industrial-art work, sewing, kindergarten work, drawing, map-drawing, penmanship, clay-modelling, and manual work of every kind produced in the schools. The pupils' work will form the most important part of the exhibit, and will be a full and fair exhibit of the regular work done in the schools since September last. An interesting feature will be the historical exhibit. This will consist of two schoolrooms so fitted up as to represent and contrast the arrangement and conveniences for public-school education furnished by Philadelphia to-day and half a century ago. This exhibit will unquestionably prove a strong stimulus to progress and improvement to the teachers and pupils of the Philadelphia schools, as well as an attractive object of interest to those in other cities.

ADDRESS OF HON. GARDINER G. HUBBARD, PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY, AT ITS FIRST MEETING, MARCH, 1888.

I AM not a scientific man, nor can I lay claim to any special knowledge that would entitle me to be called a 'geographer.' I owe the honor of my election as president of the National Geographic Society simply to the fact that I am one of those who desire to further the prosecution of geographic research. I possess only the same general interest in the subject of geography that should be felt by every educated man.

By my election you notify the public that the membership of our society will not be confined to professional geographers, but will include that large number who, like myself, desire to promote special researches by others, and to diffuse the knowledge so gained among men, so that we may all know more of the world upon which we live.

By the establishment of this society, we hope to bring together (1) the scattered workers of our country, and (2) the persons who desire to promote their researches. In union there is strength, and through the medium of a national organization we may hope to promote geographic research in a manner that could not be accomplished by scattered individuals or by local societies; we may also hope (through the same agency) to diffuse the results of geographic research over a wider area than would otherwise be possible.

The position to which I have been called has compelled me to become a student. Since my election I have been trying to learn the meaning of the word 'geography,' and something of the history of the science to which it relates. The Greek origin of the word (ἡ γῆ, 'the earth;' and γράφω, 'I write') betrays the source from which we derived the science, and shows that it relates to a description of the earth. But the 'earth' known to the Greeks was a very different thing from the earth with which we are acquainted.

To the ancient Greek it meant land; not all land, but only a limited territory, in the centre of which he lived. His earth comprised simply the Persian Empire, Italy, Egypt, and the borders of the Black and Mediterranean Seas, besides his own country. Beyond these limits the land extended indefinitely to an unknown distance, till it reached the borders of the great ocean which completely surrounded it.

To the members of this society the word 'earth' suggests a very different idea. The term arouses in our minds the conception of an enormous globe suspended in empty space, one side in shadow, and the other bathed in the rays of the sun. The outer surface of this globe consists of a uniform, unbroken ocean of air, enclosing another, more solid surface (composed partly of land, and partly of water), which fairly teems with countless forms of animal and vegetable life. This is the earth of which geography gives us a description.

To the ancients the earth was a flat plain, solid and immovable, and surrounded by water, out of which the sun rose in the east, and into which it set in the west. To them 'geography' meant simply a description of the lands with which they were acquainted.

Herodotus, who lived about the year 450 B.C., transmitted to posterity an account of the world as it was known in his day. We look upon him as the father of geography as well as of history. He visited the known regions of the earth, and described accurately what he saw, thus laying the foundations of *comparative geography*.

About 300 years B.C., Alexander the Great penetrated into hitherto unknown regions, conquered India and Russia, and founded the Macedonian Empire. He sent a naval expedition to explore the coasts of India, accompanied by philosophers or learned men, who described the new countries discovered and the character of their inhabitants. This voyage may be considered as originating the science of political geography, or the *geography of man*.

About the year 200 B.C., Eratosthenes of Cyrene, the keeper of the Royal Library at Alexandria, became convinced, from experiments, that the idea of the rotundity of the earth, which had been advanced by some of his predecessors, was correct, and attempted to determine upon correct principle the magnitude of the world. The town of Cyrene, on the river Nile, was situated exactly under the tropic, for he knew that on the day of the summer solstice the sun's rays illuminated at noon the bottom of a deep well in that city. At Alexandria, however, on the day of the summer solstice, Eratosthenes observed that the vertical finger of a sun-dial cast a shadow at noon, showing that the sun was not there exactly overhead. From the length of the shadow he ascertained the sun's distance from the zenith to be 7°12′, or one-fiftieth part of the circumference of the heavens; from which he calculated, that, if the world was round, the distance between Alexandria and Cyrene should be one-fiftieth part of the circumference of the world. The distance between these cities was 5,000 stadia, from which he calculated that the circumference of the world was fifty times this amount, or 250,000 stadia. Unfortunately we are ignorant of the exact length of a stadium, so we have no means of testing the accuracy of his deduction. He was the founder of *mathematical geography*.

