*Aalenian (Jurassic) Ammonites from Mae Sot, Northwestern Thailand**

—Contributions to the Geology and Palaeontology of Southeast Asia, XIV

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[With Plate VI]

Our knowledge on Jurassic rocks is quite meagre in Thailand. Except the so-called "Khorat Series" presumably attributed to Triassic-Jurassic, while its dating is now open to question, only two places are known as Jurassic fossil localities (Fig. 1). One is near the Chumphon river mouth in the east coast of Peninsular Thailand, where *Eomiodon chumphonensis* was reported (HAYAMI, 1961). The other is on the eastern border of the Mae Sot basin, about 100 km west from Tak in Northwestern Thailand. There, SRESTHAPUTRA *et al.* (in BROWN *et al.* 1953) reported the occurrence of the following ammonites (determination by R. W. IMLAY) from the limestone beds at Ban Yang Puteh and 5 km east of Ban Mae Kon Ken: *Erycites* sp., *Tmetoceras* sp. and *Ludwigia* sp.

SATO (1961) and HAYAMI (1961) have respectively described an *Erycites* sp. juv. and *Posidonia* sp. ex gr. *ornati* QUENSTEDT with Y. NAITO's collection from the Mae Sot basin, probably near Ban Hui Hin Fon as discussed below.

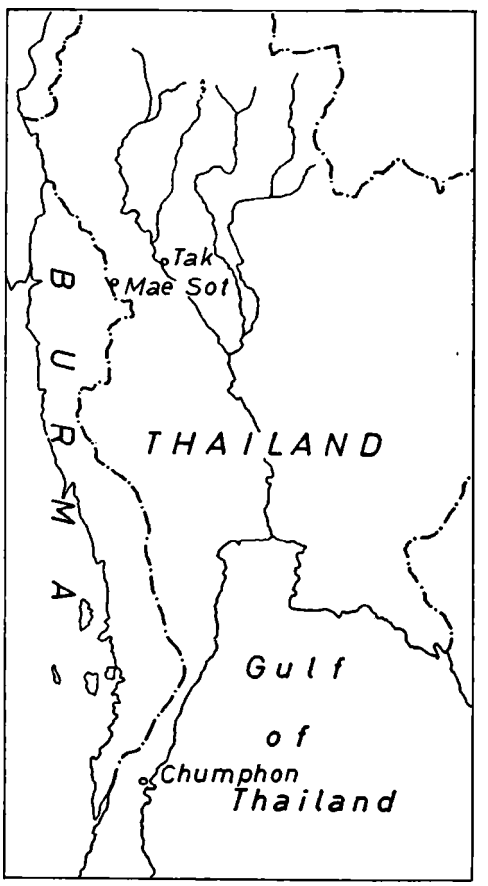

Fig. 1. Map showing Jurassic fossil localities in Thailand.

* Received Sept. 26th, 1963.

In winter of 1962, the authors had an opportunity to carry out a brief geologic survey around the Mae Sot basin together with Professor W. HASHIMOTO of Tokyo University of Education and to collect some relatively well preserved ammonites. The Jurassic rocks crop out mainly at 2 localities: one along the national highway under construction from Tak to Mae Sot, 109 km from Tak, east of Ban Hui Hin Fon. The other is east of Ban Yang Puteh about 11 km SE of Mae Sot. Locality east of Ban Mae Kon Ken described by SRESTHAPUTRA (SETHAPUT) *et al.* was not found.

Lithology:—The rocks of the two localities are slightly different in aspect. Namely, the Ban Hui Hin Fon bed is dark impure marly limestone, highly argillaceous, while the Ban Yang Puteh bed is dark brownish grey cryptocrystalline marly limestone. The mother rock of NAITO's specimens suggests that they were collected from Ban Hui Hin Fon bed.

Fauna:—The fauna collected from each bed is as follows:

Ban Hui Hin Fon bed

(horizon 1): *Erycites* sp.

(horizon 2): *Tmetoceras dhanarajatai* SATO, nov. sp.
Inner whorls of *Erycites*-like ammonite. Besides, *Erycites* sp. juv. and *Posidonia* sp. ex gr. *ornati* QUENSTEDT are supposed to occur in this bed, as mentioned above.

Ban Yang Puteh bed: *Tmetoceras regleyi* DUMORTIER
Graphoceras concavum (SOWERBY)

Age:—The age of the beds is undoubtedly Aalenian. *Tmetoceras dhanarajatai* is an indigenous form and incapable to be an index: *T. regleyi* is, in turn, a species established in SE France and known mainly from the *scissum* Zone and the *murchisonae* Zone of the NW European province, and also in the equivalent zones in Canada and Argentina. *Graphoceras concavum* is an index species of the *concavum* Zone of NW Europe, though it ranges vertically from *murchisonae* Zone up to *discites* Subzone. *Erycites* is a genus characteristic of Aalenian in the Mediterranean province, occurring frequently in association with *Tmetoceras* and also *Graphoceras*. It is reported also from Alaska and Peru.

