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Yezo Group Research in Sakhalin—A Historical Review

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Abstract Historically, research on the Cretaceous Yezo Group of Sakhalin may be divided into four major stages, each partly dependent upon the international political situation at the time, as well as "state of the art" practices of the day in paleontology and stratigraphy. The first stage, from 1860 to 1905, is characterized by early geological expeditions and subsequent fossil descriptions by pioneer workers in paleontology. Throughout the second stage, from 1905 to 1945, research in northern Sakhalin was conducted mainly by workers from the U.S.S.R., while Japanese workers limited most of their research activities to southern Sakhalin. During the third stage, from 1945 to 1989, many workers from the U.S.S.R. were active, but they confined their research to a comprehensive study of the Cretaceous in the Naiba area. The fourth stage, beginning in 1990 and continuing to the present, consists of Japanese–Russian Joint Research groups primarily studying various modern day disciplines such as paleobiology, taphonomy, magnetostratigraphy, and isotope stratigraphy.

Key words: Cretaceous, historical review, Sakhalin, Yezo Group

Introduction

Outcrops of the Cretaceous Yezo Group are widely distributed in a 350 km long band running in a north-south direction in the central portion of Hokkaido. These sediments are thought to have been deposited in the ancient Yezo forarc basin along the eastern margin of the paleo-Asian continent (Okada, 1979, 1983). Numerous well-preserved ammonoids and inoceramids occur at various horizons, and these fossils have been the subject of the many geological and paleontological studies conducted during the last century (see Hayami & Yoshida, 1991; Hirano *et al.*, 2001; Ando, 2003; Takashima *et al.*, 2004).

Yezo Group deposits cross under the La Perouse Strait (Soya Strait) from northern Hokkaido and extend over a distance of 750 km northward from the Kril'on Peninsula to the Khoe Cape in the western Sakhalin region (Vershchagin, 1970, 1977; Fig. 1). Sakhalin has long been recognized as one of the important reference areas for the marine Cretaceous in the North Pacific realm, and consequently, these deposits and their respective faunas have been the focus of numerous research projects beginning as long ago as 1860.

In this paper we mainly review past research on the Cretaceous Yezo Group in the western Sakhalin region and discuss future research projects.

History of research

Historically, research on the Yezo Group of Sakhalin may be divided into four major stages. Each stage is partly dependent upon the international political situation at the time, as well as “state of the art” practices of the day in paleontology and stratigraphy.

The first stage (1860 to 1905)

During this period the numerous expeditions by pioneer workers in geoloy resulted in discovery of many fossils. In 1860 F. B. Schmidt and P. V. Glen, who were members of the Russian Geological Society expedition to Siberia, made the first discovery of Cretaceous deposits on Zhonkier Cape in northern Sakhalin (Fig. 2; Glen, 1868; Schmidt, 1868a, b). F. B. Schmidt (1873), who described the first molluscan fossils from Sakhalin, described an interesting inoceramid species that is characterized by a peculiar divergent ribbing, and assigned it to *Inoceramus digitalis* Sowerby. It was later redescribed by Michael (1899) who named it *Inoceramus schmidti* in honor of F. B. Schmidt (Fig. 3). It is now regarded as an important zonal index fossil for the middle part of the Campanian of the North Pacific realm. Plant fossils collected from the Zhonkier Cape by F. B. Schmidt, from the Mgachi area by P. V. Glen, and from the northwestern coastal area of southern Sakhalin by A. F. Andrea were sent to Dr. Heer in Stockholm who described them as a Miocene age flora (Heer, 1871, 1878a, b).

In 1867–1868 J. Ropatin discovered Cretaceous deposits along the eastern coast of southern Sakhalin (Lopatin, 1870; Schmidt, 1970), and D. L. Ivanov discovered Upper Cretaceous deposits on the Kril’on Peninsula in 1890 (see Vereshchagin, 1977).

The second stage (1905–1945)

During this period workers from the U.S.S.R. confined their research activities mainly to the Cretaceous deposits of northern Sakhalin, whereas Japanese workers limited their research primarily to southern Sakhalin.

