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A new species of *Tanabeceras* (Ammonoidea, Gaudryceratidae) from the lowest Cenomanian of Hokkaido, Japan

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Abstract. ***Tanabeceras horokanaiense*** **sp. nov. is described from the lowest Cenomanian (Upper Cretaceous) in the Horokanai area, Hokkaido, northern Japan. This new taxon, which represents an intermediate form between *T. yezoense* (Shigeta, 1996) and *T. mikasaense* (Shigeta, 1996), suggests that *Tanabeceras* evolved and radiated in the Northwest Pacific realm during the early Cenomanian. This evidence together with the presence of many endemic gaudryceratid ammonoids strongly suggests that there was something to separate distribution of the gaudryceratids between the Northwest Pacific realm and other regions during early Cenomanian time.**

Key words: ammonoid, Cenomanian, Cretaceous, Hokkaido, *Tanabeceras*

Introduction

Tanabeceras Shigeta *et al.*, 2012, a genus belonging to the subfamily Gabbioceratinae Breistroffer, 1953 of the family Gaudryceratidae Spath, 1927, probably evolved from *Gabbioceras* Hyatt, 1900 during early Albian time, and it subsequently became widely distributed in California and the Mediterranean area during early to middle Albian time (Murphy, 1967; Shigeta *et al*., 2012). It then disappeared from both areas, and late Albian to Cenomanian family members are known only from Hokkaido and Sakhalin (Shigeta, 1996; Hayakawa and Nishino, 1999; Yazykova *et al*., 2004; Shigeta *et al*., 2012). Three species have been reported from the Northwest Pacific realm: *T. pombetsense* Shigeta *et al*. (2012) from the upper Albian, *T. yezoense* (Shigeta, 1996) from the lowest Cenomanian, and *T. mikasaense* (Shigeta, 1996) from the upper lower to middle Cenomanian (Shigeta *et al*., 2012). Judging from their stratigraphic distribution, Shigeta (1996) hypothesized that the Cenomanian species, i.e., *T. yezoense* and *T. mikasaense*, probably belonged to the same lineage and evolved in this particular realm.

My recent examination of the specimen assigned to *Gabbioceras yezoense* Shigeta, 1996 by Nishida *et al*. (1997, pl. 7, fig. 5) from the lowest Cenomanian in the Horokanai (Soeushinai) area, northwestern Hokkaido leads me to recognize it as a new taxon. I herein describe it as a new species of *Tanabeceras* and discuss its evolution during Cenomanian time.

Paleontological description

The systematic description basically follows the classification established by Klein *et al*. (2009). Morphological terms in the systematic description are those used in the *Treatise on Invertebrate Paleontology* (Moore, 1957). Quantifiers used to describe the shape of the ammonoid shell replicate those proposed by Matsumoto (1954, p. 246) and modified by Haggart (1989, table 8.1).

Abbreviations for shell dimensions.—*D* = shell diameter; *U* = umbilical diameter; *H* = whorl height; *W* = whorl width.

Institution abbreviations.—MCM = Mikasa City Museum, Mikasa; NMNS = National Museum of Nature and Science, Tsukuba; TKD = Institute of Geoscience, University of Tsukuba, Tsukuba.

Superfamily Tetragonitoidea Hyatt, 1900
Family Gaudryceratidae Spath, 1927
Subfamily Gabbioceratinae Breistroffer, 1953
Genus ***Tanabeceras*** Shigeta, Futakami and Hoffman, 2012

Tanabeceras horokanaiense sp. nov.

Figures 2F–J, 3

Gabbioceras yezoense Shigeta. Nishida *et al*., 1997, pl. 7, fig. 5.

