5.2.4.2.2 Petroleum Hydrocarbons in Suspended Solids

Total petroleum hydrocarbon (TPH) pollution in the suspended solids was analyzed with GC/FID and the results are shown in Figure C2.4.2.-2.

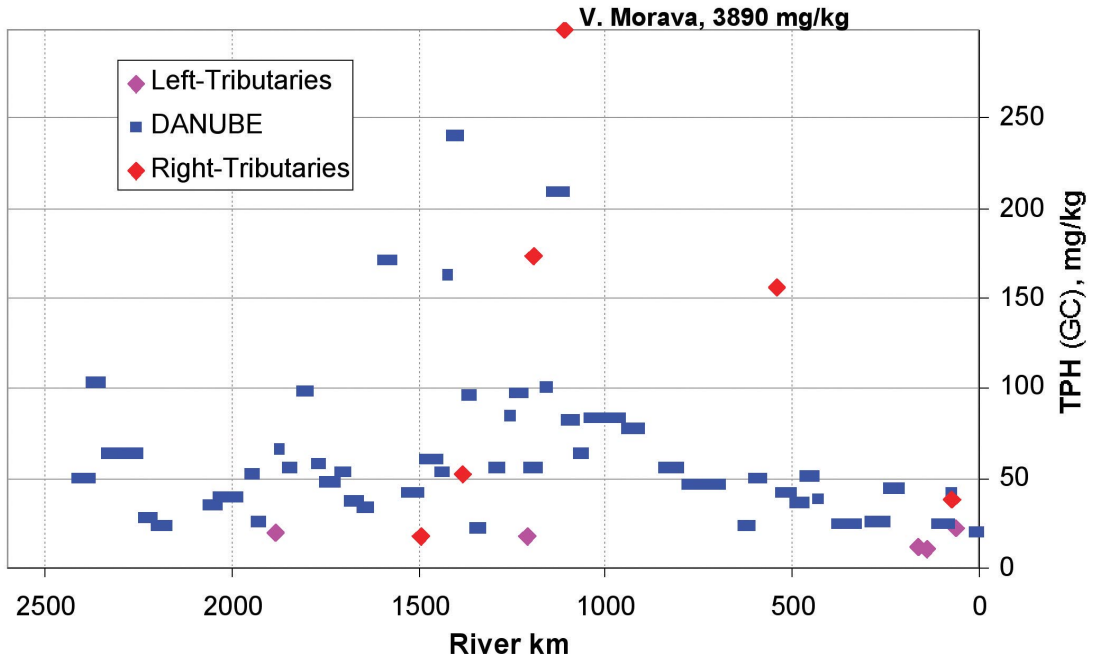

FIGURE C2.4.2.-2: Longitudinal variation in the concentration of TPH in suspended solids collected from the Danube River and its tributaries during JDS.

The petroleum hydrocarbons in the suspended solids demonstrated higher contamination and variations in the pollution input in the Middle Danube Reach. The first significant increase was observed downstream of Budapest. Higher contaminations were measured further downwards in the Yugoslavian section of the Danube, reaching extremely high concentration in the river Velika Morava.

5.2.4.2.3 Petroleum Hydrocarbons in Bottom Sediment

The bottom sediment samples were analysed for petroleum hydrocarbon contamination using both spectrophotometric (UV absorption and fluorescence) and chromatographic (GC-FID) methods.

Comparison of the results obtained with these analytical methods is given in Figure C2.4.2.-3.