By 1910 numerous Upper Cretaceous outcrop localities were known in many areas of southern Sakhalin (Jimbo, 1906, 1907; Kawasaki, 1907; Kawasaki & Shimotomai, 1908; Hirano & Tsurumaru, 1908; Inoue & Otsuki, 1909), and it had became obvious that these outcrops were widely distributed in a north-south direction in the west Sakhalin region (Jimbo, 1908; Yabe, 1909).

During the same period several Russian geologists investigated Cretaceous deposits in northern Sakhalin (Tikhonovitch & Polevoy, 1910, 1915; Polevoy, 1914; Tikhonovitch, 1914). In 1914 Sokolov published a monograph on inoceramids in which he concluded that the Cretaceous System in northern Sakhalin is of Campanian and Maastrichtian age.

In 1917 A. N. Krishtofovitch began studying the plant fossils of northern Sakhalin, and over the next 20 year period, he published many papers in which he described an extensive flora of Cretaceous age (Krishtofovitch, 1918a, b, 1920, 1927a–c, 1932, 1935, 1937). In addition, he studied the Cretaceous System in many other areas of the far eastern region of Russia, including Primorye and Kamchatka (Krishtofovitch, 1932, 1935). H. Yabe and S. Shimizu also explored the Cretaceous System in northern Sakhalin and attempted to correlate it with the deposits in southern Sakhalin (Yabe & Shimizu, 1924a, b; Shimizu, 1925; Yabe, 1926, 1927). Hayasaka (1921), and Yabe and Nagao (1925) described several Cretaceous mollusks from northern Sakhalin, while Yabe and Shimizu (1925) described a Cretaceous heteromorphic ammonite from southern Sakhalin.

Typical outcrops of Cretaceous sediments in southern Sakhalin are found along the Naiba River (Figs. 4, 5). In 1926 M. Kawada carefully surveyed the Naiba area deposits and developed a biostratigraphic scheme based on the abundant molluscan fossils that occur in many horizons (Kawada, 1929a). S. Shimizu also in-

