

Contributions to the Paleozoic evolution of Northern Thailand

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Introduction

When the geodynamic evolution of Northern Thailand and the question of possibly Gondwana derived terranes is discussed, then the tectonic model including a cryptic suture of Triassic age between the "Inthanon zone" and the "Sukhothai zone" proposed by Barr and Macdonald (1991) is of special interest. Data obtained during recent field work in Northern Thailand and Southern Yunnan (P.R. of China) revealed, however, that more data on the Paleozoic evolution of this region are needed to unravel the long lasting geodynamic history.

During the past years it could be proved that a zone containing Triassic radiolarian cherts may extend from the Fang-Chiang Dao region to the area of Lamphun and may extend even further to the South (Caridroit, 1993, Caridroit et al., 1992, Sashida et al., 2000, Feng et al., 2002). It may be speculated that these deep water sediments of Triassic age can be interpreted as possible indications of a cryptic suture of Triassic age in this region (Barr and Macdonald, 1991, Fig. 3 place this cryptic suture somewhat further east). Other geological data from Northern Thailand and southwestern Yunnan, however, are apparently not substantiating this interpretation. In this contribution we like to concentrate on these contradictions. First we mention some features of the Khuntan Range as exposed for example along the highway Chiang Mai – Lampang and then we compare these features with data from the Lancang Jiang Zone in southern Yunnan (P.R. of China) recently published (Helmcke et al., 2001).

Geological frame of the Khuntan Range

The Khuntan Range stretches roughly in N-S direction between two intramontane basins of Tertiary age: the basin of Chiang Mai – Lamphun is situated to the West and the basin of Lampang is situated to the East of the Khuntan Range (comp. Geol. Map of Thailand, 1:1.000.000, 1999). This map reveals that the Khuntan Range is build up in this part by two main units, which are separated by a major fault (Mae Tha Fault). The northwestern part from Lamphun to the fault is characterized mainly by a thick sequence of siliciclastics said to be mainly of Carboniferous age (Mae Tha Formation) with minor occurrences of limestones (Permian) and cherts, which may be as young as Middle Triassic (Feng et al., 2002). The structural deformation and the metamorphic print of these strata seem to be quite modest.

The southeastern part of the section, which crosses the main water divide of the Khuntan range, is composed of quartz-phyllites (Don Chai Group), which show multiple deformation. They are – according to the above mentioned map – said to be of Silurian-Devonian age. Into this sequence the Khuntan granite intruded. This granite is of Triassic age (Rb-Sr whole-rock isochron age: 212 ± 12 my; Teggin, 1975, v. Braun et

al., 1976; quoted from Nakapadungrat and Putthapiban, 1992). The two parts of the section mentioned are separated by the significantly curved Mae Tha Fault, which is shown on geological maps and can be traced on satellite-imagery.

The sedimentary pile exposed in the NW part of the section was deposited apparently during a long lasting period ranging in age probably from the Carboniferous well into the Triassic: during this time sedimentation changed from siliciclastics via carbonates to cherts and may indicate a deepening of the depo-center. The thick siliciclastic pile at the base is composed of mature light coloured sandstones, which are obviously poor in fossils and sedimentary features. Therefore the question arises in which kind of geodynamic environment these strata were deposited. Even more interesting is the question about the source of this huge amount of siliciclastic material: where was the mountain belt or the land, which was eroded, located? How came this sediment source into existence?

Age control of the phyllitic sequence, which is exposed in the southeastern part of the Khuntan section, is poor since no K/Ar-ages are published. The Triassic age of the Khuntan granite, however, seems to be reliable – it indicates that the main metamorphic print of the quartz-phyllites is older. Apparently no outcrop in this region showing an angular-unconformity between the phyllitic rocks and roofing strata is mentioned in the literature. To the E this section is fault controlled against the young strata of the Lampang Basin. This fault is Tertiary in age. However, it can not be excluded that today's fault-plane is a re-activation of an older thrust. Therefore it seems at present not advisable to include informations gained from the Permian and Triassic strata of the Lampang area into this scenario.

