

# The Source-to-Sink processes of sediment and paleo-environment change

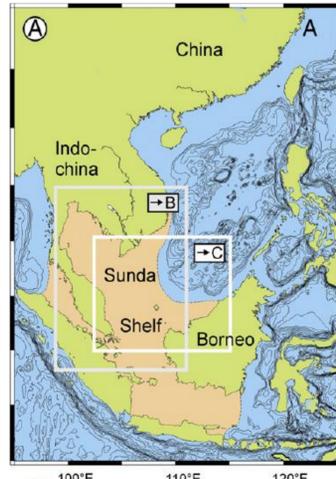
## in the western Sunda Shelf since the Holocene

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### Introduction

- Continents and islands in Southeast Asia have the **highest denudation rate** in the world. They supply **70%** of the global suspended sediment to the world ocean.
- Sunda shelf** is the widest low-latitude shelf in the world, intense weathering brings huge amounts of terrigenous material. However, source and distribution of sediments in the western Sunda shelf are still not clear.
- Sediment discharge in mountainous rivers in Southeast Asia was previously underestimated by 3 orders of magnitude. **Tropical mountainous rivers** play an important role in sediment source to sink process in tropical region.



Location of Sunda Shelf (Hanebuth et al., 2011)

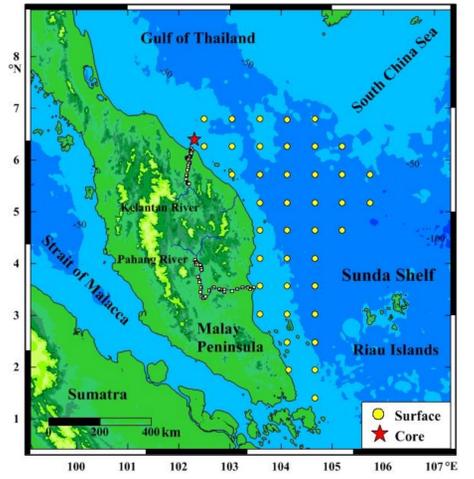
### Samples and Methods

#### Samples

- Kelantan River: 22 surface sediments
- Pahang River: 28 surface sediments
- Sunda shelf: 40 surface sediments
- Core (K17): 132 sediments

#### Methods

- Sedimentology: Grain size-mean grain size, sand(%), silt(%), clay(%)
- Mineralogy: XRD minerals-quartz, feldspar...
- Geochemistry: Major, trace and rare earth elements (REE)
- Isotope: Sr-Nd isotopes

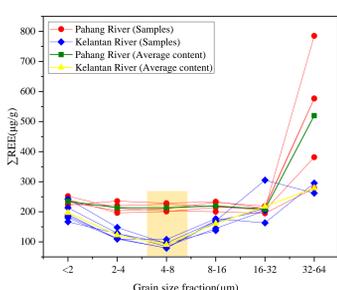


Sampling location of rivers and shelf of Malay Peninsula

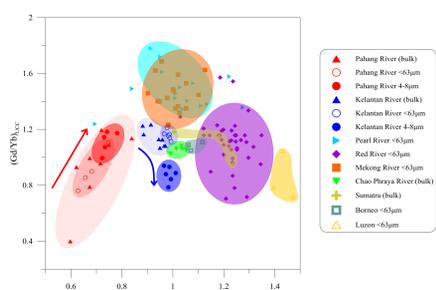
### Research Results

#### 1. Characteristics of grain-size fractions of fluvial sediments in Malay Peninsula and their provenance significance

- Samples from two rivers were divided into 7 size fractions: <63, 32-63, 16-32, 8-16, 4-8, 2-4, <2 μm.
- 4-8μm fraction has obvious difference among REE concentrations, UCC-normalized patterns and REE parameters, therefore, 4-8 μm fraction can be used as a sensitive grain size to distinguish sediment sources from Pahang and Kelantan rivers.