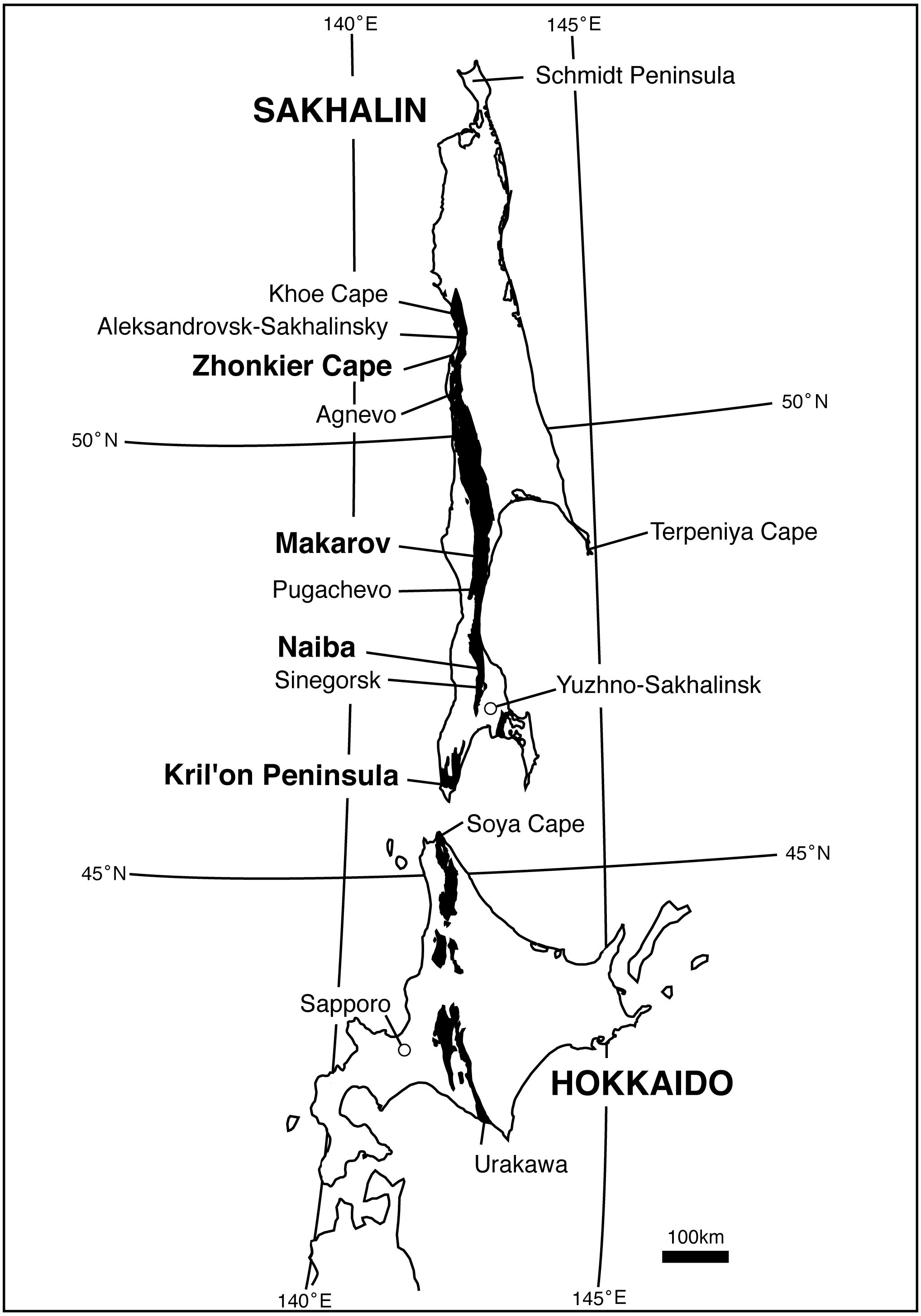

Fig. 1. Index map showing distribution of Cretaceous Yezo Group exposures (black areas) in Sakhalin, Russia, and Hokkaido, Japan.

Fig. 2. Outcrop of the Cretaceous Yezo Group at Zhonkier Cape in northern Sakhalin, site of the first discovery of Cretaceous deposits in Sakhalin. Upper: View of the port of Alexandrovsk-Sakhalinsky from Zhonkier Cape. Lower: Large outcrop of the Cretaceous Yezo Group at Zhonkier Cape. The beds strike N10–20°E, and dip 70° westward. The uppermost Zhonkier Formation is comprised mainly of fine-grained, bedded sandstone, mudstone and coal, while the Krasnoyarka Formation, which is about 120 m thick, consists primarily of sandstone and sandy mudstone, rich in adesitic volcanic rock fragments. It conformably overlies the Zhonkier Formation, and is unconformably overlain by Paleogene conglomerate. The Krasnoyarka Formation is fossiliferous—*Sphenoceramus orientalis* (Sokolov) and "*Gigantocaplus*" *transformis* (Dundo) are found in the basal part, and *Gigantocaplus giganteus* (Schmidt) is abundant in lower to middle part, while *Sphenoceramus schmidti* (Michael) is abundant throughout the formation.

Fig. 3. *Sphenoceramus schmidti* (Michael). NSM PM17303 from the Krasnoyarka Formation at Zhonkier Cape, northern Sakhalin, ×0.6. This species is one of the first molluscan fossils described by Schmidt (1873) from the Yezo Group, and is now regarded as an important zonal index fossil for the middle Campanian of the North Pacific realm.

vestigated the Cretaceous System in the Naiba area and proposed a provisional scheme for the stratigraphic correlation of the deposits in northern and southern Sakhalin (Shimizu, 1929a–d).

