Impacts of Land Use Change on the Sedimentary Organic Matter in Peat–draining Rivers, Sarawak, Malaysia

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Introduction

Unlike boreal and temperate peatlands, tropical peatlands are mostly forested, and most tropical peat forests are located in South East Asia. Peatlands in Southeast Asia form globally significant carbon pools comprising 11–14% of C stored in peat (Page *et al*., 2011).

In recent decades, the original vegetation cover of peatland in Southeast Asia has suffered rapid degradation where there are strong economic and social pressures for timber, agriculture and plantations of oil palm and pulp trees. While the impacts of this alteration on the delivery of terrigenous organic carbon in the peat-draining rivers are largely unknown.

Tab.1 Global distribution of peat

Peat	Area (km^2)	Volume (Gm^3)	Storage (Gt)
Earth	3997435	7093	479.7
Temperate zone	3556410	5335	391.1
Boreal zone			
Tropic	441025 (11%)	1758 (24.8%)	88.6 (18.5%)
Southeast Asia	247778 (6.2%)	1359 (19.2%)	68.5 (14.3%)

Study Area and Methods

1. Study area

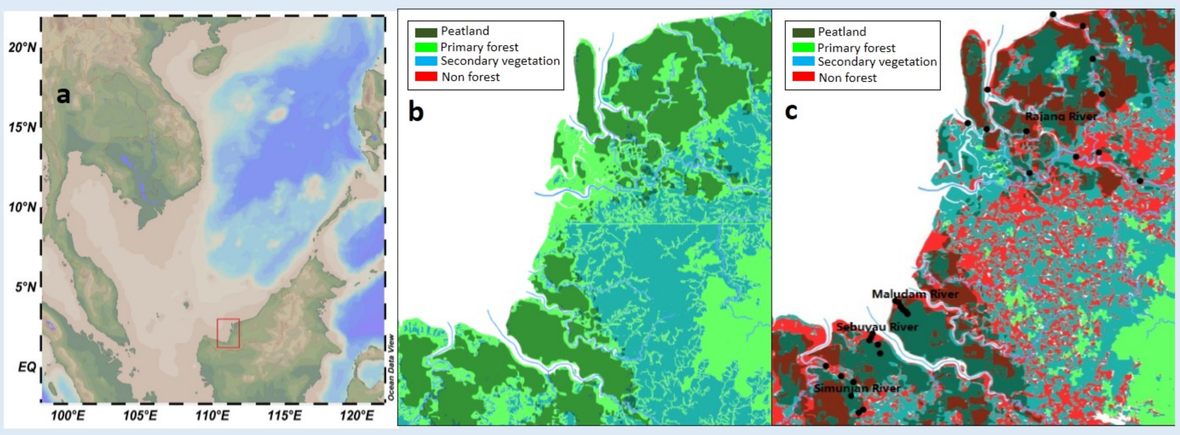

Fig.1 a: Sampling area in Sarawak; b: Land cover in 1960ies; c: Land cover in 2010, the black dots are sampling stations in four rivers.

We collected surface sediments and plants from three peat-draining rivers (Maludam River, Sebuyau River and Simunjan River, the degree of land use: Maludam＜Sebuyau＜Simunjan) in Apr.,2017 and Sep.,2017, and Rajang River in Aug.,2016 and Apr.,2017, in which Aug.,2016 and Apr.,2017 are relatively dry season, Sep.,2017 is wet season.

2. Methods

We used lignin phenols to trace the humic and degradation process of the sedimentary organic matter (SOM) in southeast Asia.

Result and Discussion

1. Hydrological influence

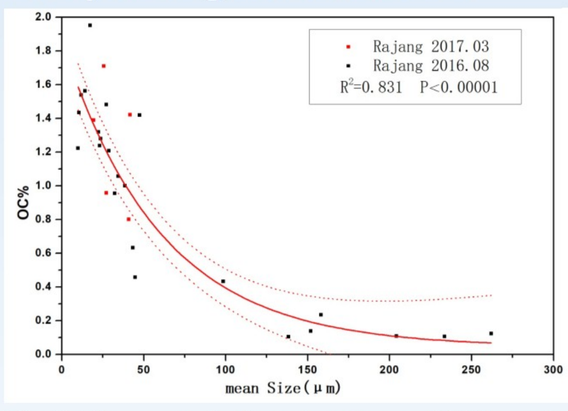

Fig.2 The correlation between OC% and grain size in Rajang River. The black spots represent mean values in Aug.,2016, the red spots represent mean values in Apr.,2017.

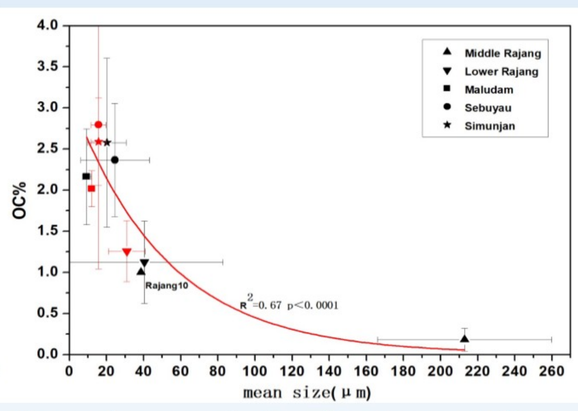

Fig.3 The correlation between OC% and grain size in four rivers. The black spots represent mean values in dry season, the red spots represent mean values in wet season.

