vestigation, to be made by D. F. V. Hayden. This was adopted after a warm debate, and from this small beginning the present extensive and efficient organization known as the United States Geological Survey took its origin, and its growth upwards was due almost wholly during 1868 to 1872 to Stevenson's careful management. In 1867 and 1868 he again went with the annual expeditions, the work during these two summers being chiefly in Nebraska. In 1869 he took a trip along the eastern slope of the Rocky Mountains in Colorado and New Mexico. In 1870 the party went out on the Platte and into the Green River basin.

In 1871 Professor Hayden's party made the first geological surveying trip into the Yellowstone Park; and Stevenson, as usual, went along, acting as executive officer and general manager as well as collector in his own field. They took a pack train at Bozeman and an escort of cavalry from Fort Ellis. In 1872 the Hayden survey again went into the park, in two parties this time. They rendezvoused at Ogden and divided; the main party, under Professor Hayden, going in from the north by Bozeman, as before.

Stevenson went to Fort Hall and organized the Snake River expedition, which entered the park from the south by way of the Teton Mountains. On this expedition he ascended the great Teton, and nearly lost his life through slipping and falling several hundred feet on the snow, but miraculously escaped, and persisted in an effort to reach the summit, which he accomplished. It is not known that any other white man ever set foot upon the peak. He verified an Indian tradition by finding on the mountain-top an ancient stone altar.

He joined Professor Hayden's party at Yellowstone Lake, after which they again separated, each going out in the direction by which he had entered.

The season of 1873 again found Stevenson in the field, collecting and acting as executive officer for Hayden's surveying party in Colorado; and for the three following years his work was a repetition of this experience, and in the same field. In 1877 they went to Idaho, Wyoming, and Utah, and in 1878 to Yellowstone Park once more. On this trip Mr. Stevenson made a most complete collection of those specimens of the phenomena of the Geysers, which may be seen at the Smithsonian and National Museum in Washington.

In this connection it is worthy of mention that the first hydrographic survey of the Yellowstone Lake, which was made in 1871 and published by Henry W. Elliott, assisted by Campbell Carrington, United States Geological Survey, names the largest island in that remarkable body of water 'Stevenson Island,' and the loftiest peak that overlooks it 'Mount Stevenson.' This was done by Elliott in spite of Stevenson's strong disinclination to have it so recorded. He was always modest and retiring in so far as his own individuality was concerned. Thus his name is perpetuated by the largest island in that beautiful lake and one of the highest peaks on the east side of that famous park.

In 1879 the Hayden Survey was disbanded, and the Bureau of Ethnology was organized. Major Powell, the director, at once appointed Stevenson as a specialist in ethnological work, and he began an investigation, which has made him noteworthy, among the Pueblos of the Rio Grande and at Zuñi. During this year and the next, and again in 1881, he made an exhaustive collection of pottery, costumes, and ceremonial objects. Among the rest, he secured from the Zuñis a complete collection of their animal fetiches held sacred by them, and never before allowed to go out of their possession. During 1881 he also visited the Moqui Pueblo, making vast collections of objects illustrating both the ancient and modern life of the race.

The annual report of the bureau for 1881 contains an exhaustive descriptive catalogue of his collections among these Pueblos.

In 1882 he was off again, this time to explore the remains of the cliff and cave dwellers in New Mexico and Arizona at Cañon de Chelly and Cochiti, bringing back, among other things, two perfect ancient skeletons found in the largest of the cave-dwellings of the prehistoric inhabitants. From 1883 to 1885 he continued in this work, and in 1886 he paid a visit to the Mission Indians of California. By his familiarity with the inner life of these races he was enabled to discover, that, although these Indians had been ostensibly Catholics for two centuries, still at heart they were yet Pagans, and worshipped and sacrificed to the gods of their forefathers in secret.

During the trip of 1885 he contracted the worst type of that peculiar 'mountain fever' which is so well known and dreaded in the high mesas of Arizona and New Mexico. He fought it off, however, after a severe siege of illness. It was the first real sickness that he ever had in his life, for he possessed a fine physique, and was remarkably temperate and regular in his diet and living.

