

Early Tithonian (Late Jurassic) Ammonite *Parapallasiceras* newly discovered from the Itoshiro Subgroup (Tetori Group) in the Hida Belt, northern Central Japan

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(Communicated by Tatsuro MATSUMOTO, M. J. A.)

Abstract: Early Tithonian (Late Jurassic) ammonite *Parapallasiceras* cf. *pseudocontiguum* (Donze and Enay) was discovered *in situ* from the Kamihambara Formation of the Itoshiro Subgroup (Tetori Group) distributed in the Hida Belt, in Fukui Prefecture, northern Central Japan. It is a Perisphinctid characterized by polygrate ribbing and can be compared to the said species originally described in Southeast France. The species occurs in the Lower Tithonian of the Submediterranean region. Therefore at least a part of the Itoshiro Subgroup can be dated Early Tithonian, judged by this ammonite.

Key words: Ammonoidea; Tithonian; Jurassic; Tetori Group; *Parapallasiceras*.

Introduction. The Tetori Group is a series of clastic rocks of Middle Jurassic to Cretaceous age, widely distributed in the Hida Belt of the Inner Japan. It covers unconformably older igneous, metamorphic and sedimentary rocks, giving a chronological constraint to the crustal movement which took place in the Mesozoic Japanese Islands. The group was subdivided into three subgroups by Maeda (1961),¹⁾ namely Kuzuryu, Itoshiro and Akaiwa Subgroups in ascending order, and this classification is generally accepted up to now.

The lower Kuzuryu Subgroup includes at least four ammonite assemblage zones (Sato & Westermann, 1991)²⁾ which range from late Bathonian to middle Oxfordian in age. The upper Akaiwa Subgroup is a series of fresh water sediments, dated basically Early Cretaceous mostly by plants and fresh water mollusks. The intermediate Itoshiro Subgroup is in turn composed mostly of brackish water sediments, though a few marine beds are intercalated as shown by the occurrences of marine bivalves. The subgroup has been dated late Late Jurassic to early Early Cretaceous by mollusks and plants (e.g. Maeda, 1961).¹⁾

An Early Cretaceous ammonite, *Pseudothurmannia*, was discovered from the Uchinami River area in Ono City, but unfortunately from a float. The strati-

graphic position of this ammonite horizon was tentatively assigned by lithological similarity to the Itsuki Formation of the Itoshiro Subgroup by Goto (2001),³⁾ but it is not definitive. The age suggested by this ammonite is late Hauterivian to early Barremian. This was adopted later by Fujita (2002).⁴⁾

Recently, beautifully preserved ammonites are discovered *in situ* from a locality in a branch valley of the Tachiiwa-dani on the northern slope of the Kuzuryu Lake, first by one of the co-authors (T. Y.), then by K. Hachiya, H. Kato, Y. Mizuno, T. Momoyama, F. Sakakura and other members of the Tokai Fossil Society at Nagoya.

The ammonites are indicative of early Tithonian age, as described below. This is the first report of the ammonites from the Itoshiro Subgroup with rigorous stratigraphical control. One of the co-authors (T. Y.) established the stratigraphical position of the ammonite-bearing horizon and the other (T. S.) studied the specimens paleontologically. The stratigraphical and paleontological descriptions follow.

Location and stratigraphy. The ammonites studied here were discovered and collected from a locality in a branch valley of the Tachiiwa-dani, in the eastern part of Izumi-mura, Fukui Prefecture, on the northern slope of the Kuzuryu Lake (Fig. 1). The locality is situated in the easternmost part of the upper Kuzuryu River area, where the Tetori Group is most completely exposed.

A sketch map of the area and the lithological succession established along the traverse section are given