It became possible through the labors of Eratosthenes to determine the location of places on the surface of the earth by means of lines corresponding to our lines of latitude and longitude. Claudius Ptolemy, in the second century of the Christian era, made a catalogue of the positions of plans as determined by Eratosthenes and his successors, and, with this as his basis, he made a series of twenty-six maps, thus exhibiting at a glance, in geographical form, the results of the labors of all who preceded him. To him we owe the art of map-making, — the *origination of geographic art*.

We thus see that when Rome began to rule the world, the Greeks had made great progress in geography. They already possessed comparative, political, and mathematical geography, and geographic art, or the art of making maps. Then came a pause in the progress of geography.

The Romans were so constantly occupied with the practical affairs of life, that they paid little attention to any other kind of geography than that which facilitated the administration of their empire. They were great road-builders, and laid out highways from Rome to the farthest limits of their possessions. Maps of their military roads were made, but little else. These exhibited with accuracy the less and greater stations on the route from Rome to India, and from Rome to the farther end of Britain.

Then came the decline and fall of Rome, and with it the complete collapse of geographical knowledge. In the dark ages, geography practically ceased to exist. In the typical map of the middle ages, Jerusalem lay in the centre, with Paradise on the east, and Europe on the west. It was not until the close of the dark ages that the spirit of discovery was re-awakened. Then the adventurous Northmen from Norway and Sweden crossed the ocean to Iceland.

From Iceland they proceeded to Greenland, and even visited the mainland of North America about the year 1000 A.D., coasting as far north as New England; but these voyages led to no practical results, and were forgotten, or looked upon as myths, until within a few years. For hundreds of years geography made but little advance, and the discoveries of five centuries were less than those now made in five years. In the fourteenth or fifteenth century the mariner's compass was introduced into Europe from China, and it then became possible to venture upon the ocean far out of sight of land. Columbus, instead of coasting from shore to shore like the ancient Northmen, boldly set sail across the Atlantic. To many of his contemporaries it must have seemed madness to seek the east by thus sailing towards the west, and we need hardly wonder at the opposition experienced from his crew. The rotun-

dity of the earth had become to him an objective reality, and in sublime faith he pursued his westward way. Expecting to find the East Indies, he found America instead. Five centuries had elapsed since the Northmen had made their fruitless voyages to these shores, and their labors had proved to be barren of results. The discovery of Columbus, however, immediately bore fruit. It was his genius and his perseverance alone that gave the New World to the people of Europe, and he is therefore rightfully entitled to be called the discoverer of America. His discovery was fraught with enormous consequences, and it inaugurated a new era for geographic research. The spirit of discovery was quickened, and geographic knowledge advanced with a great leap. America was explored, Africa was circumnavigated. Magellan demonstrated the rotundity of the world by sailing due west until he reached his starting-point. Everywhere, all over the civilized world, the spirit of adventure was aroused. Navigators from England, Holland, France, and Spain rapidly extended the boundaries of geographical knowledge, while explorers penetrated into the interior of the new lands discovered. The mighty impetus given by Columbus set the whole world in motion, and it has gone on moving ever since with accelerated velocity.

The great progress that has been made can hardly be realized without comparing the famous Borgia map, constructed about one hundred years before the discovery of America, with the modern maps of the same countries; or Hubbard's map of New England, made two hundred years ago, with the corresponding map of to-day. The improvements in map-making originated with Mercator, who, in 1556, constructed his cylindrical projection of the sphere. But it was only during the last one hundred years that great progress was made. Much yet remains to be done before geographic art can fully accomplish its mission.

