

Svalbard's Arctic Settlements: From Mining Sites to Urbanized Environments

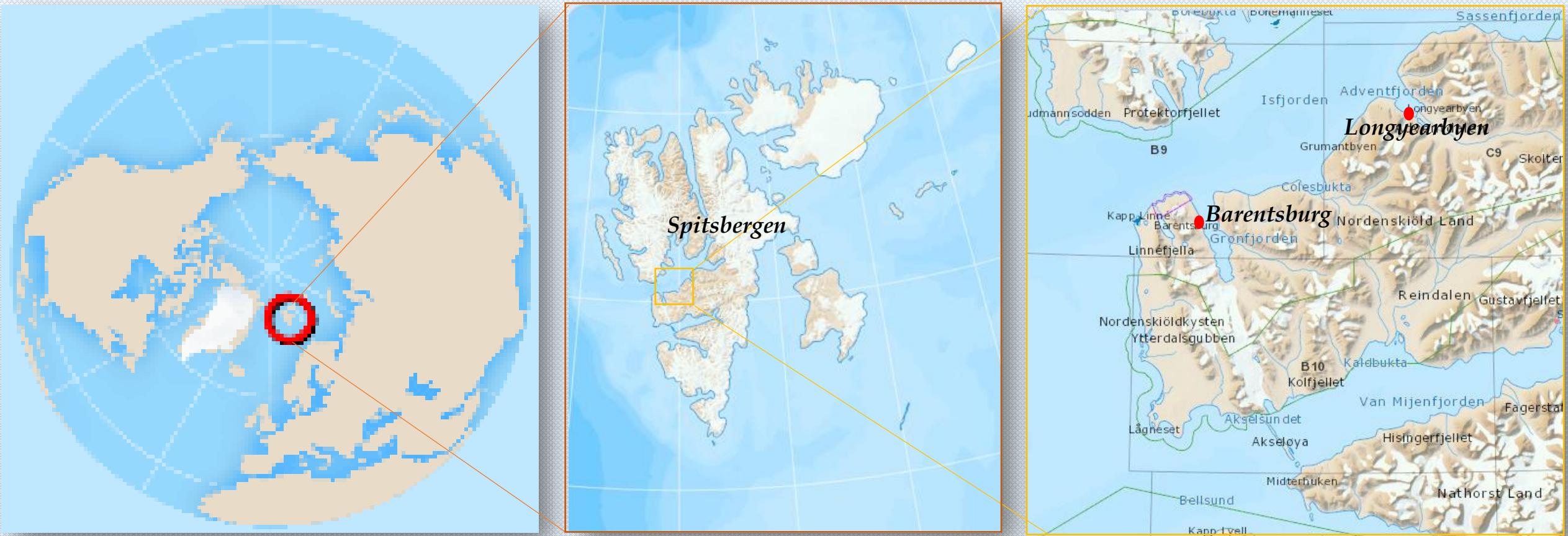
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Spitsbergen is the northernmost permanently inhabited Arctic island, and it has a coal mining history that covers over a century.



Basemap (c) Norwegian Polar Institute.

