CHAPTER II

GENERAL GEOLOGY

Introduction

The Khanom and neighboring area is located between the eastern part of Changwat Surat Thani and northern part of Changwat Nakhon Si Thammarat (Figure 2.1). The oldest rocks are high-grade metamorphic complex of inferred Precambrian age, including gneiss, schist, calc-silicate, quartzite and marble, which outcrop in the southern part of Khanom town. This complex group is subsequently cross-cut by Mesozoic granite with equigranular medium-grained texture. Unless specified, the terms " granitic rocks " and " granitiods " are loosely applied herein to represent the rocks with/without foliation which have the gross mineralogical composition; i.e., quartz and feldspar, similar to granite " sensu stricto ". The complex is surrounded by clastic and non-clastic Lower Paleozoic rocks, and the Khao Luang granite and leucocratic granite exposure on the southern rim of the map, which both granites are some northern part of the Khao Luang batholith. Quaternary deposits cover most of the low lands and shore-line areas. Tectonically, the Khanom Complex is situated in the so-called Shan- Thai- Malay microcontinental block (Bunopas,1981; Charusiri et al., 1996).

Geology of Paleozoic sedimentary rocks of this area is divided into four rock units, namely, Thung Song Limestone, Khao Si In Formation, Laem Thap Formation and Ratburi Limestone.

