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A new section of Lower Palaeozoic rocks in Kayin State (Southeast Myanmar)

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ABSTRACT

Lower Palaeozoic rocks have been mapped in Kayin State in an area previously shown on published maps as either metamorphic or possibly Lower or Upper Palaeozoic rocks. Three new formations, with a total thickness of over 900 m, apparently overlain by an, at least, 100 m thick Upper Palaeozoic formation are mapped along the Salween River and along the road from Yinbaing, in Myanmar, to Tha Song Yang, in Thailand. The Lower Palaeozoic succession consists of the predominantly siliciclastic Kyaukpulu and Kushwe–e–we formations and an overlying, predominantly carbonate Meseik Ashe Formation which contains Middle Ordovician (Darriwilian) conodonts. The older two formations are probable correlates of the Ngwetaung and Lokeypin formations of the southern Shan State of Myanmar and the Lower Ordovician siliciclastics of western Thailand. The overlying, peritidal to shallow subtidal carbonates of the Meseik–Ashe Formation are correlates of the Wunbye and Sitha formations of Shan State, Myanmar. The thick-bedded, quartz arenites of the Nyaungwiang Formation are faulted against the Ordovician carbonates and are probable lithological correlates of the Carboniferous Taungnyo Formation. The folds in the Lower Palaeozoic rocks are overturned to the northeast and deformation was in one major phase between the Tournaisian and the Early Permian. The Lower Palaeozoic strata may probably be followed as a ridge for at least 100 km towards the NNW, close to the western border of the Sibuma Block which is separated by a postulated cryptic suture from the Irrawaddy Block to the west.

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1. Introduction

Lower Palaeozoic sequences on the Sibumasu Terrane (or in part, Shan–Thai Terrane) extend from Malaysia, through Thailand and the Shan States of Myanmar (Burma) to the Baoshan Block of western Yunnan (China) (Agematsu and Sashida, 2009; Aye Ko Aung and Cocks, 2017; Bunopas, 1982; Burrett et al., 2016; Cocks et al., 2005; DMR, 2014; Fortey and Cocks, 1998; Lee, 2009; Myint Lwin Thein, 1973; Reed, 1906; Ridd, 2011; Shergold et al., 1988; Wolfart, 2001; Wongwanich, 2001; Wongwanich and Burrett, 1983; Wongwanich et al., 1983; Zhang et al., 2014). They have been well studied in northern Malaysia, southern Thailand, in the Shan State of Myanmar, in Baoshan and to a lesser extent in Kanchanaburi province in

Thailand (Fig. 1). However, within Myanmar, there is little documentation of Lower Palaeozoic rocks or fossils between Kanchanaburi in western Thailand and the Shan Plateau. Here we report initial mapping, lithostratigraphy and preliminary sampling for conodonts from a previously undocumented Upper Cambrian (?) to Ordovician sequence in Kayin (Karen) State, covering an area exceeding 250 km² (Fig. 2). Core samples were obtained from shallow boreholes (BH1–BH10) and thin sectioned for petrographic work and processed with acetic acid and sodium polytungstate for conodonts in the Applied Palaeontology and Biostratigraphy Research Unit of Mahasarakham University and in the Palaeontological Research and Education Centre, Mahasarakham University.

Although work in the area is prevented by the current security situation, it is expected that future fieldwork and palaeontological collection will establish an important section linking the Lower Palaeozoic sections of the Shan State of Myanmar with those in Thailand and Malaysia.

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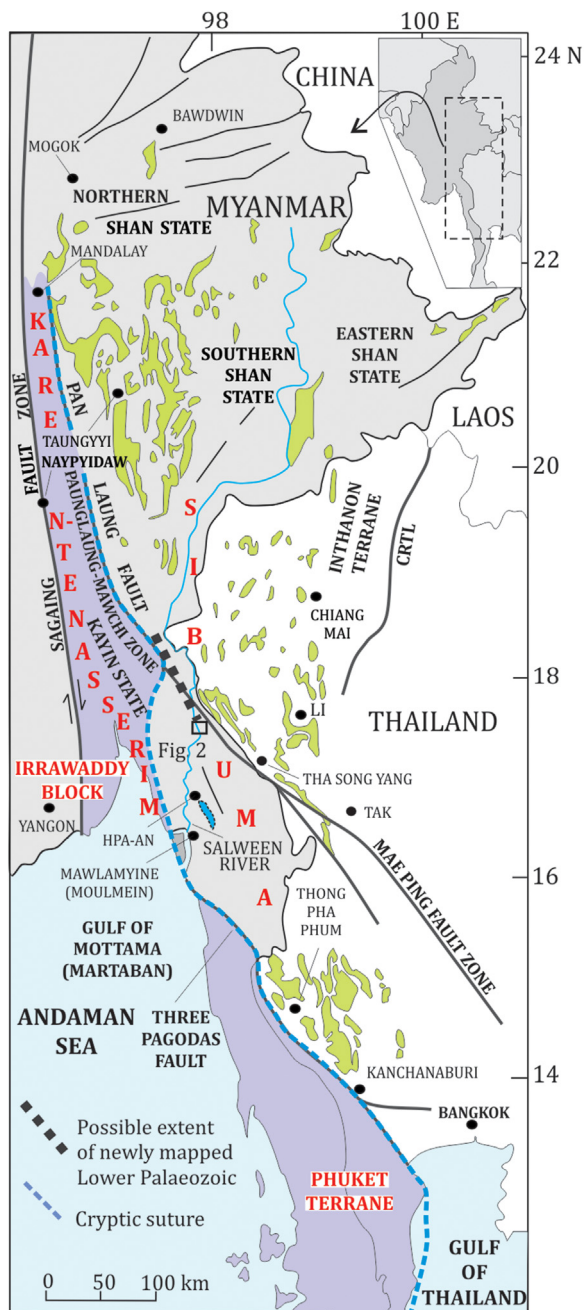


