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Outstanding Student & PhD candidate Presentation contest

EGU22-783

TS6.2

Variation in Cenozoic tectonic subsidence in Luconia-Balingian provinces, Sarawak Basin, Malaysia: influence of extensional and compressional tectonics

Siti Nur Fathiyah binti Jamaludin[1]

Manuel Pubellier[2]

Mazlan Madon[3]

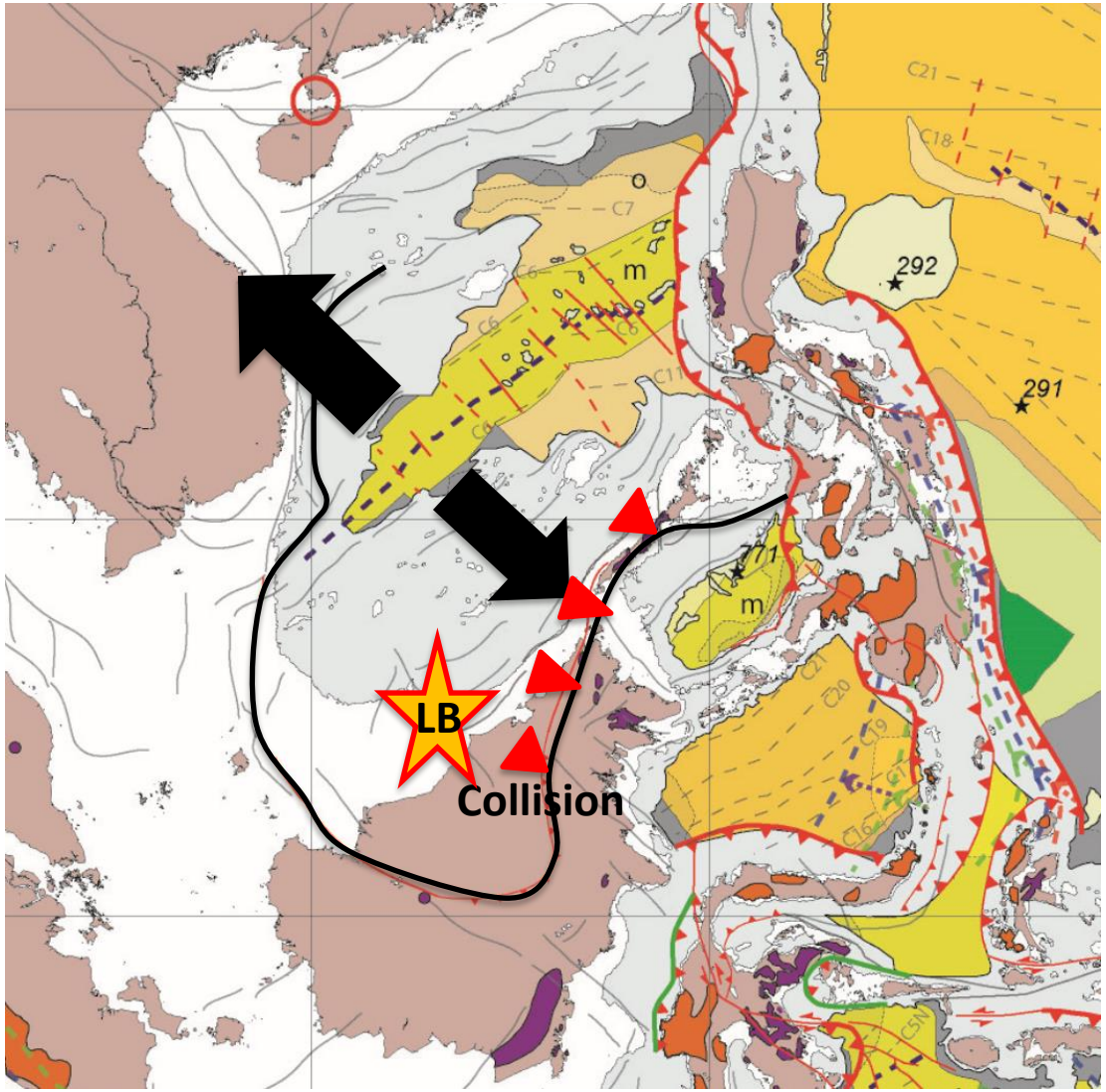
[1] Department of Geoscience, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

