the importance of further search after evidences of ingulfment.

Regarding the age of the caldera, it would be premature to offer any opinion, beyond the vague and general statement, that it is certainly many thousands of years old. There is abundant reason to hope, however, that further examination will throw some light on this question. We cannot, indeed, expect to reach any estimate of its age in terms of years and centuries; and our hope must be confined to that of fixing its relative age in terms of the geological calendar. Viewed in that relation, it may be said with equal confidence that its age is not great. C. E. DUTTON.

THE FISH-CULTURAL STATION AT GLOUCESTER, MASS.

WE are informed that it is the intention of Professor Baird, the U. S. commissioner of fisheries, now that methods and apparatus for hatching successfully the buoyant eggs of the cod, halibut, and other marine species have been devised, to prosecute the work on as extensive a scale as the means at the command of the commissioner will permit.

Gloucester, being the centre of the cod and halibut fisheries, furnishes unusual facilities for procuring an abundant supply of eggs within easy and convenient reach of the station, and has therefore been selected as the most advantageous location, for the extensive fish-cultural work with the marine species, now projected by the U. S. commissioner. The commission steamer, the Fish Hawk, thoroughly equipped for hatching-work, has been ordered to Gloucester, and will take her position in the outer harbor, at some convenient point where the anchorage is safe, the water pure and free from sediment, and of sufficient density to insure the buoyancy of the eggs during incubation.

All the usual methods for collecting eggs will be resorted to, and, in addition, it is expected to interest the fishermen themselves in the work of collecting by paying a reasonable price for impregnated eggs delivered at the station. Experimental investigations will also be made to determine the practicability of forwarding impregnated eggs from Gloucester to Wood's Holl and other stations to be hatched. The species which will chiefly engage the attention of the experts of the commission are the cod, halibut, haddock, herring, and the mackerel.

The results of the work with the halibut will be watched with special interest, both by fish-culturists and by those who are engaged in the fisheries. This fish is even more prolific than the cod-fish. Once in extraordinary abundance in Massachusetts and Ipswich bays, it has, within the memory of man, been almost exterminated in the area referred to. Have the conditions changed so as to determine the migration of the species to more congenial waters, or has man, by his direct agency in the fisheries, effected the extermination, over a given area, of a marine species of such marvellous fecundity? This is a question to which the work of the commission promises, in a few years, to furnish a satisfactory answer.

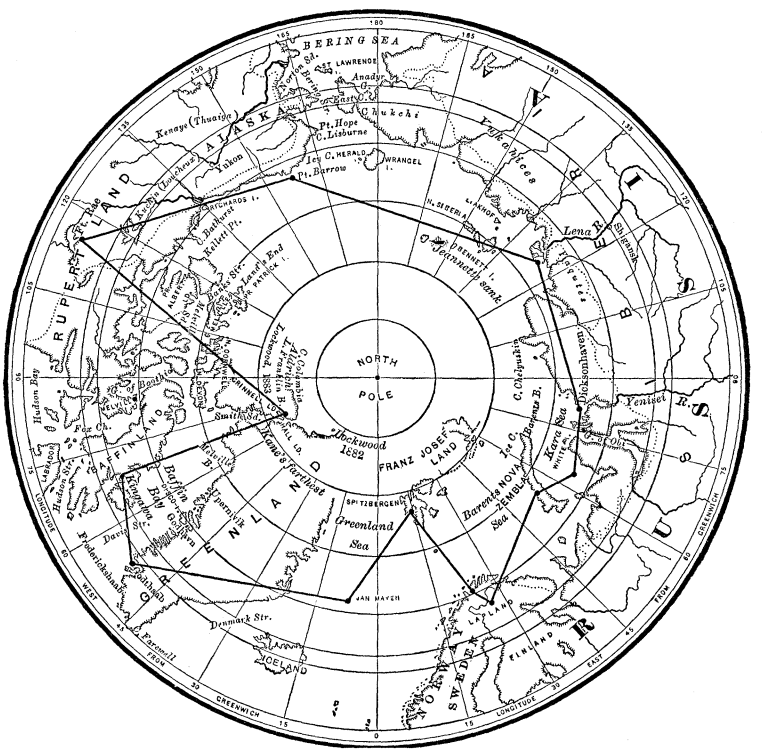
GREELY'S THREE YEARS OF ARCTIC SERVICE.

