

EVOLUTION

Depression Spurs Evolution

Today's Economic Depression is Trivial Compared With Geologic Hard Times That Hit the Earth Often

By DR. FRANK THONE

DEPRESSION is a word of harsh and hideous sound to the ears of most of us just now. To those who "holler" loudest, it means at least temporary deprivation of accustomed luxuries. To those who have been saying least, it means the grim endurance of bitter want. But to all of us the idea that depressions have been the world's great spur to progress, that successive hard times have been a series of evolutionary sieves to sort the fit from the unfit, hardly comes at first as at all a cheering gospel. Each of us, nursing his own trouble and making it seem as big as possible, may be too apt to see himself as among the lost, the non-survivors.

But there is at least one philosophic scientist, Dr. Carey Croneis of the University of Chicago, who looks back over the earth's immensely long geologic history and sees in it the same moral that the more thoughtful historians and economists have been finding in the story of our own briefer, more rapid pulse of financial booms and slumps. Resolutely he tells us that through the millions of centuries, hard times have been good times, and good times really bad times in disguise. Geologic history has repeated itself over and over in an ever-ascending spiral: a cosmic depression has scourged the planet, eliminating inflated stocks, trimming the chastened survivors to the bone and sending them forth fitter, more alert, more able to take advantage of the returning better times. But the better times have betrayed those who trusted them too much, luring them into overdevelopment and too-optimistic expansion, so that when the next crash came—as come it always did—down they went in their turn and the cycle repeated itself.

"Even the continents have had their ups and downs," Dr. Croneis writes in the *Scientific Monthly*, "and of course their areas have changed remarkably throughout the past. They have presented bold, swashbuckling outlines when they stood high, but they have made sorry, attenuated showings during their

periods of depression. Old Mother Earth has indeed suffered many vicissitudes. Her facial expression is one of great mobility. Although the changes are ordinarily too slight to be noted by the casual observer, the geologist knows that during the long geologic past her face has been wrinkled where now it is smooth, and unmarked where now it is deeply furrowed. As amanuenses to the 'Old Lady' the geologists also know that she still entertains young ideas. She has surreptitiously lifted her face time and again. But the parable from the past is more clearly understood and more definitely encouraging when we remember that the earth has not only risen above her earlier depressions, but she has generally risen higher, rejuvenated and youthful after each succeeding deluge. . . .

Vital Panics

"The record of earlier depressions is, of course, only in part a physical story. Even more pertinent comparisons may be drawn with the panics which life itself has encountered and survived Anteus-like, with strength redoubled.

"If all geologic time is taken as 2,000,000,000 years and is represented on a clock dial as one hour, then 33 minutes of that hour elapse before the age of invertebrate animals is well under way. Even the beginning of the age of reptiles and the dominance of the dinosaurs occurs only nine minutes before the minute hand reaches twelve. More surprising still is the fact that mammals, the dominant life of the present, have been the ruling animals of only the last paltry two and a half minutes of the hour.

"And man, commonly thought to have been present for 1,000,000 to 2,000,000 years has only occupied the center of the stage a breathless two or three split seconds. In fact, man is such a newcomer that he has existed only while our geological clock has been striking the hour.

"But in spite of the fact that 'depressions' occurred long before the advent of life, it is the effect of 'hard times' upon the organisms which particularly

concerns man, the rankest of the untried *nouveau riche* among the animals, many of which for ages have lived in intimate association with man's relatively new acquaintance, Immortal Depression."

Through all of these ages of recurring depressions, the curve of life has pursued an upward spiral, as Dr. Croneis sees it. However, it is not the smooth optimistic unbroken rise pictured by well-fed philosophers of mid-Victorian days, when evolution as a popular idea was a new thing under the sun. Dr. Croneis admits setbacks as well as advances; the curve is ragged, though still always upward trending. In times of stress, he says, the weak organisms have died out, but the strong have always emerged from the troughs of trouble more powerful than ever. Modified to fit the changing environment, they have been ready to take advantage of the return of "good times."

When Dr. Croneis speaks of a "strong" organism, he does not at all mean bulky in muscle, but strong in the balance of a fit body and an alert mind. If the world's recurring geologic hard times have been consistently ruthless toward any one tendency, it has been toward the piling up of huge bulk without intelligence governing it. One need only mention the dinosaurs, out of a dozen possible examples. A *Diplodocus* stuffed with his own flesh was like a bank stuffed with unrealizable paper, or a huge over-capitalized corporation, while its poor teacupful of brains swings the figure, with inevitable irony, to golf-playing dummy directors. No wonder such monsters, with all their resources tied up in unwieldy "organization," could not change front to meet the crisis when it came, and so perished!

