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Review paper

The Phuket-Slate Belt terrane: tectonic evolution and strike-slip emplacement of a major terrane on the Sundaland margin of Thailand and Myanmar

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ABSTRACT

The Phuket-Slate Belt terrane can be traced for 1700 km from Phuket to Mandalay, and has a distinct stratigraphy and tectonic history. It is characterized by a very thick Carboniferous-Lower Permian succession which includes diamictites interpreted as glacio-marine rift-infill deposited when the Sibumasu block separated from Gondwana. It was emplaced in the Late Cretaceous-Palaeogene by dextral strike-slip movement on a fault system which includes the Khlong Marui and Panlaung Faults. Southwards the Khlong Marui bounding-fault and its close associate, the Ranong Fault, are postulated to extend to Sumatra where they align with the restored proto-Indian Ocean location of the India–Australia transform at the time that both were undergoing dextral displacement and Greater India was moving toward its collision with Eurasia. It is suggested that emplacement of the Phuket-Slate Belt terrane was the result of its coupling with the north-going India plate, resulting in up to about 450 km of dextral shift on the terrane's bounding fault system. Post-emplacement sinistral movement on the cross-cutting Mae Ping and Three Pagodas Faults offset the terrane boundary resulting in its present outline.

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1. Introduction

Since the discovery of major strike-slip faults in Thailand over four decades ago, important advances have been made in understanding their role in the tectonic history of mainland SE Asia. Garson and Mitchell (1970) described the Khlong Marui Fault belt which coincides with the prominent bend of the Thai Peninsula and separates the upper- from the lower Peninsula, while Ridd (1971a) identified the NW–SE-trending Mae Ping and Three Pagodas Faults which extend from western Thailand into Myanmar. Since then the broader network of faults into which they fit has emerged (Fig. 1), and studies of the mineralogy and internal

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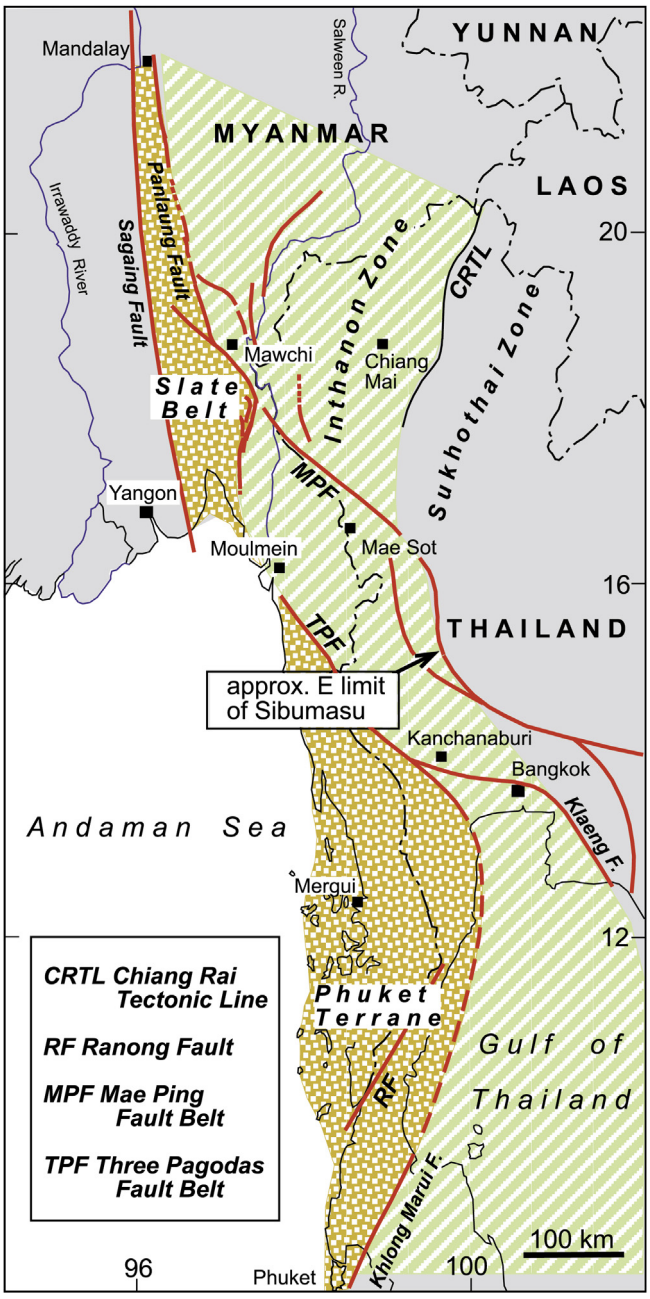

