

Kinta Valley Limestone: Clues for a New Play?*

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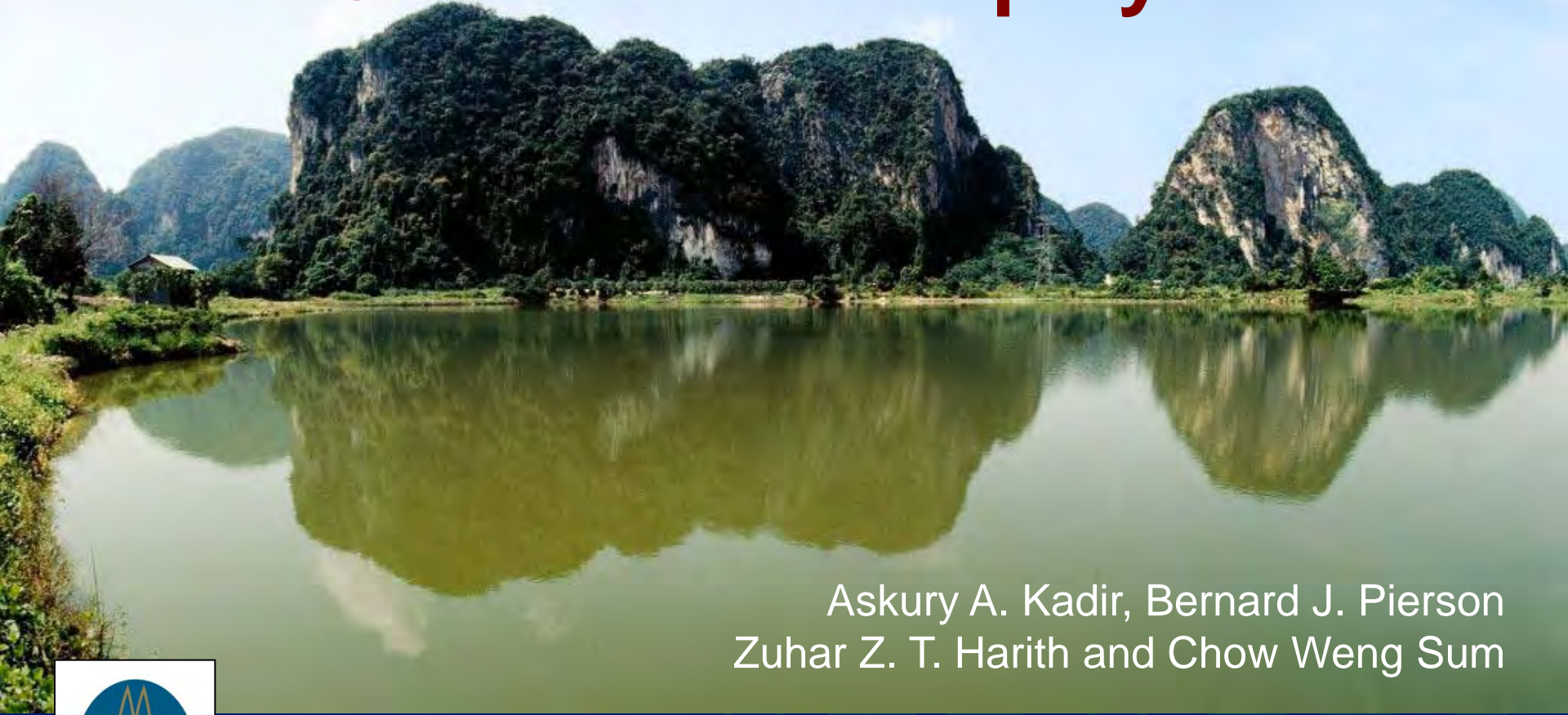
Abstract

A number of isolated Paleozoic (Ordovician to Permian) limestone hills with prominent karstic features cover an area of about 200 km² within the 1,200 km² area in the Kinta Valley in Peninsular Malaysia. These are remnants of extensive limestone beds, which are part of a very large Paleozoic carbonate complex that covered large parts of Southeast Asia. The limestone beds are interbedded with sandstone, siltstone and carbonaceous shale over a thickness of up to 3000 m.

The Paleozoic Kinta Valley limestone overlies younger Triassic granite bodies which had affected the texture and composition of the limestone and shale through contact metamorphism. In spite of this, sedimentary structures, such as thin laminations, slumps and meter-thick beds of brecciated shallow-marine fragments are still clearly visible in some places. These indicate that the Paleozoic limestone of the Kinta Valley was deposited on a slope. The dip and strike directions of the slumps indicate the presence of a north-south oriented shallow marine platform margin to the east of the Kinta Valley, prograding towards Central Peninsular Malaysia. Outcrops in eastern Peninsular Malaysia confirm the presence of a shallow marine platform, with potential reservoir horizons, that probably extended eastwards far into the South China Sea.

Paleogeographic reconstruction of the Paleozoic deposits in Peninsular Malaysia suggests that a potential new carbonate play may lie unexplored east of peninsular Malaysia. In the early 1970's, pre-Tertiary carbonate were penetrated offshore, at three localities east of peninsular Malaysia. These wells penetrated 8 to 492 m of limestone below the Base Tertiary unconformity, but did not encounter hydrocarbons. However, Paleozoic structures are possibly offset from the Tertiary structures at these locations and recent seismic may indeed reveal the presence of untested pre-Tertiary structures.

Kinta Valley Limestone: Clues for a new play?