Last year he returned to the New Mexico region, exploring and collecting, and renewed that wretched fever which finally destroyed the tissues of his heart, so that when he returned last December he was literally prostrated. He made, however, an heroic struggle for his life, and, growing worse as time passed on, he was advised to go to Gloucester, Mass., to spend the summer, and was on his way back from there, accompanied by his wife, when overtaken by death in New York.

His remains were taken to Washington, and after appropriate ceremonies were interred at Rock Creek Cemetery, just outside of the Soldiers' Home.

It is to be regretted that he did not write more; but the fact is, he had little time for that purpose. But as an original investigator, whose results some other hand must record, he was and is justly famous.

He left some manuscripts, however, which will have a lasting interest, one of which is upon 'The Mythologic Painting of the Navajos,' which, with the rest, will no doubt appear in due time in the publications of the bureau.

Mr. Stevenson was a man of singular firmness and rare amiability. He had an intuitive appreciation of men and what they really amounted to. This faculty made him one of the most efficient and prompt managers of the varied men of the survey, as they were despatched into the field with their outfits every spring, and recalled from it every fall.

SCIENTIFIC NEWS IN WASHINGTON.

A New Way of using Oil to calm the Troubled Sea. — How a Mound was made: Interesting Discoveries in Ohio by Mr. Gerard Fowke of the National Bureau of Ethnology. — How the Monthly Pilot Chart is made, and What it shows.

Oil-Exploding Rockets.

THE pamphlet describing and explaining the exhibit sent to Cincinnati by the Hydrographic Office of the Navy Department, which is now ready for the printer, contains a description of an oil-exploding rocket invented by Mr. W. Missel of the German steamer 'Werra,' and forwarded by Lieutenant Cottman, U.S.N., in charge of the branch hydrographic office, New York. The following extracts are made: —

"It is stated that experiments have been made with this rocket at sea and on shore which have proved very successful, particularly those by the German life-saving stations. Trials were made during a fresh wind and moderate sea off the mouth of the Elbe, and the rockets were exploded outside the breakers, in the breakers, and inside of the same. Outside the breakers, oiled areas of about three hundred feet long and nearly one hundred feet wide formed and calmed the sea very much, and remained a long time on the surface of the water. Those which exploded among the breakers exercised a remarkable quieting effect, and gave evidence of their value in facilitating the handling of lifeboats in case of shipwreck, as the resulting oil areas will enable the boat to get through the breakers without shipping water.

"A trial was made at sea on board the 'Werra' by firing a rocket from the bridge directly against the wind. It flew directly ahead against a wind whose force was 9, and the oil cylinder exploded in the water. The oil at once smoothed the sea, the heavy waves facilitating its rapid spread, and no seas were seen to break within the oiled area.

"Above the rocket composition the shell is prolonged $1\frac{1}{2}$ inches to receive the oil cylinder, which contains within it an exploding chamber filled with powder. Some loose powder is poured on top of the fuze composition, and the cylinder then shipped on the rocket. The stick is weighted with lead to balance exactly, so as to prevent trembling. All being ready, the rocket is set off from a tube, and follows the direction given it. The burning composition finally reaches the loose powder, and the flame is communicated through a small hole in the bottom of the cylinder to the bursting charge of powder within the exploding chamber, the cylinder is thrown forward and exploded, and the oil spread upon the surface of the water."

How a Mound was built.

"While exploring mounds in Ohio this season, under the direction of the National Bureau of Ethnology," says Mr. Gerard Fowke in a paper prepared for *Science*, "I used great care in the examination of one mound in Pike County, in order to ascertain, if possible, the exact method of its construction.

"The mound was built upon the site of a house, which had probably been occupied by those whose skeletons were found. The roof had been supported by side-posts, and at intervals by additional inner posts. The outer posts were arranged in pairs a few inches apart, then an interval of about three feet, then two more, and so on. They were all about eight inches in diameter, and extended from two and a half to three feet into the ground, except one a few feet from the centre, which went down fully five feet. All the holes were filled with the loose dark dirt which results from decay of wood; a few contained fragments of charcoal, burned bones or stone, but no ashes; nor was the surrounding earth at all burned.