The combination of these three genera discussed above is known from several spots of the Mediterranean and Pacific provinces, in the bed whose Aalenian age is generally accepted. For example, an ammonite fauna of Monte San Giuliano (Monte Erice) in West Sicily is composed of numerous Graphoceratids including *G. concavum* and Hammatoceratids, besides subordinate *Tmetoceras, Erycites* of Aalenian age, in addition to other upper Toarcian and Bajocian species. RENZ (1925) pointed out that these ammonites represent several different horizons. In fact, they constitute some lots of different ages and no trial was attempted to discriminate them stratigraphically.

The same is true for the case of the Cap San Vigilio limestone on the shore of Lake Garda in North Italy. It is rich in ammonites most of which indicate Aalenian, besides several species ranging from upper Toarcian to lower Bajocian. Four species of *Erycites* and *Tmetoceras scissum* in VACEK's monograph draw attention to the affinity of their horizon to the Mae Sot fauna.

In North Pacific, contemporaneous faunas of similar composition are found in North Japan, Alaskan Peninsula and Canada. Their age is Aalenian. In some cases their ages are more precisely analysed and the corresponding zones of NW Europe are determined.

In conclusion, no contradiction is present for placing these marly limestones in Aalenian.

Geology:—In the western flank of the Pa Wau limestone ridge which defines the eastern border of Mae Sot basin, the limestone bearing sediments which overlie quartzose sandstone of uncertain age were preliminarily attributed to the upper Triassic "Kamawkala limestone series" which is well exposed along the Thangyin river valley in Burma.

The following sequence is observable in the east of Mae Sot in descending order:

Ban Yang Puteh bed
Ban Hui Hin Fon bed
..... relation uncertain .....
Medium grained sandstone and calcareous mudstone
Impure zoogenetic limestone and marl
..... relation uncertain .....
Medium grained sandstone well bedded
Calcareous mudstone

The strike is NNW-SSE and nearly constant through the succession. Jurassic rocks are known to occur also in the east of Ban Mae Kon Ken, in the small valley of Huai Ta Dam, 3 km south of Ban Yang Puteh, and are reported to yield Jurassic ammonites. The bed is shown to be folded in S. BURAVAS' Pl. 19 (in BROWN *et al.* 1953), but this is somewhat extraordinary and could not be unfortunately examined.

The "Kamawkala limestone series" is apparently not inserted within the "Khorat series". The Jurassic appears to be the substratum below the gently undulated Tertiary Mae Sot series.

In fact, the Tertiary veneer and its substratum are evidently different in the mode of deformation. The former is nearly horizontal except in marginal part, and is warping with fold axes at random, while the substratum inclusive of Jurassic is steeply tilted and folded with axes perfectly concordant to the general trend of the metamorphic axis of the orogenic belt in the Burmo-Siamese frontier (Fig. 2). Therefore, the substratum is a part of the orogenic belt and a deformation took place at least once after the Aalenian.

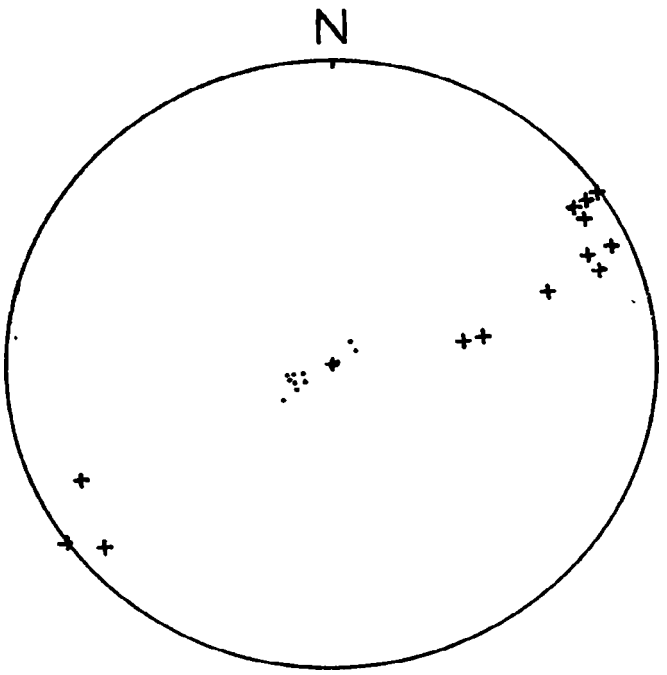

Fig. 2. Equal area projection of poles of bedding planes (lower hemisphere). • Tertiary Mae Sot series. + Jurassic-Triassic Kamawkala limestone series.

