that these principles had been so stated as to convey a meaning quite different from that intended. It is hoped that these notes concerning the writer's statements that have been criticized will throw a somewhat different light on their interpretation.

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AN IMPROVED METHOD OF HOLDING LARGE SPECIMENS FOR DISSECTION

MR. JOHN M. LONG[1] recently published a scheme for holding large specimens open while dissecting them in which he uses "trays of galvanized iron with four or more loops of metal soldered on the sides to which ordinary heavy rubber bands are attached. To these rubber bands are tied small fishhooks which have had their barbs filed off. These hooks are to be fastened to any part of the anatomy so as to hold the specimen firmly, or to pull certain parts to the desired position." As these rubber bands with the sharp fishhooks attached are permanently tied to the sides of the trays, there is some danger and inconvenience in handling the latter. This difficulty can be overcome and the whole scheme improved upon by fastening small, blunt hooks to the rubber bands at the opposite ends from the fishhooks, thus making them so that they can be easily removed from the trays. It is also a good idea to file the points of the fishhooks down somewhat so that they are not so dangerous to handle, and yet they can be easily thrust through the skin or flesh of the specimen to be held.

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SCIENTIFIC BOOKS

South. The Story of Shackleton's Last Expedition, 1914–1917. By SIR ERNEST SHACKLETON, C.V.O. With 88 illustrations and diagrams. The Macmillan Company, New York, 1920. $6.00.

It has been well said that peace has its victories as great as those of war. Too much praise can not be given the men who for country alone, or for the whole world, have struggled and suffered, bled or died. But peace, not war, is the normal phase of our life, and its unwarlike victories—material, mental and spiritual—most deeply affect us. For this reason the world delights to read this straightforward tale of Shackleton, wherein are embodied high adventure, unique experiences and thrilling situations with displays of courage and persistence, of fidelity and solidarity—qualities which ennoble mankind.

The scientific work in view was the most comprehensive and ambitious ever attempted by a polar expedition. In extent and importance it approached, if it did not surpass, the International Polar Conference program of 1881–1884. Geographically the vast ice-clad continent of Antarctica was to be crossed from Weddell Sea to Ross Sea, and its glacier-lined, unknown coasts charted by cruises in unvisited waters of the Antarctic Ocean. Scientifically were to be studied the fauna of the sea, the hydrography of the ocean, the geology of the land, the meteorology of the air, and the mysteries of magnetism. The primary base, under Shackleton personally, was to be established near Vachsel Bay, Luitpold Land, discovered in Weddell Sea by Filchner in 1912.

It is of special interest that this south-polar area, through the comprehensive policy and timely application of England's colonial methods, is a part of her empire. By proclamation of July, 1908, this region was declared to be British territory which was defined as "Situated in the South Atlantic Ocean to the south of the 50th parallel of south latitude and lying between 20 degrees and 80 degrees west longitude."

The second party—to enter Ross Sea—will be later considered. Sailing from Plymouth, August 8, 1914, after the Admiralty had declined the offer for war purposes of his ship *Endurance*, Shackleton made his final arrangements at Grytvikin, South Georgia whence he steamed south on December 5. His ship was fitted for every contingency, and his crew

[1] SCIENCE, Vol. XLIX., pp. 120–121.

of 28 were men selected from nearly 5,000 volunteers, eager for polar adventure.

Two days later the ship entered the pack which was found very far north, and proved to be increasingly unfavorable. Five hundred bergs were passed in a single day, and the *Endurance* sailed over the projecting foot of a berg 150 feet high. After steaming over 700 miles through the pack Coats Land, discovered by Bruce in the *Scotia,* 1904, was sighted from 72° 20′ S. on January 10, 1915. This land was skirted its entire length, from 72° 34′ S., 16° 40′ W., to about 74° 04′ S. 22° 48′ W. Beyond this coast Shackleton discovered new land, which he named Caird Coast, which he followed about 200 miles to its junction with Leopold Coast of Filchner, 1912. The extreme northerly point of Caird Coast is in about 73° 20′ S., 26° W. and the southern point in 76° 30′ S., 28° W.

Shackleton thus describes it: "It is fronted by an undulating barrier, which terminates usually in cliffs ranging from 10 to 300 feet in height, but in a very few places sweeps down level with the sea. At the southern end of Caird Coast the ice-sheet, undulating over the hidden and imprisoned land, is bursting down a steep slope in tremendous glaciers bristling with ridges of ice and seamed by thousands of crevasses. Along the whole length of the coast we have seen no bare land or rock. Not as much as a solitary nunatak has appeared."

On January 18, 1915, the *Endurance* was beset in the pack, in 76° 34′ S., 31° 30′ W., never to be released. Thus ended the chance of landing and of crossing Antarctica. This besetment occurred in midsummer, when unusually low temperatures of zero and below were observed.

