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# CORRESPONDENCE

The Editor,

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SIR, *About the use of the expression "inland ice"*

In much recent glaciological literature the Danish word *Indlandsisen*, and its equivalents *the Inland Ice* (English) and *l'Indlandsis* (French) have caused some confusion. These expressions have been used as synonymous with "ice sheet" or "ice cover", as well as in a more restricted way to mean the Greenland Ice Sheet. It might therefore be of interest to clarify the origin of the word *Indlandsisen*, from which the terms *the Inland Ice* and "*l'Indlandsis*" are presumably derived.

It is significant that the expression "*the* Inland Ice" is generally used with the definite article, just as in the Danish word Indlandsis*en* (*-en* being the definitive form). This alone implies that in both languages the term denotes a specific ice mass and is not merely descriptive.

Concerning the origin of the word *Indlandsisen* the Danish geologist K. J. V. Steenstrup (1900, p. 278) wrote "Concerning the origin of this name, Dr. Rink has informed me that he on his return from Greenland in 1851 was not sure what he should call the general ice cover of the country, until then called the Ice Blink (*Isblinken*), to distinguish it from the ice cover of the peninsulas and islands, and when he on that occasion asked Forchhammer and Jap. Steenstrup for advice, the last named suggested to him the name of *Indlandsisen*" (translated from Danish by the present writer).

Of the individuals mentioned by K. J. V. Steenstrup, H. Rink (1819–1893) was the first to draw attention to the Inland Ice and the problems concerning its production of calf ice and its origin (Kayser, 1928, p. 367; Oldendow, 1955). J. G. Forchhammer (1794–1865) was professor of mineralogy at Copenhagen University from 1831 and Japetus Steenstrup (1813–1897) professor of zoology at the same university from 1845. K. J. V. Steenstrup (1842–1913) who is quoted above and who was a nephew of Japetus Steenstrup, made extensive investigations of the west coast of Greenland between 1871 and 1899.

There is no doubt that the word *Indlandsisen* originally meant an ice cover, barred from the sea by a generally wide coastal land strip and, in contrast to normal glaciers, of an immense extent and with a base situated at sea-level. Furthermore, from its origin, it is clear that the name is restricted to such an ice cover in Greenland. "The Inland Ice" or *Indlandsisen* should therefore be emphasized as a place name rather than as a descriptive term for an ice sheet; just as the Sahara is the great Libyan desert and not a synonym for "desert", *Indlandsisen* is the great Greenland Ice Sheet and not a synonym for "ice sheet". To talk about "the Antarctic Inland Ice" or worse, "the Pleistocene Scandinavian Inland Ice" is therefore not correct. It is proposed that in future the word *Indlandsisen* or the English equivalent "the Inland Ice" is restricted to its original meaning: the ice sheet of Greenland, and that the general expression for extensive ice covers elsewhere or at other times should be "ice sheet" or "ice cover".

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*28 December 1966*

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SIR, *Walsh Glacier surge, 1966 observations*

Walsh Glacier (Canada and Alaska) was observed making a remarkable surge between 1961 and 1965, a maximum movement of about 10,050 m. occurring during that interval (Post, 1966). Oblique



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aerial photographs of the glacier taken in 1966 show that the surge has continued, the greatest changes being recorded in the terminal region. A maximum movement of about 4,000 m. occurred in the narrow, lower part of the Walsh Valley between 23 August 1965 and 17 September 1966. The influx of Walsh Glacier ice has completely transformed Logan Glacier below the point where Walsh Glacier joins. Virtually stagnant ice, largely derived from Logan Glacier, is now completely invaded and activated by ice from Walsh Glacier, and the terminus of Logan Glacier has been thrust ahead as much as 1,500 m. (Fig. 1).

*Fig. 1. Walsh Glacier (left) and Logan Glacier (center), 17 September 1966. The surge of Walsh Glacier, which in August 1963 had just reached the point where the glaciers join, has now completely dominated lower Logan Glacier. Formerly, ice below the junction was virtually stagnant and the positions of the medial moraines indicated that Walsh Glacier had furnished only about one-quarter of the ice in the lower valley. The stagnant, moraine-covered ice in the foreground, now being over-ridden by the advancing ice from Walsh Glacier, is a part of Chitina Glacier which flows in from the lower left. (Photograph by Austin Post, U.S. Geological Survey)*

Ice movement farther up Walsh Glacier has been much less than in the lower valley during the past year. In the vicinity of the first tributary (Post, 1966, fig. 1, table I) surface features were displaced down-valley about 2,100 m.; near Cadorna Glacier the movement was approximately 1,500 m. The reduced rate of flow in the upper part of the valley is considered evidence that the surge is about over. This surge is unusual both in the maximum movement recorded (about 11,500 m.) and in the period of time during which the surge has been in progress (more than 4 years). The former position of the Logan Glacier medial moraines indicates that no former surge of Walsh Glacier of this magnitude has occurred in the past 100 years or more.

Increased activity of at least three other glaciers in the vicinity of Walsh Glacier in 1966 may be evidence of new surges developing. These are: (1) Baldwin Glacier; (2) the first tributary of Logan Glacier east of Baldwin Glacier; (3) the next valley glacier west of Baldwin Glacier. The last-mentioned glacier had started to advance slightly in 1966. There was also evidence (in the form of increased marginal crevassing) that the large Anderson Glacier, the major source of ice for Chitina Glacier, is now moving more rapidly than in 1960. Unstable conditions in the Chitina Glacier system, similar to those of Muldrow Glacier prior to its surge (Post, 1960), and Steele Glacier, which surged in 1965–66, suggest that a large-scale glacier surge may occur in these glaciers in the next few years.

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*1 November 1966*

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SIR, *Measurement of the permittivity of ice*

S. Evans writes in his very interesting publication (Evans, 1965, p. 785): "We have shown that pure ice has a relaxation spectrum, related to temperature, but more measurements are needed on naturally occurring snow and ice. It may then be possible to develop a technique for temperature measurement in deep ice by investigating the relaxation spectrum with electrodes on the surface." For such a technique it is important to measure the permittivity* of deep ice layers under the original conditions of temperature, pressure and grain structure. This could be done by means of electro-thermal deep drilling. I want to suggest a simple device for achieving this.

The flat or pyramidally pointed bottom of the deep-drilling probe (Philberth, 1966) is one electrode, the cylindrical side wall of the probe is the earthed electrode; both electrodes together form a capacitor. Its capacitance can be measured as follows: A capacitor $C$ of high precision is connected parallel to it (in order to reduce the loss tangent) and by means of a transistor–amplifier $A$ auto-oscillation is caused; this is brought about by parallel connection of an inductor $L$, or by one of the known $RC$-circuits.

The frequency of the oscillation is a function of the real part of the complex permittivity; the maximum sensitivity of the real part to changes of temperature is in the range where the imaginary part (loss factor) reaches its maximum. For ice temperatures between $-20$°C. and 0°C., this range is realized for frequencies in the order of 3 kHz. For Greenland conditions frequencies of the order of 3 to 10 kHz.

* Permittivity is the term recommended by the Commission on Symbols, Units and Nomenclature of the International Union of Pure and Applied Physics for the quantity sometimes known as dielectric constant. As the quantity is not a constant but varies with frequency and temperature—in the case of ice the relative permittivity can be anywhere between 3 and 100—a term which does not use the word constant is to be welcomed. *Ed.*