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689. A NEW TEXANITINE AMMONITE FROM HOKKAIDO (STUDIES OF CRETACEOUS AMMONITES FROM HOKKAIDO AND SAGHALIEN—XXXIV)*

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With Notes on the Santonian Biostratigraphy

(Tatsuro MATSUMOTO)

Abstract. This is an addition to a previously published monograph of the Texanitinae (MATSUMOTO, 1970). A new species of *Texanites* is described on the basis of a recently obtained specimen from about the middle of the Santonian in the Oyubari district, central Hokkaido. It is allied to *Texanites* (*Texanites*) *hourcqui* COLLIGNON, from the Middle Santonian of Madagascar, but is distinguished by its rursiradiate, distant ribs, inequidistant configuration of tubercles and diverging deep branches of L in the suture.

As an appendix, notes are given on the biostratigraphic subdivision and correlation of the Santonian primarily on the grounds of texanitine species.

Introduction

From the Upper Cretaceous of Japan and Saghalien altogether 23 species of the Texanitinae, a subfamily of the Collignoniceratidae, have hitherto been known, of which a majority is from Hokkaido (see MATSUMOTO, 1970). Their mode of occurrence in the Cretaceous muddy sediments in the basin of Hokkaido (the so-called Yezo geosyncline) is scattered and rather isolated, although they tend to be somewhat more common in the probably shallower facies, for example in fine-sandy siltstones of the Haboro-Kotambetsu-Obira areas of northwestern Hokkaido. In the Oyubari district of central Hokkaido, the sediments are more clayey and seem to represent comparatively more off-shore, somewhat deeper facies. From this area, however, a fairly large texanitine ammonite was reported about 50 years ago. That is *Mortoniceras nomii* YABE and SHIMIZU, 1925, recently revised to be called *Protexanites* (*Anatexanites*) *nomii* (YABE and SHIMIZU) (MATSUMOTO, 1970, p. 242). Its holotype is unfortunately missing and only its plaster cast is preserved in Tohoku University, Sendai. The type-locality of that holotype was "the cliff at the junction of the Shiyuparo and the Panke-mo-yuparo", which is now under the water of an artificial lake of the Shuparo [=Shiyuparo] dam.

While we are continuing a field work in the Oyubari district, we have sought so far in vain any example of the same

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species, aside from an immature specimen from the Haboro area (MATSUMOTO, 1970, pl. 32, fig. 1). Meanwhile, one of us (Y. H.) found another texanitine ammonate from another locality of the same Oyubari district. This represents an interesting new species which we describe in this paper.

Before going further we thank Messrs. Junichi YAZAKI, Yoshihiro MATSUBARA, Katsuo YAMAZAKI and Katsuo IRIE of the Oyubari Office of the Forestry Bureau, who gave us facilities for our field work. We also thank Drs. Hiromichi HIRANO and Kazushige TANABE, who helped us in both the field and laboratory works. Miss Mutsuko HAYASHIDA assisted us in preparing the manuscript.

Geological Setting

Fig. 1 is a geological map of the northern part of the Oyubari district, prepared tentatively by one of us (Y. H.). The area is partly overlapped with and primarily continued to the southwest of the Shiyubari [Shiyuparo] area, mapped 35 years ago by the other of us (MATSUMOTO, 1942, pl. 13). Broadly speaking, the Cretaceous outcrops become younger as we go westward, but in detail the structure is imbricated by minor thrusts and overturned folds.

On account of this geologic structure we see the repeated occurrence of the zones defined by the first appearance of the named inoceramid species as follows (in ascending order):

1: Zone of *Inoceramus* aff. *saxonicus* PETRASCHECK (temporarily called *Inoc.* aff. *teshioensis* in our field work)
2: Zone of *Inoceramus hobetsensis* NAGAO and MATSUMOTO
3: Zone of *Inoceramus teshioensis* NAGAO and MATSUMOTO
4: Zone of *Inoceramus uwajimensis* YEHARA (closely allied to but at least subspecifically distinguished from *Inoceramus stantoni* SOKOLOW)
5: Zone of *Inoceramus mihoensis* MATSUMOTO (somewhat allied to *Inoceramus erectus* MEEK)
6: Zone of *Inoceramus* (*Platyceramus*) *amakusensis* NAGAO and MATSUMOTO
7: Zone of *Inoceramus* (*Cladoceramus*?) *japonicus* NAGAO and MATSUMOTO

where zones 1, 2 and 3 are Turonian, 4 and 5 Coniacian, and 6 and 7 Santonian (see NODA and MATSUMOTO, 1976). The described ammonite was solitarily embedded in a mudstone which is assignable to zone 6 or 7 in the upper part of the Upper Yezo Group, exposed at a locality not far from the outcrops of the sandstones of the Hakobuchi Group.

Palaeontological Description

Family Collignoniceratidae WRIGHT & WRIGHT, 1951

Subfamily Texanitinae COLLIGNON, 1948

Genus *Texanites* SPATH, 1932

Type-species:—*Ammonites texanus* ROEMER, 1852.

Generic diagnosis:—See MATSUMOTO, 1970, p. 266.

