Bull. Nat. Sci. Mus. Tokyo, 9 (1), February 26, 1966

An Acanthoceratid Ammonite from Sakhalin

By

Tatsuro MATSUMOTO

Department of Geology, Kyushu University, Fukuoka

and

Ikuwo OBATA

Department of Palaeontology, National Science Museum, Tokyo

Introductory Notes

While ammonites belonging to Acanthoceratidae are found fairly frequently in the Cretaceous of Hokkaido, they are, for some reasons, very rare in that of Sakhalin. *Pseudaspidoceras* cf. *armatum* PERVINQUIÈRE may be a sole example of the family among the numerous ammonoid species listed or described in the previous papers (see SHIMIZU, 1935, p. 177). Therefore we have been anxious to obtain more examples.

One of us (I.O.) had an opportunity to look through the collection of the late Mr. Shokichi NAKASE, preserved in the Agricultural Museum attached to the Shrine of Ise, Miye Prefecture. This collection is primarily made up of the fossils from South Sakhalin, which are mostly of the species familiar to us. However, there is among them one specimen of interesting acanthoceratid ammonite, which has been kindly transferred to the Department of Palaeontology, National Science Museum, Tokyo. This paper is a report of our study of this acanthoceratid ammonite.

Palaeontologic Description

Family Acanthoceratidae

Subfamily Acanthoceratinae

Genus **Acanthoceras** NEUMAYR, 1875

Type-species. Ammonites rhotomagensis DEFRANCE in BRONGNIART, 1822, as subsequently designated by DE GROSSOUVRE, 1894, p. 27.

Generic diagnosis. The shell-form in later growth-stages is characterized by rather evolute whorls with quadrate or subquadrate sections, being nearly as broad as or broader than high.

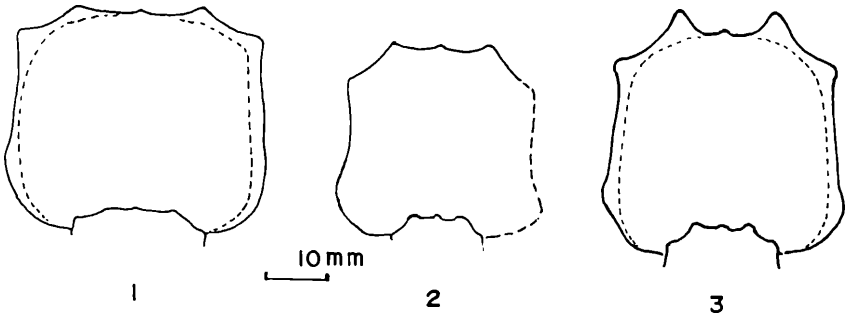
The ribs are typically rather low, while the tubercles are well developed. In some species the ribs may be moderately strong at least in a part of the growth-stages. On

the inner whorls the ribs are alternated in length, but on the outer whorl they are equally long and rather distant. They are usually rectiradiate or slightly prorsiradiate but occasionally somewhat flexuous. There are seven rows of tubercles. The umbilical tubercles are rather bullate and their highest point may be shifted upward as the whorl enlarges. The ventrolateral (or to be better called lower ventrolateral) ones are usually most prominent, forming horns on the outer whorl of some species. The paired ventral (i.e. upper ventrolateral) tubercles are moderately strong in early growth-stages, being sometimes clavate, but sooner or later become weak. They may be finally obsolete or absorbed by horn-like ventrolateral tubercles. The siphonal tubercles are the weakest of all and become obsolete in more or less late growth-stage. They may finally disappear. Sometimes they are clavate and apparently form a low, discontinuous keel-like elevation.

The suture is less complex. The ventral lobe (E) is the deepest. The lateral lobe (L) is of moderate depth and breadth, typically bifurcated at the bottom but may be modified. The first lateral saddle between E and L is broad, subquadrate in a rough outline, and bipartite with a small lobule in the middle. The second lateral saddle and U_2 are about half as small as the first lateral saddle and L respectively and are rather of irregular shape. Minor incisions of the suture are relatively shallow.