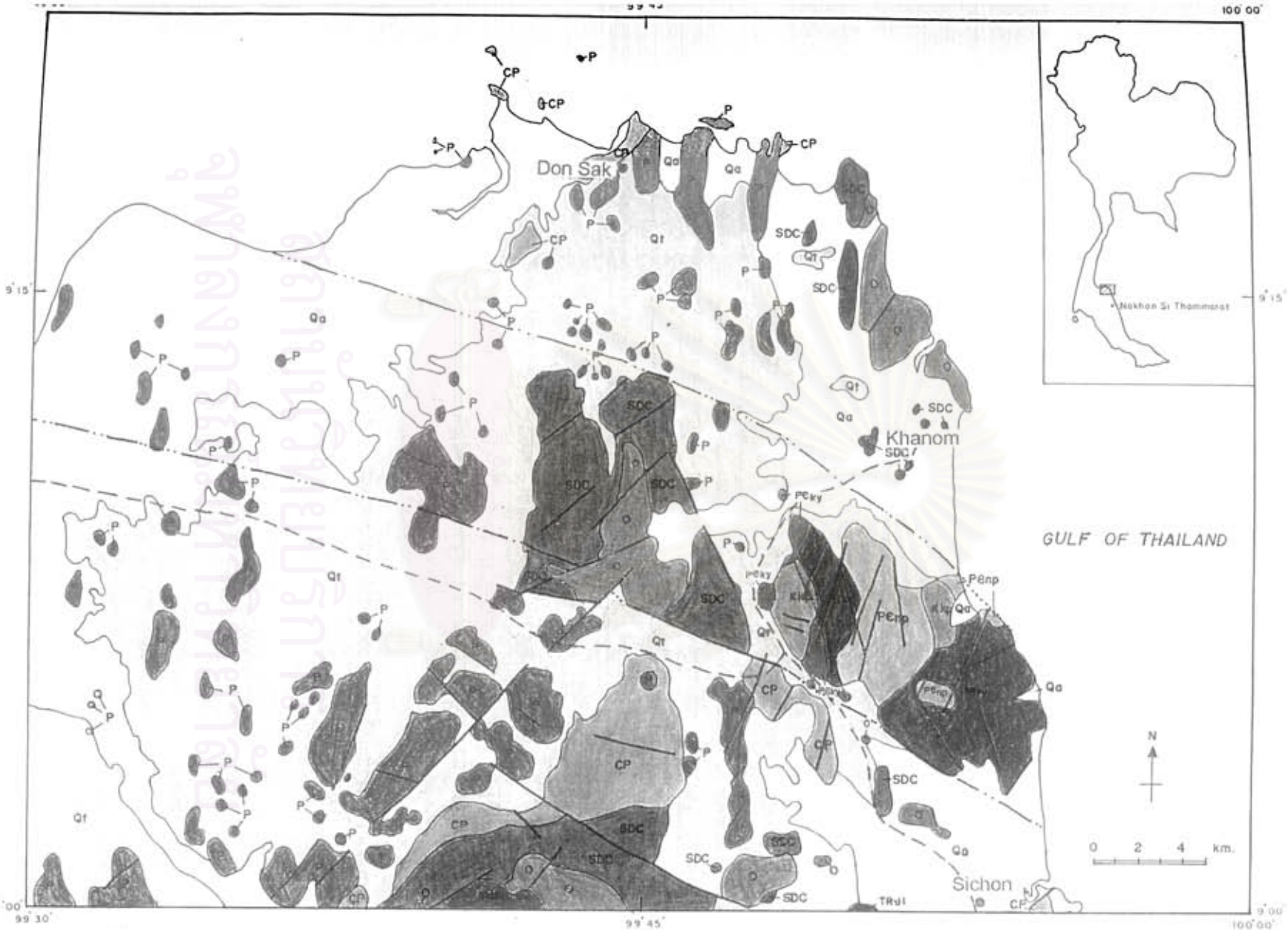

Figure 2.1. Geological map of the Donsak - Khanom - Sichon area. (modified from Chaimanee, 1992; Sripongpan, 1992).

LEGEND

SEDIMENTARY AND METAMORPHIC ROCKS

Qa — Alluvial Deposits: Gravel, sand, silt, clay, and beach sand.

Qt — Terrace Deposits: Gravel, sand, silt and lateritic soil.

P — Ratburi Limestone
Limestone, gray to dark gray, thick bedded to massive, with *Parafusulina sp.*, *Marginifera sp.*, gastropod, algae; dolomitic limestone.

CP — Laem Thap Formation
Sandstone interbedded with shale, brown to greenish gray, with *Nucula sp.*, *Leptodesma sp.*; mudstone interbedded with greywacke, greenish gray to dark gray, slightly pebbles.

SDC — Khao Si In Formation
Shale, brown to reddish brown and light gray to white, interbedded with sandstone, purplish brown, fine-grained, and siltstone with *Posidonomya sp.*, *Styliolina sp.*, *Tentaculite sp.*, trilobite; limestone lenses; quartzitic sandstone, light gray, medium- to coarse- grained, thick bedded, occurred at the upper part of sequence.

O — Thung Song Limestone
Argillaceous limestone, gray to dark gray, well bedded; chert bed at the lower part, with Nautiliod.

PEty — Laem Thong Yang Gneiss
Porphyroblastic biotite gneiss, augen shape, white to dark gray, strong to moderate foliation.

PEky — Khao Yoi Schist
Quartz-mica schist, mica schist, quartzite, white to yellowish brown, well developed schistosity; impure marble lenses, white.

PEnp — Haad Nai Phlao Gneiss
Equigranular biotite±sillimanite gneiss, white to light gray, strong foliation; diopside calc-silicate.

IGNEOUS ROCKS

Kkp — Khao Pret Granite
Equigranular, biotite granite, granodiorite, medium- to coarse-grained.

TR-Jl — Leucocratic Granite
equigranular, tourmaline-muscovite granite, white, medium- to coarse-grained.

TR-Jkl — Khao Luang Granite
equigranular, porphyritic biotite-muscovite granite, gray, medium- to coarse-grained.

PEkd — Khao Dat Fa Granite
Foliated, biotite granite, equigranular, fine- to medium-grained.

SYMBOLS

Fault

Road

Figure 2.1 (continue).

Thung Song Limestone

In this area, the Thung Song Limestone of Ordovician age is found at Khao Chi San, Khao Ho Khan and Khao Pot beside the northern part of Khanom town, the central part and southern part of the study area as well as isolate form of Khao Pluck Mia, northern part of Sichon town. The sequence with a thickness of 400 meters consists of grey to dark grey bedded argillaceous limestone and massive limestone with thin intercalation of argillaceous and dolomitic bands, and locally chert beds at the lower part. The massive limestones also contain several Ordovician fossils including nautiliods, sponges, gastropods and brachiopods. The general strikes vary from 170° to 190° and dips from 40° to 50° in west direction. The limestones are quite similar to the other Ordovician limestone nearby (see also Wongwanich, 1990). For convenience, due to their widespread distribution throughout peninsular Thailand and proximity to the study area, the Thung Song Limestone was applied herein for the Ordovician carbonate strata in the area surveyed.