Correlation :—

Burma: The Namyau Series of Northern Shan States is thought Bathonian by its brachipod fauna. It is composed of conglomerate, alternation of sandstones and shales of characteristic dark red colour, intercalated by thin limestone bands. Its relation with the Kamawkala limestone series is not actually determined. No Aalenian is reported.

Indochina: Though largely dissected and eroded away, upper Liassic sediments are believed to have been spread in a narrow belt of central and southern Viet Nam, from Trian region NE of Saigon, through Sekong valley as far as Ban Don (Darlac) and Ya Khong (Pleiku province), named " sillon cochinchinois " (E. SAURIN, 1935), and represents a fracturé zone between the pre-existed consolidated land masses, namely " môle cambodgien " and " massif subannamitique ". It is calcareous sandstone or black shale of embayment type that yielded upper Toarcian *Hildoceras* cf. *quadratum*, *Grammoceras* (*Lillia* ?) *lantenoisi* MANSUY and many other pelecypods. The determination of the ammonites, however, requires confirmation; the former will be a *Pseudogrammoceras* and the latter *Dumortieria*. The bed is correlated with the *jurense* Zone of NW Europe, as noted by ARKELL (1956, p. 433).

The Mae Sot Jurrassic has no equivalent ammonites in this country. It fact, the " sillon cochinchinois " opens to south, and links directly to western Borneo. No evidence of its connection with western Thailand is present.

Structurally, the two regions belong to entirely diffrent tectonic units in Southeast Asia.

Indonesia: Abundant Jurassic ammonites are reported from various points of Indonesia. Several Bajocian ammonites are said to occur in Sunda Island arc.

ARKELL pointed out that *Esericeras timorense* (*pro Grammoceras* KRUMBECK) from Timor, *Grammoceras kiliani* KRUIZINGA from Sula are the indicators of upper Toarcian age. Generally various forms described under the ambigous name "*Harpoceras*" may be upper Toarcian species.

Hammatoceras moluccanum and its varieties, reported from Sula, Misol, and Sumba by CLOOS (1916) have been considered as lower Dogger in age and this interpretation has been largely adopted by later authors (KRUIZINGA, 1926, 19e1, WANNER, 1931 etc.). But because this is an indigenous species and its stratigraphical relation with any other fossil horizon is known, its lower Dogger age cannot be warrented. Judging from the photographs given by KRUIZINGA (1926, pl. 2), the ammonites bear some characteristics of *insigne* type, and therefore they are probably upper Lias in age, as ARKELL suggeted (1956, p. 440).

Another *Hammatoceras* from Taliabu (*Hammatoceras* cf. *lotharingicum*) is a fragment of the septate whorl and no exact age can be mentioned. Be this really close to *lotharingicum*, it may indicate lower Dogger instead of upper Lias. At any rate, no definite age can be said for the Taliabu form.

On the other hand, *Eudmetoceras klimakomphalum* shows middle Bajocian age.

Japan: In Shizukawa area of the Southern Kitakami province, two Aalenian (Upper Toarcian inclusive) zones are discriminated in Hosoura black sandy shales of Shizukawa series; upper *jurense* Zone to *scissum* Zone are represented by *Hosoureites ikianus* Zone and *murchisonae* Zone to *sowerbyi* Zone by *Planammatoceras kitakamiense* Zone. The first zone is characterized by abundant *Hosoureites ikianus* which is akin to *Graphoceras concavum*, and associated with numerous *Tmetoceras recticostatum*. *Harpoceras okadai* (species closely resembling *exaratum*) occurs homotaxially in the same bed, and generally considered as lower Toarcian indicator. *Tmetoceras* and *Hosoureites* are strong indicators of Aalenian. This is, therefore, a bed with which some European zones are synchronisable, such as *jurense*, *opalinum* and *scissum* Zones.

The second zone is characterized by rich *Hammatoceras*, *Tmetoceras*, *Graphoceras* and *Hyperlioceras* assemblage, with subordinate *Hosoureites*. *Hammatoceras* are mostly much specialized forms, such as *Planammatoceras*, and of *murchisonae* Zone to *sowerbyi* Zone.

The common occurrence of *Tmetoceras* and *Graphoceras* is a strong evidence for the equivalency of the Hosoura to the Mae Sot beds. *Tmetoceras* in Japan is a link between the SE Asiatic and North Pacific faunas.

Canada and Alaska: In Canada, a horizon is dated by *Tmetoceras regleyi* in Whitesail Lake area (FREBOLD, 1951). It forms a well defined zone in the Hazelton group and is certainly of Aalenian age. ARKELL suggested the *scissum* Zone as its correlative, but this is indefinite, because this species is not restricted to the *scissum* Zone. Though FREBOLD's specimens are incomplete, it is true that the Canadian form strikingly resembles the Thai *regleyi*. The age of the bed is better ascertained in Mae Sot basin than in Whitesail lake area, by co-existence of *Graphoceras concavum* and *Erycites* sp.

Lower Bajocian and upper Toarcian are distributed much more widely in Canada than the Aalenian, but are not treated here.

