GEOCHEMICAL CHARACTERIZATION OF PARTICULATE ORGANIC MATTER ASSOCIATED WITH HYDROTHERMAL VENT ACTIVITY IN THE COASTAL AEGEAN SEA.

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Abstract

Two particle interceptor traps were moored from June to September 1996 along the SE coast of Milos (Aegean Sea), in an area known for its extensive seabed geothermal activity. The settling particles collected differed between sites not only in quantity but also in their composition. In the area directly influenced by the warm water vents, the vertical flux of particulate material was almost one order of magnitude higher than that observed in the reference site, and its lipid composition (sterols) reflected a locally enhanced productivity, mostly associated to diatom blooms, which play a significant role in the accumulation and deposition of petrogenic hydrocarbons from the water column.

Key-words: Aegean Sea, thermal vents, particulates, chemical analysis

n-hexane (alkanes), (II) 5 ml of 1:2 *n*-hexane-dichloromethane (PAHs), (III) 5 ml of 1:1 dichloromethane-methanol (alcohols and sterols), and (IV) 5 ml of methanol. The different fractions were rotary evaporated to almost dryness, reconstituted with *iso*-octane, and spiked with 1-phenyldodecane, octachloronaphthalene and epicoprostanol as internal standards, respectively, for alkanes, PAHs and sterols. The determination of the individual components of the different fractions was performed by capillary gas chromatography (30 m x 0.25 mm i.d. DB-5 fused silica) coupled to a Fisons MD800 mass spectrometer, under the conditions described elsewhere (3).

Results and Discussion

Particle fluxes were highly variable and clearly different at the two sites. During most of the sampling period, one or two orders of magnitude more particulates were produced and exported at vent site A than at control station B. Mean fluxes throughout the summer period at sites A and B were 2207 and 251 mg m^{-2} d^{-1}, respectively (2).

Although the traps were deployed within a total distance of 3.5 nautical miles, the settling particles differed between sites not only in quantity but also in their composition. Effectively, the difference in mean fluxes between sites was even more significant for POC than for total mass fluxes, with averages of 549 and 30 mg POC m^{-2} d^{-1} at sites A and B, respectively, indicating a higher contribution of abiogenic material in the latter. However, the particles collected at all sites during the observation period were largely related to pelagic production, and were mainly composed of zooplankton detritus. The sinking particles collected in summer at station A were mostly amorphous marine snow with very few fecal pellets. Bacteria were also more abundant in samples from the vent site A than in those at the site further away. Apparently, the higher fluxes in the vent site were a consequence of an enhanced production and export of organic material originating from the thermophilic ecosystem developed around the vents.

The profiles of aliphatic and aromatic hydrocarbons exhibited striking differences between particles of the two sites, A and B. The composition of sinking particles in station A, influenced by the thermal vent, exhibited an aliphatic fraction with a clear petrogenic fingerprint (Figure 2), whereas station B showed n-alkane distributions with a high even carbon number predominance in the C16-C24 range, which could be attributed to a biogenic (planktonic) origin (4).

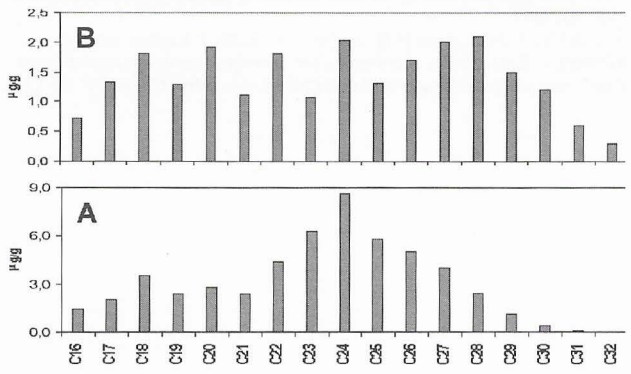

Fig. 2. *n*-Alkane distributions in particulates from stations A and B.

On the other hand, the aromatic fraction in particles from station A exhibited a high predominance of alkylated PAHs, whereas a more pyrogenic nature was observed in station B. The profiles in station B were consistent with atmospheric deposition of remote continental aerosols. In turn, the enhanced biological production in station A may have significantly contributed to the sedimentation of the more bioavailable petrogenic hydrocarbons accumulated by organisms and subsequently exported within fast sinking fecal pellets.

The sterol composition in the sinking particles also differed both in concentration and composition according to the sampling area. In fact, particles collected in the thermal vent affected area (A) exhibited remarkably unusual concentrations of 5β-stanols and related stanones, which were not detected or occurred at very low concentrations in the other area. The higher concentrations of sterols at station A is consistent with a higher productivity mostly associated to blooms of diatoms (Δ^5, $\Delta^{5,22}$ and $\Delta^{5,24(28)}$ stenols) in clear contrast with the oligotrophic conditions prevailing at the reference station B.

In summary, the Aegean Sea hydrothermal system has a strong but rather limited influence on the production of particulate organic matter and the transport of petrogenic compounds in the water column.

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