Remarks:—Two subgenera, *Texanites* and *Plesiotexanites*, are distinguished (MATSUMOTO, 1970, p. 267). Nine species of *Texanites* have hitherto been described from Hokkaido and other areas in Japan of which three are referable to *Texanites* (*Texanites*). The new species described below is also assigned to *Texanites* (*Texanites*).

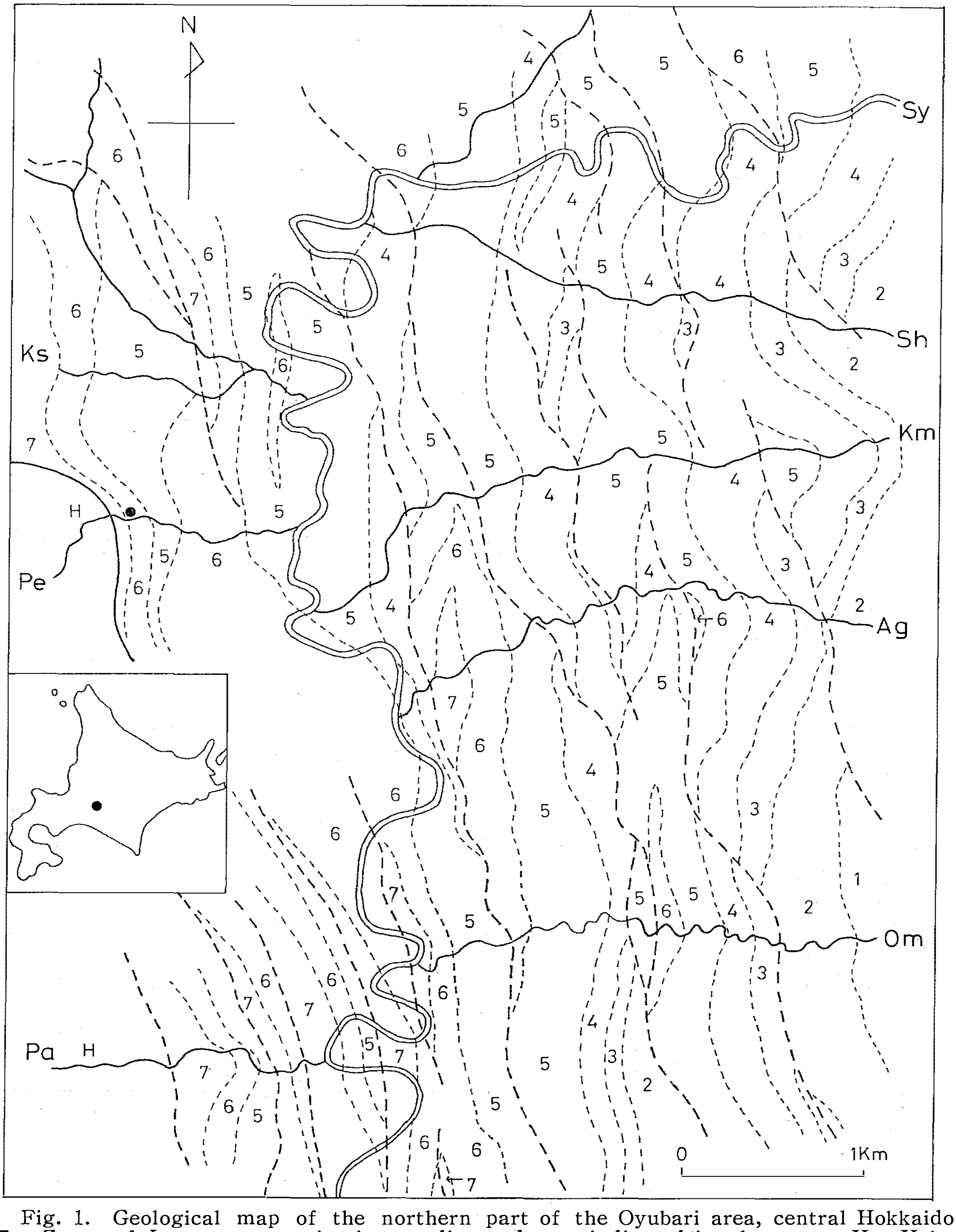

Fig. 1. Geological map of the northern part of the Oyubari area, central Hokkaido. 1-7: Zones of *Inoceramus* species in asending order as indicated in the text. H: Hakobuchi Group. Thick line: Major thrust. Thick broken lines: Minor thrusts and faults: Solid circle: Locality of the described *Texanites*. Abbreviations of the streams are Sy: Shiyuparo, Sh: Shimizu-zawa, Km: Komaki-zawa, Ag: Agemaki-zawa [=Kamimaki-zawa], Om: Omaki-zawa, Ks: Kosenzawa, Pe: Penke-horoka-yuparo, Pa: Panke-horoka-yuparo. Inset is a small map of Hokkaido, indicating Oyubari with a small solid circle. (prepared by Y. HARAGUCHI)

Texanites (*Texanites*) *yazakii* sp. nov.

Pl. 42, Fig. 1 ; Text-fig. 2

Holotype:—GK. H5865, from loc. Y1120, collected by Yoshimitsu HARAGUCHI, now preserved at Kyushu University.

Etymology:—This species is dedicated to Mr. Junichi YAZAKI, former Director of Oyubari Office, Bureau of Forestry.