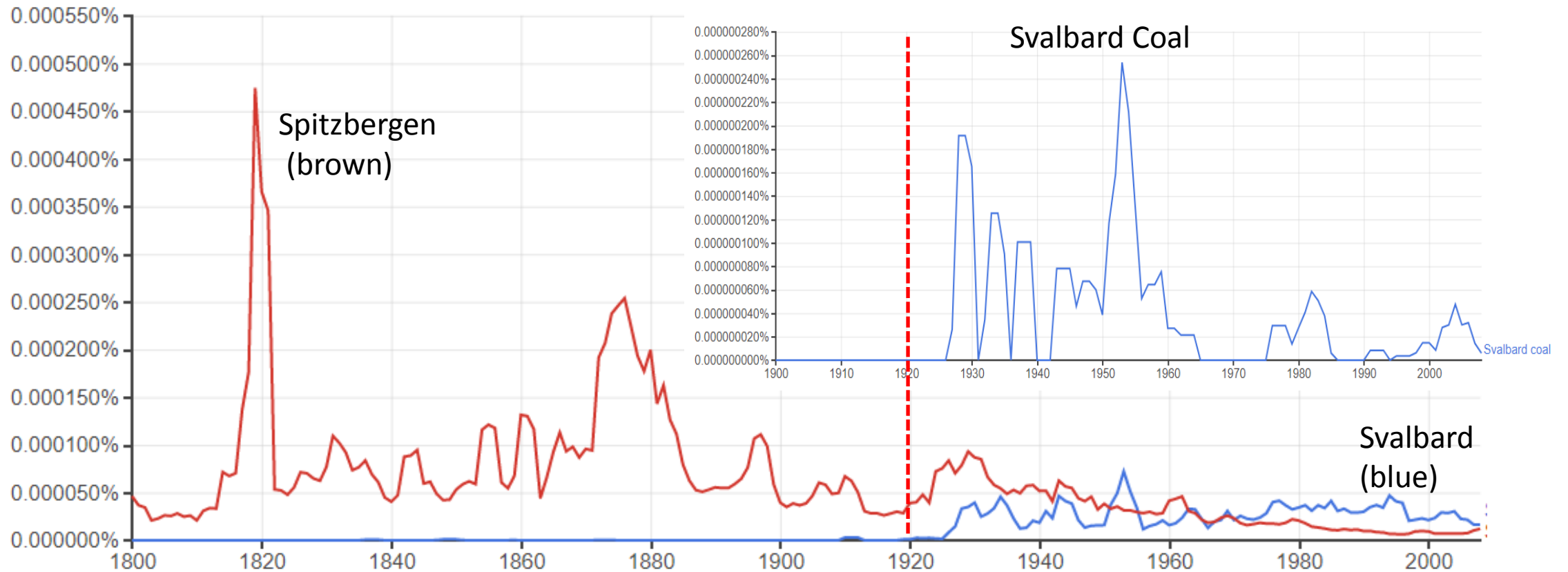


Spitzbergen and Svalbard in Books