Remarks. The above diagnosis is essentially similar to but somewhat modified from that given by MATSUMOTO *et al.*, 1957 (p. 32) on the basis of studying more examples.

The specific name of the type-species, *Acanthoceras rhotomagense*, is well known, but the species itself needs up-to-date restudy. We have not seen the type-specimens of DEFRANCE and need the redescription and reillustration of them by someone who is accessible to the French specimens. We do not either precisely know the true extent of variation and the details of its ontogenetic change of this species. The specimens which are probably identified to *A. rhotomagense* (e.g. D'ORBIGNY, 1840, pl. 105; SHARPE, 1855, pl. 16, fig. 2; BAYLE, 1878—see WRIGHT, 1957, fig. 534–7) are nearly or less than 100 mm in diameter. In them, some of which were examined by one of us (T.M.) in Paris, London and Austin, the lower and upper ventrolateral tubercles persist to the outer whorl but the siphonal ones are much weakened in more or less late growth-stage, depending on individuals. Two examples, BM. 39947, from Le Mans (Sarthe), France, and GSM. 7758, from England, whose whorl-sections are illustrated here (Figs. 1, 2), like other examples, show the prominent lower ventrolateral tubercles, although they do not form large horns at the shell-diameter of 85 mm. In another French specimen (Fig. 3), which one of us (T.M.) studied in the Muséum National d'Histoire Naturelle, Paris, the siphonal tubercles become inconspicuous in earlier growth-stage and the upper ventrolateral tubercles are more distinctly clavate than the British Museum specimen. Whether or not these specimens represent the full-grown

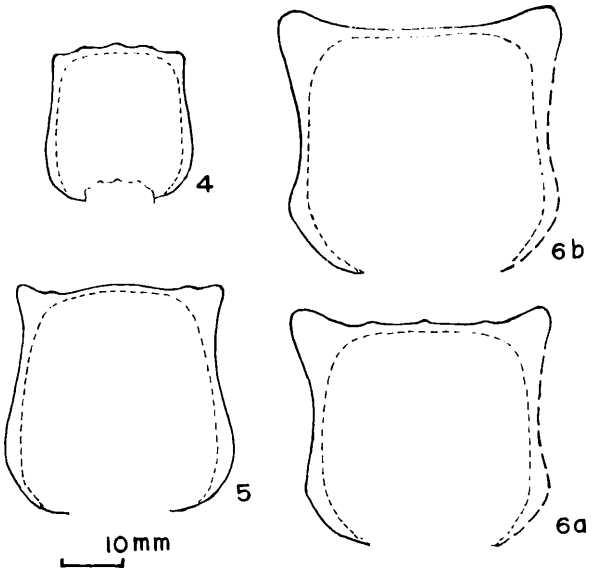


Figs. 1-3. *Acanthoceras rhotomagense* (DEFRANCE in BRONGNIART). Whorl-sections of three examples.
1. BM. 39947, Lower Chalk, Le Mans (Sarthe), France.
2. GSM. 7758, Hypotype of SHARPE, 1855, pl. 16, fig. 2, from Lower Chalk, England.
2. MNHN. Coll., another example from France, which is somewhat similar to *Acanthoceras deciduum* (HYATT).

stage is questionable. A larger example from Madagascar, with diameter of 146 mm, is still wholly septate, as shown by COLLIGNON (1964, pl. 372, fig. 1618). To know the characters of still outer whorl is needed, if it is existent.

These examples of *Acanthoceras rhotomagense*, from Europe, considerably resemble the immature shells of such species as *Acanthoceras amphibolum* MORROW, 1935, from the Interior Province of North America. On the outer whorl of the latter, however, the lower ventrolateral tubercles gradually become horn-like, absorbing the upper ventrolateral ones (see Figs. 4-6). *Acanthoceras hazzardi* STEPHENSON, 1953, from the Woodbine Formation of the Gulf Coast Province of North America, is almost indistinguishable from *A. amphibolum*. The only distinction that can be noticed is in that the upper ventrolateral tubercles disappear slightly earlier in the holotype of *A. hazzardi* (Fig. 7) than in the syntypes of *A. amphibolum*. The validity of such a slight difference as specific distinction may be doubtful, although this could be sufficient for subspecific distinction if the difference had proved to occur constantly between separate provinces. In the subsequent collections there are specimens, e.g. USNM. 24319, of *A. amphibolum* which have stronger horns than its syntypes.

