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New palaeontological investigations in the Jurassic of western Thailand

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ABSTRACT

The paleontological investigations of the Jurassic of Western Thailand, districts of Mae Sot (Tak–Mae Sot highway, Padaeng Tak and Ban Mae Kut Luang Zinc mines) and Umphang (Klo Tho), provide age constraints for the Late Indosinian orogeny, the Paleotethys closure and the timing of the marine Jurassic inundation of Sundaland. The basal conglomerate of the Jurassic is derived from the pelagic Triassic Mae Sariang substratum. Stratigraphy, microfacies and paleontology of the Jurassic marine strata focus especially on ammonites, bivalves, large benthic foraminifera and algae. Among ammonites, the Tethyan *Catulloceras perisphinctoides* Gemmellaro marks the Upper Toarcian (Aalensis Zone) along the Tak–Mae Sot highway and *Riccardiceras longalvum* (Vacek), *Malladaites pertinax* (Vacek), *Abbasites* sp. and *Vacekia* sp. indicate Middle Aalenian to lowermost Bajocian in the Padaeng Mine (SE of Mae Sot) and Klo–Tho (Umphang). *Vacekia* sp., *Spinammatoceras schindewolfi* Linares and Sandoval and *Malladaites vaceki* Linares and Sandoval indicate Middle Aalenian to lowermost Upper Aalenian at Ban Mae Kut Luang (NE of Mae Sot). Among foraminifers, the large benthic foraminifer *Timidonella sarda* Bassoullet, Chabrier and Fourcade in the Western Tethys is indicative for Aalenian–Bajocian times, as characterized in the section at the Tak–Padaeng Zinc mine and the Klo–Tho Formation near Umphang. The endemic foraminifer *Gutnicella kaempferi* characterizes the Pu Khloe Khi Formation near Umphang. Among bivalves, shallow marine, dominantly endemic fauna includes *Parvamussium donaiense* (Mansuy) and *Bositra ornate* (Quenstedt), from the Toarcian to the Early Bajocian. A consideration of the faunal affinity shows that the fauna is partly endemic with Northern Tethyan (Eurasian) affinity.

1. Introduction

Mainland Southeast Asia encompasses the three major tectonic terranes namely, Western Burma, Shan–Thai and Indochina (Burrett, 1974; Stauffer, 1974; Hutchison, 1975; Gatinsky et al., 1978; Ridd, 1980; Bunopas, 1981; Mitchell, 1981; Burrett et al., 1990; Charusiri et al., 2002, 2006; Hirsch et al., 2006; Metcalfe, 2006; Nakano et al., 2007; Srinak et al., 2007; Hara et al., 2009; Metcalfe, 2011 — this issue). Contiguous in Triassic times, the Shan–Thai, Indochina and South China terranes, in the continent-continent collision tectonic framework as a part of the Indosinian orogeny, the Shan Thai block to the west and the Lampang–Chiang Rai and Nakhon–Thai block to the east were welded together and joined Indochina further east forming the SE Asian amalgamation of Sundaland. After the Latest Triassic welding of the Shan–Thai block, the main marine Jurassic transgression in Western Thailand covers mainly the Mae Sariang and adjacent Inthanon zones, in a long narrow N–S trending strip running along the Thailand–Myanmar border.

These marine Jurassic sediments are distributed in three sedimentary basins, the Mae Hong Son–Kanchanaburi Basin in the northwest and west of Thailand, the Chumphon and Songkhla basins in Peninsular Thailand. Among these basins, the Mae Hong Son–Kanchanaburi Basin has the most developed Jurassic marine strata. Meesook and Grant-Mackie (1996) distinguish the overlying Triassic strata, in ascending order, the Pa Lan, Mai Hung and Kong Mu formations of the Huai Pong Group (Mae Hong Son area), the Khun Huai, Doi Yot and Pha De formations of the Hua Fai Group (Mae Sot–Phop Phra area) and the Klo Tho, Ta Sue Kho, Pu Khloe Khi and Lu Khoc To formations of the Umphang Group (Umphang area). They consist of mudstone, siltstone, sandstone, limestone and marl. Marls occur only in Mae Sot. The Jurassic strata in the eastern and western parts of the Mae Sot Basin, a part of the

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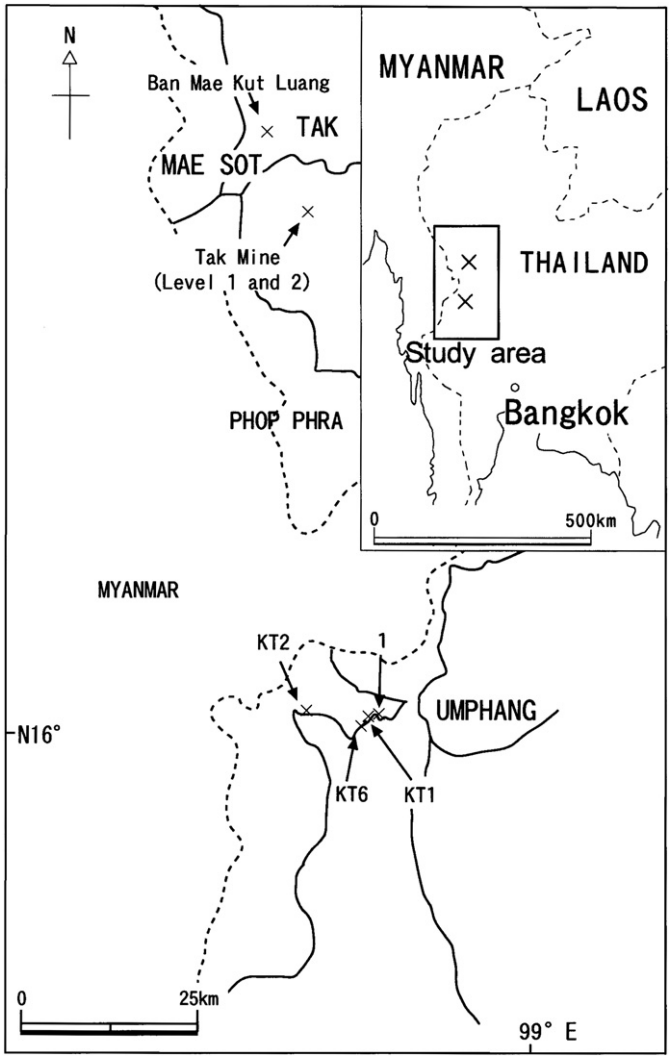

Fig. 1. Fossil localities of Mae Sot–Umphang areas.