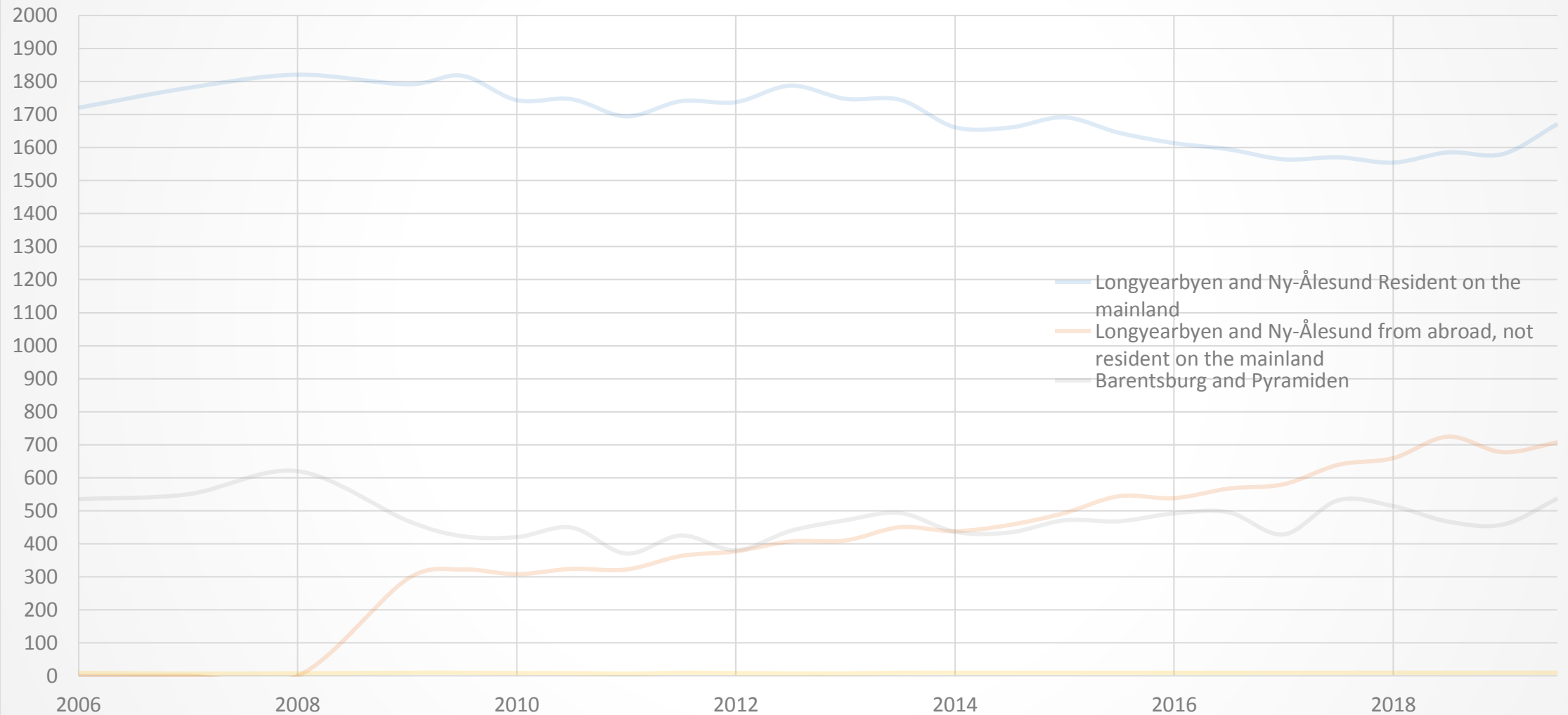
After the Svalbard Treaty (1920), Svalbard starts as a mining site.