The present century forms a new era in the progress of geography, — the era of organized research. In 1830 the Royal Geographical Society of England was founded, but it already forms a landmark in the history of discovery. The Paris Society preceded it in point of time, and the other countries of Europe soon followed the example. Through these organizations, students and explorers have been encouraged and assisted, and information systematically collected and arranged. The wide diffusion of geographical knowledge through the medium of these societies, and the publicity of the discussions and criticism that followed, operated to direct the current of exploration into the most useful channels. Before organized effort, darkness gave way at every step. Each observer added fresh knowledge to the existing store, without unnecessary duplication of research. The reports of discoveries were discussed and criticised by the societies, and the contributions of all were co-ordinated into one great whole.

America refuses to be left in the rear. The American Geographical Society, so long and wisely presided over by Chief-Justice Daly, has kept pace with the foreign societies. Explorers from America are in every land and on every sea. Already she has contributed her quota of martyrs in the frozen North, and has led the way into the torrid regions of Africa. The people of Europe, through Columbus, opened up a new world for us; and we, through Stanley, have discovered a new world in the old, for them.

Much has been done on land, little on the other three-quarters of the earth's surface. But here America has laid the foundations of a new science, — the geography of the sea.

Our explorers have mapped out the surface of the ocean, and discovered the great movements of the waters. They have traced the southward flow of the Arctic waters to temper the climate of the torrid zone. They have followed the northward set of the heated waters of the equator, and have shown how they form those wonderful rivers of warm water that flow, without walls, through the colder waters of the sea, till they strike the western shores of Europe and America, and how they render habitable the almost arctic countries of Great Britain and Alaska. They have even followed these warm currents farther, and shown how they penetrate the Arctic Ocean to lessen the rigors of the Arctic cold. Bravely but vainly have they sought for that *ignis fatuus* of explorers — the open polar sea — produced by the action of the warm waters from the south.

American explorers have sounded the depths of the ocean, and discovered mountains and valleys beneath the waves. They have found the great plateaus on which the cables rest that bring us into instantaneous communication with the rest of the world. They have shown the probable existence of a vast submarine range of mountains, extending nearly the whole length of the Pacific Ocean, — mountains so high that their summits rise above the surface, to form islands and archipelagoes in the Pacific. And all this vast region of the earth, which, a few years ago, was considered uninhabitable on account of the great pressure, they have discovered to be teeming with life. From the depths of the ocean they have brought living things, whose lives were spent under conditions of such pressure that the elastic force of their own bodies burst them open before they could be brought to the surface; living creatures whose self-luminous spots supplied them with the light denied them in the deep abyss from which they sprang, — abysses so deep that the powerful rays of the sun could only feebly penetrate to illuminate or warm.

The exploring vessels of our Fish Commission have discovered in the deep sea, in one single season, more forms of life than were found by the 'Challenger' Expedition in a three-years' cruise. Through their agency we have studied the geographical distribution of marine life; and in our marine laboratories, explorers have studied the life-history of the most useful forms.

The knowledge gained has enabled us to breed and multiply at will; to protect the young fish during the period of their infancy (when alone they are liable to wholesale destruction); finally to release them in the ocean, in those waters that are most suitable to their growth. The fecundity of fish is so great, and the protection afforded them during the critical period of their life so ample, that it may now be possible to feed the world from the ocean, and set the laws of Malthus at defiance. Our geographers of the sea have shown that an acre of water may be made to produce more food for the support of man than ten acres of arable land. They have thrown open to cultivation a territory of the earth constituting three-quarters of the entire surface of the globe.

And what shall we say of our conquests in that other vast territory of the earth, greater in extent than all the oceans and the lands put together, — the atmosphere that surrounds the world.

Here, again, America has led the way, and laid the foundations of a geography of the air. But a little while ago, and we might have truly said with the ancients, "The wind bloweth where it listeth, and we know neither from whence it comes, nor whither it goes;" while now our explorers track the wind from point to point, and telegraph warnings in advance of the storm.

In this department — the geography of the air — we have far outstripped the nations of the world. We have passed the mob-period of research, when the observations of multitudes of individuals amounted to little, from lack of concentrated action. Organization has been effected. A central bureau has been established in Washington, and an army of trained observers have been dispersed over the surface of the globe, who all observe the condition of the atmosphere according to a preconcerted plan.