In South Alaska, fossiliferous Kialagvik formation of Wide Bay is roughly dated by three faunal assemblages. It is reported that the lowest one is composed of *Erycites howelli*, *E. kialagvikensis*, *Pseudolioceras whiteavesi*, and *Tmetoceras* (after IMLAY, 1952), besides a few representatives of *Hammatoceras* and *Sonninia*. A small old collection was figured by White. According to IMLAY, this assemblage indicates Aalenian age by the reason that *Sonninia* represents the age younger than the *murchisonae* Zone. If these forms are collected from a single bed, a condensation of several zones is likely to occur.

ARKELL, in turn, expressed the controversial opinion that it is correlative with *Pseudolioceras* horizon in Greenland, which is of upper Toarcian age, judged by the occurrence of similar *Pseudolioceras whiteavesi*.

The reference of *howelli* to *Erycites* (*pro Lillia*, WHITE, 1889) requires reexamination. The figures given by WHITE appear so inadequate that any reliable determination cannot be made from them. A suture-line for *Erycites howelli* shows definitely oblique umbilical lobes of Hammatoceratid type, but general features of the whorls are not quite of *Erycites* type. Therefore, this form must be excluded from the chronological consideration. *Tmetoceras* appears from upper Toarcian and not always restricted to the Aalenian, as in NW Europe and also in North Japan.

"*Erycites*" *kialagvikensis* is still more difficult to be determined. Probably it is not an *Erycites*. The upper two assemblages contain predecessors of Stephanoceratids and are not younger than the *sowerbyi* Zone.

The same horizon is expectable in the Tuxedoni formation (lower part) in Tuxedoni bay and Matanuska valley of Cook Inlet region. *Tmetoceras* and *Erycites* are reported, but no illustration is given. Its correlation with the lower Kialagvik formation is certainly correct, but its definite age is uncertain.

Tmetoceras and *Pseudolioceras* are collected from the boring cores of North Alaska (Topagoruk test well, no. 1, 8113 feet, South Barrow test well, no. 2, 2391 feet). IMLAY figured the specimens and correlated this horizon with lower part of Kialagvik formation. *Erycites* spp. associated by *Pseudolioceras whiteavesi* was also reported from Canning river region.

Argentina: An Aalenian fossil fauna, of which history of research goes

back into the 19th century, is reported from Espinazito pass. The unquestionable lower Bajocian with *Sonninia* and *Emileia* lies on the calcareous sandstone yielding *Tmetoceras regleyi* and *Graphoceras concavum* (BODENBENDER's horizon I) which are figured by GOTTSCHE and TORNQUIST, by the intermediate of *Trigonia* bearing horizon (BODENBENDER's horizon II). It is thus likely to be correlative with *murchisonae-concavum* Zones in NW Europe and also beds containing Mae Sot fauna.

Summary: The age of Mae Sot ammonite fauna is Aalenian. Chronological analyses of each element which constitutes the fauna have given this result, and the correlations with North Pacific Aalenian corroborate the fact.

Systematic Descriptions of Ammonites

Genus *Tmetoceras* BUCKMAN, 1922

Tmetoceras dhanarajatai SATO, nov. sp.

Pl. VI, figs. 1-9, 16-18

Materials:—More than 12 paratypes from the same locality among which specimen 11 bis-1 is designated as holotype. The species is dedicated to the PrimeMinister S. DHANARAJATA of Thailand, who facilitated our survey in many ways.

Measurements:—in mm.

	Diam.	Diam. Umb. (ratio DU/D)	Height	Width
11 bis-1	20.0	11.5 (.58)	5.7	5.0
11 bis-2	14.1	7.0 (.49)	5.0	4.1
11 bis-3	ca 15.0	ca 7.0 (.47)	5.6	5.5
11 bis-4	13.0	7.0 (.53)	4.8	3.5
11 bis-5	13.0	6.6 (.51)	4.3	4.5
11 bis-6	6.1	3.0 (.49)	2.3	2.2
11 bis-7	13.4	9.8 (.73)	5.3	4.5

Descriptions:—

Fragmocone:—serpenticone with almost circular whorl section; whorls in very early stage of ontogeny (until about 2 mm in diameter) fairly wider than high in cross section, then in adult whorls slightly higher than wide. Septa widely spaced, in particular in early stage (6-8 per whorl). No constriction present; shallow but distinct ventral furrow develops throughout the life except in early stage. Length of body chamber unknown. Volution evolute (0.47-0.58 of ratio DU/D) except in very early stage of development (0.35-0.38 at the stage of 1.5-2 mm in diameter). Aperture unknown.

Ornamentation:—In early stage of development (until about 2mm in diameter), only widely spaced blunt prorsiradiate swellings are present on the flanks.