The toponym Svalbard and the phrase “Svalbard Coal” entered publications within less than five years.

However, sustained environmental awareness is not present at this point.

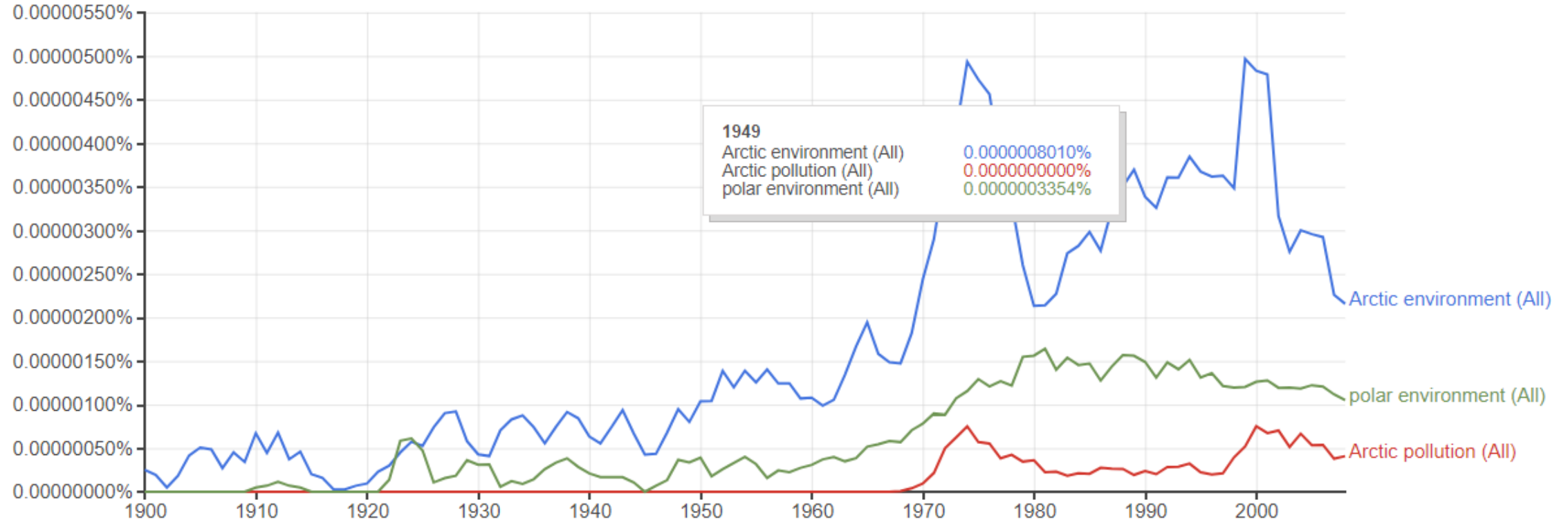


Population in the Settlements. Svalbard



Interest in the Arctic Environment grows from 1970 onward

The 1970s coincide with the establishment of the Polish Polar Station in Hornsund (established in 1957, expanded for full year observation in 1978). The 2000s coincide with the establishment of UNIS (est. 1993, new science center opened in 2006). Peak production in the mining industry was already over by this point.