The vessels of our navy, and mercantile marine of our own and other countries, have been impressed into the service: thus our geographers of the air are stationed in every land, and traverse the waters of every sea. Every day, at the same moment of absolute time, they observe and note the condition of the atmosphere at the part of the earth where they happen to be, and the latitude and longitude of their position. The collocation of these observations gives us a series of what may be termed 'instantaneous photographs' of the condition of the whole atmosphere. The co-ordination of the observations, and their geographical representation upon a map, are undertaken by a staff of trained experts in the central bureau in Washington, and through this organization we obtain a weather-map of the world for every day of the year. We can now study at leisure the past movements of the atmosphere, and from these observations we shall surely discover the grand laws that control aerial phenomena. We shall then not only know, as we do at present, whence comes the wind and whither it goes, but be able to predict its movements for the benefit of humanity.

Already we have attained a useful though limited power of prediction.

Our central bureau daily collects observations by telegraph from

all parts of this continent, and our experts are thus enabled to forecast the probabilities by a few hours. Day by day the results are communicated to the public by telegraph in time to avert disaster to the mariners on our eastern coast, and facilitate agricultural operations in the Eastern and Middle States.

Although many of the predictions are still falsified by events, the percentage of fulfilments has become so large as to show that continued research will in the future give us fresh forms of prediction, and increase the usefulness of this branch of science to mankind.

In all departments of geographical knowledge, Americans are at work. They have pushed themselves into the front rank, and they demand the best efforts of their countrymen to encourage and support.

When we embark on the great ocean of discovery, the horizon of the unknown advances with us, and surrounds us wherever we go. The more we know, the greater we find is our ignorance. Because we know so little, we have formed this society for the increase and diffusion of geographical knowledge. Because our subject is so large, we have organized the society into four broad sections, relating to the geography of the land (H. G. Ogden, vice-president), the sea (J. R. Bartlett, vice-president), the air (A. W. Greely, vice-president), the geographical distribution of life (C. H. Merriam, vice-president); to which we have added a fifth, relating to the abstract science of geographic art, including the art of map-making, etc. (A. H. Thompson, vice-president). Our recording and corresponding secretaries are Henry Gannett and George Kennan.

We have been fortunate indeed to secure as vice-presidents and secretaries men learned in each department, and who have been personally identified with the work of research.

WATER-SPOUTS OFF THE ATLANTIC COAST OF THE UNITED STATES.

THE Hydrographic Office has published a very interesting supplement to the Pilot Chart of the North Atlantic Ocean, showing the positions of water-spouts sighted by masters of vessels during January and February in the western portion of the North Atlantic. The map, which is reproduced here, is accompanied by remarks of Everett Hayden, of which we give the following abstract: —

"Although the reports now at hand for these two months were received from incoming vessels only, yet they are very characteristic, and indicate fairly well the regions where these phenomena are of most frequent occurrence.

"Before quoting the reports themselves, it may be well briefly to refer to what is known regarding the character and formation of water-spouts, which are simply special cases of whirlwinds and tornadoes, as these are special cases of cyclones, but on a much smaller scale.

"When a whirlwind is formed over the ocean, water is often drawn up the centre of the whirl some distance, owing to the suction created, and at the same time the moisture in the air is condensed as it rises, so that the name 'water-spout' is very applicable. Indeed, sometimes a spout will burst over a vessel, and flood her decks with water, as a cloud-burst does a mountain-side. When a spout is forming, its upper portion is often visible first, seeming to grow downwards from the clouds. By observing carefully with a telescope, however, it will be seen that the motion in the column itself is upwards, although the moisture in the air which is rising is condensed lower and lower down, thus rendering the whirl visible lower down continually, and making it appear to be actually descending.

"On Jan. 12, Captain Hess, American steamship 'Philadelphia,' saw four water-spouts in latitude 36° 41′ north, longitude 72° 27′ west. On the 19th, Captain Lawson, British steamship 'Lizzie English,' reports several a little farther to the eastward (latitude 36° 41′ north, longitude 71° 40′ west); and from the Dutch steamship 'Edam,' Captain van der Zee, a detailed report has been received from third officer De Boerk of a large spout sighted at 7 A.M., Jan. 21, latitude 41° 50′ north, longitude 60° 25′ west. In the last case the spout is described as being small and straight at the base, increasing in size towards the top, where it mingled with the clouds. Ascending currents could be plainly seen; there was a strong westerly gale at the time, with occasional hail and snow; temperature of the air 0° C.; water, 11°; direction of rotation of the whirl, with the hands of a watch.

