PRECAMBRIAN ROCKS IN THE ANADYR-KORYAK REGION

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ABSTRACT

The Anadyr-Koryak geosystem is located within the continent-to-ocean transition zone in the northwestern Peripacific. Distinguished here are noncontemporaneous and different Precambrian structural complexes that make up the heterogeneous basement of Phanerozoic structures of the Koryak Region.

Different tectonic environments and structures are featured by outcrops of supposedly Archean schists and gneiss, structures, and fragments of greenschist metamorphic rocks with evidence of Riphean to Lower Cambrian lawsonite-glaucophane metamorphism as well as garnet pyroxenites and garnet amphibolites, which are fragments of the deep Earth's crust. The extensive distribution of these rocks and new data obtained on the composition and age of different structural complexes permit us to distinguish a new area of Precambrian rock occurrences in the northwestern Pacific mobile belt.

INTRODUCTION

In the last few decades, geologic mapping and exploration in the Koryak highlands has encountered problems in determining the age, composition, and structure of regional basement. Proposals of melanocratic basement (Markov et al., 1982) and oceanic paleocrust fragments (Tilman et al., 1982) are not supported by data or logic. The author of this paper and his colleagues have gathered extensive data on the composition, structure, and age of different types of metamorphic complexes in the Koryak highlands, which allow the reconstruction of the heterogeneous Precambrian basement of the Anadyr-Koryak geosystem.

METHODS, MATERIAL STUDIED, AND AREA DESCRIPTION

These investigations include large-scale mapping of some objects of geologic interest; compilation of bed-by-bed descriptions for individual, composite, and generalized sections; gathering of samples for microfossil, algae, and acritarch studies; and chemical, geochemical, petrographic, and microprobe analyses. Contacts of metamorphic outcrops with other rocks, and fold and fault deformation of metamorphic rocks were examined. This paper presents information obtained by the author and his colleagues, as well as the result of map compilation for the Koryak Region. It includes descriptions of Archean (?) rocks that outcrop in Zolotogorsky and Pekulney uplifts and late Precambrian rocks in the Iomraut tectonic nappe, Vaezhsky uplift, Pontoney horst anticline, and Pekulney and Kankaran blocks (Fig.1).

RESULTS

Outcrops of crystalline metamorphic rocks are found in the periphery of the Anadyr-Koryak geologic system. Rocks such as plagiogneiss, scarce marble, clinopyroxene, feldspar-amphibole, anthophyllite and

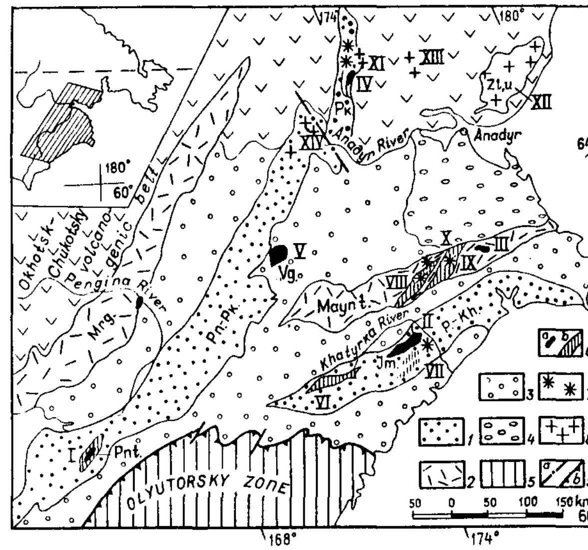

Fig.1. Outcrops of Prephanerozoic metamorphic rocks within the Anadyr-Koryak Region. 1 - eugeosynclinal polycyclic troughs (O_2-K_1): Pn-Pk - Penzhin-Pekulney, P-Kht - Pikasvayam-Khatyrka; 2 - island arcs ranging from Late Jurassic to Early Cretaceous in age: Maunt-Mainits median, Mp - Murgal marginal; 3 - orogenic structures; 4 - Anadyr depression; 5 - Olyutor zone; 6 - greenschist outcrops (R-V): a) in blocks and tectonic nappes: I - Pontoney horst- anticline, II - Iomraut tectonic nappe, III - Kankaran block, IV - Pekulney, V - Vaezhsky uplift; b) fragmentary outcrops of the same rocks in serpentinite melanges: VI - Verkhne-Khatyrka, VII - Chetkivayam, VIII - Chirynai, IX - Yagel, X - Elgevayam. 7 - outcrops of garnet amphibolites and garnet pyroxenites; 8 - outcrops of crystalline rocks and gneiss in serpentinite melanges: XI - Pekulney, XIV - Ust-Belsky, and blocks: XII - Zolotogorsky (Zl), and XIII - Kanchlan. 9 - faults (a) and thrust faults (b).