In 1926 Shimizu reported the occurrence of the peculiar heteromorph genus *Nipponites* from the Naiba area. It is interesting to note that even after the original description of the Hokkaido specimen by Yabe (1904), many paleontologists still considered this strange ammonoid to be a pathologic individual of another heteromorph, since it was the only specimen known at the time. Thus, the taxonomic authenticity of *Nipponites* was confirmed by the discovery of the specimen from Sakhalin. Kawada (1929b) later described this specimen as a new variety of *Nipponites mirabilis* Yabe, *N. mirabilis* var. *sachalinensis*.

Shimizu (1929e) published an innovative paper in which he not only discussed the evolution and function of the siphuncle, but also described the early internal shell features of Upper Cretaceous ammonites from southern Sakhalin and Hokkaido. Later Shimizu (1933) described a new ammonite from southern Sakhalin and developed a biostratigraphic scheme for the correlation of Upper Cretaceous deposits in Sakhalin and Japan (Shimizu, 1935). In 1934 a dinosaur skeleton was discovered in Upper Cretaceous sediments in the Sinegorsk area of southern Sakhalin. Eventually, Nagao (1936, 1938a) described and named the reptile *Nipponosaurus sachalinensis*.

During this same period coal beds of Tertiary age in southern Sakhalin were thoroughly explored for potential industrial use, and their stratigraphic relationship to the underlying Cretaceous deposits was discussed by many geologists (Tokuda, 1924, 1929; Imai, 1929a, b; Kawasaki, 1929, 1934, 1935; Saito, 1931; Kurosawa, 1932; Morita, 1933). For several years prior to 1937 many Japanese workers studied the geology of various areas in southern Sakhalin and reported on the regional Cretaceous stratigraphy and fossils (Murayama, 1933; Inai, 1935; Uwatoko, 1937, 1938, 1939; Sasa & Nishida, 1935, 1937; Oishi & Matsumoto, 1937, 1938; Ishizaki, 1935, 1937; Inai & Seki, 1937, 1938; Ishizaki & Sakakura, 1937, 1938; Sakakura, 1937; Sasa, 1938; Uwatoko & Takeda, 1938).

In 1937 T. Matsumoto meticulously examined the Cretaceous deposits along the Naiba and Ai Rivers (Matsumoto, 1938a, b, 1940, 1942c, d, 1943) and at the same time, systematically collected an enormous amount of ammonites and inoceramids, which are presently stored in the University Museum at the University of Tokyo (Fig. 6). During the1930's to early 1940's various taxa of Cretaceous age was described in publications by different specialists as follows: ammonoids (Matsumoto, 1938c, 1942a, b); inoceramids (Nagao & Matsumoto, 1939, 1940); other bivalves, gastropods and scaphopods (Nagao, 1932, 1938b, 1939; Nagao & Huzioka, 1941); shark tooth (Yabe and Obata, 1930). Subsequently, Matsumoto developed a comprehensive biostratigraphic scheme based on ammonoids and inoceramids for the Cretaceous System of southern Sakhalin.

The third stage (1945–1989)

Following World War II the Cretaceous deposits in Sakhalin were studied only by workers from the U.S.S.R. After the research work of E. M. Smekov and A. A. Kapitsa in the 1950's (see Vereshchagin, 1970, 1977), V. N. Vereshchagin and his co-workers examined various Cretaceous sections in Sakhalin during the period from1957 to 1960. When a stratigraphic meeting was held at Okha in northern Sakhalin in 1959, V. N. Vereshchagin proposed that the Naiba section be recognized as one of the reference sections for the Cretaceous in Sakhalin (Vassoyevich 1961; Vereshchagin, 1961, 1963). Following this meeting a national research program was organized. Then, after an agreement was reached on proposals by Vereshchagin and Salnikov (1968) to standardize the procedures utilized to describe the sediments, as well as the fossils contained therein, Russian workers carried out many systematic studies in the Cretaceous deposits of the Naiba area. These results were published in 1987 (Poyarkova, 1987a). In the late 1970's Y. D. Zakharov and his co-workers also worked in the Naiba area and discussed the Cretaceous ammonoid succession (Zakharov *et al.*, 1978, 1981, 1984).

