NA^+ ACTIVITY AS MEASURED IN NATURAL WATERS, HUMID SOILS AND VEGETATION IN THE AREA AROUND FISKENÆSFJORDEN (QEQERTARSSUATSIAIT KANGERDLUAT), SOUTHERN WEST GREENLAND

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In order to gain some knowledge of the regional distribution of sodium and of the release of sodium from silicate rocks under sub-arctic conditions, Na^+ activity has been measured by means of a selective glass-electrode on a variety of naturally occurring substances in the Fiskenæsfjorden area. The technique employed is rather similar to that used for pH measurements; results are therefore expressed as pNa, being the negative logarithm of the Na^+ activity.

The field work was carried out from the base camp Midgård (see Kalsbeek, this report). The area, like Greenland as a whole, is considered to be well suited for measurements of this kind for the following reasons:

1. the population (around 50 000 inhabitants) is concentrated in small settlements along the outer coast;
2. agriculture and hence possible use of fertiliser is restricted to the southernmost tip of Greenland;
3. pollution caused by local industrial waste or by wind-borne industrial exhausts from North America does not contribute appreciably to the Na^+ activity level, as deduced from chemical studies on arctic glacier ice (Langway, 1967).

The only added source of sodium is salt spray from the ocean.

The pNa due to precipitation was monitored and it was found that apart from the coastal lowland fringe, the mountainous central coastal area received precipitation with a mean pNa $(\bar{x}) = 4.71$, the standard deviation (s) being 0.51 pNa units. This comparatively large standard deviation reflects the influence of the direction of the winds. South-western winds are predominant in the area.

The pNa of the precipitation along the border of the Inland Ice and of glacier ice in that area was found to be pNa $(\bar{x}) = 5.12$, $s = 0.30$ pNa units. This figure compares well with the Na^+ content as determined in melt water samples of snow, firn cores and ice cores from various locations in North Greenland, not far from Site 2 (76°59'N, 56°04'W) (Langway, 1967), having pNa $(\bar{x}) = 5.48$, $s = 0.24$ pNa units.

The pNa measurements of natural waters, soils and vegetation of the central coastal area in the Fiskenæsfjorden region are given in the table below.

pNa units	$\bar{x}$	s
Melt water streams from the Inland Ice	4.77	0.11
Run-off water in streams and brooks	4.46	0.22
Lake water	4.17	0.41
Peat water	3.69	0.54
Humid silty soils	3.83	0.46
Topsoils (B_o layer)	2.67	0.44
Vegetation	2.36	0.43

The measurements on vegetation were carried out on the widespread moss *Polytrichum* sp. (Haircap moss), by direct electrode contact with a slightly compacted wet sample in its natural state.

From the figures given above it is evident that precipitated sodium is, to a large extent, retained by the vegetation, and slightly concentrated in the topsoil layer.

The Na^+ activity of peat water reflects the regional level of the environmental balanced sodium content in the area, positioned between the pNa level of the soils and that of the topsoil which contains sodium released from vegetational debris.

The balanced Na^+ activity can also be expressed as being 4.7 mg Na^+/1000 g, or approximately 0.2 meq/1000 g.

An acceptable estimate of Na^+ dissolved from exposed rocks, loose rock fragments and from the rock bottom of glaciated areas may be obtained by comparing the Na^+ activity of run-off waters and melt water from the Inland Ice against the background of Na^+ activity of the precipitation in the area.

Thus rivulets and streams with run-off water carry about 14 μeq/l, as contributed by dissolution of sodium from exposed surfaces, on a total of 34 μeq/l, i.e. 41 %, while the figure for melt water from the Inland Ice is as low as 9 μeq/l, which is 56 % of the total Na^+ activity in melt water.

From the balanced Na^+ activity of the natural waters in the central coastal area, it can be deduced that the "average" Na^+ activity as contributed by exposed surfaces and particulate matter in the waters will be about 49 μeq/l, being nearly 25 % of the total measured Na^+ activity.

Although the release of Na^+ from exposed rock surfaces and from glacial rock debris is found to be at a general low level, it nevertheless reaches appreciable values.

The average content of particles less than 60 μm found in melt water from the Inland Ice in this area, is around 0.21 g/l, with a specific surface of about 0.24 m^2/g. In other words 0.051 m^2 rock flour is in contact with 1 l melt water. As the released Na^+ activity in melt water is 9 μeq/l, this means that 196 μeq Na^+/m^2 have been dissolved from the rock fragments in melt water having a mean summer temperature of 7.2° C.

Pedro (1964) obtained an average Na_2O content of 85 μg/l water, in contact

with 100 g crushed granite, by controlled soxhlet extraction at 70° C. This figure is equivalent to 2.7 μeq/l. Although no figures have been given for the specific surface of the sample which was used in his experiments, it can be deduced from the descriptions to be of the order of 4.4 10^{-4} m^2/g, which gives a Na^+ release of approximately 250 $\mu eq/m^2$.

References

Langway, C. C. 1967: Stratigraphic analysis of a deep ice core from Greenland. *Res. Rep. Cold Reg. Res. Engng Lab.* **77,** 130 pp. New Hampshire.

Pedro, G. 1964: Contribution a l'étude expérimentale de l'altération géochimique des roches cristallines. *Ann. agronom.* **15,** 85-191.

HYDROLOGICAL PROJECT AT NARSSAQ BRÆ, SOUTH GREENLAND, AS PART OF THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAMME

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Narssaq river valley constitutes the third Danish representative area investigated in the UNESCO International Hydrological Decade (IHD) (see Larsen, 1970). Field work continued there in 1971 from the beginning of June to the end of August.

As proposed by UNESCO/IASH (1970) a drainage basin selected for a combined balances project should meet the following requirements: (a) the basin should be well defined hydrologically and include a glacier covering at least 30 % of the drainage area, (b) the glacier should be normal in regard to size, accumulation, activity and other characteristics and (c) there should be a possibility of measuring simultaneously heat, mass and water balances for at least three years during the IHD.

Narssaq Bræ meets most of these requirements. The glacier occupies two well-defined cirques which form a compound glacier basin with two individual accumulation areas feeding two coalescing ablation areas. The glacier lobes are situated at different levels and have contrasting exposure and directions of movement. The lowest one (900–1200 m above sea level) has a north-western exposure and the highest glacial lobe (1100–1300 m above sea level) a south-western exposure. About 60 % of the total drainage area of the glacier basin is glaciated.

Heat balance

A climatological station at Narssaq Bræ (1015 m above sea level) yields together with the long-term climatological station in Dyrnæs (15 m above sea level),