Held fast the ship drifted with the main ice-pack and reached an extreme southing of 77° S. 35° W. The drift was first to the west and then to the north-by-west attaining April 9, 1916, 62° S., 54° W. Crushed by the ice the *Endurance* sank November 21, 1916, in 69° S., 53° W. when the crew took to the ice. They were then 346 miles from Paulet Island, the nearest place of safety, which two separate attempts to reach, by travel over the ice-floes, proved impossible of attainment. They were forced to depend on the northerly drift of the main pack for safety. Their drift life of four and a half months was marked by vicissitudes and miseries inseparable from storms, with tent-shelter only, and lack of heat. Food was also insufficient, their daily ration for a while being below ten ounces of food, and despite continuous hunting they finally were forced to eat their dogs. Storms were frequent and one blizzard caused intense suffering with temperatures of 21 to 34 degrees below zero. Dredging, soundings, weather observations, hunting and games were carried on in such manner as to preserve the morale of the men.

There had been a northerly drift of about 1,500 miles, making good a northing of 573 miles before the *Endurance* sank. This drift continued until the end of the antarctic summer, in March, found them outside of the antarctic circle and in sight of Joinville Island, with the close ice-pack so disintegrated as to make travel thereto impossible, either by boat or by sledge. On April 7, 1916, after the breaking up of floes had several times threatened the loss of boats and party they sighted Elephant Island. Launching their three boats under conditions of great and continuing danger they were day after day obliged to take refuge from closing ice on the nearest floe or berg of size. Almost as by miracle they reached and landed on glacier-covered Elephant Island, where a narrow fringe of tide-swept beach was the only visible land. Fortunately penguins and seal were present in such numbers as to save them from immediate starvation. With coming winter there was such danger of the party perishing that Shackleton with five men sought relief from South Georgia, over 800 miles distant. This journey, across the most tempestous storm-swept southern ocean in approaching winter, and the crossing of South Georgia by land, are among the most thrilling experiences in polar history. Tortured by thirst, benumbed by cold, water-soaked whether on duty or in their sleeping bags, their skill as

navigators was all that enabled them to make the journey, while they were exhausted by the necessity of bailing the boat continuously for days, to keep her from swamping under pouring sprays and whelming waves.

Four relief expeditions were necessary under Shackleton before the party on Elephant Island were rescued. Through the energy and direction of Frank Wild, the marooned party of 22 men lived through four and a half months of winter in huts with stone walls, and boat-covered, as had been done by the Greely Arctic Expedition at Cape Sabibe in the winter of 1883–1884.

At Elephant Island the food supply was limited almost to a starvation point, though their regular food was supplemented by penguins, seals, seaweed and sea-limpets. While the Weddell Sea scientific observations have not been published some items of interest are given in this narrative. In 77° S. 34° W. the magnetic variation was found to be six degrees west; auroras were rare. Meteorologically clear sky increased steadily from 7 per cent. in January to 45.7 in July; it decreased to below 30 from September to November and nearly to zero in December. Temperatures were fairly high, the minimum for the year being 35 degrees below zero in July. Generally southerly winds brought clear weather with low temperatures, while the reverse conditions obtained with northerly winds. The ice-drift, due partly to currents but more largely to winds of Weddell Sea, is contrary to the movements of the hands of a watch. Doubtless it conforms almost entirely to a course nearly parallel to the general contours of the land masses of Antarctica. Geographically the only direct contribution is the connection of Coats Land and Luitpold Land, which determines the continuity of the continent of Antarctica from 6 to 43 degrees west longitude, and from 72.5 to 78 degrees south latitude. The North Greenland of Morrell disappeared long since from charts, but the reviewer's belief, in his Hand-Book of Polar Discoveries, that Morrell's longitudes were to blame would throw this land some 12 degrees west to Palmer or Graham Land. Astronomical observations proved that Shackleton's chronometer longitudes were one degree in error. Again he throws Foyn coast two degrees to the west of its reported position, and states that his observations place Sanders Island three miles east and five miles north of its charted position. These corrections indicate clearly the liability of explorers, unless highly skilled, to material errors when making observations under abnormal and difficult conditions. Hydrographically Weddell Sea is very deep, averaging in the large over 2,000 fathoms. Shackleton mentions three soundings of 2,400, 2,810 and 2,819 fathoms. He mentions the shoaling of the sea as he drifted "north either to east or west, from 77° S., and the fact suggested that the contour lines ran east and west roughly." The reviewer thinks that this indicates the existence of a continental shelf, off land trending westerly along the 77th parallel, and changing to north-northwest between longitudes 55° and 60° west.