Then begins the ordinary ribbing composed of rather obtuse weakly sinuated simple ribs which are strongly prorsiradiate and very weak in umbilical edge, then fairly rectiradiate, and finally bend forward on the border of ventral furrow. At about 6-7 mm in diameter ribbing merges into complete adult style, being sharp and prominent, approximate and almost rectiradiate without inflexion on the umbilical border and with sharp forward bend on the border of ventral furrow.

Sutures:—Rather simple in pattern. Clearly definable E and I exist as early as in the earliest stage. Blunt L develops gradually but never incised instead of denticulated sutures of *Tmetoceras*. U2 present throughout the life but invariably small. High and wide S1 is divided inequally by small accessory lobe at the top. S2 small and entirely rounded.

Comparisons:—The species described above is closely related with *Tmetoceras hollandae* BUCKMAN, which is persistently ornamented by fine, approximate

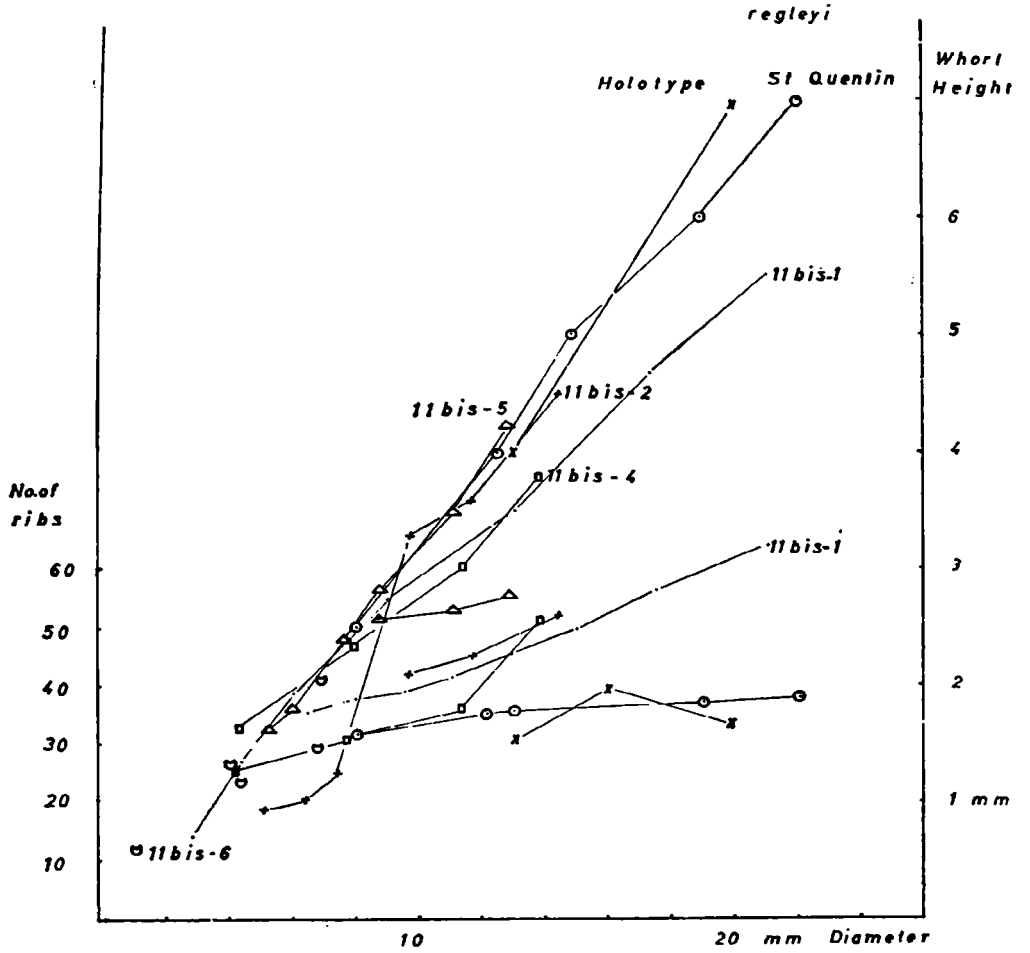

Fig. 3. Diagram of whorl height and number of ribs (per whorl) in *Tmetoceras dhanarajatai*, in function of whorl diameter, Those of *T. regleyi* (holotype and St. Quentin form) are given for comparison.

sinuous ribs. Although the earliest stage of development is unknown in *T. hollandae*, the growth of the whorls in this species is relatively rapid in comparison to our species (see Fig. 3), while the number of ribs is still less than the Thai species.

The general feature of suture-line remains of quite reduced pattern throughout the ontogeny of *T. dhanarajatai* though the essential frame is typical of *Tmetoceras*.