two-pyroxene schist, amphibolite containing garnet, orthopyroxene, and cummingtonite are present in the northern Zolotogorsky uplift, where they are distributed over an area of about 900 km^2. Here, these rocks are most intensely plagiomigmitized and granitized, with local large potassium-sodium and sodium anatectic granite bodies. Metamorphic rocks are dissected by conformable and cross-cutting gneiss-granite and trondhjemite bodies. The Zolotogorsky complex seems to be Lower Archean in age, according to regional correlation. Rock outcrops, supposedly Archean in age, are present west of the Zolotogorsky uplift on the left bank of the Tanyurer River (high-alumina schists) and in the Pekulney uplift (Fig.1). In the southern Pekulney Range, block-hosted biotite-garnet gneiss and amphibolites are found. Garnets contain 17-20 percent pyrope and an increased amount of manganese and reveal a clear-cut zoning (Zhulanova, 1990). The middle portion of the eastern side of the Pekulney Range is characterized by fine-grained rocks with graphite, mica, garnet, and diopside at Sbornoe Lake; and migmatized amphibolites containing plagiogneiss and two-pyroxene schist lenses outcrop at

Spokoinoe Lake. Fragments of muscovite gneiss, plagiogneiss, and two-mica garnet gneiss are found in serpentinite melanges occurring at the Yanranai River in the Ust-Belsky Mountains and Eldynyr massif (Palanjan, pers. commun., 1980). Outcrops of garnet biotite gneiss were found by G.E. Nekrasov in Early Paleozoic ophiolites of the Penzhin range (Markov et al., 1982) and on the left bank of the Talovka River (V.P. Pokhialainen, pers. commun., 1985).

The age assignment of all these rocks is based on petrological similarities with known Archean rocks and early Precambrian regional metamorphism.

The Lower Archean Avek complex (plagiogneiss and amphibolites) and the Upper Archean Ekaterina complex (amphibole schists containing garnet, biotite, muscovite, and graphite) outcrop in the Varchalam and Taigonos blocks (Zhulanova, 1990) within the southeastern marginal area of the geologic system. Gneiss and schist xenolith formed during the Precambrian and Paleozoic (?) occur in Cenozoic volcanic sheets on the Kamchatka Isthmus (Bogdanov et al., 1988).

Outcrops of upper Precambrian greenschist rocks are widespread in the northern Koryak highlands and differ in their size and tectonic environments (Fig.1). Major greenschist outcrops occur in the Pontoney Mountains, the Penzhin Range horst-anticline, the Vaezhsky uplift dome, the tectonic nappe at the Iomrautvaam River, the southern Pekulney range, Kankaran Range, and also in all polymictic serpentinite melanges of the Koryak highlands, including the Verkhne-Khatyrka, Chetkinvayam, Rossomashin, Chirynai, and others, where these outcrops occur as fragments (blocks or sheets) (Ivanov and Baratov, 1974).

The Iomraut tectonic nappe is located in the lower Iomraut River valley along the right tributary to the lower Khatyrka River. This tectonic nappe is 15 km long, 3 to 4 km wide, and is bounded at its top and bottom by serpentinite melanges. In the south, a sheet of Riphean-Vendian metamorphic rocks overlies intercalated Paleozoic, Upper Jurassic-Early Cretaceous, and Paleogene rocks and underlies a sandstone sequence of Senonian age.

The greenschist sequence at the Iomraut River was first recognized as an independent stratigraphic subdivision by Rusakov in 1958. It was distinguished as the Yandanai suite with its Upper Proterozoic age established by microfossil studies (Rusakov and Egiazarov, 1958).