Fig. 1. Simplified map showing the principal strike-slip faults identified in Thailand and part of Eastern Myanmar. Also shown is the eastern limit of Sibumasu, the Gondwana-derived composite block which includes the Phuket Terrane and Slate Belt (combined under the name Phuket-Slate Belt terrane). Sundaland was created by the Triassic collision of Sibumasu with the combined Sukhothai zone and Indochina block.

fabric of the main fault zones, together with radiometric dating, have thrown light on the timing and the sense of movement on them (e.g. Lacassin et al., 1993, 1997; Watkinson et al., 2008, 2011; Watkinson, 2012; Nantasin et al., 2012; Kanjanapayont et al., 2012).

Few of those earlier studies considered the fault-bounded blocks themselves, and differences between adjacent blocks which might exist. The present study concentrates on just one: the block bounded on its east by the Khlong Marui Fault in Thailand, for which Ridd (2009) adopted the name Phuket Terrane. (This and many of the other named faults in Southeast Asia are fault belts with multiple strands, but for convenience are described here as if they were single strands.) He showed that whereas the upper Carboniferous-Lower Permian succession west of the Khlong Marui Fault (i.e. in the upper Peninsula) is characterized by very thick intervals of diamictite (named by Mitchell et al., 1970 the Phuket Group), such intervals are thin or absent east of the fault, in the lower Peninsula. And moreover, whereas east of the fault the Carboniferous-Lower Permian succession is underlain by Devonian and Lower Palaeozoic rocks, pre-Carboniferous rocks have not been seen anywhere on the west side of the fault as the base of the Phuket Group does not reach the ground surface (Fig. 2).

Northwards and westwards the Phuket Terrane passes into Myanmar where its approximate continuation was called the Karen–Tenasserim Unit by Bender (1983), although the Slate Belt (Mitchell et al., 2002, 2004, 2007) is more clearly the continuation of the Phuket Terrane and is the name adopted here. The name Phuket-Slate Belt terrane is used here for the combined entity, while also retaining the component names as appropriate.

A feature of this terrane is that it hosts the Western Granite Province of SE Asia (Mitchell, 1977; Cobbing et al., 1992; Charusiri et al., 1993; Putthapiban, 2002). Insofar as those granite (*sensu lato*) intrusions are largely confined to the Phuket-Slate Belt terrane it raises the question: is that because the terrane in some way favoured the intrusion of those plutons, or were they intruded over a wider area and then isolated in the terrane by strike-slip faulting which displaced both terrane and intrusions?

The aim of this paper is to demonstrate the existence of the Phuket-Slate Belt terrane northward from Thailand into Myanmar, to comment on its relations with the Western Granite Province of SE Asia, and to suggest how the terrane was emplaced in its present position. It is tentatively suggested that dextral strike-slip movement on its eastern boundary-fault occurred in the Late Cretaceous–Palaeogene when the terrane became coupled with the north-going India plate, ceasing only after India itself had collided with Eurasia. It is suggested, furthermore, that a later phase of cross-cutting sinistral strike-slip faulting resulted in the outline of the terrane we see today.

2. Thailand segment of the Phuket-Slate Belt terrane

That the Phuket Terrane is a terrane in the full sense of that term was argued by Ridd (2009): (i) it has a different and distinctive stratigraphy, geological and magmatic history from that of adjacent blocks (Figs. 2 and 3), (ii) it is linear and extensive (800 km in Thailand alone), and (iii) it is bounded by one of the major fault systems in Thailand, the Khlong Marui and Three Pagodas Faults.

As shown in Fig. 3 the Kaeng Krachan Group is the stratigraphic unit which shows the pronounced difference between the Phuket Terrane and the adjacent block. In the Phuket Terrane several attempts have been made to subdivide it into component formations (Piyasin, 1975; Raksaskulwong and Wongwanich, 1993; Chaodumrong et al., 2007). But beneath the top few hundred metres the succession lacks fossils and marker beds are not persistent, and therefore stratigraphic units cannot be correlated over any distance and so are unmappable. Mitchell et al. (1970) and Garson et al. (1975), who adopted the name Phuket Group for the entire succession beneath the Ratburi Limestone in upper Peninsular Thailand, found that they could divide the succession into only two mappable units which they named informally the 'Upper Formation' up to 200 m thick comprising mudstones, thick-bedded sandstones and shales with a bryozoa-rich shelly fauna in its lower part, and the 'Lower Formation' of unknown thickness which is essentially barren of fossils. (The name Phuket Group has been dropped among geologists in Thailand, but is retained here as it highlights the different successions in the upper and lower Peninsula). The