Specific characters:—Shell fairly large, about 250 mm in diameter of restored figure, consisting of slowly enlarging evolute whorls, which are subrectangular in cross-section, higher than broad (with a proportion of height to breadth about 10 : 8), broadest in the lower part with slightly convergent flanks. Umbilicus wide, surrounded by low but steep wall and abruptly rounded shoulder.

Ribs strong, mostly somewhat rursiradiate and a few of them nearly rectiradiate, comparatively denser on the inner whorl separated by the interspaces which are as wide as the ribs, moderately distant with wider interspaces on the next whorl of probably adolescent stage, and much distant and coarse on the body-whorl of the adult stage. On the outer two whorls there is as a rule intercalation or branching of the ribs. The secondary ribs begin to appear somewhere near the mid-flank or near the umbilical shoulder. On the inner whorl the intercalation seems to be less frequent.

Tubercles unequally distributed in five rows. The distance between the first (i. e. umbilical) and the second (i. e. inner lateral) is longer than that between the second and the third (i. e. outer lateral), that between the third and the fourth (i. e. ventrolateral) is the shortest, and that between the fourth and fifth (i. e. ventral) is moderate. This configuration of tubercles is regularly maintained all through the observable three whorls.

The tubercles change with growth in strength and shape. On the body-whorl and the preceding part (about 300°) of the septate whorl the umbilical tubercles are the most prominent, the inner lateral ones on the long ribs the next in prominence, and the outer lateral the weakest. The ventrolateral tubercles of moderate intensity, indistinctly clavate on the late septate whorl but not clavate on the body-whorl. The ventral tubercles narrowly clavate all through the visible stages.

On the inner whorl (of 40 to 70 mm in diameter) the outer lateral as well as the ventrolateral tubercles are clavate and sharp-headed, the inner lateral ones indistinctly clavate and moderately strong, and the umbilical ones small but prominent, with a bullate base.

Sutures of general texanitine pattern and characterized by narrow and fairly deep branches diverging from the reversed omega-shaped stem of L, the tall second lateral saddle between L and U2 much narrowed near the base of its stem. These sutural characters appear already on the inner whorl of about 40 mm in diameter.

Measurements (in mm on the whorl of adolesent stage) :—

Diameter	Umbilicus	Height	Breadth	B./H.
127.0	59.8	41.6	17.2×2	0.82
(1)	(0.47)	(0.32)	(0.27)	

Remarks:—One side of the specimen is incompletely preserved and the last part of the body-whorl squashed. Otherwise the characters are well shown at successive three stages. The extent of variation is unknown at present.

Comparison:—Although a single specimen (holotype) is available at present, it shows distinctive characters which enable us to regard it as representing a new species.

This species resembles *Texanites* (*Tex-*

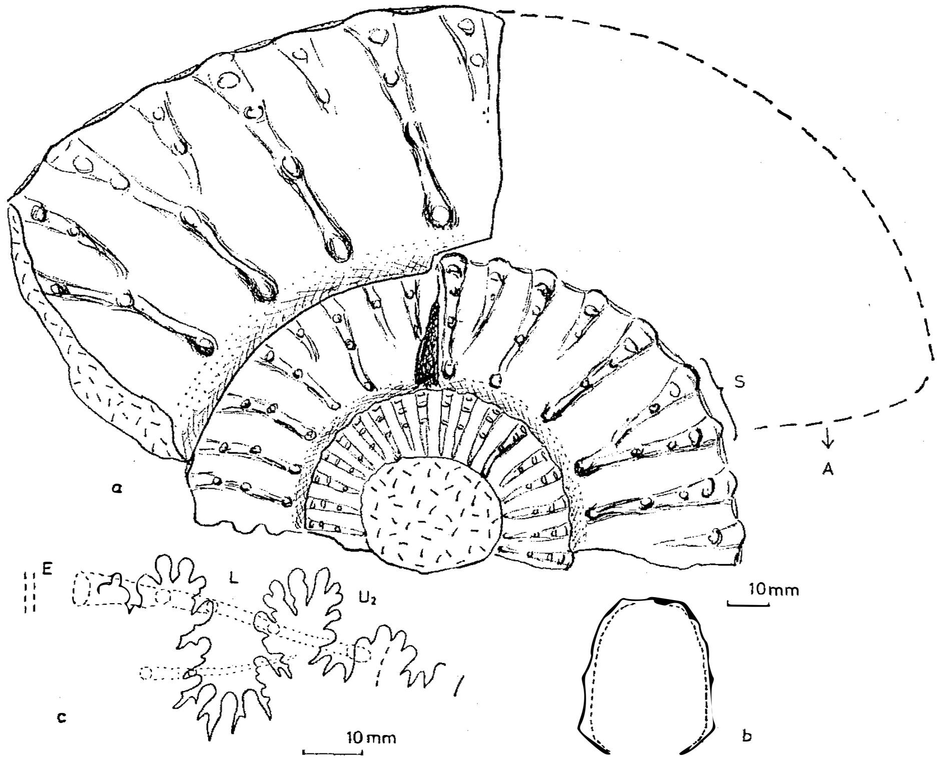

Fig. 2. *Texanites yazakii* sp. nov. Diagrammatic sketch of the holotype, GK. H 5856, from loc. Y 1120. Lateral view (a), in which the deformed last part is roughly outlined, with A towards anterior. Whorl-section (costal and intercostal) at the middle growth stage (b). External suture (c) at about S. (T. M. *delin.*)

