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Morewites, a new Campanian (Late Cretaceous) heteromorph ammonoid genus from Hokkaido, Japan

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Abstract. **A new genus *Morewites* is herein erected for a Cretaceous heteromorph ammonoid from the Campanian (Upper Cretaceous) of Hokkaido, northern Japan. The new genus differs from previously described genera of the family Nostoceratidae by its minute helical initial whorls, whose axis of coiling is at right angles to that of its loosely elliptically coiled planispiral whorls.**

Key words: ammonoid, Campanian, Cretaceous, Hokkaido, *Morewites*, Nostoceratidae

Introduction

The Nostoceratidae Hyatt, 1894, one of several Cretaceous heteromorph ammonoid families, is characterized by helicoid forms in which coiling is commonly irregular in the early or late stage or both or throughout ontogeny (Wright *et al*., 1996). The family was probably derived from Albian *Turrilitoides* Spath, 1923 of the family Turrilitidae Gill, 1871, and it evolved and radiated throughout the world during Turonian to Maastrichtian time (Matsumoto, 1967).

Ammonoids belonging to the Nostoceratidae are one of the most common forms in Turonian to Maastrichtian deposits in the Northwest Pacific, and more than twenty species have been described from Japan and the Russian Far East (Yabe, 1902, 1904; Kawada, 1929; Matsumoto, 1967, 1977; Matsumoto and Kanie, 1967; Matsumoto and Muramoto, 1967; Hayakawa, 1998). However, due to their inherent shape, it is not uncommon for heteromorph ammonoid shells to have suffered serious damage or even total fragmentation during the taphonomic process. This damage generally makes taxonomic work difficult. Thus, discovery of a relatively complete specimen provides an important key for the study of heteromorph ammonoid taxonomy.

In 1978, Kazuhito Sakakibara (Kadoma, Osaka) discovered a small heteromorph ammonoid specimen with nearly complete early whorls in Campanian deposits in the Urakawa area (Hokkaido, northern Japan). This specimen is described herein as a new genus and species of the Nostoceratidae.

Notes on stratigraphy

The Cretaceous Yezo Group exposed along the southern coast of Ikandai, 3 km west–northwest of Urakawa, has been divided lithostratigraphically into the underlying Urakawa Formation and overlying Chinomigawa Formation (Kanie, 1966; Sakai and Kanie, 1986; Wada *et al*., 1992). The Urakawa Formation consists of mudstone and is equivalent to the Kashima Formation in south-central Hokkaido (Takashima *et al*., 2004). A Santonian-age species of *Texanites* Spath, 1932 is found in its upper part (Matsumoto and Kanie, 1982).

The overlying Chinomigawa Formation consists mainly of sandstone and sandy mudstone and is equivalent to the Hakobuchi Formation in south–central Hokkaido (Takashima *et al*., 2004) and the Heitaro-zawa Formation in northern Hokkaido (Ando *et al*., 2001). It has been divided into four members (U2–U5, Sakai and Kanie, 1986), but only the lower two members (U2 and U3) are exposed along the southern coast of Ikandai (Matsumoto and Kanie, 1982; Wada *et al*., 1992).

Member U2, composed mainly of sandstone with intercalations of conglomerate beds in the basal part and sandy mudstone and mudstone in the main part, contains the lower Campanian inoceramids, *Sphenoceramus nagaoi* (Matsumoto and Ueda, 1962) in the lower part and *S. orientalis* (Sokolov, 1914) in the upper part. Member U3, consisting of sandstone in the basal part and mud-