HAUG (1887) and SPATH (1936) suggested that *Tmetoceras* was derived from *Dumortieria*. The present species reveals no resemblance with the latter genus in the initial 1st and 2nd whorls where ribbing is fairly blunt and strongly prorsiradiate, but the whorls of about 2.5-3 mm in diameter (3rd whorl) show similar ribbing to *Dumortieria*'s inner whorl (e. g. *Dumortieria radians*, BUCKMAN, Inf. Oolite, pl. XLIII, fig. 3 etc.) and lack any trace of ventral depression, until the 4th or 5th whorl.

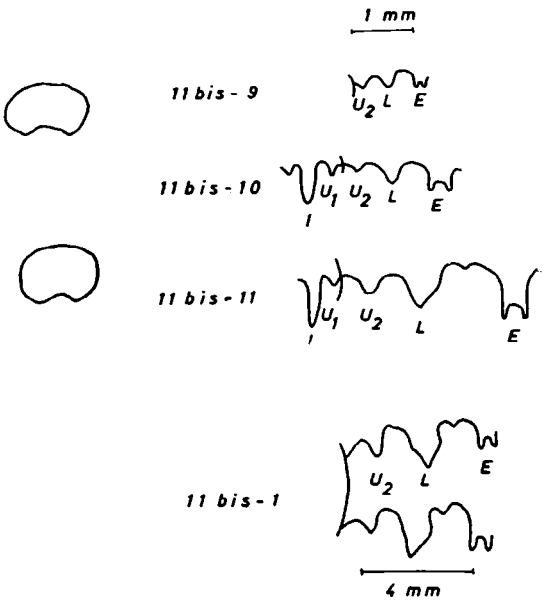

Fig. 4. Whorls ections and suture lines of *Tmetoceras dhanarajatai*.

Occurrence:—Horizon 2 of Ban Hui Hin Fon bed, east of Mae Sot, Changwat Tak, road side outcrop at km 109 from Tak.

Tmetoceras regleyi DUMORTIER sp.

Pl. VI, figs. 10-12, 14, 15

1874. *Ammonites regleyi* DUMORTIER, p. 119, pl. 31, figs. 8, 9.
1892. *Tmetocerrs scissum*, BUCKMAN (pars), p. 273, pl. 48, figs. 4-10.
1923. *Tmetoceras scissum*, ROMAN et BOYER, p. 36, pl. 6, fig. 6-8, figs. 28 in text.
1951. *Tmetoceras regleyi*, FREBOLD, p. 18, pl. 15, figs. 1-4.

Materials:—More than ten specimens from the same locality.

Remarks:—The identity of *regleyi* and *scissum* has long been discussed but the final solution is pending. DUMORTIER tended to distinguish the former species as a separate species from the latter, emphasizing the absence of constrictions in the former. BUCKMAN ignored the constriction as a character of specific value, as he noted it when he replaced one of his specimens previously named *hollandae* into *scissum*. Later (1905) he recognized *regleyi* as an independent species giving a brief summary of the specific character, but he again ignored the constriction.

ROMAN et BOYER figured the type specimen of THIOLLIÈRE on which DUMOR-

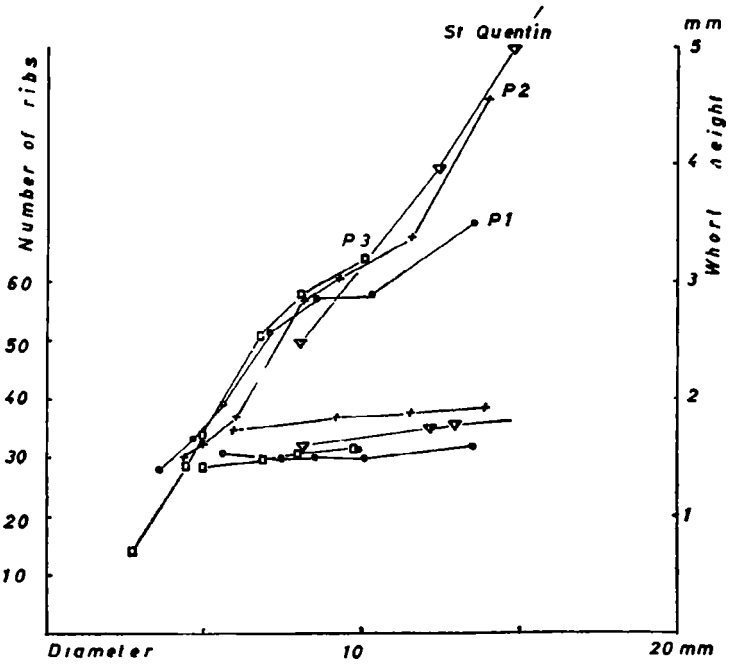

Fig. 5. Diagram of whorl height and number of ribs (per whorl) in *Tmetoceras regleyi* from Ban Yang Puteh bed. Those of St. Quentin form are given for comparison.

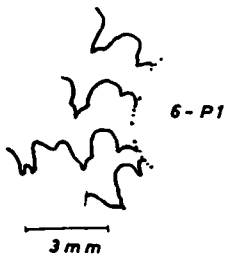

Fig. 6. Suture line of *Tmetoceras regleyi* from Ban Yang Puteh.