anites) hourcqui COLLIGNON (1948, p. 78, pl. 10, fig. 1 ; pl. 7, fig. 1 ; 1966, p. 72, pl. 484, fig. 1957), from the Santonian of Madagascar, in the fairly large, widely umbilicate, evolute shell, slowly enlarging whorls with a subrectangular to subtrapezoidal cross-section, and strong straight ribs which show the intercalation or bifurcation occurring even on the adult whorl. It is, however, distinguished by its much more distant and somewhat rursiradiate ribs on the whorl of later growth-stages and the deeper, more diverging branches of L and the narrowed stem of the second lateral saddle. Tubercles are nearly equidistant in that Madagascar species, whilst they are arranged at unequal distance in our species as described above.

The present species is similar to *Texanites* (*Texanites*) *dichotomus* COLLIGNON (1948, p. 80, pl. 7, fig. 2 ; pl. 9, fig. 3 ; pl. 11, fig. 1), from the Upper Santonian of Madagascar, with respect to the frequent intercalation or branching of the secondary ribs and the deep branches diverged from the fairly narrow stem of L. That species from Madagascar is distinct from ours in its more rapidly growing whorls, narrower umbilicus, prorsiradiate (instead of rursiradiate) ribs, nearly equidistant configuration of the inner three rows of tubercles and on the average less compressed whorl. Moreover, a larger outer whorl has not yet been reported in that Madagascar species.

With respect to the configuration of

tubercles, the distant ribbing on the outer whorl, and the diverging branches of L, the present species is similar to *Texanites quadrangulatus* COLLIGNON (1966, p. 76, pl. 486, fig. 1961), from the Upper and the Middle Santonian of Madagascar, but its whorl is distinctly more compressed than the nearly square whorl (H.=B.) of *T. quadrangulatus* and this Madagascar species has simple, equally long ribs without notable intercalation or branching of the secondary rib.

The branching or intercalation of the ribs is characteristic of the genus *Submortoniceras*, which, however, is more involute, with rapidly growing whorls, and the ornaments (except for the umbilical tubercles) are weakened on the outer whorl. In the latter respect the present species is not related with *Submortoniceras*.

Occurrence:—The holotype was collected by one of us (Y. H.) from the mudstone exposed at loc. Y1120 on the left side of the creek called the Penke-horoka-yuparo, a tributary of the Shiyuparo in the Oyubari district, central Hokkaido; location approximately 7150 m east and 3150 m south from the northwestern corner (i. e. Lat. 43°10′N, Long. 142°0′E) of the geological map of Oyubari (NAGAO et al., 1954). It was embedded solitarily without accompanied macrofossils.

This locality is situated at about the middle of the "Santonian" sequence exposed along this stream, but whether it is assigned to the lower part of the Zone of *Inoceramus* (*Cladoceramus* ?) *japonicus* or to the upper part of the Zone of *Inoceramus* (*Platyceramus*) *amakusensis* is not determined on a direct evidence. The assignment to the latter in Fig. 1 (geological map) is tentative.

Appendix

Notes on the Santonian Biostratigraphy

Tatsuro MATSUMOTO

Introductory:—I have already summarized the biostratigraphic implications of the collignoniceratid ammonites from Hokkaido (MATSUMOTO, 1971, p. 153–156). Here I should like to give some notes from the interregional standpoint on the biostratigraphic subdivision and correlation of the Santonian primarily on the grounds of species of the Texanitinae.

The genus *Texanites* in a revised sense (MATSUMOTO, 1970, p. 266), including the subgenera *Texanites* (s. s.) and *Plesiotexanites*, is widespread in various regions of the world. Regarding the biostratigraphic implications of *Texanites* in the Santonian, at least four regions should be taken into consideration. They are western Europe, Madagascar, Texas and Japan.

Zonal occurrences in the four regions:—From the district of Charente, southwestern France, where COQUAND (1857) established the Santonian stage, DE GROSSOUVRE (1894) described a small specimen of *Texanites texanus* (ROEMER), which, was subsequently designated by COLLIGNON (1948b, p. 42) as the type (i. e. holotype) of *Texanites texanus* var. *gallica* COLLIGNON, and also another example of the same species [the same variety according to COLLIGNON, 1948] from Aude, Southern France. DE GROSSOUVRE (1901) subdivided the type Santonian into the Zone of *Texanites texanus* in the lower part and the Zone of *Placenticeras syrtale* (ROEMER) in the upper. There is in France an attempt of tripartite zonation of the Santonian, with the Zone of *Muniericeras lapparenti* at the middle (see POMEROL, 1975, p. 247), but this does not seem to be based on sound grounds of the data in the type sequence. *Muniericeras* is restricted to the Upper Santonian in the well studied sequence of Madagascar (COLLIGNON, 1966, p. 96).

In the Wessex-Paris Basin *Texanites* seems to be still rarer and *T.* cf. *texanus* was listed as a very rare species from the *Coranguinum* Zone of Kent (WRIGHT and WRIGHT, 1951, p. 30).