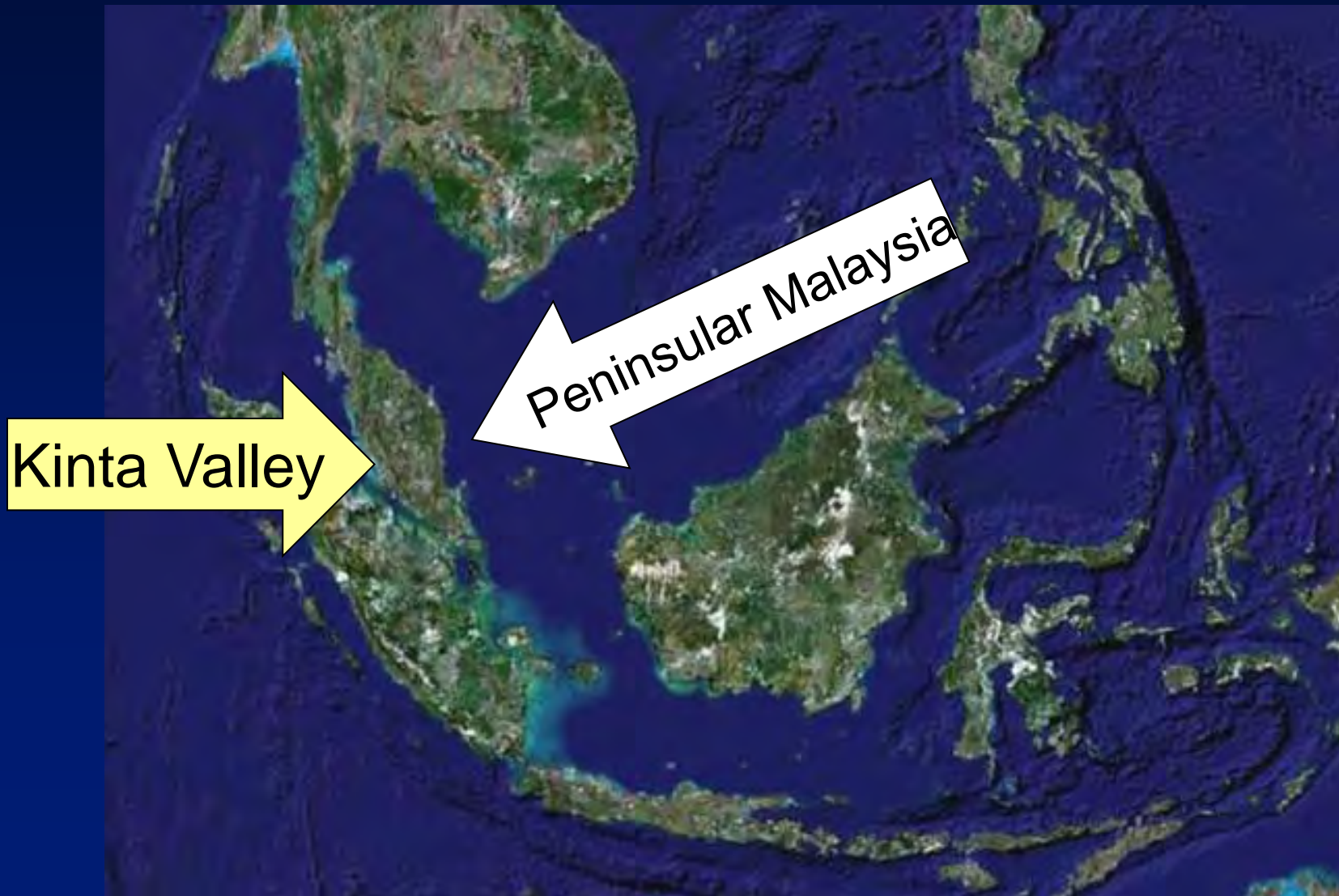


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Location of Study Area



Stratigraphy of Malaysia

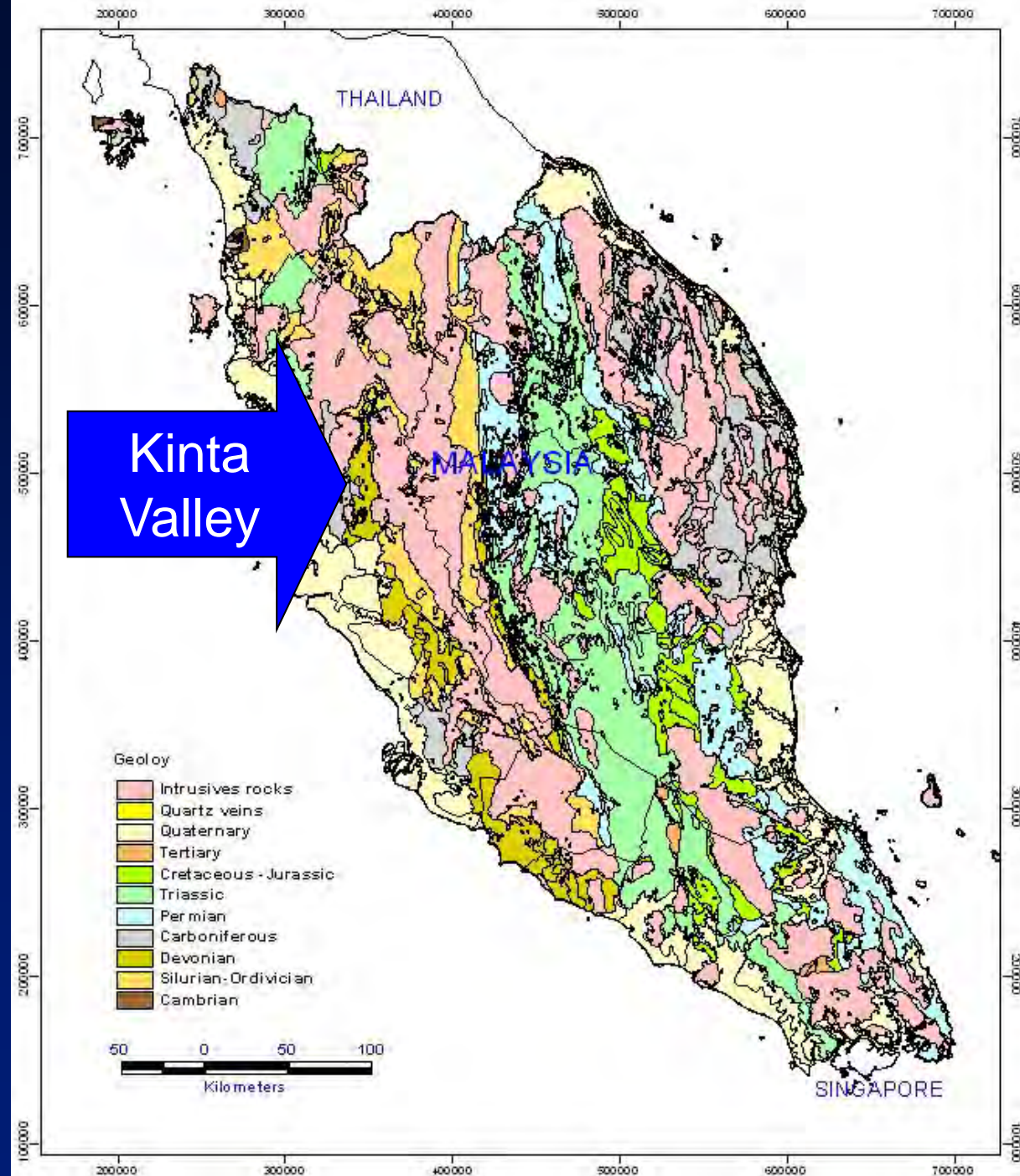
- Focus on pre-Tertiary
- Not much known about pre-Tertiary formations
- Paleozoic limestone and clastic sequences reported from Peninsular Malaysia

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Geological Map of Peninsular Malaysia