Acanthoceras stephensoni ADKINS, 1928, from the Basal Flag Member of the Eagle Ford Formation of Texas, is closely allied to the broadly whorled variety of *A. rhotomagense* but has more prominent, somewhat spinose, lower ventrolateral tubercles and weakened ribs on the flanks in the late growth-stage. *Acanthoceras wyomingense* (REAGAN) (MATSUMOTO, 1960, p. 43), from the Western Interior Province of North America, is very close to *A. stephensoni* in the weakened ribs on the flanks and prominent ventrolateral tubercles, but its whorl is narrower, its ventrolateral tubercles are developed



Figs. 4-6. *Acanthoceras amphibolum* MORROW. Whorl-sections of three syntypes, from Kansas, preserved in the University of Kansas.
4. Original of MORROW, 1935, pl. 49, fig. 3.
5. Original of MORROW, 1935, pl. 49, fig. 1.
6. Original of MORROW, 1935, pl. 49, fig. 4.
Whorl-sections, a, b, along two successive ribs (and also interspaces with dotted lines).

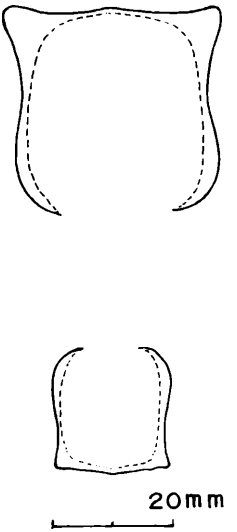


Fig. 7. *Acanthoceras hazzardi* STEPHENSON. Whorl-sections of the holotype, USNM.104971, from Texas.

into larger horns and the siphonal tubercles disappear somewhat earlier than in *A. stephensoni*. The distinction is, in our opinion, specific.

Acanthoceras pepperense MOREMAN, 1942, from the Tarrant Member of the Eagle Ford Formation, Texas, another species ornamented with upright ventrolateral horns on the outer whorl, in its pre-horned stage up to diameter of about 100 mm, is very close to *Acanthoceras sherborni* SPATH, 1926 [=*Ammonites cenomanensis*, SHARPE, 1857 (*non* D'ARCHIAC)], from England, as has already been pointed out (MATSUMOTO, 1959, p. 86). Similarly *Acanthoceras alvaradorense* MOREMAN, 1942, from Texas, is in the pre-horned stage similar to *Acanthoceras evolutum* SPATH, 1926 [=*Ammonites sussexiensis*, SHARPE, 1857 (*non* MANTELL)], from England.

On the basis of these observations it does not seem natural and reasonable to separate a group of such horned species as represented by *A. amphibolum*, *A. hazzardi*, *A. wyomingense*, *A. alvaradoense*, *A. pepperense*, and also *Ammonites loevianus* WHITE, 1876, as generically distinct from the group of *A. rhotomagense*. In other words we

hesitate to accept *Plesiacanthoceras* HAAS, 1964 [=*Paracanthoceras*, HAAS, 1963 (*non* FURON, 1935)] as a distinct genus. Similarly we do not intend to separate generically such species as *Acanthoceras whitei* MATSUMOTO, 1959, in which the lower ventrolateral tubercles exhibit only subangular shoulders without hypernodosity and the upper ventrolateral and siphonal tubercles almost disappear on the outer whorl. Various species of *Acanthoceras* are intimately related one with another. *A. rhotomagense*, in which the ventrolateral tubercles are at present understood as persisting for comparatively longer period, seems to represent the generalized type of ornamentation common to various species in immature stage.

It should be noted, furthermore, that in many horned ammonoids the spines or elongated horns are septate at their bases. In unfavorable conditions they may be destroyed away and only subrounded, node-like elevations at their bases are preserved. Such a state could occur in some specimens of *Acanthoceras*, too, and this should be considered in the identification.

Aside from the above discussed species of *Acanthoceras*, there are some others which distinctly need new generic names, but this is not the place to establish them.