The Yandanai stratigraphic section at Central Creek was described by the author in 1978 (Ivanov et al., 1989). Fig.2 shows the intercalation of beds and their composition and the thicknesses of strata in the main and some individual sections. The bottom of section (1) consists of 80 m of quartzite schists with rare phyllite interbeds bearing the acritarchs *Leiosphaeridia crassa* (Naum.) Tim., *L. laminaritum* Tim., *Protosphaeridium flexuosum* Tim., *Synsphaeridium sorediforme* Eis. (Fig.2, bed 1). This is overlain by a member (340 m thick) of alternating horizons of albite-chlorite-micaceous schists (42 m thick) and albite-amphibole-epidote-chlorite schists (84 m thick), which may represent metavolcanics, quartzites (57 m thick), intercalated micaceous shales (98 m thick), and phyllites. The overlying phyllites (115 m thick) contain *Protosphaeridium holtedalii* Tim., *Leiosphaeridium minutissima* (Naum.), Tim., *L. crassa* (Naum.) Tim., *L. obsulata* (Naum.) Tim., *L. jakutica* (Tim.) Nikh. et Jank., *L. laminaritum* Tim. (Fig.2, bed 9). These microfossil assemblages from different horizons testify to the Riphean age of the rocks. The next member (611 m thick) reveals an intricate alternation of quartzite, micaceous-chlorite-quartz, and calcareous schists and is overlain by a horizon (140 m thick) of amphibole-epidote-albite schists (metavolcanic rocks) with scarce interbeds of different schists and phyllites. The section is terminated by a sequence (210 m thick) of phyllites and quartzite interbedded with chlorite schists and sporadic calcareous rocks bearing metamorphosed algae colonies. Phyllites from the lower third of the member contain *Bavlinella faveolata* Schep., *Aspevatopsophosphaera* Volk., *Spumiosa rubiginosum* (Andr.), *Leiosphaeridia bicrura* Jank., *Chuaria circularis* Walcatt., and different algae *Eomycetopsis typicus* Herm., *E. maculatis* Herm., *Tortunema sibirica* Herm., *Oscillatoriopsis sp.*, *Arctocellularia ellipsoidea* Herm., testifying to the Vendian age of the member (Fig.2, bed 19). The contact between the Ripean and Vendian is gradational and conformable; rocks of both ages have the same lithologies and metamorphic grade and lack structural dislocations (Ivanov,1989). Individual sections and their litholgies are given in Fig.2.

The Iomraut sequence is of volcanogenic-sedimentary origin. Metavolcanites are mainly distributed throughout the Upper Riphean and Vendian portions of the Iomraut sequence. These are dominated by high-sodium, calcareous, low-potassium, and moderately titanic basalts; picrobasalts are less common (Table 1).

The second section, from the Vaezhky uplift in the Berezovaya River basin (Fig.1), is of Vendian to Early Cambrian age according to microfossil evidence. Here, washout breccias containing greenschist clasts occur in Silurian and Devonian limestones, which rest on underlying metamorphic rocks with sharp angular unconformity (Ivanov et al., 1973).

The sequence of late Precambrian rocks is approximately 800 m thick in the Vaezhsky uplift. It is mainly

Table 1. Chemical composition of late Pre-cambrian metavolcanics in the Koryak highlands[a].

Oxides	1(9)	2(21)	3	4	5	6	7	8	9
SiO_2	47.65	47.00	44.05	41.03	43.28	41.69	48.27	47.94	46.67
TiO_2	1.28	1.89	1.08	2.07	1.84	3.10	1.37	2.27	1.81
Al_2O_3	14.30	13.24	7.60	12.63	13.90	16.61	15.42	16.76	15.44
Fe_2O_3	3.98	10.18*	2.59	12.79*	10.95*	14.85*	8.00*	12.91*	11.15*
FeO	6.96		7.71						
MnO	0.20	0.18	0.17	0.17	0.15	0.29	0.18	0.23	0.19
MgO	8.29	6.08	18.61	12.17	8.56	5.87	2.90	5.75	5.05
CaO	11.32	10.29	13.13	13.62	15.85	8.57	7.98	3.71	9.06
Na_2O	2.55	3.19	0.54	1.82	2.27	3.76	4.39	6.00	5.25
K_2O	0.47	0.67	0.06	0.20	0.03	1.40	0.23	0.94	0.34