[2] CNRS UMR 8538, École Normale Supérieure, PSL University, France

[3] Malaysian Continental Shelf Project, National Security Council, Putrajaya, Malaysia

Background Image: Structural map of the South China Sea (CMGW-IUGS)

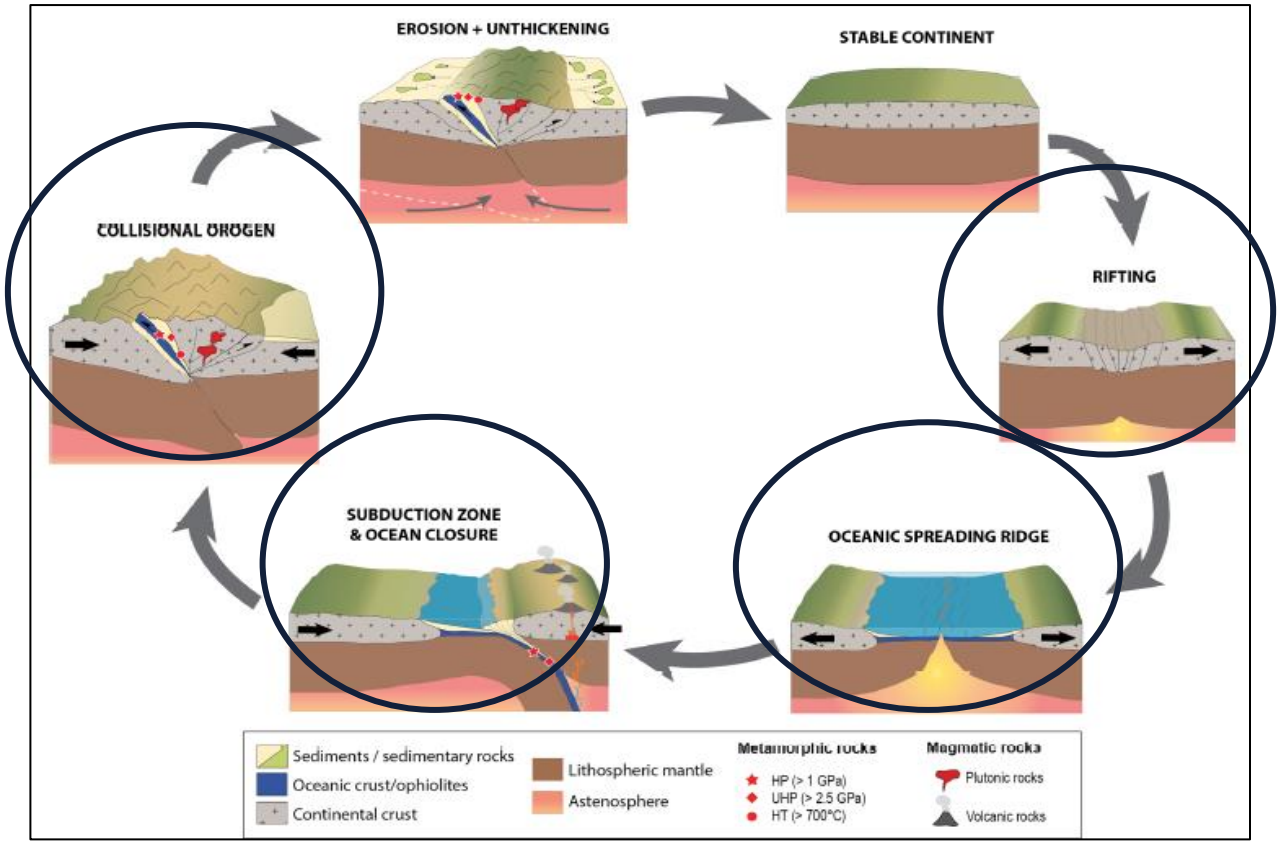
Tectonic Influences



Structural Map of the Western Pacific Ocean, Miles et al., 2016© CCGM-CGMW

Timing	Events	References
55 Ma	Initiation of rifting	Clift & Lin (2001); Wang & Li (2009); (Doust & Sumner, 2007)
50 Ma	Intensified rifting	Clift & Lin (2001); Wang & Li (2009); (Doust & Sumner, 2007)
37.8 to 32.9 Ma	1st Continental rifting in E-W (widespread) and seafloor spreading	Barckhausen et al. 2014; Hsu et al. 2004; Yeh et al. 2010;)
32 to 16 Ma	2nd rifting episode (southern SCS), cont. seafloor spreading	Barckhausen et al.,2014; Cullen et al. 2010; Barckhausen & Roeser, 2004; Brias et al. 1993; Taylor & Hayes, 1983)
