

**Supplementary materials for the manuscript titled**  
**“Focus on Arsenic in Ambient Air Particulates: A Synchrotron Radiation Based X-ray  
Fluorescence and X-ray Absorption Near Edge Structure Study”**

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## 1. Mapping and Correlation Coefficients of As with Pb, Fe, and Ca

The correlations between the arsenic and the main detected elements (Ca, Pb and Fe) were calculated using Pearson's correlation coefficients. Prior to the correlation analysis, the correction of matrix effect was taken into account by calculating the primary, secondary, and tertiary fluorescence of each element using the PyMca software. The Pearson's correlation coefficients  $r_{xy}$  was calculated according the following formula,

$$r_{xy} = \frac{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}} \sqrt{\frac{\sum_{i=1}^N (y_i - \bar{y})^2}{N-1}}} \quad (1)$$

Where  $\bar{x}$  represents the average value of  $i$  number of  $x$ 's and  $\bar{y}$  is the average value of  $i$  number of  $y$ 's. The values of the correlation coefficient vary from  $-1$  to  $+1$ . As the correlation coefficients approach  $+1$  or  $-1$ , it indicates the perfect positive or perfect negative correlations, respectively. As the correlation coefficients approaches to zero ( $r_{xy}=0$ ), there is no correlation between the elements of interest. The strong positive or negative correlation is expected when the values of the correlation coefficient vary from  $\pm 0.5$  to  $\pm 1$ . The moderate positive or negative correlation is obtained when the values of the correlation coefficient vary from  $\pm 0.3$  to  $\pm 0.49$ . As the values of the correlation coefficients are less than  $\pm 0.3$ , there is a low degree of correlations between the elements of interest.