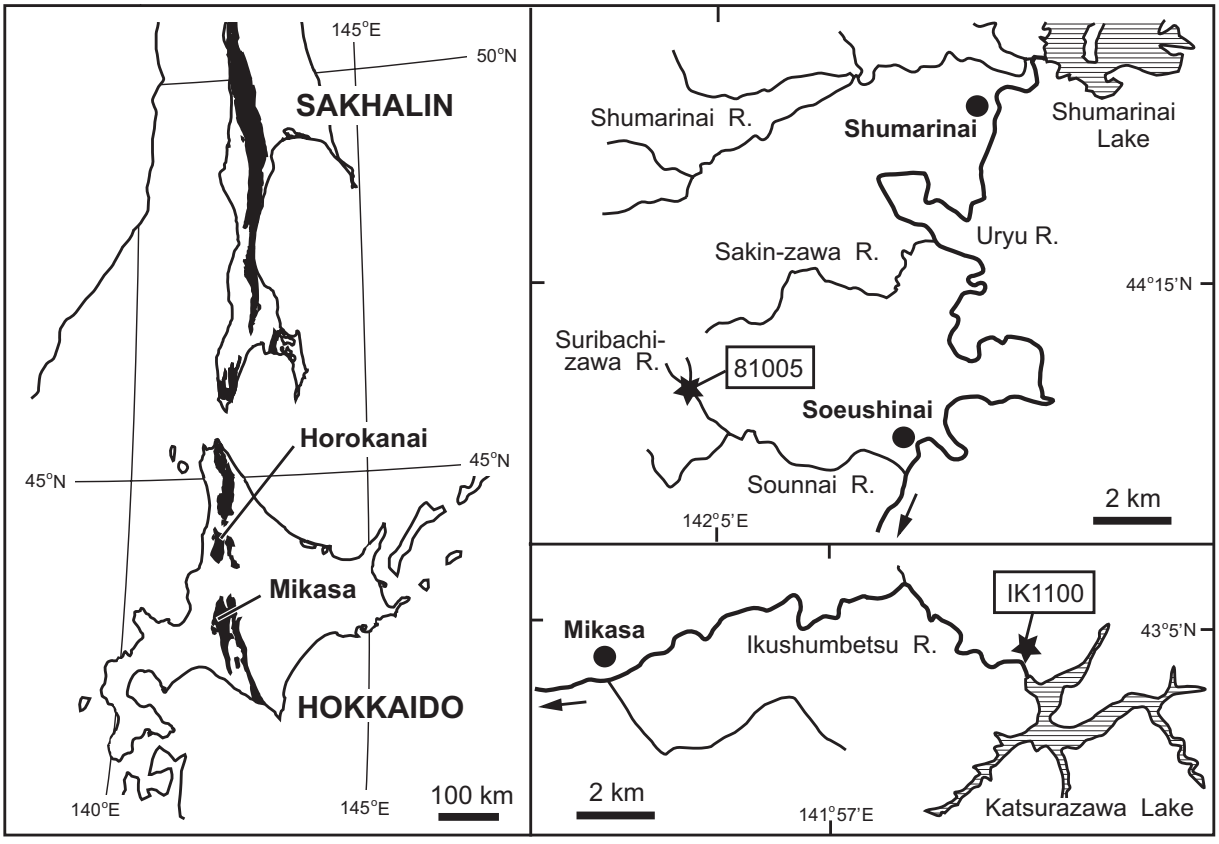

Figure 1. Maps showing distribution of the Cretaceous Yezo Group (black areas) in Hokkaido, Japan and Sakhalin, Russia, and localities of *Tanabeceras* in the Horokanai area (Loc. 81005 in Matsumoto and Inoma, 1975) and the Mikasa area (IK1100 in Matsumoto, 1965).

Holotype.—TKD 30051 (repository, Department of Earth Sciences, Kyushu University) consists of a phragmocone collected as a floated pebble from Loc. 81005 along the Suribachi-zawa River in the Horokanai (Soeushinai) area, Hokkaido (see Matsumoto and Inoma, 1975, fig. 2; Figure 1). Shell diameter at the last preserved septum is 18.7 mm (probably middle-growth stage), and if the entire body chamber had been preserved, its diameter would be 33–35 mm, assuming a body chamber length of about 300 degrees, as in other depressed gaudryceratids.

Diagnosis.—*Tanabeceras* with rounded venter and a fairly narrow, deep umbilicus with a subangular umbilical shoulder, and ornamentation characterized by fine lirae and constrictions.

Etymology.—Named after the Horokanai area, northwestern Hokkaido.