[a] 1-Iomraut metabasalts; 2-3 according to Dobretsov (1974), 2- glaucophanized basalt from the Ilpiney suite, 3- metapicrite, sample 891 a; 4-6 samples from the collection of Kolyasnikov, 1978, 4-metapicrobasalt, sample K93-4, 5-calcareous metabasalt, sample K93-1, 6-subalkalic high-titanic basalt, sample K84; 7-9- samples from the collection of Belyi, 7-subalkalic metabasalt, sample 47/27, 8-9 alkalic basalt, samples 47/25 and 47/26; samples 2-9 from the Ilpiney suite in the Pontoney mountains. Figures in brackets show the number of sample analyses. (*) is the total Fe_2O_3 determined by ARL-72000 quantometer.

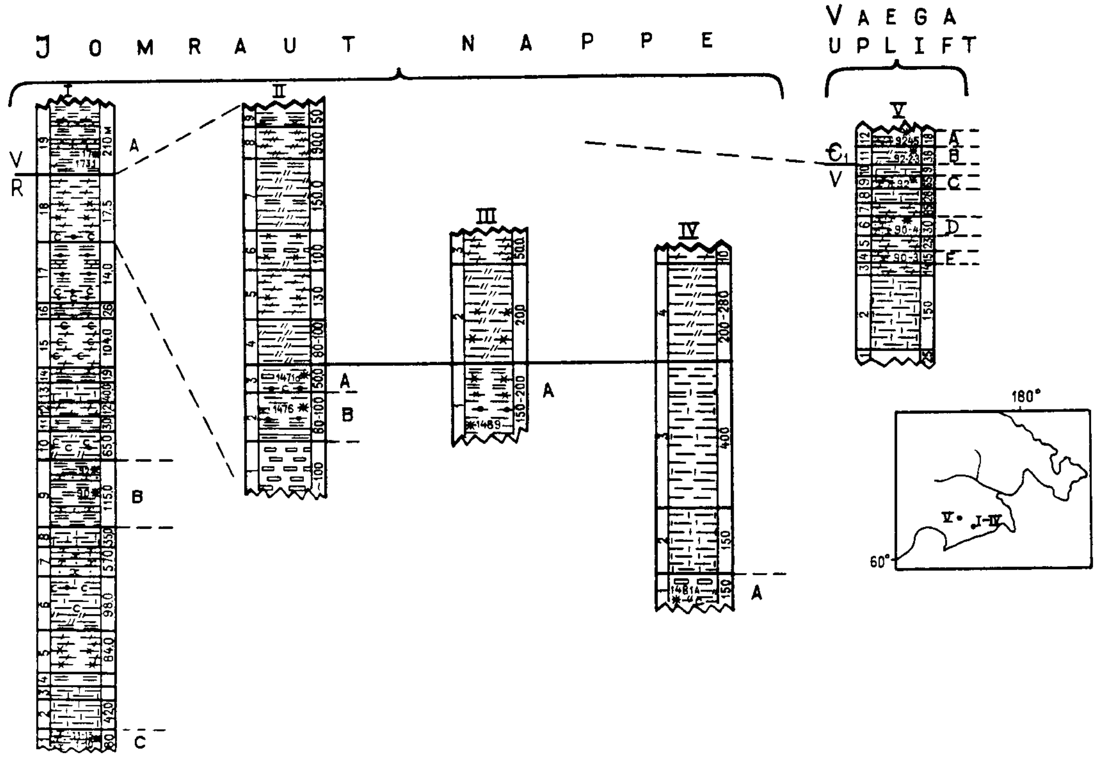

Fig.2. Schematic correlation of upper Precambrian formation in the Koryak highlands.

composed of hematitic quartzites and quartzite schists with thin interbeds of phyllite, and micaceous and chlorite schists; amphibole-chlorite schists, often glaucophane bearing, are less widespread but are distributed throughout the section (Fig.2, section V).