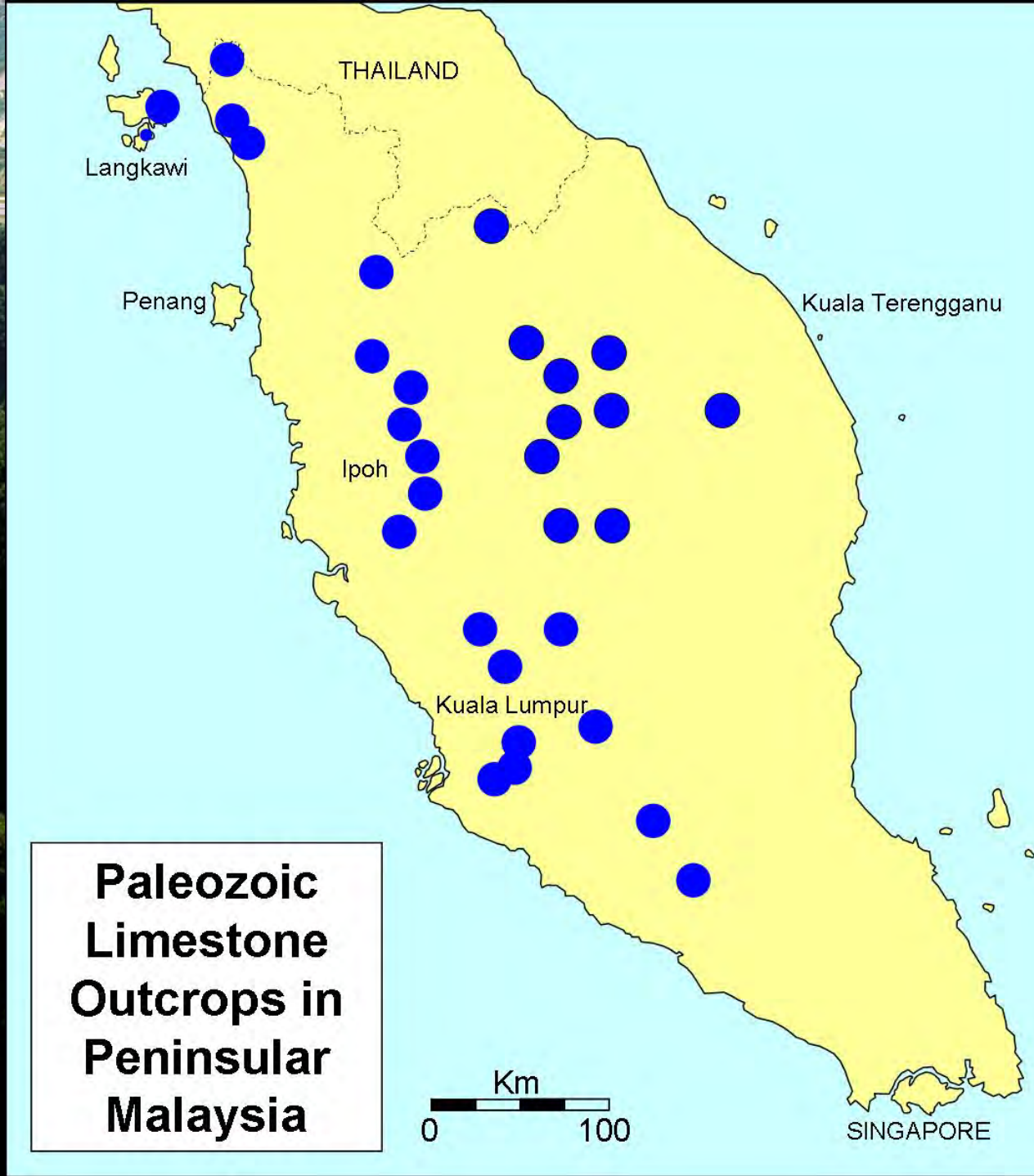
Peninsular Malaysia consist of parallel terrains of alternating granite and sedimentary rocks mainly of Pre-Tertiary age

The Kinta Valley comprises mainly Paleozoic limestone formations bounded by granitic ridges

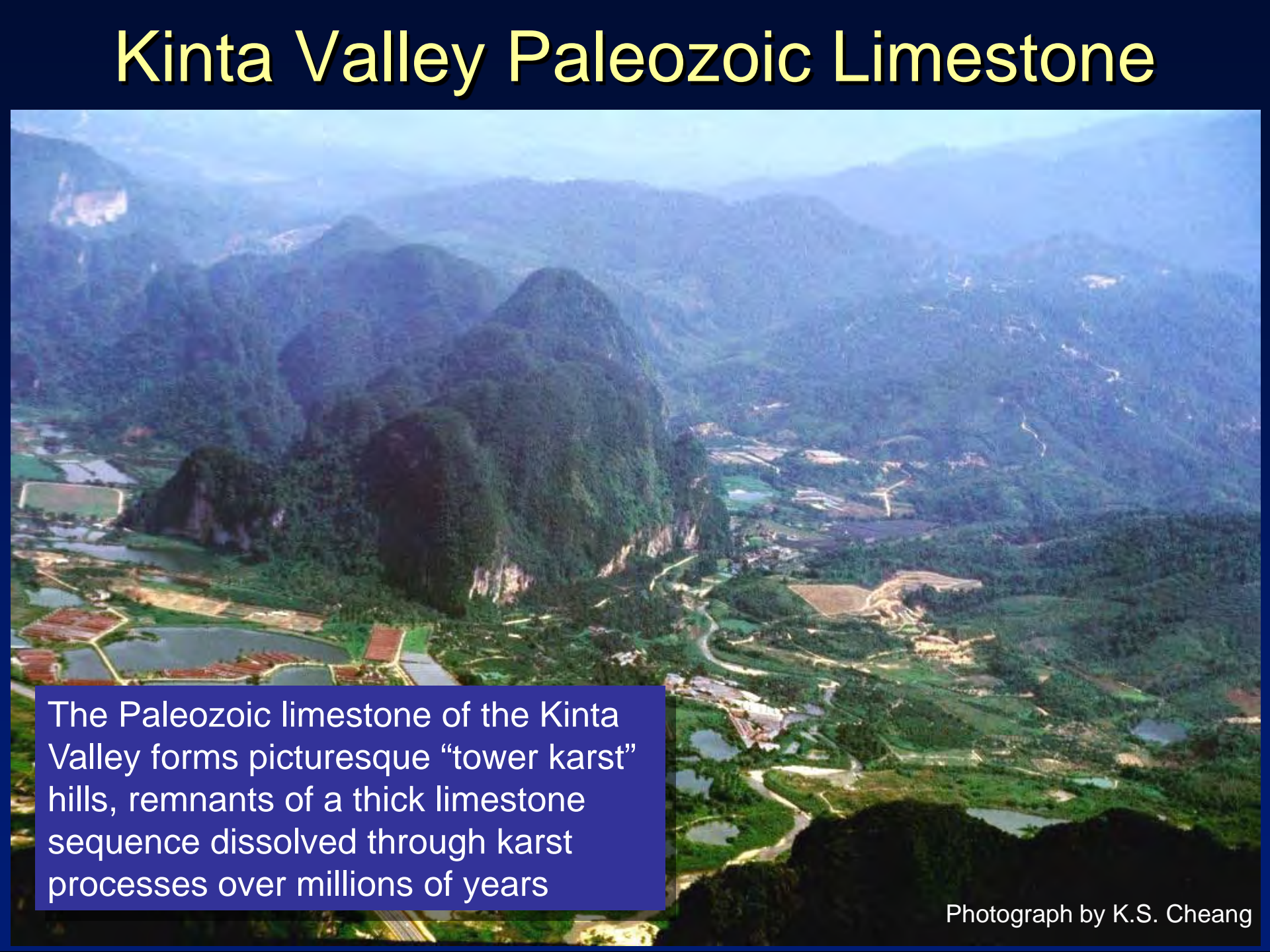




Photograph by K.S. Cheang



Kinta Valley Paleozoic Limestone

An aerial photograph of the Kinta Valley in Malaysia, showcasing the iconic 'tower karst' hills. These are steep, forested limestone peaks that rise abruptly from the surrounding green valley floor. The valley is a patchwork of green agricultural fields, small ponds, and some built-up areas. In the background, more layers of these karst hills are visible, creating a sense of depth. The sky is a pale blue, and the overall scene is a beautiful example of karst topography.