23-16 Ma	Colliding/Docking of proto-SCS-Borneo; cont seafloor spreading and ceased	Wu & Suppe, 2018; Metcalfe, 2017; Hall & Breitfeld, 2017; Xu et al. 2016; Zahirovic et al. 2014; Hall, 2012;

Scientific issues



Simplified Wilson Cycle showing stages of plate tectonic development (Francois et al., 2021)

- Theoretically, rifting of the continents is followed by the seafloor spreading phase during basin opening (Wilson, 1966; Wilson et al., 2019) to form the new oceanic floor.
- There was **overlap** in between **continental rifting** and **seafloor spreading** in the SCS.
- Existence of **subduction slab** underneath Borneo is still **uncertain** although there are rising evidences from velocity tomography and magnetic responses (Wu & Suppe, 2018; Lin et al., 2020).
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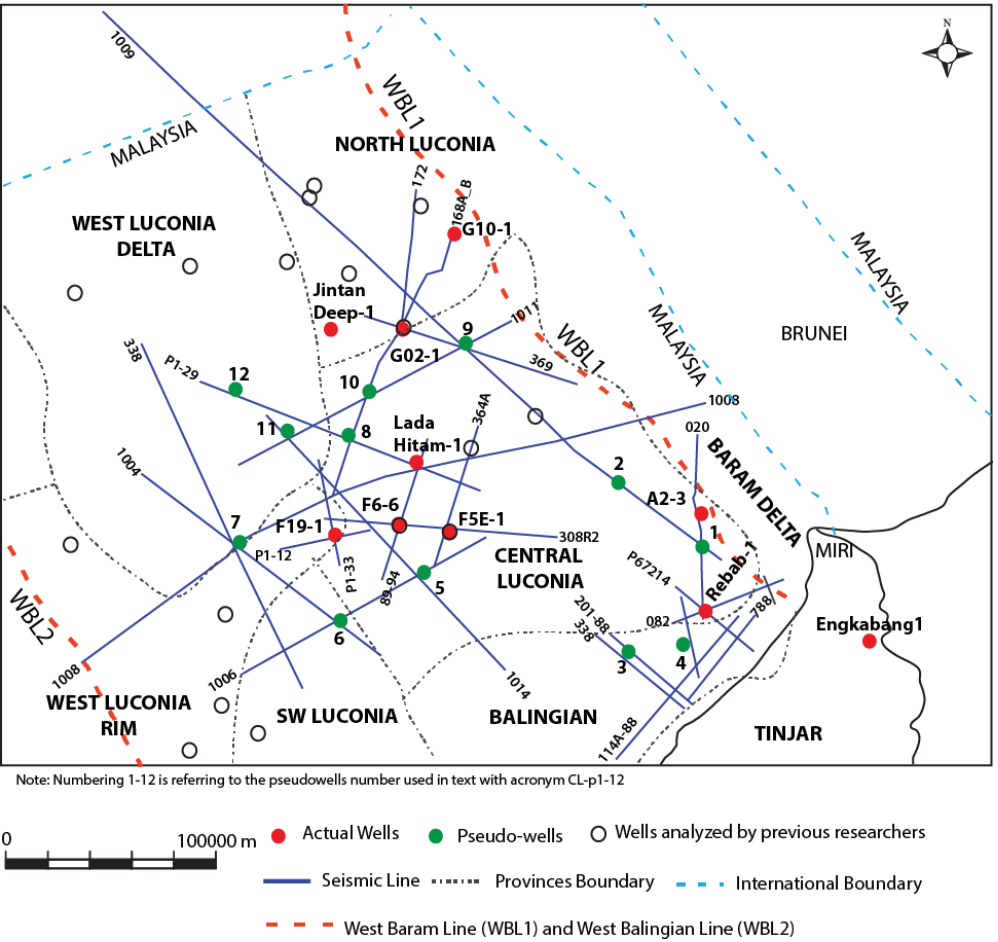
Basin Analysis

