# CHARACTERISATION OF SEDIMENTARY ORGANIC MATTER IN AN ARSENIC CONTAMINATED AQUIFER CAMBODIA

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High concentrations of arsenic in the groundwater of South and South East Asia have been linked to millions of deaths and many serious illnesses across the region over the past 25 years (Ravenscroft et al., 2009). It is widely accepted that this arsenic release is driven by microbial catalysed reactions between organic material (OM) and arsenic-bearing iron-oxide minerals (Islam et al., 2004). A significant reservoir of OM in the aquifer is sedimentary OM from a variety of sources. In this study we combine bulk analysis (C/N, $\delta^{13}C$ and $\Delta^{14}C$) with lipid analyses to examine and map the origin of OM in arsenic-prone sediments in Cambodia.

Previous studies showed that the shallow sediments are generally clay deposits with a predominant immature/plant derived origin whilst deeper, generally coarser grained, sediments contain more mature, petroleum derive hydrocarbons (Al Lawati et al., 2012; Eiche et al., 2016; van Dongen et al., 2008). In this study we map, for the first time, not only the composition of OM along core profiles in the Kandal province (arsenic prone region in the lowlands of Cambodia) but also along a transect from the Bassac river, a distributary of Mekong, to the central wetlands in this region, creating a 2 dimensional map.

Radiocarbon analyses when combined with analyses of sedimentary grainsizes indicate that the sediments in this area were deposited during three key periods of deposition in the Holocene. First in the early Holocene (12,000 to 7,000 years BP) consisting of predominantly clays, then in the mid Holocene (4,000 to 2,000 years BP) consisting of mostly sands and finally the recent Holocene (2,000 year to present) forming a clay cap on the surface (Figure 1). Each of these periods of deposition co-inside with regional Holocene climate change (respectively rising sea-levels, increased monsoon and the opening up of the Tonle Sap river upstream of the study area).

The organic composition, both at bulk and molecular level, is strongly linked to this sedimentary history and organic geochemical degradation proxies show that the most oxidised organic carbon is hosted in the early Holocene facies. Analyses indicate that there is a clear correlation between clay deposits, bulk C/N and hydrocarbon maturity in these profiles/transect, with plant derived debris strongly correlated with the clay sections and the mature hydrocarbons with the sandy sediments. However, in contrast to previous studies, this study, for the first time, clearly shows that the clay caps at the surface are not as uniform as previously suggested and mature hydrocarbons can ‘flow’ around these caps into shallower sediments.

Considering that it is established that arsenic release is driven by the microbial oxidation of OM during the reduction of iron-(hydr)oxides in these sediments, the results of present study indicate that early Holocene organic carbon is implemented in arsenic release.

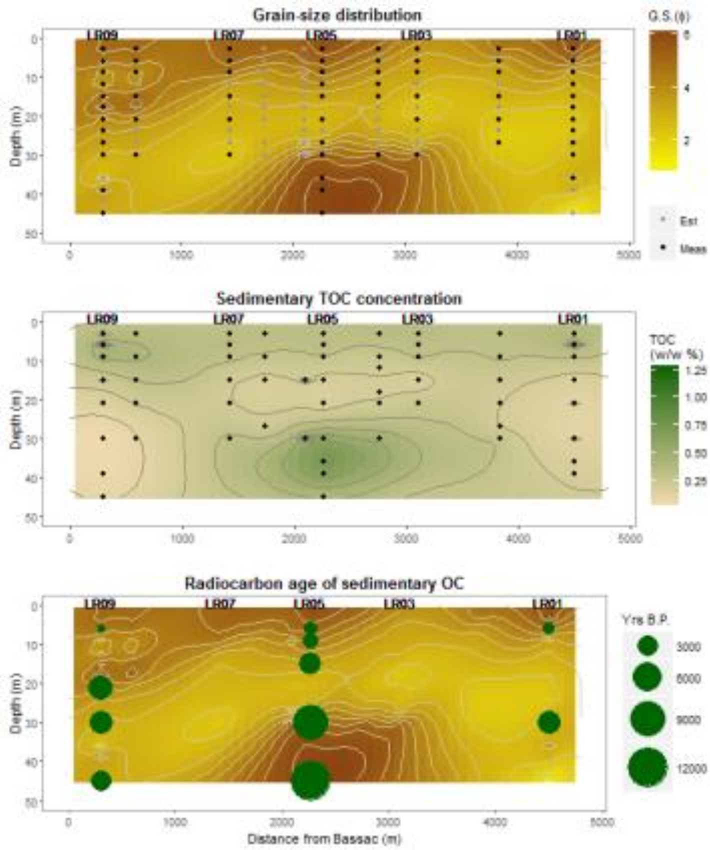


***Figure 1*** *Kriged results for the distribution of sedimentary median grain size, TOC % (w/w), and distribution of radiocarbon dates on the transect of this study. Black dots are measured values from which kriging was calculated grey dots are estimate values used for co-kriging.*

## References

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