The Paleozoic limestone of the Kinta Valley forms picturesque “tower karst” hills, remnants of a thick limestone sequence dissolved through karst processes over millions of years

Photograph by K.S. Cheang

Paleozoic Limestone around the South China Sea

Tower karst near
Phuket, Thailand



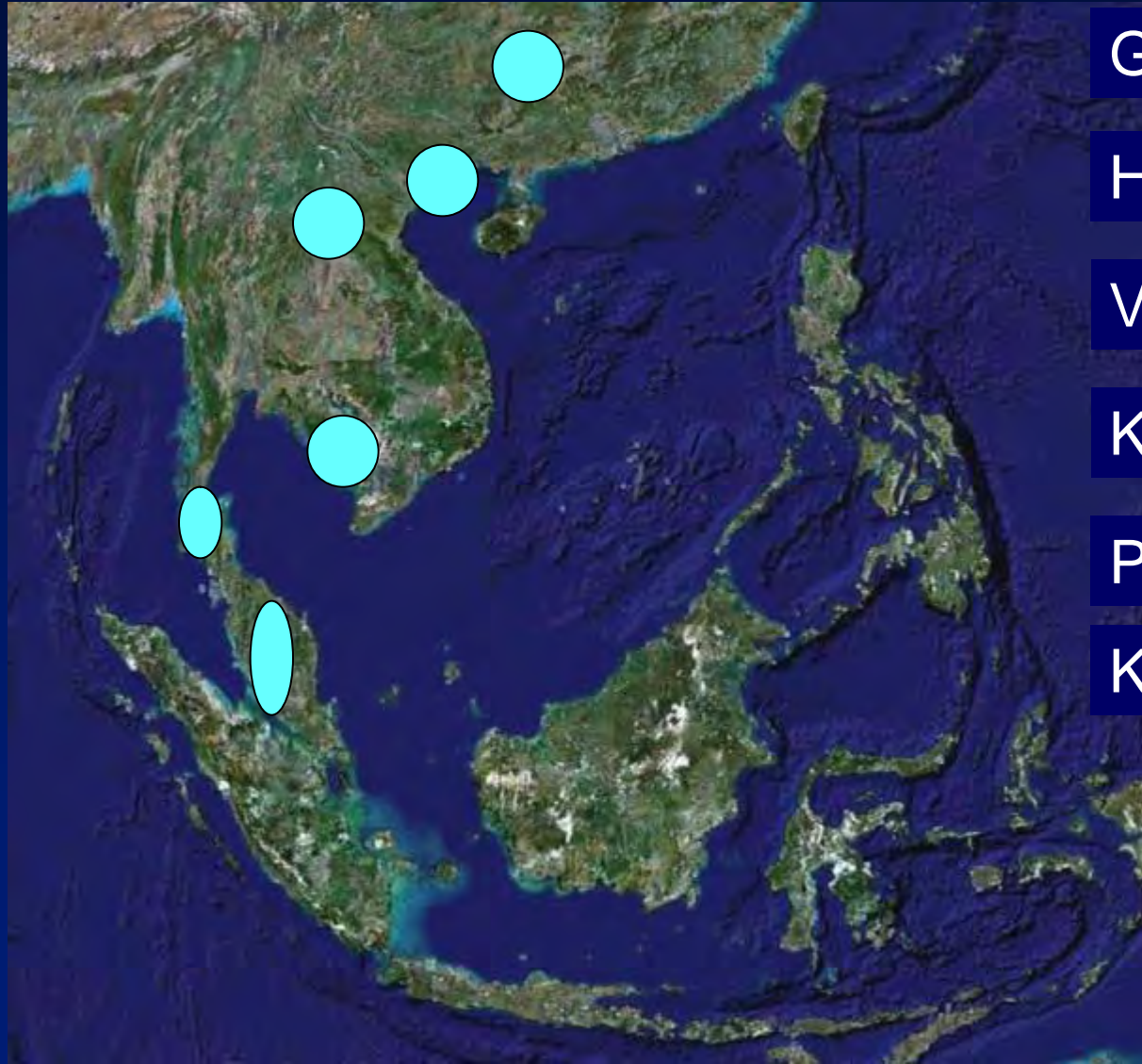
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Paleozoic Limestone around the South China Sea

Karst landscape in
Guangxi, China



Paleozoic Limestone in South Asia



Guangxi, China

Halong Bay, Vietnam

Vang Vien, Laos

Kampot, Cambodia

Phuket, Thailand

Kinta Valley, Malaysia

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Limestone Sedimentary Structures



Thick bed

Thinly-laminated
limestone

Thinly laminated beds of fine-grained limestone make up the bulk of the Paleozoic limestone hills. Occasional thicker beds occur within the monotonous thin bed sequence.

Limestone Composition: Thick Beds



Photograph by K.S. Cheang

The thick limestone beds contain coarse (here crinoid fragments) and fine-grained carbonate sediments, a mixture of shallow-marine and deep marine particles, typical of turbiditic deposits.

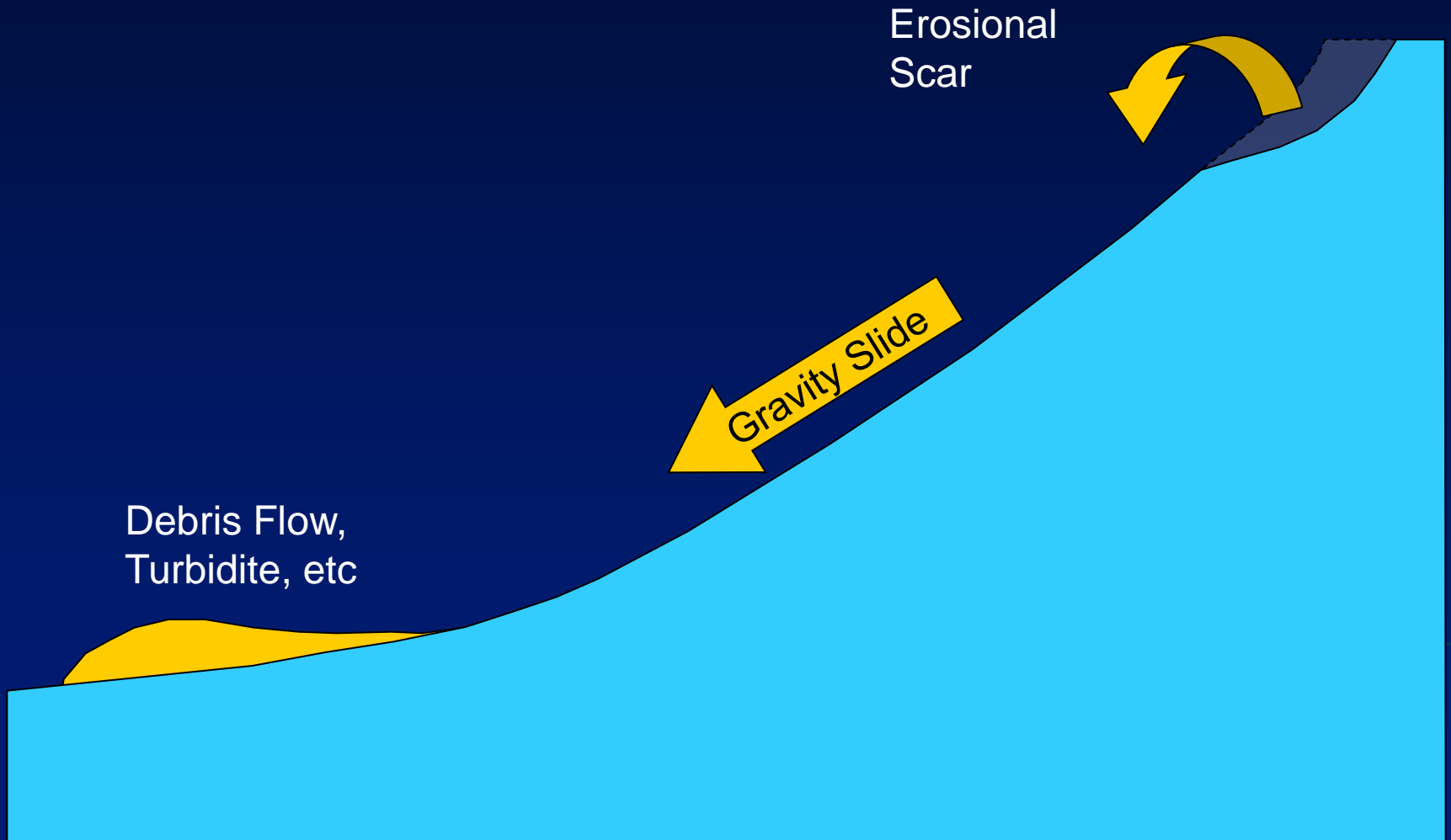
Limestone Composition: Thick Beds

The thick beds locally consist of carbonate breccia and megabreccia. The block to the right is a fragment of shallow marine limestone rich in brachiopod shells.