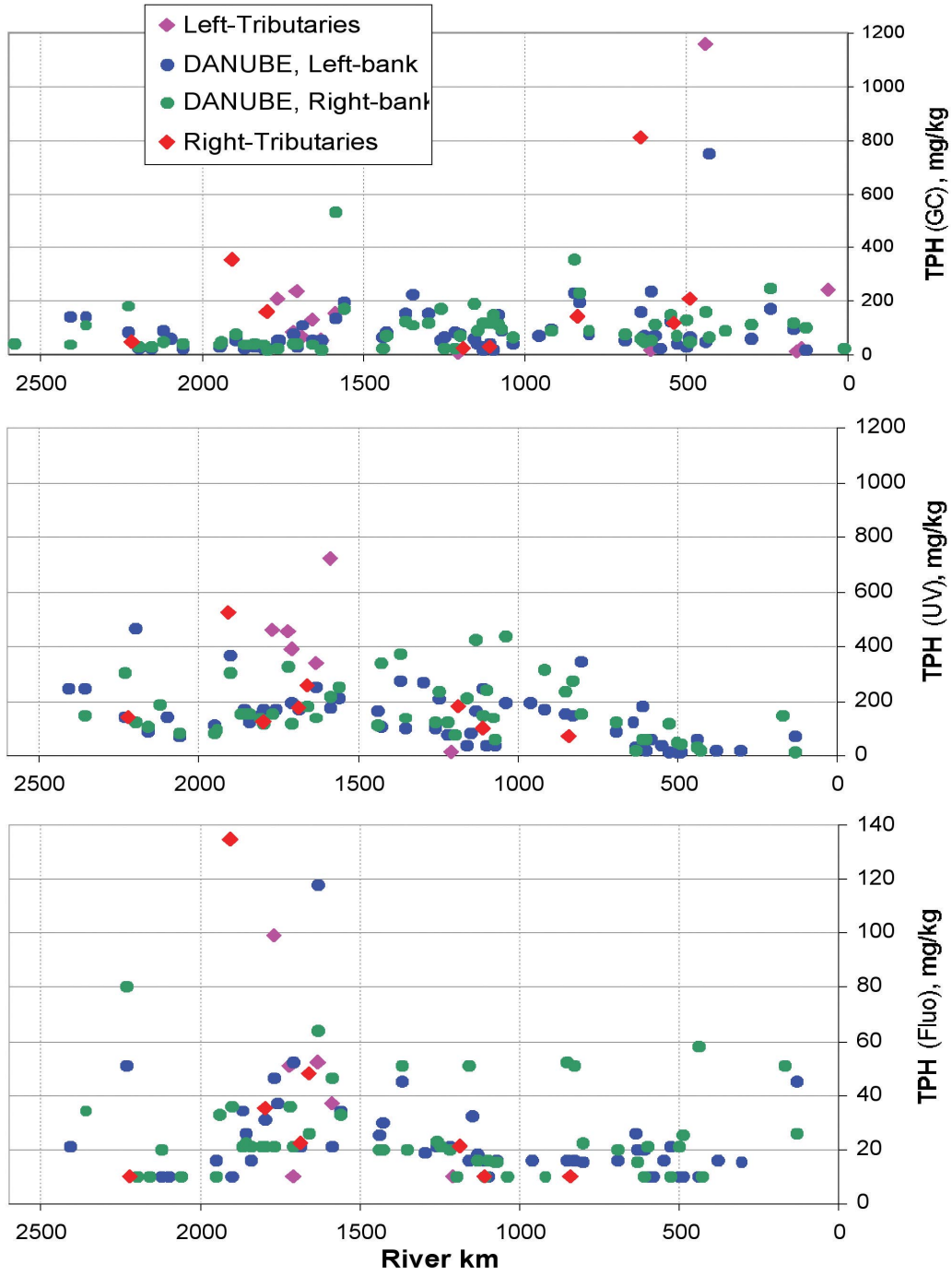

FIGURE C2.4.2.-3: Longitudinal variation in the concentration of TPH, measured with three different methods, in the bottom sediment samples collected from the Danube River and its tributaries during JDS.

The vertical distribution of TPH in the sediment core samples is shown in Figures C.2.4.2.-4 through C2.4.2.-6.

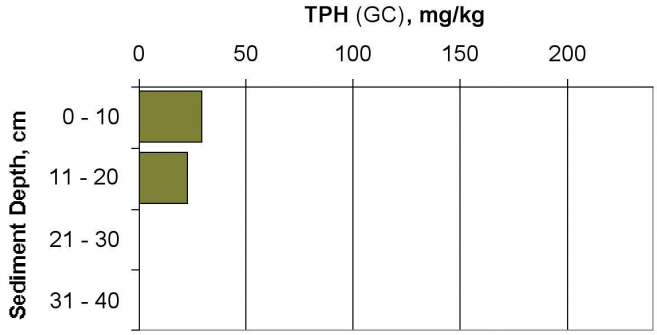

FIGURE C2.4.2.-4: Vertical variations in the concentration of TPH in the Danube bottom sediment, collected in the Gabcikovo Reservoir (JDS-19).