Distribution. World-wide in the Upper Cenomanian. Some species begin to appear in the middle part of the Cenomanian, immediately above the *Mantelliceras* bearing zone. There is no stratigraphic nor geographic separation between the strongly horned species-group and the hornless one.

Acanthoceras sanctorum sp. nov.

(Plates 1-4; text-figs. 8, 9)

Material. Holotype, NSM. 5635, collected from South Sakhalin by the late Mr. Shokichi NAKASE and donated to the Shrine of Ise. Its preservation is fairly good, but a half of the last septate whorl is unfortunately missing. No other examples are available.

Measurements.

Position	Diameter	Umbilicus	Height	Breadth	B./H.
(1) (ic)	—	—	57.0	63.0	1.105
(2) (c)	*c.* 170*(1)	*c.* 67*(0.39)	59.0 (0.35)	69.0 (0.40)	1.17
(3) (c)	123.5*(1)	47.1 (0.38)	48.3 (0.39)	55.2*(0.45)	1.14
(4) (c)	75.0 (1)	27.6 (0.37)	28.5*(0.39)	34.7 (0.46)	1.21

(1) : At the anterior end; (2): Near the anterior end;
(3) : In front of the last septum; (4): A half whorl earlier than (3); (c): costal; (ic): intercostal; *restored. Measurements are in millimeters.

Diagnosis. The preserved last quarter whorl is unseptate and probably represents the posterior part of the body-chamber of an adult shell, which if restored would be

about 170 mm in diameter. The complete shell must have been larger.

The shell is evolute in the observable growth-stages, the outer whorl overlapping only the low ventral part of the inner whorl outside the row of lower ventrolateral tubercles. The umbilicus is widely open, occupying about 37 to 39 percent of the entire shell-diameter.

The whorl is roughly quadrangular in cross section (Fig. 8; Pl. 4) and broader than

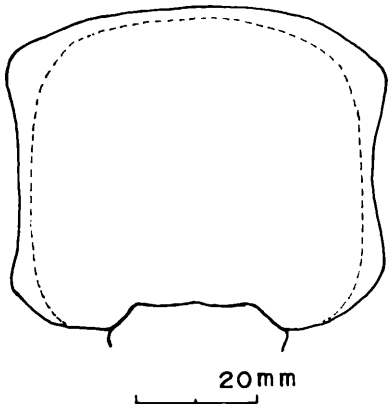


Fig. 8. *Acanthoceras sanctorum* sp. nov.
Whorl-section of the outer whorl of the holotype, at height=52.5 mm, breadth=62.0 mm. Dotted line approximately shows a section across the interspace immediately behind the rib.

high. The outer whorl has a proportion of 1: 1.14 - 1.21 between height and breadth in costal section and that of 1: 1.10 in intercostal section, but the inner whorl seems to be broader. The umbilical wall is high and steep, being almost perpendicular to the plane of coiling. The flanks are flattened and nearly parallel. The venter is broad and rather flat or very gently convex. The umbilical and ventrolateral shoulders are abruptly rounded (in intercostal parts) or subangular (along the costae).

On the inner whorls the ribs are numerous, 38 at diameter of 75 mm and rather crowded, being separated by interspaces nearly as narrow as or slightly broader than the ribs. They are as a rule alternately long and short, and sometimes bifurcated. Some of the shorter ribs start near the umbilical bullae, some others at the midflank and still others near the lower lateral tubercles. Most of the ribs are rectiradiate but some show gentle projection near the umbilical margin and are then bent backward to take the radial direction. The umbilical tubercles are bullate and highest at the shoulder. The lower and upper ventrolateral and also siphonal tubercles are distinct on the inner whorl, although the last ones are somewhat weaker than others.

On the body-chamber the ribs are moderately broad, equally long, rectiradiate, and distant, being separated by wider interspaces. In the observable last part the interspaces are especially wide and have a few, very faint riblets. The umbilical tubercles are shifted somewhat upward. The lower ventrolateral tubercles are prominent, forming subangular shoulders. Some of them can be called to form short horn-like elevation but they do not seem to form strongly elongated horns. The upper ventrolateral and siphonal tubercles are extremely weakened and almost undiscernible, although a very faint keel-like elevation may be seen on the mid-venter of the body-chamber. The ribs are lowered on the venter crossing straightly but sometimes divided to form indistinct loops between the ventrolateral tubercles.

