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Anthropogenic dissolved samarium and gadolinium in the Van Uc River. Environmental issue in the estuary, impact on the Gulf of Tonkin.

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Van Uc River is one of the three largest mouths of Red-Thai Binh River system, located in Southwest of Do Son peninsula, north Vietnam. This hydrological context is characterized by a shallow bathymetry, displaying diurnal tide system with fairly high amplitude (~ 3.5 m). The rapid development of coastal Hai Phong city with many industrial zones, deep water harbours and 2.5 million inhabitants likely suggests that the estuary of Van Uc river and consequently the Gulf of Tonkin are impacted by human activities. We propose to investigate the estuary turbidity maximum fate, through its chemical composition evolution, using the powerful geochemical tool that are Rare Earth elements. Dissolved and particulate Rare Earth element concentration and Nd isotopic composition will help to to: 1) identify the REE natural (lithogenic) fraction and disentangle the authigenic fraction from natural sources, 2) bring to light the human impact using the REE anomalies and 3) indirectly quantify the heavy metal that could be discharged to the sea. Here, we present preliminary results of dissolved REE (DREE, ≤0.2µm) concentrations from 20 stations/samples collected from the river to the plume, characterizing the estuary turbidity maximum area. The total DREE (∑REE) concentrations are ranging within 61.72 - 7595 ng/kg. The concentrations of the DREE in river and estuarine waters are similar to what have been found in Rhine River (Kulaksiz and Bau ,2013) and Pearl River Delta (Ma et al., 2019). Contrastingly, the Gd level found in the study area reach up to 15-fold of what was found in the San Francisco Bay (Hatje et al 2016). The Sm and Gd positive anomalies (normalized to PAAS) are significant and confirm the anthropogenic impact to the river and estuary as noticed by Hatje et al (2016) and Kulaksiz and Bau (2013). On-going analyses of particles and Nd isotopes will allow calculating the distribution coefficient and also describing the exchange between dissolved and particulate phases.

Hatje et al.(2016). *Environmental Science and Technology,* **50**, no. 8: 4159–68

Ma et al (2019). *Environmental Pollution*, **244**,190-201

Kulaksiz and Bau (2013). *Earth and Planetary Science Letters* **362**, 43–50