BasinVis

Data and Workflow



Note: Numbering 1-12 is referring to the pseudowells number used in text with acronym CL-p1-12

Setup

- Well Locations Information
- Stratigraphy of the area
  Age determination
  Regional tectonic evolution

Stratigraphic Setting

- Sediment profile
  (Thickness and rates)
- Decompaction parameters
  Decompaction profiles

Compaction Trend

- Estimation of porosity-depth
  Compaction trend plots

Subsidence Calculation

- Backstripping parameters (sea level; water depth; grain density; compaction coefficient; initial porosity)
  - Total Subsidence
  - Tectonic Subsidence

Subsidence Evaluation

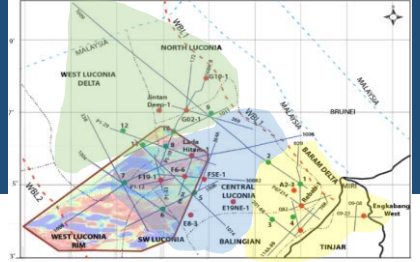
- Calculation of McKenzie Theoretical Curve for Luconia-Balingian
- Determination of Stretching factor
  Tectonic subsidence signatures

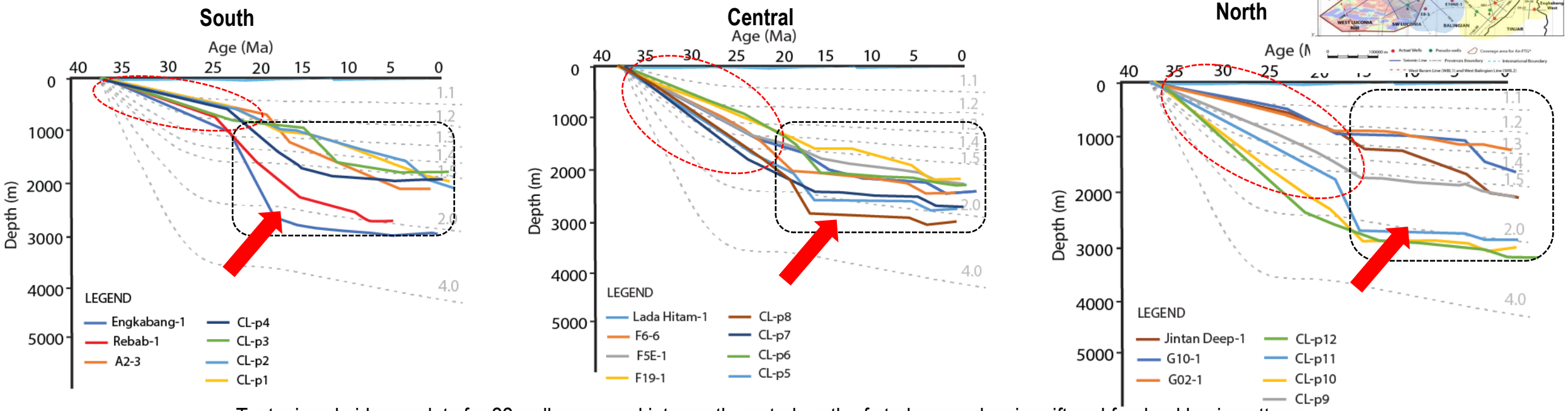
Surfaces Visualizations

Comparison

- Tectonic subsidence rate mapping
- Structural Trends Maps
- Existing Structural Maps