"Around the outside a trench from three to four feet wide, and from eighteen to twenty inches deep, had been dug, to carry away the water which fell from the roof. Near the middle of this house, which measured about forty feet from side to side, a large fire had been kept burning for several hours, the ashes being removed from time to time. The ash-bed was elliptical in form, measuring about thirteen feet from east to west, and five from north to south. Under the centre of it was a hole, ten inches across and a foot deep, filled with clean white ashes in which was a little charcoal, packed very hard. At the western end, on the south side (or farthest from the centre of the house), was a mass of burned animal bones, ashes and charcoal. This was continuous with the ash-bed, though apparently not a part of it. The bones were in small pieces, and were, no doubt, the remains of a funeral feast or offering.

"After the fire died down, rude tools were used to dig a grave at the middle of the house. It measured ten feet in length, from east to west, by a little more than six in breadth. The sides were straight, slanting inward, with rounded corners. The bottom was nearly level, fourteen inches deep, but slightly lower at the centre. Over the bottom, ashes had been thinly sprinkled, and on these a single thickness of bark had been laid. The sides had been lined with wood or bark from two to four inches thick. When this was done, two bodies were placed side by side in the grave, both extended at full length on the back, with heads directly west. One, judging from the bones and condition of the teeth, was a woman of considerable age. She was placed in the middle of the grave. Her right arm lay along the side, the left hand being under the pelvic bones of the other skeleton. This was apparently of a man not much, if any, past maturity. The right arm lay across the stomach, the left across the hips. This skeleton was five feet ten inches in length; the other, five feet four inches.

"The space between the first skeleton and the south side of the grave was covered with the ashes that had been removed from the fire. Beginning at the feet in a thin layer, — a mere streak, — they gradually increased in thickness toward the head, where they were fully six inches thick. The head was embedded in them. They extended to the end of the grave, reaching across its entire width, and coming almost, but not quite, in contact with the other head. A considerable amount of the burned bones lay in the south-western corner of the grave, and the ashes along this part curved up over the side until they merged into what remained of the ash-bed. This had extended to the west slightly beyond the end of the grave.

"As the earth removed from the grave had been thrown out on every side, the bodies were in a hole that was nearly two feet deep. The next step was to cover them. There was no sign of bark, cloth, or any other protecting material above them. They were covered with a black sandy earth, which must have been brought from the creek not far distant. This was piled over them while wet, or at least damp enough to pack firmly, as it required the pick to loosen it, and, besides, was steeper on the sides than dry dirt would have been. It reached just beyond the grave on every side, and was about five and a half feet high, or as high as it could be conveniently piled.

"So far, all was plain enough; but now another question presented itself that puzzled me not a little; and that was, what became of the house? That there had been one, the arrangement of the numerous post-holes plainly showed; but the large earth-mound above the tumulus or grave was perfectly solid above the original surface, giving not the slightest evidence that the posts or any part of the house had ever reached up into it. I incline to the opinion that the great fire near the middle of the house had been made from the timbers composing it; that the upper timbers had been torn down, and the posts cut off at the surface, the whole being a kind of votive offering to the dead. At any rate, it is plain that a house stood there until the time the mound was built; and it was not there afterwards.

"For the purpose of covering the grave, sand was brought from a ridge a short distance away. There was no stratification, either horizontal or curving. Earth had been piled up first around the black mass forming the grave-mound, and then different parties had deposited their loads at convenient places, until the mound assumed its final conical arrangement. The lenticular masses through almost the whole mound showed that the earth had been carried in skins or small baskets. The completed mound was thirteen feet high, and about one hundred feet in diameter.

"Two and a half feet above the original surface was an extended skeleton, head west. It lay just east of the black earth over the grave. Sixteen feet south of the grave, on the original surface, and within the outer row of post-holes, were two skeletons extended, heads nearly west. It would seem that the flesh was removed before burial, as the bones were covered with a dull-red substance, which showed a waxy texture when worked with a knife-blade.

"No relics of any description were found with any of the skeletons; but a fine copper bracelet was picked up in a position that showed it was dropped accidentally."

The Pilot Chart of the North Atlantic Ocean.

The Pilot Chart is published by the Hydrographic Office on the first day of every month, and, although reference is frequently made to it in the daily and weekly press, no comprehensive description of it, its scope and objects, and the method of its preparation, has been written previous to a paper read a few months ago, and recently published by Mr. Everett Hayden, in charge of the Division of Marine Meteorology of the United States Hydrographic Office. In the following abstract are presented the essential parts of Mr. Hayden's paper.