An abandoned coal transportation station

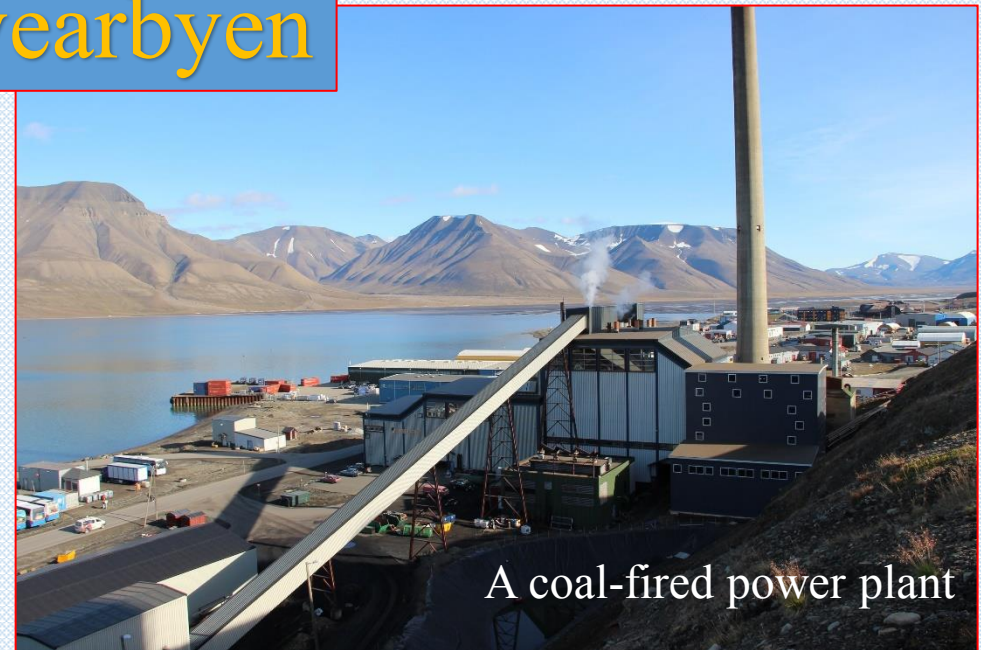


A reindeer in the town

Longyearbyen



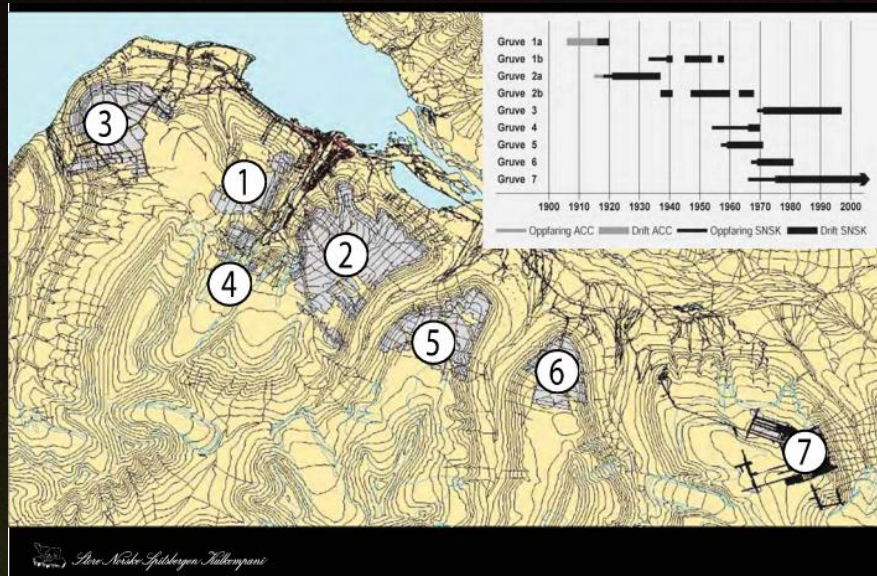
A dog sled



A coal-fired power plant



Coal dust as the main source of contamination in Svalbard



(c) Store Norske Spitsbergen Kulkompani



Coal mining area (Grove 7) in Longyearbyen



Coal pier in Longyearbyen