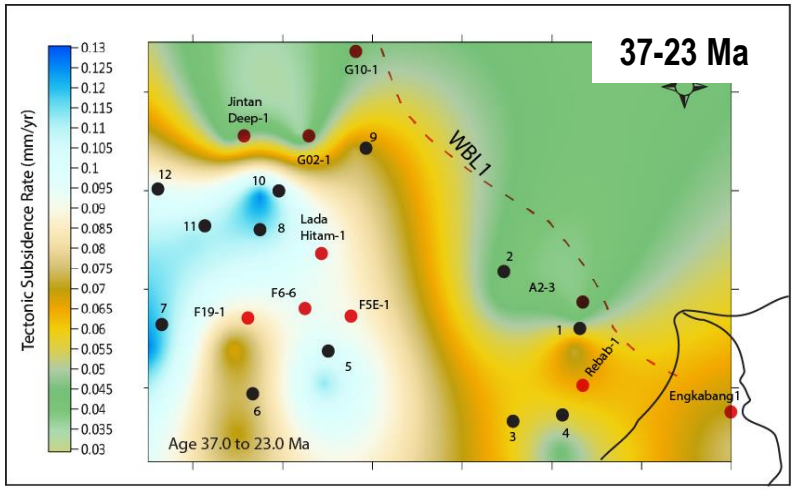
Tectonic Subsidence

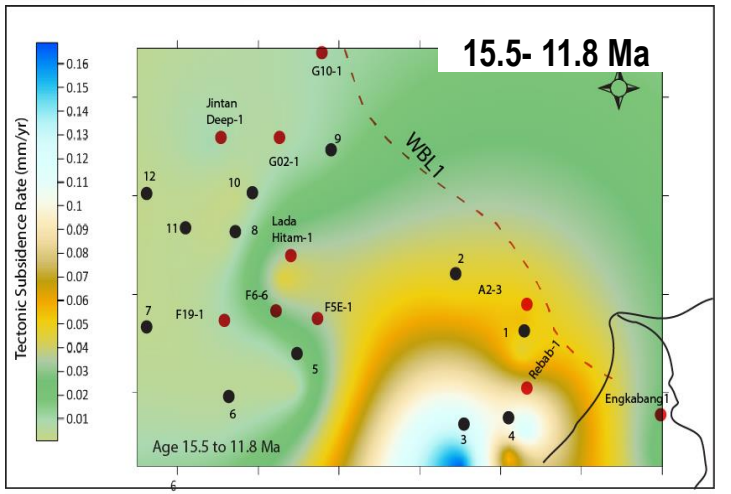




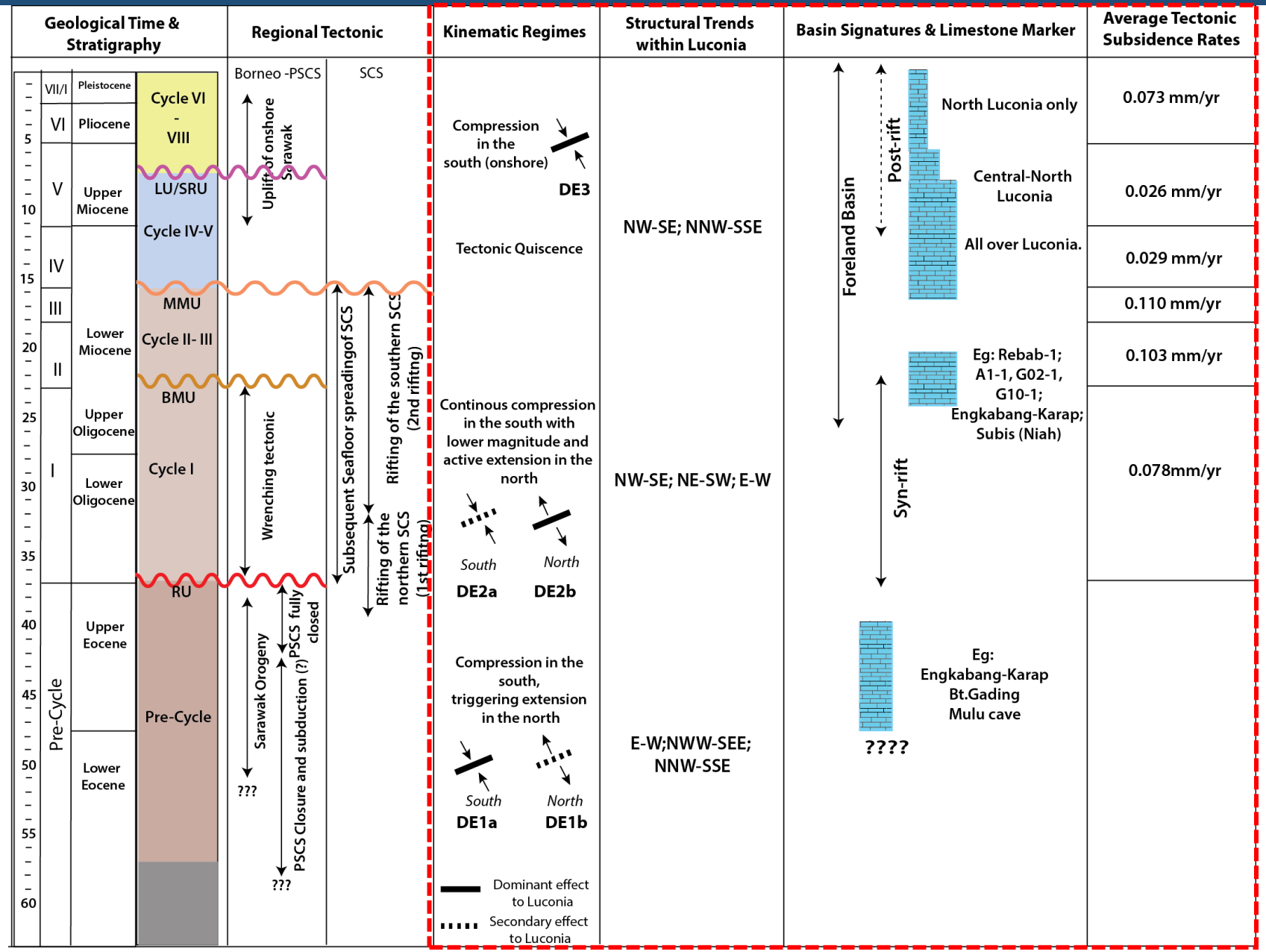
Tectonic subsidence plots for 22 wells, grouped into south-central-north of study area showing rift and foreland basin patterns.