The base of the Pilot Chart, the permanent portion which does not change from month to month, is simply a track chart of the North Atlantic on Mercator's projection. This is lithographed in black. Near the top is a compass-card, which the navigator uses to lay off his course; and in the lower left-hand corner, a storm-card, which illustrates the circulation of the wind around an area of low barometer, with brief practical rules for action to avoid the dangerous portions of an approaching cyclone. Light curved lines cross the chart, showing the variation of the magnetic compass, and a light dotted line near the coast is the hundred-fathom line. Small arrows indicate the general drift of ocean-currents. All of this is printed in black, and is not changed from month to month.

The portion of the chart printed in blue comprises essentially a meteorological forecast for the month following the date of issue, and in addition to this there are plotted the principal steamship and sailing routes recommended for the month. Small circles and arrows plotted uniformly over the chart indicate graphically the probable percentage of calms, and the frequency and force of the prevailing winds in each five-degree ocean square. There being no fixed meteorological stations on the high seas, it is necessary to group together observations made on board vessels in some way by which they can be localized and averaged up. This is done by dividing up the ocean into squares bounded by five degrees of latitude and longitude; and every vessel which goes through one of these squares and keeps meteorological observations adds to the existing knowledge of the prevailing weather conditions in that square. It therefore happens that there are many squares whose meteorological conditions are very well known, on account of the very great number of vessels which traverse them; while, on the contrary, there are other squares which lie off the tracks of commerce whose meteorological conditions are only approximately known. In addition to this graphic representation of the frequency and force of prevailing winds in each ocean square, there is printed a brief forecast and a table showing the normal reading of the barometer, arranged in tabular form by ocean squares. A double dotted line near Newfoundland shows the probable limit of the region of frequent fogs for the coming month, and dotted lines across the lower parts of the chart indicate the limits of the trade-winds. Where the north-east and south-east trade-winds meet, there is the region of equatorial rains, indicated on the chart by a blue belt of irregular shape, lying principally north of the equator. These constitute the blue data or portions of the chart.

The portions of the chart printed in red comprise information collected during the month preceding the date of issue. On the ocean are plotted the latest reported positions of derelict vessels, wrecks and drifting buoys. Dotted lines indicate the drift which each wreck has followed since it was first reported. There are also plotted the positions where whales and waterspouts were reported during the previous month, and a red belt off Newfoundland indicates the region where frequent fogs were encountered. In the lower right-hand corner is printed a brief weather review of the preceding month, written at the last moment before going to press, but necessarily more or less incomplete so far as the entire Atlantic is concerned. Above is a large amount of printed matter, comprising a list of notices to mariners issued during the previous month, dangerous obstructions to navigation along the coast, charts published and cancelled, transatlantic steamship and sailing routes, the latest reported positions of logs from the big lumber raft which was abandoned off Nantucket, and various other matter likely to be of timely interest. To one who is not familiar with the subject it would seem almost impossible to publish on one chart such a variety of information of such a diverse character, and yet have a chart that can be of practical use in plotting a vessel's track. It would be very difficult to do without the distinction of colors.

In describing the methods by which the data for the Pilot Chart are collected from masters of vessels, Mr. Hayden referred to the branch hydrographic offices established in Boston, New York, Philadelphia, Baltimore, New Orleans, and San Francisco. At these offices masters of vessels can find all the latest nautical information — charts, light-lists, sailing directions — for every ocean of the globe, and standard barometers and thermometers for purposes of comparison. The naval officer in charge of such a branch office, during his three-years' tour of shore duty, is thrown into intimate relations with the owners, agents, and especially with the practical and energetic masters, of merchant vessels of every description, to mutual advantage, and to the benefit of both the commercial marine and the naval service. Mr. Hayden referred for illustration to the working of the branch office established in the Maritime Exchange, New York, which Lieut. V. L. Cottman, U.S.N., during the few years he has been in charge, has brought into a position of usefulness commensurate with the vast shipping interests of the great commercial metropolis of the United States. In a single year (1886–87), 6,739 vessels were visited, nautical information furnished to 83,345 masters of vessels and others, 10,397 Pilot Charts distributed, and 3,601 special detailed reports of marine meteorology forwarded for use in the preparation of the Pilot Chart alone, in addition to all the regular office-work, of which this is but a small fraction.