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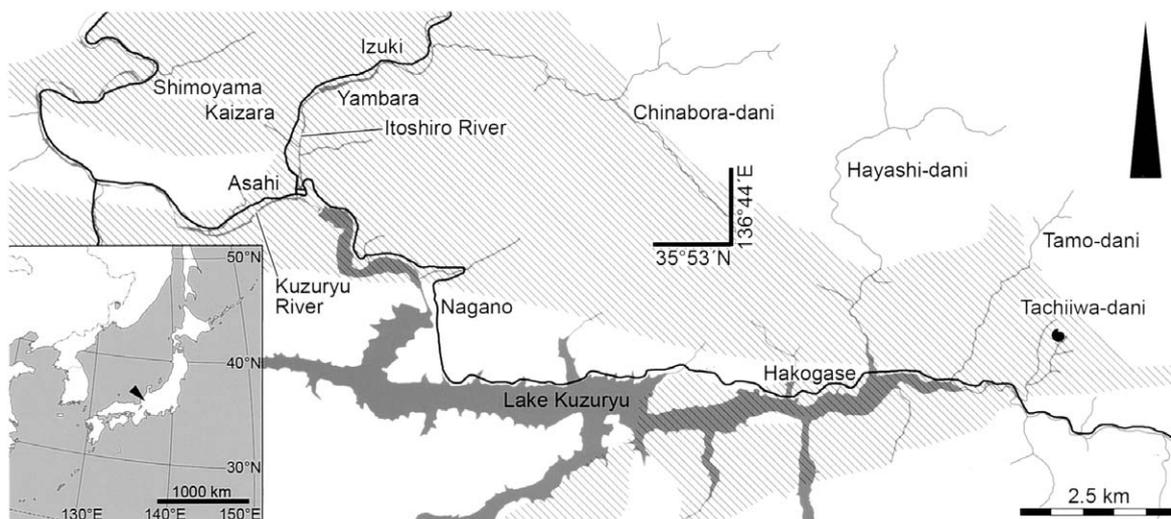


Fig. 1. Index map of the fossil locality. Shaded area denotes the area of distribution of the Tetori Group in the Kuzuryu River area. Ammonite-shaped dot indicates the fossil locality. Adopted from the Geological Map of Gifu Prefecture at the scale of 1:200,000.

in Fig. 2. The beds exposed here are exclusively clastic, predominantly sandstone and siltstone, with various sedimentary structures including bioturbation.

The observable sequence can be classified into the Ashidani and Kamihambara Formations (Fujita, 2002)⁴ judged from the horizontal continuity, lithology and contained fossil fauna.

The Kamihambara Formation, upper part of the sequence, consists mainly of fine- to medium-grained sandstone and siltstone, with a conglomerate bed at the base. The sandstone beds show frequently graded bedding and symmetrical ripple-laminae. The siltstone is often bioturbated and/or laminated. Slump blocks occur in the upper part. These features suggest the slope condition as a whole for the depositional environment of the formation.

The ammonites described here were collected from the horizon IT024, at the topmost part of the studied sequence (Fig. 2). They are accompanied by *Solemya suprajurensis* Hayami and *Nuculopsis* sp. The locality of *Inoceramus* sp. cf. *I. maedae* Hayami and *Oxytoma tetoriensis* Hayami described by Fujita *et al.* (1998, their Loc. 3 on p. 53)⁵ is situated at a slightly lower horizon, here designated as IT021.

Chronological discussion. The genus *Parapallasiceras*, to which the present species is judged to belong, was established by Spath (1925)⁶ on *Berriasella praecox* Schneid⁷ as type species. This species is reported from the upper part of upper lower

Tithonian of Franconian Alb in Germany (Schneid, 1915).⁷ The genus is distributed as a whole in the "Submediterranean region" (Ogg, 2004)⁸ including southern Germany, SE France and Carpathians. It is also known from Somaliland, Himalaya, South Andes and so on. Among species belonging to the genus, *P. pseudocontiguus* (Donze and Enay),⁹ closely related to the present form, occurs in the lower Tithonian of SE France and the upper lower Tithonian of Franconian Alb (Zeiss, 1968).¹⁰ More precisely, it occurs in the *Semiformiceras fallauxi* Zone (Enay and Geysant, 1975)¹¹ or in the *Parapallasiceras (Danubisphinctes) palatinum* Zone (Zeiss, 1968),¹⁰ both of lower Tithonian. Though the age of some other species of the genus ranges up to the middle Tithonian, the Itoshiro ammonites can be judged to indicate the early Tithonian age.

In conclusion, the age of the Kamihambara Formation, at least its ammonite-bearing horizon, is early Tithonian. The age of the Itoshiro Subgroup should thereby include early Tithonian.

The Kuzuryu Subgroup, lower member of the Tetori Group, ranges from the *Clydoniceras discus* Zone (upper Bathonian) to the *Gregoryceras transversarium* Zone (upper middle Oxfordian) by ammonites (Sato and Westermann, 1991).² The latter age gives therefore the constraint to the earliest age of the Itoshiro Subgroup.