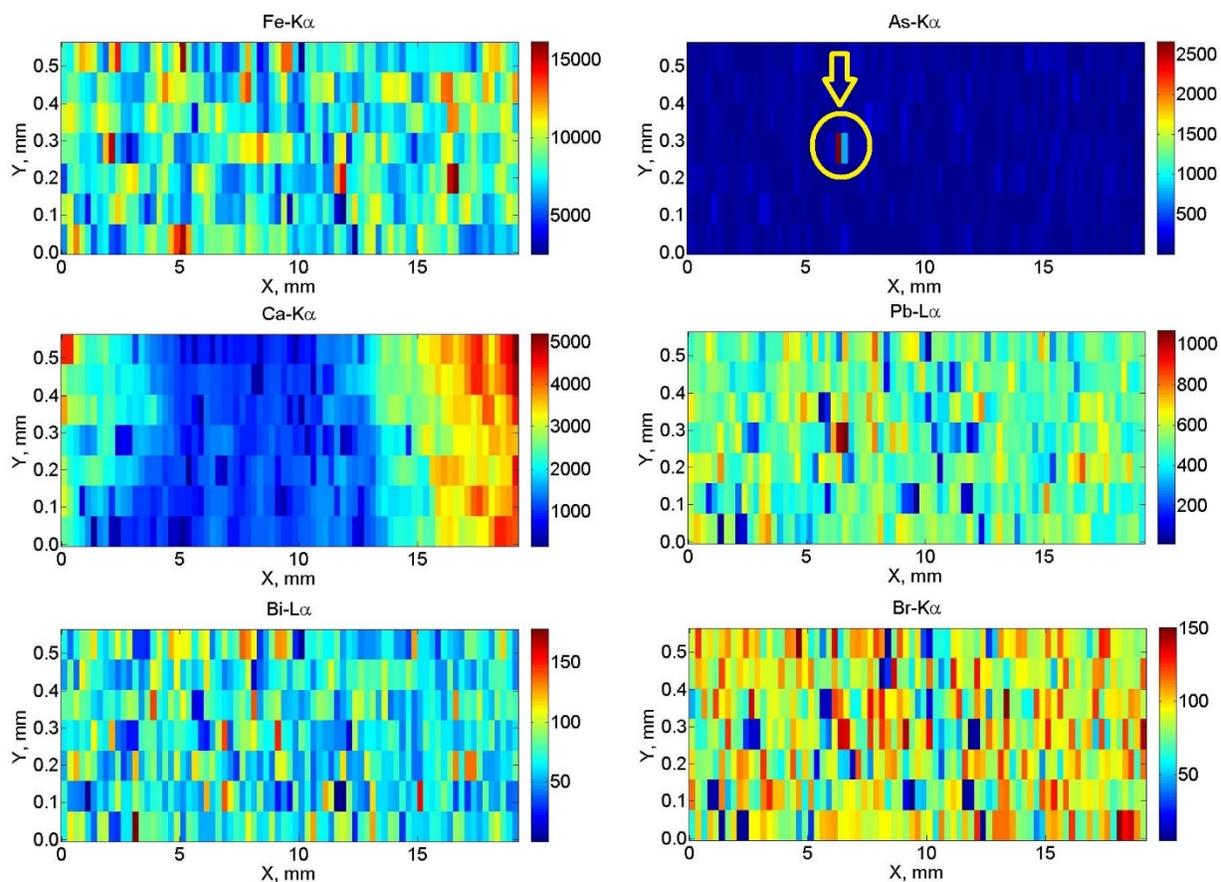


Figure S1. Elemental maps of TSP sample (I02) from industrial area, Fe ( $K\alpha$ ), Ca ( $K\alpha$ ), As( $K\alpha$ ), and Pb( $L\alpha$ );  $7 \times 77$  pixels (step size:  $0.5 \times 0.25 \text{ mm}^2$ ); excitation energy: 13.6 keV.

Table S1. The overall correlation coefficients of the different elements with As for the TSP and PM<sub>2.5</sub> samples collected from industrial and residential areas, Cairo, Egypt

	<b>Pb</b>	<b>Ca</b>	<b>Fe</b>	<b>Br</b>	<b>Bi</b>
<b>I02 -1 (TSP, Industrial)</b>	0.27	0.03	-0.01	0.06	0.02
<b>I02 -2 (TSP, Industrial)</b>	0.27	-0.01	-0.003	0.13	-0.01
<b>I15 (TSP, Industrial)</b>	0.60	0.10	0.15	0.22	0.29
<b>I20 (TSP, Industrial)</b>	0.51	0.11	0.05	0.14	0.28
<b>R11 (TSP, Residential)</b>	-0.30	-0.001	-0.03	-0.08	-0.14
<b>JED108 (PM<sub>2.5</sub>, Industrial)</b>	0.004	0.06	0.06	0.06	0.12

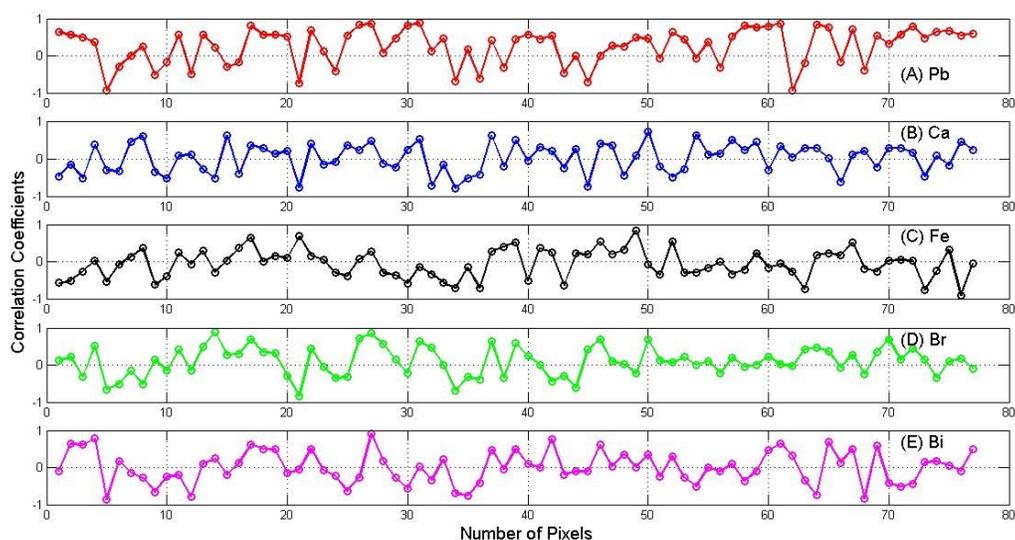


Figure S2. Correlation coefficients calculated between each line of vertical pixels for As( $K\alpha$ ) with (A) Pb( $L\alpha$ ), (B) Ca ( $K\alpha$ ), (C) Fe ( $K\alpha$ ), (D) Br ( $K\alpha$ ), and (E) Bi ( $L\alpha$ ) for the TSP sample (I02) from industrial area. Map dimension:  $7 \times 77$  pixels (step size:  $0.5 \times 0.25$  mm<sup>2</sup>); excitation photon energy: 13.6 keV.