Khao Si In Formation

The Khao Si In Formation takes its name from the hill of Khao Si In situated about 1 kilometer at the east side of Khanom town. The type section is the small hill, whose elevation is about 51 meters msl and an aerial extent of about 400 m. It also outcrops in Khao Khu Ra, Khao Khiam, Khao Khanom, Khao Klaong, Khao Pot, Khao Fai, Khao Chang Sam, Khao Khuan Reng, Khao Ok and Khao Phat.

The Khao Si In formation is a coarsening-upward sequence conformably overlies the Thung Song Limestone. The lower part of this formation consists of alternating beds of siltstone and fine sandstone, brown to reddish brown, purplish brown and light grey to white, with limestone lenses, containing various index fossils, e.g. *Posidonomya sp., Chonetes sp., Bucanella sp., Proetus sp., Pecten sp., Styliolina sp., Tentaculite sp.* and trilobite, indicating Devonian to Early Carboniferous age. The formation grades up to more sandstone beds, including quartzitic, light grey, medium-

to coarse-grained, thick bedded, with intercalation of black shale, gypsum and anhydrite at the top. Its estimate thickness is about 350 meters. In general speaking, the attitude of Khao Si In Formation varies in strike from 130° to 150° and in dip from 30° to 60° in southwest direction.

Since the Khao Si In Formation conformably overlies the Ordovician Thung Song Limestone. It can be considered that the Khao Si In Formation is probably Silurian to Early Carboniferous age.

Laem Thap Formation

The Laem Thap Formation of Nakinbodee et al. (1985) was erected to include the Silurian - Carboniferous rocks in the eastern part of peninsular Thailand (Changwat Nakhon Si Thammarat to Changwat Songkha), its type section was defined at the Laem Thap headland of Amphoe Khanom, Changwat Nakhon Si Thammarat.

The Laem Thap Formation is redefined herein as the 520 m - thick sequence of dominantly dark grey laminated to very thick bedded mudstone, fine- to medium-grained quartzitic sandstone with cross-bedding, load casts, flute casts and conglomerate lenses. This is conformably succeeded by pebbly mudstone (diamictite). The pebbly mudstone is poorly-sorted and predominantly contains clasts of argillaceous limestones and minor amount of sandstone, chert and foliated granite. The size of the clasts ranges from granule to pebble (2-60 mm). Most of the clasts are subangular to subrounded. Subangular clasts are more common and distributed irregularly thoughout massive beds of highly lithified, medium to dark grey mudstone. The interbedded mudstones contain various fossils, e.g. *Linoproductus sp., Ruggiscostella sp., Neochonetes sp., Kitakamithyris sp., Rhynohonellacean sp., Setigenites sp., Nucula sp., Leptodesma sp.,* strongly indicating Late Carboniferous to Early Permain age. The uppermost part of this unit is largely composed of brownish grey to greenish grey shale interbedded with mudstone, siliceous shale and siltstone

showing ripple marks and cross-bedding. Regionally, the attitude of this formation strikes averagely 180° and dips about 60° in west direction.

The Laem Thap Formation conformably overlies the Khao Si In Formation and is conformably overlain by the Ratburi Limestone. This formation has good exposures at Laem Thap headland, the easthern shoreline of Amphoe Don Sak of Changwat Surat Thani, Khao Leng, Khao Lak and Khao Sam Sap.

Ratburi Limestone

The Permain rocks are firstly proposed as Ratburi Limestone by Brown et al. (1951). Later, they were redescribed by Javanaphet (1969) and Garson et al. (1975) as the Ratburi Group (Upper Carboniferous to Permain) and Ratburi Limestone Formation (Permain), respectively.

The Ratburi Limestone rocks are widely distributed throughout this area as isolated hills or monadnocks, which expose in area between Amphoe Don Sak and Amphoe Khanom as well as eastern part of Amphoe Kanchanadit. The mountain ranges of limestone expose at Khao Yuan Mo, Khao Um Luk, Khao Maen, Khao Wang Ri and Khao Hua Chang.

This sequence consists predominantly of massive and bedded limestone, light grey to dark grey, white and cream in colour, with chert nodules, locally dolomitic limestone and dolomite. Fossils of fusulinids, brachiopods, bryozoas, corals, ammonoids, pelecypods and crinoids found in many places indicating Middle Permain in age. The thickness of Ratburi Limestone is less than 800 m.

Quaternary

The Quaternary deposits of this area are mostly of stream and beach origin. They can be classified into terrace deposits of presumably Pleistocene age and alluvial and beach deposits of Holocene age (Chaimanee, 1992).