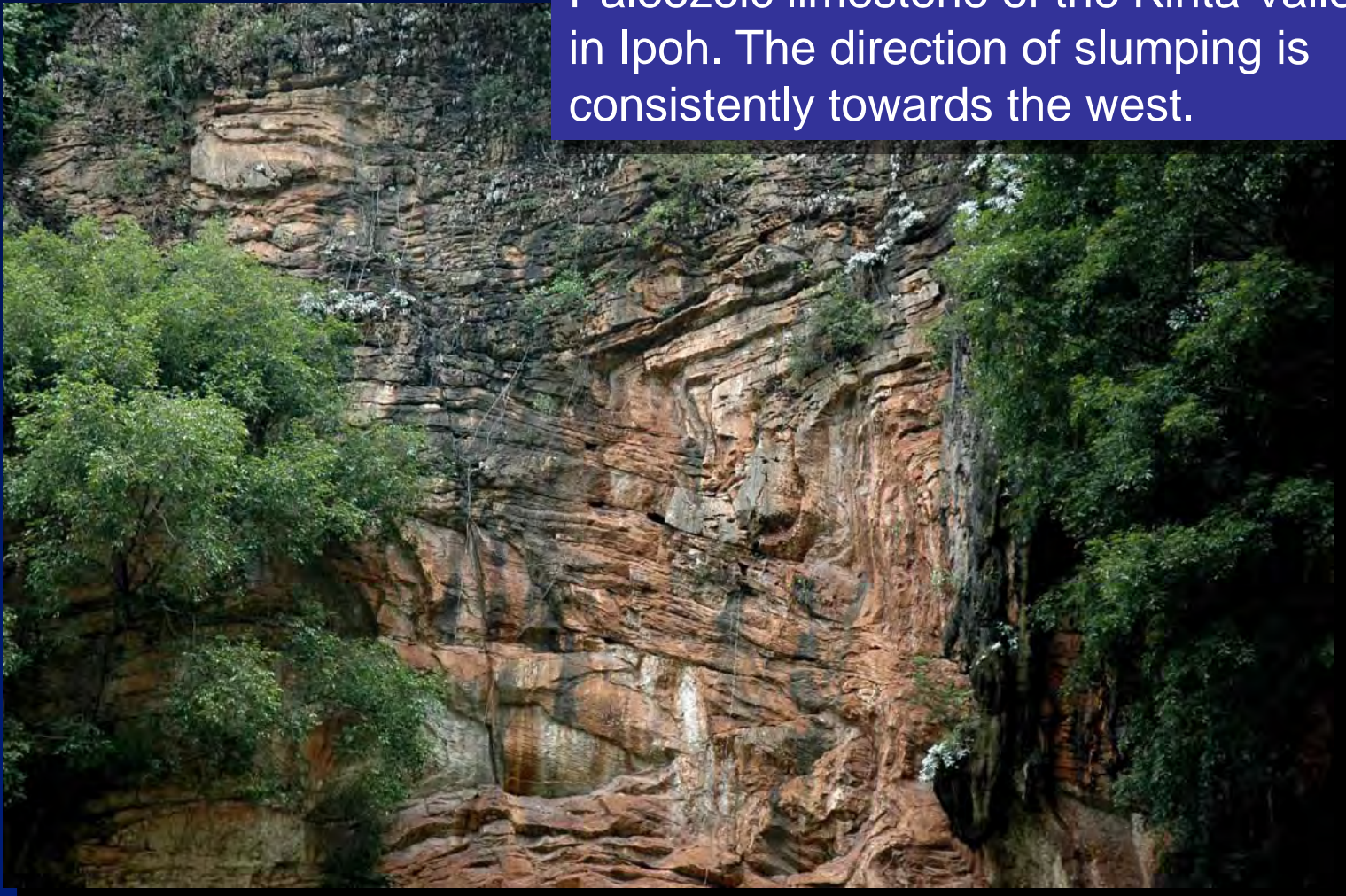
The megabreccia to the left contains blocks of shallow marine limestone in a deep marine fine matrix, typical of re-deposited sediments on a slope.