Coal transportation in Longyearbyen



An erosion stream at the coal stockpile
in Longyearbyen, August 2015



Coal terminal area in Longyearbyen,
August 2015



Coal-fired power plant in Barentsburg,
April 2014.



Coal-fired power plant in Longyearbyen,
August 2015

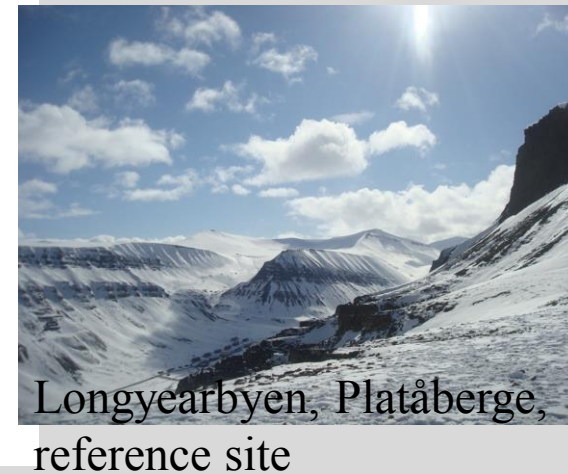
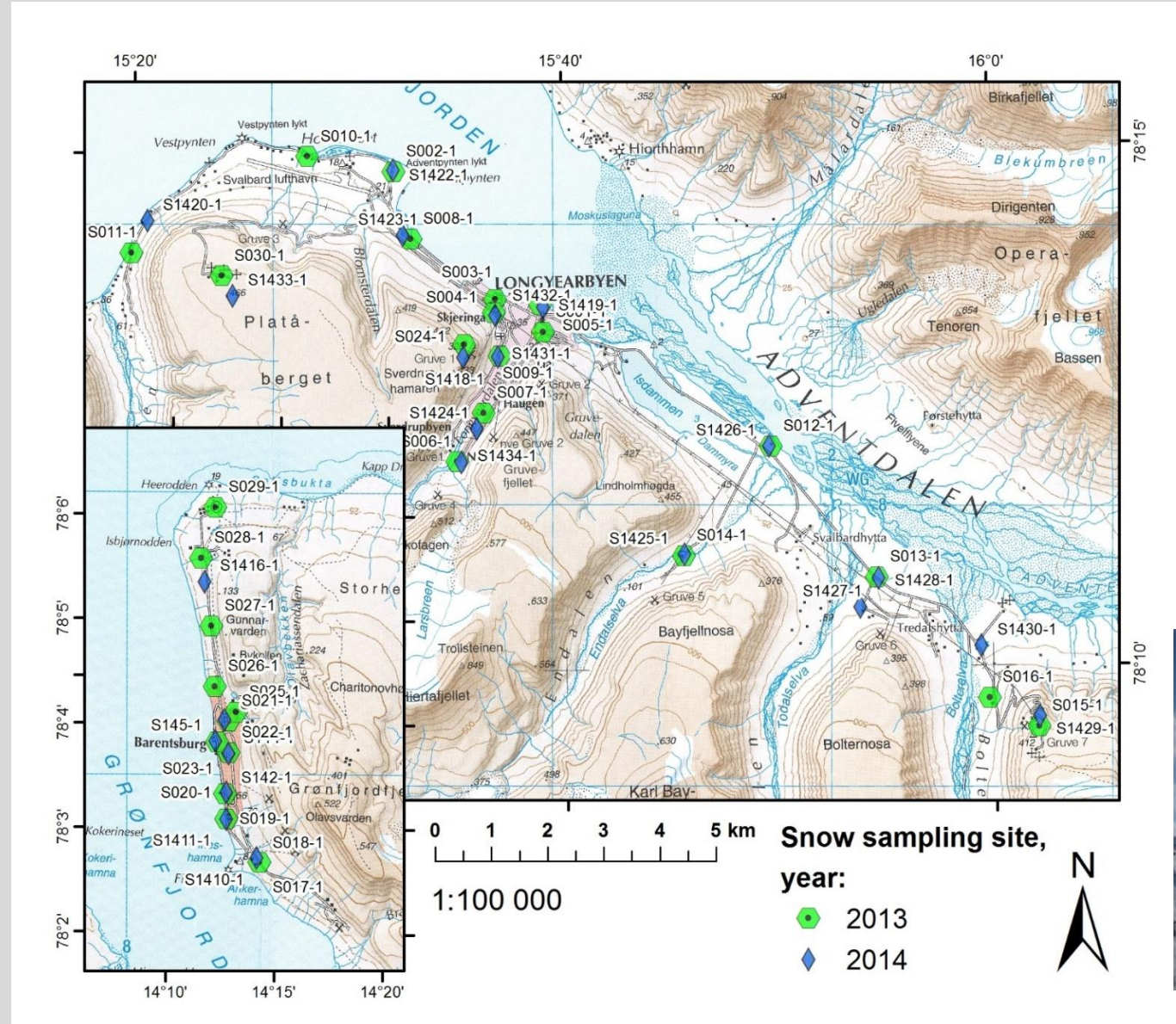
Local sources of contamination