TIER based his *regleyi*, and pointed out that DUMORTIER's *scissum* is not quite similar to the type of BENECKE's original. However, they assimilated two species under the consideration that DUMORTIER's *regleyi* is different from his *scissum* (=*Parkinsonia sutuneri* by HAUG) but conspecific with BENECKE's *scissum*

With regards to the figures published, the type of *scissum* shows clearly 5-6 constrictions at the diameter of about 30 mm. This diameter is attained also by DUMORTIER's *regleyi*, which is not provided in fact of any traces of constriction, as in DUMORTIER's description.

The Thai form now in question shows complete lacking of constrictions through all the stages of ontogenetic development. Still imperfectly known is its adult whorls but the development of the whorls coincides perfectly to that of *regleyi*.

Occurrence:—At the outcrops in teak woods, east of Ban Yang Puteh, about 11 km SE of Mae Sot.

Genus *Graphoceras* BUCKMAN, 1898

Graphoceras concavum SOWERBY sp.

Pl. VI, fig. 3

1815. *Ammonites concavus*, SOWERBY, p. 214, pl. 94, lower figure.
non 1874. *Ammonites concavus*, DUMORTIER, p. 59, pl. xiii, figs. 1-3.
1889. *Lioceras concavum*, BUCKMAN, p. 56, pl. ii, figs. 6-7, pl. viii, figs. 1-4 (refigured SOWERBY's type)
1901. *Ludwigella concava*, BUCKMAN, p. 266.
1913. *Ludwigia concava*, HOFFMANN, p. 169, pl. 14, figs. 10-11, pl. 15, figs. 6-10, pl. 16, figs. 4-6, pl. 17, figs. 1-7, pl. 18, figs. 1-9.
1921. *Ludwigia concava*, ROMAN, p. 4, pl. 2, fig. 1, pl. 3, fig. 1, pl. 4, fig. 5.
1925. *Ludwigia concava*, SCHMIDTILL, p. 98, pl. 12, fig. 3.
1933. *Ludwigella concava*, ARKELL, pl. xxxiii, fig. 2.
1936. *Ludwigia concava*, DORN, p. 75, pl. xx, fig. 6, pl. xxi, fig. 9.
1940. *Ludwigia concava*, GÉRARD et BICHELONNE, p. 44, pl. xx, figs. 4, 4'.
1940. *Ludwigia concava*, ALTHOFF, p. 27, pl. 5, figs. 9-11, plate in text C, figs. 19-22.
1956. *Graphoceras concavum*, ARKELL, pl. 32, fig. 4.
1960. *Ludwigella concava*, LELIÈVRE, p. 24.

Materials:—A single specimen relatively well preserved, of which inner whorls are missing.

Remarks:—Fragmentary but not deformed inner mould without shell. Quite safely attributable to the genus *Graphoceras*, especially to *G. concavum*, judging from the general feature of its whorls, ornamentation and also suture-lines. Small and rather deep umbilicus provided with concave steep wall, narrow and typically fastigate ventral region with high solid keel, and fairly sinuated ribbing are the characteristics of the species.

Taxonomy of *concavum*, proposed by SOWERBY, is confused. Even ignored BUCKMAN's old reference to *Lioceras* (which has to be *Leioceras* according to nomenclatural rule), the species has been classified in classic but ambiguously defined genus, *Ludwigia*, as did some German authors.

On the other hand, BUCKMAN included *concavum* in *Ludwigella*, which he created on the basis of *L. arcitense*, and this classification has been followed by some French authors as well as ARKELL.

Meanwhile, BUCKMAN established the genus *Graphoceras* on the basis of a variety of *concavum* (*v-scriptum*, BUCKMAN, 1888) and it is a group of ammonites ornamented by strongly rursiradiate and biconcave ribbing. *Concavum* was not included in this genus when BUCKMAN has created the genus. In reality, *Ludwigella* is hardly distinguishable from *Graphoceras*, and if it is subjectively synonymous with the latter, *concavum* is obviously a species of *Graphoceras*. ARKELL changed his opinion and cited in the zone-table of Jurassic chronology (1956, p. 34) as *Graphoceras concavum*, instead of *Ludwigella concava* formerly adopted by himself (1933, p. 189).

Measurements:—In mm. Diam. 43, Diam. Umb. 8.4 (.19), Height 22.4 Width 10.8.

Occurrence:—East of Ban Yang Puteh, 11 km SE of Mae Sot, in association with *Tmetoceras regleyi*.

Genus *Erycites* GEMMELLARO, 1886

Erycites sp.

Pl. VI, fig. 19

1961. *Erycites* sp. juv. indét. SATO, p. 137, pl. 7, fig. 4.

Material:—A single specimen, poorly preserved.