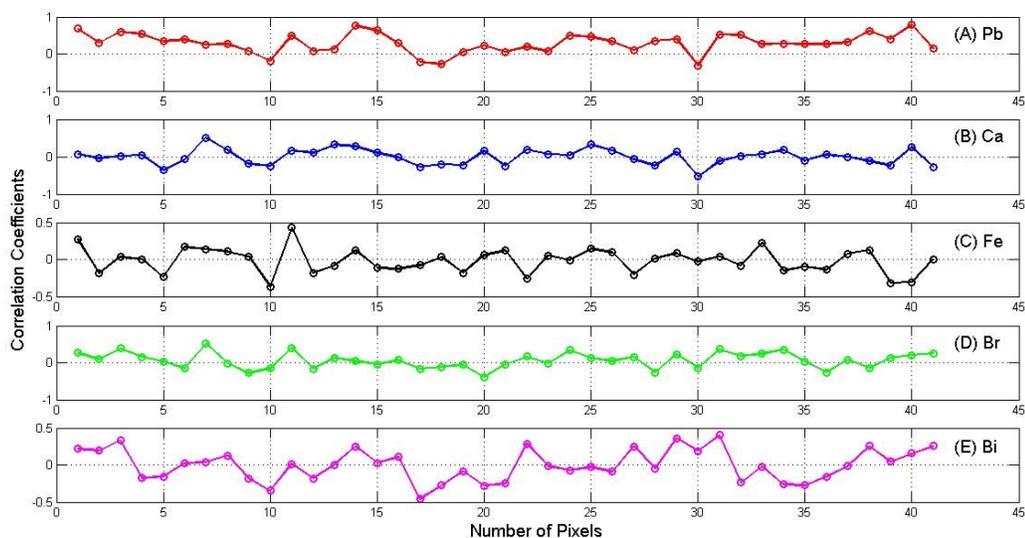


Figure S3. Correlation coefficients calculated between each line of vertical pixels for As( $K\alpha$ ) with (A) Pb( $L\alpha$ ), (B) Ca ( $K\alpha$ ), (C) Fe ( $K\alpha$ ), (D) Br ( $K\alpha$ ), and (E) Bi ( $L\alpha$ ) for the TSP sample (I02) from industrial area. Map dimension:  $26 \times 41$  pixels (step size:  $0.08 \times 0.25$  mm<sup>2</sup>); excitation photon energy of 13.6 keV.