The terrace deposits (colluvial and residual deposits) consist of gravel bed, sand, silt, lateritic soil and tuffa. Alluvial, lagoonal, black swamp and beach deposits are belonging to Holocence epoch, and are shown in Figure 4.1.

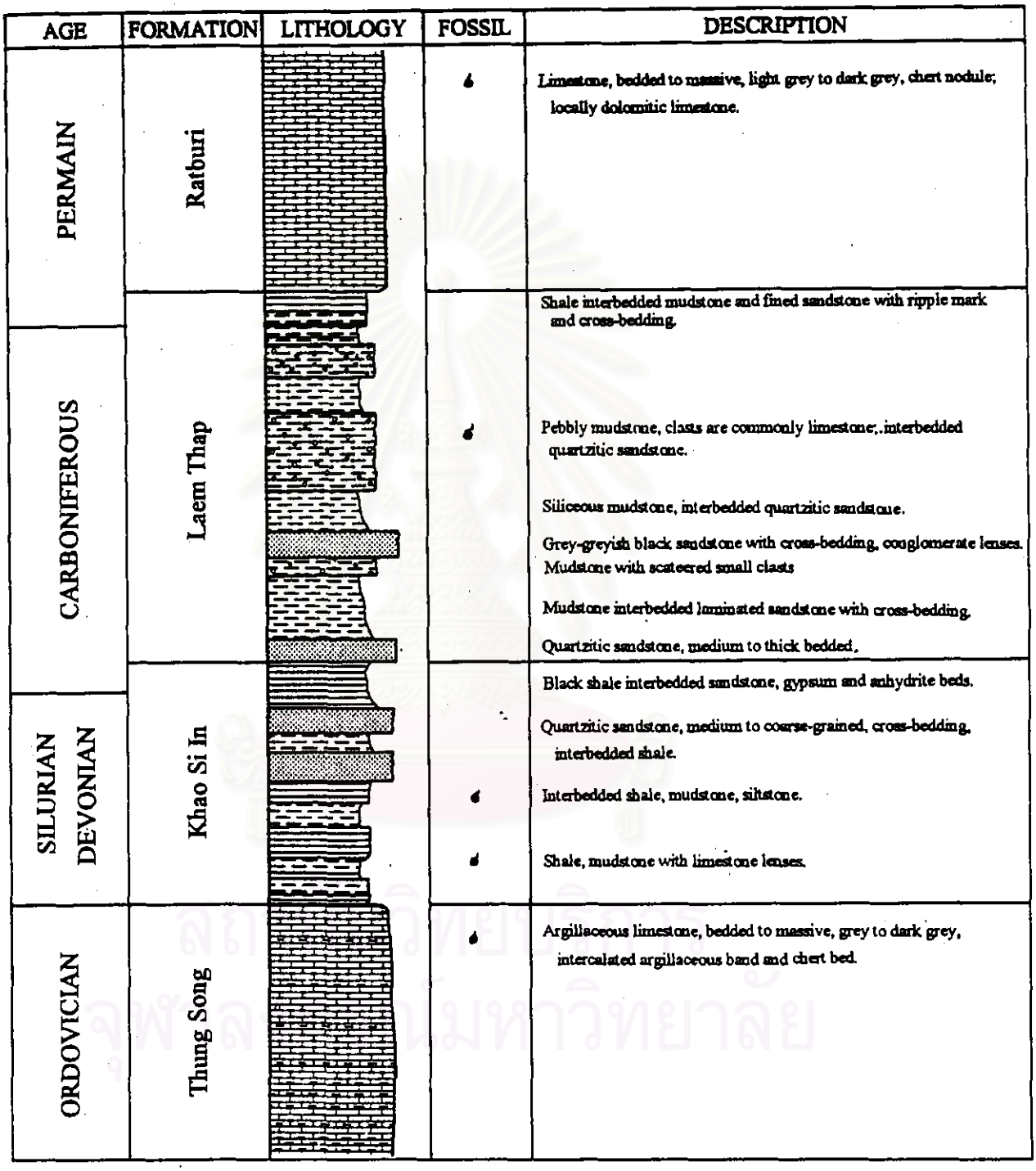

Figure 2.2. Stratigraphic correlation of Paleozoic rocks in the Khanom area (modified from Nakinbodee et al.,1985; Udomratn et al.,1981; Lumjuan, 1993).