ELECTRICAL SCIENCE.

Change of Potential in a Voltaic Couple by Variation of Strength of the Liquid.

DR. G. GORE, F.R.S., read before the Royal Society, June 14, a communication on the above subject. A voltaic couple, consisting of zinc and platinum in distilled water, was opposed to a thermo-electric pile, the latter being regulated until there was no deflection of a galvanometer in the circuit. To the distilled water there was added potassic chlorate, potassic chloride, hydrochloric acid, or bromine, in gradually increasing quantities, and the change in the electro-motive force of the voltaic couple was measured in each case. The following are the minimum proportions of the above substances required to change the potential of the couple in water: potassic chlorate, between 1 in 221 and 1 in 258 parts of water; potassic chloride, between 1 in 695,067 and 1,390,134; hydrochloric acid, between 1 in 9,300,000 and 9,388,188; of bromine, between 1 in 77,500,000 and 84,545,000 parts. With each of these substances a gradual and uniform increase of the strength of the solution from the weakest to a saturated solution was attended by a more or less irregular change of electro-motive force.

By plotting the results in curves, — the quantities of dissolved substance as ordinates, the electro-motive forces as abscissæ, — each substance will yield a different curve, the form of which is characteristic of the substance.

As a very slight addition of a foreign substance greatly changes the 'minimum point,' and alters the curve of variation of potential, the two may probably be used as tests of the chemical composition of the substance, and as a means of examining its state of combination when dissolved.

THE 'MINIMUM POINT' OF CHANGE OF POTENTIAL OF A VOLTAIC COUPLE. — Dr. Gore, at the same meeting of the Royal Society, described experiments made to determine the minimum amount of any substance that would affect the electro-motive force of a voltaic cell. To do this he arranged two magnesium-platinum couples in distilled water, and opposed them to each other with a sensitive galvanometer in their circuit. He then added known quantities of the substances to be investigated to one of the cells, and noted when the balance between the two couples was upset. The results were as follows: potassic chloride, between 1 part in 3,875 and 4,650 parts of water; potassic chlorate, between 1 in 4,650 and 5,166; hydrochloric acid, between 1 in 516,666 and 664,285; chlorine, between 1 in 15,656,500,000 and 19,565,210,000. The proportion required of each of these different substances is dependent upon very simple conditions, — unchanged composition of the voltaic couple, uniform temperature, and the employment of the same galvanometer. If a more sensitive galvanometer was employed, of course the numbers would be increased, but they are relatively correct. With constant conditions, the numbers obtained may possibly be used to test the purity or the uniformity of composition of the dissolved substances. The 'minimum point' varies with (1) the chemical composition of the liquid; (2) the kind of positive metal; (3) to a less degree with the kind of negative metal; (4) the temperature at the surface of the positive metal, and that of the negative one; (5) with the galvanometer used. The degree of sensitiveness is related to the degree of free chemical energy of the liquid, also to the atomic and molecular weights of the dissolved substances. The greater the degree of the free chemical energy of the dissolved substance, and the greater its action upon the positive metal, the smaller the proportion of it required to change the potential. As the 'minimum point' of a substance dissolved in water is usually much altered by adding almost any soluble substance to the mixture, measurements of that point in a number of liquids at a given temperature, with the same voltaic pair and galvanometer, will probably throw some light upon the degree of chemical freedom of substances dissolved in water.

ELECTRICAL TREATMENT OF ZINC AND ITS ORES. — Mr. Alexander Watt has brought forward a process of purifying and reducing zinc that promises to be largely used. In the purifying process the zinc is made the anode in a bath containing an organic acid, and is dissolved and deposited upon the cathode. Acetic acid is generally used in the process, the ordinary commercial acid being mixed with water in the proportion of one to two. The impure zinc plates are suspended in the bath, and the pure zinc is deposited on thin zinc plates, or on copper or iron plates coated with plumbago. When the operation is finished, the cathode plates are washed, and melted into ingots. To reduce the ores of zinc, especially the carbonate, the minerals are first reduced to a powder, and then submitted to the action of the acid, being added a little at a time. When the zinc is completely dissolved, the liquid is allowed to stand, and is then drawn off, and mixed with water in equal pro-