mountain. The rock, *a*, upon this side corresponds with the rock, *a*, upon that side, the rock, *b*, on this side, with the rock, *b*, on that side, and so on.

When the unstratified rocks were forced up among the rocks lying above them, they were in a state of igneous fusion. This is shown in the fact that they have run into and filled the crevices and cavities in the stratified rocks, which they certainly could not have done if they had been in a solid state. The fact is farther proved by the alteration which they have made in the portions of the rock with which they came in contact. We know that if marble is put into the fire it will be reduced to quick lime; and that if sandstone is highly heated it is formed into coarse glass. The effects of heat upon rocks of various kinds is well known, and we find these effects wherever the mass from below has broken through the stratified rocks. There can be no doubt that that mass was in a state of igneous fusion.

All over the world the highest mountains have been raised up since the lower ones. The oldest mountains on this continent are the Capotian, extending in an easterly and weserly direction north of the great lakes. The Appalachian chain is older than that of the Rocky mountains. So in Europe, the Alps are newer than those of less elevation. This is what we should have expected if we had reasoned on a sound basis. When the hard crust of the earth was comparatively thin, it would yield to a slight force of upheaval, but as it became thicker from the gradual cooling of the globe, it would require a greater force to break it up, and, consequently, the forces accumulated and produced proportionably greater effects.

When we find one rock which has unquestionably been deposited upon another rock, it is manifest that the one lying below was formed first; and thus we are furnished with sure evidence of the relative ages of the rocks. The successive layers of rock are like the pages of a book, arranged one after another in regular order.

Now let us take a general view of the history of animal life, as preserved in this record. The rocks of the earth are naturally divided into several classes, resting one upon another in the order represented on this table:—

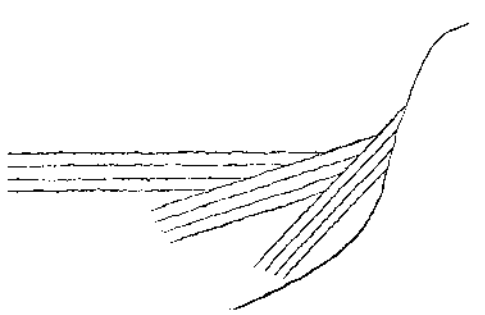
	Radiates.	Molusca.	Articulates.	Vertebrates.		
Recent						Mammals.
Pleocine					Birds.	
Meocine						
Eocine						
Cretaceous				Reptiles.		
Jurassic						
Permian						
Carboniferous						
Devonian						
Silurian				Fishes.		
Unstratified						

At the bottom we have the unstratified rocks—granite, scienite, trap, &c., and above these the stratified rocks named generally from the localities in which they come to the surface.

The lowest of the stratified rocks contain no animal remains, and are therefore called azoic. But in the silurian we find all four orders of animals; the radiates, of which the starfish and the coral are samples; the moluscs, to which the oyster and clam belong; the articulates, embracing the lobster and all insects; and even the vertebrates are represented in certain low forms of fishes. This commencement of the creation of animal life upon these four modes of structure shows the formation of a determined plan from the beginning—a plan that embraced the creation of man as its final culmination.

The three lower orders are represented by all the classes which now exist, but at the beginning there was only one class of vertebrates, the fishes, after a a long time the reptiles were created, then birds, and finally mammals, to which class man belongs. The lower orders are not represented in the older rocks by the same species which now exist, but even in these there has been some degree of improvement—a general tendency to a higher and more complex structure.

The several species have not been gradually developed one out of another, but in each case a new creation has succeeded to the old. This diagram repre-



sents the manner in which the different rocks rest one upon another on the sides of mountains. The rocks nearest the the mountain being the most inclined in this way, then other rocks lapping over them and less inclined, till we come to the upper rocks, which are generally horizontal or nearly so. As the shells in these rocks and other evidences prove that they were all deposited in a horizontal position, it is evident that they have been inclined one after another by successive upheavals of the mountain. The injection of a vast mass of matter in a state of igneous fusion must have destroyed all animal life in the adjacent waters, rendering a new creation necessary. The persistent following of the same plans through all of these successive creations shows the existence of a preconceived design. In my next lecture, I will examine the progress of animal creation more in detail, this lecture being intended as a general introduction to the subject.

Science a Civilizer.

Dr. J. Buller at a recent meeting of the Southampton Microscopical Society, said:—The social aspect of our society commends it. It is a pleasant way of spending an evening where there is a scientific object of natural interest, and, at the same time, a social gathering of many having the same tastes and objects, and, therefore, the same sympathies. The anatomy of an insect, too, is a more harmless occupation than the minute dissection of a neighbor's natural history. Tea and coffee, pleasant chat with those of like tastes, and then the table covered with microscopes and specimens explained by one and passed round for each to examine, calling out animated talk on subjects worth discussing, or a short paper read and discussed on the subject illustrated, are civilizing. For science is a civilizer. It refines the tastes and elevates the thoughts, as it is the search after truth for truth's own sake. And in this age, when the progress of the nation and of the world is estimated by the money-value of exports and imports (and in this aspect the world's progress is prodigious and annually increasing), the danger must lie in estimating all things in reference to money rather than to truth. Now, science is a counteracting force. It neither brings wealth to its true cultivators, nor can wealth buy scientific tastes or scientific fame. It belongs to a higher region than "the diggings." It must breathe "a purer ether, a diviner air." And those who are engrossed in commerce would often do well, for their own content and happiness, by seeking in the recreations of science a complete change of action, thought, and feeling. Obviously the eye service which the microscope requires, trains the eye to minute and discriminative observation, and the hand to delicate accuracy. It leads on, if used scientifically, to the improvement of the scientific powers. The memory, the investigation of causes, the estimation of evidence, the power of distinguishing and of generalizing may be called into activity. But the mind has other and deeper needs than these. The senses lead to the awakening and culture of deeper powers inherent in the soul itself, and the microscope may excite and cultivate, not only the sense of the true, but of the beautiful. Constable, the landscape-painter, said that, pictorially, nothing in nature was ugly; and surely we may say the same microscopically. The higher the magnifying powers, the more minutely extensive the investigations, the more beauty do we see. Even in the unhealty secretions—in what look to the unscientific eye like repulsive fluids, in the very disorganizations which slowly ruin this goodly human frame, the microscope discovers forms of the highest geometrical accuracy, as well as of the most delicate beauty. And this beauty and consummate finish are everywhere, and are found farther and deeper as our powers increase of observing them. Here, too, at every step we find the limitation of our own powers, and the illimitable field of nature; the infinite contrasting with the finite teaching us the moral lesson of science—humility.

PAINTING WITH ANILINE COLORS.—Professor Seely, in the last number of the *American Journal of Photography*, says—"The aniline colors may be used for painting albumen photographs. These colors are all soluble in alcohol and being thickened with the proper spirit varnish are especially suitable for painting transparencies on glass for the magic lantern and other purposes. There are no colors more dazzlingly bright than the aniline dyes, and they are as permanent as any others of a similar tint."

THE *Lake Superior Miner* states that $100,000 of silver is obtained annually from the copper mines.