Slope Deposits: Debris Flow

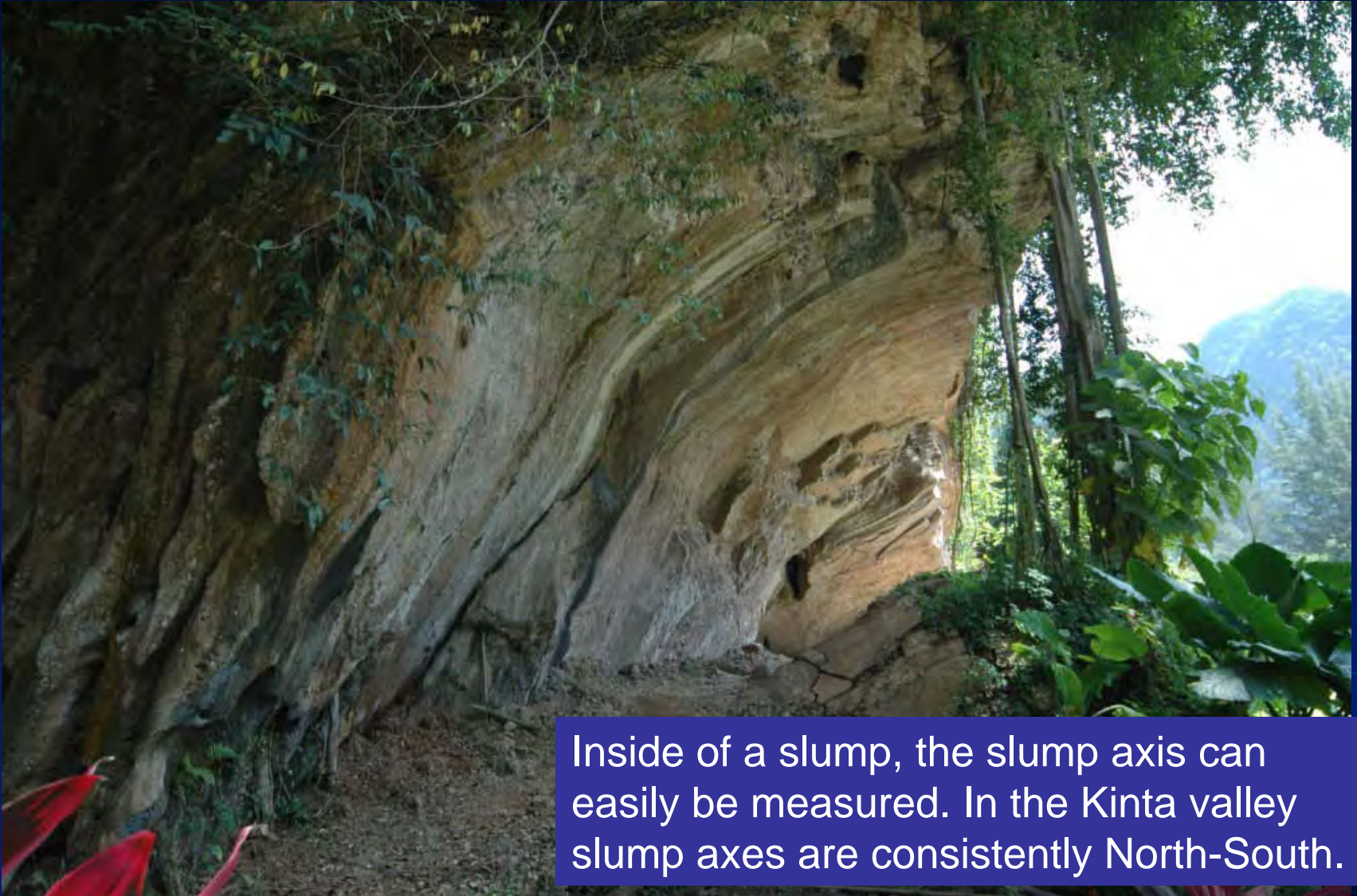


Slope Structures: Slumps

Large slumps in slope deposits, Paleozoic limestone of the Kinta Valley in Ipoh. The direction of slumping is consistently towards the west.

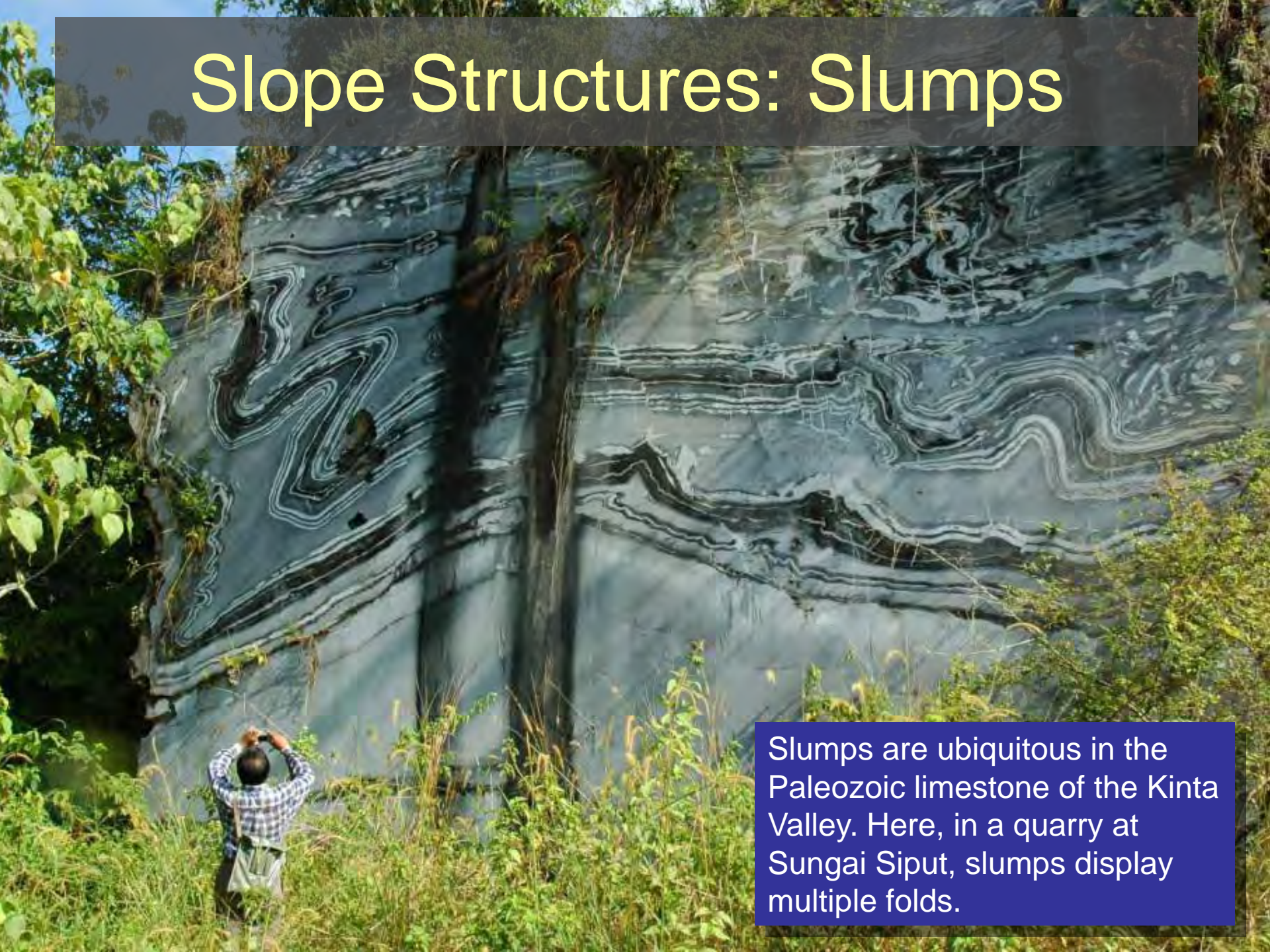


Slope Structures: Slumps



Inside of a slump, the slump axis can easily be measured. In the Kinta valley slump axes are consistently North-South.