In the late 1950's T. G. Kalishevitch and V. Y. Posylny conducted a comprehensive investigation of the Cretaceous-Paleogene boundary in southern Sakhalin and suggested that the unit previously thought to be uppermost Cretaceous in age may, in fact, be of Danian age. Furthermore, they concluded that the Paleogene conformably overlies the Cretaceous (Kalishevitch & Posylny, 1958; Kalishevitch,

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Fig. 4. Photographs of representative lithofacies of the Yezo Group in the Naiba area, site of one of the reference sections for the Cretaceous in Sakhalin. Successive exposures of the Yezo Group occur along the Naiba River and its tributaries (Krasnoyarka and Seim Rivers). The beds, which generally strike N–S and dip westward, exceed 5,000 m in thickness. They are in fault contact with Neogene deposits in the eastern part of the area, and unconformably underlie the Paleogene coal measures in the west. In the Naiba area, the Yezo Group is subdivided lithologically into the Ai, Naiba, Bykov, and Krasnoyarka formations, in ascending order. The Ai Formation (Albian) exceeds 610 m in thickness and consists mainly of dark grey, well-laminated mudstone with beds of turbiditic sandstone, while the 1,180 m thick Naiba Formation (upper Albian to Cenomanian) is comprised of alternating beds of sandstone and mudstone, turbiditic sandstone, and dark grey, well-laminated mudstone. Its contact with the Ai Formation is conformable. The Bykov Formation (upper Cenomanian to lower Campanian) is 2,300 m thick and consists of a dark grey, intensely bioturbated, massive or mottled mudstone intercalated with thin turbiditic sandstone and acidic tuff layers. Well-preserved ammonoids and inoceramids occur throughout the formation except for its lower part. The +800 m thick Krasnoyarka Formation (middle Campanian to Maastrichtian, Danian?) conformably overlies the Bykov Formation and is composed primarily of dark, greenish grey, poorly-sorted, bedded sandstone and mottled sandy mudstone. Fossiliferous calcareous concretions are abundant throughout the formation except for its uppermost part.

Upper left: Dark, greenish grey, bedded sandstone of the lower part (middle Campanian) of the Krasnoyarka Formation at Loc. NB3030 along the Krasnoyarka River. Upper right: Dark, greenish grey, poorly-sorted, bedded sandstone and mottled sandy mudstone of the upper part (upper Maastrichtian or Danian?) of the Krasnoyarka Formation at Loc. NB3044 along the Krasnoyarka River. Kalishevich *et al.* (1981) and a few other Russian geologists assumed that the K/T boundary occurs in this outcrop. Lower: Dark grey, intensely bioturbated, massive mudstone with thin turbiditic sandstone and acidic tuff layers of the upper part (lower Campanian) of the Bykov Formation at Loc. NB3022 along the Krasnoyarka River. For locality details, see Kodama *et al.* (2002).

Fig. 5. *Canadoceras kossmati* Matsumoto. NSM PM8263 from the lower part (middle Campanian) of the Krasnoyarka Formation at Loc. NB3029 along the Krasnoyarka River in the Naiba area, southern Sakhalin, ×0.19.

1961, 1969). Kalishevitch described the fauna and micro-flora found in the Danian deposits and applied the term “Sinegorsk” horizon to these beds (Kalishevitch, 1973; Kalishevitch *et al.*, 1981). Vereshchagin and his co-workers investigated various areas in western Sakhalin and arrived at the same conclusion regarding the placement of the boundary (Vereshchagin *et al.* 1978).