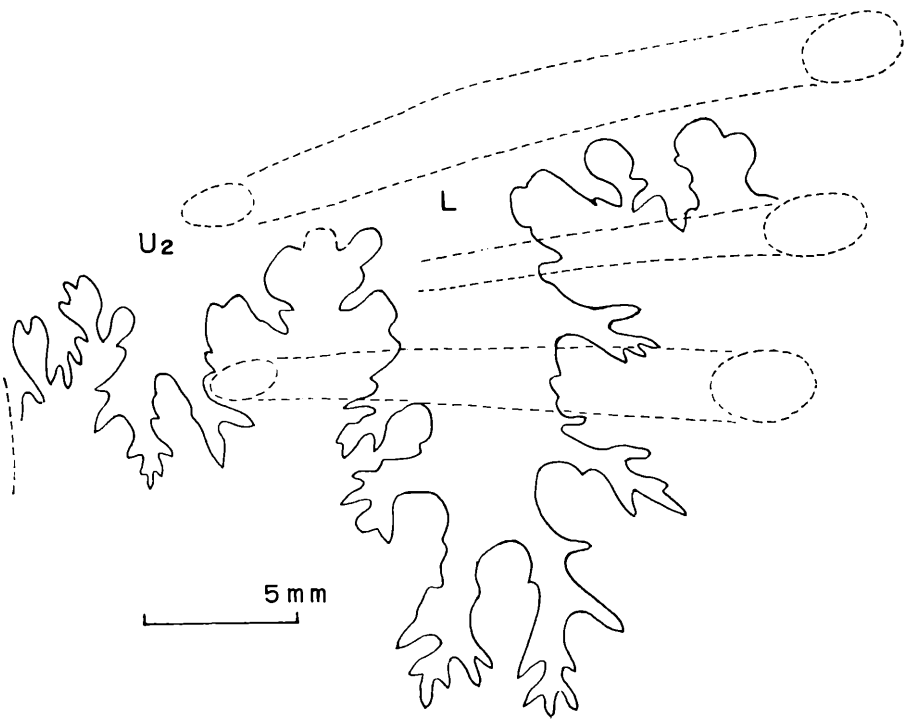


Fig. 9. *Acanthoceras sanctorum* sp. nov.
Exposed part of the suture on the inner whorl of the holotype.

A suture on the inner whorl is illustrated here (Fig. 9). Unfortunately the ventral lobe is not exposed. The observable part shows a general *Acanthoceras*-type suture, with massive saddles and somewhat reduced outline. The lateral lobe (L) is moderately broad and deep, having two, fairly long, basal branches divided by a central foliole, two

pairs of somewhat shorter, lateral branches and still smaller upper lateral lobules. The lobe U_2 is much smaller than L and irregularly divided.

Remarks. We cannot describe the extent of variation, because only a single specimen is at present available.

Affinities. The present species is most closely allied to *Acanthoceras whitei* MATSUMOTO, 1959 [=*Ammonites turneri* WHITE, 1889, *non* SOWERBY, 1825], from California and Middle Ootatoor Group of South India (KOSSMAT, 1897), in the broad, squarish whorls, change of ornamentation from crowded ribs with equally developed tubercles in 7 rows on the inner whorl to much distant ribs with obsolete ventral tubercles, and other respects. The holotype of the former is distinguished from the holotype and hypotypes of the latter by its much wider umbilicus (37 - 39 percent of diameter as compared with 28 - 29), with less involution and slower growth of whorls, and more numerous (38 per whorl as compared with 28 - 32) ribs on the inner whorl. The distinction is, in our opinion, significant enough for specific separation. Minor difference may be, furthermore, in somewhat stronger ribs and less depressed cross section of the outer whorl in the former than in the latter.

Acanthoceras sp. cf. *A. whitei*, from the Lower Chalk of England as represented by C. W. WRIGHT's Coll. 22300 (see MATSUMOTO, 1959, p. 84), is likewise similar to the present species, but it is much closer to typical examples of *A. whitei* than to the present species in the less numerous ribs on the inner whorl and broader whorls.