The summary of Lieutenant Clark on the whaling industry of the Dependencies of the Falkland Islands is of special interest. The total value of the fisheries, in pounds sterling, were: 1913, 1,252,342; 1914, 1,300,978; 1915, 1,333,401 and in 1916, 1,774,570. In 1916 11,860 whales were captured in this area. The industry is now dependent on large fin and blue whales, humpbacks having been largely reduced in numbers.

The Ross Sea story is one of heroic effort not unmixed with disaster. The *Aurora,* Captain Mackintosh, left Hobart in December, 1914, and reached Cape Evans January 16, 1915, and after preliminary movements went into winter-quarters. While Mackintosh was absent, and all stores for the expedition not yet landed, the *Aurora* was forced by a violent blizzard into the pack on May 6, 1915, and drifting north was not able to clear the pack until March 14, 1916, in 62° 28′ S., 158° W. The marooned party, ten men only, by heroic effort, succeeded in establishing, as planned, a supply depot for the party which was expected to cross Antarctica from Weddell Sea. This depot was laid down at the base of Mt.

Hope, at the foot of the Beardmore, Glacier, in 83° 30′ S. These field parties in 160 days traveled 1,561 miles, of which distance 830 miles were made in laying down from Hunt Point the depot at Mt. Hope. Scurvy attacked the main party in the field and one man, Spencer Smith, died the day before their return journey was completed. Later Captain Mackintosh and Hayward perished in a blizzard during a short journey—probably from disruption of the ice-pack. Shackleton went at once to the rescue of this party, sailing in the *Aurora,* which was commanded by the veteran polar captain, Davis, in December, 1916. The voyage was short and the marooned men were brought safely to Hobart.

The illustrations are of unusual value, conveying as they do a clearer and more accurate view of polar scenes and lands, and especially as to Caird Coast and Elephant Island. The set illustrating various types of ice are important, and should become standard.

The narrative is marked by its appreciation of the members of the two expeditions, and from it one is confirmed in the realization that Shackleton is a leader of men of unusual ability and force. Considerate of his subordinates, he never spared himself, and under a less able leader the Weddell Sea party would have perished.

A. W. Greely

SPECIAL ARTICLES

THE ASH OF DUNE PLANTS

Sand, the final residue after weather and water have worked their will on the silicate rocks, is possibly the poorest substratum in a chemical sense for the growth of plants. Under the action of glaciers and running water followed or accompanied by the hydrolyzing action of water in the presence of carbon dioxide and lastly subjected to the monotonous attrition of particle against particle acutated by wave motion, nothing is left of the original rock masses except partially rounded particles of quartz accompanied by grains of the more resistant silicate minerals and magnetic oxide of iron (Fe_3O_4). The finely divided silt and clay produced during the formation of the sand by wave abrasion and containing the most valuable mineral constituents for plant growth, consisting as they do of particles approaching colloidal dimensions, remain easily in suspension and are carried away by very slight water currents to be deposited far apart from the sand in quiet places. That which remains with the sand after deposition on beach or shore is carried away by the wind and redeposited at a distance, so that beach, shore or dune sand contains a minimal quantity of clay—not enough in a handful to cloud a tumbler of water.

In ordinary sand the silica content varies from approximately 92 to 98 per cent. A part of this exists free as quartz and a part in combination in silicate minerals which have resisted decomposition. The following analyses from Clarke[1] show the composition of sands from various sources.

	A	*B*	*C*	*D*	*E*	*F*
SiO_2	77.78	90.74	82.13	89.99	55.03	91.39
Al_2O_3	9.95	5.16	9.04	7.36	14.12	5.44
Fe_2O_3	2.55	1.14	2.94	.72	10.15	.89
FeO	.21	.08	.....	.13	.....	..16
MnO	.....	Trace	.....	Trace	.....	Trace
OaO	.71	.69	1.28	.46	6.88	Trace
MgO	.17	Trace	.84	Trace	6.38	Trace
K_2O	2.50	1.19	1.93	.33	1.66	1.19
Na_2O	1.82	.26	.95	.33	.87	.70
P_2O_5	.....	.....	.20	.....	.....	.....
Ignition	2.74	1.30	1.01	.60	4.55	.65
	98.43	100.56	100.01	100.43	99.64	100.42

A, B. Glacial sands.
C. Average of five river sands.
D. Sea sand.
E. Sea sand derived from subsilicic igneous rocks.
F. Blown sand.

In spite of its chemical poverty and its inadequacy as a soil for the support of nearly all agricultural plants, sand, nevertheless, has certain physical advantages which are of importance and valuable to such vegetation as

[1] "The Data of Geochemistry," by F. W. Clarke, Bull. 616, U. S. Geological Survey.