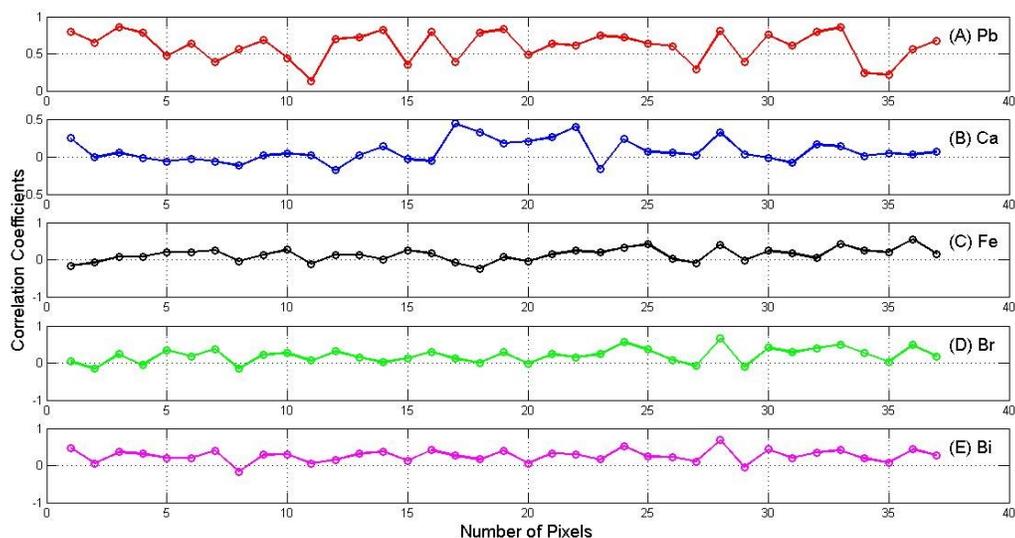


Figure S4. Correlation coefficients calculated between each line of vertical pixels for As(K $\alpha$ ) with (A) Pb(L $\alpha$ ), (B) Ca(K $\alpha$ ), (C) Fe(K $\alpha$ ), (D) Br(K $\alpha$ ), and (E) Bi(L $\alpha$ ) for the TSP sample (I15) from industrial area. Map dimension:  $41 \times 37$  pixels (step size:  $0.08 \times 0.25$  mm $^2$ ); excitation photon energy: 13.6 keV.

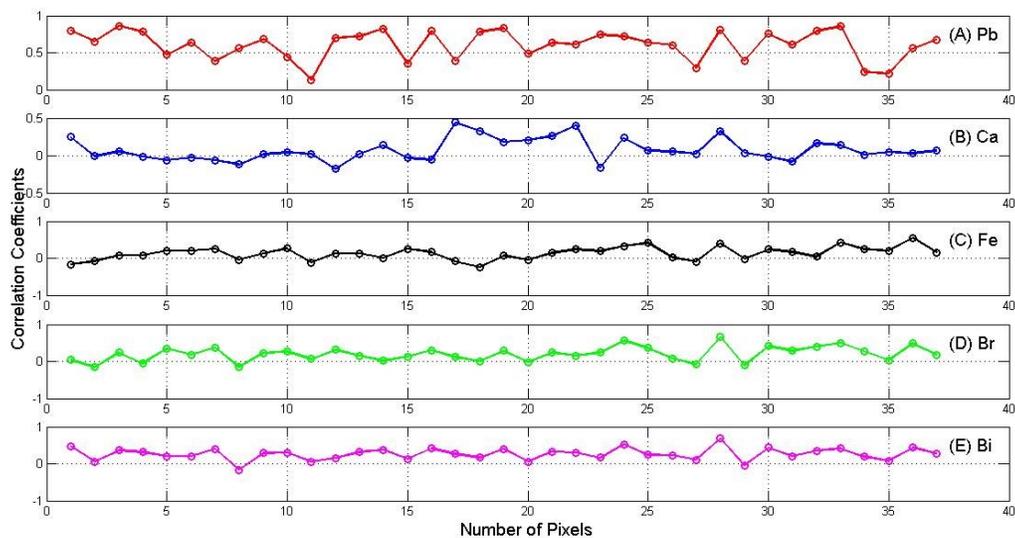


Figure S5. Correlation coefficients calculated between each line of vertical pixels for As(K $\alpha$ ) with (A) Pb(L $\alpha$ ), (B) Ca(K $\alpha$ ), (C) Fe(K $\alpha$ ), (D) Br(K $\alpha$ ), and (E) Bi(L $\alpha$ ) for the TSP sample (I20) from industrial area. Map dimension:  $41 \times 41$  pixels (step size:  $0.08 \times 0.25$  mm $^2$ ); excitation photon energy: 13.6 keV.