Description.—Very involute, very depressed shell characterized by a depressed reniform whorl section with a gently convex umbilical wall, subangular umbilical shoulder, and rounded venter. Maximum whorl width occurs on umbilical shoulders at one-third to one-fourth of whorl height. Umbilicus fairly narrow, deep and funnel-shaped. Ornamentation consists only of constrictions and fine lirae, which arise at umbilical seam, curve backwards on umbilical shoulder, become slightly rursiradiate, and cross venter in a broad, slightly concave arch. Lirae are sometimes prominent on inner flank. Suture consists of early gaudryceratid-type characters with bipartite lateral saddles. Lateral angulation located in middle of umbilical lobe.

Measurements.—Taken at D = 18.7 mm of TKD 30051, U = 4.4 mm, H = 8.4 mm, W = 14.9 mm, U/D = 0.24, W/H = 1.77.

Comparison.—*Tanabeceras horokanaiense* sp. nov. is very close to *T. yezoense*, but differs by its more compressed whorls and rounded venter. According to Shigeta (1996), the W/H values of *T. yesoense* at shell diameters of 13.0–15.3 mm vary from 2.42 to 2.48. In contrast, the W/H value of the new species at a diameter of 18.7 mm is 1.77. Compared in the same growth stage, the new species also resembles *T. mikasaense* in having a rounded