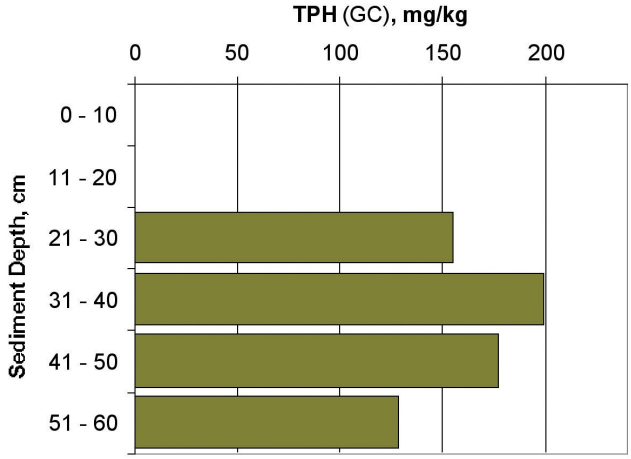

FIGURE C2.4.2.-5: Vertical variations in the concentration of TPH in the bottom sediment, collected in the Rackeve-Soroksar Danube Arm (JDS-36).

The two analysed layers in the core sample collected from the Gabcikovo Reservoir showed very low contamination; however, the TPH contamination in the sediment core from the Rackeve-Soroksar Danube-Arm (Figure C2.4.2.-5) demonstrated significantly higher contamination. The vertical variation was insignificant in both sediment cores.

Although TPH concentrations in the core samples collected in the upper part of the Iron Gate Reservoir, see Figure C.2.4.2.-6, were not very high but significant differences were observed in the different layers particularly in the right bank of the Danube. The vertical variation in the core indicates time to time pollution input as accumulating in the bottom sediment.

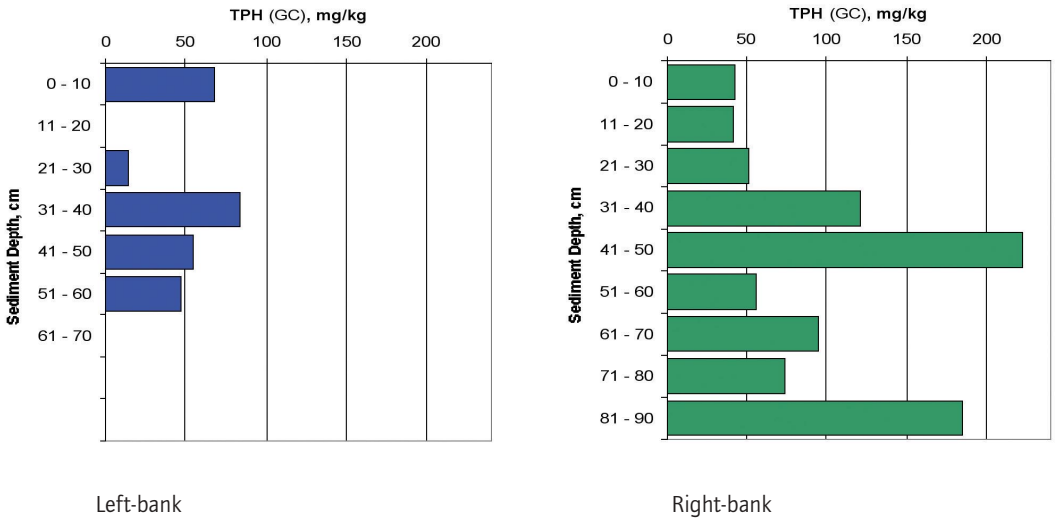

FIGURE C2.4.2.-6: Vertical variations in the TPH in the Danube bottom sediment at 1077 river km (JDS-63).

Comparison between the TPH and TOC values in suspended solids and sediment samples is shown in Figure C2.4.2.-7. No significant correlation between the TPH and TOC can be observed in general. It is interesting to note that the high TPH and low TOC values were in the sediment samples collected from the oil-contaminated tributaries and in downstream Danube samples, i.e. JDS-87, Arges and JDS-88, Danube downstream of the Arges. On the other hand, high TOC and low TPH values were found in the suspended solid samples which contained high percentage of the algal biomass resulting in high TOC values.