Mae Hong Son–Kanchanaburi string of basins, near the Thailand–Myanmar border, consist of the Hua Fai Group (Meesook, 1994; Meesook and Grant-Mackie, 1996). The group is approximately 900 m thick, consisting of the Khun Huai, Doi Yot and Pha-De formations of 140, 370 and 400 m thickness, respectively.

The study of marine Jurassic strata in Thailand goes back to Heim and Hirschi (1939), Brown et al. (1951), Komalarjun and Sato (1964) von Braun and Jordan (1976), Sato (1975) and Chonglakmani et al. (1985). Fontaine and Suteethorn (1988) summarized the paleontological investigations in Thailand during the last century. This includes the preliminary note on Jurassic foraminifera and algae by Bassoullet (in Fontaine and Suteethorn, 1988) and ammonite determinations by Sato, Cariou and Gabilly (in Fontaine and Suteethorn, 1988). Complementing the data are the studies of Sato and Westermann (1991), Meesook (1994), Meesook and Grant-Mackie (1994, 1996), Yang et al. (1995) and Kozai et al. (2006). These authors mention ammonites, such as the Toarcian *Pleydellia* and the Aalenian *Tmetoceras* around Ban Huai Hin Fon (Mae Sot), setting Toarcian–Early Bajocian time constraints, a latest Early Pliensbachian to Early Toarcian *Protogrammoceras,* and a Late Toarcian *Dumortieria* around Klo Tho (Umphang).

Meesook and Grant-Mackie (1994, 1996) also distinguished the mollusk bio-environments of the Thai Jurassic, including the significant Toarcian–Aalenian bivalve *Parvamussium donaiense* Hayami. Among foraminifera, *Timidonella sarda* Bassoullet, Chabrier and Fourcade represents, based on its Western Tethys distribution, a characteristic

Table 1
Stratigraphy of the Hua Fai Group.

Hua Fai Group (900 m)	
Aalenian–E. Bajocian	Pha De Fm. (limestone and marl)
Aalenian	Doi Yot Fm (mudstone)
Toarcian–Aalenian	Khun Huai Fm (Conglom., sand-, silt-limestone)

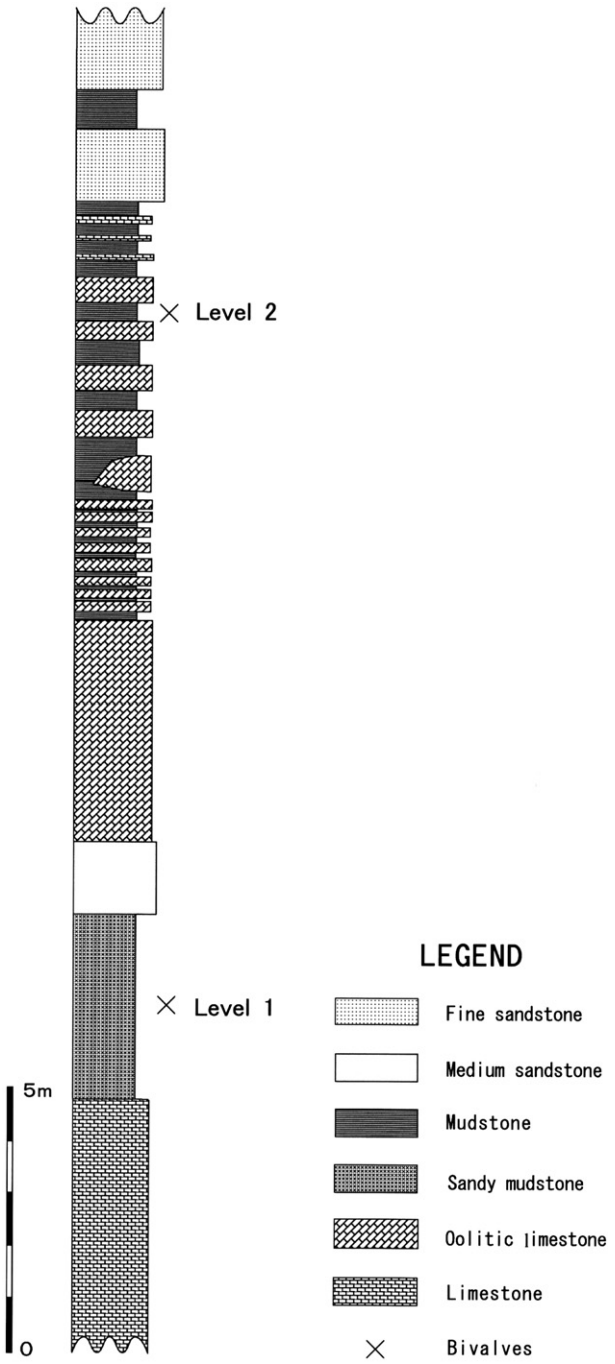

Fig. 2. Geological columnar section of the Khun Huai Formation exposed in the Tak Zinc mine (after Kozai et al., 2006).