During the period between 1960 and 1987 several specialists published numerous papers containing not only discussions of biostratigraphy and paleogeography, but also descriptions of the following various fossil taxa: inoceramids (Glazonov, 1965, 1967; Zonova, 1965, 1970, 1974, 1976, 1977, 1987a, b; Pergament, 1966, 1971, 1973, 1974); other bivalves (Salnikova, 1980, 1987a, b); gastropods (Poyarkova, 1984, 1987b, c; Poyarkova & Dzhalilov, 1985); ammonoids (Glazunova, 1960; Zhuravlev, 1969a, b; Grabovskaya, 1981, 1984; Zonova *et al.*, 1986; Mirolyubov, 1987a, b); various micro fossils (Vasilenko, 1965; Budin & Gromova, 1973; Zonova & Turenko, 1986; Turenko, 1987a, b; Kazintsova, 1987; Budrin & Komarova, 1987); flora (Krishtofovitvh & Bajkovskaya 1960; Krassilov, 1979) (Fig. 7). During the same period Fursenko (1974) discussed the evolutionary patterns of the Cretaceous fauna as well as the paleoenvironment of Sakhalin, while Liverovskaya (1960), Vereshchagin *et al.* (1965), and Vershchagin (1970, 1977) reviewed the island’s Upper Cretaceous fauna.

Throughout the late 1970’s to early 1980’s several workers conducted paleobiological studies of ammonoids and other invertebrate fossils collected from Sakhalin. Drushchitz *et al.* (1978), Drushchitz and Doguzhaeva (1981), and Zakharov and Grabovskaya (1984) studied shell microstructures and early internal shell features of Upper Cretaceous ammonoids

Fig. 6. Numerous specimens of Cretaceous megafossils from Sakhalin collected by M. Kawada and T. Matsumoto are kept in the University Museum at the University of Tokyo, Japan. Left: Storeroom of the specimens. Right: Type specimen room.

from southern Sakhalin in an effort to further understand their biology and evolution. In addition, Zakharov *et al.* (1984) examined the stable isotopes of oxygen and carbon in the shells of the Cretaceous invertebrate fossils from Sakhalin.

Japanese workers also continued their research during the third stage by studying the ammonoids and other invertebrate fossil specimens collected from southern Sakhalin prior to 1945 (Matsumoto, 1954a–c, 1955a, b, 1957, 1970, 1988; Matsumoto & Obata, 1955, 1966; Obata, 1959, 1960; Hirano, 1975, 1978; Kanie, 1975; Tanabe, 1975, 1977; Matsumoto *et al.*, 1978; Kanie *et al.*, 1978; Noda, 1988). In addition, Matsumoto (1954d, 1959a, b) further improved the understanding of the Cretaceous lithostratigraphy and biostratigraphy of Japan and Sakhalin during this period. Sasa and Koiwa (1960a–j) compiled the geological map of Sakhalin with a scale of 1 to 250,000.

The fourth stage (1990–)

In the early 1990's Japanese and Russian workers organized a joint working group for the express purpose of conducting research on the Cretaceous deposits of Sakhalin (Fig. 8). Throughout the 1990's various members of this group carried out several scientific expeditions to Sakhalin where they studied modern day earth science disciplines including magnetostratigraphy, isotope stratigraphy, paleobiology, and taphonomy. Subsequently, Shigeta (1993) and Kase *et al.* (1994) published papers in which they discussed ammonoid paleoecology, while Maeda and Seilacher (1996) discussed ammonoid taphonomy. Kodama *et al.* (2000, 2002) and Kodama (2003) recognized 13 magnetozones in the Upper Cretaceous deposits in the Naiba area and correlated them

Fig. 7. The Central Museum of Geological Research and Exploration (CNIGR Museum), founded in 1882 in St. Petersburg, Russia and named for Academician F.N. Chernyshev, is one of the largest natural history museums in the world, and possesses a large collection of fossils. Numerous specimens of Cretaceous megafossils from Sakhalin described by Russian workers are kept in this museum. Left: Type specimen room. Right: Wooden chest containing described specimens.

with polarity chrons from C34n through C30n. Hasegawa *et al*. (2003) demonstrated that time-stratigraphic patterns of stable carbon isotope ratios from Cenomanian-Maastrichtian sequences in the Naiba area, could be correlated with those from well-studied successions in other parts of the world. Zakharov *et al.* (1999, 2001a, b) discussed paleotemperature curves for Late Cretaceous deposits of Sakhalin based on oxygen isotope analysis.