In the evolute mode of coiling the present species is somewhat similar to *Acanthoceras evolutum* SPATH, 1926 [=*Ammonites sussexiensis*, SHARPE (*non* MANTELL), 1855, p. 34, pl. 15, fig. 1], from the Cenomanian of England, but the latter has stronger and more distant ribs already on the inner whorl and multiple and more persistent ventral tubercles.

In the multicostate ornamentation and the pattern of suture the immature shell of the present species somewhat resembles the holotype and a hypotype of *Acanthoceras breistrofferi* COLLIGNON (1937, p. 52, pl. 6, fig. 4; pl. 9, fig. 2; 1964, p. 140, pl. 171, fig. 1616), from the "Middle Cenomanian" of Madagascar, but the latter species has sharper ribs, a narrower umbilicus and higher whorls with more rounded shoulders and does not seem to have so distant ribs on the outer whorl.

Occurrence. Cretaceous near the Kawakami coalfield, South Sakhalin. No further information is recorded. The rock matrix of the specimen, which is the greenish (brownish-purplish under weathered conditions) grey, fine sandy calcareous siltstone, resembles that of the calcareous nodules of zone Mh_0 of the Naibuchi area (MATSUMOTO, 1942), which, in turn, is referred to the upper part of Lower Gyliakian, approximately Upper Cenomanian in terms of the international scale.

Concluding Remarks

An acanthoceratid ammonite described in this paper is a new species which is allied

to *Acanthoceras whitei* MATSUMOTO. As the distribution of *Acanthoceras* is world-wide, it is not surprising to obtain an example of this genus from South Sakhalin. It is regrettable to have only incomplete record of locality for this interesting ammonite and further search for more examples from stratigraphically well determined localities is needed.

The hitherto explored Cenomanian part of the Cretaceous sequence in South Sakhalin consists mostly of muddy rocks with few sandy intercalates. In Hokkaido the Gyliakian (i.e. approximately Cenomanian plus Turonian), as represented by the Mikasa and the Saku Formation, has more sandstone of probably shallower sea facies and more examples of Acanthoceratidae have been obtained. This difference in facies may be one of the reasons why the acanthoceratids are rare in Sakhalin. There should be somewhere in Sakhalin Cenomanian sediments of shallower sea facies than the hitherto explored part and we expect the results of studies by geologists of the USSR.

Acknowledgements. We wish to thank Messrs. Shizuo HAYAMA and Shigeru ABE of the Shrine of Ise and to Dr. Hiroshi OZAKI and Dr. Kin'ichi SAKURAI of the National Science Museum for their kind help during the course of this study. The photographs were taken by Mr. Koichi TOISHI of the Museum.

Abbreviations of the Museums

BM. : British Museum (Natural History), London
GSM. : Geological Survey and Museum, London
MNHN. : Muséum National d'Histoire Naturelle, Paris
NSM. : National Science Museum, Tokyo
USNM. : United States National Museum, Washington, D.C.

References Cited

ADKINS, W. S., 1928. Handbook of Texas Cretaceous fossils. *Univ. Texas Bull.* **2838**: 303p., 37pls., index.

BAYLE, E., 1878. Fossiles principaux des terrains. *Explic. Carte géol. France*, **4** (1): Atlas, 158 pls.

BRONGNIART, A., 1822. In CUVIER and BRONGNIART: *Description géologique des environs de Paris*. New ed., viii+ 428 p., 16 pls., 2 maps, Paris.

COLLIGNON, 1937. Ammonites Cénomaniennes du sud-ouest de Madagascar. *Ann. géol. Serv. Mines, Madagascar*, **8**: 31-72, pls. 1-11.

——— 1964. *Atlas des Fossiles caracteristiques de Madagascar* (*Ammonites*), Fas. 11 (*Cenomanien*). xi+ 152 p., pls. 318-375.