THE name and fame of Lieut. A. W. Greely of the U. S. army now belong to the history of geographical research and of undaunted heroism. The pages of this journal have so often referred to his arctic explorations that it would be superfluous to review again the thrilling incidents of his perilous voyage. The scientific world is well aware that he was sent by the U. S. government as the leader of an expedition which was to co-operate with many kindred parties in the observation of physical phenomena in the extreme north; that this arduous enterprise was not for the gratification of personal or national pride by extending the coast-lines of the northern chart, or by carrying the flag a little nearer to the pole than it had ever been borne before; that it was not for the purpose of adding renown to the army, or glory to the explorers, but to help in solving important problems in terrestrial physics by a series of exact, patient, long-continued, and carefully recorded observations in the ice-bound regions of the north.

As long ago as 1875, Lieutenant Weyprecht of the Austrian navy, who had won experience and distinction in arctic researches, succeeded in calling the attention of the civilized world to the idea that future voyages should not be planned with reference to the increase of our knowledge of geographical boundaries, but rather to the ascertainment of scientific facts, by contemporaneous observations in well-chosen stations at the north, under the concerted actions of the most experienced men and the most enlightened governments. As a result of the acceptance of this idea, fourteen stations were established by eleven co-operating nations; namely, Austria, Denmark, France, Germany, Great Britain, Holland, Norway, Russia, Sweden, and the United States. Many astronomical observatories in different parts of the globe lent their aid to the project, so that the number of

Three years of arctic service. An account of the Lady Franklin Bay expedition of 1881-84, and the attainment of the farthest north. By ADOLPHUS W. GREELY. 2 vols. New York, *Scribner*, 1886, 8°.

stations observing in concert was more than forty. Seven hundred men, in all, were exposed to the dangers of arctic life; but so skilful were the arrangements that no man perished, with the unfortunate exception of some who were connected with the Lady Franklin Bay expedition, and not they until after their appointed duties had been successfully completed. The results of all these efforts are gradually becoming the possession of the scientific world. It will take a long while to reduce the observations and to publish them in



ARCTIC REGIONS, SHOWING LOCATION OF CIRCUMPOLAR STATIONS, 1881–83.

[Reproduced through the courtesy of Charles Scribner's Sons.]

proper form, and longer still to discover the laws which are suggested by the recorded phenomena; but the work projected has been done, and well done, and mankind will reap the benefits. Whether the results are more or less, Lieutenant Greely is right in saying that the work of the International polar commission will live in history, if only as an epoch in modern civilization, marked by the union of eleven great nations in planning and executing for strictly scientific purposes so expensive and dangerous a work.

For the services which were required in the Lady Franklin Bay expedition, Lieutenant Greely, although not a seaman, had some unusual qualifications. He had entered the army at the age of seventeen, and endured the privations and dangers of the civil war. After peace was established, he continued in the army as one of the officers of the signal service, and thus became expert in the kind of observations to be made at the north. His physical, intellectual, and moral qualities, as the sequel proved, were adequate to his great responsibilities, and, although disaster has cast a gloom over the close of his voyage, his conduct of the work intrusted to him deserves the highest praise; and the modest record which he has now published exhibits with great accuracy and comprehensiveness the various aspects of his expedition. His pages bear the stamp of trustworthiness. There is no boasting, no self-laudation, no concealment of the embarrassments which beset the party. There is a generous recognition of the parts which were performed by all his brave associates. There is a careful record of experiences which may be useful to other navigators. There are preliminary

announcements of the scientific work of the expedition. There is no attempt at fine writing, even in those chapters which refer to most thrilling incidents; but throughout the volume may be traced the hand of a calm, observing, fair-minded, and unostentatious lover of the truth.