In the Münster Basin of Germany *Texanites pseudotexanus* (DE GROSSOUVRE) (1894) and *T.* (*P.*) *schlueteri* MATSUMOTO (1970) are known, but they are based on SCHLÜTER's old collections from the shafts in the Emscher Mergel, and it seems difficult to allocate them precisely in the up-to-date biostratigraphic sequence (letter from Dr. SEITZ).

Owing to the admirable works of COLLIGNON (1948a, b ; 1966) and BESAIRIE and COLLIGNON (1972), the Texanitinae are best studied both palaeontologically and biostratigraphically in Madagascar, where species of *Texanites* occur in three zones of the Santonian as follows :

(1) Lower Santonian Zone of *Texanites oliveti* (BLANCKENHORN), from which *T. texanus gallicus, T. texanus hispanicus* COLLIGNON and *T.* cf. *roemeri* (LASSWITZ) are also recorded.

(2) Middle Santonian : Zone of *Texanites hourcqui*, in which *T. hourcqui* var. *souromarayensis* COLLIGNON, *T. oliveti* var. *spinosa* COLLIGNON, *T. texanus gallicus, T. rarecostatus* COLLIGNON, *T. quadrangulatus* COLLIGNON, *T. venustus* COLLIGNON, *T. soutoni* (BAILY), *T.* aff. *quinquenodosus* (REDTENBACHER) and *T.* (*Plesiotexanites*) *stangeri* (BAILY), including var. *densicosta* SPATH and var. *sparsicosta* SPATH, also occur.

(3) Upper Santonian : Zone of *Pseudoschloenbachia umbulazi* (BAILY), in which *T. dichotomus* COLLIGEON, *T. mikobokensis* COLLIGNON, *T. ralijaonai* COLLIGNON are characteristic and also *T. quadrangulatus, T. texanus gallicus, T. texanus hispanicus, T. hourcqui* var. *souromarayensis, T. pseudotexanus, T. quinquenodosus* and *T.* (*P.*) *stangeri* var. *densicosta* are reported to occur.

The list may give some question about the taxonomy and nomenclature of certain taxa, which will be discussed in later pages.

In Texas, where the type-locality of *Texanites texanus* is located, YOUNG (1963) has accomplished another admirable work, showing a scheme of zonation for the Santonian of Texas and also a range chart of selected species, in addition to the full palaeontological descriptions. YOUNG has subdivided the Santonian of Texas as follows, without using the term Middle Santonian.

Lower Santonian
- (1) Zone of *Texanites stangeri densicostus*
- (2) Zone of *Texanites texanus texanus*
- (3) Zone of *Texanites texanus gallicus*

Upper Santonian
- (4) Zone of *Texanites shiloensis* YOUNG

The last species occurs, according to YOUNG (1963, p. 90), abundantly in the lower part of the Dessau Limestone of Austin Group. It ranges upward into the lower part of the Zone of *Submortoniceras tequestiquense* YOUNG, which is assigned to the lower part of the Lower Campanian. From the same zone *Texanites roemeri* (YABE and SHIMIZU) and probably also *Texanites lonsdalei* are recorded. These two species show characters which suggest a close affinity with *Submortoniceras*.

Another diagnostic species, *Texanites americanus* (LASSWITZ) typically occurs with *Inoceramus* (*Cladoceramus*) *undulatoplicatus* ROEMER in the lower half of the Santonian, but seems to extend upward to the top of unit C of the Austin Group (YOUNG, 1963, p. 84).

In Japan the available records (MATSU-

MOTTO and UEDA, 1962; MATSUMOTO, 1970; TANAKA and TERAOKA, 1973 and this paper) of species of *Texanites* and *Protexanites* may be summarized into three parts as follows:

(1) Lower part of the Santonian equivalent, i.e. the Lower half of the Zone of *Inoceramus* (*Platyceramus*) *amakusensis*: *Texanites oliveti* was found here at the type locality of *I.* (*P.*) *amakusensis* in Amakusa, western Kyushu. In Hokkaido this species has not yet been confirmed, but *Texanites* aff. *quinquenodosus* and *Protexanites* (*Protexanites*) *bontanti shimizui* MATSUMOTO occur in this part.

(2) Middle part, i.e. the upper part of the Zone of *Inoceramus* (*Platyceramus*) *amakusensis* and the lower part of the Zone of *Inoceramus* (*Cladoceramus* ?) *japonicus*: *Texanites* (*Plesiotexanites*) *kawasakii* (KAWADA), *T.* (*P.*) *pacificus* and *Protexanites* (*Anatexanites*) *fukazawai* (YABE and SHIMIZU) seem to characterize this part. *Texanites yazakii* sp. nov. is probably referred to this part.

(3) Upper part, i.e. the upper part of the Zone of *Inoceramus* (*Cladoceramus* ?) *japonicus*: *Texanites* cf. *shiloensis* is probably from this part. Its occurrence in the Zone of *Inoceramus* (*Sphenoceramus*) *orientalis* SOKOLOW, lower part of the Campanian, has recently been confirmed in Koshiki-jima, western Kyushu.

There are a few other species whose stratigraphic positions are not precisely known but somewhere in the Santonian equivalent in Japan. They are *T.* (*P.*) *sanushibense* (YABE and SHIMIZU) and *T.* (*P.*) *yezoensis* MATSUMOTO. The last species seems to occur rather in the upper half, i.e. the Zone of *Inoc.* (*Cladoc.* ?) *japonicus*, although its precise range is yet to be worked out.