The late Hauterivian to early Barremian age, sug-

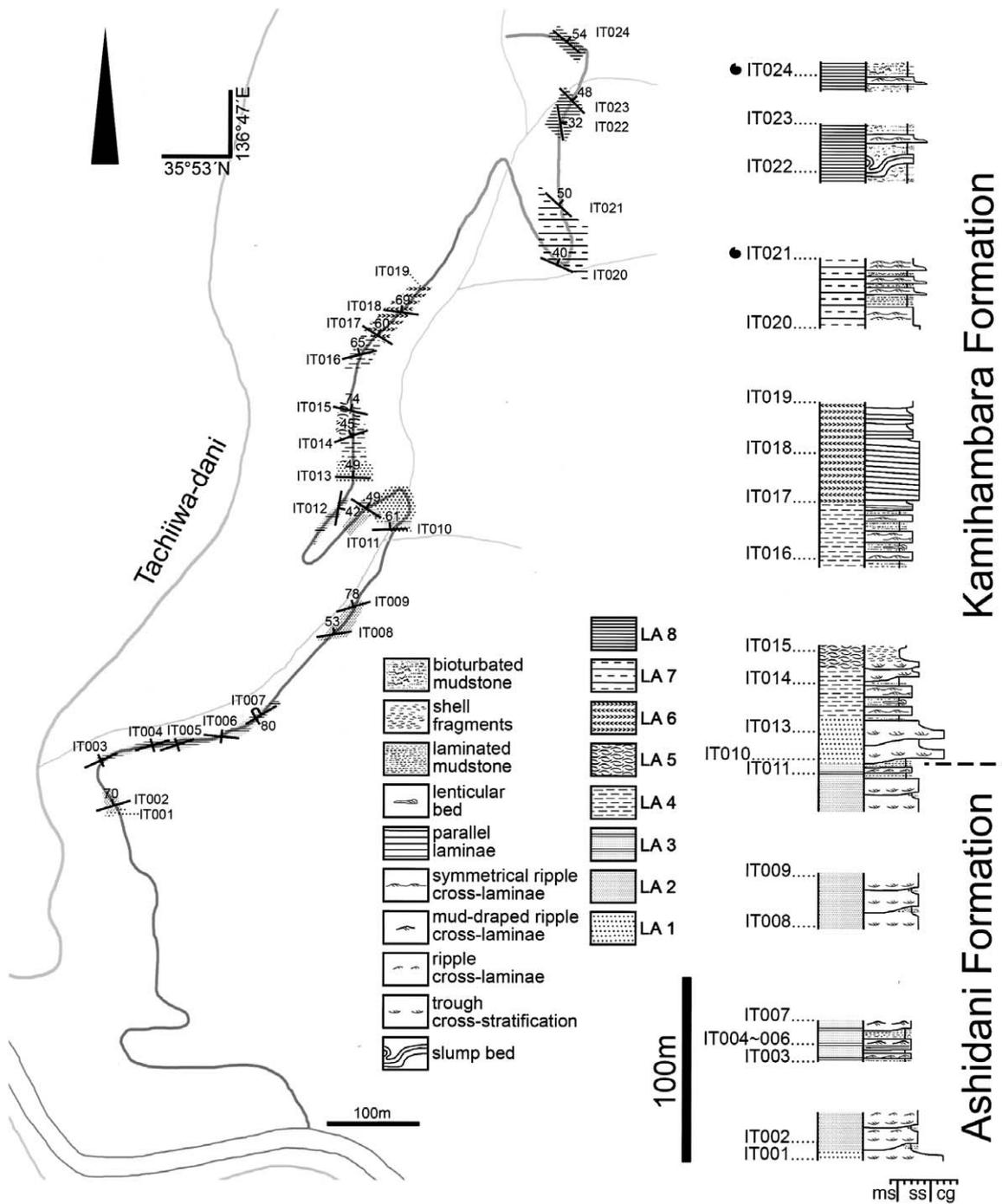


Fig. 2. Columnar sections along the logging road in the branch valley of Tachiwa-dani. IT024: Ammonite locality; IT021 Inoceramus locality. Lithofacies associations, LA1: trough-cross-stratified conglomerate beds grading to medium to coarse sandstone; LA2: trough-cross-stratified medium sandstone beds grading to parallel laminated fine sandstone; LA3: alternation of very fine parallel laminated sandstone and ripple-cross-laminated fine sandstone; LA4: alternation of parallel-laminated siltstone and ripple-cross-laminated fine sandstone; LA5: siltstone and very fine to medium sandstone with densely aggregated shell fragments; LA6: planar stratified fine to medium sandstone; LA7: sandstone with graded bedding (from coarse to fine grain size) interbedded with parallel-laminated very fine sandstone, characterized by mud-draped ripple cross-laminae with somewhat symmetrical crests; LA8: bioturbated siltstone intercalated with coarse to fine sandstone, characterized by mud-draped ripple cross-laminae with somewhat symmetrical crests, containing slumped blocks.