Science Cannot Answer

When or how life began on earth is a riddle which science is still unable to answer. The oldest rocks that contain fossils at all, known as the Cambrian, show that at that remote point in time (roughly half a billion years) animal life was already amazingly diversified. All the principal groups except the backboneed animals were represented, and even these showed some hints of beginnings. It would not be too rash to say, therefore, that the known fossil record accounts for only the last half

of life's long story on this planet; though admittedly it is this second half that is the most dramatic and exciting, and the nearer you come to the present the faster the action becomes.

In the lack of fossil records, then, we cannot say what catastrophic depressions preceded the Cambrian, the first stage we know anything about. From the tortured shapes of some of the earlier rocks, we can guess that they were numerous enough, and severe enough. For the present the rest remains shrouded in mist.

But from the Cambrian on, through all the Paleozoic, or Elder Age of Animals, the response of life to the challenge of calamity is writ large, time after time.

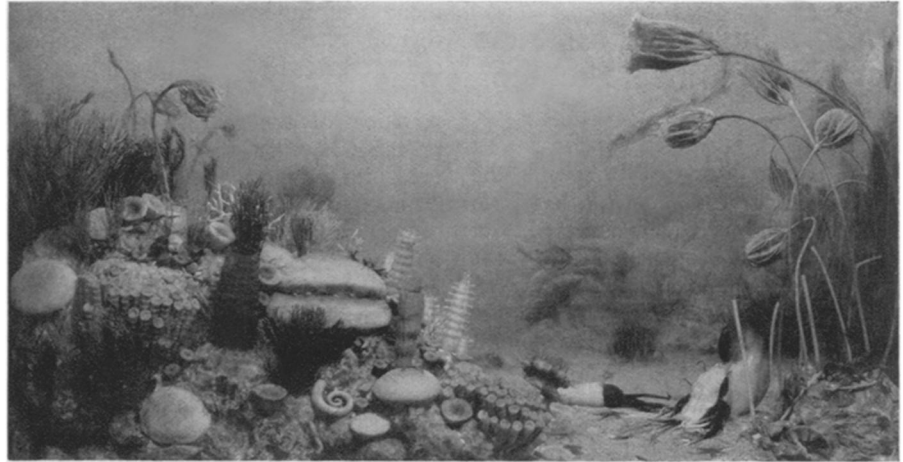
In the early seas, the aristocracy were the trilobites, creatures related to crabs and lobsters, resembling in general appearance their diminutive remote cousins the many-legged "pillbugs" you find under boards and in damp cellars.

"Incredible as it may seem," remarks Dr. Croneis, "they were the first families then; and in their time there was no living thing to dispute their prominence, at least in the matter of intelligence. Nevertheless, in their own life history they tell the old but ever recurrent story of the survival of the simple and the destruction of the specialized. The ornate members of the group (for even the intelligent have never completely resisted the urge of megalomania), like over-expanded individuals, families or industries, flourished in times of plenty, but they became extinct long before their lowly, generalized and conservative cousins had departed from the scene."

Fish Ruling the World

At last, however, times got too hard even for the fittest of the trilobites; or more likely a newer aristocracy, driven into more efficient living by the spur of tight times, eliminated them. At any rate, we see, several geological depressions later, the race of fishes ruling the world and facing another period of crisis, with their water supply dwindling and their pools becoming so stagnant that gill-breathing was becoming nearly impossible.

This was one of the Big Moments of the history of animal life. Dr. Croneis pictures it briefly: "A few ganoid types, with the true spirit of pioneers, used their fringed fins to crawl painfully from the desiccating ancestral pools to other less stagnant ones. These first



THE BEST PEOPLE

These were the best people about a dozen major depressions ago. It took all the hard knocks the world has had since then to evolve Homo sapiens of 1933. This restoration at the Buffalo Museum of Science depicts a coral reef community of Devonian time.

air-breathing, partially land-living vertebrates not only gave rise to the amphibians (relatives of frogs and salamanders)—they originated a Paleozoic parable to the effect that, then as now, animals or industries which, instead of bowing to hard times, use what resources they have to meet the changing situations are likely to be rewarded handsomely with the return of prosperity."

These fish that came ashore because they had to, and liked it, ruled the world when the land consisted largely of endless warm swamps rich with coal-forming vegetation and ahum with giant insects for the new rulers to eat. The Coal Age was a time like the still-lamented Late Twenties: an apparently boundless era of easy pickings, a "permanent plateau" at a bull market level. But like the same lush period in our own memories, the Coal Age crashed into a terrific period of cold and drought—and woe then to its fat, easy-going amphibian bosses!

This particular geologic depression ended not merely a chapter, but a whole volume. The Paleozoic was closed, and the Mesozoic, the Middle Ages of geologic history, came on.