In thinking of the results of the Lady Franklin Bay expedition, the popular applause will commonly be given to the bravery of Lockwood and Brainard, who in May, 1882, attained the highest latitude yet reached by man (83° 23.8′ north [1]). Lockwood, unfortunately, died before the rescue of the expedition. Brainard came home, and, after eight years' service in the ranks, remains a sergeant, when his record would have gained him a commission at once in any other service in the world.

Another important reconnaissance was accomplished by Lockwood in a prolonged tour across Grinnell Land, where a remarkable series of fertile valleys was found, in which herds of musk-oxen pasture. Over a hundred of these animals were killed, and two hundred others were seen. The glaciers of Grinnell Land are extraordinary. On the shores of Lake Hazen, Greely discovered what he believes to have been the most northerly permanent habitation of man that is known, though the inhabitants thereof have vanished.

The physical observations proposed by the Hamburg polar conference were maintained from July 1, 1881, until June 21, 1884, — forty hours before the rescue of the survivors. Observations as to atmospheric pressure, temperature, and dew-point; direction and force of the wind; quantity, kind, and movement of clouds; the aurora, and the state of the weather, — were made hourly after Fort Conger was reached. Of the magnetometer (by which the declination of the magnetic needle was noted) there were ten hourly readings, except on the 1st and 15th of every month, when the readings were much more frequent. The magnetic inclination or dip was also observed, but the instrument was so poor that the value of the record is seriously impaired. Tidal observations, which promise to be of much value, were likewise made. Great pains were taken to secure accurate observations of the pendulum as a contribution to geodesy. Air samples were secured, but abandoned on the retreat. The velocity of sound at low temperatures was noted. Each day there were 526 recorded observations, — 264 magnetic, 234 meteorological, and 28 tidal. Careful memoranda were made upon the diet of the members of the party, and upon all the circumstances which tended to keep up their health; and the chapter on hygiene and routine is by no means the least important in the volumes. Geological, paleontological, zoölogical, botanical, and ethnological facts were noted whenever there was opportunity to collect such information. On all these points the appendixes are very full.

[1] Markham's highest point in 1876 was 83° 20′ 26″.

It only remains for us to add that these volumes are printed in a most attractive manner, and that the illustrations and maps are abundant and satisfactory. In all respects the book is a credit to the author and the publishers. We purposely avoid here all comment on the cause of the sad failure to relieve at the appointed time the party, and all questions in respect to the imperfections of the outfit. There was a sad lack of thorough attention to some details, — a lack which has greatly impaired the satisfaction with which the expedition would otherwise have been regarded. But Greely and his brave comrades have borne their part nobly, and we trust that a grateful republic will ponder the words with which these volumes close, and act, through congress, before it is too late.

"No man of the party has received promotion, except such temporary advancement as my personal urging could secure. Two men, with broken health, have adventured their private fortunes; and one, a most self-sacrificing, soldierly, temperate, and loyal man, lies, as these lines are penned, helpless in a city hospital, aided by private charity, his pension not even awarded. Even the meagre allowances originally promised for arctic service have not been fully paid, and the widows of the dead are generally as yet unrecognized.

"Our great country in these days asks not in vain for its sons to venture their lives for any idea which may subserve its interests or enhance its greatness. I trust that posterity may never mourn the decadence of that indomitable American spirit which in this generation fought out to the bitter end its great civil war, and made it seem an easy thing in time of peace to penetrate the heart of Africa, to perish in the Lena Delta, to die at Sabine, or to attain the farthest north."

LONDON LETTER.

ALL friends of scientific education, as well as a wider circle, hail with the greatest satisfaction the appointment of Sir Lyon Playfair, the present president of the British association for the advancement of science, to the post which is practically minister of education under Mr. Gladstone's government, which has just been constituted. For many years Sir Lyon Playfair was chairman of committees of the house of commons, and at one time he held the position of postmaster-general in a former government. It is often re-