Quartzites of beds 4, 6, and 9 (Fig.2, section V) contain acritarchs and algae of Vendian as follows: *Spumiosa rubiginosum* (Andr.), *Asperatopsophosphaera partialis* (Andr.), *Asperatopsophosphaera partialis* Schep., *A. magna* Schep., *Bavlinella fuveolata* Schep., colonial *Oscillatoriopsis* Schep. (bed 6) and *Asperatopsophosphosphaera bavlinensis* Schep., *A. magna* Schep., *Pterospermopsimorpha annulata* Ilt., *Spumiosa rubiginosum* (Andr.), *Lophomarginata porata* Ilt. (bed 9), and Vendian colonial filamental algae.

Chlorite schists in the upper portion of the section (Fig.2, bed 11) contain *Leiosphaeridia* ILt., *Granomarginata squamacea* Volk., and colonial algae; and the overlying quartzite schists (bed 12) contain *Lophomarginata porata* ILt., *Granomarginata squamacea* Volk., *G. sibirica* Ilt., *Baltisphaeridium orbiculare* Volk., *Leiosphaeridia perforata* Ilt., *Pterospermopsimorpha annulata* ILt., and *Tasmanites variabilis* Volk., which testify to the Early Cambrian age of the upper portion of the section in gradational contact with the lower section of Vendian age. In comparison with the Yandanai, the Vaezhsky sequence contains more carbonate interbeds, different amphibole schists subject to superimposed lawsonite-glaucophane metamorphism, and contains ferruginous quartzites and hematite-bearing quartzite schists.

Metamorphic carbonate-pelitic rocks and a gabbro sheet occur in the Pontoney horst-anticline core in the southwestern Penzhin Range. Metamorphosed rocks are separated by faulting from terrigenous deposits, supposedly of Carboniferous or Permian age, and Lower Cretaceous deposits.

The Ilpiney suite section of Ilpineygenilkhin Mountain was described by L.G. Ponomareva and N.A. Dobretsov (Dobretsov, 1974). The lower subsuite is more than 800 m thick and contains metavolcanic schists and thick coloured quartzite horizons. The upper third of the section includes calcareous pelites, a horizon of recrystallized limestones, and a thick member of red and white banded quartzite schists. Basaltoids and lithoclastic coarse tuffs are found on the southeastern side of Ilpineygenilkhin Mountain. The middle subsuite is 500 to 600 m thick and is composed of two or three 70-100 m thick horizons of marble and quartzite lenses intercalated with schist horizons. The upper subsuite is 300 m thick and contains glaucophane bearing metavolcanogenic rocks with quartizite interbeds. According to Belyi et al. (1984), ferruginous varieties of quartzite horizons are present here. The total thickness of the section is less than 1,700 m. The Ilpiney sequence is dominated by metabasalts (Belyi et al., 1984) consisting of a broad range of picrites and subalkalic and alkalic high-sodium, low-potassium, and potassium-sodium basalts (Table 1). The suite includes two contemporaneous teschenite-dolerite and picrite-basalt complexes (Ivanov et al., 1989). According to K-Ar dating, the ultramafite-gabbro complex in contact with the Ilpiney suite, is 236 Ma, the superimposed glaucophane metamorphism is 300-35 Ma (Dobretsov, 1974), and apodiabase rocks are 431+50 Ma, which corresponds to the Llandoverian.

Greenschist pebbles of metabasalts, limestones, and quartzites are present in Elgeminai suite conglomerates (O_2 - S_1), which testifies to presumably late Precambrian to early Paleozoic age of Ilpiney suite (Zaborovskaya and Nekrasov, 1974).

Among other outcrops of supposedly upper Precambrian rocks, there are greenschist rocks in the southern Pekulney Range. In the Kruglaya Mountain area, a block is exposed that is made of variegated phyllites, quartzites, chlorite-calcareous schists, and ferruginous and sometimes garnet-bearing quartzite schists. Glaucophane is widespread.

Greenstones occur in the Kankaran Range in the upper valleys of Neptun Creek and the Kanchalan River, where schists are overlain by Carboniferous deposits. The author also has found greenstones on the right side of the Penzhina River, opposite the mouth of the Murgal River. The rock composition in this area is the same: quartzites, intercalated phyllites, micaceous-chlorite-quartzite, and amphibole-chlorite schists. Outcrops of greenstone rocks are quite comparable with fossil-dated Iomraut and Vaezhsky sequences of the Koryak highlands in terms of their composition, deformation, metamorphic facies, and alteration stages.

