

Chemical and Molecular Composition of Holocene Age Sediment for Provenance Study using WD-XRF

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Chemical species and concentration levels are defined as the toxicity of elements. In river sediment, major inorganic elements are present in the form of oxides species and these species properties may change with environmental conditions (i.e. pH, temperature) and possibility of toxic species formation. It is necessary to identify the specific species present in the sediment to understand in-depth the environmental conditions. Four borehole core sediment samples of Krishna delta petroliferous basin, India were analyzed for chemical and molecular composition. The species and mass fractions of core sediments were employed using high resolution WD-XRF spectrometry using specific crystal to dispersion of X-rays according to their wavelengths. In the present study, a simple non-destructive speciation analysis methodology for light elements (Al, Si, P and S) was standardized using $K\alpha$ and $K\beta$ emission spectra. Pure chemical compounds and NIST SRM1646a (Estuarine sediment) were used for species identification and mass fraction validation. The core sediment composition profile varied greatly among the samples from different depths. Sources of sediment fingerprinting and interrelationship of elements was investigated using major elements concentrations (Figure 1). The dendrogram clearly showed association between elements belongs to sand (Si) and silt, clay (Al, Fe, Ca, K, Ti, Mg, P, Sr and Mn) constituents. Major elemental species (Si, Al, P and S) also identified using reference chemical compounds based on the $K\alpha$ and $K\beta$ emission structure. The WD-XRF methodology was standardized for light element speciation and major elemental concentration determination. This methodology will apply to estimate the environmental conditions and toxicity of elements as well as complementary to XANES.

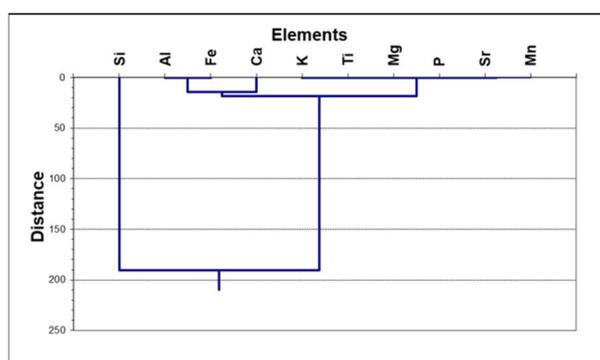


Figure 1: Cluster dendrogram of core sediment geochemical data derived using Ward's method

References

Demina et al., Geochemical Signatures of Paleoclimate Changes in the Sediment Cores from the Gloria and Snorri Drifts (Northwest Atlantic) over the Holocene-Mid Pleistocene. *Geosciences* 9, 432, (2019).