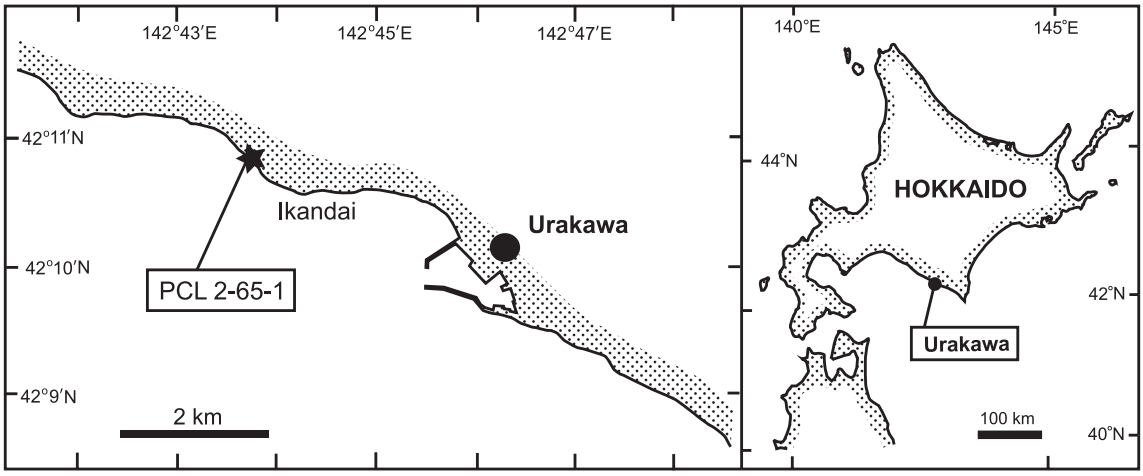

Figure 1. Index map showing collection locality (NMNS PCL 2-65-1) of *Morewites sakakibarai* Shigeta gen. et sp. nov. in the Urakawa area, Hokkaido.

stone in the main part, includes the lower Campanian inoceramid, *S. schmidti* (Michael, 1899).

The specimen described herein was obtained from a calcareous concretion found in Member U2 that also contained *Eupachydiscus haradai* (Jimbo, 1894) and *Sphenoceramus nagaoi*.

Paleontological description

Systematic descriptions follow the classification established by Wright *et al*. (1996). Morphological terms in the systematic description are those used in the Treatise on Invertebrate Paleontology (Moore, 1957).

Institution abbreviation.—NMNS = National Museum of Nature and Science, Tsukuba.

Superfamily Turrilitoidea Gill, 1871
Family Nostoceratidae Hyatt, 1894

Discussion.—According to Wright *et al*. (1996), the Nostoceratidae is characterized by helicoid forms with coiling commonly irregular in the early or late stage or both or throughout ontogeny, whereas the Diplomoceratidae Spath, 1926 tends to lose its helical coiling. Although *Glyptoxoceras* Spath, 1925 has been assigned to the Diplomoceratidae, its helical initial whorls suggest that it probably belongs to the Nostoceratidae. Such helical initial whorls are not known in other genera assigned to the Diplomoceratidae.

Genus ***Morewites*** gen. nov.

Type species.—*Morewites sakakibarai* Shigeta gen. et sp. nov.

Diagnosis.—Genus characterized by minute, tightly coiled, helical initial whorls followed by loosely coiled elliptical planispiral whorls, whose axis is at right angles to that of its initial spire. Shell surface ornamented with simple, fine ribs.

Etymology.—Genus name refers to the Ainu word morew, meaning spiral.

Discussion.—Its tightly coiled, helical initial whorls suggest that *Morewites* gen. nov. probably belongs to the Nostoceratidae. The new genus is somewhat similar to *Glyptoxoceras* in having open, planispiral, elliptically coiled whorls with tightly coiled helical initial whorls. However, specimens assigned to *Glyptoxoceras* with initial helical whorls, with the exception of specimens identified as *G. subcompressum* (Forbes, 1846) by Ward (1976) from the Nanaimo Group in Washington State, have a nearly parallel relationship between the axis of their initial whorls and that of their following planispiral whorls (Matsumoto, 1959; Kennedy and Henderson, 1992). In contrast, the new genus has a perpendicular relationship between these coiling axes. Ward's specimens (1976) have similar coiling axes to the new genus, and are probably assignable to the new taxon. The coiling of *Ainoceras zinsmeisteri* Olivero, 1988 from Antarctica resembles that of *Morewites* gen. nov., but the initial helix is quite large and the succeeding whorl contacts the helix in its early part.

Occurrence.—Lower Campanian of Hokkaido and *Bostrychoceras elongatum* Zone (upper Santonian) of Washington State (Ward *et al*., 2012).

Morewites sakakibarai Shigeta sp. nov.