Extensive, thick fragments of late Precambrian rocks occur in nearly all polymictic serpentinite melanges, for example, the Verkhne-Khatyrka, Chirynai, Chetkinvayam, Yagel, and others. The rocks are composed of phyllite; quartzite; various schists, including actinolite, epidote, chlorite, quartz, plagioclase, and phengite; carbonate interbeds; metavolcanics; and glaucophane bearing rocks (the Chirynai and Verkhne-Khatyrka melanges), which are petrographically similar to the known Upper Cambrian sequences in terms of their composition and metamorphic facies. In addition, a block of phyllite-quartzite rocks up to 3.5 km long, 1-1.5 km wide, and 0.8 km thick is hosted by the Chirynai melange in the upper valley of the Elgevayam River. These phyllite rocks contain the algae *Rodiosus oviformis* Milst. (msc) of Vendian to Early Cambrian age (Ivanov and Ilchenko, 1978). A block of phyllitic schist of the Chetkivayam melange contains the acritarchs *Leiosphaeridia crassa* (Naum) Tim., *Protosphaeridium sp.*, *Macroptycha biplicata* Tim., *M. uniplicata* Tim., and algae *Tortunema sibirica* Herm. of established Riphean age (Ivanov et al., 1989).

Generalized sections of the largest outcrops consist of amphibole schists with various amounts and combinations of epidote, chlorite, albite, and quartz at the base of the section. The middle portion of the section includes quartzite with sporadic interbeds of chlorite, mica, calcareous schists, and phyllites. The upper and greatest portion of the section is composed of phyllites intercalated with schist, quartz, mica, albite, and rare chlorite, amphibole and calcareous pelite, and quartzite schist. The group of amphibolite schists with feldspar and epidote is characterized by relict structures and accessory minerals and is petrochemically similar to volcanic rocks (Ivanov, 1978). Thus, the original composition of metamorphic rocks under consideration corresponds to a volcanogenic-sedimentary section with a predominantly sedimentary component. Such factors as the predominance of quartzites and jaspilitoides (in the Vaezhsky uplift and the Penzhin Range); thick layers of carbonate rocks (in the Pontoney Mountains); and phyllites (in the Iomraut nappe), and different combinations of sedimentary rocks and andesite-basalt, picrite-basalt, and teschennite-basalt complexes, testify to the varied geodynamic environment of the basin. Fig.2 shows the correlation of some sections, their bedding, and distribution of fossils. The original volcanogenic-sedimentary rocks were altered under the conditions of regional metamorphism B_4 facies at P_{total}=6-8 kb, P_{H_2O}= $(0.7\text{-}0.9)_{P_{total}}$, T=450-520° C (Dobretsov et al., 1969). Greenschist outcrops locally display superimposed lawsonite-glaucophane metamorphism.

The late Precambrian (Riphean to Early Cambrian) age of the metamorphic rocks is supported by the fact that pebbles of greenschist rocks and marble of the Ilpiney series occur in Middle Ordovician to Lower Silurian conglomerates in the Pontoney Mountains. In the Vaezhsky uplift, Devonian and Sillurian carbonate beds overlie with angular unconformity a steeply dipping schist-quartzite series of Vendian to Early Cambrian age. There are also breccias at the bottom of the section. Evidence of Preordovician to Silurian ages for greenschist rocks are quite convincing. Radiometric age-dating are not available for these rocks. According to K/Ar dates obtained by Dobretsov (1974), glaucophane metamorphism, occured at 300 to 350 Ma in the Pontoney Mountains and the Ilpiney metabasalts yileded an age of 431 ± 50 Ma. Outcrops of metasedimentary rocks in the Iomraut tectonic nappe, Vaezhsky uplift, and Chirynai Mountains contain abundant acritarchs and algae assemblages of Riphean, Vendian, and Lower Cambrian age. Detailed descriptions of the Iomraut (Riphean to Vendian) and Vaezhsky sections are available. Here, three acritarch assemblages of Riphean, Vendian, and Early Cambrian ages are distinguished, which gradually replace each other throughout the section. These fossil assemblages are discriminated in terms of their vertical distribution and relative quantitative ratio (not less than 5 percent). The Riphean acritarch assemblage is dominated by *Leiosphaeridia crassa* (Naum.) Tim., *L. jacutica* (Naum.) Tim., *L. minutissima* (Naum.) Tim., *L. obsulata* (Naum.) Tim., *L. laminaritum* Tim., *Protosphaeridium flexuosum* Tim., *P. densum* Tim., *P. holtedali* (Naum). Also present are rare algae including *Macroptycha nuiplicata* Tim. and *M. biplicata* Tim. and some filamentous algae such as *Eomycetopsis typicus* (Herm.) and *Tortunema sibirica* (Ilt.).

