

VI.—SUPPLEMENTARY NOTES ON DRIFT ICE AS A TRANSPORTING  
AGENT.—BY WALTER H. PREST, *Bedford, N. S.*

(*Read 10th March, 1902.*)

A second visit to Labrador has largely confirmed my observations of 1900\*, and convinced me that the transportation of debris by floating ice has been greatly overrated. Although again in the midst of icebergs and field-ice for over three months, I could find extremely few icebergs carrying earthy material. The field-ice, in huge pans, often several acres in extent, and 40 or 50 feet thick, seemed almost as destitute of debris as the bergs. The only drift-bearing ice was comparatively thin, usually much broken up and refrozen, and without doubt formed in shallow coast waters. Near the Straits of Belle Isle, the little remaining debris on this was nearly all marine or much mixed with marine organisms. Further north, especially in the bays, the transported material was largely of littoral origin. This difference was owing to the fact that the surf had nearly completed its cleansing process before the arrival of the ice at the Straits. Some of this debris-bearing ice, when examined closely, is found to be merely discoloured by a very fine, dust like material, probably not  $\frac{1}{1000}$  part of the weight of the ice bearing it.

I had the pleasure of seeing how the harbor ice received its burden, on a shallow, sandy shore called the Strand, a short distance north of Sandwich Bay. Parts of this coast, even in the month of June, were fringed with ice near high-water mark. Over this ran rivulets carrying mud and gravel from the banks above, while the waves contributed their share of debris in the form of sand, seaweed, and shells.

One fact strongly supporting my contention of 1900, was brought the more prominently to my notice as I went north. This was the ever increasing quantity of debris on the thin ice

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\* See paper by the writer in *Trans. N. S. I. S.*, vol. x, pt. 3.

as I proceeded toward its source, showing that the ice drops the greater part of its burden near the northern Labrador coast. But the heavy field-ice and bergs even in the latitude of Nain, showed very few traces of impurities. Further south the remarkable cleanliness of the heavy ice was more noticeable. Along the southern 150 miles of the north-east Labrador coast, although icebergs were constantly in sight, I saw only five that carried impurities, the most of these having merely discoloured patches and bands. The pure white sides of the vast number of these ice masses gave evidence of the cleansing power of sun and surf since leaving their northern home.

I have made many enquiries concerning the presence of earth and stones on the ice in the North Atlantic. Among the men questioned was Captain Nordby, an old Norwegian mariner, now at Parrsboro, N. S.; Captains James and William McConnell, of Port Hilford, N. S., who have had life long experiences in these northern seas; and also several Newfoundland sealing captains, men who have had more experience with drift ice than any other seamen in the world. I find among them an almost unanimous opinion that the quantity of debris brought south by the bergs and field-ice is extremely small, and that the addition to the Grand Banks by these means would be hardly noticeable even in a hundred centuries.

That the Grand Banks of Newfoundland are not the immense deposits of ice-transported mud and other debris formerly supposed, I may instance the Virgin Ledges, awash at low water. The Tertiary fragments dredged up there indicate the existence of large areas of exposed rocky ledges, rather than the results of drift transportation from more northern regions. The disintegration of these rocks, no doubt, greatly assisted in the formation of outlying portions of the banks at a time when the eastern part of the American continent was much higher and more extensive than at present. The evidence seems to point to the existence there of an undulating, rocky plateau, which, like the adjacent provinces, had its morraines, kames, and other accumulations of drift, subsequently slightly added to by oceanic circulation.

In reference to erosion by drift ice—noticed in my former paper—an exact counterpart of the peculiar markings and furrows seen in Labrador is to be seen in the Mount Uniacke gold district, Nova Scotia. There, about three-quarters of a mile east of the 30-stamp mill, on several large exposures of quartzite, are seen hundreds of the curved furrows and scratches possible only with the irregular movements of storm-tossed boulders. These scratched surfaces incline slightly toward a shallow valley to the northwest, and show on that side the strongest evidences of ice action. Some of the more protected portions show evidences of earlier glacial action, the striations varying from S. 8° to S. 16° E.

In concluding these notes, I can only reiterate my opinions of a year ago:—1st, that the drift ice from the Arctic performs but an extremely infinitesimal part in the building of the accumulation known as the Banks of Newfoundland; 2nd, that these banks had their origin in Pleistocene times, and are simply glacial debris worked over by the sea; 3rd, that their terrestrial equivalents can be traced in the broad belt of morrains, kames, dunes, and other modified deposits which reach in a huge, irregular curve from Nova Scotia and the southern part of the New England States to the prairies of the Canadian Northwest.