- ✚ Mine;
- ✚ Slope conveyor lines;
- ✚ Coal and waste (gob) piles;
- ✚ Coal dumps at the power plant and quay;
- ✚ Coal terminal areas;
- ✚ Motor roads connecting the mine with final sites of coal transportation;
- ✚ Weathered and eroded dumps and piles near the abandoned mines and jetties;
- ✚ Mountainsides covered with coal fragments;
- ✚ Coal-fired power plants;
- ✚ Fuel storage areas.



Mountainsides covered with coal fragments

Field work: snow sampling sites



Field investigations: the procedure of snow sampling



Snow-sample site near the power plant in Barentsburg

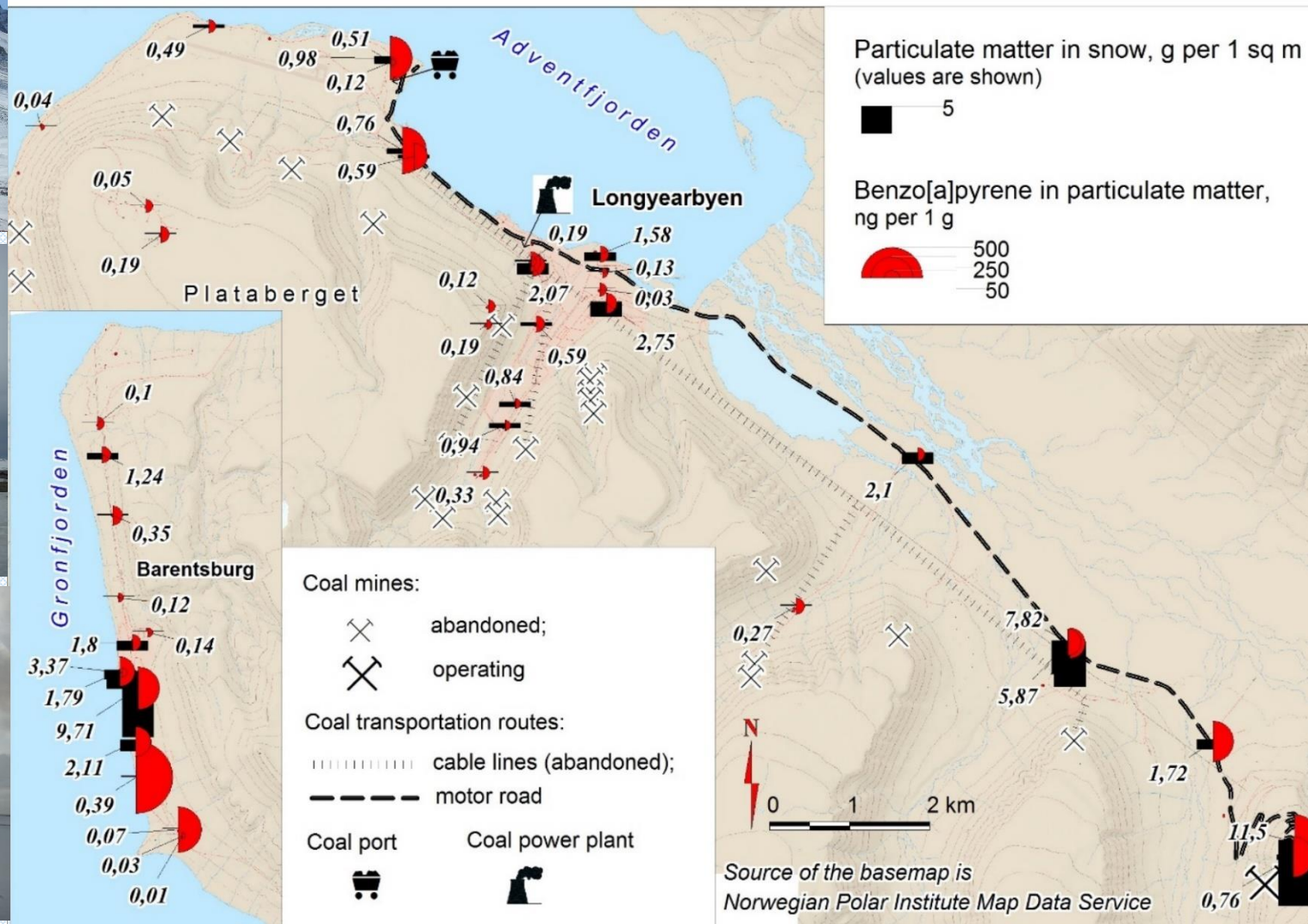


Taking the snow sample in Barentsburg area in April 2014

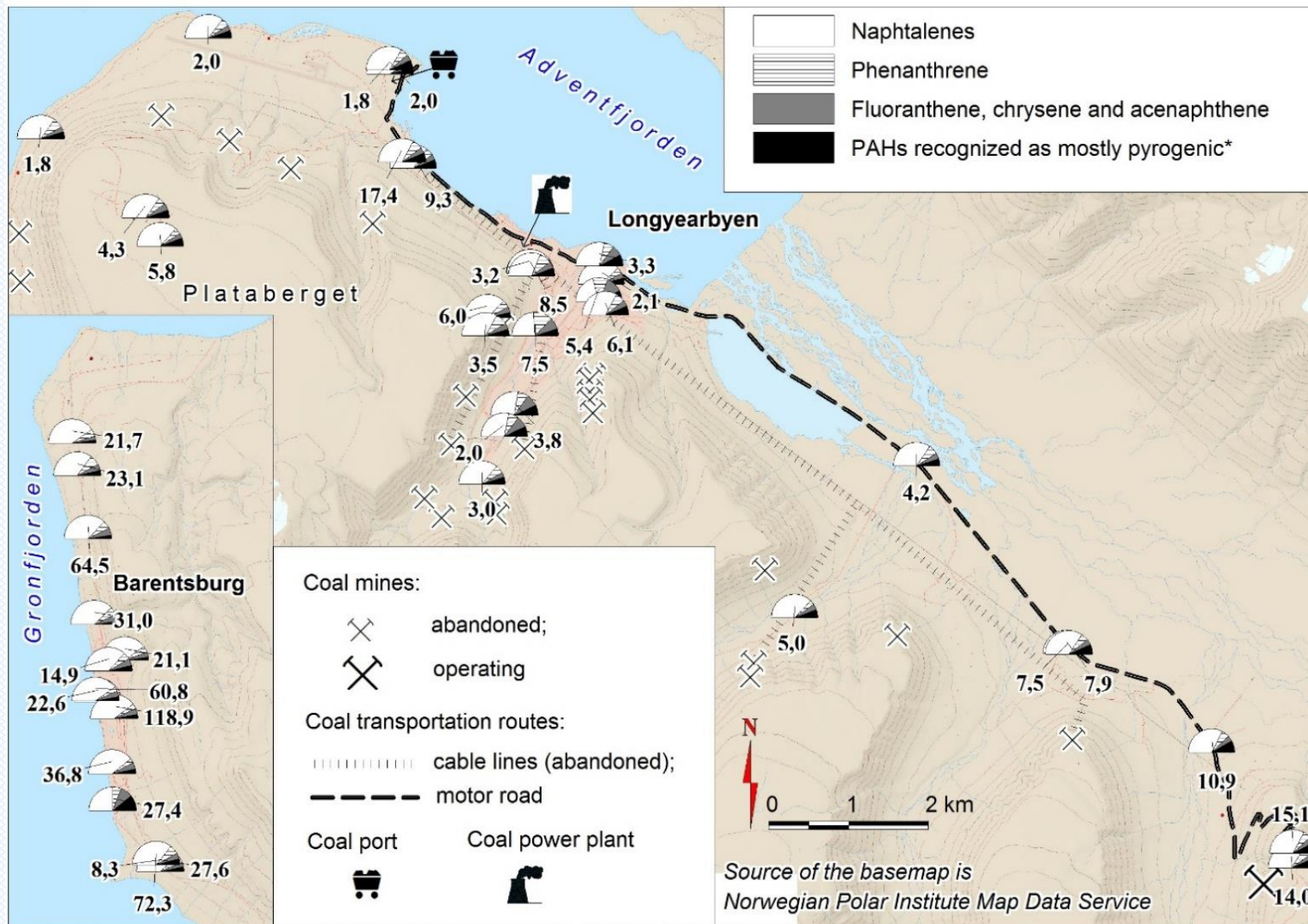


Snow pit near the Power plant in Barentsburg

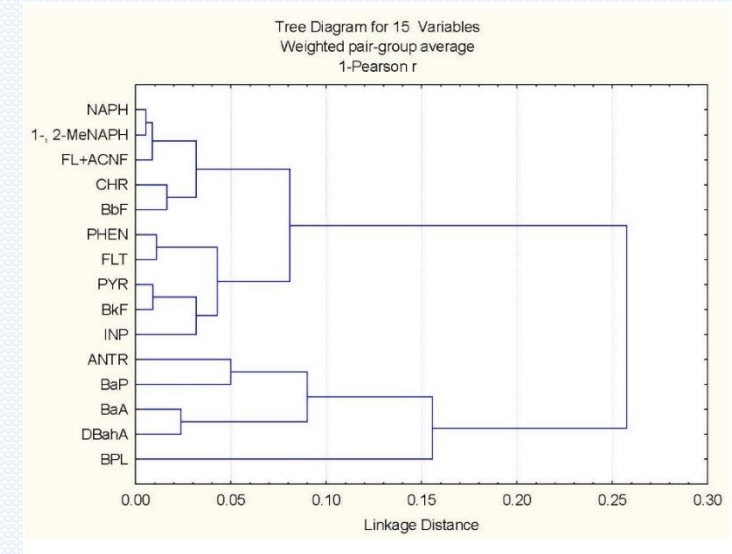
Results: the concentrations of airborne PM and the presence of benzo(a)pyrene in snow particulates.



Results: total level (values are shown in $\mu\text{g g}^{-1}$) and composition of PAHs in snow particulates.



*Pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene



A cluster tree

Thank you for your attention.