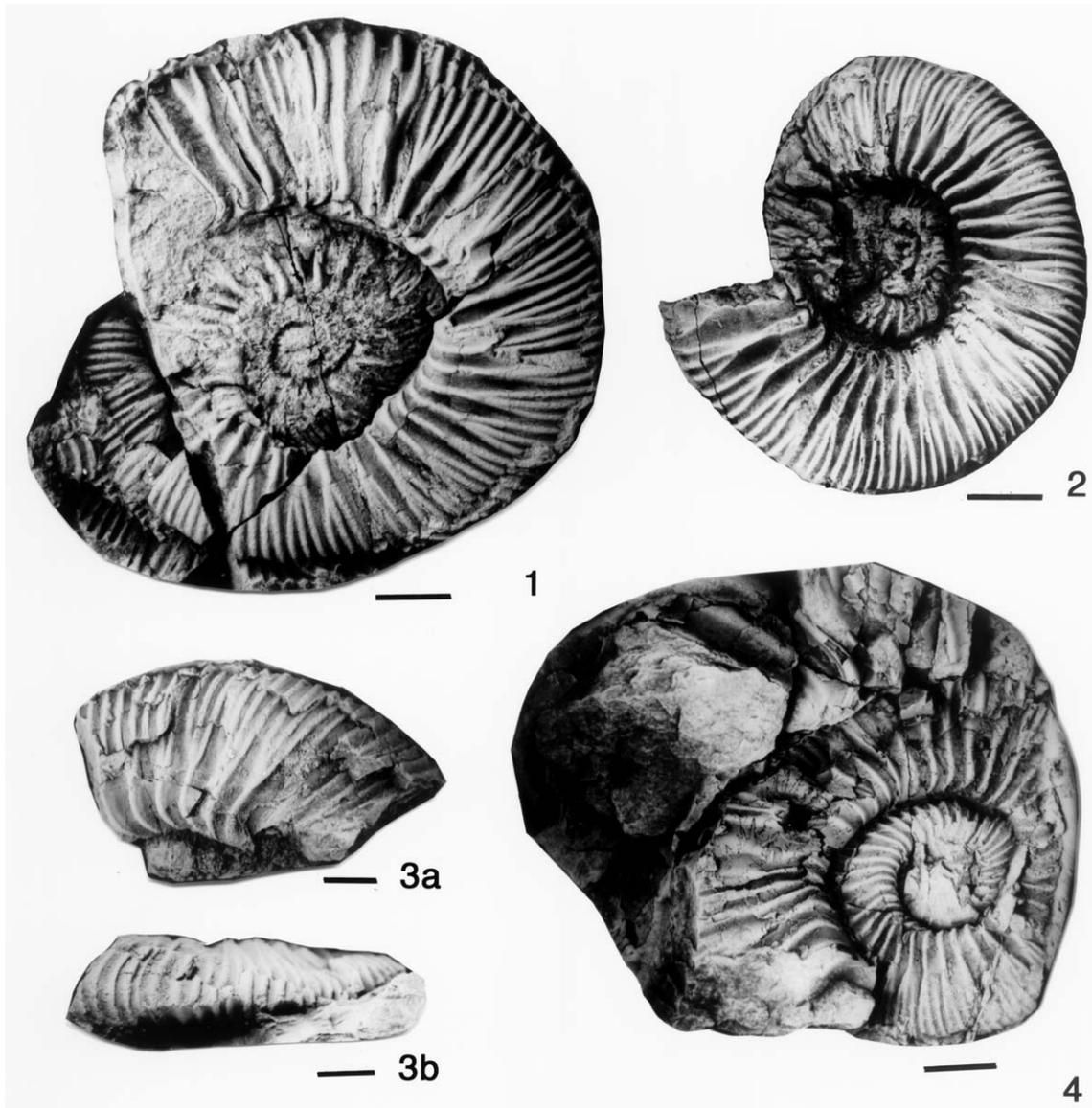


Fig. 3. *Parapallasiceras* cf. *pseudocontiguus* (Donze & Enay). All collected at the Locality IT024 (cf. Fig. 2) in the Tachiiwadani, Izumi-mura. 1: NSM-PM-17146 (coll. H. Kato, T. Momoyama, K. Hachiya), side view; 2: NSM-PM-17147 (coll. F. Sakakura), side view; 3: NSM-PM-17157 (coll. Y. Mizuno), 3a side view, 3b ventral view; 4 NSM-PM-17148 (coll. F. Sakakura), side view. Scale bar: 10 mm.

gested by Fujita (2002),⁴⁾ could give the upper age limit of the subgroup. Fossil spores and pollen obtained from the Itoshiro and Akaiwa Subgroups (Umetsu and Matsuoka, 2003)¹²⁾ is not inconsistent with the age discussed above.

Correlation. A similar sequence is exposed in the Shokawa area, about 20 km northeast of the present area. The ammonite-bearing Mitarasi (*sic*) Formation (Iwaya, 1940)¹³⁾ is of Tithonian-Berriasian age, as shown recently by a rich ammonite fauna (Sato *et al.*,

2003).¹⁴⁾ Therefore this is nearly contemporary with the Kamihambara Formation, and strongly suggests that the Mitarasi Formation as well as underlying Ushimaru Formation are better placed in the Itoshiro Subgroup, instead the Kuzuryu Subgroup as generally accepted until now (e.g. Matsukawa *et al.*, 2003).¹⁵⁾

Systematic Description

Family Perisphinctidae Steinmann, 1890
Subfamily Virgatosphinctinae Spath, 1923

Table I. Measurements in mm., excluding fragmentary specimens