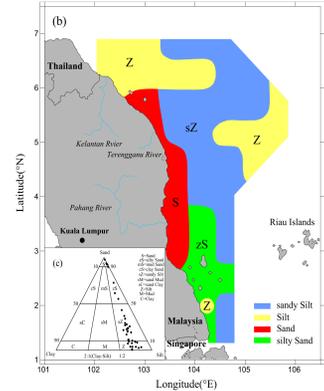


Variations of ΣREE in different grain-size fractions of Pahang and Kelantan rivers

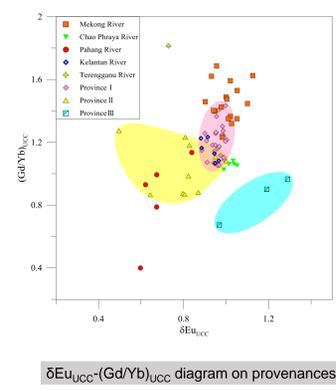


Discriminant plot of δEu<sub>UCC</sub> - (Gd/Yb)<sub>UCC</sub> in different size fractions from rivers surrounding the South China Sea

#### 2. Characteristics, provenance and transport patterns of sediments in the western Sunda Shelf

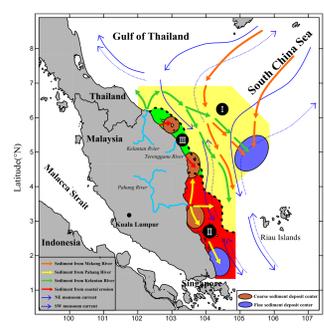


Sediment types of surface sediments



δEu<sub>UCC</sub> - (Gd/Yb)<sub>UCC</sub> diagram on provenances

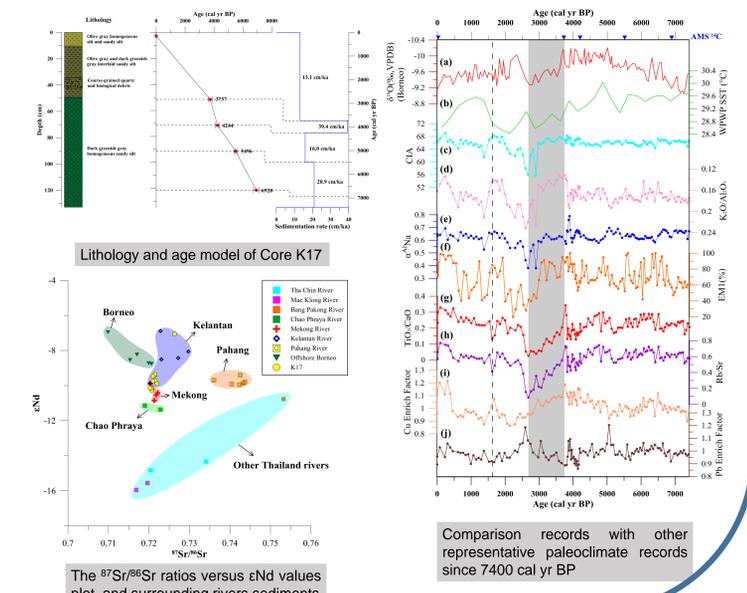
- Increasingly finer towards the offshore region.
- REE distribution can be divided into three geochemical regions.
- Provenance and driving forces:**
  - I-Mekong and Kelantan rivers, Northeast monsoon current
  - II-Pahang River, Coastal currents
  - III-Coastal erosion, Wave energy



Sediment transport patterns in the western Sunda Shelf

#### 3. Sedimentary responses to climate changes and human activities over the past 7400 years

- Kelantan River is the primary provenance of Core K17.
- Nature>Human:** 7400-1600 cal yr BP-chemical weathering and terrigenous input controlled by rainfall and temperatures.
- Human>Nature:** Since 1600 cal yr BP-decoupling relationship between climate and weathering/erosion



Lithology and age model of Core K17

The <sup>87</sup>Sr/<sup>86</sup>Sr ratios versus εNd values plot, and surrounding rivers sediments

Comparison records with other representative paleoclimate records since 7400 cal yr BP

### Conclusions

- δEu<sub>UCC</sub> and (Gd/Yb)<sub>UCC</sub> diagram could be used as an effective indicator for identifying river-sourced sediments around the southern SCS.
- 4-8 μm fraction is the sensitive grain size to distinguish the sediment from Pahang and Kelantan rivers.
- Provenances in the western Sunda Shelf primarily include **Kelantan River and Mekong River, Pahang River**, and coastal erosion.
- 7400-1600 cal yr BP, **natural climate** control weathering and terrigenous input processes in the western Sunda Shelf.
- Human activities** have overwhelming impact on weathering and erosion processes in southern SCS since the past 1600 years.

### Acknowledgements & References

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