Remarks:—A Hammatoceratid with moderately evoluted volution. Individualized primary obtuse ribs giving rises to secondary faded weakly prorsiradiate ribs. Ventral keel seems to be absent. The determination of this specimen is open to question.

Four other nuclei of planulate whorls giving suture-lines of Hammatoceratid type with fairly oblique umbilical lobes. These specimens are not provided with ventral keel and presumably inner whorls of *Erycites*.

Occurrence:—Ban Hui Hin Fon, road side outcrop at km 109 from Tak, horizon 1. Immature specimens are from horizon 2.

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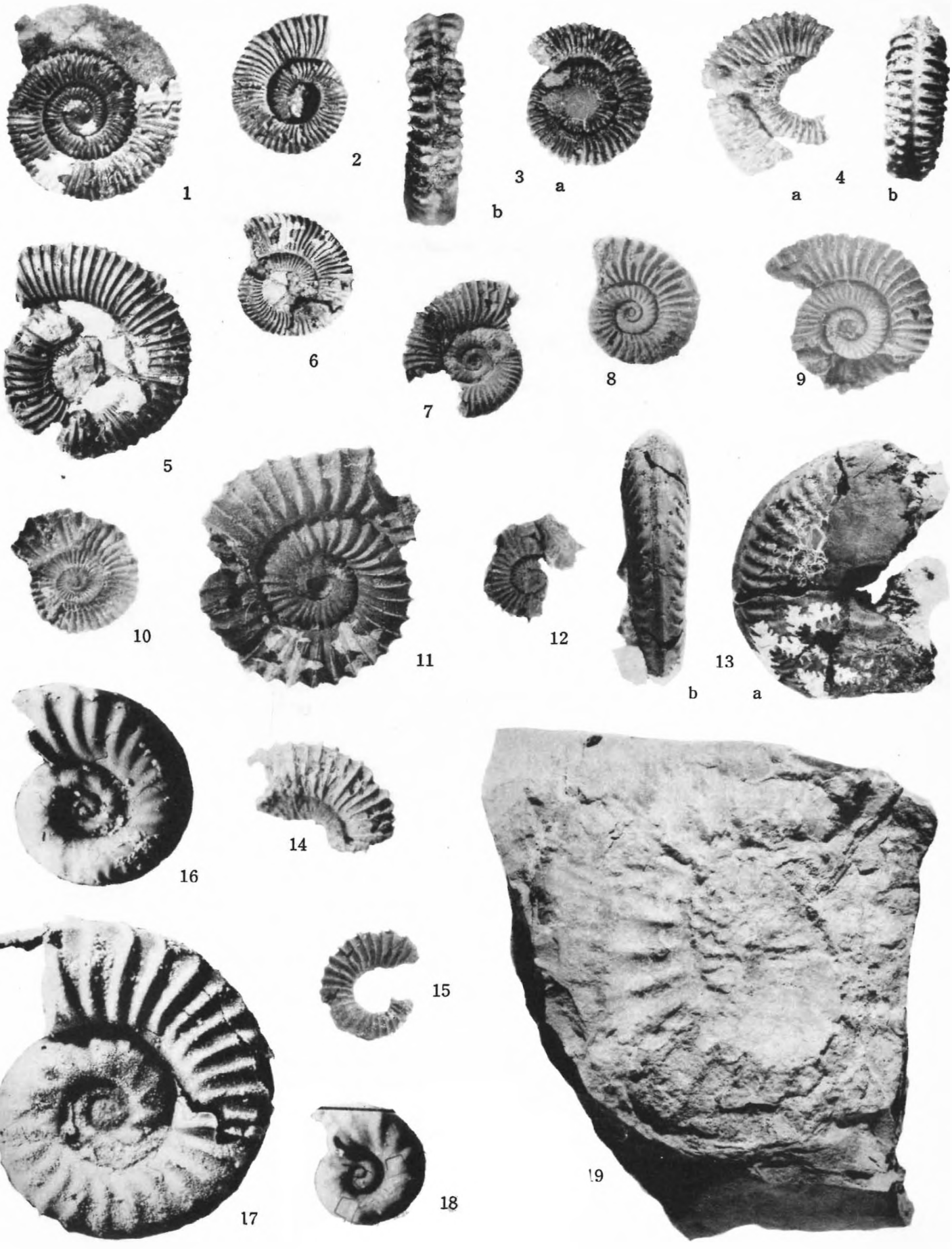
Explanation of Plate VI

Tmetoceras dhanarajatai SATO nov. sp.
Fig. 1-9, 16-18 (Fig. 1-9, ×1.5; fig. 16-18, ×15)
Tmetoceras regleyi DUMORTIER
Fig. 10-12, 14-15. (×1.5 except fig. 11, ×3)
Graphoceras concavum (SOWERBY)
Fig. 13, ×1
Erycites sp.
Fig. 19, about ×1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2
3 a
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4 a
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13 b
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