2. Vegetation sources of SOM

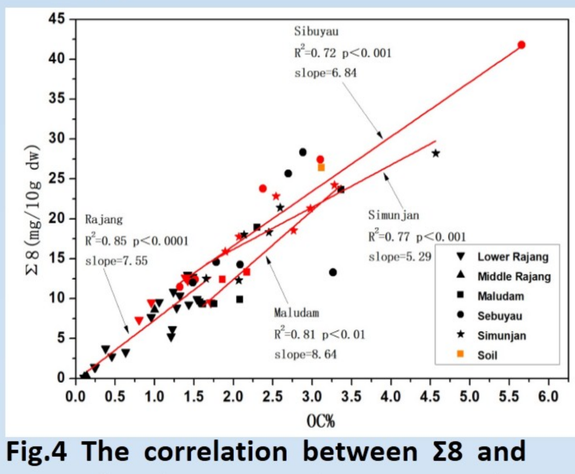

Fig.4 The correlation between Σ8 and OC% of sediments in four rivers. The black spots represent dry season, the red spots represent wet season.

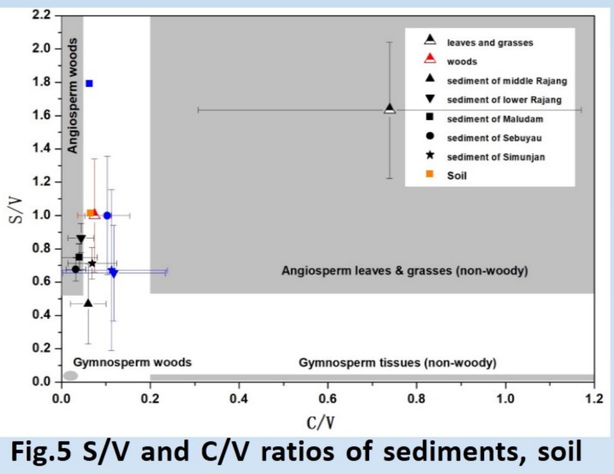

Fig.5 S/V and C/V ratios of sediments, soil and plants in four rivers' catchments. The blue spots represent plant debris in sediments.

1) Σ8 had a positive correlation with OC% in all four rivers, indicates that SOM are mainly from of terrigenous organic matter;
2) S/V and C/V shows the main vegetation source of SOM is angiosperm woods.

3. Degradation of SOM in river sediments

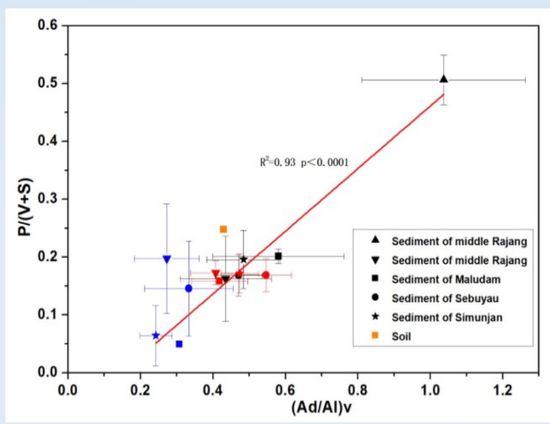

Fig.6 The correlation between P/(V+S) and (Ad/Al)v of sediments. The black spots represent dry season, the red spots represent wet season.

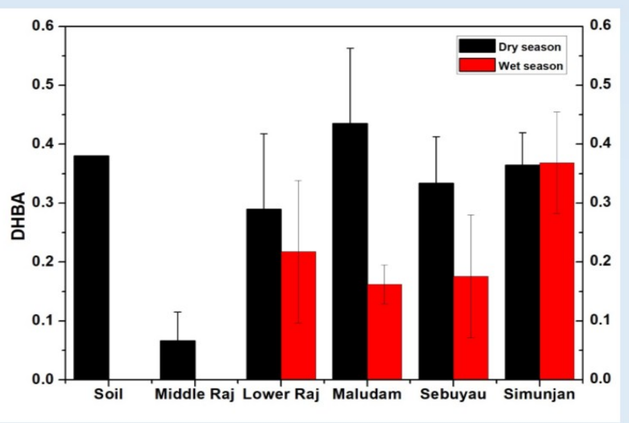

Fig.7 DHBA values of sediments between two seasons.

1) (Ad/Al)v increases during oxidative degradation, P/(V+S) increases during demethoxylation, the values shows river SOM in this area experienced moderate degree of oxidative degradation and slight demethoxylation;
2) DHBA value increases during soil humification, the higher value in dry season mainly because the surface peat eroded easier after exposed to air for a long time.

4. POC:DOC ratios increased with the degree of land use change

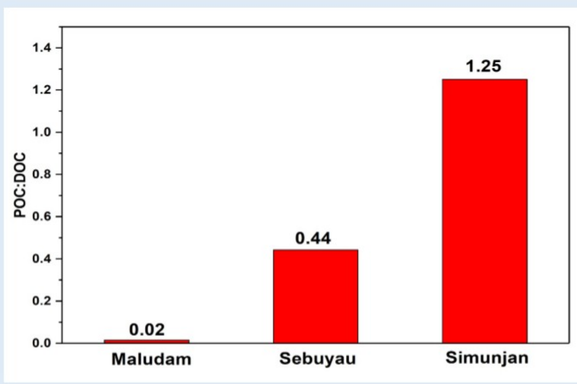

Fig.8 POC:DOC ratios in three black waters, which can be used as an index to evaluate the degree of peat erosion in peat-draining river catchments. In the blanket peatlands of the UK, POC:DOC ratios exceed unity throughout the catchment with maximum values of 4 (Pawson *et al*., 2012).

POC in slightly eroded or intact systems is typically 5–50% of the total organic carbon load (TOC). Even in pristine black-water rivers in Southeast Asia, POC is typically less than 5% of TOC (Moore *et al*., 2013). POC:DOC values in three black waters shows different degree of erosion in their own catchments.

Acknowledgements

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