The Vendian fossil assemblage is taxonomically quite different from the Riphean assemblage. It is distinguished by the first occurrence of the *Bavlinella, Spumiosa, Asperatopsophosphaera*, and *Granomarginata* species. The fossil assemblage includes *Asperatopsophosphaera partialis* Schep., *A. magna* Schep., *A. preudus* Schep., *Bavlinella faveolata* Schep., *Spumiosa rubiginosum* (Andr.), *Granomarginata squamacea* Volk., *G. sibirica* Ilt., rare *Leiosphaeridia bicrura* Jank., and others. The Vendian fossil assemblage is characterized by *Ostiana microcystis* (Herm.), *Eomycetopsis maculatus* (Herm.), *E. typicus* (Herm.), *Arctocellularia ellipsoides* (Herm.), and filamentous algae. In the Vaezsky uplift, the fossil assemblages of Early Cambrian age do not contain filamentous algae but are characterized by the presence of *Granomorginata squamacea* Volk., *G. sibirica* Ilt., *Baltisphaeridium orbiculare* Volk., *Tasmanites variabils* Volk., *Lophomarginata porata* Ilt., and *Leiosphaeridia perforata* (Ilt.).

Thus, the Preordovician age of greenstone metamorphic rocks is supported by geologic observations, whereas the Riphean, Vendian, and Lower Cambrian ages are indicated by paleontologic data.

The Riphean to Vendian rocks of the Koryak region are quite comparable with the Kelkhin series in eastern Chukotka (Kryukov, 1977), the Seshan and Kolovrun suites of Seshan Cape (Oradovskaya and Obut, 1977), and the metamorphic sequence of Wrangel Island (Ivanov, 1973; Cecile et al., 1991) in terms of composition (volcanogenic-sedimentary complexes) and index fossils (acritarch, algae, and others). The Wrangel complex includes the Gromov suite ranging from Middle to Upper Riphean in age, the Inkalin suite of Vendian age, and the Raskhok suite of Lower Cambrian age (Kameneva et al., 1976). In Alaska, the Kanauguk Formation and the Tindir Group are correlative with the Koryak sequences (Eberlein and Lanphere, 1988), both in lithology and metamorphic facies (Patrick and Evans, 1989) and fossils (Allison, 1988). A correlation chart of these rocks is shown in Fig.3.

The continental marginal zone of the northern Peripacific framework includes the greenschist belt of volcanogenic-sedimentary formations of late Precambrian age. Unequal fragments of eclogite-like rocks, garnet pyroxenites and garnet websterites, amphibolites, garnet amphibolites, and garnet-amphibole plagiogneiss are hosted in numerous serpentinite melanges of the northern Anadyr-Koryak geosystem. Different garnet pyroxenities hosted in the melanges of the Pekulney Range, Krasnye and Chirynai Mountains, and the Khatyrka River basin are composed of almost sodium-free, high-alumina clinopyroxene, garnet with pyropeminal content from 40 up to 52 percent, and oligoclase and pargasite amphibole. In the opinion of Pertsev (Ivanov et al., 1989), the eclogite-like rocks here can be distinguished into two groups. The first one includes late spinel pyroxenite differentiates (the Pekulney Range) and is close to griquaites (Moukadiri, 1984), and the second one (the Chetkinvayam melange) is represented by metamorphic garnet pyroxenites.

Amphibolites and their garnet-bearing varieties, and garnet-amphibole plagiogneiss rocks at the Chetkinvayam River consist of magnesian hornblende, almandine garnet, and gneiss-hosted sericitized oligoclase N 29.

Different metamorphic garnet pyroxenites, amphibolites and garnet amphibolites, and gneiss that are hosted in serpentinite melanges seem to be the fragments of a deep subcontinental crust.