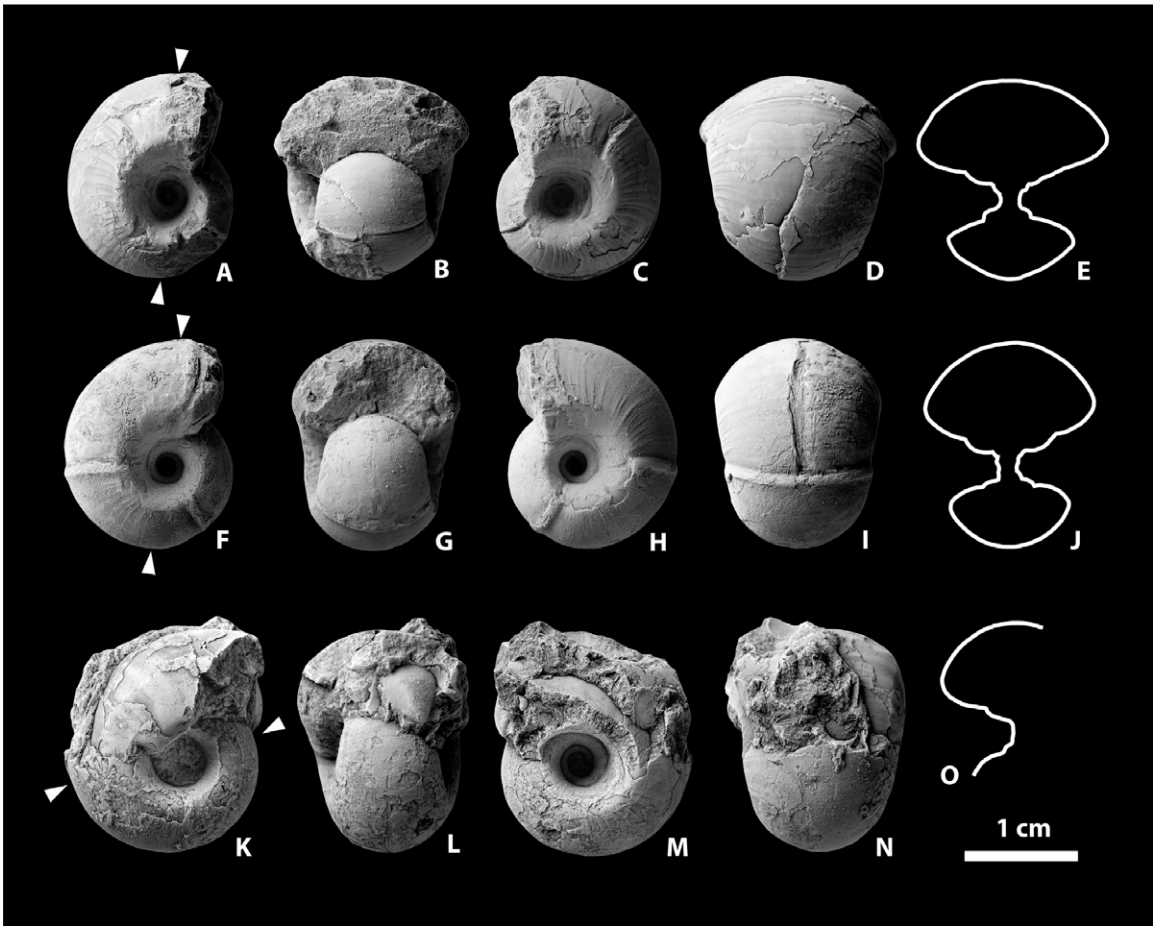

Figure 2. **A–E**, *Tanabeceras yezoense* (Shigeta, 1996), NMNS PM23457, from the lowest Cenomanian in the Horokanai area (Sakinzawa River, precise locality unknown), middle-growth stage; **F–J**, *Tanabeceras horokanaiense* Shigeta sp. nov., TKD 3051 (holotype), from the lowest Cenomanian in the Horokanai (Soeushinai) area (Loc. 81005 in Matsumoto and Inoma, 1975), probably middle-growth stage; **K–O**, *Tanabeceras mikasaense* (Shigeta, 1996), MCM A400 (paratype), from the upper lower Cenomanian in the Mikasa area (Loc. IK1100 in Matsumoto, 1965), middle-growth stage. Arrows indicate position of whorl cross sections.

venter. However, the latter has only fine lirae, while the former possesses constrictions in addition to fine lirae. The phragmocone of *T. pombetsense* is somewhat similar to *T. horokanaiense* sp. nov., but its whorls are more depressed (W/H = 2.0 at shell diameter 20.0 mm) and its umbilical wall is slightly concave. The adult body chamber of *T. pombetsense* is ornamented with flat-topped, band-like or low fold-like broad major ribs.

Occurrence.—The holotype, TKD 30051, was collected from a float calcareous concretion along the Suribachi-zawa River in the Horokanai (Soeushinai) area. Although the exact stratigraphic horizon from which the concretion came is uncertain, judging from its location, it without doubt came from the mudstone of the Member My3 of the "Middle Yezo Group" (Hashimoto *et al*., 1965; Nishida *et al*., 1997), which can be correlated with the *Graysonites adkinsi-G. wooldridgei* Zone (= lowest Cenomanian, Toshimitsu *et al*., 1995).

Discussion

Tanabeceras yezoense and *T. mikasaense* each exhibit quite different shell forms and ornamentation features (Figure 2). On the other hand, *T. horokanaiense* sp. nov. shows intermediate features between the two species, namely the new species shares constrictions with *T. yezoense*, and a gently convex umbilical wall and rounded venter with *T. mikasaense.* This evidence suggests a close phylogenetic relationship for *T. horokanaiense* sp. nov. with both species. *T. mikasaense* most likely evolved from *T. yezoense* via *T. horokanaiense* sp. nov., but it is also possible that *T. mikasaense* and *T.*

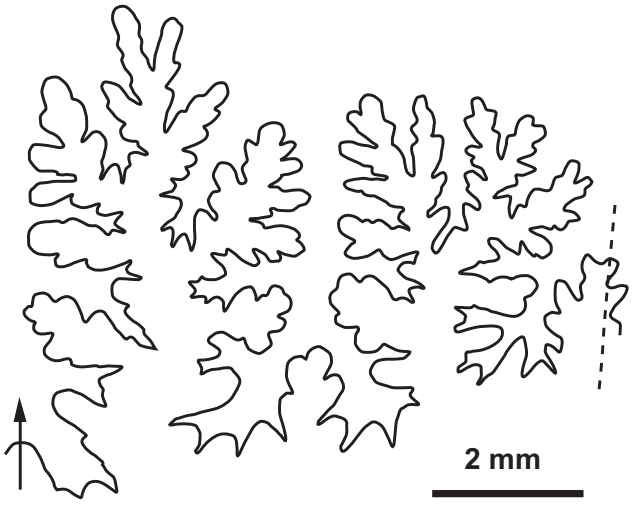

Figure 3. Suture line of *Tanabeceras horokanaiense* Shigeta sp. nov., TKD 3051 (holotype), from the Horokanai area, Hokkaido, at H = 6.6 mm. Solid line represents siphuncle, and broken line indicates position of umbilical shoulder.

yezoense may have evolved independently from *T. horokanaiense* sp. nov., since *T. mikasaense* occurs in younger horizons.