Figure 2

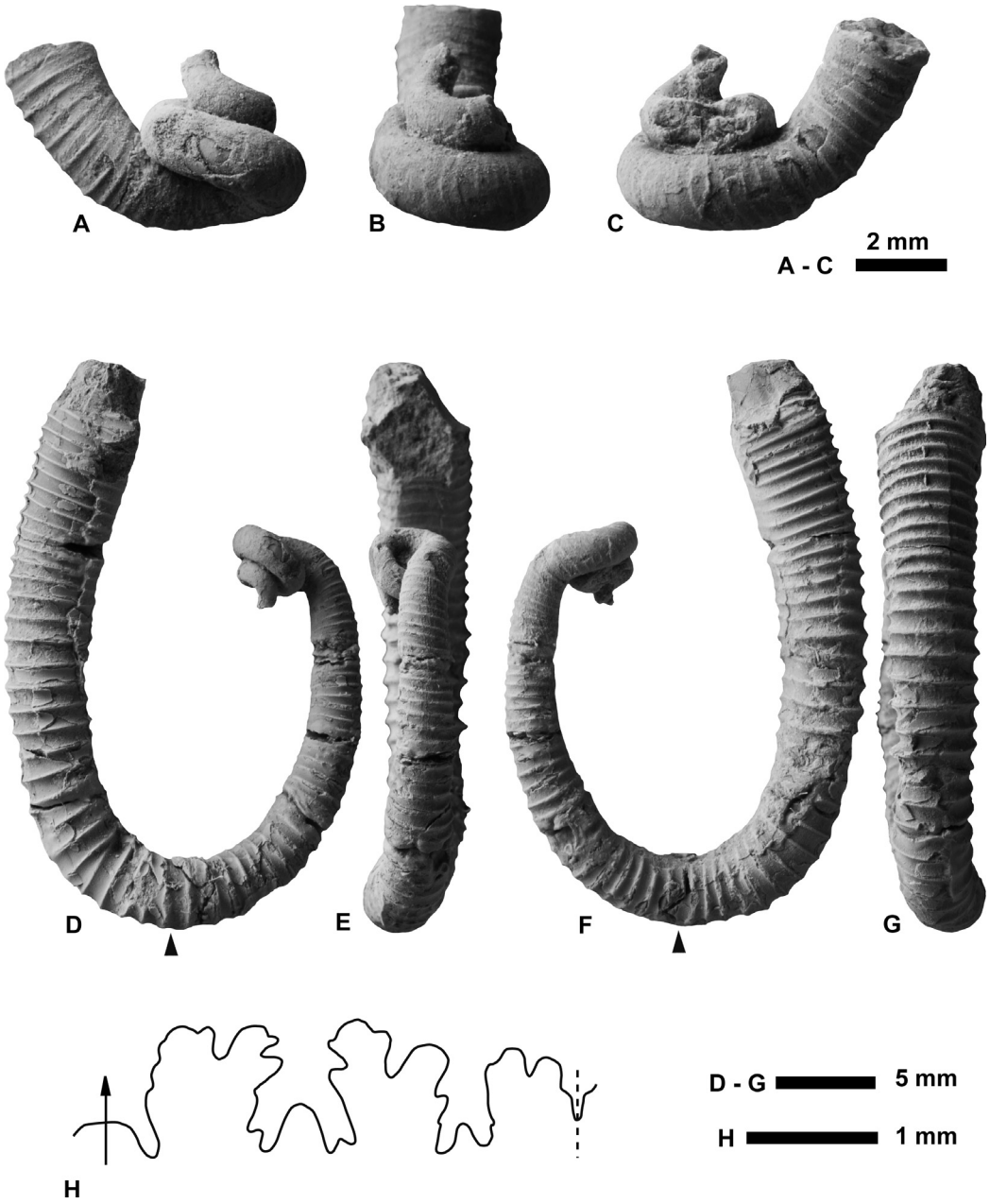

Figure 2. *Morewites sakakibarai* Shigeta gen. et sp. nov., NMNS PM23458 (holotype), from the Urakawa area, Hokkaido. **A–C**, enlarged photos showing helical, tightly coiled initial whorls (initial chamber and ammonitella not preserved); A, lateral view; B, lateral view rotated 90° from A; C, lateral view rotated 90° from B; **D–G**, overall views; D, lateral view; E, frontal view rotated 90° from D; F, lateral view rotated 90° from E; G, ventral view rotated 90° from F; Black arrows indicate position of last septum. **H**, suture line at last septum. Solid line represents the siphuncle, and broken line indicates the middle dorsal position.