Duration (Ma)	Av. Tectonic Sub. Rates (mm/yr)
37- 23	0.078
23- 18	0.103
18- 15.5	0.110
15.5 – 11.8	0.029
11.8- 5.2	0.026
5.2-3.0	0.073

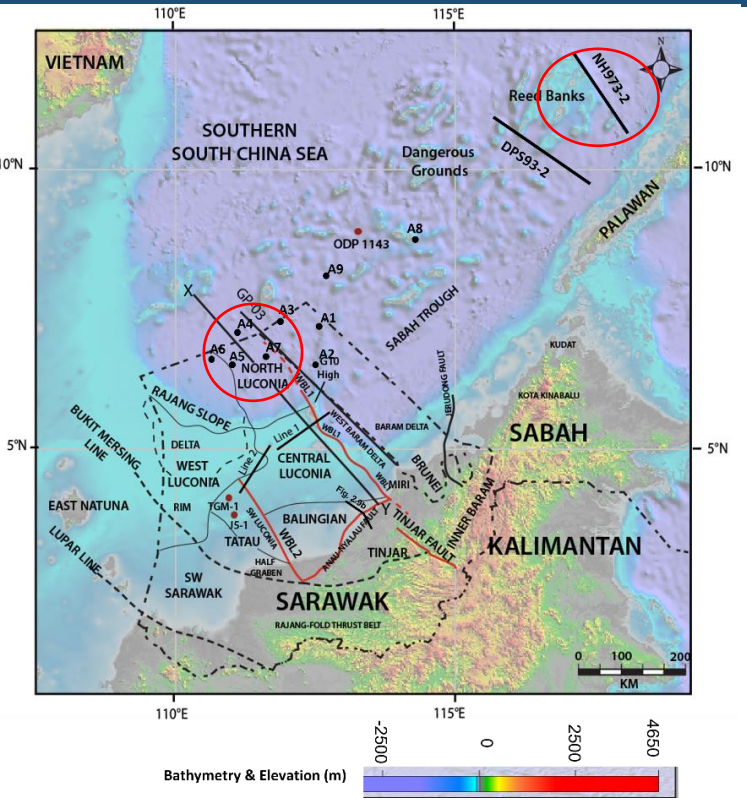


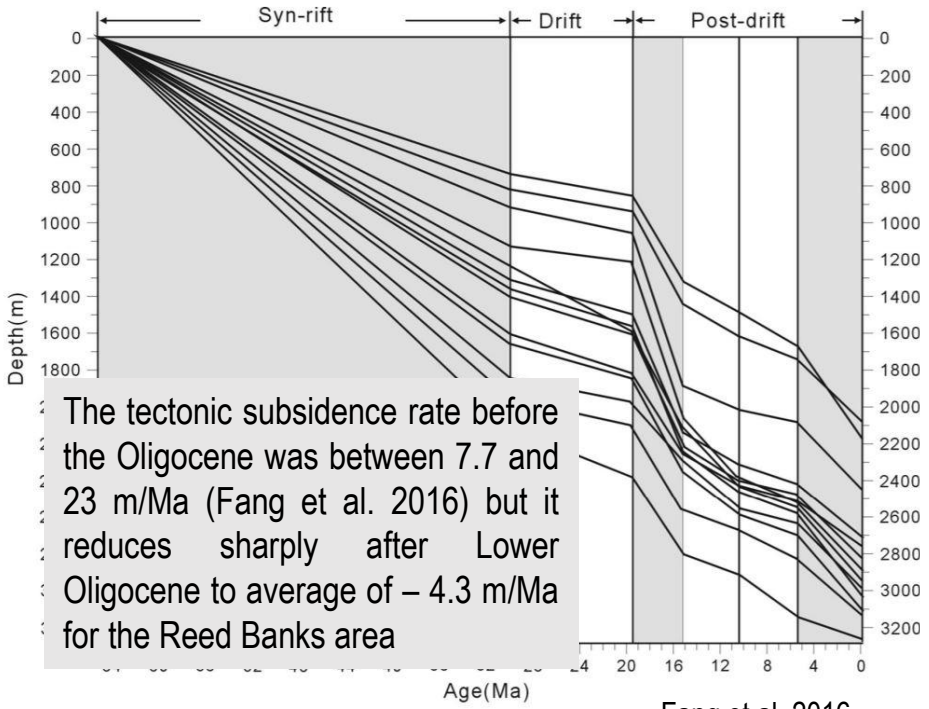


Graphical Summary



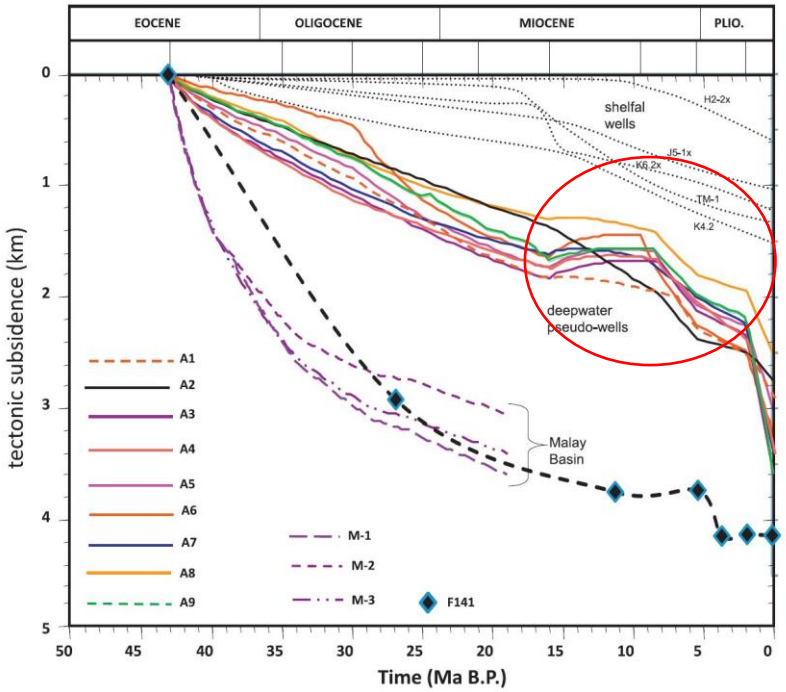
Conclusion





The tectonic subsidence rate before the Oligocene was between 7.7 and 23 m/Ma (Fang et al. 2016) but it reduces sharply after Lower Oligocene to average of – 4.3 m/Ma for the Reed Banks area

Fang et al. 2016



Madon et al. (2013)

- Accurate subsidence rates are deduced and specific tectonic characterization in different parts of Luc-Balingian at different stages of basin development.
- Luconia-Balingian Provinces were developed in intermediate stage **foreland basin setting, preserving syn-rifting influence at the first 14 Ma of basin life.**
- Northern and southern parts also affected by **localized strike-slip tectonic.**