Compared in the same later growth stage, late Albian *Tanabeceras pombetsense* is characterized by a slightly concave umbilical wall and flat-topped, band-like or low fold-like, broad major ribs on its body chamber, features which are quite different from those of *T. yezoense* and *T. mikasaense* (Shigeta, 1996; Shigeta and Izukura, 2013). Therefore, any supposed phylogenetic relationship between *T. pombetsense* and these Cenomanian species is uncertain.

It is a well known fact that the early Cenomanian ammonid fauna of Hokkaido, particularly gaudryceratids and marshallitines, contains several endemic genera and species that are restricted to just Hokkaido and Sakhalin (Matsumoto, 1943, 1955, 1984, 1991, 1995; Matsumoto *et al*., 1972a, 1972b, 1997, 2004; Shigeta *et al*., 2010). Furthermore, the lack of overlap of gaudryceratids and marshallitines between the Yezo Group (northern Japan) and the Goshoura Group (southwestern Japan) even within the confines of Japan already existed in the lowest Cenomanian *Graysonites adkinsi-G. wooldridgei* Zone (Komatsu and Maeda, 2005). These occurrences, which suggest that there was something to separate the distribution of gaudryceratids between the Northwest Pacific realm and other regions during early Cenomanian time, are clearly supported by the evidence that *Tanabeceras* flourished only in the Northwest Pacific realm during early to middle Cenomanian time.

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References

Breistroffer, M., 1953: Commentaires taxonomiques. *Travaux du Laboratorire de Géologie de la Faculté des Sciences de l'Université de Grenoble*, vol. 30, p. 71–74.

Haggart, J. W., 1989: New and revised ammonites from the Upper Cretaceous Nanaimo Group of British Columbia and Washington State. *Geological Survey of Canada Bulletin*, vol. 396, p. 181–221.

Hashimoto, W., Nagao, S. and Kanno, S., 1965: *Explanatory Text of the Geological Map of Japan*, *Scale 1:50000, Soeushinai (Asahikawa-35)*. 92 p. Geological Survey of Hokkaido, Sapporo. (*in Japanese with English abstract*)

Hayakawa, K. and Nishino, T., 1999: Cenomanian ammonite fauna from Nakagawa, Hokkaido, Japan. *Bulletin of Nakagawa Museum of Natural History*, vol. 2, p. 1–40. (*in Japanese with English abstract*)

Hyatt, A., 1900: Cephalopoda. *In*, Zittel, K. A. *ed*., *Textbook of Palaeontology*, *English ed.*, *translated by C. R. Eastman*, p. 502–592. Macmillan, London and New York.

Klein, J., Hoffmann, R., Joly, B., Shigeta, Y. and Vašíček, Z., 2009: *Fossilium Catalogus I: Animalia Pars 146*, *Lower Cretaceous Ammonites IV*, *Boreophylloceratoidea*, *Phylloceratoidea*, *Lytoceratoidea*, *Tetragonitoidea*, *Haploceratoidea including the Upper Cretaceous representatives*, 416 p. Buckhuys Publishers, Leiden.

Komatsu, T. and Maeda, H., 2005: Stratigraphy and fossil assemblages of the mid-Cretaceous Goshoura Group, southwest Japan. *Paleontological Research*, vol. 9, p. 119–142.

Matsumoto [=Matumoto], T., 1943: A note on the Japanese ammonites belonging to the Gaudryceratidae. *Proceedings of the Imperial Academy of Japan*, vol. 18, p. 666–670.

Matsumoto, T., 1954: *The Cretaceous System in the Japanese Islands*, 324 p. Japan Society for the Promotion of Science, Tokyo.

Matsumoto, T., 1955: Family Kossmaticeratidae from Hokkaido and Saghalien. *Japanese Journal of Geology and Geography*, vol. 26, p. 115–164.

Matsumoto, T., 1965: A monograph of the Collignoniceratidae from Hokkaido, Part 1. *Memoirs of Faculty of Science*, *Kyushu University*, *Series D*, vol. 16, p. 1–80.

Matsumoto, T., 1984: A new tetragonitid ammonite from Hokkaido. *Proceedings of the Japan Academy*, *Series B*, vol. 60, p. 33–35.

Matsumoto, T., 1991: The mid-Cretaceous ammonites of the family Kossmaticeratidae from Japan. *Palaeontological Society of Japan*, *Special Papers*, no. 33, p. 1–143.