Holotype.—Specimen NMNS PM23458 was extracted from a calcareous concretion found along the western coast of Ikandai (Loc. NMNS PCL 2-65-1:42°10′52″N, 142°43′45″E, Figure 1), Urakawa area, Hokkaido.

Diagnosis.—As for the genus.

Etymology.—Named after Kazuhito Sakakibara, who discovered the holotype.

Description.—Earliest whorls including initial chamber and ammonitella not preserved. Preserved initial two whorls helical and tightly coiled, forming apical angle of approximately 55°. Whorl cross section nearly circular. Shell surface ornamented with oblique, narrow raised

ribs with flat interspaces. As shell grows, coiling axis turns 90° and succeeding whorls become U-shaped. Whorl cross section becomes broadly oval with fairly flattened dorsal side. Ribs gradually increase in strength and become more distant as size increases, but they become denser on last quarter of U-shaped whorl. Ribs relatively weak and project forward on dorsum, but strengthen on flank, and pass straight across venter. Suture fairly simple, with moderately incised, bifid lobes and shallowly incised, bifid, asymmetrical saddles.

Comparison.—Specimens identified as *Glyptoxoceras subcompressum* (Forbes, 1846) by Ward (1976) from the Nanaimo Group in Washington State share many similarities with this new species, such as simple ribs and the coiling axis of its initial helix at right angles to that of succeeding elliptical planispiral whorls, but differ by having a larger initial helix and higher expansion rate of planispiral whorls. They probably belong to an undescribed species of *Morewites* gen. nov.

Remarks.—Adult ammonoid shells sometimes exhibit a gradual approximation of ribs on the body chamber; this feature has been recognized as one of several mature modifications that may indicate an adult shell (Davis, 1972; Davis *et al*., 1996). A somewhat similar rib pattern was observed on the holotype of *Morewites sakakibarai* gen. et sp. nov., but other important mature modifications, such as approximation of the last several septa, simplification and thickening of the last septum, apertural constriction and apertural shell thickening were not observed. This evidence suggests that the holotype most likely is an immature shell.

Occurrence.—The holotype was collected from Member U2 of the Chinomigawa Formation in the Urakawa area, together with *Eupachydiscus haradai* and *Sphenoceramus nagaoi*. Member U2 has been correlated with the lower Campanian (Sakai and Kanie, 1986; Wada *et al*., 1992; Toshimitsu *et al.*, 1995).

Discussion

Several simple rib-bearing, loosely coiled heteromorph ammonoid specimens resembling *Morewites* gen. nov. have been reported from the Campanian deposits in various areas of the Northwest Pacific realm. Most of these have been assigned to *Glyptoxoceras*. For example, Inoue *et al*. (1982) identified a specimen as *Glyptoxoceras indicum* (Forbes, 1846) and Tashiro and Noda (1973) illustrated a specimen as *G.* cf. *indicum* from the Himenoura Group in Kagoshima (Naka-koshiki-jima Island), Southwest Japan. Misaki and Maeda (2009) assigned a specimen to *Glyptoxoceras* sp. from the Toyajo Formation of the Sotoizumi Group in Wakayama, Southwest Japan. However, since the initial whorls of these specimens were not preserved, their assignments to *Glyptoxoceras* must be regarded as uncertain.

Maeda *et al*. (2005) described one small specimen as *Glyptoxoceras* sp. from the lower upper Maastrichtian in southern Sakhalin, Russian Far East. Although the initial whorls are not preserved, its loosely helical whorl tends to satisfy the generic assignment.

Specimens resembling *Morewites* gen. nov. have not yet been recorded from the Santonian. The Turonian–Coniacian genus *Scalarites* Wright and Matsumoto, 1954 of the family Diplomoceratidae is somewhat similar to the new genus in having loose, elliptical coiling confined to nearly the same plane, but differs by its nearly straight shaft followed by a very shallow, open helicoid spire in its early stage (Tanabe *et al*., 1981). The ancestor of *Morewites* gen. nov. remains uncertain, but a thorough study of heteromorph ammonoid initial whorls will probably provide an important key to the evolution of this new genus.

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