Speculations on the geological interpretation of the Khuntan Range

At present there seem to be two interpretations possible:

1. Based on the radiolarian cherts of upper Paleozoic and Triassic age known from the Fang – Chiang Dao region (Caridroit, 1993, Caridroit, 1992, Sashida, 2000) and on the newly discovered middle Triassic radiolarian cherts near Lamphun (Feng et al., 2002) it can be discussed that a cryptic suture of Triassic age is developed west of the Khuntan Range. This cryptic suture would place the described siliciclastics of the Mae Tha Group together with the described phyllites on the terrane of the “Sukhothai Zone” (Barr and Macdonald, 1991), while the mountains to the W of the Chiang Mai – Lamphun Basin would be part of the “Inthanon Zone”.

2. Based on other data available it can be speculated also on the following scenario: a cryptic suture is developed in the region proposed by Barr and Macdonald (1991, Fig. 3). This suture, however, closed already during the Paleozoic and not during the Triassic. Possibly the first metamorphic print of the quartz-phyllites exposed in the Khuntan Range might be connected with this process and the siliciclastics of the Mae Tha Formation might be regarded as post-collisional detritus derived from the newly uplifted mountain belt which was formed after the Paleozoic closure of this cryptic suture. This interpretation is speculative, since a major fault-plane is located between the sediments of the Mae Tha Formation and the phyllites of the Khuntan Range.

Chonglakmani et al. (2001) correlated the zone along the Lancang Jiang (= Mekong) in southern Yunnan with the region of the Khuntan Range of Northern Thailand. If this correlation is not fundamentally wrong, then some data from Southern Yunnan may help in this discussion. Detailed maps of the region along the Lancang

Jiang in Southern Yunnan show three characteristic units said to be of Upper Paleozoic to Upper Triassic age: mainly acidic volcanics, mapped as upper Triassic, continental red clastics, mapped as Middle Triassic, and phyllites, mapped as Upper Permian (P2). Between the phyllites and the red sandstones an unconformity is mapped (an convincing outcrop of this angular unconformity was found at km 90 – 91 km along the highway Lancang to Simao, comp. Helmcke et al., 2001). Data published by Xiong (1984) from the Nangan Section as well as own new data obtained in different sections close to the Lancang Jiang substantiate the phyllites are not of Upper Permian age (P2) but older: first results of K/Ar dating (courtesy K. Wemmer, GZG, University of Goettingen) point to an Upper Carboniferous age of the tectono-metamorphic event which formed the phyllites (Wennai section, km 2754 of highway 323, for details comp. Helmcke et al. 2001).

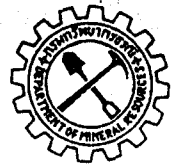
Though there remain many uncertainties these data may give some support for a Paleozoic age of the discussed closure of the cryptic suture and may indicate that already during Carboniferous times an mountain belt was uplifted. The products of the erosion of this mountain belt may form the siliciclastics of the Mae Tha Formation. The age control of the Mae Tha Formation in the Khuntan Range is very poor. There are, however, siliciclastics known in regions NE of Mae Hong Son, which are of Carboniferous age (Ingavat-Helmcke, 1994, Ishibashi et al., 1997) and which are quite similar to the siliciclastics of the Mae Tha Formation of the Khuntan Range. Also in SW Yunnan quite similar sediments are known: the strata of the Nanduan and Laba Formations (Carboniferous and Permian) in the eastern subzone of the Changning – Menglian Belt (Liu et al., 1996). Tentatively we conclude that a suture as proposed by Barr and Macdonald (1991) is quite likely to occur in this region. However, according to our data this suture closed already during the Carboniferous and was not open during later times (i.e. Middle Triassic). This is also strongly supported by the nature of the faunas of Upper Paleozoic age known from Northern and Northeastern Thailand (Toriyama, 1944, Konishi, 1953, Toriyama, 1984).

To support further the above discussed parallelization of the phyllitic sequences found in the Khuntan Range with those found in Southern Yunnan future research should concentrate on regions in Northern Thailand, where outcrops might be expected, which possibly expose an angular unconformity between the quartz phyllites (Don Chai Group) and roofing strata.

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