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Petrography, mineralogy and geochemistry of Cretaceous sediment samples from western Khorat Plateau, Thailand, and considerations on their provenance

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ABSTRACT

At Mo Hin Khao on the western flank of Khorat Plateau, Thailand, the Phra Wihan Formation reveals litharenite and sublitharenite with some subarkose and arkose. A cuesta in the eroded sedimentary sequence exhibits spectacular rock pillars of considerable geotourist potential. The rock sequence is high in silica (SiO_2 67–98 wt%) and contains quartz, mica, magnetite, chert fragments and accessory minerals such as zircon and tourmaline and amphibole species. These accessory minerals suggest felsic rocks, such as granite, granodiorite and pegmatite, were sources for the sandstones. Geochemical analyses of the sedimentary sequence suggest that source rocks may lie in the passive continental margin, before sediment transport and deposition in the Khorat Basin by rivers flowing across a large flood plain. Many depositional sequences/episodes formed thick beds of cross bedded clastic rocks. A high average maturity index (>5) indicates sedimentary reworking/recycling. Chemical Index of Alteration (CIA) values range from 47 to 98, suggesting variable chemical weathering within the source area rocks, largely representing moderate to high degrees of weathering. The average CIA value of these sediments (78) suggests that relatively extreme alteration factors were involved.

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1. Introduction

The Mo Hin Khao cuesta on the western edge of the Khorat Plateau, formed by erosion of clastic rocks of the Phra Wihan Formation, within the Mesozoic Khorat Group (Fig. 1). The site is located within the Phulaenkha national forest in the Chaiyaphum province, Thailand and covers an area of 0.32 km^2 at an elevation of 800 m a.s.l. The dipslope (strike N–S with low-angle dip, <15°E) has a steep escarpment to the west. The Phra Wihan Formation was deposited in the early Cretaceous (Barriasian to Barremian, 125–145 Ma), on the basis of palynological data from near the base of the formation (Racey et al., 1996; Racey and Goodall, 2009). These light buff to gray, fine-grained to coarse-grained quartzitic sandstones and rarer siltstone and mudstone with occasional conglomerate were reported as deposits of braided and meandering streams in a tropical palaeoclimate (Meesook, 2000). Racey and Goodall (2009) interpreted them as deposits within a fluvial environment dominated by high-energy, shallow braided rivers with subordinate low energy meandering river systems and associated floodplains. Both the Phra Wihan and underlying Phu Kradang Formations have been interpreted as deposits of an anastomosing river system within a semi-arid to sub-humid paleoclimate with wet-dry cycles (Horiuchi et al., 2012). The contacts between the Phu Kradung and overlying Phra Wihan and Sao Khua Formations are all gradational and conformable. The high-frequency occurrence of *Corollina* (*Classopollis*) indicates an Early Cretaceous age for the Phra Wihan Formation with a warm climate, seasonally dry, and subtropical palaeoclimate for the area. The thickness is 100–250 m (Racey and Goodall, 2009; Meesook, 2011). Although the Phu Kradung Formation is also early Cretaceous, the lowest part could be Late Jurassic (Racey and Goodall, 2009); its thickness ranges from 800 m to 1200 m. The rocks are generally composed of maroon siltstone and claystone but sandstone and conglomerate are also found (Meesook and Saengsrichan, 2011). According to Racey (2009), the Phu Kradung Formation sits conformably on the Nam Phong Formation, which includes an upper member of Late Jurassic age, and a lower member of Late Triassic age, separated by a hiatus (Racey, 2009). That hiatus is adopted by some authors as the base of the Khorat Group (e.g. Racey, 2009; Booth and Sattayarak, 2011), whereas others (e.g. Meesook and Saengsrichan, 2011) place the base of the Khorat Group at the base of the lower Nam Phong Formation. The Phu Kradung Formation comprises red-brown micaceous sandstone, conglomerate, siltstone and mudstone of mainly fluviatile origin.