Fig. 1. Map showing distribution of Ordovician and Upper Cambrian strata in northwest Thailand and in Myanmar (adapted from Stait and Burrett, 1984a,b; Bender, 1983). The area of South East Asia covered is shown in the inset. Myanmar is shaded. Square shows mapped area adjacent to the Thanlyin (Salween) River in Kayin State (Fig. 2). A possible northward extension of the newly mapped Lower Palaeozoic strata is shown. Areas of Lower Palaeozoic sedimentary rocks previously mapped in Thailand and Myanmar are shaded. Area of Ordovician Wunbye Formation shown by Mitchell on his map (Mitchell, 2017; Fig. 4.11) is shown in dark shade (blue in colour version) south east of Hpa-an. Ridd (2016) has divided the Sibumasu Terrane into the Permian glaci-marine sediment-bearing Irrawaddy Block and the Sibuma Block that has extensive Lower Palaeozoic strata and little to no Upper Palaeozoic glaci-marine strata. Ridd (2017) extends the Irrawaddy block to the west of the Sagaing Fault Zone and divides the block into the Karen–Tennasserim Unit and the Phuket Terrane. The Lower Palaeozoic strata identified in this study may continue close to the eastern margin of Ridd’s (2016, 2017) proposed cryptic suture—the Paunglaung–Mawchi Zone. CRTL is the Chiang Rai Tectonic Line which constitutes the eastern margin of the Inthanon Terrane (see Barber et al., 2011). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

2. Regional geology

Mainland South East Asia consists of two main, probably composite, tectonic terranes – the Sibumasu (or Shan–Thai) and Indochina terranes (Fig. 1) (Bunopas, 1982; Metcalfe, 1984). Most of eastern Myanmar and western Thailand, western Malaysia and the Baoshan Block in Yunnan, China belong to the Sibumasu Terrane which was part of the Australian sector of Gondwana during the Early Palaeozoic and was affected by and rifted off during the waning stages of the Early Permian Gondwana glaciation (Audley-Charles, 1983; Burrett and Stait, 1985, 1987; Burrett et al., 1990, 2016; Metcalfe, 1984; Niko and Sone, 2014, 2015; Ridd, 1971, 2007, 2009a,b, 2016; Stauffer, 1974). The Inthanon Terrane (Fig. 1) was recognised as a tectonic block in northern Thailand floored by autochthonous Sibumasu Lower–Middle Palaeozoic successions, with a superstructure of allochthonous Late Carboniferous – Permian tropical sea–mount carbonates and ocean–floor sediments, emplaced as a nappe or nappes in the Late Triassic (Metcalfe et al., 2017; Ridd, 2015; Ueno and Charoentitirat, 2011).

The widespread occurrence of Late Carboniferous–Early Permian glacial marine sediments and associated cool-water faunas, within the Sibumasu Terrane from Sumatra, through peninsular Thailand and Baoshan, is the best proof that Sibumasu was part of Gondwana (Ampaiwan et al., 2009; Chaodumrong, 2010; Fontaine, et al., 1994; Ridd, 2009a,b). This is also supported by palaeomagnetic data (e.g. Ali et al., 2013), by shallow–water Ordovician faunas only found in Sibumasu and Australia (e.g. Burrett and Stait, 1985; Burrett et al., 1990; Laurie and Burrett, 1992; Niko and Sone, 2014, 2015; Stait and Burrett, 1987) and by studies on detrital zircons (Burrett et al., 2014).

It was recognised that the characteristic sedimentary rocks constituting the Mergui Group in Myanmar, are restricted to south–west of the Paunglaung Fault (part of the Paunglaung–Mawchi Zone) and are absent from the main area of the Shan Plateau, and that they belong to a distinctive allochthonous Mergui Group Nappe (Mitchell, 1992) and named the Karen–Tenasserim Unit by Bender (1983). Similarly, in Thailand, Cooper et al. (1989), Ridd (2009a) and Ridd and Watkinson (2013) recognised a Phuket (or Phuket Slate) belt, block or terrane. Ridd (2015, 2017) proposed the division of the Sibumasu Terrane into the Sibuma and Irrawaddy Blocks separated by the Paunglaung–Mawchi Zone (Fig. 1). The Sibuma Block is characterised by complete Lower Palaeozoic successions and a lack of thick Gondwanan glacial sediments and the Irrawaddy Block is characterised by thick Gondwanan glacially–influenced sediments such as the Mergui, Phuket and Kaeng Krachan groups and lacks completely Lower Palaeozoic successions. Recognising the priority of Bender’s (1983) block definitions, Ridd (2017) uses the terms Karen–Tenasserim Unit and Phuket Terrane, which, along with some areas of Myanmar west of the Sagaing Fault Zone, constitute his Irrawaddy Block (Fig. 1).

The area documented herein is clearly part of the Sibuma Block (Ridd, 2016) as it consists of a succession of Lower Palaeozoic sedimentary rocks overlain by probable Carboniferous sandstones of the Taungnyo Group, that lack evidence of glacial or glaci-marine influence.

3. Kayin State geology

Although Mitchell (2017, Figs. 4–11) shows an area of Ordovician carbonates assigned to the Wunbye Formation to the southeast of Hpa–An (see Fig. 1), very little has been published on the Palaeozoic geology of Kayin State (previously Karen State) and this paper is the first documentation and illustration of definite Lower Palaeozoic strata and fossils in Myanmar, south of latitude 19°N.

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