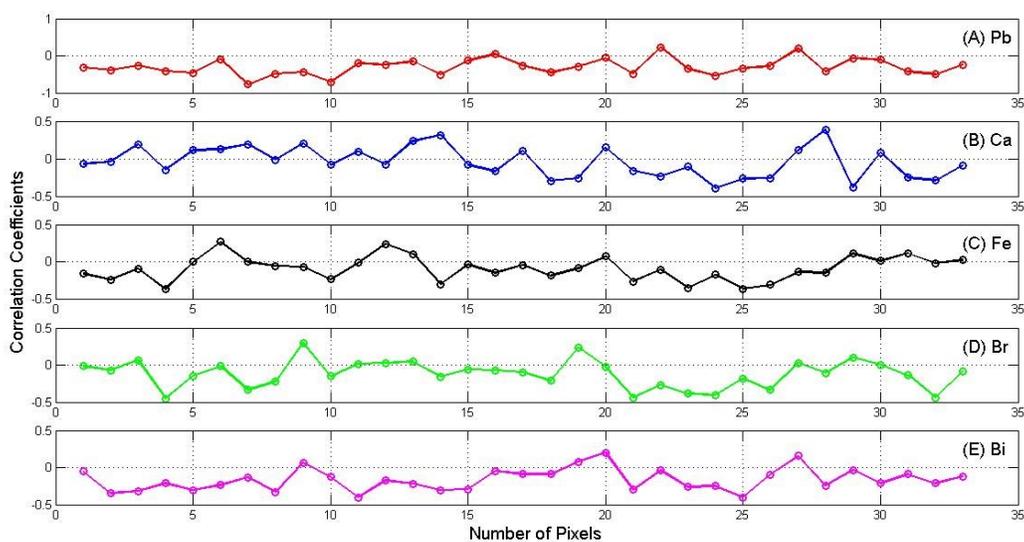


Figure S6. Correlation coefficients calculated between each line of vertical pixels for As( $K\alpha$ ) with (A) Pb( $L\alpha$ ), (B) Ca ( $K\alpha$ ), (C) Fe ( $K\alpha$ ), (D) Br ( $K\alpha$ ), and (E) Bi ( $L\alpha$ ) for the TSP sample (R11) from residential area. Map dimension:  $36 \times 33$  pixels (step size:  $0.08 \times 0.25$  mm<sup>2</sup>); excitation photon energy: 13.6 keV.