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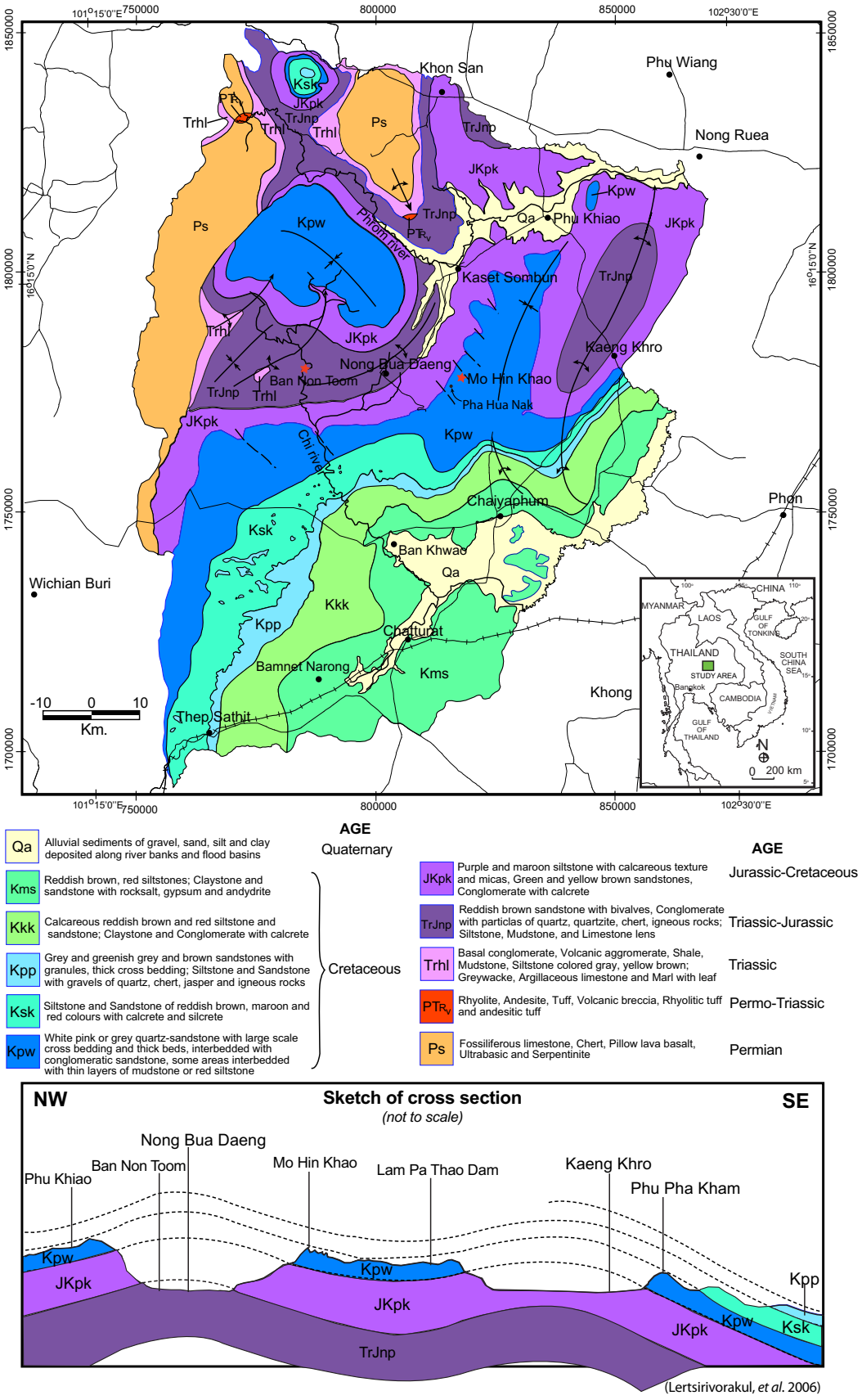

Fig. 1. Location and geological maps of Chaiyaphum province. (Rock boundaries are from Department of Mineral Resources (2007).) (See above-mentioned reference for further information.)

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