"Another very complete report has been received from Captain Dexter, American steamship 'City of Para,' who saw several large spouts, Jan. 22, in latitude 31° 47′ north, longitude 74° 33′ west. The wind was strong from the north-east, and the sky overcast, with light scud, but the sea was comparatively smooth. Three huge spouts were seen at once, and six in the course of half an hour. The water seemed to be drawn up from the sea, mounting in spiral columns of tremendous thickness, with a loud, roaring sound. Some of the columns were vertical, some inclined at a considerable angle; all of them increased in size at the top, and blended with the clouds. A fine rain or mist filled the air, and continued for some time. The wind soon after changed to east.

"Perhaps the most interesting cases of all, however, are those which were reported Jan. 26, 27, and 28, for the reason that they were clearly associated with a low-barometer area of considerable energy, which moved across the Great Lakes on the 25th, and was central off Nantucket on the 26th. It has been clearly shown by the United States Signal Service, that, when tornadoes occur on land, they take place almost invariably in the southern quadrants of an area of low barometer. It might therefore be expected that whirlwinds and water-spouts would sometimes be found associated in a similar way with a cyclonic storm at sea. The following reports seem to leave no doubt that such is the case. The area of low barometer, which was central over the Great Lakes Jan. 25, barometer 29.7, gathered increased energy when it reached the Atlantic, and off Nantucket the following day the barometer read 29.2; and in the Gulf of Newfoundland, on the 27th and 28th, it read as low as 28.6. The cold, dry, north-westerly winds in the western quadrants of this cyclone, and the warm, moist air flowing into the eastern quadrants, mingled to the southward of the storm-centre, and gave rise to the conditions most favorable to the development of tornadoes on land and water-spouts at sea. Accordingly, Captain Haskell, British bark 'Shetland,' reports that on the 26th, in latitude 39° 34′ north, longitude 71° 16′ west (a little to the southward of the storm-centre), he saw a large spout; the following day (latitude 39° 12′ north, longitude 70° 44′ west) he saw several more; and on the 28th, still more. Captain Garvin, British steamship 'Orinoco,' reports that on the 27th, when entering the Gulf Stream from the north, in about latitude 37° 20′ north, longitude 70° 40′ west, the sea was covered with thick vapor from five to fifteen feet high. The heavy, low-lying clouds seemed to draw the vapor up, and many water-spouts were formed, both large and small; temperature of the water, 60° F.; air, 40°. Captain Cleary, British steamship 'River Avon,' states that on the 28th, in latitude 39° 30′ north, longitude 57° 20′ west, he saw what he took to be a heavy squall to the south-east. Upon looking at it with his glass, he saw that it was a whirlwind, raising the water to a great height. It must have been over a mile in diameter, but he hesitates to even estimate the height to which the water was raised, or the size of the spout, although it must have had terrific power. Shortly afterwards a smaller one passed close to the ship, whirling along the water, and raising the spray to a height of fully a hundred feet. Even as far south as Bermuda the conditions were the same, for on the 27th a whirlwind swept across the parishes of Southampton and Warwick, unroofing houses, blowing down trees, and damaging property generally.

"Similarly, two cyclonic storms, which seem to have originated about the Bermudas on the 10th and 12th of February, as indicated in the weather review published on the March Pilot Chart, were attended by water-spouts, at least one of which was disastrous to shipping. Feb. 10, at 9 A.M., Captain Smith, British steamship 'Ethelbald,' in latitude 28° 18′ north, longitude 74° 06′ west, reports a large spout travelling in a north-easterly direction, rotating, apparently, with the hands of a watch. The barometer was rising; fresh, variable winds, mostly southerly, and sky overcast, with very heavy rain. At this time the American bark 'Reindeer,' Captain Strandt, was about two hundred miles to the westward of the 'Ethelbald,' running up the coast towards New York, in the Gulf Stream. On the 11th the weather became squally, with light southerly winds; and at 10.30 A.M., in latitude 32° 04′ north, longitude 76° 06′ west, when the vessel was under full sail, a heavy