Registration Number	Diameter D	Umbilical Diameter UD	Whorl Height H	Whorl Width W	UD/D	Number of primary ribs per whorl	Number of secondary ribs per whorl
NSM-PM-17146	74.0	36.0	22.2	?	0.3	36	
Id. (Inner whorl)	49.2	20.6	20.5	?	0.41		
17147	61.5	23.2	21.6	ca 12.5	0.35	35	96
17148	79.2	37.5	25.4	?	0.32	37	
Id. (Inner whorl)	55.3	20.0	20.0	ca 19	0.36	35	
17149	ca 66	29.0	ca 27	?		32 ?	
17152	45.0	15.7	16 ?	?	0.35	ca 34	
17153	ca 74	28.7	ca 25	?	ca 0.3	34	
Id. (Inner whorl)	ca 56	19.8	21.8	?	ca 0.38	32	
17155	22.0	4.9	12	ca 5	0.22	20 +	
17157			31.4	12.5			60
17158	12.5	2.0	5.4	?	0.20	22 +	

Genus *Parapallasiceras* Spath, 1925⁶⁾

Parapallasiceras cf. *pseudocontiguum* (Donze and Enay)⁹⁾

Fig. 3.

cf. 1961 *Subplanites pseudocontiguus*, Donze and Enay, p. 110, Pl. 16, Figs. 1-2 (Holotype).⁹⁾

cf. 1968 *Parapallasiceras* (*Parapallasiceras*) *pseudocontiguum*, Zeiss, p. 108, Pl. 19, Fig. 5; Pl. 21, Fig. 1.¹⁰⁾

Materials: Thirteen specimens collected from the upper Tachiwa-dani area. All specimens are kept in the National Science Museum, with the registration numbers of NSM-PM-17146 to NSM-PM-17158.

Collection: NSM-PM-17146 assembled from three pieces collected separately by H. Kato, T. Momoyama and K. Hachiya; 17147 and 17148 by F. Sakakura; 17150, 17151, 17153, 17156, 17157 and 17158 by Y. Mizuno; 17152 and 17155 by K. Hachiya; 17149 and 17154 unknown collection.

Measurements: see Table I (excluding fragmentary specimens).