Slope Structures: Slumps



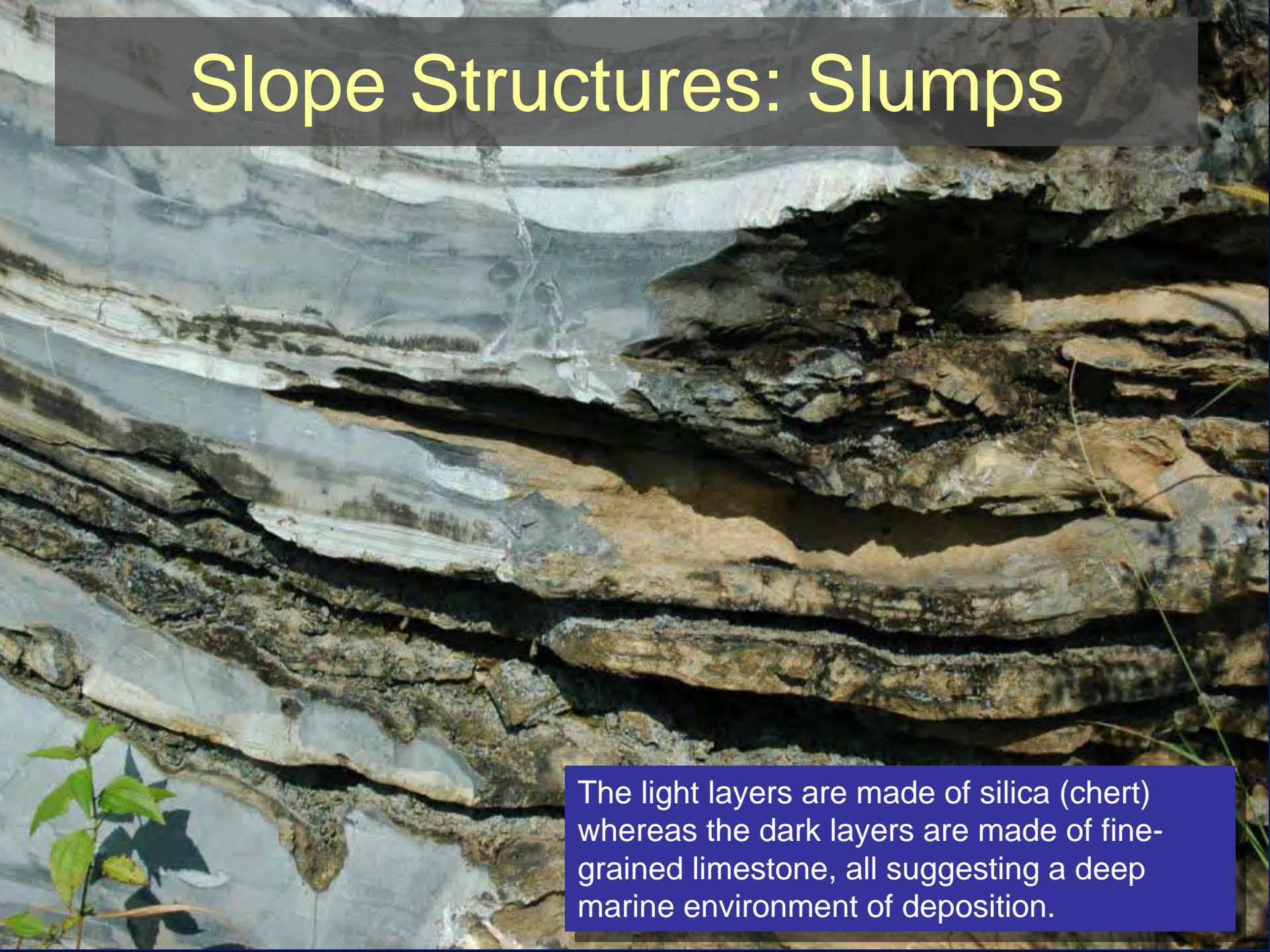
Slumps are ubiquitous in the Paleozoic limestone of the Kinta Valley. Here, in a quarry at Sungai Siput, slumps display multiple folds.

Slope Structures: Slumps



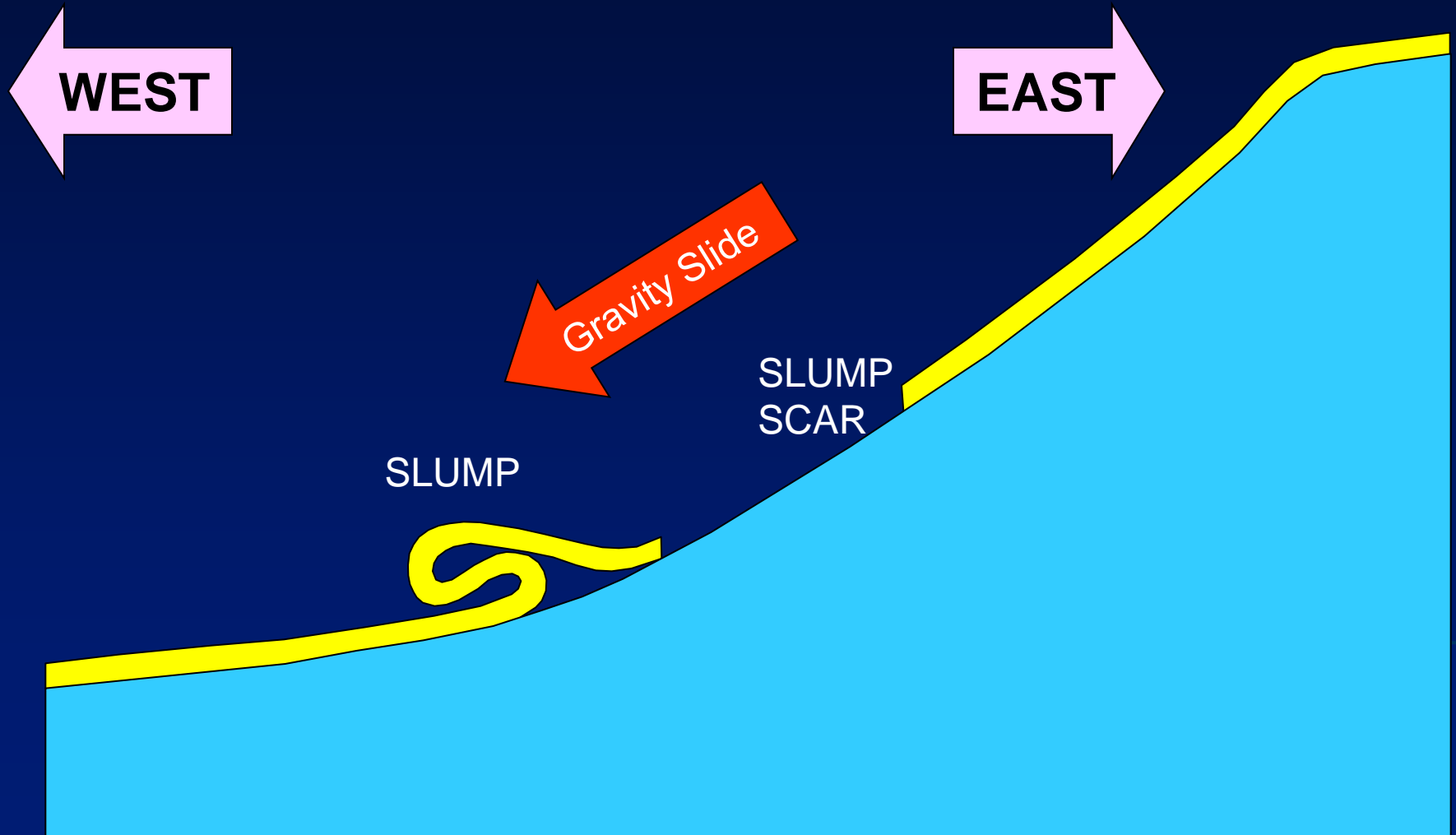
Slumps at Sungai Siput are highlighted by a succession of light and dark layers.

