

PAHs and ALKs in the Arctic (Svalbard Island) aerosol: results from the AREX2011 oceanographic campaign



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AREX2011 campaign

Arctic region is a very critical area for transport, deposition and accumulation of airborne pollutants.

During summer 2011 (20 June-12 August 2011), the AREX2011 oceanographic campaign was organised on board OCEANIA ship (Fig.1) in the Arctic Glacial sea. Oceanographic activity was coupled with the study of the atmospheric particulate matter (PM) load and chemical composition in that marine area. PM samples were collected during the cruise from Tromsø (Norway) to Svalbard Islands, and the concentration of particle-phased trace organic compounds, that is polycyclic aromatic hydrocarbons (PAHs) and *n*-alkanes (ALKs), was determined.

PM sampling on board OCEANIA ship



Fig.1 OCEANIA ship and atmospheric TSP sampler on board during the AREX2011 campaign

24 samples of total suspended particles (TSP) collected by using a medium volume sampler (200 l min⁻¹, 48 h, on 110 cm Ø quartz fiber filters)

PAHs and ALKs analysis

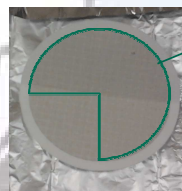


Fig.2 TSP collected on quartz fiber filter (S1)

TSP samples (a spot of 3/4 filter each) were extracted in CH₂Cl₂ by ultrasonic bath, and analysed by GC-MS for PAHs and ALKs.

A total of **15 PAHs (3 to 6 aromatic rings)** and **13 ALKs (C20 -C32)** were determined.

TSP, PAH and ALK concentrations

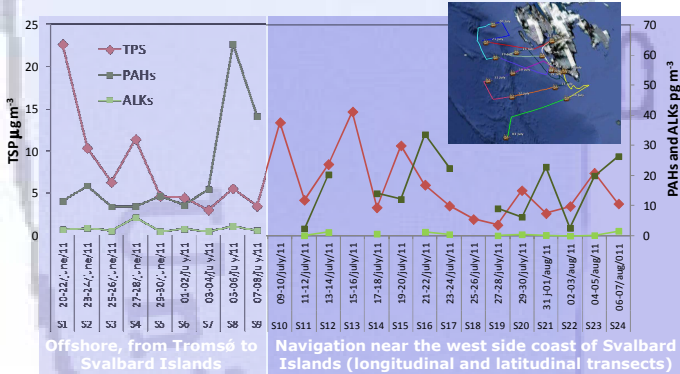


Fig.3 TSP concentrations ($\mu\text{g m}^{-3}$) and particle-phased trace organic concentrations, PAHs and ALKs (pg m^{-3}), measured during the cruise in the Arctic Glacial Sea.

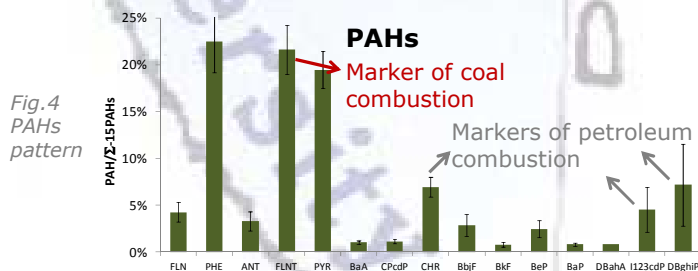
RESULTS

- **TSP concentrations** in the Arctic Glacial sea during summer 2011 ranged from $< 2.2 \mu\text{g m}^{-3}$ to $23.6 \mu\text{g m}^{-3}$ ($6.8 \pm 5.0 \mu\text{g m}^{-3}$)
- **TSP, PAHs and ALKs concentrations** measured along the navigation were **not correlated each other**
- **maximum PAHs concentrations** (S8, S9, S12, S16, S17, S21 and S24 $> 20 \text{ pg m}^{-3}$) were measured **near the west side coast of Svalbard Islands**
- **PAHs and ALKs concentrations measured in the Arctic marine aerosol were much lower than that reported in the literature for Svalbard Islands** (Cecinato et al., 2000) (Tab.1)

SITE	Arctic marine aerosol (this study)	Svalbard Islands (Cecinato et al., 2000)	
Period	Summer 2011	Summer 98	Spring 99
PAHs (pg m^{-3})	18 (± 14)	600	1900
ALKs (pg m^{-3})	1.4 (± 1.3)	18	98

Tab.1 Particle-phased PAHs and ALKs concentrations

PAHs and ALKs chemical profile and sources



□ PHE, FLNT and PYR were the most abundant PAHs (~23% each of total PAHs)

□ through a **receptor model study** (Chemical Mass Balance, CMB) it was estimated that **petroleum combustion (50%)** and **coal combustion (30%)** were the major contributing sources to total PAH concentrations measured in the Arctic Glacial Sea aerosol

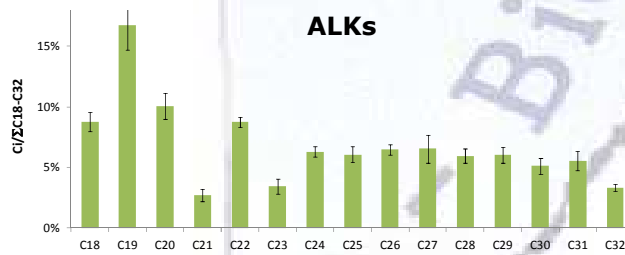


Fig.5 ALKs pattern

Biogenic marine source (Wang et al., 2010)

Anthropic source (Pietrogrande et al., 2010)

□ ALKs pattern indicates a **contribution of both anthropic source and biogenic marine (fitoplankton) source**

References

- Cecinato et al., 2000. *Atmospheric Environment*, 34, 5061-5066
Pietrogrande et al. 2010. *Environmental Science & Technology*, 44, 4232-4240
Wang et al., 2010. *Applied Geochemistry*, 25, 1478-1486