X. Source identification

X.x.1 Pearson correlation

Pearson correlation analysis investigated the relations between the trace metals found in the sediment samples to identify potential sources. Figure X showcased the correlation coefficients, revealing a remarkable positive association between Sr and Zn (0.8). This strong correlation, along with similar relationships between Sr and other elements like Y (0.68), Rb (0.52), Ti (0.5), and Ca (0.45), suggests that these elements likely share a common source. A moderate positive correlation was also observed between Rb and Zn (0.62), further strengthening the notion of a unified origin for these elements. Additionally, moderate correlations were detected between other metal pairs like Zn-Ti (0.48), Ti-Ca (0.5), Fe-K (0.52), Zr-As (0.4), and Nb-Ca (0.47), indicating potential shared sources for these groups as well. Overall, the analysis points towards the existence of different source scenarios for various trace metals present in the sediment.

X.x.2 Principal component analysis

To further decipher the relationships between trace metals in the dataset, principal component analysis (PCA) was performed on standardized data. This analysis revealed three prominent principal components (PCs) explaining over half (53.4%) of the total data variance. The first PC (PC1), accounting for 23.44% of the variance, is heavily influenced by high loadings of Sr (0.91), Zn (0.83), Ca (0.69), Ti (0.67), and Y (0.61). This implies that these elements likely share a common source influencing their occurrence. In contrast, PC2, explaining 17.16% of the variance, exhibits a distinct pattern with high negative loadings for Zr (-0.73) and As (-0.5) and positive loadings for Fe (0.7), Rb (0.57), K (0.57), and Mn (0.5). This suggests a separate origin or process governing the distribution of these elements compared to those associated with PC1. Finally, PC3, with an eigenvalue of 1.923 and explaining 12.8% of the variance, is characterized by higher loadings of Pb (-0.63), Co (0.61), and Nb (0.56) at the significance level of p < 0.05. This further strengthens the notion of potentially diverse sources or controlling factors for these specific elements.

X.x.3 Cluster analysis

To gain insights into the origins and potential shared characteristics of trace metals studied, cluster analysis helps group elements based on their similarities, providing statistical information of the trace metals potential sources. Ward's hierarchical clustering with the square euclidean distance metric is calculated and shown in Fig x. revealed three distinct clusters of statistical significance. Group 1 consists of Ca, Fe. Their close proximity in the dendrogram suggests they share a common source. Group 2 comprises Ti, K. Similar to Group 1, short length clustering indicates shared characteristics and potentially a common origin. Group 3 encompasses a wider range of elements of Mn, Co, Y, Cu, Nb, As, Pb, Zr joining with subgroups of Rb, Zn, and Sr. Notably, this group shows a relatively close relationship with Group 2, as indicated by the shorter distance between their branches in the dendrogram. This suggests that some elements in Group 3 might share similar origins with those in Group 2.