In addition to the contemporary research described above, conventional studies have also continued. E. A. Yazykova and T. D. Zonova studied ammonoid and inoceramid biostratigraphy, as well as bioevents in Sakhalin (Zonova, 1990, 1992; Yazykova, 1991, 1992, 1996, 2002; Yazikova (Yazykova), 1994; Zonova *et al.*, 1993; Zonova & Yazykova, 1994, 1998; Yazykova *et al.*, 2002, 2004). Although Zakharov *et al.* (1996) and Alabushev and Wiedmann (1997) proposed a zonal scheme based on the Cretaceous ammonoids of Sakhalin, Yazykova (2004) later conducted a comprehensive review of Cretaceous stratigraphy and ammonoid faunas of Sakhalin and proposed a zonal scheme consisting of 24 ammonoid zones.

In 1995 Alabushev published a paper in which he discussed the sedimentary formations of the Cretaceous Sakhalin Basin. At about the same time, Markevitch (1995) summarized the palinoflora of the Russian Far East, and later she and Bugdayeva (1997) examined the flora of the dinosaur bearing beds in the Russian Far East. In 2003, Wilmsen and Yazykova published a paper in which they described Campanian nautiloids. In addition, Japanese paleontologists published several papers in which they described the following Cretaceous taxa: ammonoids (Shigeta, 1992; Matsumoto, 1995); gastropods (Kase & Shigeta, 1996); sopres and pollen (Takahashi, 1997). Suzuki *et al.* (2004) redescribed the only known specimen of the dinosaur *Nipponosaurus sachalinensis* Nagao, 1936 and determined its ontogenetic stage and diagnostic characters, as well as its systematic position.

In 1993 and 1994 Maeda *et al.* (2005) and Maeda and Shigeta (2005) studied the Cretaceous System in the Makarov and Pugachevo areas of southern Sakhalin and noted the sequential occurrence of several fossil assemblages of Campanian and Maastrichtian age. Subsequently, in 1996 Shigeta *et al.* (1999) investigated the Cretaceous System in the Kril'on Peninsula area of southern Sakhalin and found megafossil assemblages that are identical to those in the Middle and Upper Campanian in other areas of Sakhlain, as well as in Hokkaido.

Future research

When considering future investigations, members of the Joint Research Program of the Yezo Group should remember the following three major tasks.

1) Exploitation of various modern correlation methods

2) Maintain a broader perspective when viewing the distribution of the group as a whole

3) Qualitative improvement of basic observations

Concerning the first point, radioisotope analysis, for instance, has been utilized only sparingly. This becomes painfully obvious when one considers its potential to facilitate correlation of the Yezo Goup both in Japan and Russia. Although traceable tuff beds are abundant, precisely dated marker-tuffs are few (Shibata & Miyata, 1978; Shibata *et al.*, 1997). In contrast, the Upper Cretaceous System in the Western Interior of North America, which is widely known for its excellent marine biostratigraphy and paleontology, has been extensively dated by K-Ar and/or other radioisotope methods (Obradovich & Cobban, 1975). Even bentonite tuffs, which are never ideal materials for radioisotope analysis, are utilized.

Various other modern methods ideally suited for correlation of geological events on an international scale, such as magnetostratigraphy and stable-isotope stratigraphy, have recently been proposed by Kodama *et al.*, (2000, 2002) and Hasegawa *et al.*, (2003). Furthermore, calcareous-nannoplankton biostratigraphy is also expected to play a key role in the cross-checking of biostratigraphic schemes in the Far East Realm.

In regard to the second point, the most significant stratigraphic feature of the Yezo Group is the uniformity of its lithology and fauna. In spite of a wide geographic distribution, extending for 1,200 km or more, its lithology and faunal content are remarkably monotonous. Its sedimentary features and biofacies show minimal lateral change, particularly in a north-south direction.