CONCLUSIONS

1. The Anadyr-Koryak geosystem is located within the Koryak Region and includes the Archean (?) crystalline complex, greenschist metamorphic rocks ranging from Riphean to Vendian in age, and various eclogite-like rocks and garnet amphibolites.

2. Archean (?) and late Precambrian structural complexes make up the heterogeneous basement of the regional Phanerozoic structures, whereas garnet pyroxenites, different amphibolites, and gneiss are fragments of the deep Earth's crust.

3. The late Precambrian Koryak complex is evidently distinquished by Riphean, Vendian, and Lower Cambrian rocks with similar lithologies, which grade into each other throughout the section. The rocks were originally of volcanogenic-sedimentary composition in association with

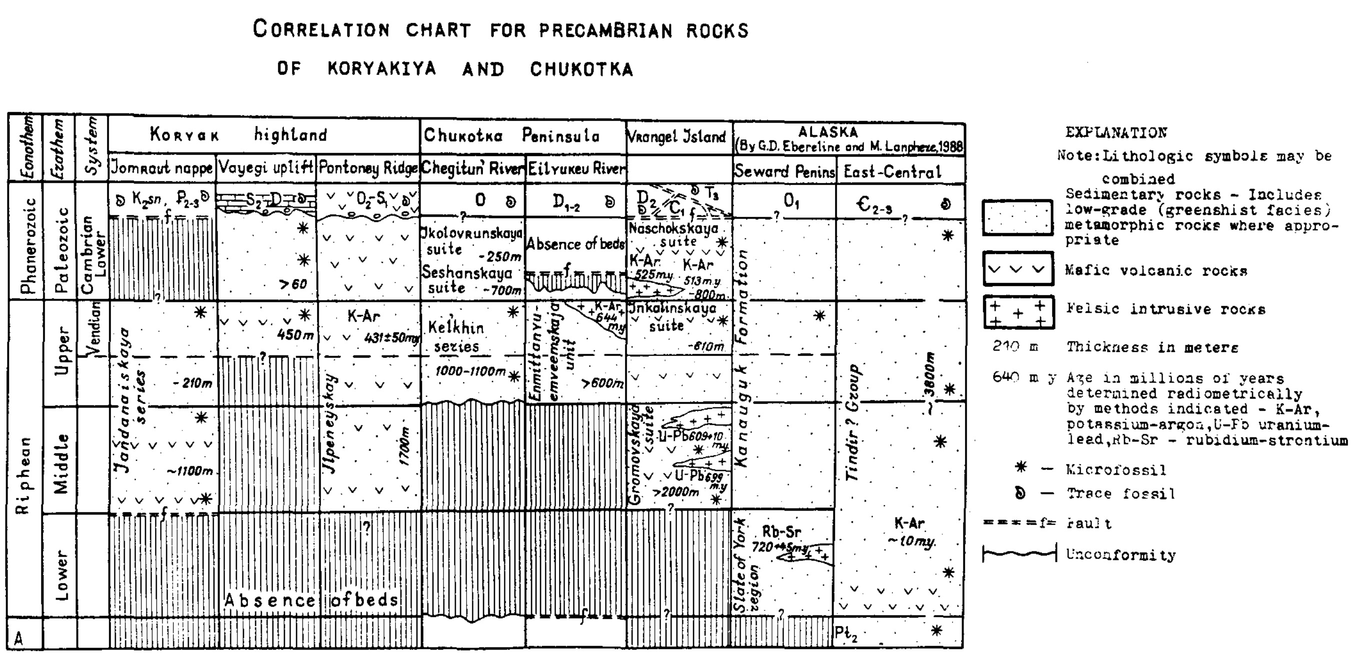

Fig.3. Correlation of upper Precambrian sequences of the continental marginal zone.

sodium series basaltoids. They may belong to the supposed late Precambrian ophiolite complex. The rocks underwent regional greenschist metamorphism with superimposed lawsonite-glaucophane metamorphism. Plutonic rocks probably include rare ultramafites, plagiogranites, and solitary gabbroids.

4. The Koryak greenschist belt is a part of the established late Precambrian continental marginal zone in the northern Peripacific framework.

5. The newly distinguished area of Precambrian outcrops should be taken into consideration when developing regional geologic and tectonic models of the Pacific framework.

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