Towards the interregional correlation:—Aside from the regions where a few texanitine species are known without records of successive occurrence, there is some difficulty in the zonal correlation of the Santonian between any two of the above mentioned better studied four regions. The difficulty comes from (1) that the widespread species which occur commonly between two regions are often rather long-ranging, as exemplified by *T. texanus*, *T. quinquenodosus* and *T.* (*P.*) *stangeri*; (2) that the zones are rather of provincial subdivisions defined on the basis of biostratigraphic records in respective regions, as best exemplified by YOUNG's (1963) work in the Gulf Coast province; and (3) that some of the characteristic species of a zone have a restricted geographical distribution and have not yet or scarcely been found from other regions, for instance, *T. hourcqui*, *T. mikobokensis*, *T. ralijaonai*, *T. quadrangulatus* and *T. dichotomus* in Madagascar, *T. americanus* in Texas, and *T.* (*P.*) *kawasakii*, *T.* (*P.*) *pacificus*, *T.* (*T.*) *yazakii* and *Protexanites* (*Anatexanites*) *fukazawai* in the Japanese province.

In connexion with these points the problem of speciation and phyletic evolution in *Texanites* and related genera should be worked out. Our present knowledge is not satisfactory for these requirements. *Texanites texanus* (ROEMER), for instance, was subdivided into "varieties" by COLLIGNON (1948a, b) with the implication of geographic subspecies: *T. texanus texanus* in Texas, *T. texanus gallicus* in France and other circum-Alpine area, and *T. texanus hispanicus* in Spain. Although COLLIGNON (1966) subsequently regarded them as distinct species, YOUNG (1973) has kept COLLIGNON's earlier intention and has added *T. texanus twiningi* from Trans-Pecos Texas. I should like to admit this subspecific separation as reasonable, if it could fit the facts in the nature. Actually the extent of variation has not yet been so satisfactorily studied to make clear the relations of the nominal subspecies. It is difficult for me to understand the meaning of the fact that *T. texanus galicus* and *T. texanus hispanicus* both occur in Madagascar and are recorded from any of the three zones. In Texas *T. texanus galicus* does occur but in a zone above that of *T. texanus texanus*. Does this mean that the French subspecies migrated back to Texas in a delayed geological age? Or is *T. texanus galicus* a "chronological subspecies" of *T. texanus texanus*? In the latter case did *T. texanus galicus* migrate to France, Madagascar and other regions in that delayed age ? The reason why the lower three zones in Texas were assigned to the Lower Santonian was that *T. texanus gallicus,* the same subspecies as the index of the Lower Santonian in France, characterizes the third zone (YOUNG, 1963, table 7). In view of the long range of *T. texanus gallicus,* as shown in Madagascar, such a reasoning would not necessarily be maintained in the interregional correlation. Thus, it seems me difficult to conclude an interregional correlation in such a fine scale by means of the hitherto known subspecies of *T. texanus* and furthermore, even the adequacy of this subspecific separation may become doubtful. Should we follow COLLIGNON's later interpretation of specific distinction, the separated species would be said useless for the correlation in a fine scale. It would be desirable to reexamine the true state through the concept of population palaeontology.

The hitherto admitted subspecies within *Texanites (Plesiotexanites) stangeri* (BAILY) is likewise meaningless, although SPATH's (1922) variety names *densicosta* and *sparsicosta* may be convenient to express certain forms in the variation of that species. Be that as it may, *T. (P.) stangeri* is widespread, being found even in Hokkaido, but seems to have a long vertical true range, since it is recorded to characterize the lower part of the Lower Santonian in Texas and to occur in the Middle and Upper Santonian of Madagascar. Thus, in the world scale the well known species *T. texanus* and *T. (P.) stangeri* can only indicate the Santonian stage and do not seem to be suitable for finer correlation.

Texanites (T.) oliveti seems to be a better index species, for it occurs in a comparatively lower part of the Santonian in both Madagascar and Japan. By courtesy of Dr. W. A. COBBAN I saw once a probable example of *Texanites oliveti* in the collection of the United States Geological Survey at Denver, which came from loc. USGS. 1467 in western Texas. As it is associated with *Clioscaphites vermiformis* (MEEK and HAYDEN), it records the occurrence of this species in the lower part of the Santonian in North America.

Texanites oliveti in the above discussion is in the sense of redefinition by COLLIGNON (1948a, p. 72). Whether this is truly identical with the original of *Mortoniceras oliveti* BLANCKENHORN (1905) or not may be a question, since the type specimen from the Middle East is secondarily much compressed. Furthermore, whether *T. oliveti* (of a larger size) from the Middle East is specifically well distinguished from *T. quinquenodosus* (of smaller sizes) may be another problem. In the Middle East, according to Dr. Z. LEWY (1977, personal information), *Texanites* sp. of the *quinquenodosus* subgroups occurs in the Lower Santonian closely associated with *Spinaptychus spinosus*. Whether *T. oliveti* var. *spinosa* COLLIGNON is a mere variant or has a meaning of the so-called chronological subspecies should also be reexamined.