When hard times hit the world of the amphibians, some of them, more enterprising than the rest, were stimulated into developing more active bodies, armored with scales, able to withstand the droughtier air and to scramble more ably for the living that was now harder to get. They were like the energetic tribal chieftains of the ancient world at the breakup of the Roman Empire, who founded the first

feudal aristocracies. Their descendants, bigger and more heavily armored, became the real barons of the geological middle ages, the dinosaurs. Thus an entirely new ruling group arose out of the depression, and when prosperity came again they were its masters.

But they learned nothing from the experiences of their ruined predecessors. "The Mesozoic reptiles were megalomaniacs of the most confirmed sort," says Dr. Croneis. "They were the masters of all the important habitats. The dinosaurs ruled the land, marine reptiles invaded and conquered the sea, and the 'flying dragons' or pterodactyls were lords of the air.

"But scurrying underfoot of the giant dinosaurs were a few mouse-like primitive mammals. They were subservient indeed to the gigantic masters of the moment, who, as is characteristic of the great (and especially the near-great), probably were totally unaware of the mammals' presence. But these small creatures, like some apparently insignificant individuals and many unpromising infant industries, had great potentialities. They proved their mettle at the close of the Mesozoic, when the earth went through one of her really great depressions.

"This was, indeed, a time of revolution and of the 'reddest' sort, for the reptiles, like Russian royalists, were nearly blotted out, and they have never again been particularly dominant. But the small mammals weathered the hard times successfully. Out of their crude beginnings have come the greatly diversified and ruling mammalian types of today. (Turn to Page 30)



BOTANY

The Nymphs' Flower

See Front Cover

SERENE, cool, immaculate, the water lily floats beneath the summer sun, where the big flat drops of water shine like silver coins on the round, flat leaves. The water lily has been the delight of poets of all ages and peoples. Of moralists, too, who like to reflect that all that superb beauty has been extracted from the black mud of the bottom, where the rootstocks of the plant have their hold.

There are only a few kinds of water lilies in America. The white one is the most familiar, as well as the most beautiful. And it has the advantage over the European white water lily in that

it is very fragrant. Then we have a smaller yellow species, vulgarly called "cow lily" or "spatterdock" in the eastern states: but in the Rocky Mountains, where the white one does not grow, a second yellow species reaches a much larger size.

The tropics are the real home of the water lilies; here they develop all sizes and colors, including delicate pinks, glowing reds, and gorgeous blues. The great Brazilian species, *Victoria regia*, has inconspicuous flowers, but leaves so large that they will bear a grown man's weight.

Botanical names sometimes sound harsh to the layman, but there can be no quarrel with the Latin names of the water lily. There is some disagreement among botanists as to its proper name. One group calls it *Castalia*, which is the name of a fountain where the Muses of Greek mythology used to come. Other botanists, following the lead of the great Linnaeus, name it *Nymphaea*, which needs no explanation.

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But, if that were so, points out M. Thon, the hydrogen atoms which consist of just such a combination of a proton and an electron should have the tendency to be transformed spontaneously into neutrons, which so far as we know is not the case.

Both the neutron and the positron have been discovered during the last year or so, the former in England, and the latter in America, by Dr. C. D. Anderson of California.

Dr. Anderson in March also made the suggestion that the proton, previously considered an elementary particle, may be a complex combination of a neutron and a positron

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They were one group which was not over-expanded at the time when opportune depression hit them. In effect, they sold the market short and made their fortunes in the steady decline of reptilian values. The roots of that great modern spreading tree of mammalian types were firmly anchored in the very depression which was too drastic for the optimistic dinosaurs who, to the final crash, continued bullish on 'Brawn not Brains, Inc.'

So far Dr. Croneis. He does not tell the final tale, or point the final moral, perhaps as being too obvious. But for the sake of completeness, the story of man himself might be added.

For man also was born of a depression, one of the greatest of depressions of more recent geologic time, the Pleistocene Ice Age. Human beings may have existed on the earth before the glaciers came, burdening the land over half Europe and North America and chilling the rest far down toward the tropics, but if they did we have no very conclusive evidence of it. Such pre-glacial men, if they existed at all, lived in days of ease and didn't have to hustle for a living. So, in all likelihood, they would have been contented to remain very much like their zoological cousins, the apes, clever and entertaining up to a certain point, but dull beyond that, and quite irresponsible and improvident.

The glaciers changed all that. By the time the Ice Age was half over we have plenty of evidence that man was on the job, looking out for Number One and Family in first-class order. He had learned to keep warm in spite of the glaciers, by taking to caves or

PHYSICS

Protons Seen as Source Of New Atomic Particles

THAT THE NEWLY discovered particles, neutron and positron, supposed to be fundamental bricks from which all matter is built, are formed from the break up of protons, positively charged atomic hearts, is the view put forward by M. N. Thon, of the Institute of Chemistry of Paris, in a communication to *Nature*. The small number of neutrons and positrons met

with in the Universe is easily explained by the fact that a large amount of energy is needed to break up the protons.