Slope Structures: Slumps

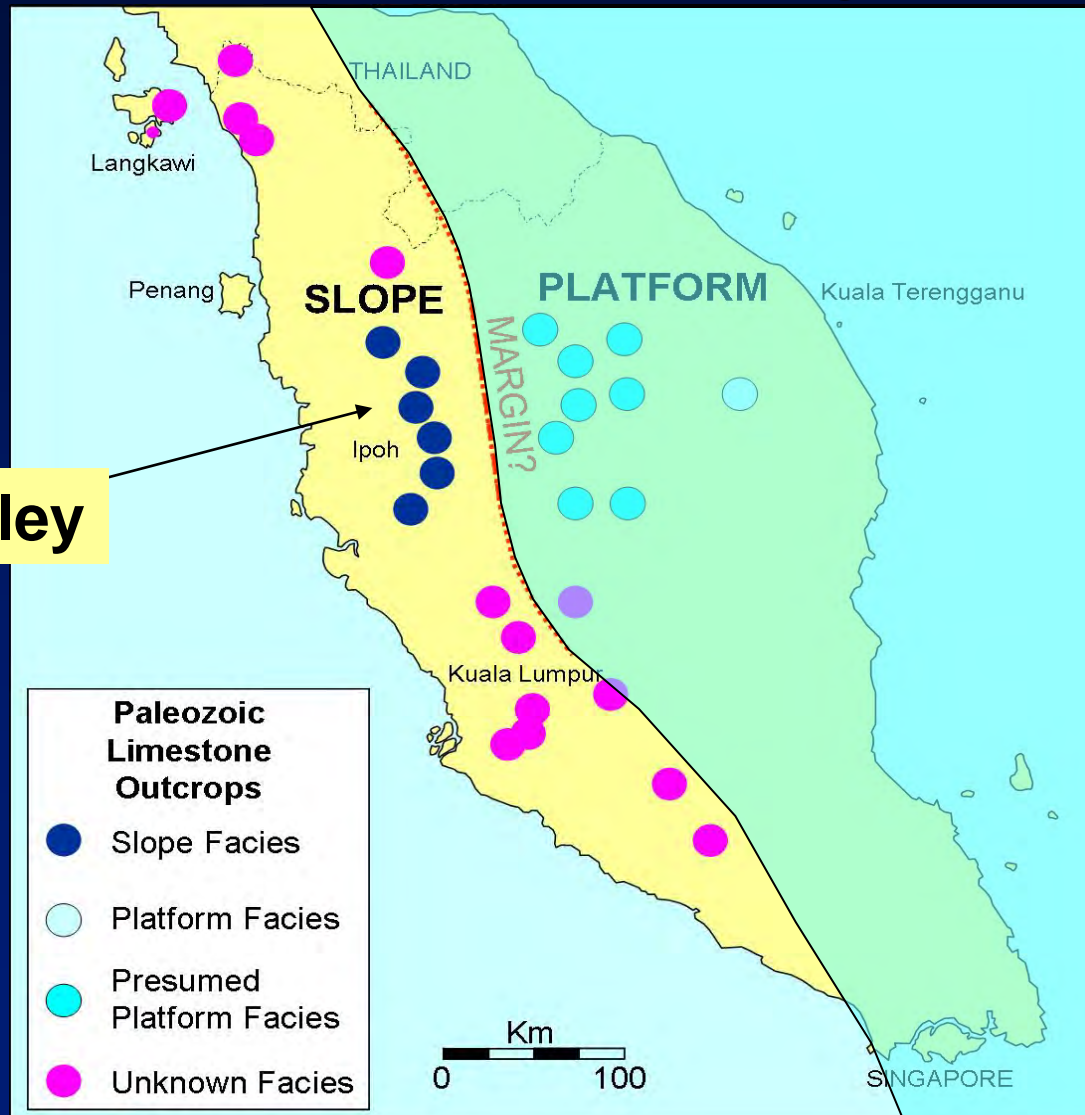


The light layers are made of silica (chert) whereas the dark layers are made of fine-grained limestone, all suggesting a deep marine environment of deposition.

Slope Structures: Slumps



Paleozoic Limestone Paleogeography, Peninsular Malaysia



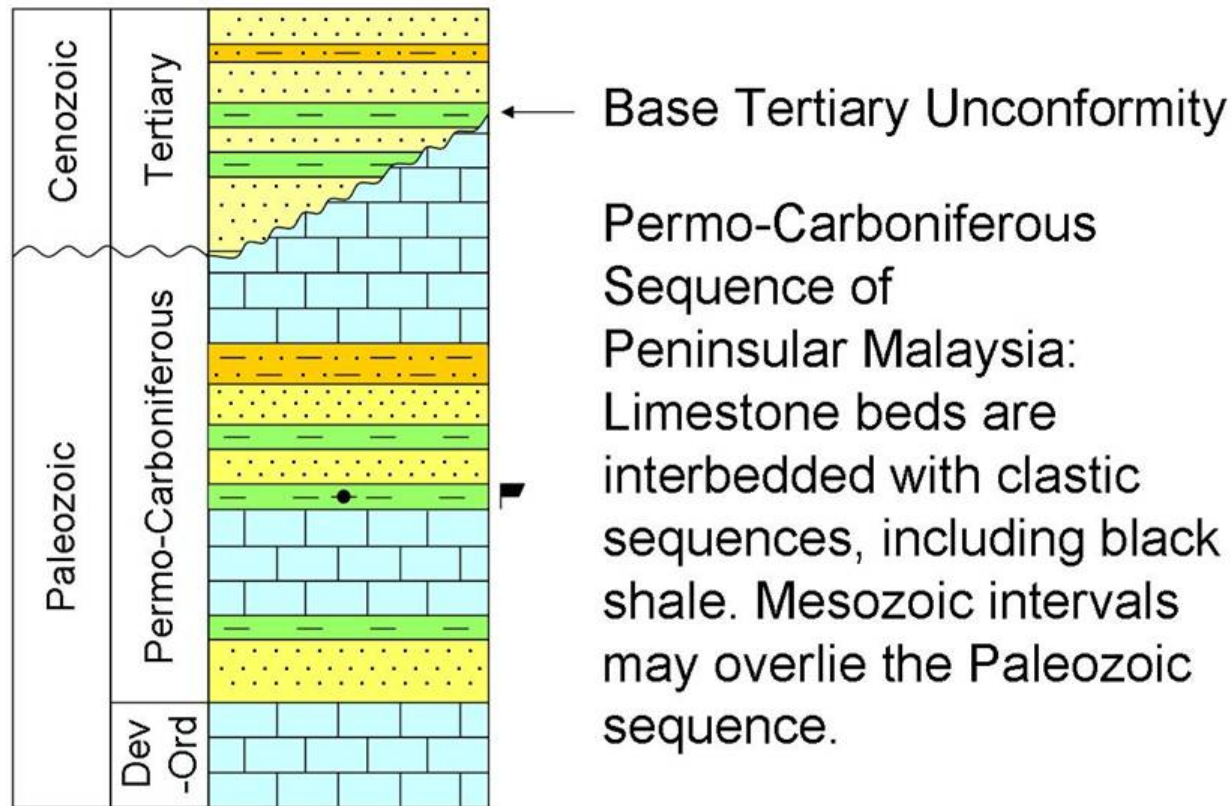
Kinta Valley

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PETROLEUM PLAY?

- A Paleozoic limestone play may exist in the eastern part of peninsular Malaysia.
- This play would include the following elements:
 - Shallow marine limestone reservoirs, possibly fractured.
 - Carbonaceous shale part of the Paleozoic clastic sequences ($\pm 3000\text{m}$), as source rocks
 - Pre-Tertiary structural events may have created traps that would be offset from Tertiary traps

Pre-Tertiary Hydrocarbon System



Notes by presenter: We have, on Peninsular Malaysia, all the elements of hydrocarbon system. The Permo-Carboniferous consists of alternating sequences of carbonates and clastics, with some rich source rocks and some good potential clastic and carbonate reservoirs. Let us have a closer look at the upper carbonate and clastic sequences.



Thick sequence of carbonaceous shale observed in Batu Gajah area. This Carboniferous shale classified into the Argillaceous Facies within the Calcareous Series, and estimated $\pm 3000\text{m}$ thick.

CONCLUSIONS

- The Paleozoic limestone of the Kinta Valley is part of regional carbonate complex extending from Malaysia to China
- The Paleozoic Limestone of the Kinta Valley consists of marine slope deposits
- Paleogeographic reconstruction indicates that a shallow marine platform lies to the east of the Kinta Valley



THANK YOU

Photograph by K.S. Cheang