Texanites (*Plesiotexanites*) *shiloensis* seems to be another good index of the Upper Santonian plus basal Campanian, because its occurence in Texas and Japan show a good correspondence. Certain associated species can tell the discrimination of the Upper Santonian from the Lower Campanian.

Despite a number of difficulties, I dare attempt to set forth a tentative scheme of a tripartite subdivision of the Santonian by ammonites as a step towards future refinement. The three zones in Madagascar are tentatively correlated with the tripartite units in Japan; the fourth zone in Texas with the upper unit in Japan; the second and the third zones in Texas are assumed to be approximately correlated with the Middle Santonian in Madagascar (and in Japan). When we admit this scheme, how the three parts are correlated respectively with what parts of the Santonian in France and other areas of western Europe is a keen problem. Anyhow, on the ground of this provisional correlation, a tentative range-chart of some selected species of the Texanitinae is shown in Fig. 3. In a few cases the range of a species is definitely known by the successive occurrence of its fossils in a measured sequence. In many other cases the locality records of a named species are scattered somewhere within a given unit. Even in such a case, the species is tentatively indicated in Fig. 3 as if it ranges throughout the unit. When the available records are still more uncertain, the presumed range is indicated by a broken line in the chart. These may be revised in the future, if more accurate locality records are enough assembled. The chart (Fig. 3) contains *Texanites* (*Plesiotexanites*) *thompsoni* (JONES) (see MATSUMOTO, 1970, p. 277), as an example from the West Coast of North America, for the age of which I depend on DOUGLAS (1969) who refined the record of JONES (1966). The chart may also be useful to know the general evolutionary pattern of *Texanites* species. As is shown in Fig. 3, the diverging speciation is considerable in *Texanites*, whilst little has been known about the successive phyletic evolution of a particular lineage. The dotted line connecting any set of two species in Fig. 3 means that the two species are described to be allied to each other, although the actual line of descent has not yet been traced with sufficient evidence. There are a few long-ranging species. Certain species of restricted distribution may have been diverged or specialized from a common root species simultaneously or at dissimilar times. Only a roughly parallel similarity is found between certain two species with respect to a certain character but they are dissimilar in other characters. *T. yazakii* and *T. hourcqui* may demonstrate such a case of seemingly similar but actually differentiated or diverged species. Their presumed contemporarity is by no means strictly evidenced. Therefore, they should not be too much relied upon for a precise interregional correlation, until their wider distribution be known.

Incidentally, *T. hourcqui* has been reported from bed 72 in the upper part of the Calendin Formation of Peru which is assigned to the Zone of *Lenticeras baltai* LISSON (BENAVIDES-CACERAS, 1956). The age of this zone was regarded by the same author as early Santonian. Presumably he must have depended on COLLIGNON's earlier paper (1948a, p. 79), in which the age of *T. hourcqui* was referred to the Upper Coniacian or the Lower Santonian. In the later works of COLLIGNON (1966) and BESAIRIE and COLLIGNON (1972) *T. hourcqui* has turned to be a zonal index of the Middle