GROSSOUVRE, A. DE, 1894. Recherches sur la Craie supérieure. II. Paléontologie. Les ammonites de la Craie supérieure. *Mém. Carte géol. dét. France* (1894 [1893]), 264 p., 39 pls,

HAAS, O. 1963. *Paracanthoceras wyomingense* (REAGAN) from the Western Interior of the United States and from Alberta (Ammonoidea). *Am. Mus. Novitates*, **2151**: 1-19.

——— 1964. *Plesiacanthoceras*, new name for *Paracanthoceras* HAAS, 1963, *non* FURON, 1935. *Jour. Paleontology*, **38** (3): 610.

KOSSMAT, F, 1897. Untersuchungen über die Sudindische Kreideformation, II. *Beitr. Paläont. Geol. Öster.-Ungarns u.d. Orients*, 11: 1-46 [108-153], pls. 1-8 [12-19].

MATSUMOTO, T., 1942. Fundamentals in the Cretaceous stratigraphy of Japan. Part 1. *Mem. Fac. Sci. Kyushu Imp. Univ.*, (D), 1: 129-210, pls. 5-20.

——— 1959. Upper Cretaceous ammonites of California, Part II. *Mem. Fac. Sci., Kyushu Univ.*, (D), *Spec. Vol.* 1: 1-172, pls. 1-41.

——— 1960. On some type ammonites from the Gulf Coast Cretaceous. *Sci. Rep. Fac. Sci., Kyushu Univ., Geol.*, **5** (1): 36-49. (In Japanese.)

MATSUMOTO, T., R. SAITO & A. FUKADA, 1957. Some Acanthoceratids from Hokkaido. *Mem. Fac. Sci. Kyushu Univ.*, (D), **6** (1): 1-45, pls. 1-18.

MOREMAN, W. L., 1942. Paleontology of the Eagle Ford Group of north and central Texas. *Jour. Paleont.*, **16**: 192-220, pls. 31-34.

MORROW, A.L., 1935. Cephalopods from the Upper Cretaceous of Kansas. *Jour. Paleont.*, **9**: 463-473, pls. 49-53.

NEUMAYR, M., 1875. Die Ammoniten der Kreide und die Systematik der Ammonitiden. *Zeitschr. deutsch. Geol. Gesell.*, **27**: 854-892.

ORBIGNY, A. D', 1840. *Paléontologie française. Terrains crétacés*, 1, Céphalopodes, 662p., 148pls. [1-120 (1840)], Paris.

SHARPE, D. 1853-57. Description of the fossil remains of mollusca found in the chalk of England. 1. Cephalopoda. *Palaeontogr. Soc.*, 68 p., 27 pls. (27-36, pls. 11-16, 1855; 37-68, pls. 17-27, 1857).

SHIMIZU, S, 1935. The Upper Cretaceous cephalopods of Japan, Part 1. *Jour. Shanghai Sci. Inst.*, (II), **2**: 159-226.

SPATH, L. F., 1926. On new ammonites from the English Chalk. *Geol. Mag.*, **63**: 77-83.

STEPHENSON, L. W., 1953. Larger invertebrate fossils of the Woodbine formation (Cenomanian) of Texas, with Decapod crustaceans from the Woodbine formation of Texas by H. B. STENZEL. *Geol. Surv. Prof. Paper*, **242** (1952): 226 p., 59 pls.

WHITE, C. A., 1875. Report upon the invertebrate fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona, by parties of the expeditions of 1871, 1872, 1873, 1874. *Rept. Geog. and Geol. Expl. and Survey west of 100th Merid.*, **4** (1): paleontology, 1-219, pls. 1-21.

——— 1889. On invertebrate fossils from the Pacific coast. *Bull. U. S. Geol. Surv.*, **51**: 1-70, pls. 1-14.

WRIGHT, C. W., 1957. In MOORE, R. C. [Editor], *Treatise on Invertebrate Paleontology, Part L*, Mollusca, Cephalopoda, Ammonoidea, L1-L490, Geol. Soc. Amer. & Univ. Kansas Press.

Explanations of Plates 1-4

Acanthoceras sanctorum sp. nov. ..... Page 47
Holotype, NSM. 5635, from South Sakhalin. Two lateral (1, 2), ventral (3) and apertural (4) views, all in natural size.