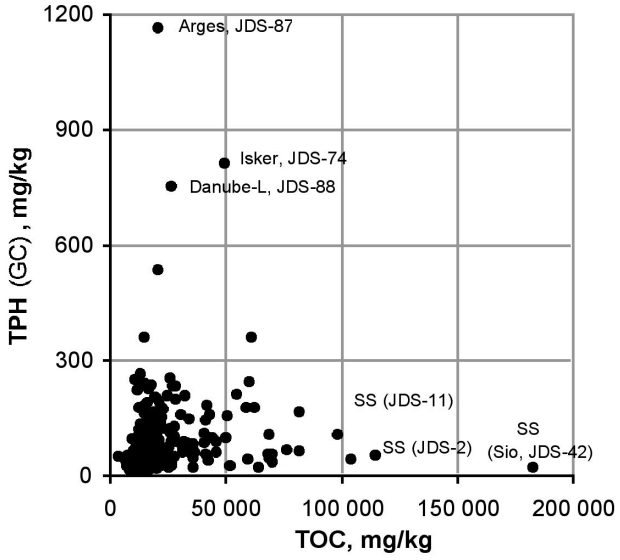

FIGURE C2.4.2.-7: Correlation between THP and TOC on the basis of measurements in suspended solids (SS) and sediments.

5.2.4.2.4 Polyaromatic Hydrocarbons (PAHs)

Results of the determination of PAHs in the bottom sediment samples are shown in Figures C2.4.2.-8 and C2.4.2.-9.

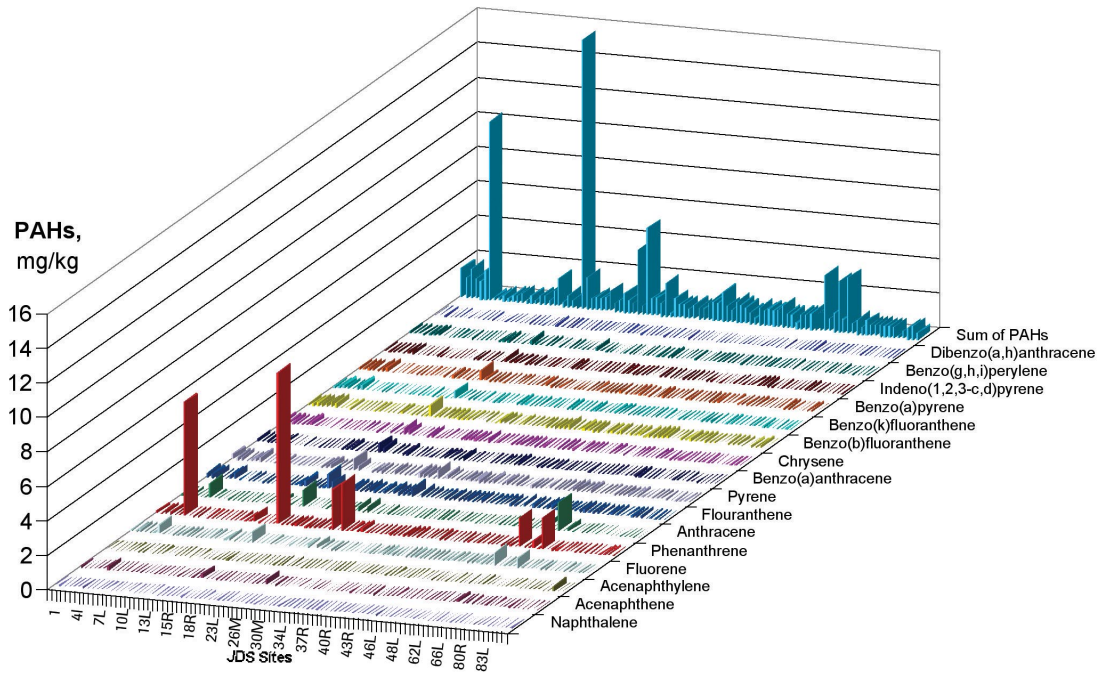

FIGURE C2.4.2.-8: Longitudinal variation in the concentration of individual PAHs in the bottom sediment samples collected from the Danube river and its tributaries during the JDS.