Previous stratigraphic studies have attached great importance to the coarse grained deposits which are occasionally interspersed in the monotonous mudstones of the Yezo Group (Matsumoto, 1942d, 1954d; Poyarkova, 1987a; Takashima *et al.*, 2004). However, these sandstone and conglomerate beds are generally interpreted as regional deposits originating from the development of local fan-deltas, channels and/or levees with dimensions on the order of 5–20 km. Alternatively, the importance of the sedimentary and ichnological features of the monotonous mudstones has been stressed in only a few pioneer works (Shigeta *et al.*, 1999; Kodama *et al.*, 2002; Maeda *et al.*, 2005 etc.). Unlike the local sandstone beds, the Albian-Cenomanian laminated mudstone and the Lower Turonian *Planolites* mudstone extend

Fig. 8. Sampling for paleomagnetic analysis by the Japanese-Russian Joint Research group in the Naiba area, southern Sakhalin. Samples were collected utilizing a portable, gas-powered coring machine and then oriented in the field. A total of 1,062 samples were collected from Cretaceous outcrops in the Naiba area (Kodama *et al.*, 2000).

for about 900 km (Maeda, 1987; Maeda *et al.*, 1987; Kodama *et al.*, 2002). It is entirely possible that the lithostratigraphic schemes may be revised as a result of viewing the distribution of the group as a whole from a wider perspective, both in Hokkaido and Sakhalin. Rather than debating local differences within the Yezo Group, emphasis should be directed towards recognition of the uniqueness of the group's uniformity, as well as attempting to reach agreement on the reasons for its uniformity. A series of recent OAE studies is a positive sign of this trend (Hirano, 1995; Hasegawa, 1995, 1997 etc.)

As to the third point, basic observations should play an important role inYezo Group research, even in the 21st century. As illustrated by the debate between Yazykova and Zonova (2004) and Hasegawa *et al.* (2004), Russian and Japanese workers cannot agree on biostratigraphic ammonoid schemes, even in the same Yezo Group. This misinterpretation is partly attributable to the misidentification of taxa by Russian paleontologists, who have never personally examined the type specimens (Hasegawa *et al.*, 2004, p. 181). To avoid such confusion, the level of infrastructure must be enhanced by joining in open, forthright taxonomic and stratigraphic discussions in an effort to resolve such differences of opinion. The international joint-research program on the Yezo Group is an excellent solution to this problem because it provides a good opportunity to examine the other party's data and correct misunderstandings at an early stage. Precise field observations seem out of date but they are indispensable. These detailed observations still give rise to new research trends, even in this day and age, e.g., stratigraphy and sedimentology (Hayakawa, 1990; Ando, 1990, 2003; Takashima & Nishi, 1999; Takashima *et al.*, 2001; Iba *et al.*, 2005), taxonomy by population concepts (Shigeta, 1989, 1992; Maeda, 1993; Matsuda & Ubukata, 1999; Tsujino *et* *al.*, 2003; Harada & Tanabe, 2005), paleoecology (Kase *et al.*, 1994; Hikida *et al.*, 2003; Moriya *et al.*, 2003), taphonomy (Maeda, 1987, 1991; Maeda & Seilacher, 1996) and theoretical morphology (Okamoto, 1989; Okamoto & Shibata, 1997; Ubukata & Nakagawa, 2003).

Our goal should not be to look for easy applications for popular concepts, but rather to concentrate on the original ideas advanced by ourselves as members of the Yezo Group.

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サハリンにおける蝦夷層群研究史：サハリンの白亜系蝦夷層群の研究は，古生物学や層序学の発達と国際的な政治情勢により，4 段階に区分される．第 1 期 (1860–1905) には，開拓者により地質調査と化石の記載が行われた．第 2 期 (1905–1945) には，サハリン北部は主にソビエト連邦の研究者により，サハリン南部は日本の研究者により調査された．第 3 期 (1945–1989) の間，サハリンの白亜系は多くのソビエト連邦の研究者により調査され，特にナイバ地域において包括的な研究がなされた．第 4 期（1990 以降）には，日本とロシアの共同研究グループが組織され，生物学的古生物学，タフォノミー，古地磁気層序学，同位体層序学など様々な観点からの研究が進められている．
重田康成・前田晴良