Description: Planispiral whorls with moderately involute coiling (ratio of umbilical diameter to diameter around 0.35); whorl section not precisely determined because of deformation, but presumably compressed

elliptical with maximum thickness at the umbilical margin; flank generally flat but slightly convex; ventral region rounded without furrows or ridges; umbilicus shallow, bounded by rounded but steep wall; one or two somewhat oblique, deep constrictions per whorl, accompanied by simple or irregular ribs. Ribbing sharp, numerous, generally rectiradiate, with slightly backward inclination at the umbilical margin; ribs generally dichotomous in inner whorls, but predominantly polygyrate in outer whorls with some trifurcated or bifurcated ribs inserted; branching generally at the middle of flanks; polygyrate secondary ribs branched off on both sides of the primaries, and generally curved backwards; sometimes primaries at the first branching points are elevated to make sharp, narrow ridges which look like minuscule tubercles; secondary ribs pass through the ventral region without interruption.

Near the aperture ribs become remarkably thick and spacious, accompanied by deep constriction and irregular ribs. Exact shape of aperture is not known. Suture lines are generally deeply incised, and characterized by strong, tripartite first lateral lobes and smaller but independent second lateral lobes.

Comparisons: The general shell form of this species is quite similar to that of *P. pseudocontiguum*, created by Donze and Enay (1961, Pl. 16, figs. 1-2)⁹⁾ as *Subplanites pseudocontiguus*, on the basis of the specimens collected from La Croix-de-Saint-Concors

near Chambéry, SE France. The species was originally classified to the genus *Subplanites* Spath, 1925,⁶⁾ but later transferred to the present genus by Zeiss (1968).¹⁰⁾ The ribbing of the Itoshiro form is almost identical to that of *P. pseudocontiguum*.

Of other forms identified with this species by the last author, a specimen rather small in size (about 6 cm in diameter) (Zeiss, pl. 19, Fig. 5)¹⁰⁾ showing quite similar ornamentation, is provided with clearly projected lateral lappets, which are unfortunately not preserved in the Japanese form. Among other *Parapallasiceras* species, *P. lateumbilicatum* (Zeiss, p. 106, Pl. 22, Fig. 1),¹⁰⁾ founded on imperfect specimens, shows very similar ribbing at least on the preserved whorls, but it is impossible to compare specifically with the Japanese form, because of the imperfect state of preservation. In conclusion, it is appropriate to describe the present form as *Parapallasiceras* cf. *pseudocontiguum*.

Remarks: The genus *Parapallasiceras* was created by Spath (1925)⁶⁾ on *Berriasella praecox* Schneid in his monograph of the Somaliland ammonites. This genus was rejected by Mazenot (1939),¹⁶⁾ who retained the generic assignment of *Berriasella* for this immature species. Donze and Enay (1961)⁹⁾ declined to adopt *Parapallasiceras*. However, Arkell *et al.* (1957, p. L329)¹⁷⁾ retained Spath's genus, and placed it in the subfamily Virgatosphinctinae. Zeiss (1968)¹⁰⁾ adopted Spath's *Parapallasiceras* and placed some other species in this genus in his monograph on the Lower Tithonian ammonites of southern Franconian Alb in Germany. He also noticed that *Parapallasiceras* s.s. represents a microconch and created a subgenus *Danubisphinctes* for corresponding macroconch which is characterized by larger size and simple aperture. Thus his *Parapallasiceras* includes two subgenera *Parapallasiceras* s.s. and *Danubisphinctes*. Later Cecca and Enay (1991)¹⁸⁾ followed the same classification, when they described two species of *Parapallasiceras* from the Ardèche region in SE France. Therefore, the sexual dimorphism between *Parapallasiceras* and *Danubisphinctes* is not formally accepted until present.

It is worthy of noting that lateral lappets possibly exist at the apertural region of the specimen NSM-PM-17147 (Fig. 3, no.2). If so, the present species from the Itoshiro Subgroup seems to be microconch, as suggested by its smaller size (about 70 to 80 cm in diameter). This is one reason why the present form is placed in *Parapallasiceras*, not in *Danubisphinctes*, though the general feature is also quite similar.

Stratigraphic horizon: Upper part of the Kamihambara Formation, a member of the Itoshiro Subgroup of the Tetori Group.

Geological age: Early Tithonian.

Acknowledgments. The authors thank Messrs. Kiichiro Hachiya, Hisao Kato, Yoshiaki Mizuno, Takashi Momoyama and Fujio Sakakura of the Tokai Fossil Society for providing us the opportunity to study this interesting faunule. Thanks are also due to Professor Em. Tatsuro Matsumoto, M. J. A., and Professor Em. Hisayoshi Igo of the University of Tsukuba for the critical reading the manuscript.

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(Received July 27, 2005; accepted Sept. 12, 2005)