Phenanthrene and Antracene dominated the PAHs contamination in most of the sediment samples, however, the sum of the PAHs rarely Reached the 2 mg/kg. As it is better seen in Figure C2.4.2.-8, the highest values were observed in tributaries. None of the samples had higher contamination than 20 mg/kg.

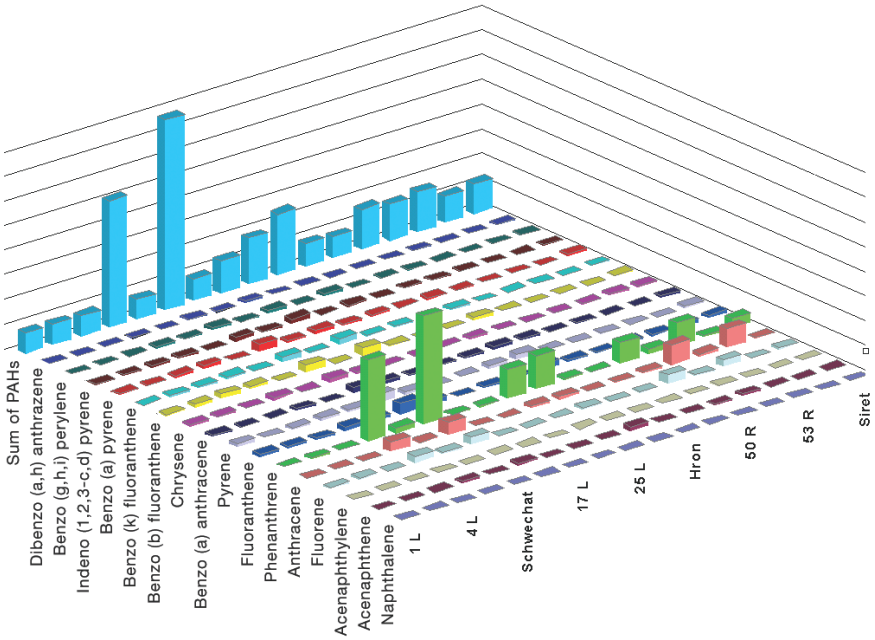

FIGURE C2.4.2.-9: Longitudinal variation in the concentration of individual PAHs in selected bottom sediment samples, in which sum of PAHs exceeded 2 mg/kg.

The PAHs distribution in the sediment core samples is demonstrated in Figures C2.4.2.-10 through C2.4.2.-12.

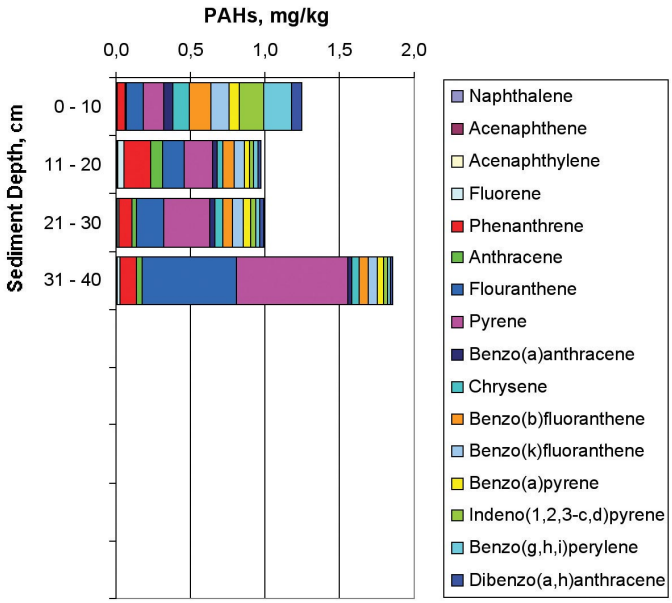

FIGURE C2.4.2.-10: Vertical variations in the concentration of the PAHs in the Danube bottom sediment, collected in the Gabcikovo reservoir (JDS-19).