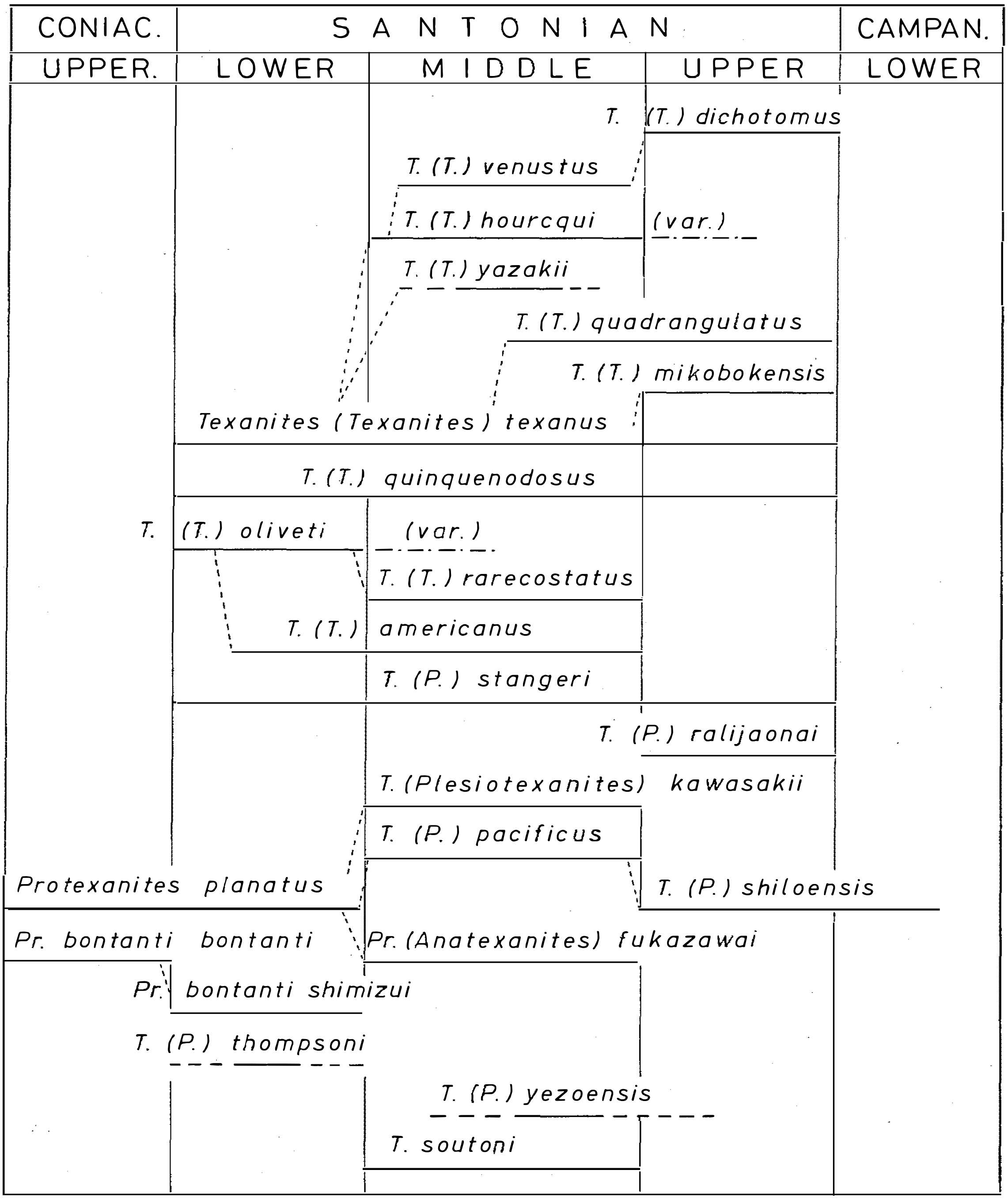

Fig. 3. Selected species of Santonian Texanitinae and their known stratigraphic ranges in the tentative scheme of subdivision.

Santonian.

Finally I must give comments on some inoceramid species. The well known species *Inoceramus* (*Cladoceramus*) *undulatoplicatus* ROEMER is regarded as a world-wide index of the Lower Santonian (KAUFFMAN, 1975, oral comm.). In Texas, the type area of this species, YOUNG (1963, text-fig. 4) has clearly indicated that it ranges in the lower part of the

Santonian, occurring in the first two zones of *Texanites*. As it is distributed widely in various regions and occurs more abundantly than any species of *Texanites*, it must be useful to check the age correlation between species of *Texanites* or other ammonites of scattered occurrence. This should, however, be maintained within the true distributional area of *I.* (*C.*) *undulatoplicatus*.

Inoceramus (*Cladoceramus* ?) *japonicus* NAGAO and MATSUMOTO in a revised sense [see MATSUMOTO and UEDA (1962, p. 165) in which the best preserved SASA's specimen (forma γ of NAGAO and MATSUMOTO, 1940, pl. 9, fig. 1; MATSUMOTO and UEDA, 1962, pl. 24, fig. 1) was designated as the lectotype] characterizes the upper part of the Santonian correlative in Japan, while *Inoceramus* (*Platyceramus*) *amakusensis* is characteristic of the lower part. Now, *I.* (*C.* ?) *japonicus* is seemingly very similar to *I.* (*C.*) *undulatoplicatus* and some authors (e.g. STEPHENSON, 1950) considered that they could be identical. If this was admitted, then the age discrepancy would be evident in the stratigraphic occurrence of this "identical species" between the Japanese (or northwestern Pacific) and the Euramerican provinces. The associated *Texanites* species may demonstrate this. I still hold the opinion of MATSUMOTO and UEDA (1962) that *I.* (*C.* ?) *japonicus* is not identical with *I.* (*C.*) *undulatoplicatus* but that they show a convergence in the divergent ribbing between fairly close but not quite identical lineages. SEITZ (1961, p. 109) seems to have the same opinion.

In concluding the above discussions, a number of questions has been pointed out to be worked out in the future towards a refined scheme of Santonian zonation and correlation.

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北海道産の新しいテキサナイテス： 北海道上部白亜系産の Texanitinae(Collignoniceratidae 科の中の1亜科) に属するアンモナイトは，MATSUMOTO (1970) のモノグラフに記載されているが，最近大夕張地方を地質調査中に，従来記載されていないテキサナイテスを採集した。これはマダガスカル産の *Texanites hourcqui* に，殻形と肋の挿入や分岐が成年時まである点などが似ているが，突起の配列の間隔や縫合線の L の性状などに明確な差異があり，特異な1新種を代表するとみなされるので，ここに記載する。産出層はサントニアン相当部のほぼ中ほどであり，住房を持ったやや大型の化石が，比較的沖合相の泥岩に孤立して産したことも興味がある。 松本達郎・原口善光

附録： この機会に，サントニアンの化石層序学的区分と対比について，テキサナイト亜科の種を中心として，国際的見地からの論議を試みる。 松本達郎

Explanation of Plate 42

Figs. 1-2. *Texanites yazakii* sp. nov. .... Page 307
Holotype, GK. H5865, from loc. Y1120, collected by Y. HARAGUCHI.
1. Lateral (a), ventral (b) and frontal (c) views of the inner whorls, ×1.
2. Lateral view of the entire specimen, excluding the deformed last part, ×0.5.

Kyushu University (K. TANABE) photos without whitening.

2

1b

1c

1a