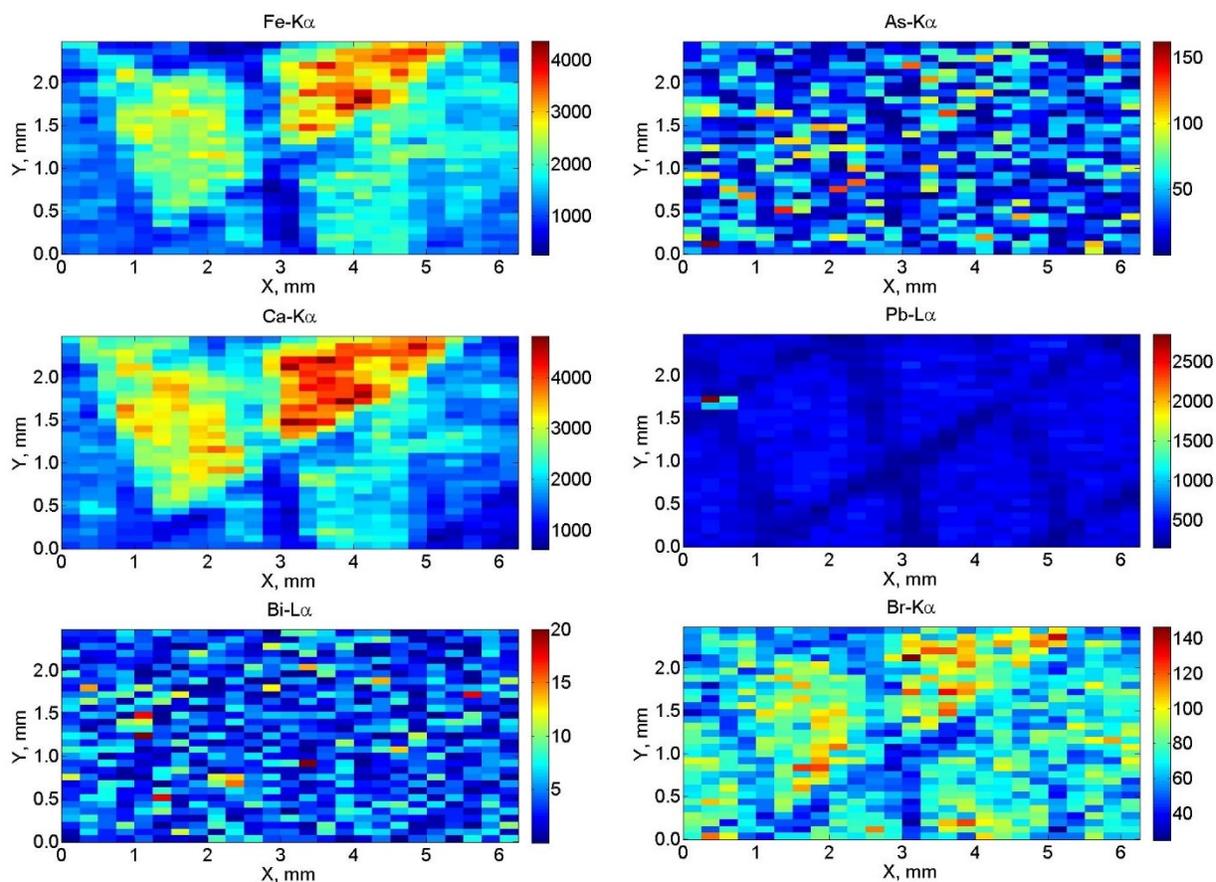


Figure S7. Elemental maps for PM<sub>2.5</sub> aerosol (JED108) from industrial area: Fe(K $\alpha$ ), As(K $\alpha$ ), Ca(K $\alpha$ ), Pb(L $\alpha$ ), Bi (L $\alpha$ ), Br (K $\alpha$ );  $31 \times 25$  pixels (step size:  $0.08 \times 0.25$  mm<sup>2</sup>); excitation photon energy: 13.6 keV. The mesh structure is coming from the supported mesh used under the filter inside the cyclone.

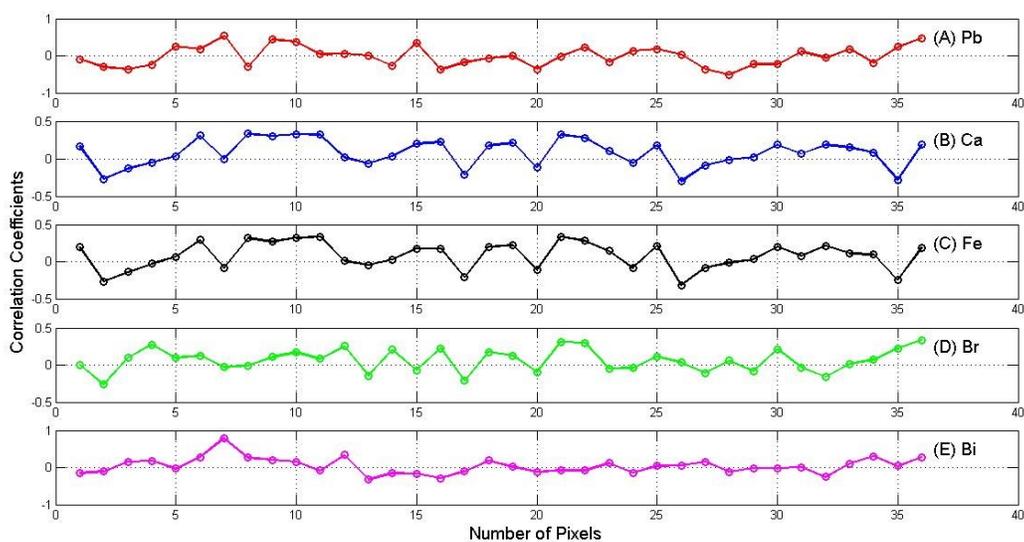


Figure S8. Correlation coefficients calculated between each line of vertical pixels for As( $K\alpha$ ) with (A) Pb( $L\alpha$ ), (B) Ca ( $K\alpha$ ), (C) Fe ( $K\alpha$ ), (D) Br ( $K\alpha$ ), and (E) Bi ( $L\alpha$ ) for PM<sub>2.5</sub> aerosol (JED107) from industrial area. Map dimension:  $33 \times 36$  pixels (step size  $0.08 \times 0.25$  mm<sup>2</sup>); excitation photon energy: 13.6 keV