M. Thon looks upon the neutron as an elementary material corpuscle without electric charges. The usual view taken considers the neutron as an aggregate of opposite electrical charges formed of a proton and an electron.

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building wickiups on the riverbanks where he fished, and by wearing clothing made of animal skins. He had invented improved tools and weapons of stone, which no ape ever did or thought of. He had made the most important discovery of all human history, lowbrow though he was: he had learned the use of fire.

All honor to Homo Neanderthalensis! He was no beauty to look at—decidedly not as handsome as his artist cousin of Crô-Magnon who came along later and supplanted him. He had a queer-shaped head, with a queer-shaped brain inside. But such talents as he had, he used in a tough spot, and he had the gumption to found the fortunes of the whole human race, right in the middle of the world's worst depression!

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ARCHAEOLOGY

24-Foot Weeping Idol Unearthed in Andes

A WEEPING stone giant 24 feet tall has been discovered at prehistoric ruins in the highlands of the South American Andes. Three big stone tears are carved on the giant's cheeks. Discovery of the enormous statue, pronounced unique in size, is reported by Wendell C. Bennett, anthropologist of the American Museum of Natural History.

While he was digging at the famous ruins of Tiahuanaco, near Lake Titicaca, Mr. Bennett struck stone, and uncovered the statue lying flat on its back. Prehistoric Indians who carved the idol gave it a head band with plumes, cloth trousers in a polka dot design, and a wide, decorated belt. The hands are held before the chest and the left hand holds a cup.

When the great figure stood erect and looked tearfully down on the little humans who made it, it was in the center of a small temple.

Mr. Bennett estimates that the stone weighs 18 tons. Indians of this part of South America had extraordinary skill and ant-like tenacity which enabled them to handle enormous stones and to make them into gates, statues, and monumental walls.

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A diamond needle sharpened to one-tenth of one-thousandth of an inch is used by engineers at the University of Michigan to test the smoothness of polished steel.

GENERAL SCIENCE

Economy Axe Falls Heavy On U. S. Bureau of Standards

THE "ECONOMY" axe has fallen hard on the scientific research work of the Government which has been conducted at the National Bureau of Standards. A loss of 380 persons, separated or furloughed for an indefinite period, from a total staff of only 974 is made necessary by new reductions in funds. This means a personnel cut of 39 per cent.

Drastic reductions in important and profitable research programs will be necessitated by this slash in personnel. The complete elimination of other projects appears to be inevitable.

Industry in the United States will be affected by the loss of 80 of the Bureau's personnel in the divisions working on commercial standards, including the divisions of building and housing, simplified practice, and trade standards. Another large group of 35 goes from the division which has been

doing aeronautic research under funds transferred from the aeronautics branch of the Department of Commerce.

Two of the research projects which will have to be completely abandoned are the study of photographic emulsions and the production of levulose sugar from artichokes.

Officials of the Bureau hope that it may be possible to obtain, from the appropriation for public works projects, funds to take care of the tests of materials that the Bureau will be expected to make in connection with the enormous public works program now being begun. In this case it may be possible to restore some of the furloughed employees.

Otherwise the Bureau of Standards will be faced with greatly increased volume of routine work to be handled by only 60 per cent. of their present personnel.

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CHEMISTRY

Heavy-Weight Hydrogen Great Scoop for America

"A GREAT scoop for America." The discovery of the heavy-weight hydrogen isotope, twin to the ordinary light kind of this basic element, was characterized in these words by Dr. F. W. Aston, British Nobel prize chemist and one of the leading foreign guests of the Century of Progress meeting of the American Association for the Advancement of Science.

Intensive studies of heavy water made from the double-weight hydrogen are being made in five or six American laboratories. Dr. Aston is meeting chemists and physicists engaged in these researches and discussing results.

Since Dr. Aston was the discoverer of the first isotope of a non-radioactive element, his praise of the discovery and exploration of the heavy isotope of hydrogen is authoritative. In a Science Service interview he also expressed admiration for the production of water

nine-hundredths heavier than ordinary water, which has been achieved at the University of California.

In 66 non-radioactive chemical elements which Dr. Aston, his collaborators at Cambridge and others have investigated, 191 isotopes have been found. This means that where scientists fifteen years ago thought one element "grew" nearly three are now known.

It is still proper to say there are 92 elements, or 93 if it is desired to consider the neutron as an element. But science now knows that there are varieties of each element, called isotopes. In the radioactive elements there are many more isotopes not included in this count.

The discovery of the mass two isotope of hydrogen by a group of scientists of Columbia University and the U. S. Bureau of Standards, praised by Dr. Aston, is the latest and most spectacular isotope discovery.

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