Matsumoto, T., 1995: Notes on gaudryceratid ammonites from Hokkaido and Sakhalin. *Palaeontological Society of Japan*, *Spe-*

cial Paper, no. 35, p. 1–152.
Matsumoto, T. and Inoma, A., 1975: Mid-Cretaceous ammonites from the Shumarinai-Soeushinai area, Hokkaido, Part 1. *Memoirs of Faculty of Science*, *Kyushu University*, *Series D*, vol. 23, p. 263–293.
Matsumoto, T., Muramoto, T. and Inoma, A., 1972a: Two small desmoceratid ammonites from Hokkaido. *Transactions and Proceedings of the Palaeontological Society of Japan*, *New Series*, no. 87, p. 377–394.
Matsumoto, T., Muramoto, T. and Takahashi, T., 1972b: A new gaudryceratine ammonite from Hokkaido. *Memoirs of Faculty of Science*, *Kyushu University, Series D*, vol. 21, p. 207–215.
Matsumoto, T., Nishida, T. and Toshimitsu, S., 2004: The early Cenomanian (Cretaceous) ammonite fauna from the Soeushinai area of Hokkaido, North Japan. *Bulletin of the Geological Survey of Japan*, vol. 55, p. 67–92.
Matsumoto, T., Yokoi, K. and Kawashita, Y., 1997: Futher notes on the ammonoid genus *Parajaubertella*. *Paleontological Reserarch*, vol. 1, p. 188–199.
Moore, R. C., 1957: *Treatise on Invertebrate Paleontology*, *Part L*, *Mollusca 4*, *Cephalopoda*, *Ammonoidea*, 490 p. Geological Society of America, New York and University of Kansas Press, Lawrence.
Murphy, M. A., 1967: The ammonoid subfamily Gabbioceratinae Breistroffer. *Journal of Paleontology*, vol. 41, p. 595–607.
Nishida, T., Matsumoto, T., Kawashita, Y., Egashira, N., Aizawa, J. and Ikuji, Y., 1997: Biostratigraphy of the middle part of the Cretaceous Yezo Group in the Soeushinai area of Hokkaido, with special reference to the transitional part from Lower to Upper Cretaceous: supplement. *Journal of the Faculty of Culture and Education*, *Saga University*, vol. 1, p. 237–279. (*in Japanese with English abstract*)
Shigeta, Y., 1996: The genus *Gabbioceras* (Ammonoidea, Gaudryceratidae) from the Upper Cretaceous of Hokkaido, Japan. *Bulletin of the National Science Museum*, *Series C*, vol. 22, p. 1–9.
Shigeta, Y., Futakami, M. and Hoffmann, R., 2012: Two new ammonoid genera of the subfamily Gabbioceratinae from the Upper Albian (Lower Cretaceous) of Hokkaido, Japan. *Paleontological Research*, vol. 16, p. 208–218.
Shigeta, Y., Hoffmann, R. and Izukura, M., 2010: Systematic position and origin of the Cretaceous ammonoid genus *Takahashia*. *Paleontological Research*, vol. 14, p. 196–201.
Shigeta, Y. and Izukura, M., 2013: The earliest Cenomanian ammonoid *Tanabeceras yezoense* (Shigeta) from the Hobetsu area, Hokkaido. *Bulletin of the Hobetsu Museum*, no. 28, p. 1–6.
Spath, L. F., 1927: Revision of the Jurassic cephalopod fauna of Kachh (Cutch), part 1. *Memoirs of the Geological Survey of India*, *Palaeontologia Indica*, *New Series*, vol. 9, p. 1–71.
Toshimitsu, S., Matsumoto, T., Noda, M., Nishida, T. and Maiya, S., 1995: Towards an integrated mega-, micro-, and magnetostratigraphy of the Upper Cretaceous in Japan. *Journal of the Geological Society of Japan*, vol. 101, p. 19–29. (*in Japanese with English abstract*)
Yazykova, E. A., Peryt, D., Zonova, T. D. and Kasinzova, L. I., 2004: The Cenomanian/Turonian boundary in Sakhalin, Far East Russia: ammonites, inoceramids, foraminifera, and radiolarians. *New Zealand Journal of Geology and Geophysics*, vol. 47, p. 291–320.