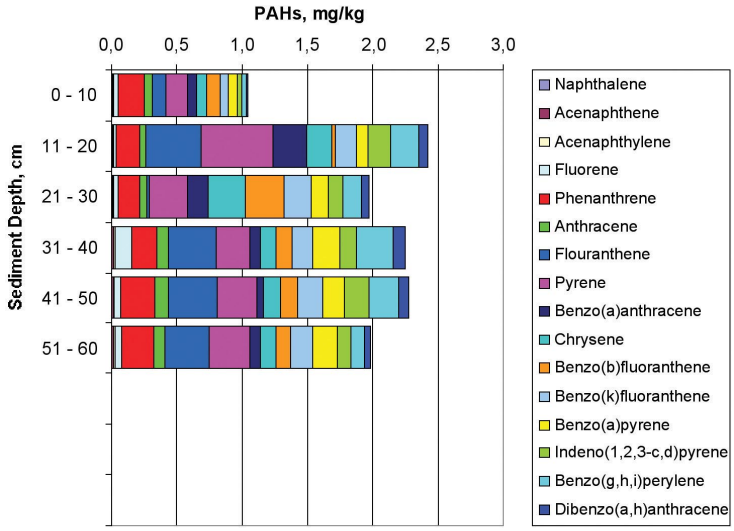

FIGURE C2.4.2.-11: Vertical variations in the concentration of the PAHs in the bottom sediment, collected in the Rackeve-Soroksar Danube-Arm (JDS-36).

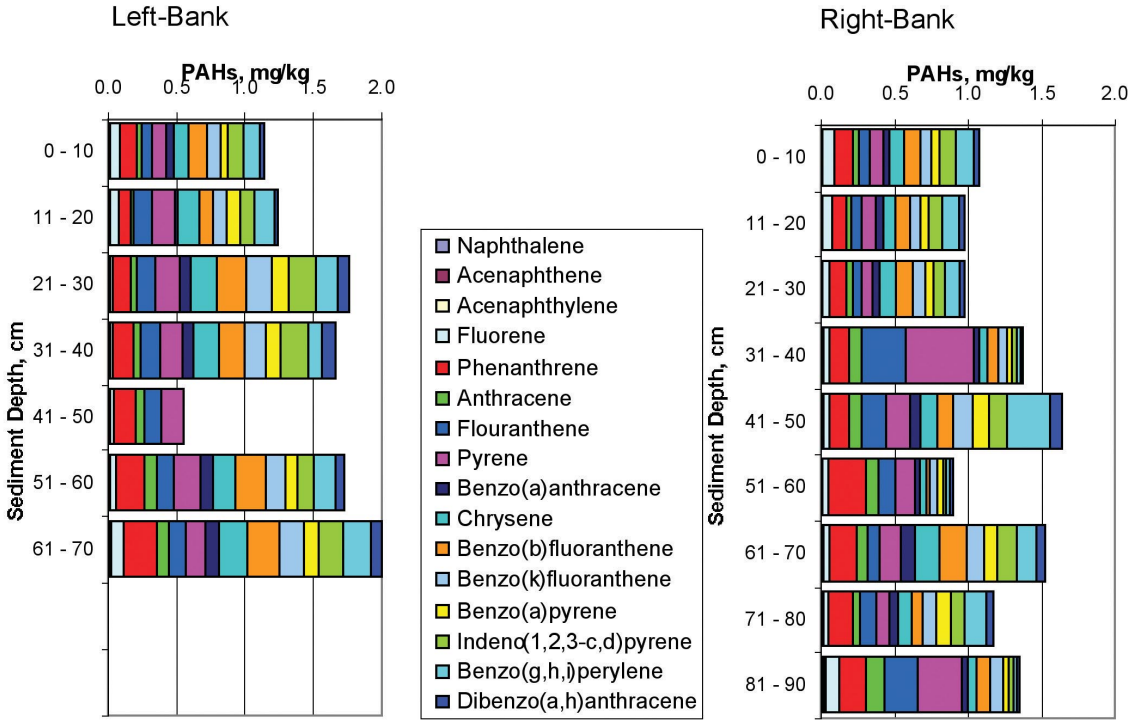

FIGURE C2.4.2.-12: Vertical variations in PAHs in the Danube bottom sediment at 1077 river km (JDS-63).

The overall PAHs contamination in the sediment cores were in the same range as in the surface sediment samples, however, in the deeper sediment layers pyrene became one of the highest contributor to the total PAHs concentration.